DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

[Docket No. NHTSA–2010–0053]

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.

SUMMARY: The National Highway Traffic Safety Administration (NHTSA) is concerned about the effects of distraction on motor vehicle safety due to drivers' use of electronic devices. Consequently, NHTSA is issuing nonbinding, voluntary Driver Distraction Guidelines (NHTSA Guidelines) to promote safety by discouraging the introduction of excessively distracting devices in vehicles.

This notice announces the issuance of the final version of the first phase of the NHTSA Guidelines. This first phase applies to original equipment (OE) in-vehicle electronic devices used by the driver to perform secondary tasks (communications, entertainment, information gathering, navigation tasks, etc. are considered secondary tasks) 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).

The NHTSA 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 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.

FOR FURTHER INFORMATION CONTACT: For technical issues, you may contact Dr. W. Riley Garrott, Vehicle Research and Test Center, phone: (937) 666–3312, facsimile: (937) 666–3590. Dr. Garrott's mailing address is: National Highway Traffic Safety Administration, Vehicle Research and Test Center, P.O. Box B–37, East Liberty, OH 43319.

SUPPLEMENTARY INFORMATION: This final version of the first phase of the NHTSA Guidelines does not have the force and effect of law and is not a regulation. These Guidelines will not be published in the Code of Federal Regulations but will be posted on NHTSA's Web site, *www.nhtsa.gov,* and on DOT's distracted driving Web site Distraction.gov.

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I. Executive Summary

A. The Problem of Driver Distraction and Related Research

The term ''driver distraction,'' as used in these guidelines, refers to a specific type of inattention that occurs when drivers divert their attention away from the driving task to focus on another activity. In general, distractions derive from a variety of sources including electronic devices, such as navigation systems and cell phones, as well as conventional distractions such as sights or events external to the vehicle, interacting with passengers, and eating. These distracting tasks can affect drivers in different ways, and can be categorized into the following types:

- Visual distraction: Tasks that require the driver to look away from the roadway to visually obtain information.
- Manual distraction: Tasks that require the driver to take a hand off the steering wheel and manipulate a device.
- Cognitive distraction: Tasks that require the driver to avert their mental attention away from the driving task.

Tasks can involve one, two, or all three of these distraction types.

The impact of distraction on driving is determined from multiple criteria: the type and level of distraction, the frequency and duration of task performance, and the degree of demand associated with a task. Even if performing a task results in a low level of distraction, a driver who engages in it frequently, or for long durations, may increase the crash risk to a level comparable to that of a more difficult task performed less often.

NHTSA is concerned about the effects of driver distraction on motor vehicle safety. Crash data show that 17 percent (an estimated 899,000) of all police-reported crashes involved some type of driver distraction in 2010. Of those 899,000 crashes, distraction by a device or control integral to the vehicle was reported in 26,000 crashes (3% of the distraction-related police-reported crashes).

For a number of years, NHTSA has been conducting research to better understand how driver distraction impacts driving performance and safety. This research has involved original equipment (OE) and portable devices, various task types, and both visual-manual and auditory-vocal tasks (i.e., tasks that use voice inputs and provide auditory feedback). Additionally, both NHTSA and the Federal Motor Carrier Safety Administration (FMCSA) have sponsored analyses focused on distracted driving using data from naturalistic driving studies performed by the Virginia Tech Transportation Institute (VTTI).

The automobile industry and academic researchers in Europe, Japan, and the United States have all conducted valuable research that has increased the available knowledge regarding driver distraction and its effects on safety. The results of this work are summarized in various sets of guidelines that minimize the potential for driver distraction during visual-manual interactions while driving. NHTSA has drawn heavily upon these existing guidelines in the development of its visual-manual Driver Distraction Guidelines for OE in-vehicle devices.

B. NHTSA's Driver Distraction Program

In June 2012, NHTSA released a ''Blueprint for Ending Distracted Driving'' [1] 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'' [2] which was released in April 2010.

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. These guidelines will be developed in three phases. The first phase will cover visual-manual interfaces of electronic devices installed in vehicles as original equipment. The second phase will include visual-manual interfaces of

[1] ''Blueprint for Ending Distracted Driving,'' DOT HS 811 629, June 2012. Accessed at: *http://www.distraction.gov/download/campaign-materials/8747-811629-060712-v5-Opt1-Web-tag.pdf.*

[2] ''Overview of the National Highway Traffic Safety Administration's Driver Distraction Program,'' DOT HS 811 299, April 2010. Accessed at *http://www.nhtsa.gov/staticfiles/nti/distracted_driving/pdf/811299.pdf.*

portable and aftermarket devices. The third phase will expand these guidelines to include auditory-vocal interfaces.

C. The Visual-Manual NHTSA Guidelines for In-Vehicle Electronic Devices

This notice announces the issuance of the Phase 1 NHTSA Driver Distraction Guidelines. The first phase covers OE in-vehicle 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).

To facilitate the development of these guidelines, NHTSA studied the various existing guidelines relating to driver distraction prevention and reduction and found the ''Statement of Principles, Criteria and Verification Procedures on Driver-Interactions with Advanced In-Vehicle Information and Communication Systems'' developed by the Alliance of Automobile Manufacturers (Alliance Guidelines [3]) to be the most complete and up-to-date. The Alliance Guidelines provided valuable input in current NHTSA efforts to address driver distraction issues. Although NHTSA drew heavily on that input in developing the NHTSA Guidelines, the agency identified a number of aspects that could be improved upon in order to further enhance driving safety, enhance guideline usability, improve implementation consistency, and incorporate the latest driver distraction research findings.

NHTSA issued an Initial Notice [4] proposing these Guidelines and soliciting comments on them that was published on February 24, 2012.

Since light vehicles comprise the vast majority of the vehicle fleet, NHTSA focused its distraction research on this type of vehicle, instead of heavy trucks, medium trucks, motorcoaches, or motorcycles. Therefore, the NHTSA Guidelines are only applicable to light vehicles, i.e., passenger cars, multipurpose passenger vehicles, and trucks and buses with a Gross Vehicle Weight Rating (GVWR) of not more than 10,000 pounds. However, the NHTSA Guidelines do not cover vehicles used for emergency purposes (e.g., law enforcement). While much of what NHTSA has learned about light vehicle driver distraction undoubtedly applies to vehicle types other than light vehicles, additional work would be necessary to assess whether all aspects of the NHTSA Guidelines could be applicable to those vehicle types.

The NHTSA Guidelines are based upon a number of fundamental principles. These principles include:

• The driver's eyes should usually be looking at the road ahead,

• The driver should be able to keep at least one hand on the steering wheel while performing a secondary task (both driving-related and non-driving related),

• The distraction induced by any secondary task performed while driving should not exceed that associated with a baseline reference task (manual radio tuning),

• Any task performed by a driver should be interruptible at any time,

• The driver, not the system/device, should control the pace of task interactions, and

• Displays should be easy for the driver to see and content presented should be easily discernible.

The NHTSA Guidelines include several approaches to limit potential driver distraction associated with visual-manual tasks.

The NHTSA Guidelines list certain secondary tasks believed by the agency to interfere inherently with a driver's ability to safely control the vehicle. These include activities that are discouraged by public policy and, in some instances, prohibited by Federal regulation and State law (e.g., entering or displaying text messages), activities identified in industry driver distraction guidelines which NHTSA agrees are likely to distract drivers significantly (e.g., displaying video or automatically scrolling text), and activities that are extremely likely to be distracting due to their very purpose of attracting visual attention but whose obvious potential for distraction cannot be measured using a task timing system because the activity could continue indefinitely (displaying video or certain images). The NHTSA Guidelines refer to these activities as ''per se lock outs.'' The NHTSA Guidelines recommend that in-vehicle devices be designed so that they cannot be used by the driver to perform these inherently distracting activities while driving. The list of activities considered to inherently interfere with a driver's ability to safely operate the vehicle include:

• Displaying video not related to driving;

• displaying certain graphical or photographic images;

• displaying automatically scrolling text;

• manual text entry for the purpose of text-based messaging, other communication, or internet browsing; and

• displaying text for reading from books, periodical publications, Web page content, social media content, text-based advertising and marketing, or text-based messages.

These recommendations are not intended to prevent the display of images related to driving such as simple, two-dimensional map displays for the purpose of navigation and images for the purpose of aiding a driver in viewing blind areas around a vehicle, as long as they are displayed in a safe manner. These recommendations are also not intended to prevent the display of internationally standardized symbols and icons, Trademark™ and Registered® symbols (such as company logos), or images intended to aid a driver in making a selection in the context of a non-driving-related task, provided that the images extinguish automatically upon completion of the task.

For all other visual-manual secondary tasks, the NHTSA Guidelines specify two test methods for measuring the impact of performing a task on driving safety and time-based acceptance criteria for assessing whether a task interferes too much with driver attention to be suitable for performance while driving. If a task does not meet the acceptance criteria, the NHTSA Guidelines recommend that OE in-vehicle devices be designed so that the task cannot be performed by the driver while driving. Both of these test methods focus on the amount of visual attention necessary to complete a task because existing research on visual-manual distraction establishes a link between visual attention (eyes off the road) and crash risk.[5] Although NHTSA considered other distraction metrics and alternative protocols for assessing visual-manual distraction and discussed these in the Initial Notice (e.g., driving performance metrics like lane keeping) none of these other metrics has an established link to crash risk, and, accordingly, NHTSA has not included the alternative test methods in these Guidelines.

The first recommended test method measures the amount of time that the

[3] 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 version, Alliance of Automobile Manufacturers, Washington, DC.

[4] Notice of Proposed Federal Guidelines, Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices, 77 FR 11200 (Feb. 24, 2012).

[5] Klauer, S.G., Dingus, T.A., Neale, V.L., Sudweeks, J.D., and Ramsey, D.J., ''The Impact of Driver Inattention on Near-Crash/Crash Risk: An Analysis Using the 100-Car Naturalistic Driving Study Data,'' DOT HS 810 594, April 2006.

driver's eyes are drawn away from the roadway during the performance of the task. The NHTSA Guidelines recommend that devices be designed so that tasks can be completed by the driver while driving with glances away from the roadway of 2 seconds or less and a cumulative time spent glancing away from the roadway of 12 seconds or less. The second test method uses a visual occlusion technique to ensure that a driver can complete a task in a series of 1.5-second glances with a cumulative time of not more than 12 seconds.

In addition to identifying inherently distracting tasks and providing a means to measure and evaluate the level of distraction associated with other secondary tasks, the NHTSA Guidelines contain other recommendations for in-vehicle devices designed to limit and reduce their potential for distraction. 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.

The NHTSA Guidelines cover any OE electronic device that the driver can easily see and/or reach, even if intended for use solely by passengers. However, the NHTSA Guidelines do not cover any device that is located fully behind the front seat of the vehicle or any front-seat device that cannot readily be reached or seen by the driver.

NHTSA has opted to pursue nonbinding, voluntary guidelines rather than a mandatory Federal Motor Vehicle Safety Standard (FMVSS). NHTSA explained in the Initial Notice that voluntary guidelines are appropriate at this time because of the need for additional research on distraction and its effects on driving and because of the rapid pace of technology changes in the area of in-vehicle electronic devices. The agency also noted concerns with the sufficiency of existing data to estimate the benefits of an in-vehicle electronic device regulation and that driver distraction testing involves drivers with inherent individual differences. These individual differences present new challenges to NHTSA in terms of developing repeatable, objective test procedures to determine conformance. After carefully considering all of the comments, NHTSA continues to believe that voluntary guidelines are the appropriate action to take at this time in order to reduce the potential for driver distraction.

Since these voluntary NHTSA Guidelines are not a FMVSS, NHTSA's normal enforcement procedures are not applicable. As part of its continuing research effort on distracted driving, NHTSA does intend to monitor manufacturers' voluntary adoption of these NHTSA Guidelines.

Major Differences Between the Proposed and Final Phase 1 NHTSA Guidelines

NHTSA received comments from a total of 83 entities in response to its Initial Notice proposing Phase 1 of its Driver Distraction Guidelines. In response to the comments received, NHTSA has made numerous changes, both substantive and editorial, to its Guidelines. The more substantial changes include:

- Clarification that the NHTSA Guidelines apply both to some driving-related secondary tasks and to all non-driving-related secondary tasks performed using an original equipment electronic system or device.
- The NHTSA Guidelines are not applicable to any vehicle that is manufactured primarily for one of the following uses: ambulance, firefighting, law enforcement, military, or other emergency uses.
- Numerous changes have been made to the recommended per se lock outs.
  - The character-based limit for manual text entry has been replaced by a recommendation against any amount of manual text entry by the driver for the purpose of text-based messaging, other communication, or internet browsing.
  - The character-based limit for displaying text to be read has been replaced by a recommendation against displaying any amount of text for reading from books, periodical publications, Web page content, social media content, text-based advertising and marketing, or text-based messages. The display of limited amounts of other types of text during a testable task is acceptable with the maximum amount of text that should be displayed during a single task determined by the task acceptance tests.
  - The statement is explicitly made that the display of dynamic and static maps and/or location information in a two-dimensional format, with or without perspective, for the purpose of providing navigational information or driving directions when requested by the driver is acceptable. However, the display of informational detail not critical to navigation, such as photorealistic images, satellite images, or three-dimensional images is not recommended.
  - The language for the per se lock out of display of graphical and photographic images has been revised to permit images displayed for the purpose of aiding a driver to efficiently make a selection in the context of a non-driving-related task if the image automatically extinguishes from the display upon completion of the task.
  - A recommendation has been added that the display of visual images of the area directly behind a vehicle intended to aid a driver in performing a maneuver in which the vehicle's transmission is in reverse gear (including hitching a trailer) is acceptable, subject to certain conditions.
- A recommendation has been added that every electronic device not essential to the driving task or the safe operation of the vehicle should provide a means by which the device can be turned off or otherwise disabled.
- Task acceptance tests except for Eye Glance Measurement Using a Driving Simulator and Occlusion Testing have been removed from the Guidelines.
- The method for determining the maximum display downward angle has been amended to allow any of the following versions of SAE J941 to be used to determine the driver's eye point: SAE J941 (June 1992), SAE J941 (June 1997), SAE J941 (September 2002), SAE J941 (October 2008), or SAE J941 (March 2010).
- Several definitions have been added and numerous ones modified to improve the clarity of the Guidelines.
- The device response time recommendation has been modified to better match the Alliance Guidelines' recommendation.
- Numerous changes to the driving simulator recommendations and recommended driving simulator scenario used for one of the task acceptance test protocols were made in response to comments.
- In response to comments and NHTSA's recent research indicating that the relationship between the total eyes off road time (TEORT) to complete a task and the total shutter open time (TSOT) to complete a task using the visual occlusion technique is near 1:1, the acceptance criteria have been amended. The TSOT criterion has been changed from 9 seconds to 12 seconds so that it is consistent with the 12-second TEORT criterion.
- The recommendations for acceptance test participant selection criteria have been revised to reflect that participants need only drive a minimum of 3,000 miles per year and do not

necessarily need to be comfortable communicating via text messages.

In response to comments, NHTSA has also addressed issues raised by commenters including:

- NHTSA intends to issue its Phase 2 Driver Distraction Guidelines as soon as feasible. The Phase 2 Guidelines will be based on general principles similar to those upon which these Phase 1 Guidelines are based. These principles are:
  - The driver's eyes should usually be looking at the road ahead,
  - The driver should be able to keep at least one hand on the steering wheel,
  - Any task performed by driving should be interruptible at any time,
  - The driver should control the human-machine interface and not vice versa, and
  - Displays should be easy for the driver to see.

Until such time as the Phase 2 Guidelines are issued, the agency recommends that developers and manufacturers of portable and aftermarket devices consider these principles as they design and update their products. NHTSA further encourages these developers and manufacturers to adopt any recommendations in the Phase 1 Guidelines that they believe are feasible and appropriate for their devices. However, NHTSA understands that implementation of some recommendations may require development of a means to distinguish whether the driver or front-seat passenger is performing a task.

- NHTSA intends to issue Driver Distraction Guidelines (Phase 3) for auditory-vocal human-machine interfaces as soon as possible after the necessary research has been completed.
- NHTSA will also continue to collect information on driver distraction and to conduct research, and NHTSA's Guidelines will be updated as needed in response to new information. NHTSA will also clarify the meaning of its Guidelines in response to questions that are asked through the issuance of Guideline Interpretation letters and has described the procedure for obtaining these letters.
- Since these voluntary proposed NHTSA Guidelines are not a FMVSS, NHTSA's normal enforcement procedures are not applicable. NHTSA Vehicle Safety Research will perform future monitoring to assess which vehicle make/models conform to these Phase 1 Guidelines.
- NHTSA believes that it is feasible for manufacturers to make the necessary changes to implement these Guidelines for existing vehicle models that undergo major revisions beginning three or more years from today's date. This three-year time frame is an increase from the two-year time frame stated in the Initial Notice because the agency recognizes that instrument panel and console design changes occur early in the revision cycle and these systems may already have been designed for vehicles undergoing revisions in two years. Likewise, NHTSA believes it should be feasible for new vehicle models entering the market in three or more years (again, an increase from the two or more years stated in the Initial Notice) from today's date to meet the NHTSA Guidelines. For existing vehicle models that do not undergo major revisions, NHTSA is not suggesting that the recommendations of these Guidelines would be met.

NHTSA expects the main effect from these Guidelines to be better-designed OE in-vehicle electronic device human-machine interfaces that do not create an unreasonable level of driver distraction when used by a driver to perform visual-manual secondary tasks. While voluntary and nonbinding, the NHTSA Guidelines are meant to discourage the introduction of both inherently distracting secondary tasks and tasks that do not meet the acceptance criteria when tested using the test methods contained in the Guidelines.

II. Background

A. Acronyms Used in Document

AAM Alliance of Automobile Manufacturers
Alliance Alliance of Automobile Manufacturers
BM Benchmark
CAMP Crash Avoidance Metrics Partnership
CD Compact Disc
CDS Crashworthiness Data System
CU Consumers Union
DFD Dynamic Following and Detection
DFT Driver Focus-Telematics
DRL Daytime Running Lights
DOT Department of Transportation
DS–BM Driving Test Protocol
DS–FC Driving Test Protocol with Fixed Acceptance Criteria
DVI Driver-Vehicle Interface
DWM Driver Workload Metric
EGDS Eye Glance Testing Using a Driving Simulator
EO Executive Order
EORT Eyes-Off-Road Time
FARS Fatality Analysis Reporting System
FMCSA Federal Motor Carrier Safety Administration
FMCSR Federal Motor Carrier Safety Regulation
FMVSS Federal Motor Vehicle Safety Standard
FR Federal Register
GES General Estimates System (NASS–GES)
GVWR Gross Vehicle Weight Rating
HMI Human-Machine Interface
HVAC Heating, Ventilation, and Air Conditioning
ISO International Organization for Standardization
JAMA Japanese Automobile Manufacturers Association
KLM Keystroke, Level Model
LCT Lane Change Test
MAP–21 Motor Vehicle and Highway Safety Improvement Act of 2012
MEMA Motor & Equipment Manufacturers Association
MGD Mean Glance Duration
mph Miles per hour
NADS National Advanced Driving Simulator
NAFA National Association of Fleet Administrators
NASS National Automotive Sampling System
NCAP New Car Assessment Program
NHTSA National Highway Traffic Safety Administration
NMVCCS National Motor Vehicle Crash Causation Survey
NSC National Safety Council
NTSB National Transportation Safety Board
NTTAA National Technology Transfer and Advancement Act
OE Original Equipment
OEM Original Equipment Manufacturer
PAD Portable or Aftermarket Device
PDT Peripheral Detection Task
SAE Society of Automotive Engineers
SHRP2 Strategic Highway Research Program 2
SUV Sport Utility Vehicle
TEORT Total Eyes-Off-Road Time
TGT Total Glance Time to Task
TLC Time to Line Crossing
TSOT Total Shutter Open Time
VRTC Vehicle Research and Test Center
VTI Swedish National Road and Transport Institute
VTTI Virginia Tech Transportation Institute

B. The Driver Distraction Safety Problem

The term ''driver distraction,'' as used in this notice, is a specific type of inattention that occurs when drivers divert their attention away from the driving task to focus on another activity. These distractions can come from electronic devices, such as navigation systems and cell phones, more conventional activities such as sights or events external to the vehicle, interacting with passengers, and/or eating. These distracting tasks can affect drivers in different ways, and can be categorized into the following types:

- Visual distraction: Tasks that require the driver to look away from the roadway to visually obtain information;
- Manual distraction: Tasks that require the driver to take one or both

hands off the steering wheel to manipulate a control, device, or other non-driving-related item;

• Cognitive distraction: Tasks that require the driver to avert their mental attention away from the driving task.

Tasks can involve one, two, or all three of these distraction types.

The impact of distraction on driving is determined from multiple criteria; the type and level of distraction, the frequency and duration of task performance, and the degree of demand associated with a task. Even if performing a task results in a low level of distraction, a driver who engages in it frequently, or for long durations, may increase the crash risk to a level comparable to that of a more difficult task performed less often.

Hundreds of studies have been conducted on the topic of driver distraction over the past several decades, starting as early as the 1960s. The recent edited book by Regan, Lee, and Young (2009) [6] provides a comprehensive treatment of the range of issues relating to distraction, including theoretical foundations, crash risk, effects on driver performance, exposure, measurement methods, and mitigation strategies. A sample of these papers may be found at *www.distraction.gov.* NHTSA recognizes this large body of research and the important contributions it makes to better understanding the impacts of distraction on crash risk and driving performance. However, because NHTSA is an agency driven first and foremost by the goal of reducing the frequency and severity of crashes, the agency's focus has been on research and test procedures that measure aspects of driver performance that have the strongest connection to crash risk. Accordingly, the research noted below provides a brief overview of the distraction safety problem as manifested in crashes and the relationship between distraction and crash risk.

NHTSA data on distracted driving-related crashes and the resulting numbers of injured people and fatalities is derived from the Fatality Analysis Reporting System (FARS) [7] and the National Automotive Sampling System (NASS) General Estimates System (GES).[8]

The most recent data available, 2010 data, show that 899,000 motor vehicle crashes involved a report of a distracted driver (17 percent of all police-reported crashes: fatal, injury-only, and property-damage-only). As seen in Table 1, the percentage of all police-reported crashes that involve distraction has remained consistent over the past five years. On average, these distraction-related crashes lead to thousands of fatalities (3,092 fatalities or 9.4 percent of those killed in 2010) and injuries to over 400,000 people each year (approximately 17 percent of annual injuries).

TABLE 1—POLICE REPORTED CRASHES AND CRASHES INVOLVING DISTRACTION, 2006–2010 (GES)

Year	Number of Police-Reported Crashes	Police-Reported Crashes Involving a Distracted Driver	Police-Reported Crashes Involving a Distracted Driver Using an Integrated Control/Device *	Police-Reported Crashes Involving a Distracted Driver Using an Electronic Device *
2006	5,964,000	1,019,000 (17%)	18,000 (2%)	24,000 (2%)
2007	6,016,000	1,001,000 (17%)	23,000 (2%)	48,000 (5%)
2008	5,801,000	967,000 (17%)	21,000 (2%)	48,000 (5%)
2009	5,498,000	957,000 (17%)	22,000 (2%)	46,000 (5%)
2010	5,409,000	899,000 (17%)	26,000 (3%)	47,000 (5%)

* The categories for Integrated Control/Device and Electronic Device are not mutually exclusive. Therefore the data *cannot* be added or combined in any manner.

Of the 899,000 distraction-related crashes, 26,000 (3%) specifically stated that the driver was distracted while adjusting or using an integrated device/control. From a different viewpoint, of those 899,000 crashes, 47,000 (5%) specifically stated that the driver was distracted by a cell phone (no differentiation between portable and integrated cell phones). It should be noted that these two classifications are not mutually exclusive, as a driver distracted by the integrated device/control may have also been on the phone at the time of the crash and thus the crash may appear in both categories. While all electronic devices are of interest, the current coding of the crash data does not differentiate between electronic devices other than cell phones.

Identification of specific driver activities and behaviors that serve as the distraction has presented challenges, both within NHTSA's data collection and on police accident reports. Therefore, a large portion of the crashes that are reported to involve distraction do not have a specific behavior or activity listed; rather they specify *other distraction* or *distraction unknown.* One could reasonably assume that some portion of those crashes involve a portable, aftermarket, or original equipment electronic device. This would increase the numbers and percentages of distraction-related crashes involving integrated controls/devices or electronic devices (columns four and five of Table 1).

1. Estimation of Distraction Crash Risk Via Naturalistic Driving Studies

One approach to estimating the driving risks due to various types of distraction is naturalistic driving studies. As noted earlier, NHTSA's focus in developing these visual-manual guidelines has been on data and measures that most closely link to crash risk. Naturalistic data collection is currently the best method available for determining the crash risks associated with distracted driving because it combines two key data sources for estimating crash risk: Crash data and direct observation of drivers to link

[6] Regan, M.A., Lee, J.D., & Young, K. (Eds.), Driver distraction: Theory, effects, and mitigation, Boca Raton, FL: CRC Press (2009).

[7] FARS is a census of all fatal crashes that occur on the roadways of the United States of America. It contains data on all fatal crashes occurring in all 50 states as well as the District of Columbia and Puerto Rico.

[8] NASS GES contains data from a nationally-representative sample of police-reported crashes. It contains data on police-reported crashes of all levels of severity, including those that result in fatalities, injuries, or only property damage. National numbers of crashes calculated from NASS GES are estimates.

actual behaviors to consequent crashes and near-crashes. No other method can establish the direct association of distracting behaviors while driving under real-world, non-contrived conditions and crash risk. In naturalistic driving studies, drivers are observed in their natural environment, and, therefore, they are free to drive where they wish. Unlike commanded task testing (e.g., simulator and test-track studies), in which an experimenter instructs a test participant when to perform a task, test participants perform tasks at will in naturalistic studies. Test participants volunteer to drive a vehicle, their own or one provided to them, fitted with unobtrusive data recording instrumentation to record their driving behavior. Drivers can be observed in this manner for long periods of time, only limited by the amount of data storage available in the data recording system and the capacity of the researchers to handle the potentially large volumes of data collected. Naturalistic driving research is labor intensive to conduct. It is also lengthy in duration if crash or near-crash events are of interest, since these events are relatively rare.

For light vehicles, the NHTSA-sponsored 100-Car Naturalistic Driving Study,[9 10 11 12 13] performed by the Virginia Tech Transportation Institute (VTTI), provided information about the effects of performing various types of secondary tasks on crash/near crash risks. Secondary tasks include communication, entertainment, informational, passenger interaction, navigation, and reaching (e.g., for an object) tasks (along with many others). For the 100-Car Study, VTTI collected naturalistic driving data for 100 vehicles from January 2003 through July 2004. Each participant's vehicle was equipped with a data acquisition system including five small video cameras and sensors to measure numerous vehicle state and kinematic variables at each instant of time. The vehicles were then driven by their owners during their normal daily activities for 12 to 13 months while data were recorded. No special instructions were given to drivers as to when or where to drive and no experimenter was present in the vehicle during the driving. All of this resulted in a large data set of naturalistic driving data that contains information on 241 drivers (100 primary drivers who performed most of the driving and 141 secondary drivers who drove the instrumented vehicles for shorter periods of time) driving for almost 43,000 hours and traveling approximately 2 million miles.

Data from the 100-Car Study provides the best information currently available about the risks associated with performing a variety of secondary tasks while driving light vehicles (vehicles under 10,000 pounds GVWR). While this was a large, difficult, and expensive study to perform, it was small from an epidemiological viewpoint (100 primary drivers, 15 police-reported, and 82 total crashes, including minor collisions). Drivers from only one small portion of the country, the Northern Virginia-Washington, DC, metro area, were represented.

The 100-Car Study was deliberately designed to maximize the number of crash and near-crash events through the selection of participants with higher than average crash or near-crash risk exposure.[14] This was accomplished by selecting a larger sample of drivers below the age of 25 and by including a sample that drove more than the average number of miles.

Due to the rapid pace of technological change, some devices (e.g., smart phones) and secondary tasks of great current interest (e.g., text messaging) were not addressed by 100-Car Study data because they were not widely in use at the time.

Subsequent to the 100-Car Study, the Federal Motor Carrier Safety Administration (FMCSA) sponsored an analysis of naturalistic driving data[15] to examine the effects of driver distraction on safety for commercial motor vehicles (three or more axle trucks, tractors-semitrailers (including tankers), transit buses, and motor coaches). This analysis used data collected during two commercial motor vehicle naturalistic driving studies. Since the data analyzed was collected during two studies, this study will, hereinafter, be referred to as the ''Two Study FMCSA Analyses.''

The Two Study FMCSA Analyses combined and analyzed data from two large-scale commercial motor vehicle naturalistic driving studies: the Drowsy Driver Warning System Field Operational Test[16] and the Naturalistic Truck Driving Study.[17] The combined database contains naturalistic driving data for 203 commercial motor vehicle drivers, 7 trucking fleets, 16 fleet locations, and approximately 3 million miles of continuously-collected kinematic and video data collected over a period of three years (May 2004 through May 2007). This data set was filtered using kinematic data thresholds, along with video review and validation, to find safety-critical events (defined in this report as crashes, near-crashes, crash-relevant conflicts, and unintentional lane deviations). There were a total of 4,452 safety-critical events in the database: 21 crashes, 197 near-crashes, 3,019 crash-relevant conflicts, and 1,215 unintentional lane deviations. In addition, 19,888 time segments of baseline driving data were randomly selected for analysis.

One major source of differences in the results obtained from analyses of the 100-Car Study with those obtained from the Two Study FMCSA Analyses is the different time frames in which their data collections were performed. The 100-Car Naturalistic Driving Study data collection was from January 2003 through July 2004. The Drowsy Driver Warning System Field Operational Test collected data from May 2004 through September 2005 and the Naturalistic Truck Driving Study collected data from November 2005 through May 2007. Due to the rapid changes occurring in consumer electronics, the specific types of electronic device related distraction observed across studies, while similar, were not identical. For example, while the Two Study FMCSA Analyses found a high safety critical event risk due to

[9] Neale, V. L., Dingus, T. A., Klauer, S.G., Sudweeks, J., and Goodman, M., ''An Overview of the 100-Car Naturalistic Study and Findings,'' ESV Paper 05–0400, June 2005.

[10] Dingus, T. A., Klauer, S.G., Neale, V. L., Petersen, A., Lee, S. E., Sudweeks, J., Perez, M. A., Hankey, J., Ramsey, D., Gupta, S., Bucher, C., Doerzaph, Z. R., Jermeland, J., and Knipling, R.R., ''The 100-Car Naturalistic Driving Study, Phase II—Results of the 100-Car Field Experiment,'' DOT HS 810 593, April 2006.

[11] Klauer, S.G., Dingus, T.A., Neale, V.L., Sudweeks, J.D., and Ramsey, D.J., ''The Impact of Driver Inattention on Near-Crash/Crash Risk: An Analysis Using the 100-Car Naturalistic Driving Study Data,'' DOT HS 810 594, April 2006.

[12] Guo, F., Klauer, S.G., McGill, M.T., and Dingus, T.A., ''Task 3—Evaluating the Relationship Between Near-Crashes and Crashes: Can Near-Crashes Serve as a Surrogate Safety Metric for Crashes?'' DOT HS 811 382, September 2010.

[13] Klauer, S.G., Guo, F., Sudweeks, J.D., and Dingus, T.A., ''An Analysis of Driver Inattention Using a Case-Crossover Approach On 100-Car Data: Final Report,'' DOT HS 811 334, May 2010.

[14] Neale, V.L., Dingus, T.A., Klauer, S.G., Sudweeks, J., and Goodman, M., ''An Overview of the 100-Car Naturalistic Study and Findings,'' ESV Paper 05–0400, June 2005.

[15] Olson, R.L., Hanowski, R.J., Hickman, J.S., and Bocanegra, J., ''Driver Distraction in Commercial Vehicle Operations,'' FMCSA–RRR–09–042, September 2009.

[16] Hanowski, R.J., Blanco, M., Nakata, A., Hickman, J.S., Schaudt, W.A., Fumero, M.C., Olson, R.L., Jermeland, J., Greening, M., Holbrook, G.T., Knipling, R.R., and Madison, P., ''The Drowsy Driver Warning System Field Operational Test, Data Collection Methods,'' DOT HS 811 035, September 2008.

[17] Blanco, M., Hickman, J.S., Olson, R.L., Bocanegra, J.L., Hanowski, R.J., Nakata, A., Greening, M., Madison, P., Holbrook, G.T., and Bowman, D., ''Investigating Critical Incidents, Driver Restart Period, Sleep Quantity, and Crash Countermeasures in Commercial Vehicle Operations Using Naturalistic Data Collection,'' in press, 2008.

drivers engaging in text messaging, there was no text messaging observed during the 100-Car Study. This is because the widespread popularity of text messaging did not occur until after the 100-Car Study data collection was completed.

Other sources of differences between the results obtained from analyses of the 100-Car Study and those obtained from the Two Study FMCSA Analyses are that one of the heavy truck studies (the Drowsy Driver Warning System Field Operational Test) covered sample situations likely to produce drowsiness (e.g., long nighttime drives in uneventful conditions). In addition, both truck studies involved work situations.

2. Summary of Naturalistic Driving Study Distraction Risk Analyses

Figure 1 gives a graphical representation of some of the secondary task risk odds ratios determined from the 100-Car Study and the Two Study FMCSA Analyses. In this figure, a risk odds ratio of 1.00 (shown as ''1'' in the figure) equates to the risks associated with typical undistracted driving. Risk odds ratios above 1.00 indicate secondary tasks that increase driving risks while risk odds ratios below 1.00 indicate protective effects (i.e., performing these secondary tasks makes a crash or near-crash event less likely to occur than driving and not performing any secondary task.) This figure provides a quick, visual summary of the risks associated with performing a variety of secondary tasks while driving both light and heavy vehicles.

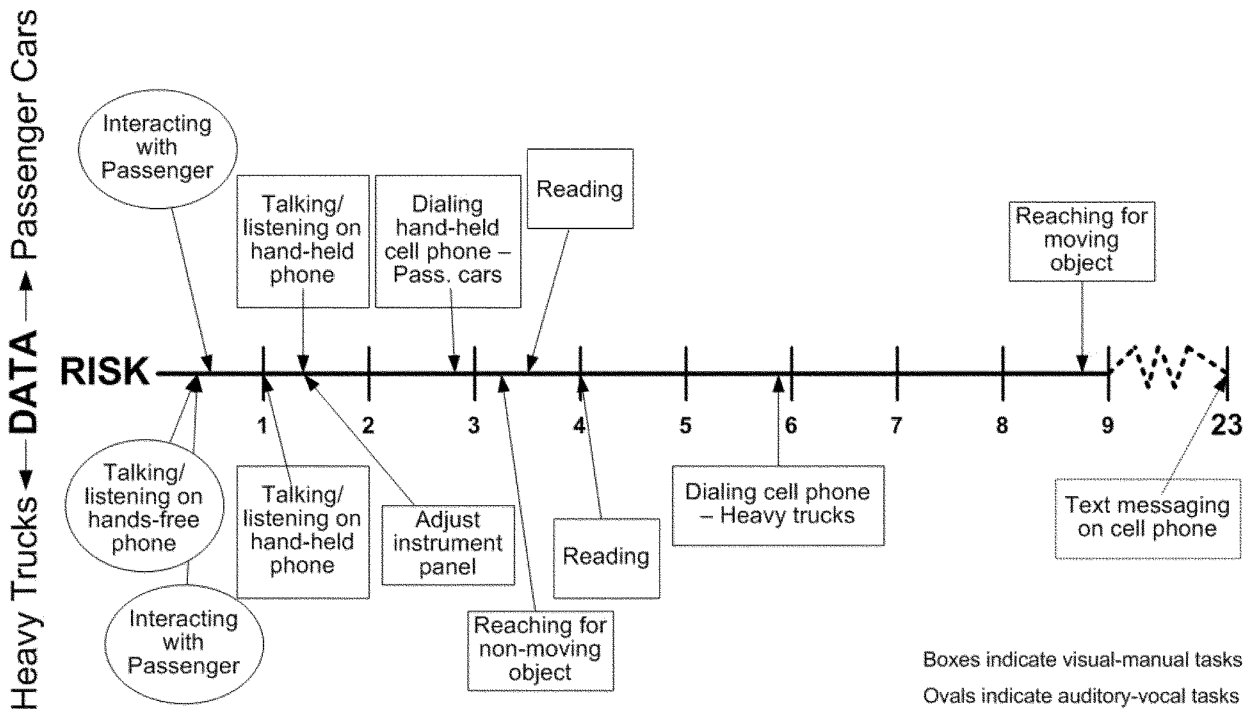

Figure 1: Risk Odds Ratios Determined by the 100-Car Study Analyses and Two Study FMCSA Analyses

The various naturalistic data study analyses established several important points about driver distraction which are directly relevant to the NHTSA Guidelines for reducing driver distraction due to device interface design:

• Secondary task performance is common while driving. They were observed during the majority (54%) of the randomly selected baseline time segments analyzed during the 100-Car Study analyses. Some secondary task performance involves the use of electronic devices; these secondary tasks are the primary focus of this document.

• Secondary task performance while driving has a broad range of risk odds ratios associated with different secondary tasks. The observed risk odds ratios range from 23.2, indicating a very large increase in crash/near-crash risk to 0.4 indicating a large protective effect. Again, a risk ratio of 1.0 means that a secondary task has the same risk as average driving; a risk ratio of 23.2 means that risk associated with performance of this secondary task is increased by 2,220 percent compared to average driving. Any value less than 1.0 indicates a situation with less risk than average driving, indicating a protective effect; a risk ratio of 0.4 means that risk associated with performance of this secondary task is reduced by 60 percent compared to average driving. This indicates that it may be possible to improve at least some secondary tasks with high risk odds ratios (i.e., risky tasks) so as to make them substantially safer to perform. The logical place to reduce crash/near-crash risk odds ratios for these secondary tasks is through improvements to their driver interface.

• Naturalistic driving research shows that the secondary tasks with the highest risk odds ratios have primarily visual-manual interactions with a relatively small cognitive component. While, every secondary task results in some cognitive load, some tasks that may not require a lot of thought, such as Reaching for a Moving Object, are towards the right side of Figure 1. The secondary tasks ''Interacting with Passenger'' and ''Talking/Listening on Hands-Free Phone'' create a low visual-manual load for the driver. Both of these secondary tasks have risk odds ratios that are statistically significantly less than 1.00 (at the 95 percent confidence level). These two secondary tasks appear to have protective effects.

Since primarily visual-manual secondary tasks have the highest risk odds ratios, and because measurement of cognitive distraction needs further research, the NHTSA Guidelines will initially only apply to the visual-manual aspects of devices' driver interfaces. Phase 3 of these NHTSA Guidelines will cover the auditory-vocal portions of device interfaces.

- Long (greater than 2.0 seconds) glances by the driver away from the forward road scene are correlated with increased crash/near-crash risk. When drivers glance away from the forward roadway for greater than 2.0 seconds out of a 6-second period, their risk of an unsafe event substantially increases relative to the baseline.

NHTSA's Comprehensive Response to Driver Distraction

NHTSA's safety mission is to ''save lives, prevent injuries, and reduce economic costs due to road traffic crashes.'' One focus of this mission is to prevent road traffic crashes for which driver distraction is a contributing factor.[18]

In June 2012, NHTSA released a ''Blueprint for Ending Distracted Driving.''[19] This is an update of the ''Overview of the National Highway Traffic Safety Administration's Driver Distraction Program,''[20] which was released in April 2010. These two documents summarize NHTSA's planned steps to ''help in its long-term goal of eliminating a specific category of crashes—those attributable to driver distraction.''[21] NHTSA's work to eliminate driver distraction-related crashes consists of four main initiatives:

1. Improve the understanding of the extent and nature of the distraction problem. This includes improving the quality of data NHTSA collects about distraction-related crashes and improving analysis techniques.
2. Reduce the driver workload associated with performing tasks using original equipment, aftermarket, and portable in-vehicle electronic devices by working to limit the visual, manual, and cognitive demand associated with secondary tasks performed using these devices. Better device interfaces will minimize the time and effort involved in a driver performing a task using the device. Minimizing the workload associated with performing secondary tasks with a device will permit drivers to maximize the attention they focus toward the primary task of driving.
3. Keep drivers safe through the introduction of crash avoidance technologies. These include the use of crash warning systems to re-focus the attention of distracted drivers as well as vehicle-initiated (i.e., automatic) braking and steering to prevent or mitigate distracted driver crashes. Research[22 23 24 25] on how to best warn distracted drivers in crash imminent situations is also supporting this initiative. NHTSA is also performing a large amount of research on forward collision avoidance and mitigation technologies such as Forward Collision Warning, Collision Imminent Braking, and Dynamic Brake Assist.
4. Educate drivers about the risks and consequences of distracted driving. This includes targeted media messages, drafting and publishing sample text-messaging laws for consideration and possible use by the states, and publishing guidance for a ban on text messaging by Federal government employees while driving.

This notice is part of NHTSA's effort to address the second of these initiatives, reducing driver workload by working to limit the visual and manual demand associated with in-vehicle electronic device interface designs. As discussed in NHTSA's Driver Distraction Program, NHTSA's intent is to ''*develop voluntary guidelines for minimizing the distraction potential of in-vehicle and portable devices.*''[26] The current notice contains voluntary NHTSA Guidelines only for OE in-vehicle electronic devices; portable and aftermarket electronic devices will be addressed by Phase 2 of the NHTSA Guidelines.

Drivers perform primary tasks to directly control the vehicle (e.g., turning the steering wheel, pressing on the accelerator and throttle pedal, and others). Primary tasks include all vehicle control tasks necessary for safe driving.

Drivers may also perform secondary tasks. Secondary tasks are performed for purposes other than direct control of the vehicle (e.g., communications, entertainment, informational, and navigation tasks among others).

Drivers may perform secondary tasks using an in-vehicle electronic device. If they do, they interact with the electronic device through its driver interface. These interfaces can be designed to accommodate interactions that are visual-manual (visual display and manual controls), auditory-vocal, or a combination of the two. Some devices may allow a driver to perform a task through either manual control manipulation with visual feedback, or through voice command with auditory feedback to the driver.

For the purposes of this document, a driver's interactions with device interfaces are described by two functional categories based on the mode of interaction: visual-manual and auditory-vocal. Visual-manual interactions involve the driver looking at a device, making inputs to the device by hand (e.g., pressing a button, rotating a knob), and/or the device providing visual feedback being provided to the driver. Auditory-vocal interactions involve the driver controlling the device functions through voice commands and receiving auditory feedback from the device. A single interface may accommodate both visual-manual and auditory-vocal interactions.

These voluntary NHTSA Guidelines apply to in-vehicle OE electronic device tasks performed by the driver through visual-manual means. The goal of these Guidelines is to discourage the implementation of tasks performed using in-vehicle electronic devices

[18] Information on NHTSA's efforts to address this problem can be found at *http://www.distraction.gov/.*

[19] ''Blueprint for Ending Distracted Driving,'' DOT HS 811 629, June 2012. Accessed at: *http://www.distraction.gov/download/campaign-materials/8747-811629-060712-v5-Opt1-Web-tag.pdf.*

[20] ''Overview of the National Highway Traffic Safety Administration's Driver Distraction Program,'' DOT HS 811 299, April 2010. Accessed at *http://www.nhtsa.gov/staticfiles/nti/distracted_driving/pdf/811299.pdf.*

[21] Ibid.

[22] Lerner, N., Jenness, J., Robinson, E., Brown, T., Baldwin, C., and Llaneras, R., ''Crash Warning Interface Metrics: Final Report,'' DOT HS 811 470a, August, 2011.

[23] Robinson, E., Lerner, N., Jenness, J., Singer, J., Huey, R., Baldwin, C., Kidd, D., Roberts, D., and Monk, C., ''Crash Warning Interface Metrics: Task 3 Final Report: Empirical Studies of Effects of DVI Variability'' DOT HS 811 470b, August, 2011.

[24] Robinson, E., Lerner, N., Jenness, J., Singer, J., Huey, R., Baldwin, C., Kidd, D., Roberts, D., and Monk, C., ''Crash Warning Interface Metrics: Task 3 Report Appendices'' DOT HS 811 470c, August, 2011.

[25] Forkenbrock, G., Snyder, A., Heitz, M., Hoover, R.L., O'Harra, B., Vasko, S., and Smith, L., ''A Test Track Protocol for Assessing Forward Collision Warning Driver-Vehicle Interface Effectiveness,'' DOT HS 811 501, July 2011.

[26] ''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,* P. 21.

unless the tasks and driver interfaces are designed to minimize driver workload when performing the tasks while driving. These Guidelines specify criteria and acceptance test protocols for assessing whether a secondary task performed using an in-vehicle electronic device may be suitable for performance while driving, due to its minimal impact on driving performance and, therefore, safety. These Guidelines also identify secondary tasks that interfere with a driver's ability to safely control the vehicle and to categorize those tasks as being unsuitable for performance by the driver while driving.

III. The February 2012 Proposed NHTSA Guidelines and Comments

A. The Initial Notice Proposing the NHTSA Guidelines

On February 24, 2012, NHTSA published in the **Federal Register**[27] an Initial Notice proposing the first phase of its voluntary Driver Distraction Guidelines. The first phase covers electronic devices installed in vehicles as original equipment (OE) 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). Because the driver distraction crash statistics discussed above showed that the types of secondary tasks correlated with the highest crash/near crash risk odds ratios primarily had visual-manual means of interaction, this first phase of guidelines focuses on visual-manual interfaces.

The goal of the Phase 1 NHTSA Guidelines is to limit potential driver distraction associated with secondary visual-manual tasks (e.g., information, navigation, communications, and entertainment) performed using OE electronic devices. In drafting the proposed NHTSA Guidelines, the agency excluded primary driving controls and displays (e.g., instrument gauges, or telltales) from the scope of the proposed NHTSA Guidelines because operating these systems is part of the primary driving task. However, NHTSA does believe that controls and displays for primary driving tasks should be designed for efficient performance of tasks and to minimize distraction. Likewise, the agency excluded collision warning or vehicle control systems designed to aid the driver in controlling the vehicle and avoiding crashes. These systems are meant to capture the driver's attention. Finally, the agency excluded heating-ventilation-air conditioning (HVAC) adjustment tasks performed through dedicated HVAC controls from the scope of the proposed NHTSA Guidelines, but notes that efficient design of such controls and displays is recommended to minimize distraction.

In developing its proposed guidelines, NHTSA studied various existing guidelines relating to driver distraction prevention and reduction and found the ''Statement of Principles, Criteria and Verification Procedures on Driver-Interactions with Advanced In-Vehicle Information and Communication Systems'' developed by the Alliance of Automobile Manufacturers (Alliance Guidelines[28]) to be the most complete and up-to-date. The Alliance Guidelines provided valuable input in current NHTSA efforts to address driver distraction issues. While NHTSA drew heavily on that input in developing the proposed NHTSA Guidelines, it incorporated a number of changes to further enhance driving safety, enhance guideline usability, improve implementation consistency, and incorporate the latest driver distraction research findings.

NHTSA focused its distraction research on light vehicles because they comprise the vast majority of the vehicle fleet, instead of heavy trucks, medium trucks, motorcoaches, or motorcycles. On this basis, the agency proposed to limit the NHTSA Guidelines to light vehicles, i.e., all passenger cars, multipurpose passenger vehicles, and trucks and buses with a Gross Vehicle Weight Rating (GVWR) of not more than 10,000 pounds. While much of what NHTSA has learned about light vehicle driver distraction may apply to other vehicle types, additional research is necessary to assess whether all aspects of the NHTSA Guidelines apply to those vehicle types.

The proposed NHTSA Guidelines were based upon a limited number of fundamental principles. These principles include:

- The driver's eyes should usually be looking at the road ahead,
- The driver should be able to keep at least one hand on the steering wheel while performing a secondary task (both driving-related and non-driving related),
- The distraction induced by any secondary task performed while driving should not exceed that associated with a baseline reference task (manual radio tuning),
- Any task performed by a driver should be interruptible at any time,
- The driver should control the pace of task interactions, not the system/device, and
- Displays should be easy for the driver to see and content presented should be easily discernible.

The proposed NHTSA Guidelines listed certain secondary tasks believed by the agency to interfere inherently with a driver's ability to safely control the vehicle. The proposed NHTSA Guidelines referred to these as tasks as ''per se lock outs.'' The proposed NHTSA Guidelines recommended that in-vehicle devices be designed so that they could not be used by the driver to perform such tasks while driving. The list of tasks considered to inherently interfere with a driver's ability to safely operate the vehicle included: displaying images or video not related to driving; displaying automatically scrolling text; manual text entry of more than six button or key presses during a single task; or reading more than 30 characters of text (not counting punctuation marks) during a single task. The proposed NHTSA Guidelines specified that these recommendations were intended to prevent the driver from engaging in tasks such as watching video footage, visual-manual text messaging, visual-manual internet browsing, or visual-manual social media browsing while driving. These recommendations were not intended to prevent the safe display of images related to driving, such as images depicting the blind area behind a vehicle.

For all other secondary visual-manual tasks, the proposed NHTSA Guidelines recommended multiple task acceptance test methods that could be used for measuring the impact of performing a task on driving safety. Acceptance criteria were proposed to assess whether a task interferes too much with driver attention to be suitable for performance while driving. If a task does not meet the acceptance criteria, the proposed NHTSA Guidelines recommended that OE in-vehicle devices be designed so that the task could not be performed by the driver while driving.

The proposed Guidelines included two test methods preferred by NHTSA for use in assessing whether a task interferes too much with driver attention. One method measured the amount of time that the driver's eyes are drawn away from the roadway during the performance of the task. Research shows that the driver looking away from the roadway is correlated with an increased risk of a crash or near-crash.

[27] ''Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices, Notice of Proposed Federal Guidelines.'' 77 FR 11200 (February 24, 2012).

[28] 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 version, Alliance of Automobile Manufacturers, Washington, DC.

The proposed NHTSA Guidelines recommended that devices be designed so that tasks could be completed by the driver while driving with: A mean eye glance duration away from the roadway of 2 seconds or less; 85 percent of eye glance durations away from the roadway being 2 seconds or less; and a cumulative time spent glancing away from the roadway of 12 seconds or less. The second proposed test method used a visual occlusion technique to ensure that a driver could complete a task in a series of 1.5-second glances with a cumulative time spent glancing away from the roadway of not more than 9 seconds.

In addition to identifying substantially distracting tasks and providing a means for measuring and evaluating the level of distraction associated with other visual-manual secondary tasks, the proposed NHTSA Guidelines contained other interface recommendations for in-vehicle electronic devices to minimize their potential for distraction. For example, the proposed NHTSA Guidelines recommended that all device functions designed to be performed by the driver through visual-manual means should require no more than one of the driver's hands to operate. Another example was the recommendation that each device's active display should be located as close as practicable to the driver's forward line of sight and included a specific recommendation for the maximum downward viewing angle to the geometric center of each display.

The agency proposed that the NHTSA Guidelines would cover any OE electronic device that the driver could easily see and/or reach (even if intended for use solely by passengers). However, the agency proposed to limit the applicability of the NHTSA Guidelines by excluding any device located fully behind the front seat of the vehicle or any front-seat device that cannot reasonably be reached or seen by the driver.

NHTSA stated in the Initial Notice that it had opted to pursue nonbinding, voluntary guidelines rather than a mandatory Federal Motor Vehicle Safety Standard (FMVSS). NHTSA explained that voluntary guidelines are appropriate at this time because additional research is needed on distraction and its effect on driving and because of the rapid pace of technology changes in the area of in-vehicle electronic devices. The agency also noted concerns with the sufficiency of existing data to estimate the benefits of an in-vehicle electronic device regulation and that driver distraction testing involves drivers with inherent individual differences. These individual differences present new challenges to NHTSA in terms of developing repeatable, objective test procedures to determine conformance.

In the Initial Notice, NHTSA sought comment on how to revise the proposed NHTSA Guidelines to improve motor vehicle safety. Because these Guidelines are voluntary and nonbinding, they will not require action of any kind, and for that reason they will not confer benefits or impose costs. Nonetheless, and as part of its continuing research efforts, NHTSA sought comments on the potential benefits and costs that would result from voluntary conformance with the draft Guidelines.

Much of the remainder of this notice analyzes and responds to comments that NHTSA received on the Initial Notice. The following subsection gives an overall summary of the comments that were received. The next section of this notice contains a detailed, issue-by-issue analysis and response to the comments on the Initial Notice.

Summary of Comments on the Proposed NHTSA Guidelines

NHTSA received comments from a total of 83 entities in response to its Initial Notice proposing Phase 1 of its Driver Distraction Guidelines. These comments came from government entities, industry associations, automotive and equipment manufacturers, consumer and safety advocacy organizations, university and research organizations, and individuals. A number of entities submitted more than one set of comments.

Government entities providing comments were:

- The National Transportation Safety Board (NTSB), and
- The Texas Department of Transportation.

Industry associations submitting comments were:

- The Alliance of Automobile Manufacturers (Alliance),
- American Insurance Association,
- Connected Vehicle Trade Association,
- The German Association of the Automotive Industry,
- Global Automakers, and
- The Motor & Equipment Manufacturers Association (MEMA).

Vehicle manufacturers submitting comments were:

- American Honda Motor Co., Inc.,
- BMW of North America, LLC,
- Chrysler Group LLC,
- Ford Motor Company,
- General Motors LLC (GM),
- Hyundai Motor Group,
- Mercedes-Benz USA, LLC,
- Nissan North America, Inc.,
- Toyota Motor North America, Inc.,
- Volkswagen Group of America,
- Volvo Car Corporation, and
- Volvo Group.

Aftermarket product manufacturers were:

- Applikompt Applied Computer Technologies Inc.,
- Agero, Inc.,
- Garmin International, Inc.,
- Global Mobile Alert Corporation,
- Gracenote,
- Lindsey Research Services,
- Monotype Imaging Inc.,
- Nuance Communications, and
- Realtime Technologies, Inc.

Organizations submitting comments were:

- The AAA,
- Advocates for Highway and Auto Safety,
- Center for Auto Safety,
- Consumers Union,
- Distracted Driving Safety Alliance,
- Focus Driven Advocates for Cell Free Driving,
- Highway Safety and Technology,
- Insurance Institute for Highway Safety (IIHS),
- The International Organization for Standardization (ISO),
- The NAFA Fleet Management Association, and
- The National Safety Council.

University or Research Organizations commenting were:

- The Institute of Ergonomics (Germany),
- The National Advanced Driving Simulator (NADS) of the University of Iowa,
- The Swedish National Road and Transport Research Institute (VTI), and
- Wayne State University.

In addition, 39 individuals commented on the proposed Guidelines.

Comments were grouped into the 12 general areas listed below. The comments for nine general areas were further subdivided into individual issues. This resulted in a total of the following 51 individual issues:

- General Issues
  - NHTSA Should Issue a FMVSS Instead of Guidelines
  - The Alliance Guidelines Adequately Address Distraction
  - Suggestions to Wait for Better Data or Additional Research to be Completed
  - Suggestions for Using Voluntary Consensus Standards as a Basis for Developing NHTSA's Guidelines
  - NHTSA Should Publish the Phase 2 Guidelines Applicable to Portable and Aftermarket Devices as Soon as Possible
  - NHTSA Should Develop the Phase 3 Guidelines to Address Cognitive Distraction and Voice Interfaces as Soon as Possible

◦ NHTSA's Intentions for Future Updating of its Guidelines
◦ Concerns about NHTSA's Apparent Reliance on Limited Amount of Research in Developing NHTSA's Guidelines
◦ Concerns that Updating Vehicle Models To Meet the NHTSA Guidelines will be Expensive
◦ Concerns About the NHTSA Guidelines Preventing ''911'' Emergency Calls
◦ Concerns About the NHTSA Guidelines Preventing Passenger Use of Electronic Devices
◦ Comments on Daytime Running Lights as a Major Cause of Driver Distraction
• Issues Specific to the NHTSA Guidelines Stated Purpose
◦ Concern That Failure to Meet the NHTSA Guidelines Could Result in Enforcement Action
◦ NHTSA's Monitoring of Vehicles' Conformance to its Guidelines
◦ Questions on Whether Automakers have to Perform Testing as Described in the NHTSA Guidelines?
◦ Lead Time for the NHTSA Guidelines
• Issues Relating to the Scope of the NHTSA Guidelines
◦ Inclusion of Conventional Electronic Devices and Heating, Ventilation, and Air Conditioning in Scope of the NHTSA Guidelines
◦ Confusion About Limiting Scope of NHTSA Guidelines to Non-Driving Activities
◦ Suggestions to Expand Scope of the NHTSA Guidelines to Cover Medium and Heavy Trucks and Buses
◦ Request That Scope of the NHTSA Guidelines Exclude Emergency Response Vehicles
◦ Request That Scope of the NHTSA Guidelines Not Include Displays Required by Other Government Bodies
• Definition of Driving and Lock Out Conditions
◦ Automatic Transmission Vehicles—In Park Versus At or Above 5 mph
◦ Definition of Driving for Manual Transmission Vehicles
• Comments About Per Se Lock Out of Devices, Functions, and/or Tasks
◦ The NHTSA Guidelines Should Not Recommend Per Se Lock Outs of Devices, Functions, and/or Tasks
◦ Per Se Lock Out Relating to Reading
◦ Per Se Lock Out of Manual Text Entry
◦ Per Se Lock Out of Static Graphical and Photographic Images
◦ Per Se Lock Out of Displaying Video Images—Dynamic Maps
◦ Per Se Lock Out of Displaying Video—Trailer Hitching
◦ Per Se Lock Out of Automatically Scrolling Lists and Text
◦ Requests for Clarification on the Acceptability of Technology That Allows the Driver and Passenger To See Different Content from Same Visual Display
• Task Acceptance Test Protocol Issues
◦ Suggestions for Other Acceptance Test Protocols
◦ Concerns About the Use of Radio Tuning as Reference Task
◦ NHTSA Has Not Shown That Tasks With TEORTs Longer Than 12 Seconds are Less Safe
◦ Suggestions for More Stringent Task Acceptance Criteria
◦ Concerns Expressed About Long Eye Glances
◦ Eye Glance Measurement Issues
◦ Occlusion Acceptance Test Criteria Issues
◦ Suggestions to Include Effects of Workload Managers in Task Acceptance Criteria
• Definition of Goal, Dependent Task, and Subtask
• Driving Simulator Issues
◦ Driving Simulator Specifications
◦ Suggestions to Improve the Driving Scenario
• Test Participant Issues
◦ Test Participant Demographics
◦ Test Participant Impartiality
◦ Other Test Participant Qualifications
◦ Test Participant Instructions, Training, and Practice
• Device Response Time Recommendations
• Downward Viewing Angle Issues
• Miscellaneous Issues
◦ Concerns About Recommendation That Drivers Should Have One Free Hand
◦ Concerns About Device Sound Level Control Recommendations
◦ Suggestion That the NHTSA Guidelines Should Recommend That All Devices can be Disabled

The concerns and suggestions raised by commenters for all of these issues have been addressed in the following portions of this notice.

IV. Analysis of Proposal Comments by Issues

A. General Issues

1. NHTSA Should Issue a FMVSS Instead of Guidelines

a. Summary of Comments

Numerous comments focused on NHTSA's decision to promulgate voluntary guidelines rather than a regulation or to take no action at all. Voluntary guidelines were supported by motor vehicle manufacturers and suppliers; regulations were supported by safety advocacy groups; and the preference for no action was supported by multiple individuals.

Support for promulgating voluntary guidelines was indicated by the majority of commenters. The following quote from the Motor & Equipment Manufacturers Association (MEMA) comments illustrates the position of those supporting voluntary guidelines:

> MEMA agrees with the NHTSA approach to propose non-binding, voluntary guidelines—as opposed to regulations—because of the expedited technology growth in this sector as well as the need and desire for more research and data.[29]

Support for promulgating a Federal Motor Vehicle Safety Standard (FMVSS) on driver distraction was indicated by: Advocates for Highway and Auto Safety (Advocates), Center for Auto Safety, and Focus Driven Advocates for Cell Free Driving.

Detailed comments responding to points made by NHTSA rationalizing the appropriateness of voluntary guidelines were submitted by Advocates. In response to NHTSA's point that this is an area in which learning continues, and at this time, continued research is both necessary and important, Advocates said:

> Advocates concurs that continued research and learning is always necessary with any regulation and new technology, both prior to and after implementation, to ensure that the regulation meets the needs of the motoring public and safety. However, convincing and compelling research has already been conducted on the subject of distracted driving. The research, cited in this and other related notices regarding distractions due to electronic devices in motor vehicles, shows that distracted driving has an increased association with visual distractions that divert driver vision from the road, manual distractions that reduce the physical ability of drivers to control the vehicle, and cognitive distractions that reduce attention and mental focus to the driving task.[30] By their very nature these types of distractions interfere with or reduce the ability of the driver to operate a vehicle safely and warrant regulation.[31]

[29] Comments received from the Motor & Equipment Manufacturers Association, pp. 1–2. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0091.

[30] Federal Motor Carrier Safety Administration Final Rule, Limiting the Use of Wireless Communication Devices, 75 FR 59118, 59120–121 (Sept. 27, 2010) (''In work involving equipment such as vehicles, one distraction classification system includes three categories: visual (taking one's eyes off the road), physical (taking one's hands off the wheel), and cognitive (thinking about something other than the road/driving).)''

[31] Comments received from the Advocates for Highway and Auto Safety, p. 6. Accessed at

Continued

In response to NHTSA's point that technology is changing rapidly and a static rule put in place at this time may face unforeseen problems and issues as new technologies are developed and introduced, Advocates said:

> Technology is constantly changing, in every aspect of safety, but that cannot be used as an excuse to avoid establishing minimum levels of safe operation for motor vehicles. The fact that future technological advances are likely should not prevent the need for minimum safety requirements. NHTSA has clearly identified the problem as distraction from the driving task, a safety problem that is independent of the specific distracting technology. While future technologies may involve different levels of driver distraction, the problem of driver focus being diverted from the task of operating a motor vehicle safely remains a constant. It makes no sense to avoid regulating current technologies that are overly distracting because future developments may present additional technological distractions. Assuming that the NHTSA guidelines embody the proper limitations on secondary tasks, they could apply to future as well as current technologies. Moreover, establishing regulations that prohibit the installation of new devices unless research clearly indicates that the device does not impair a driver's ability to operate a motor vehicle safely would apply equally to all new electronic devices regardless of technology.[32]

In response to NHTSA's point that available data are not sufficient at this time to permit accurate estimation of the benefits and costs of a mandatory rule in this area, Advocates said:

> Finally, the agency cites the limitation of data to accurately estimate the benefits and costs of a mandatory rule in this area. However, the agency indicates that ''17 percent (an estimated 899,000) of all police reported crashes involved some type of driver distraction in 2010. Of those 899,000 crashes, distraction by a device/control integral to the vehicle was reported in 26,000 crashes (3% of the distraction-related police reported crashes).'' By that account, a police-reported distracted driving crash occurs every 20 minutes involving a device/control integral to the vehicle. Furthermore, this is likely a conservative estimate of distraction-related collisions given the current difficulties in identifying distraction as a cause in crashes, the ability of law enforcement to discern distraction from in-vehicle devices for inclusion on police accident reports and the recording capability of current crash databases. * * * [G]iven the significant volume of crashes already recognized as linked to distraction, time spent waiting for new data amounts to unacceptable delay while people are needlessly injured or killed in these very preventable collisions.[33]

www.regulations.gov, Docket NHTSA–2010–0053, Document Number 0069.

[32] Ibid, p. 7.

[33] Ibid, p. 8.

Advocates further commented that the organization did not believe that significant effort would be required to arrive at an estimate of benefits.

Support for the ''take no action at all on driver distraction'' position on driver distraction was indicated by multiple individual commenters. Typical of this position is the following quote from a comment from an individual:

> I understand the need for regulations and appreciate that our government is trying to keep us safer, however, I also resent that our government has invaded every aspect of our lives to a ridiculous degree. This proposal, Docket No. NHTSA–2010–0053 Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices is another example of taking things too far. Immediate communications in today's society has become a necessity and instead of proposing doing away with or placing severe restrictions on everyone, place harsher sentences for people who cause accidents due to distracted driving. GPS navigation is a plus for those who are directionally challenged or those who have to make deliveries to locations to which they are unfamiliar. The many should not be restricted because of the few.[34]

b. NHTSA's Response

NHTSA declines to take no action to mitigate driver distraction, as suggested by some commenters. As discussed both earlier in this notice, and in the Initial Notice, NHTSA's crash data show that 17 percent (an estimated 899,000) of all police-reported crashes in 2010 involved some type of driver distraction. These distraction-related crashes lead, on the average, to thousands of fatalities (3,092 fatalities or 9.4 percent of those killed in 2010) and over 400,000 injured people each year (approximately 17 percent of annual injuries). This large number of fatalities, injuries, and crashes motivates NHTSA to take appropriate action to reduce these numbers.

In response to the comments that NHTSA should issue a regulation instead of voluntary guidelines, NHTSA explained in the Initial Notice that voluntary guidelines are appropriate at this time because of the need for additional research on distraction and its effect on driving and because of the rapid pace of technology changes in the area of in-vehicle electronic devices. The agency also noted concerns with the sufficiency of existing data to estimate the benefits of an in-vehicle electronic device regulation and that driver distraction testing involves drivers with inherent individual differences. These individual differences present new challenges to NHTSA in terms of developing repeatable, objective test procedures to determine conformance. After carefully considering all of the comments, NHTSA continues to believe that voluntary guidelines are the appropriate action to take at this time to reduce the potential for driver distraction.

[34] Comments received from Michael S. Dale. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0006.

The commenters who supported regulation instead of guidelines appear to have based their concerns on the premise that manufacturers will ignore the NHTSA Guidelines and that the Guidelines will have a limited effect, if any, on distracted driving. However, many vehicle manufacturers have already indicated their commitment to mitigate distracted driving and have shown great interest in the NHTSA Guidelines, providing detailed comments and participating in the technical workshop and public meetings held by the agency on this subject. Based on this interest, NHTSA strongly believes that many manufacturers will choose to design visual-manual, in-vehicle device interfaces to conform to the NHTSA Guidelines, and that, while voluntary, the NHTSA Guidelines will have the effect of reducing the potential for driver distraction from these devices. The agency plans to monitor industry conformance to the Guidelines, which will aid in evaluating the Guidelines' effectiveness.

In considering Advocates' comments opposing the agency's stated reasons for adopting voluntary guidelines instead of regulations at this time, NHTSA agrees that the issues identified by the agency in the Initial Notice do not necessarily prevent the agency from issuing a regulation. However, if the agency were to pursue a regulatory approach, these issues would be a concern, and in light of the strong likelihood that manufacturers will choose to conform to the NHTSA Guidelines, NHTSA believes that voluntary guidelines are the appropriate action to take at this time to reduce driver distraction.

NHTSA emphasizes that the issuance of voluntary guidelines at this time does not represent a decision to never issue regulations in this area. NHTSA will continue to conduct and review research on distracted driving and collect relevant data. The agency will also monitor conformance with the NHTSA Guidelines through testing of production vehicles. As NHTSA gathers more information on distracted driving, the agency may decide, at some future time, that regulation in this area is warranted.

2. The Alliance Guidelines Adequately Address Distraction

a. Summary of Comments

Comments were received from BMW Group, General Motors, and Mercedes-Benz USA, LLC, recommending that NHTSA should adopt the current voluntary Alliance Guidelines without modification. BMW's comments were the most detailed on this issue. BMW stated:

The Notice states that NHTSA has been monitoring and conducting research of the implementation of the Alliance Guidelines, and found ''(1) Manufacturers have different interpretations of the guidelines themselves, leading to different implementations, (2) newer techniques exist to evaluate these interfaces than existed nearly a decade ago, (3) the guidelines have not kept pace with technology, and (4) more recent data compiled from naturalistic driving studies implies that more stringent criteria are needed.''

BMW would like to submit the following comments to each of the above NHTSA findings:

(1) NHTSA's communication with manufacturers on how they implement the guidelines and what tools are being used was limited. Differences in the results may also be the result of differences in the HMI design of each manufacturer.

* * * * *

(2) The proposed methods in the Federal Guidelines do not differ in terms of being new from what the Alliance Guidelines propose. The Federal Guidelines include measurements of glance behavior, as well as driving performance compared to an accepted reference task, and an occlusion method. The main difference among both sets of guidelines is that NHTSA has set unfounded more stringent performance criteria than the Alliance and eliminated performance testing in terms of driving behavior.

(3) NHTSA has not stated which particular new technology is not covered by the scope of the Alliance Guidelines. In fact, the Alliance guidelines actually refer to ''new'' information and communication technology and devices with visual and manual/visual interfaces.

(4) NHTSA only provides results for light weight vehicles from the 100-Car study. However, in this study no ''new'' technology besides nomadic devices was installed in the vehicles. In addition, NHTSA does not provide any real world safety data that shows the need for the Alliance criteria to be updated. NHTSA did however provide data from a study with professional truck drivers that should not be compared to normal drivers and light weight vehicles.

* * * * *

* * * BMW believes it is easier for vehicle manufacturers to agree to modifying current guidelines based on new emerging technologies, than for the Agency to go through Federal notices, commenting periods, etc., to modify the Federal Guidelines.[35]

On the other hand, Dr. Richard A. Young of the Wayne State University School of Medicine commented that the NHTSA Guidelines represent a potential opportunity to make much-needed updates to the Alliance Guidelines.[36]

b. NHTSA's Response

After carefully reviewing all of the comments received on this point, NHTSA continues to believe that it should issue its own voluntary driver distraction guidelines that improve upon the Alliance Guidelines. Although the agency agrees with BMW that the NHTSA Guidelines adopt many of the same approaches contained in the Alliance Guidelines, the NHTSA Guidelines improve upon the Alliance Guidelines in a number of ways, and NHTSA believes that these improvements support the agency's decision to draft its own Guidelines.

First, NHTSA believes that distraction guidelines should be applicable to all communications, entertainment, information, and navigation devices installed in vehicles as original equipment. Although the Alliance Guidelines apply to new technology, as commented on by BMW, the Alliance Guidelines explicitly state that they are not intended to apply to common electronic devices referred to as ''conventional information or communications systems,'' such as radios, CD players, cassette players, and MP3 players. However, even these conventional systems can potentially distract drivers and present a safety risk,[37] and, as in-vehicle systems continue to offer more functionality, the interfaces for these conventional systems could become more complex and potentially more distracting in the future. Accordingly, NHTSA believes that it is important to establish guidelines that are applicable to tasks associated with these systems.

Additionally, new guidelines are needed so as to incorporate the latest driver distraction research into the guidelines. There has been much research on driver distraction in the nearly seven years since the Alliance Guidelines were last updated. This research includes controlled human factors studies, naturalistic study analyses, and crash statistics studies examining the real world effects of distraction on safety. NHTSA believes that it is valuable to incorporate the results of this recent research into guidelines that serve to reduce or prevent driver distraction.

In particular, some of the more recent research suggests improvements that can be made to certain aspects of the Alliance Guidelines. For example, for the eye glance test protocol, the Alliance Guidelines use radio tuning as a reference task to establish the maximum recommended threshold for the total eyes off road time (TEORT) to complete a task. NHTSA believes that the Alliance Guidelines make a strong case for basing the maximum amount of distraction associated with a task on the level of distraction induced by performing a ''reference task.'' We also agree that manual radio tuning is an appropriate reference task.

The Alliance Guidelines acceptance criterion for TEORT is 20 seconds, based on the organization's estimate of the 85th percentile TEORT for radio tuning. However, as described in the Initial Notice and in Section IV.F, NHTSA's recent research results suggested that the 85th percentile TEORT associated with radio tuning is 12 seconds rather than 20 seconds. Moreover, NHTSA's review of the Alliance's basis for the 20-second value revealed several statistical problems, described below in Section IV.F.2. Examining the data used by the Alliance, NHTSA used three methods to estimate the 85th percentile TEORT for radio tuning and the average of the three TEORT values was 12.33 seconds. Although NHTSA supports the reference-task approach used in the Alliance Guidelines, this research and analysis undermines the 20-second TEORT threshold in the Alliance Guidelines and indicates a need for more up-to-date driver distraction guidelines. Based on this research and confirmed by the agency's analysis of the data relied on in the Alliance Guidelines, the NHTSA Guidelines include a 12-second TEORT threshold.

NHTSA also used more recent research in designing the recommended test protocols. This research provided information regarding the robustness of eye glance metrics and protocol aspects such as sample size and its effect on the statistical validity of test results. A discussion of this research, completed from 2007 to 2011, is summarized in the Initial Notice.[38]

NHTSA believes that Federal driver distraction guidelines are also necessary

[35] Comments received from BMW Group, p. 4. Accessed at *www.regulations.gov*, Docket No. NHTSA–2010–0053, Document Number 0094.

[36] Comments of Dr. Richard A. Young, Docket No. NHTSA–2010–0053–0106.

[37] For example, the 100-car study indicated that operating a CD player as a risk odds ratio of 2.25. Again, a risk ratio of 1.0 means that a secondary task has the same risk as average driving.

[38] 77 FR 11207–11211.

in order to avoid potential safety risks not addressed by the Alliance Guidelines and to ensure that guidelines promoted by NHTSA are consistent with other Federal actions regarding distraction. For example, although the Alliance Guidelines list a few general categories of information that should always be inaccessible to the driver while driving (e.g., video, automatically-scrolling text), most activities are permitted if they meet the acceptance criteria. NHTSA believes that certain additional activities, including those that are discouraged by public policy and, in some instances, prohibited by Federal regulation and State law (e.g., entering or displaying text messages), should always be inaccessible to the driver while driving.

Another example relates to when excessively distracting tasks are accessible. The Alliance Guidelines recommend locking out tasks that do not meet the Alliance Guidelines while driving and define ''driving'' as when the vehicle speed is 5 mph or greater. Thus, excessively distracting tasks can be performed when the vehicle is moving slowly or stopped in traffic. However, as described in detail in Section IV.D below, NHTSA is concerned about the safety risk associated with allowing excessively distracting tasks to be performed by while a vehicle is in motion or in traffic and notes that the relevant Federal statute, regulations, and Executive Order related to texting while driving define ''driving'' to include the operation of a vehicle while temporarily stopped because of traffic, a traffic light or stop sign or other momentary delays. Accordingly, NHTSA has defined *driving* to include all situations in which the vehicle's engine or motor is operating unless the vehicle is in Park or, for manual transmission vehicles, an equivalent condition.

NHTSA has also identified some aspects of the current Alliance Guidelines that are loosely specified and believes it is necessary to provide well-specified test criteria in order to have a standardized test for measuring the impact of secondary task performance and determining whether the task is acceptable for performance while driving. Otherwise, implementation of the guidance may be inconsistent because of varying interpretations in the industry. In particular, a clear definition of a ''task'' must be asserted to specify the series of driver actions needed to perform a secondary task that should be assessed for conformance to guidelines criteria. While the definition of a task used in the Alliance Guidelines is short and conceptually clear,[39] it can be difficult to determine whether a certain activity should be considered one task or several. This is particularly challenging to do for devices and tasks that have not yet been developed. The Alliance Guidelines also provide little information about test participant characteristics and do not indicate how many participants should be tested.

Accordingly, NHTSA is specifying a recommended test procedure that is straight-forward, clearly defined, and well-substantiated to aid the voluntary adoption of its NHTSA Guidelines. Minimizing the opportunity for variability in carrying out the test procedure will ensure that manufacturers will be able to easily and consistently implement the NHTSA Guidelines across their light vehicle fleets.

Finally, in response to BMW's final point that ''it is easier for *vehicle manufacturers to agree* into [sic] modifying current guidelines based on new emerging technologies, than for the Agency to go through Federal notices, commenting periods, etc., to modify the Federal Guidelines,'' [40] (emphasis added by NHTSA), the agency notes that it is not just the vehicle manufacturers who are concerned about the effect of driver distraction on motor vehicle safety. In response to the Initial Notice, NHTSA received many comments from individual members of the general public, consumer advocacy organizations (e.g., Advocates for Highway and Auto Safety, Consumers Union) and other Government agencies (National Transportation Safety Board) all of whom were concerned about the contents of these guidelines. The input of all stakeholders, not just vehicle manufacturers, should be considered in taking action to reduce driver distraction. The advantage of issuing Federal guidelines is that by providing public notice and facilitating participation from various stakeholders through a public comment period, more information from different sources can be considered and evaluated as part of developing and updating the guidelines.

[39] The Alliance Guidelines define a task as ''a sequence of control operations (i.e., a specific method) leading to a goal at which the driver will normally persist until the goal is reached. Example: Obtaining guidance by entering a street address using the scrolling list method until route guidance is initiated.''

[40] Ibid.

3. Suggestions To Wait for Better Data or Additional Research To Be Completed

a. Summary of Comments

Comments were received from Agero, BMW Group, General Motors, Global Automakers, the National Safety Council, Toyota Motor North America, Inc., VDA, the German Association of the Automotive Industry, and Volkswagen Group of America recommending that NHTSA should delay issuance of its Guidelines (or, if NHTSA decided to issue its own guidelines now, make them identical to the current voluntary Alliance Guidelines on an interim basis) until better driver distraction data becomes available. One commonly mentioned upcoming source of better driver distraction data is that coming from the second Strategic Highway Research Program (SHRP2).

Performance of the SHRP2 program was authorized by Congress in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (Pub. L. 109–59, signed by President George W. Bush on August 10, 2005) to address some of the most pressing needs related to the nation's highway system. It is managed by the Transportation Research Board on behalf of the National Research Council. One of the four research focus areas of SHRP2 is the Safety area. The goal of the Safety area is to:

> Prevent or reduce the severity of highway crashes by understanding driver behavior. The Safety area is conducting the largest ever naturalistic driving study to better understand the interaction among various factors involved in highway crashes—driver, vehicle, and infrastructure—so that better safety countermeasures can be developed and applied to save lives.[41]

SHRP2's naturalistic data collection is currently in progress. This data collection is projected to be completed and the data is estimated to become available for analysis beginning in April 2014.

Volkswagen Group of America was typical of the commenters advocating that NHTSA wait until SHRP2 results become available before issuing its own guidelines. Quoting from the Volkswagen comments:

> Volkswagen urges the agency to reconsider the current proposal. The agency should await the results of the ongoing Strategic Highway Research Program 2 (SHRP2). The SHRP2 naturalistic driving study was in large part motivated by the need to gain a better

[41] Information taken from the SHRP2 Web site. Accessed on July 5, 2012 at *http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/General.aspx*.

understanding of driver distraction under conditions of real-world driving (as opposed to under experimental conditions). The comprehensive monitoring data collected under SHRP2 will provide evidence gathered under normal driving conditions by a wide range of drivers, the data from whom will show when and how they engage in secondary tasks while driving, including what happens when things go wrong. Given that more recent human factors studies have shown that the relationship between relative crash risk and simple eye glance metrics such as eyes-off-road time may be more complicated than first assumed, we believe that the data expected from SHRP2 will be essential to understanding whether or to what extent eye glance measures can be used to accurately assess distraction risk, or whether other performance-based measures are necessary for this purpose. We recommend that the Agency await the results of the SHRP2 project, and engage with the industry and academia in conducting peer-reviewed studies to support improved test methods and metrics.[42]

In their comments, the National Safety Council discussed what they perceive as the limitations of naturalistic driving data for determining the adequacy of countermeasures for limiting and reducing driver distraction associated with the use of in-vehicle electronic devices while driving. Quoting from the National Safety Council comments:

Over-reliance on a single study design. The decision to release guidelines in three phases, rolled out over many years, with the first phase addressing visual-manual use of electronic devices, is based on the findings of only three studies. Each of these studies has significant limitations. NSC believes that Federal guidelines with the potential to influence the safety of vehicles should be based on a much broader range of research.

Naturalistic driving studies have been described by those involved with this research as the ‘‘gold standard’’ in traffic safety research. Certainly there are some driver distraction insights that can be uniquely gained by this study design; for example, in-vehicle cameras record crash factors that otherwise may never be captured. However, the National Safety Council believes it is inappropriate to rely so heavily on only one study design with a limited number of participants and crashes. NSC does not believe there is any single gold standard study design. There simply is no perfect study design for an issue as complex as traffic safety. All study designs—including naturalistic studies—have strengths and limitations.

The best approach is to base decision-making on the findings of numerous studies of different designs, conducted by varying research institutions. If there is a convergence of similar findings from studies of varying designs, conducted by different researchers with different participant populations, NSC believes that convergence of findings deserves careful attention.[43]

b. NHTSA's Response

After carefully reviewing all of the comments received in response to the Initial Notice, NHTSA continues to believe that it should issue its voluntary Driver Distraction Guidelines immediately with this notice based on its current research base. However, NHTSA emphasizes that the agency remains open to amending the NHTSA Guidelines in the future in response to the results of SHRP2.

NHTSA has been sponsoring outside research and performing in-house research on driver distraction for approximately 20 years. In addition, during this time NHTSA has reviewed much of the research performed by academia, the motor vehicle industry, other Government agencies, and other organizations. Although the NSC is correct that there is no one gold standard study design or approach, there is in fact currently no better method for establishing crash risk for distracting behaviors than naturalistic driving studies. Experimental studies conducted with simulators and test-tracks are excellent for observing how distracting behaviors can affect driver performance measures such as reaction times to critical events, lane keeping performance, headway maintenance, and visual attention, but they cannot estimate crash risk. In addition, experimental methods do not capture the critical element of when drivers choose to engage in distracting behaviors. Naturalistic driving studies measure distracting behaviors *as drivers actually choose to engage in them in their normal driving conditions and patterns,* and they establish the crash risk associated with those distracting behaviors. Dozens of experimental studies (see Regan, Lee, and Young, 2009) have demonstrated key distraction effects like slower reaction times, but researchers can only estimate the impact of those effects on the potential for crash consequences. Although naturalistic driving studies cannot measure precise driving performance decrements like experimental studies can, naturalistic driving studies are able determine whether the behaviors associated with those performance decrements actually lead to elevated crash risk. Accordingly, NHTSA feels strongly that the referenced naturalistic driving studies provide sufficient justification for pursuing the selected test method and thresholds.

NHTSA eagerly awaits results from SHRP2, which should materialize in the next two to three years, the agency's own naturalistic cell phone data collection, and other in-progress or planned research. However, the agency notes SHRP2 is a far-reaching naturalistic driving study that was designed to address a variety of issues related to nation's highway system, including the high toll taken by highway deaths and injuries, aging infrastructure that must be rehabilitated with minimum disruption to users, and congestion stemming both from inadequate physical capacity and from events that reduce the effective capacity of a highway facility. Although distraction is an important topic for SHRP2 data, it is not one of the primary motivations for the program as suggested by Volkswagen. NHTSA strongly believes that the data gained from completed naturalistic driving studies and other research into visual attention measures is sufficient and provides a reasonable basis to proceed with the immediate issuance of Phase 1 of the voluntary NHTSA Guidelines.

A major reason compelling NHTSA to release Driver Distraction Guidelines now is that they are based on a number of fundamental principles related to driver distraction that are unlikely to be contradicted by future research. These principles are:

- The driver's eyes should usually be looking at the road ahead,
- The driver should be able to keep at least one hand on the steering wheel while performing a secondary task (both driving-related and non-driving related),
- The distraction induced by any secondary task performed while driving should not exceed that associated with a baseline reference task (manual radio tuning),
- Any task performed by a driver should be interruptible at any time,
- The driver should control the pace of task interactions, not the system/device, and
- Displays should be easy for the driver to see and content presented should be easily discernible.

Results from future research could cause NHTSA to consider changing some of the details of its Guidelines; however, modification of any of these basic principles is unlikely.

SHRP2's naturalistic data collection is projected to be completed and the data become available for analysis in March 2014. Allowing a reasonable amount of time to evaluate the results and draft guidelines based on those results,

[42] Comments received from Volkswagen Group of America, Inc., p. 7. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0101.

[43] Comments received from the National Safety Council, pp. 2–3. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0085.

awaiting the results from SHRP2 could result in approximately a three-year delay versus issuing NHTSA's Phase 1 Guidelines immediately.

There are practical consequences to delaying the issuance of the NHTSA Guidelines. As discussed above, the most recent crash data available, 2010 data, show that 899,000 motor vehicle crashes involved a report of a distracted driver. These distraction-related crashes lead, on the average, to thousands of fatalities (3,092 fatalities) and over 400,000 injured people each year. NHTSA believes that the voluntary Guidelines are an important step towards reducing the number of these crashes and resulting fatalities, and, therefore, there is a need to issue them as soon as possible.

In summary, NHTSA believes that it has sufficient information to issue good Driver Distraction Guidelines immediately that will reduce the driver distraction safety problem. With the greater flexibility afforded by voluntary guidelines, NHTSA expects that it will be able to rapidly modify its Guidelines should SHRP2 results indicate ways in which to make the NHTSA Guidelines more effective.

4. Suggestions for Using Voluntary Consensus Standards as a Basis for Developing NHTSA's Guidelines

a. Summary of Comments

Comments were received from Dr. Paul Green and American Honda Motor Company drawing NHTSA's attention to two SAE recommended practices, SAE J2364 and J2365. Both commenters disagree with NHTSA's statement in the Initial Notice that:

> The agency is not aware of any applicable voluntary consensus standards that are appropriate for driver distraction stemming from driver interactions with in-vehicle electronic devices.

Dr. Green's comments go on to state:

> The NHTSA guidelines are based on the Alliance of Automobile Manufacturers (AAM) guidelines, which are an elaboration of the European Statement of Principles. The process by which the Statement of Principles was developed is not well known, but what matters most is that the AAM is not a recognized standards development organization. Their standards were not developed in meetings the public could attend, there were no well-advertised calls for public comment, and other requirements for recognized standards development organization were not followed.[44]

Comments were also received from American Honda Motor Company and the International Organization for Standardization (ISO) drawing NHTSA's attention to a variety of international standards for assessing driver distraction. Mentioned were: ISO 15007:2002, ''Road Vehicles—Measurement of Driver Visual Behavior with Respect to Transport Information and Control Systems,'' ISO 16673:2007 ''Road vehicles—Ergonomic Aspects of Transport Information and Control Systems—Occlusion Method to Assess Visual Demand due to the use of In-Vehicle Systems,'' and ISO 26022:2010, ''Road vehicles—Ergonomic Aspects of Transport Information and Control Systems—Simulated Lane Change Test to Assess In-Vehicle Secondary Task Demand.'' The ISO also pointed out that, since NHTSA is interested in detection response tasks testing, a new ISO standard, WD 17488, ''Road vehicles—Transport Information and Control Systems—Detection Response Task,'' is under development and encourages NHTSA to participate in a joint development approach.[45]

b. NHTSA's Response

Three of the above mentioned recommended practices/international standards were not discussed in the Initial Notice. A short description of each is given followed by NHTSA's thoughts about that recommended practice/international standard.

SAE Recommended Practice J2364, ''Navigation and Route Guidance Function Accessibility While Driving Rationale,'' establishes two alternative testing procedures for determining which navigation and route guidance functions should be accessible to the driver while the vehicle is in motion. (This recommended practice could be generalized to devices other than route navigation systems). The two testing procedures are a static completion time method and an interrupted vision (occlusion) method. Compliance criterion values are 15 seconds for the static completion time method (15-second rule) and 20 seconds Total Shutter Open Time (TSOT) for the occlusion method.

NHTSA performed research on the diagnostic properties of the static completion time test method during the late 1990's.[46] Ten participants, aged 55 to 69 years, completed 15 tasks, including navigation system destination entry, radio tuning, manual phone dialing, and adjusting the Heating, Ventilation, and Air Conditioning (HVAC) controls in a test vehicle. Correlations between static task completion times and task completion times while driving were relatively low. The results were interpreted to mean that static measurement of task completion time was not sufficient for determining whether a task was so distracting that it should not be performed while driving. Based on these results, NHTSA looked to other metrics and methods for use in assessing secondary task distraction in subsequent research.

NHTSA does agree with the occlusion test method albeit with a different TSOT criterion than recommended by SAE J2364. For the procedural details of occlusion testing, NHTSA prefers ISO 16673:2007 which is an international voluntary consensus standard.

SAE Recommended Practice J2365, ''Calculation of the Time to Complete In-Vehicle Navigation and Route Guidance Tasks,'' establishes a process for estimating the static completion time required to perform a task by decomposing the task into a series of goals, sub-goals, and actions and then assigning a static completion time estimate for each action. Static completion time estimates are provided in an appendix to the document.

There are two reasons NHTSA chose not to use SAE J2365 in the NHTSA Guidelines:

- It is a method for estimating static completion times for performing a task. As such, it is useful during the design of a device. However, NHTSA's monitoring of conformance to its Driver Distraction Guidelines will be based on the testing of actual, production vehicles and devices and not on estimates of driver performance while performing a task.
- As discussed earlier, the results of past NHTSA static task completion time research were interpreted to mean that static measurement of task completion time was not sufficient to determine whether a task was sufficiently distracting that it should not be performed while driving.

For these reasons, NHTSA declines to adopt the suggestion that the agency use SAE J2365 in its Guidelines.

NHTSA has long been aware of ISO 15007:2002. Part 1 of this standard contains eye glance measurement definitions while Part 2 discusses eye glance measurement methodological issues. This standard does not specify a particular methodology for eye glance

[44] Comments received from Dr. Paul Green, p. 2. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0052.

[45] Comments received from ISO, p. 1. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0087.

[46] Tijerina, L., Parmer, E., and Goodman, M.J., ''Driver Workload Assessment of Route Guidance System Destination Entry While Driving: A Test Track Study,'' Proceedings of the 5th ITS World Congress, Berlin, Germany: VERTIS (CD–ROM), 1998.

measurement and is broad enough to cover many different methodologies.

The NHTSA Guidelines are consistent with ISO 15007:2002 with several minor exceptions. The NHTSA Guidelines also provide additional detail about the methods for determining eye glances and ways to ensure accuracy beyond ISO 15007:2002. Specifically, the NHTSA Guidelines permit verification through either manual reduction of eye glance data (researchers determining glance times from video footage) or eye tracker data (glance times and eye glance location measured by a device).

When manual reduction of eye glance data has been required, transition times (time between two eye glance fixations) are combined with dwell times (the time fixated on a particular point) to define glance duration, as specified by ISO 15007:2002.

When data from an eye tracker is used, the glance time is defined as the time away from the forward roadway view. Transition time away from the forward view is combined with the dwell time while the driver is looking at the secondary task interface, which is consistent with the ISO specification; however transition time back to the forward roadway view is not combined with the subsequent time spent looking forward. This deviation is due to the fact that while a fixed boundary is used to define the road center when analyzing the eye tracker data, a comparable boundary defining the secondary task interface is not used. This is because eye tracker precision deteriorates as the driver moves his or her head away from the forward view. Boundaries near secondary task interfaces are prone to error. Thus, NHTSA has defined its eye glance metric (TEORT) in terms of time away from the forward view to maximize precision. The agency has compared the times obtained with eye tracker and manual reduction of the same data and have concluded that differences between these approaches are negligible.

NHTSA's test procedures are generally consistent with the specifications of ISO 15007:2002, again with minor exceptions. In particular, agency testing has not involved categorization of drivers by visual ability or driving experience. Rather, NHTSA's test protocols have required only that participants have a valid driver's license, thus assuming a basic level of visual acuity, and that they drive a minimum number of miles each year. Procedures for data collection, reduction, and presentation have been consistent with ISO 15007:2002.

ISO 26022:2010 describes a dynamic dual-task method that quantitatively measures human performance degradation on a primary driving-like task while a secondary task is being performed (Lane Change Test). The result is an estimate of secondary task demand.

NHTSA performed research on the diagnostic properties of the Lane Change Test (LCT) method during 2006.[47] Twenty-six participants, aged 25 to 50 years, performed the LCT in a driving simulator while performing selected secondary tasks. The LCT uses a single metric that is driving performance related. Results from this testing found that the LCT's metric was less sensitive to differences between secondary tasks than those from the Dynamic Following and Detection (DFD) test protocol. The multiple metrics associated with the DFD protocol were better able to capture the multidimensional aspects of distraction. The Peripheral Detection Task (PDT) component of the DFD was thought to be a more sensitive detection task than the detection task component used in LCT, due to the higher frequency of stimulus presentations. As a result, subsequent NHTSA research focused on the DFD test protocol.

NHTSA agrees that the Alliance Guidelines are not voluntary consensus-based international or United States standards. In the Initial Notice, they were referred to as ''industry-developed standards.'' However, despite these facts, NHTSA continues to believe that they are a better basis for development of the NHTSA Driver Distraction Guidelines than the voluntary consensus standard cited by the commenters.

Finally, NHTSA has considerable interest in detection-response task testing and believes that it may offer considerable promise for acceptance testing for auditory-vocal human-machine interfaces. While NHTSA is just getting started on this research, we will consider participating with ISO in a joint development approach and international standard.

5. Publish NHTSA's Driver Distraction Guidelines to Portable and Aftermarket Devices as Soon as Possible

a. Summary of Comments

Numerous commenters encouraged NHTSA to quickly develop and publish its Driver Distraction Guidelines for non-OE electronic devices (referred to as portable or aftermarket devices or PAD elsewhere in this document) in light vehicles. Some commenters indicated that they would prefer that NHTSA implement the guidelines for PAD simultaneously with the guidelines for OE electronic devices.

Commenters voiced concern that by having NHTSA's Driver Distraction Guidelines only cover OE electronic devices, consumers would shift from OE electronic devices to the less-restricted (but possibly also less safe) PADs. Many commenters addressed this issue; quotes from some typical comments are below. From the comment submitted by the Alliance:

> Consumers have numerous connectivity options, particularly via portable electronic devices. They will quickly migrate to alternate, and potentially more distracting and less safe, means of staying connected if the use of in-vehicle or ''integrated'' options is overly curtailed.
>
> In this regard, it has become increasingly clear to Alliance members that guidelines for portable electronic devices need to be developed in parallel with those for integrated systems and released as a single, common set of comprehensive guideline for visual-manual interfaces.[48]

From the comments received from Toyota:

> Recommend that NHTSA consider the unintended consequences of substantially reducing the functionality of in-vehicle electronic devices when drivers can easily switch to handheld devices which are not designed specifically for use while driving.[49]

Finally, from the comments received from Consumers Union:

> In addition, although the current set of Guidelines is not intended to address portable devices, Consumers Union also hopes NHTSA will clarify that the Guidelines do encompass controls integral to the car that are meant to control portable devices. An example is the ability to integrate portable music player or cell phone control through the vehicle's controls. We also encourage NHTSA to take up consideration of the Guidelines for portable devices as soon as possible. As more and more portable technologies—tablets being just the latest—become available for incorporation into passenger vehicles, the need for NHTSA to address the safety issues inherent therein is pressing.[50]

[47] Ranney, T.A., Baldwin, G.H.S., Vasko, S.M., and Mazzae, E.N., ''Measuring Distraction Potential of Operating In-Vehicle Devices,'' DOT HS 811 231, December 2009.

[48] Comments received from the Alliance of Automobile Manufacturers, p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0104.

[49] Comments received from Toyota Motor North America, Inc., p. 2. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0092.

[50] Comments received from the Consumers Union, p. 2. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0063.

b. NHTSA's Response

NHTSA intends to publish the NHTSA Guidelines for light vehicles to cover PADs as soon as feasible. This was originally stated in the April 2010 ''Overview of the National Highway Traffic Safety Administration's Driver Distraction Program,'' [51] (NHTSA's Distraction Plan) which summarized steps that NHTSA intended to take to reduce crashes attributable to driver distraction and it remains NHTSA's intention.

As described in NHTSA's Distraction Plan, NHTSA is developing its Driver Distraction Guidelines for light vehicles in three phases. The first phase consists of these Guidelines for visual-manual interfaces of OE electronic devices in vehicles. The second phase will address visual-manual interfaces of PADs. The third phase will address auditory-vocal interfaces for both OE electronic devices and PADs. The commenters advocated for NHTSA to move rapidly ahead with Phase 2 of its guidelines, and many of them want the Phase 2 Guidelines to be released at the same time as the Phase 1 Guidelines.

Issuing the Phase 2 Guidelines at this time is not a feasible option. NHTSA is currently gathering information and developing the draft Initial Notice for the Phase 2 NHTSA Guidelines. Completion of this work is necessary before the Phase 2 Guidelines can be issued. While this work is being performed, NHTSA will have the opportunity to work with both the PAD and vehicle manufacturing communities to discover the best ways to implement our recommendations for PADs.

There are additional, PAD-specific, issues that NHTSA is considering addressing in the Phase 2 Guidelines. Some of these include:

- The issue of linking or pairing PADs and in-vehicle systems and how to encourage use of the in-vehicle human machine interface (HMI) rather than the PAD HMI.
- The issue of ensuring PAD-use is unimpaired for passengers.
- The issue of PAD positioning within a motor vehicle. A PAD could potentially obstruct a driver's vision or ability to safely operate the vehicle.
- The issue of PAD mounting within a motor vehicle. A PAD could potentially act as a projectile that may injure vehicle occupants in the event of sudden severe maneuvering or a crash.

The agency also declines to delay the Phase 1 Guidelines until the Phase 2 Guidelines are ready to be issued. As described below in Section IV.B.4, it is envisioned that automakers will likely choose to incorporate the NHTSA guidelines during their normal vehicle redesign schedule. Since this is typically every 3–5 years, it is expected that most, if not all, vehicle models will not have completed a redesign before the Phase 2 Guidelines are published. Given this, there should be minimal impact given the slight time gap between the Phase 1 and Phase 2 Guidelines and the fact that the same principles will guide both the Phase 1 and Phase 2 Guidelines.

Although some commenters expressed concern that by having NHTSA's Guidelines only cover OE electronic devices, consumers would shift from OE electronic devices to the less-restricted (but possibly also less safe) PAD devices, this concern is based on the assumption that safer in-vehicle systems will not be sufficiently functional to attract drivers away from use of hand-held devices and would somehow have the opposite effect. On the contrary, vehicle manufacturers are rapidly expanding the voice-command and hands-free, eyes-free capabilities of their in-vehicle systems. These systems (designed to at least meet the Alliance Guidelines) are engineered (and would remain so if designed in conformance with NHTSA's Phase 1 Guidelines) to encourage the handheld users to pair those devices with the vehicle's displays and controls. Having done so, NHTSA sees no evidence that drivers would un-pair the devices from the vehicle system simply to obtain marginally increased functionality in very limited situations. For example, an in-vehicle system that permits hands-free voice messaging has convenience advantages over a hand-held device, such as the use of more accessible controls and enhanced auditory clarity. As a result, the agency thinks that there would be little incentive for a driver to revert to the hand-held simply to perform a locked-out function such as texting. Therefore, should manufacturers choose to conform to the NHTSA guidelines, the agency thinks the more likely outcome is that drivers will pair their hand-helds to the vehicle systems during all driving situations, with a net benefit for safety.

Accordingly, NHTSA believes that automotive safety can best be maximized by proceeding with Phase 1 of its Driver Distraction Guidelines (covering OE electronic devices in light vehicles) at this time.

NHTSA intends to issue its Phase 2 Driver Distraction Guidelines as soon as feasible. The Phase 2 Guidelines will be based on general principles similar to those upon which these Phase 1 Guidelines are based. These principles are:

- The driver's eyes should usually be looking at the road ahead,
- The driver should be able to keep at least one hand on the steering wheel,
- Any task performed by driving should be interruptible at any time,
- The driver should control the human-machine interface and not vice versa, and
- Displays should be easy for the driver to see.

Until the Phase 2 Guidelines are issued, the agency recommends that developers and manufacturers of portable and aftermarket devices consider these principles as they design and update their products. NHTSA further encourages these developers and manufacturers to adopt any recommendations in the Phase 1 Guidelines that they believe are feasible and appropriate for their devices.

6. Develop NHTSA's Guidelines To Address Cognitive Distraction and Voice Interfaces as Soon as Possible

a. Summary of Comments

Numerous commenters discussed the role of cognitive distraction and the need for guidelines that cover voice-activated technologies. Many comments urged NHTSA to move swiftly toward the development of guidelines to cover these technologies. The National Safety Council (NSC) commented on the lack of recognition of the potential impact of cognitive distraction. Specifically:

> The choice to focus on the three naturalistic studies, rather than considering the body of research that examined cognitive distraction of cell phone use, has led to a lack of discussion about the potential impact of cognitive distraction for the first phases of the guidelines.[52]

On the relation between voice-based interfaces and cognitive distraction NSC offered the following:

> NSC is concerned about the continued advance of voice-activated in-vehicle technology without Federal guidelines in place, and without testing for cognitive impact by researchers independent of the auto industry. Once technology is introduced to the vehicle fleet and consumers are influenced to use it, it will become very difficult to change behaviors and the vehicle environment.[53]

The National Transportation Safety Board (NTSB) also expressed concern

[51] ''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.*

[52] Comments received from the National Safety Council, p. 4. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0085.

[53] Ibid, p. 5.

about the under emphasis on cognitive distraction. Specifically,

The NTSB is concerned that the NHTSA Driver Distraction Program is based on the assumption that the primary risk associated with in-vehicle PED [Portable Electronic Device; these comments use ''in-vehicle PED'' to refer to both OE devices and PADs] use by drivers is visual-manual interaction. It is essential to understand the cognitive demands associated with secondary tasks, particularly auditory-vocal communication tasks, in the context of in-vehicle information and communication devices.

As evidenced by the work of panelists attending the recent NTSB forum on countermeasures to distraction, numerous studies have shown that driver distraction occurs during both handheld and hands-free cell phone conversations. NHTSA acknowledges that there is a large amount of research on the topic of driver distraction, yet the guidelines appear to focus on naturalistic driving studies.

Particularly, this notice refers to naturalistic driving research that reports that engaging in hands-free phone conversations while driving is safe and provides a protective effect. This finding, from the commercial vehicle naturalistic study, is but one piece of an overall body of research and should be considered within the context of its limitations. Although naturalistic studies provide extremely strong evidence for distraction involving driver behaviors such as visual or manual activities, naturalistic studies, given their dependence on video data, cannot fully assess the cognitive demands associated with hands-free secondary tasks.

The measurement of cognitive distraction that does not result in drivers taking their eyes off the road is essential. Both driver performance and brain activity should be assessed to better understand cognitive load. The NTSB findings from its investigation of the 2004 Alexandria, Virginia, motorcoach accident involving the driver's use of a hands-free cell phone are consistent with research showing that drivers conversing on a cell phone—whether handheld or hands-free—are cognitively distracted from the driving task.[54]

Accordingly, the NTSB encouraged NHTSA to minimize the delay between the phases to avoid the ''* * * reliance on voice-based in-vehicle systems with flawed designs that may increase the cognitive distraction of drivers.'' [55]

Closely tied to concerns about cognitive distraction are concerns that voice recognition based controls may cause a substantial degree of cognitive distraction. The following quote from the comment submitted by Consumers Union discusses this concern:

One possible consequence of these Guidelines is that many functions will move from visual-manual control to voice recognition control. While this technology is proven to reduce eyes-off-road time, it does have some shortcomings. Systems have varying capabilities of recognizing voice commands, especially when the speaker has an accent. In addition, constant audio updates to a driver can pose their own distraction problems.

While we understand that voice controls will be addressed in a later Notice, we are concerned that manufacturers will begin to implement voice recognition technologies that are not currently covered by any NHTSA Guidelines. This is especially concerning given current driver demand for text messaging and social media capability, both of which are prohibited by the Guidelines. If manufacturers incorporate voice-controlled text messaging and social media capabilities in their vehicles instead of visual-manual controls, drivers could end up experiencing a constant and continuous audio stream of updated information while driving—a substitute that could be very cognitively distracting. Consumers Union therefore urges NHTSA to issue its Guidelines for voice operated controls as quickly as possible, and to address the shortcomings of this particular technology, so that the distractions do not simply shift from visual-manual to audio feeds.[56]

Other commenters encouraged NHTSA to consider the impact of voice-based interfaces in mitigating the distraction effects of visual-manual interfaces. General Motors (GM) offered the following comment:

The guidelines should also recognize that voice-based interactions can provide a key mechanism for drivers to interact with systems in ways that support the operation and control of the vehicle. Voice interaction can be a method to reduce both mean glance times and total eyes-off-road time.[57]

GM recommended that:

NHTSA immediately begin incorporating voice principles into its distraction guidelines for both handheld/portable and in-vehicle integrated electronic devices resulting in a fully integrated total package.[58]

Agero Inc. was one of a number of organizations that encouraged NHTSA to adopt a comprehensive and holistic approach to the development of guidelines, based on their observation that, ''* * * embedded and nomadic in-vehicle human machine interfaces (HMI)—visual, manual, interactive voice, speech recognition, haptic and gesture display technologies—have already begun to converge,'' [59] and that ''* * * natural-language speech systems present real potential to mitigate driver distraction.'' [60]

b. NHTSA's Response

NHTSA generally shares these commenters' concerns. We agree that the issues associated with cognitive distraction and voice recognition-based interactions need to be resolved to maximize motor vehicle safety. However, these are challenging issues which NHTSA believes must be carefully researched to provide a basis for guidelines.

The general issue of cognitive distraction is as much an issue of driver behavior as it is of OE/PAD device design. Cognitive distraction is difficult to quantify because it occurs in many different driving situations and is highly individualized. While drivers can be cognitively distracted while talking on a cell phone, they can also be cognitively distracted by a passenger or even just by themselves when not using an electronic device (e.g., ''lost in thought''). Drivers can be engaged in light conversation (little to no cognitive distraction) or deeply engaged in discussion or debate (highly cognitively distracting) either on a cell phone or with a passenger. Drivers participating in a casual conversation on a cell phone (or to a passenger), are likely to be minimally, if at all, cognitively distracted.

NHTSA is currently working to address driver behavior by supporting state laws which prohibit certain distracting activities while driving (e.g., texting and hand-held cell phone bans), driver education, and other driver and passenger behavior modification efforts to influence safe driving choices.

NHTSA believes that well designed human-machine interfaces may help to mitigate cognitive distraction. Complicated device interfaces can clearly induce driver distraction during use. NHTSA's Phase 1 Driver Distraction Guidelines will promote less distracting visual-manual device interfaces. However, the agency shares commenters' concerns about cognitive distraction due to driver use of auditory-vocal interfaces. As noted above in the Consumers Union comments:

If manufacturers incorporate voice-controlled text messaging and social media capabilities in their vehicles instead of visual-manual controls, drivers could end up experiencing a constant and continuous

[54] Comments received from the National Transportation Safety Board, pp. 4–5. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0066.

[55] Ibid.

[56] Comments received from the Consumers Union, p. 4. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0063.

[57] Comments received from General Motors, p. 2. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0103.

[58] Ibid.

[59] Comments received from Agero Inc., p. 3. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0090.

[60] Ibid, p. 6.

audio stream of updated information while driving—a substitute that could be very cognitively distracting.[61]

Unfortunately, recognizing the distraction potential of auditory-vocal interfaces is not the same as knowing how to prevent this issue from becoming a problem. NHTSA currently has research under way on this topic and more research is planned, which will be used as a basis for guidelines covering auditory-vocal interfaces.

NHTSA currently has two studies in progress on auditory-vocal device interfaces. One study is a naturalistic examination of cell phone usage with special emphasis on examining cognitive distraction during phone calls. The other study is performing a literature review of past cognitive distraction/auditory-vocal device interface research, preparing a database of a portion of existing devices that have auditory-vocal device interfaces, and developing additional topics (beyond those listed below) for which research should be conducted before the NHTSA Guidelines can be extended to cover auditory-vocal device interfaces.

Our principal planned research foci for upcoming NHTSA auditory-vocal device interfaces are:

- What is a suitable acceptance test for auditory-vocal device interfaces? Based on NHTSA's interpretation of current research, it appears that a detection response paradigm combined with eye glance measurement is likely to work. However, there is a multiplicity of detection response test methods in the literature; NHTSA needs to determine the best one for its purposes.
- What are suitable acceptance criteria for auditory-vocal device interfaces? Once NHTSA has selected its final detection response/eye glance measurement test, the agency needs to determine the values associated with typical driver performance of its reference task (manual radio tuning).
- Is a test of voice recognition accuracy needed? Past testing indicates that an inadequate voice recognition engine can both frustrate and highly distract drivers. However, market pressure may be adequate to force companies into using a sufficiently good voice recognition engine that neither frustrates nor distracts drivers.
- Is guidance from NHTSA on the menu structure of auditory-vocal device interfaces needed? NHTSA is aware that poor menu structures can greatly increase distraction during use of auditory-vocal device interfaces. However, having a suitable acceptance test protocol and criteria may be adequate to prevent this from becoming a problem.

NHTSA's planned auditory-vocal device interface research will take some time to perform. This is why extension of the NHTSA Guidelines to cover auditory-vocal device interfaces was delayed in NHTSA's Driver Distraction Program[62] until the third phase of guidelines development.

7. NHTSA's Intentions for Future Updating of Its Guidelines

a. Summary of Comments

Some commenters asked about NHTSA's intentions for future updating of the NHTSA Guidelines. Global Automakers outlined their vision for an ongoing process in the following comments:

> Guidelines should be a dynamic, ongoing process, rather than an endpoint as in the typical rulemaking process where a final rule is issued.[63]
>
> * * * we believe a collaborative industry-government effort provides the most constructive approach going forward. Through such an approach NHTSA benefits from the latest industry knowledge and experiences, while allowing automakers to participate in developing the guidelines we are asked to adopt. * * * industry should take a greater role in the ongoing process, since the manufacturers are on the front line of developing new technologies and are directly affected by any failure of the Guidelines to keep abreast of recent developments.[64]

Finally, Global Automakers offered the following pledge of continued involvement:

> It is our members' intention to continue their efforts to address driver distraction and maintain communication with the agency on this matter well beyond the comment period deadline.[65]

American Honda Motor Co., Inc. (Honda) provided a similar vision for ongoing refinement of the Guidelines as new empirical results become available. They refer to the human factors principles that yielded metrics for occlusion and the radio tuning reference task as a point of departure:

> We ask that NHTSA work with industry experts to peer review these and other technical aspects of the guidelines to avoid implementing overly restrictive guidelines that will require a quick reaction by the automakers to adhere to the guidelines in their current form, but may evolve to be less restrictive as additional testing and new technologies demonstrate the suitability of less severe guidelines in the future.[66]

Honda also suggested a more formal approach for ongoing work, which would first involve holding one or more workshops to identify and address unresolved questions about the proposed Guidelines:

> After NHTSA issues the final guidelines, Honda requests that NHTSA conduct a technical workshop or perhaps a series of workshops until the remaining questions about the guidelines are resolved. Past technical workshops have been beneficial in assuring a common understanding of guidelines and have helped promote consistent practices among test labs, automakers, and suppliers.[67]

The second part of the approach proposed by Honda involves assessing the effectiveness of the guidelines when they have been fully implemented:

> Honda recommends that these guidelines include periodic measurement of the effectiveness of the guidelines to assure that they are achieving the intended results.[68]

Agero, Inc. also advocated a more holistic process organized around an agency-industry coalition, which would forge a stronger connection between the technical content of the guidelines and its precursors:

> One of the first goals of this coalition would be to reach a consensus on the current knowledge gaps and a subsequent research roadmap, followed by a systematic, collaborative, multi-industry process that will arrive at revised guidelines based upon the previous work of the Alliance [of] Automobile Manufacturers and the Society of Automotive Engineers' Voice User Interface Working Group.[69]
>
> A working group framework will enable a more dynamic and thorough investigation, broaden participation, promote cross-industry consensus, and allow sufficient time to complete critical research and scope potential technology and driver education advancements.[70]

b. NHTSA's Response

NHTSA agrees with commenters that the NHTSA Guidelines should be kept up-to-date through a dynamic, ongoing process. The issuance with this notice of the Phase 1 NHTSA Guidelines, while

[61] Comments received from the Consumers Union, p. 4. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0063.

[62] "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.*

[63] Comments received from Global Automakers, p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0099.

[64] Ibid, pp. 2–3.

[65] Ibid, p. 2.

[66] Comments received from American Honda Motor Co., Inc., p. 7. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0119.

[67] Ibid, p. 8.

[68] Ibid, p. 4.

[69] Comments received from Agero, Inc., p. 4. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0090.

[70] Ibid, p. 8.

significant, is only a step in the process of the development of NHTSA's Guidelines. NHTSA intends to take multiple future actions to keep the NHTSA Guidelines up-to-date.

In its April 2010 ''Overview of the National Highway Traffic Safety Administration's Driver Distraction Program,'' [71] (NHTSA's Distraction Plan), NHTSA publically committed itself to issuing two more phases of its Driver Distraction Guidelines. Phase 2 will provide recommendations for portable and aftermarket device. Phase 3 will provide recommendations for auditory-vocal interfaces.

In addition to issuing Guideline notices, NHTSA intends to keep its Guidelines up-to-date through the issuance of Guideline Interpretation letters. These will be similar to Federal Motor Vehicle Safety Standards (FMVSS) interpretation letters. All Guideline Interpretation letters will be posted to an appropriate place on NHTSA's Web site so as to be available to all interested parties.

Procedures for requesting an interpretation of the NHTSA Guidelines have been added to the Guidelines.

NHTSA is interested in working with all interested parties to keep the NHTSA Guidelines up-to-date and, to the extent possible, to coordinate future efforts and research. In accordance with commenters' suggestion, we may hold another technical workshop on the Phase 1 Guidelines. To ensure that technical workshops are open to all interested parties, any technical workshop will be announced in advance in the **Federal Register**.

NHTSA continues to be open to meeting with interested parties that have Guidelines-related concerns or issues that they wish to discuss with us.

Finally, NHTSA will keep open a Driver Distraction Guideline docket for the foreseeable future. However, in accordance with normal NHTSA practice, a new docket number will generally be assigned with each notice announcing updates to the Guidelines. Submissions to the docket are an effective means of transmitting concerns to NHTSA.

8. Reliance on Limited Amount of Research in Developing NHTSA's Guidelines

a. Summary of Comments

Some commenters expressed concern about the reliance on a limited amount of research in developing NHTSA's Guidelines. Two commenters questioned the lack of breadth in the supporting materials cited. The following comment was provided by Dr. Paul Green:

> * * * the paucity of citations of other relevant research suggests a narrow view of relevant data, especially given the DOT-supported research is only [a] small fraction of the research * * * on driver distraction.[72]

He provided a number of sources that he thought should be cited, including several NHTSA studies. According to Dr. Green, the consequence of this narrow focus is likely to be the following:

> The docket identifies a long-term goal of having these guidelines become an international standard. However if there are no citations of relevant research from Europe and Japan (there may be 1 citation), then acceptance of the NHTSA Guidelines outside of the U.S. becomes difficult.[73]

The National Safety Council (NSC) also refers to the narrow range of research cited to support the proposed guidelines:

> The decision to release guidelines in three phases, rolled out over many years, with the first phase addressing visual-manual use of electronic devices, is based on the findings of only three studies. Each of these studies has significant limitations. NSC believes that Federal guidelines with the potential to influence the safety of vehicles should be based on a much broader range of research.[74]
>
> There is no discussion of why the preponderance of non-automobile industry-funded research, and research beyond the NHTSA and FMCSA studies with VTTI, were not drawn upon for these guidelines. It is important to provide an explanation of the reasons for ignoring such a wide body of driver distraction research. There should also be an explanation regarding why the guidelines are based only upon USDOT-funded research without review of the vast body of other research.[75]

Toyota Motor North America noted the following limitation of one of the main studies cited by NHTSA:

> * * * the 100-Car Study was completed in 2005 and does not include the in-vehicle technologies that are prevalent in our vehicles today.[76]

The NSC provided the following comments to describe the effect of this problem:

> * * * guideline decision making is therefore based on a very small number of crashes and a very limited population observed in these studies, as acknowledged by NHTSA in the guidelines document * * * Thus, crash risk estimates produced by these studies are derived from an extremely small sample of crashes and are clearly not representative. NSC questions whether these crash risk estimates should be accepted to the degree they are, and whether they should form the basis of Federal decision-making.[77]

b. NHTSA's Response

NHTSA is aware of the vast amount of driver distraction literature beyond the papers and reports referenced in the preamble of the Initial Notice. The Initial Notice preamble was not intended to serve as a comprehensive driver distraction literature review. The research mentioned in the preamble was that necessary to understand the underlying basis for NHTSA's proposed Driver Distraction Guidelines.

Relative to the concerns raised by the NSC and Toyota, NHTSA agrees that the 100-Car Study collected data on a very small number of crashes and a very limited population of drivers. Since data collection for this study was completed in 2005, it was unable to collect data of several in-vehicle technologies prevalent in our vehicles today (e.g., text messaging). However, the 100-Car Study data does provide what NHTSA believes to be the best available estimates of the crash risk of various driver distraction risks for light vehicles that we have today. As discussed earlier in this notice, NHTSA does not want to wait to issue its Phase 1 Guidelines until data from the second Strategic Highway Research Program (SHRP2) naturalistic data collection becomes available.

NHTSA believes that it has sufficient information to issue Driver Distraction Guidelines immediately that will reduce the driver distraction safety problem. Therefore, NHTSA is proceeding to issue its voluntary driver distraction guidelines immediately with this notice based upon its current research base.

9. Concerns That Updating Vehicle Models to Meet the NHTSA Guidelines Will Be Expensive

a. Summary of Comments

Two automakers (Toyota and Chrysler) disagreed with NHTSA's conclusion about the expected effects of

[71] ''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.*

[72] Comments received from Dr. Paul Green, p. 4. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0052.

[73] Ibid, p. 4.

[74] Comments received from The National Safety Council, p. 1. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 085.

[75] Ibid, p. 2.

[76] Comments received from Toyota Motor North America, Inc., p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 092.

[77] Comments received from The National Safety Council, p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 085.

the Guidelines. The following comment from Toyota Motor North America, Inc. summarizes this concern.

In the notice, NHTSA states that the proposed guidelines would require minor changes to in-vehicle electronic devices; however Toyota's analysis indicates that the majority of our in-vehicle electronic devices will not meet these Guidelines.[78]

Referring to the same statements in the guidelines proposal, Chrysler Group LLC provided the following comment:

Chrysler conducted an in-depth assessment of the guideline's testing protocols which included user testing of both the eye glance and occlusion methods per NHTSA's proposed guidelines. Based on this assessment using actual participants, Chrysler disagrees with NHTSA's above mentioned conclusion.[79]

It is likely that most of Chrysler's current in-vehicle systems will require changes to meet the new guidelines requiring significant development costs * * *[80]

b. NHTSA's Response

NHTSA emphasizes that its Driver Distraction Guidelines are voluntary and nonbinding and are neither a Federal Motor Vehicle Safety Standard (FMVSS) nor regulation. As such, automobile manufacturers are not required to adhere to these recommendations (although NHTSA certainly hopes they will do so) or incur costs as a result. In implementing the recommendations of these Guidelines, manufacturers are free to do so in the most cost effective manner.

Additionally, all members of the Alliance have committed themselves to producing vehicles that meet the Alliance Guidelines. Most of the recommendations in the Alliance Guidelines are carried over into the NHTSA Guidelines unchanged. However, the NHTSA Guidelines are more stringent than the Alliance Guidelines in two major areas:

- NHTSA has added three per se lock outs: ''displaying images,'' ''manual text entry,'' and ''displaying text to be read.''
- NHTSA is not including Alliance Principle 2.1 Alternative B, an alternative protocol for evaluating distraction, in our list of recommended acceptance test protocols.
- NHTSA has increased the stringency of the eye glance-related acceptance test criteria to correct a statistics error made during development of the Alliance Guidelines. (This is discussed in detail later in this notice.) For the Eye Glance Measurement on a Driving Simulator acceptance test protocol, the maximum acceptable total eyes-off-road time (TEORT) has been reduced from 20 seconds to 12 seconds and a second criterion limiting long eye glances away from the road has been added. For the Occlusion acceptance test protocol, the Total Shutter Open Time (TSOT) has been reduced from 15 seconds to 12 seconds. Therefore, tasks that meet the Alliance Guidelines Principle 2.1 Alternative A acceptance criteria (based on eye glances) may not meet the acceptance criteria contained in the NHTSA Guidelines.

Despite these more stringent aspects, NHTSA believes that vehicles currently meeting the Alliance Guidelines should meet or be close to meeting all of the recommendations of the NHTSA Guidelines. However, we do understand that the differences and increased stringency of the NHTSA Guidelines may lead some manufacturers to engage in additional design work. As discussed below in Section IV.B.4, NHTSA believes that manufacturers choosing to implement these NHTSA Guidelines for existing vehicle models would likely make any needed changes to meet these Guidelines when a vehicle model undergoes a major revision, thus minimizing the need to redesign existing designs and allow incorporation of any necessary research and/or conformance testing into the normal vehicle production cycle. Accordingly, we do not expect manufacturers to incur significant additional redesign costs to conform to the NHTSA Guidelines because any necessary changes would be made during the normal vehicle production cycle.

Based on comments from vehicle manufacturers, we believe that a substantial portion of the industry's concerns about the costs of meeting the NHTSA Driver Distraction Guidelines are based either on parts of the Guidelines where NHTSA did not clearly express what it recommended or on industry misunderstandings of what NHTSA meant. NHTSA has worked to improve the clarity of the NHTSA Driver Distraction Guidelines being issued with this notice.

10. Concerns About the NHTSA Guidelines Preventing ''911'' Emergency Calls

a. Summary of Comments

Several individual commenters expressed concern that the recommendations of the NHTSA Guidelines might prevent drivers from making emergency phone calls to ''911'' while driving.

b. NHTSA's Response

The recommendations of the Phase 1 NHTSA Guidelines should have no impact on the driver's ability to place an emergency call to ''911'' while driving.

Based on the recommended definition of ''task'' contained in the NHTSA Guidelines, making an emergency call to ''911'' comprises the following three tasks:

- Activating/opening a phone (the Phase 1 Guidelines only cover one that is built-in to the vehicle), dialing ''911,'' and pressing the ''Send'' or ''Talk'' button. NHTSA research[81] has found that drivers can activate/open a phone, dial up to seven digits, and press the ''Send'' or ''Talk'' button before exceeding the task acceptance criteria of the NHTSA Guidelines. Since dialing ''911'' only requires three digits to be dialed, this task can be accomplished by drivers while driving under these Guideline recommendations.
- Talking and listening to the ''911'' Emergency Operator. This is not covered by the NHTSA Guidelines.
- Hanging up the phone. Again, NHTSA research has found that this task can be accomplished by drivers while driving under these Guideline recommendations.

Since each of the tasks that comprise making an emergency call to ''911'' is, according to the NHTSA Guidelines, acceptable for performance by drivers while driving, the Guidelines should have no impact on the driver's ability to perform this task while driving.

11. Concerns About the NHTSA Guidelines Preventing Passenger Use of Electronic Devices

a. Summary of Comments

Numerous individual commenters expressed concern that the recommendations of the NHTSA Guidelines might prevent passengers from using electronic devices to perform tasks such as destination entry into a route navigation system while the vehicle is being driven.

b. NHTSA's Response

NHTSA believes that manufacturers can follow these Guidelines for visual-manual in-vehicle tasks without

[78] Comments received from Toyota Motor North America, Inc., p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 092.

[79] Comments received from Chrysler Group LLC, p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 095.

[80] Ibid, p. 9.

[81] Ranney, T.A., Baldwin, G.H.S., Mazzae, E.N., Martin, J., and Smith, L.A., ''Driver Behavior During Visual-Manual Secondary Task Performance: Occlusion Method Versus Simulated Driving,'' NHTSA Technical Report (in press), accessible at *http://www.regulations.gov/#!documentDetail;D=NHTSA-2010-0053-0077,* April 2012.

impacting front seat passengers. Quoting from the NHTSA Guidelines:

These guidelines are appropriate for devices that can reasonably be reached and seen by a driver even if they are intended for use solely by front seat passengers.

Based on this recommendation, vehicle designers will have to use care in the positioning and implementation of OE electronic devices that are intended for use by front seat passengers to avoid impacting what the passenger can or cannot do.

NHTSA encourages automakers to find solutions to meet the recommendations of the NHTSA Guidelines while allowing passengers to make full use of in-vehicle electronic devices while the vehicle is being driven.

NHTSA believes that technology exists to help companies conform fully with the NHTSA Guidelines without impacting electronic device use by front seat passengers. For example, NHTSA is aware of center stack displays that are visible to a passenger but not to a driver. This sort of technological innovation should make it possible for just passengers, but not drivers, to use electronic devices.

For passengers seated behind the front seat of a vehicle, these guidelines should have no impact. None of the recommendations of the NHTSA Guidelines apply to electronic devices that are located solely behind the front seats of the vehicle.

12. Daytime Running Lights Are Major Cause of Driver Distraction

a. Summary of Comments

Twenty private citizens commented that daytime running lights (DRLs) are a major cause of driver distraction that should be addressed. Concerns were expressed that they draw unnecessary attention to vehicles, that they blind drivers, and that they make it harder to see approaching motorcycles.

b. NHTSA's Response

The NHTSA Driver Distraction Guidelines do not cover headlights. Instead the guidelines focus on the use by drivers of OE in-vehicle devices with visual-manual interfaces while driving and reducing distraction from these devices.

Issues Specific to the NHTSA Guidelines Stated Purpose

1. Concern That Failure to Meet the NHTSA Guidelines Could Result in Enforcement Action

a. Summary of Comments

Global Automakers and multiple automobile manufacturers requested clarification of the relationship between the NHTSA Guidelines and the basis for an enforcement action possibly leading to a safety recall and/or civil penalties. Quoting from the Global Automakers comments:

A discrepancy between the Guidelines and the performance of some in-vehicle device should not form the basis for an enforcement case. However, while stating that the degree to which in-vehicle devices meet the specified criteria would not be assessed in the context of a formal compliance program, the agency is not clear in regard to whether it believes that a failure to meet some aspect of the Guidelines could be a factor in determining whether a device presents an unreasonable risk to safety warranting a recall. It is beyond question that the Guidelines are not a FMVSS subject to enforcement through civil penalties and recall authority. Nor is such a discrepancy by itself evidence of the existence of a safety-related defect.[82]

b. NHTSA's Response

The National Traffic and Motor Vehicle Safety Act (Safety Act)[83] prescribes several enforcement mechanisms, including, but not limited to, notice and remedy (together, these are parts of a recall) provisions and civil penalties. Specifically, the Safety Act authorizes NHTSA to order the recall of motor vehicles and motor vehicle equipment that do not comply with an applicable FMVSS or that contain a safety-related defect.[84] Manufacturers are required to remedy the noncompliance or defect without charge when the vehicle or equipment is presented for remedy.[85] Civil penalties are available for violations of specified sections of Chapter 301 and the regulations prescribed thereunder, including the recall and remedy provisions.[86]

NHTSA's driver distraction recommendations are being issued as Guidelines and not as a FMVSS and as such, non-adherence to the Guidelines would not result in enforcement action in the same way as noncompliance with a FMVSS would. Regardless of whether NHTSA issues Guidelines, it is possible that an in-vehicle electronic device could create an unreasonable risk to safety, either when functioning as intended or when malfunctioning. The Safety Act requires a recall where a defect in a vehicle or equipment creates an unreasonable risk to safety. Although case law provides some guidance as to what constitutes unreasonable risk, each possible safety defect requires separate analysis. For example, it is conceivable, although unlikely, that the device could malfunction in such a way as to interfere with safety-critical electronic control systems in the vehicle. Were that to occur with sufficient frequency and severity so as to constitute an unreasonable risk to safety, the device's adherence to these Guidelines would not be relevant to the determination of unreasonable risk. Moreover, if NHTSA wanted to show that a device created an unreasonable risk, the agency would need to demonstrate the existence of a defect with evidence other than mere non-adherence with the Guidelines. We agree with Global Automakers' comment to the effect that non-adherence does not constitute ''by itself evidence of the existence of a safety-related defect.''

2. NHTSA's Monitoring of Vehicles' Conformance to Its Guidelines

a. Summary of Comments

Several commenters addressed the question of whether NHTSA should monitor vehicles' conformance to the guidelines and whether the results of such monitoring should be made public.

Professor Richard A. Young provided the following comments:

Once their test procedures and criteria are validated, NHTSA should assess conformance of the in-scope products of automakers and suppliers with the NHTSA Guidelines. One way is to test products, either internally at NHTSA or through contractors, and assign safety ratings such as is done now with NCAP [New Car Assessment Program].[87]

As to the dissemination of results, Professor Young provided the following comment:

NHTSA should make public the results of that monitoring by public posting of test results, along with other safety ratings such as NCAP.[88]

Similar suggestions about NCAP were also made by other commenters. It was pointed out that the NCAP information that is made available for each vehicle make/model includes a number of icons indicating whether that make/model has electronic stability control, forward collision warning, and/or lane departure warning. Commenters suggested that a make/model also receive a suitable icon if NHTSA's testing indicated that it

[82] Comments received from Global Automakers. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0099.

[83] National Traffic and Motor Vehicle Safety Act (49 U.S.C. Chapter 301, ''Safety Act'').

[84] 49 U.S.C. 30118; 30120; 30121.

[85] 49 U.S.C. 30120.

[86] 49 U.S.C. 30165.

[87] Comments received from Professor Richard A. Young, Attachment 1 p. 16. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0106.

[88] Ibid, p. 18.

conforms to all of the recommendations of the NHTSA Guidelines.

Chrysler Group LLC (Chrysler) provided a different view in its comments about NHTSA's proposal to monitor adoption of the proposed guidelines:

> Chrysler opposes NHTSA's suggestions regarding the monitoring of adoption of its proposed guidelines. Chrysler, along with members of the Alliance of Automobile Manufacturers, has been voluntarily adhering to the Alliance's distracted driving guidelines for more than a decade without outside monitoring.[89]

Chrysler also expressed concern about the proposal to conduct ''spot check'' testing in the following comment:

> Chrysler is concerned with any comparisons NHTSA might make through ''spot check'' testing. The conclusions that could be made regarding whether a particular device creates an unreasonable risk to the driving public are subjective due to the nature of NHTSA's proposed test methodologies.[90]

On the question of reporting of results, Chrysler had the following comment:

> * * * if NHTSA were to make public any results, Chrysler's recommendation is that monitoring and reporting is conducted industry-wide, across the fleet of all makes and models so that any publication of results would not favor any single automaker.[91]

b. NHTSA's Response

NHTSA's Vehicle Safety Research intends to perform future monitoring to assess conformance to our Driver Distraction Guidelines. While the details of this monitoring have yet to be worked out, we do plan to test actual production vehicles, either internally by NHTSA or through outside contractors. Vehicles will be selected for such monitoring so that they cover a large portion of all makes and models sold. NHTSA will also consider the suggestions regarding publication of the monitoring results once this program is in place.

3. Do automakers have to perform testing as described in the NHTSA Guidelines?

a. Summary of Comments

Several commenters raised questions about how strictly manufacturers would be required to adhere to the test protocols outlined in the proposed guidelines. The Alliance expressed concern about whether the wording of the guidelines outlined a process that differed from previous NHTSA initiatives. They provided the following comment:

> It is well understood by our members that NHTSA issues compliance test procedures to document exactly how the agency intends to test compliance to standards and regulations. As part of the self-certification process, vehicle manufacturers are free to assure compliance using engineering judgment and/or internal test procedures that the manufacturer has confidence will result in vehicle performance that meets or exceeds the requirements of the subject standard. It is the Alliance's understanding that the test procedures contained in the distraction guideline proposal apply similarly. This understanding was confirmed by agency statements made at the March 23, 2012, NHTSA technical workshop.[92]

Individual automakers approached this issue more directly, requesting that NHTSA explicitly allow methods that they have used in the past. GM described a method that differs from the methods described in the proposed guidelines. Their focus was on the requirement to use 24 participants broken into four age groups, which they describe as ''overly prescriptive.'' [93] They described their practice in the following comment:

> GM's practice for evaluating tasks related to in-vehicle electronics requires that at least 85% of the test sample complete the task with a mean glance time less than two seconds and a total eyes-off road time under 20 seconds. GM concentrates on a worst-case age group: 45 to 65 years old. * * * findings based on this age group are generally more conservative.[94]

Central to their method is the use of smaller sample sizes:

> In cases when the test sample is fewer than 24, a sufficient percentage of the test sample must pass validation criteria so that Type 1 errors are no more common than if a 24 person sample was used.[95]

Based on the foregoing, GM offered the following recommendation:

> GM believes this method allows flexibility and expediency, while maintaining the 85% threshold limit established in the Alliance Guidelines. Therefore, GM recommends the proposed guideline adopt the 85% threshold limit in the Alliance Guidelines, and not adopt the specific sample requirements.[96]

b. NHTSA's Response

The Alliance's understanding of NHTSA's intended treatment of the acceptance test protocols contained in the NHTSA Guidelines is accurate. NHTSA issued these acceptance test protocols to document exactly how the agency intends to test for conformance to the NHTSA Guidelines.

Unlike FMVSS, manufacturers do not have to certify that their vehicles meet these Guidelines. While NHTSA encourages manufacturers to adhere to these Guidelines, they are voluntary. Manufacturers choosing to conform to the NHTSA Guidelines are free to use whatever methods they choose to ensure vehicle performance that meets or exceeds the recommendations of the NHTSA Guidelines.

As discussed earlier, NHTSA's Vehicle Safety Research intends to perform monitoring to find out which vehicle make/models conform to our Driver Distraction Guidelines. Such monitoring testing by NHTSA or its contractors will strictly adhere to the test procedures set forth in the NHTSA Guidelines. However, this only sets forth how NHTSA tests for conformance to these Guidelines; manufacturers are free to use any test procedures that they wish.

4. Lead Time for the NHTSA Guidelines

a. Summary of Comments

Organizations had differing opinions about how long it would take to incorporate changes to in-vehicle systems to ensure adherence to the proposed Guidelines. The following comment was provided by Chrysler Group LLC (Chrysler):

> Chrysler has assessed how these changes could be incorporated into existing timing plans at the vehicle level as well as the sub-system and component level. Product timing at each of these levels is distinct and coordination between them must be achieved in order to execute change of the magnitude suggested by NHTSA's proposed guidelines.[97]
>
> Chrysler does not believe the two year lead time suggested in NHTSA's proposed guidelines is realistic. It is possible that it may take a decade to phase in all elements of the guidelines throughout the fleet.[98]

The Consumers Union provided a different perspective:

> * * * many of the proposals outlined in the Guidelines would only require the re-design of already-existing software. Manufacturers make regular changes to software, without having to alter the

[89] Comments received from Chrysler Group LLC, p. 11. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0095.

[90] Ibid, p. 11.

[91] Ibid, p. 12.

[92] Comments received from Alliance of Automobile Manufacturers, Technical Appendix p. 21. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0104.

[93] Comments received from General Motors LLC, Attachment, p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0103.

[94] Ibid.

[95] Ibid.

[96] Ibid.

[97] Comments received from Chrysler Group LLC, p. 10. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0095.

[98] Ibid, p. 10.

hardware of the vehicle. Software re-designs can even be applied as software updates to vehicles that have already been sold. Consumers Union therefore urges auto manufacturers to implement these Guidelines as soon as possible, and not to expect the changes to be put off for as long as five years.[99]

b. NHTSA's Response

NHTSA wants to make it absolutely clear that since its Driver Distraction Guidelines are voluntary and nonbinding, they do not have a ''lead time'' in the same way that a FMVSS or other regulation has a lead time. Vehicle manufacturers are not required to meet the NHTSA Guidelines.

All members of the Alliance have committed themselves to producing vehicles that meet the Alliance Guidelines. Most of the recommendations in the Alliance Guidelines are carried over into the NHTSA Guidelines unchanged. However, the NHTSA Guidelines are more stringent than the Alliance Guidelines in three major areas:

- We have added three per se lock outs: ''displaying images,'' ''manual text entry,'' and ''displaying text to be read.''
- We are not including Alliance Principle 2.1 Alternative B, an alternative protocol for evaluating distraction, in our list of recommended acceptance test protocols.
- We have increased the stringency of the eye glance-related acceptance test criteria. For the Eye Glance Measurement on a Driving Simulator acceptance test protocol, the maximum acceptable total eye-off-road time (TEORT) has been reduced from 20 seconds to 12 seconds and a second criterion limiting long eye glances away from the road has been added. For the Occlusion acceptance test protocol, the Total Shutter Open Time (TSOT) has been reduced from 15 seconds to 12 seconds.

NHTSA believes that vehicles that meet the Alliance Guidelines would either meet or be close to meeting all of the recommendations of the NHTSA Guidelines; however, we do understand that this increased stringency of the NHTSA Guidelines may require additional work to ensure conformance. While Consumers Union may be correct that the vast majority of vehicle and device changes needed to meet the recommendations of the NHTSA Guidelines are simply software changes, some substantial vehicle and device changes may be needed in a few areas due to the increased stringency of the NHTSA Guidelines relative to the Alliance Guidelines. NHTSA does recognize that such redesigns take substantial time.

NHTSA believes that manufacturers choosing to implement these Guidelines for existing vehicle models would likely make any needed changes to meet these Guidelines when a vehicle model undergoes a major revision. This should minimize need to redesign existing models and would allow incorporation of any necessary research and/or conformance testing into the normal vehicle production cycle.

Typically, major revisions occur on about a five-year cycle for passenger cars and less frequently for light trucks. NHTSA believes that it should be feasible for manufacturers to make the necessary changes implementing these guidelines for existing vehicle models that undergo major revisions after approximately three or more years after the issuance of this notice instituting the NHTSA Guidelines (i.e., model year 2017 or later). This three-year time frame is an increase from the two-year time frame stated in the Initial Notice. NHTSA's estimate has changed after considering the comments received about the increased stringency of the NHTSA Guidelines relative to the Alliance Guidelines.

Likewise, NHTSA believes that Guideline conformance should be feasible for new vehicle models that come onto the market three or more years after the issuance of this notice instituting the NHTSA Guidelines (i.e., model year 2017 or later). For existing vehicle models that do not undergo major revisions, NHTSA is not suggesting a time frame by which the recommendations of these Guidelines could be met.

C. Issues Relating to the NHTSA Guidelines Scope

1. Inclusion of Conventional Electronic Devices and Heating, Ventilation, and Air Conditioning in Scope of the NHTSA Guidelines

a. Summary of Comments

Multiple commenters questioned the addition of conventional electronic devices to the scope of NHTSA Guidelines and stated that the inclusion of these devices is not supported by crash data.

The Alliance Guidelines do not apply to conventional information or communications systems. They list conventional information and communications systems as:

AM Radio
FM Radio
Satellite Radio
Cassette
CD
MPS
RDS
Vehicle Information Center[100]

Unlike the Alliance Guidelines, the NHTSA Guidelines are applicable to the above listed conventional information and communications systems.

The comment submitted by the Alliance stated the following about the safety of conventional information and communications systems:

> Historically, driver manipulation of common in-vehicle systems has been an infrequent factor in traffic crashes. Analysis of US crash statistics in the early 1990s, prior to the widespread introduction of OEM integrated telematics systems, revealed a very low occurrence of crashes recorded with driver manipulation of integrated displays/controls. Approximately 5% of the sources of diverted attention/workload studied by Wierwille and Tijerina (1995) were associated with the conventional types of integrated displays/controls contemplated by the expanded scope proposed in the Visual-Manual NHTSA Guidelines.[101]

Conversely, the Consumers Union comments agreed with NHTSA including conventional electronic devices in the scope of the NHTSA Guidelines and further extending them to cover heating, ventilation, and air conditioning (HVAC) controls. Quoting from the Consumers Union comments:

> However, we are concerned that some functions which NHTSA classifies as part of the primary driving task (and thus exempts from these Guidelines) could also be significant sources of needless distraction for drivers. For example, many modern vehicle designs incorporate heating, ventilation and air conditioning (HVAC) controls into their on-screen or controller based systems. This incorporation increases the complexity of these controls, since the driver must interact with the screen and select various options in order to enable heating and cooling functions, rather than simply using knobs or push-buttons. According to Consumer Reports' findings on the distractions posed by various in-car controls, published in the October 2011 issue of the magazine, even some allegedly simpler functions that we tested, such as manual radio tuning, are now so complicated that they may not meet the proposed Guidelines.[102]
>
> As a result, Consumers Union encourages NHTSA not to completely exempt HVAC controls from these Guidelines. These heating and cooling tasks could become just

[99] Comments received from Consumers Union, p. 4. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0063.

[100] P. 11, ibid.

[101] Comments received from the Alliance of Automobile Manufacturers, p. 4. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0104.

[102] See, ''Controls Gone Wild,'' available at: *http://www.consumerreports.org/cro/magazinearchive/2011/october/cars/the-connected-car/controls-gone-wild/index.htm.*

as distracting as operating a navigation system or an entertainment system.[103]

Additionally, commenters requested that NHTSA make two clarifications to the Scope section of its Guidelines:

- To explicitly state in the Scope section that these Guidelines are applicable only to the visual-manual aspects of electronic device human-machine interfaces, and
- To clarify that these Guidelines do apply to controls integral to the vehicle that are meant to control portable and/or aftermarket devices.

b. NHTSA's Response

NHTSA believes that the fact that some devices and systems have been present in motor vehicles for approximately 80 years does not imply that it is reasonable for them to be designed with interfaces that excessively distract drivers. Therefore, we have retained conventional (as listed in the Alliance Guidelines) information and communications systems in the scope of electronic devices for which the NHTSA Guidelines are applicable for the reasons discussed below.

NHTSA does not believe that there is any inherent difference in the distraction potential of new devices compared to those that have been present in motor vehicles for many years. For both types of systems, a poorly designed human-machine interface could distract the driver more than is compatible with safe driving. Both types of electronic devices should have well designed human-machine interfaces to minimize driver distraction and promote safe driving.

Additionally, past research has identified a number of crashes that are believed to involve driver distraction due to use of conventional communications and information systems.

A 1996 study by Wang, Knipling, and Goodman [104] analyzed data collected during 1995 by the National Automotive Sampling System Crashworthiness Data System (NASS CDS).[105] This analysis found that distraction due to drivers' use of a radio, cassette player, or CD player was present in 2.1 percent of all crashes.

A more recent study by Singh [106] analyzed data from NHTSA's National Motor Vehicle Crash Causation Survey (NMVCCS) [107] to estimate the incidence of crashes due to radios and CD players (cassette players in vehicles are a disappearing technology). This analysis found that distraction due to drivers' use of a radio or CD player was present in 1.2 percent of all crashes.

While NHTSA agrees with the Alliance that these percentages of crashes are well below five percent of the total crashes, that does not mean that NHTSA is not concerned about them.

Recent NHTSA research [108] has found substantial differences in Total Eyes-Off-Road Time (TEORT) for drivers performing radio tuning tasks using the radios of different production vehicles. During radio tuning testing using five production vehicles, some using button tuning and others using knob tuning, a range of 85th percentile TEORTs (one of the acceptance criteria in the NHTSA Guidelines) varying from 8.0 to 15.8 seconds were observed. NHTSA wishes to encourage the use of driver interfaces for electronic devices, whether they are used by conventional communications and information systems or by newer telematics systems that keep the driver's eyes on the road ahead as much as possible.

Finally, NHTSA is concerned that the driver interfaces of conventional electronic devices can, with modern electronics, be made far more distracting than they have been in the past. NHTSA does not believe that, for example, a future in-vehicle radio should show video clips as it plays music and be considered in conformance with the NHTSA Guidelines simply because a radio is a conventional electronic device.

Drivers' performance of aspects of the primary driving task (e.g., using the steering wheel to maneuver the vehicle, applying the throttle and brake pedals) is considered to be inherently non-distracting since distraction is defined as the diversion of a driver's attention from activities performed as part of the safe operation and control of a vehicle to a competing activity. Furthermore, NHTSA assumes that dedicated controls and displays for conventional primary driving tasks are designed to promote efficient task performance and, other than perhaps during an initial period when a driver is acclimating to a newly acquired vehicle, drivers' performance of driving-related tasks using conventional system controls and displays is unlikely to involve an unreasonable degree of distraction. However, NHTSA notes that drivers' use of primary driving controls and displays that are poorly designed or located may result in degradations in driving performance similar to that which results from a driver's performance of secondary tasks.

With regard to the suggestion from Consumers Union that HVAC controls and displays should be added to the scope of the NHTSA Guidelines, NHTSA agrees that HVAC-related tasks should meet all of the recommendations of the NHTSA Guidelines. NHTSA did not propose in the Initial Notice that dedicated HVAC controls and displays be within the scope of the Guidelines because some HVAC-related features are critical to the safe operation and control of the vehicle. For example, the FMVSS include requirements for ''Windshield defrosting and defogging systems'' (FMVSS No. 103) and ''Windshield wiping and washing systems'' (FMVSS No. 104) to ensure that the driver has a clear view of the roadway. Additionally, although not HVAC-related, another system essential to the safe operation and control of the vehicle and required by FMVSS is headlamps (FMVSS No. 108, ''Lamps, reflective devices, and associated equipment''), which also aid the driver in seeing the roadway. A driver's use of such required systems is considered to be part of the ''primary driving task'' because, in certain environmental conditions, the absence of such systems would make driving less safe and in some cases impossible. As such, the controls and displays associated with these required systems should not be locked out for use by the driver at any time, even if related tasks do not meet the task acceptance criteria.

[103] Comments received from Consumers Union, p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0063.

[104] Wang, J.S., Knipling, R.R., and Goodman, M.J., ''The Role of Driver Inattention in Crashes: New Statistics from the 1995 Crashworthiness Data System,'' 40th Annual proceedings, Association for the Advancement of Automotive Medicine, Vancouver, British Columbia, Canada, October 1996.

[105] NASS CDS, like NASS GES, contains data from a nationally-representative sample of police-reported crashes. It contains data on police-reported crashes of all levels of severity, including those that result in fatalities, injuries, or only property damage. National numbers of crashes calculated from NASS CDS are estimates. Unlike NASS GES, in 1995 NASS CDS had a variable that indicated whether a driver was distracted and the cause of that distraction (if present).

[106] P. 5, Singh, S., ''Distracted Driving and Driver, Roadway, and Environmental Factors,'' DOT HS 811 380, September 2010.

[107] NMVCCS is NHTSA's most recent, nationally representative, detailed survey of the causes of light motor vehicle crashes. For NMVCCS driver (including distraction- and inattention-related information), vehicle, and environment data were collected during a three-year period (January 2005 to December 2007). A total of 6,949 crashes met the specified criteria for inclusion in NMVCCS. Due to specific requirements that must be met by crashes for inclusion in NMVCCS, the NMVCCS data differs from other crash databases such as NASS–CDS or NASS–GES.

[108] Perez, M., Owens, J., Viita, D, Angell, L, Ranney, T.A., Baldwin, G.H.S., Parmer, E., Martin, J., Garrott, W.R., and Mazzae, E.N., ''Summary of Radio Tuning Effects on Visual and Driving Performance Measures—Simulator and Test Track Studies,'' NHTSA Technical Report in press. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0076, April 2012.

Given the importance of the availability of these FMVSS-required systems, NHTSA is continuing to exclude from the scope of the Guidelines HVAC-related systems that are required by FMVSS.

However, NHTSA has reconsidered its position on HVAC-related tasks not associated with a vehicle system or equipment required by a FMVSS and is including such tasks within the scope of the NHTSA Guidelines. Although NHTSA is not aware of any past research identifying crashes caused by driver distraction due to a driver's adjustment of traditionally-designed HVAC controls, the agency is concerned that the advent of multi-function display interfaces that permit interaction with multiple vehicle functions, including some non-required HVAC functions, may involve a greater degree of driver distraction. Specifically, NHTSA is concerned that these new interfaces can require more steps to accomplish HVAC and other tasks than a standard, dedicated control. Given this concern, NHTSA has reconsidered its position and has decided to include within the scope of the NHTSA Guidelines HVAC system adjustment tasks that are not associated with a vehicle system or equipment required by a FMVSS. NHTSA believes that providing redundant means of accomplishing secondary tasks via both dedicated controls and a multi-function display interface does not provide any added benefit to the driver if the redundant task performance means (i.e., a multi-function display) is less efficient than the original means.

Finally, NHTSA has made the two requested clarifications:

- We have explicitly stated in the Scope section that these Guidelines are applicable only to the visual-manual aspects of electronic device human-machine interfaces, and
- Added statements that these Guidelines do apply to controls integral to the vehicle that are meant to control portable and/or aftermarket devices.

2. Confusion About Limiting Scope of NHTSA Guidelines to Non-Driving Activities

a. Summary of Comments

The proposed version of the NHTSA Guidelines Scope section began with the sentence:

> These guidelines are appropriate for driver interfaces of original equipment electronic devices for performing non-driving activities that are built into a vehicle when it is manufactured.

Multiple commenters complained that this sentence was confusing and misleading since it incorrectly indicated that such clearly driving-related tasks as route navigation were not within the scope of the NHTSA Guidelines while later portions of the Guidelines clearly indicated that they were in scope. Quoting from the comment submitted by the Alliance on this topic:

> In addition the agency offers no definition for the term ''non-driving-related'' or why this distinction is important to managing driver distraction. The Alliance Guidelines do not make such a distinction because ''driving related'' tasks, available to the driver while driving, can also lead to undesirable levels of driver workload if not properly designed. * * * Moreover, NHTSA has somehow included navigation under the proposed definition of ''non-driving-related'' tasks/devices even though route finding and direction following are basic and vital parts of the driving task.[109]

b. NHTSA's Response

NHTSA agrees with the commenters that the proposed version of the NHTSA Guidelines Scope section began with a confusing and misleading sentence. As commenters pointed out, NHTSA definitely wishes to include some driving-related tasks (i.e., route finding and direction following among others) in the scope of its Guidelines.

In response to this comment, NHTSA has done four things:

1. Added a definition of Driving-Related Task to the NHTSA Guidelines Definitions section. *Driving-Related Task* means either: (1) Any activity performed by a driver as part of the safe operation and control of the vehicle, (2) any activity performed by a driver that relates to use of a vehicle system required by Federal or State law or regulation, or (3) any other activity performed by a driver that aids the driver in performing the driving task but is not essential to the safe operation or control of the vehicle (e.g., navigation, cruise control). The first two types of driving-related task are not covered by the Guidelines. The third type of driving-related task includes secondary tasks related to driving that are covered by the Guidelines.

2. Added a definition of Non-Driving-Related Task to the Guidelines Definitions section. *Non-Driving-Related Task* means any activity performed by a driver other than those related to the driving task.

3. Extensively revised the Guidelines Scope section to make it clear that the Guidelines are applicable to all non-driving-related tasks utilizing electronic devices as well as for electronic devices used for performing some driving-related tasks.

4. Added a table to the Guidelines Scope section listing for which driving-related tasks the Guidelines are applicable.

3. Suggestions To Expand Scope of the NHTSA Guidelines To Cover Medium and Heavy Trucks and Buses

a. Summary of Comments

In their comments, the National Transportation Safety Board (NTSB) provided detailed narrative descriptions of several severe distraction-related crashes that they investigated. Among these were crashes involving a heavy truck driver and a motorcoach driver, both of whom were distracted by cell phone tasks at the time of their respective crashes. Based in part on severity of these outcomes, the NTSB provided the following comment recommending the inclusion of larger size vehicles in the scope of these Guidelines:

> * * * the proposed guidelines are limited to passenger cars, multipurpose passenger vehicles and trucks and buses with a gross vehicle weight rating of not more than 10,000 pounds. However, considering the significance of large commercial vehicles in overall crash and fatality rates, and given the increasing availability and use of electronic logs, global positioning system[s], and other potentially distracting systems in these vehicles, the NTSB encourages NHTSA, with the Federal Motor Carrier Safety Administration, to monitor the introduction of in-vehicle technology and aftermarket technology into medium trucks, heavy trucks, and buses, including motorcoaches, and to conduct research as appropriate.[110]

b. NHTSA's Response

The human-machine interfaces of medium vehicles (those with a GVWR from 10,001 through 26,000 pounds) and heavy vehicles (those with a GVWR of 26,001 pounds or greater) differ from those of light vehicles (i.e., vehicles other than motorcycles with a gross vehicle weight rating (GVWR) of 10,000 pounds or less) in many ways. Medium and heavy vehicles (hereinafter just heavy vehicles) typically have more and different driver controls and displays. Heavy vehicles are typically driven for commercial purposes and may be equipped with dispatching systems or other systems or devices not found in privately-owned light vehicles. Heavy vehicle drivers are frequently seated higher above the road than is the case

[109] Comments received from the Alliance of Automobile Manufacturers. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0104.

[110] Comments received from The National Transportation Safety Board, p. 6. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0066.

for light vehicle drivers, affecting device downward viewing angle recommendations. While the fundamental principles (the driver's eyes should usually be looking at the road ahead, etc.) that underlie NHTSA's Guidelines apply to heavy vehicles just as they do to light vehicles, the details of guideline implementation needs to be different for heavy vehicles. For example, the display downward viewing angle recommendations may need to be modified.

Except for naturalistic data analyses sponsored by the Federal Motor Carrier Safety Administration (FMCSA),[111] the research that has resulted in the NHTSA Guidelines involved only light vehicles. NHTSA has many Federal Motor Vehicle Safety Standards (FMVSS) that apply to heavy vehicles. In performing the research needed to develop existing heavy vehicle FMVSS, NHTSA has learned that not all research findings for light vehicles carry over to heavy vehicles. Therefore, research would be needed to determine which research findings will carry over from light vehicles to heavy vehicles.

While NHTSA believes that addressing driver distraction in heavy vehicles is important, research needs to be performed before distraction-related recommendations for heavy vehicles can be made. Nothing precludes heavy vehicle manufacturers from following the principles and Guidelines set out in this document should they find them useful.

4. Request That Scope of the NHTSA Guidelines Exclude Emergency Response Vehicles

a. Summary of Comments

During a meeting with members of NHTSA's staff,[112] the National Association of Fleet Administrators (NAFA) commented that the recommendations of the NHTSA Guidelines should not apply to law enforcement vehicles. NAFA's written comments[113] provided extensive commentary to support their recommendation that the Guidelines should not apply to certain government fleet and emergency service vehicles, including law enforcement, fire and rescue, utility service, and medical response vehicles, such as ambulances. They provided the following rationale to support their recommendations:

> The Guidelines do not reflect the systems and procedures utilized by law enforcement agencies.[114]
>
> The per se lockout requirements of the Guidelines will impede the mission of these vehicles and their drivers. The safety of the officer and the public necessitate that the in-vehicle electronic devices be operational when the vehicle is moving. For example, in police operations, the officer often has to enter GPS coordinates while the vehicle is in motion.[115]

They assert that the ability to perform the following activities when a law-enforcement vehicle is moving is essential: (1) Visual-manual text messaging; (2) visual-manual internet browsing; (3) visual-manual social media browsing; (4) visual-manual navigation system destination entry by address; and (5) visual-manual 10-digit phone dialing.

To facilitate these requirements, they make three specific recommendations:

> The Guidelines should explicitly provide that, in the case of government vehicles and emergency service vehicles, the vehicle manufacturer program into the vehicle's Electronic Control Module the ability to override the per se lock out functions. Essentially, this would make the vehicle ''think'' that it is parked.[116]
>
> The Guidelines should permit the override function to be enabled upon the request of a government agency, law enforcement, fire and rescue, medical services agency, or utility company by providing an access code to enable/disable this feature.[117]
>
> When the vehicle is decommissioned and offered for sale, the agency should be required to restore the vehicle to factory standards.[118]

NAFA offered additional support for their recommendations:

> This approach enables the vehicle manufacturers to engineer a single system to meet the requirements of the Guidelines, thus not impeding vehicle production schedules, while also meeting the needs of those fleets where integrated, added or hand-held electronic devices are fundamental to the work requirement of the vehicle and its driver: Whether a police officer on patrol; fire personnel responding to a fire; or a state transportation representative monitoring road conditions.[119]

Chrysler made a similar suggestion in their commentary:

> With respect to special-purpose vehicles such as those used for Police vehicles and Ambulance up-fits, Chrysler asks that NHTSA expressly exempt such vehicles from the proposed guidelines. Such exemptions are common but not universal in various state laws.[120]

b. NHTSA's Response

NHTSA generally agrees with these comments. In order to respond quickly to emergencies, law enforcement, fire, and medical response personnel may need to perform tasks that might normally be locked out under the NHTSA Guidelines. The agency believes that emergency responders' effectiveness is unlikely to be jeopardized by allowing emergency response drivers to perform certain job-related tasks. As first responders, police and emergency personnel are acutely aware of the hazards of distracted driving. Additionally, many emergency responders receive additional training in driving beyond that required to acquire a driver's license and also receive training in the use of the equipment in the emergency response vehicle. NHTSA believes that this additional training and awareness may mitigate any distraction risk presented by exempting emergency response vehicles from the task lock out provisions of these Guidelines.

NHTSA does not agree with the suggestion that the NHTSA Guidelines should not apply to service vehicles. We do not believe that the response time needs of utility service vehicles are as time critical as those of the other emergency service vehicles listed in the NAFA comment. Therefore, we have not excluded utility services vehicles from the scope of the NHTSA Guidelines.

Although not requested by the commenters, NHTSA also believes that its Driver Distraction Guidelines should not apply to vehicles that are built primarily for the military or for other emergency uses as prescribed by regulation by the Secretary of Transportation. NHTSA's Driver Distraction Guidelines have been appropriately changed to exclude these vehicles from the scope of these Guidelines.

5. Request That Scope of the NHTSA Guidelines Not Include Displays Required by Other Government Bodies

a. Summary of Comments

American Honda Motor Company (Honda) requested that emissions controls and fuel economy information

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[111] Olson, R.L., Hanowski, R.J., Hickman, J.S., and Bocanegra, J., ''Driver Distraction in Commercial Vehicle Operations,'' FMCSA–RRR–09–042, September 2009.

[112] This meeting is documented in the memorandum ''Docket Submission Documenting Ex Parte Meeting with the National Association of Fleet Administrators,'' accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0080.

[113] Comments received from National Association of Fleet Administrators. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0110.

[114] Ibid.

[115] Ibid.

[116] Ibid. p. 2.

[117] Ibid. p. 2.

[118] Ibid. p. 2.

[119] Ibid. p. 2.

[120] Comments received from Chrysler Group LLC, p. 7. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0095.

not be included within the scope to the NHTSA Guidelines. Quoting from Honda's comment:

Certain emission information, such as the check engine malfunction indicator light, is required by the United States Environmental Protection Agency and the California Air Resources Board, and is specified within FMVSS 101. Supplemental information for this and other malfunction indicators can be immediately beneficial to drivers by informing them of the severity and urgency of the condition that caused the light to illuminate and helping drivers make informed decisions about the appropriate actions and timing of their responses. This type of information may be provided through a vehicle information center, and restriction of this information should be carefully considered.[121]

b. NHTSA's Response

NHTSA wishes to point out that simply because the display of certain types of information is covered by the NHTSA Guidelines does not mean that this information cannot be displayed to the driver. For covered types of information, the display of the information should not distract the driver, in accordance with these Guidelines. Such information can be displayed through a vehicle information center or multi-function display, malfunction indicators, or other types of displays.

The NHTSA Guidelines already exempted from their scope any electronic device that has a control and/or display specified by a Federal Motor Vehicle Safety Standard (FMVSS). However, a motor vehicle control and/or display could also be mandated by other United States Government agencies (such as the Environmental Protection Agency). We do not want there to be any possibility that the NHTSA Guidelines conflict with the mandates of these other government organizations. Therefore, we have expanded the exclusion for controls and/or displays covered by a FMVSS. The NHTSA Guidelines now exclude from their scope controls and/or displays specified by standards from any U.S. government organization.

D. Definition of Driving and Lock Out Conditions

1. For Automatic Transmission Vehicles—In Park Versus At or Above 5 mph

a. Summary of Comments

Multiple commenters including the Alliance, Global Automakers, and multiple individual motor vehicle manufacturers suggested that NHTSA change its definition of driving[122] so that a driver is considered to be driving a vehicle whenever the vehicle speed exceeds 5 mph but not when the vehicle is stationary or moving at less than 5 mph. The proposed NHTSA Guidelines defined driving, for automatic transmission vehicles, as being anytime the vehicle's engine was ''On'' unless the vehicle's transmission was in ''Park.''

The commenter-suggested change would make the definition of *driving* in the NHTSA Guidelines consistent with the definition of *driving* contained in the Alliance Guidelines. The reasons for this suggestion were essentially the same for all commenters. Two relevant quotes from the Alliance comments explain the commenters' rationale:

The Alliance believes that this [definition] is unnecessarily restrictive and will lead to widespread customer dissatisfaction with the (non)functionality of embedded information, communications, and entertainment (hereafter, telematics) systems. Resultant customer frustration with in-vehicle telematics systems will likely lead to a strong propensity by drivers to instead opt for the use of portable devices. Far from improving driving safety and reducing distracted driving, this would have the opposite effect, since use of portable devices while driving requires both more eyes off-road time, and more manual interaction with the device.[123]

Naturalistic data confirms that drivers self-regulate secondary task engagement, frequently waiting until driving demands (and associated crash risk) are low before engaging in secondary tasks. One of the most frequent and lowest demand/risk conditions is idling in traffic, whether at signalized intersections or when in stop-and-go traffic. Many drivers will use such short intervals of stationary operation to undertake secondary tasks that might otherwise be too demanding to perform while driving. Locking out in-vehicle telematics functions during these brief periods of stationary vehicle operation will forestall such responsible device use behaviors by drivers, and will likely lead to compensatory behaviors that are worse for driving safety. Such unsafe behaviors may include use of paper maps or portable devices, placement of the vehicle in ''Park'' while in an active driving lane, or pulling over to the road shoulder of an active roadway in order to use the device.[124]

A quote from Ford Motor Company further discusses their concerns:

Additionally, Sayer, Devonshire, and Flanagan's (2007) analysis of secondary task behavior during the Road Departure Collision Warning (RDCW) field operational test found that drivers appear to selectively engage in secondary tasks according to driving conditions. When drivers can freely choose, they elect to engage in secondary tasks when their driving skills are least needed. Most recently, Funkhouser and Sayer (2012) analyzed almost 1000 hours of naturalistic driving data and discovered that drivers frequently manage risk by initiating visual-manual cellphone tasks while the vehicle is stopped (but not in PARK). NHTSA's approach would eliminate opportunities for drivers to engage in this type of safety-positive behavior, and may result in more drivers choosing to use a hand-held device rather than the safer built-in vehicle interfaces.[125]

In its comments, the Alliance also asserted that the NHTSA Guidelines' definition of *driving* does not need to be compatible with those contained in Executive Order (EO) 13513, Federal Leadership on Reducing Text Messaging While Driving (issued on October 1, 2009) and in Federal Motor Carrier Safety Regulation (FMCSR) 49 CFR § 392.80, Prohibition Against Texting (issued September 27, 2010) since these are focused on portable, not OE, devices. The following quote from the Alliance comments presents their argument:

However, this prohibition on texting while driving is aimed at use of devices carried into the vehicle, rather than at in-vehicle devices provided as original equipment (OE) by vehicle manufacturers:

Sec. 2. Text Messaging While Driving by Federal Employees. Federal employees shall not engage in text messaging (a) when driving GOV, or when driving POV while on official Government business, or (b) when *using electronic equipment supplied by the Government while driving.* [emphasis added by the Alliance]

In-vehicle OE devices are integrated with the vehicle operating data bus, and can therefore be designed to automatically disable telematics functions deemed to be incompatible with driving. The Alliance Driver Focus-Telematics.

(DFT) Guidelines specify that such functions should be automatically disabled when the vehicle is operated at speeds above 5 mph. This threshold speed is based on the capability of wheel speed sensors to detect and measure vehicle speed. Because the device interface will cease to function within one second of normal operation (i.e., less than a single ''safe'' glance interval) it effectively addresses the concern that drivers

[121] Comments received from American Honda Company, p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0112.

[122] Underlined terms are defined in Section IV. Definitions of the NHTSA Driver Distraction Guidelines.

[123] Comments received from the Alliance of Automobile Manufacturers, p. 21. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0104.

[124] P. 22, ibid.

[125] Comments received from Ford Motor Company, p. 5. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0097.

may attempt to continue with a locked-out task after resuming travel in traffic.'' [126]

b. NHTSA's Response

Adopting this suggestion would change the conditions for which tasks would be locked out. Since lock out is only recommended by the NHTSA Guidelines for certain electronic devices and/or tasks while driving, the suggested change would mean that lock out would apply only when the speed of the vehicle exceeds 5 mph. Multiple reasons were offered for this suggestion; however none were sufficiently compelling to NHTSA to justify revising the conditions for lock out of tasks. The reasons for this decision are discussed below.

Regarding the Alliance's concern that NHTSA's proposed definition of driving may lead to increased portable device use, the agency notes that Phase 2 of NHTSA's Guidelines will help manage the use of portable devices through recommendations designed to decrease the distracting potential of these devices.

NHTSA is not convinced that drivers performing otherwise locked out tasks while stopped in traffic or at a traffic light is safe. We are concerned that a definition based on lock out of tasks only for vehicle speeds above 5 mph could result in distracted drivers inadvertently allowing their vehicles to roll forward at very low speed and possibly strike pedestrians, pedalcyclists, etc. Furthermore, the agency is concerned that drivers not paying attention to the roadway while stopped and performing a normally locked out task then switching back suddenly when traffic starts moving or the traffic light turns green creates an increased risk of a crash or, at a crosswalk, of hitting a pedestrian.

In the Initial Notice, NHTSA discussed how the definition of driving was similar to the definitions of driving contained in FMCSR 49 CFR 392.80, and Executive Order (EO) 13513. Since the publication of the Initial Notice, the Moving Ahead for Progress in the 21st Century Act (MAP–21), Public Law 112–114, 126 Stat. 405 (July 6, 2012), has been signed into law. This statute contains a similar definition of driving to that contained in the Initial Notice, FMCSR 49 CFR 392.80, and EO 13513.

Section 31105 of MAP–21 authorizes a distracted driving grant program for states that have enacted and are enforcing laws that prohibit texting while driving or youth cell phone use while driving. MAP–21 defines driving for the purposes of this program as:

> Operating a motor vehicle on a public road, including operation while temporarily stationary because of traffic, a traffic light or stop sign, or otherwise; and * * * [*Driving*] does not include operating a motor vehicle when the vehicle has pulled over to the side of, or off, an active roadway and has stopped in a location where it can safely remain stationary.

The FMCSR 49 CFR 392.80, Prohibition Against Texting definition is:

> *Driving* means operating a commercial motor vehicle, with the motor running, including while temporarily stationary because of traffic, a traffic control device, or other momentary delays. *Driving* does not include operating a commercial motor vehicle with or without the motor running when the driver moved the vehicle to the side of, or off, a highway, as defined in 49 CFR § 390.5, and halted in a location where the vehicle can safely remain stationary.[127]

The EO 13513 definition is:

> *Driving* means operating a motor vehicle on an active roadway with the motor running, including while temporarily stationary because of traffic, a traffic light or stop sign, or otherwise. It does not include operating a motor vehicle with or without the motor running when one has pulled over to the side of, or off, an active roadway and has halted in a location where one can safely remain stationary.[128]

NHTSA recognizes that it may not be easy to implement the above definitions using vehicle technology. For example, it could be very difficult to determine if a vehicle has been ''pulled over to the side of, or off, an active roadway and has halted in a location where one can safely remain stationary.'' [129] Therefore, as explained in the initial notice, the agency has modified the Guidelines' definition of *driving* from that contained in MAP–21, FMCSR 392.80, and EO 13513 to make it easier to implement. For a vehicle equipped with a transmission with a ''Park'' position, it has been changed to be whenever the vehicle's means of propulsion (engine and/or motor) is activated unless the vehicle's transmission is in ''Park.'' From a technical point of view, this should make it easier for vehicle manufacturers to determine whether a driver is *driving* a vehicle since, in order to meet the requirements of Federal Motor Vehicle Safety Standard (FMVSS) Number 114, the manufacturers of vehicles equipped with transmissions with a ''Park'' position have to be able to determine when the transmission is in ''Park.''

NHTSA agrees with the Alliance that EO 13513 and FMCSR 392.80 are both focused on portable, not integrated, electronic devices, but we do not agree with the Alliance that the extension of these documents to integrated electronic devices would change their definition of driving. There is nothing in the EO 13513 and FMCSR 392.80 definitions of driving that depends upon whether an electronic device is brought into the vehicle or is integrated into the vehicle.

Therefore, for the purposes of the Distraction Guidelines, NHTSA is using a definition of driving that is compatible with that contained in MAP–21, FMCSR 392.80, and EO 13513. The differences between the MAP–21, FMCSR 392.80, and EO 13513 definitions and the NHTSA definition are intended to make this definition easier for vehicle manufacturers to implement.

2. Definition of Driving for Manual Transmission Vehicles

a. Summary of Comments

In addition to the previously discussed comments about the definition of *driving* that are applicable to all vehicles, multiple commenters stated that there are technical barriers to implementing the definition of driving for manual transmission vehicles that was proposed in the Initial Notice version of the NHTSA Guidelines.

In the Initial Notice, NHTSA proposed to define driving for manual transmission vehicles as any condition in which the vehicle's engine is ''On'' unless the vehicle's transmission is in ''Neutral'' and the parking brake is ''On.'' However, commenters pointed out that manual transmission vehicles are frequently not equipped with a sensor that detects when the transmission is in ''Neutral.'' The addition of such a sensor would require the addition of added hardware to the vehicle and require significant resources.

This comment was made by the Alliance and multiple individual motor vehicle manufacturers.

b. NHTSA's Response

NHTSA does not believe that the addition of hardware to the vehicle or the expenditure of significant resources is necessary to implement its proposed

[126] Comments received from the Alliance of Automobile Manufacturers, p. 22. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0104.

[127] FMCSR § 392.90, Prohibition against texting, accessed from *http://www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/fmcsrruletext.aspx?reg=392.80,* issued September 27, 2010.

[128] Executive Order 13513, ''Federal Leadership on Reducing Text Messaging While Driving,'' October 1, 2009, accessed from *http://www.whitehouse.gov/the_press_office/Executive-Order-Federal-Leadership-on-Reducing-Text-Messaging-while-Driving/.*

[129] Ibid.

definition of driving for manual transmission vehicles.

Even without the presence of a sensor that detects when the transmission is in ''Neutral,'' manufacturers can still infer when the vehicle is in ''Neutral.'' Manufacturers do know the rotational speed of both the engine and the driven wheels. Dividing the rotational speed of the engine by that of the driven wheels, manufacturers can determine a current effective overall gear ratio for the transmission/vehicle. If this value does not equal, allowing for production and measurement tolerances, one of the overall gear ratios of the transmission/vehicle, the manufacturer can reasonably infer that the vehicle's transmission is in ''Neutral.'' NHTSA is amending the guidelines to make clear that such inference is acceptable for the purposes of the NHTSA Guidelines.

It is possible for a vehicle equipped with manual transmission to travel at a significant speed while in Neutral even though the vehicle's parking brake is ''On.'' This situation could occur, for example, while coasting down a long steep hill if the vehicle's parking brake was only lightly applied. To ensure that inferring that the vehicle's transmission is in ''Neutral'' while the vehicle's parking brake ''On'' does not result in unreasonable decisions as to whether a vehicle is driving, NHTSA has added an additional condition that should be met: for a manual transmission vehicle not to be considered driving, the vehicle's speed should be less than 5 mph.

The revised definition of driving is:

Driving means whenever the vehicle's means of propulsion (engine and/or motor) is activated unless one of the following conditions is met:

- For a vehicle equipped with a transmission with a ''Park'' position—The vehicle's transmission is in the ''Park'' position.
- For a vehicle equipped with a transmission without a ''Park'' position—All three of the following conditions are met:
  - The vehicle's parking brake is engaged, and
  - The vehicle's transmission is known (via direct measurement with a sensor) or inferred (by calculating that the rotational speed of the engine divided by the rotational speed of the driven wheels does not equal, allowing for production and measurement tolerances, one of the overall gear ratios of the transmission/vehicle) to be in the neutral position, and
  - The vehicle's speed is less than 5 mph.

E. Per Se Lock Out Issues

1. The NHTSA Guidelines Should Not Recommend Per Se Lock Outs of Devices, Functions, and/or Tasks

a. Summary of Comments

Vehicle manufacturers were generally against the inclusion of per se lock outs in NHTSA's Guidelines. Mercedes-Benz commented that the concept of per se lock outs is fundamentally unsound and ''does not follow the agency's own criteria to make data driven decisions.'' Ford and Chrysler specifically recommended elimination of the per se lock out of tasks. The German Association of Automotive Industry, MEMA, the Alliance, and vehicle manufacturers including Chrysler, Ford, General Motors, Honda, Hyundai, Mercedes-Benz, Nissan, and Volkswagen recommended that NHTSA's guidelines should rely on a data-driven, performance-based approach. The Alliance commented that ''decisions to limit or lock out the availability of specific features and functions to the driver should only be made based on performance data tied to real world crash risk—not by name or belief.'' Ford specifically commented that ''Per Se lockouts in general, and the specific one for 'text messaging' should be eliminated because appropriate lockouts will result from the existing criteria in the Alliance Guideline, such as limits on glance length and the total-eyes-off-road-time.'' General Motors stated in regard to the per se lock outs, ''The specificity of these requirements is very limiting and not necessary.''

NAFA supported the per se lock out of tasks as included in NHTSA's proposed guidelines, with the exception that they strongly preferred ''having lockout apply when the vehicle is stopped but transmission is still engaged.''

Multiple vehicle manufacturers, most notably Ford, indicated that the per se lock outs, as written, were insufficiently clear and overly broad and therefore, difficult to implement.

Both BMW and Toyota commented that NHTSA's inclusion of per se lock out of certain tasks is an inappropriate interpretation of the Alliance Guidelines.

Both MEMA and Nissan indicated in their comments concern that per se lock out of tasks may hinder future innovation. MEMA commented that while lock out of some tasks ''may be suitable in some cases (such as, restricting video entertainment visible to the driver),'' others, if retained, ''could negatively impact future technology development and constrain innovation of feature functions and applications.'' Nissan stated that ''per se lockouts should be determined carefully and scientifically so that the guidelines do not prevent future technological improvements or advances.'' Nissan commented that per se lock outs should be reserved for tasks which are difficult to define or those tasks that cannot be evaluated using the prescribed performance tests.

Nissan recommended removing Section V.5.h of the proposed NHTSA Guidelines, which states:

V.5.h The per se lock outs listed above are intended to specifically prohibit a driver from performing the following while driving:

- Watching video footage,
- Visual-manual text messaging,
- Visual-manual internet browsing, and
- Visual-manual social media browsing.

Two commenters recommended that NHTSA eliminate the per se lock out for certain tasks. Ford requested that text messaging, internet browsing, and social media browsing not be subject to per se lock out. Toyota requested that internet and social media browsing not be subject to per se lock out.

b. NHTSA's Response

NHTSA's proposed Visual-Manual Driver Distraction Guidelines included a list of specific in-vehicle device tasks that NHTSA considers ''unsafe for performance by the driver while driving.'' These include activities that are extremely likely to be distracting due to their very purpose of attracting visual attention but whose obvious potential for distraction cannot be measured using a task timing system because the activity could continue indefinitely (displaying video or certain images), activities that are discouraged by public policy and, in some instances, prohibited by Federal regulation and State law (e.g., entering or displaying text messages), and activities identified in industry driver distraction guidelines which NHTSA agrees are likely to distract drivers significantly (e.g., displaying video or automatically scrolling text).

Tasks such as displaying video and displaying text to be read are likely to distract drivers but may not be testable due to being unbounded or because they vary in magnitude. As a result, asserting a specific task start or end point would be somewhat arbitrary, rendering them not ''testable.'' Therefore, a data-driven approach using acceptance testing as a basis for determining whether to lock out these tasks does not appear to be feasible. A data-driven approach using crash data is also not currently feasible given the very limited amount of data collected to date for these new electronic distractions.

While Nissan commented that per se lock outs ''should be reserved for tasks which are difficult to define or those that cannot be evaluated using the prescribed tests,'' NHTSA believes that some testable tasks are also inappropriate for performance while driving, including activities that are discouraged by public policy and activities that are generally accepted as lock outs in industry guidelines which NHTSA agrees are likely to distract the driver significantly. Both BMW and Toyota commented that NHTSA's inclusion of per se lock out of certain tasks is an inappropriate interpretation of the Alliance Guidelines. NHTSA notes that several of the tasks that the agency has indicated should be locked out (e.g., displaying video, automatically-scrolling text) are also those that the Alliance Guidelines indicate ''should be disabled while the vehicle is in motion or should be only presented in such a way that the driver cannot see it while the vehicle is in motion,'' and NHTSA agrees that these tasks for lock out are tasks that are likely to be significantly distracting.

Regarding recommendations that NHTSA eliminate the per se lock out of text messaging, internet browsing, and social media browsing, the agency initially notes that these activities were not included in the proposal as tasks subject to per se lock out. Rather, as stated in the Initial Notice, the agency intended that these activities would be inaccessible to the driver while driving as a result of the per se lock outs of manual text entry and displaying text to be read. Eliminating text messaging, internet browsing, and social media browsing while driving has been a focus of the Department of Transportation's efforts to end distracted driving, and these activities are also prohibited by many State anti-texting laws and the Executive Order titled ''Federal Leadership on Reducing Text Messaging While Driving.'' Although, as discussed below, NHTSA is amending the per se lock outs of manual text entry and displaying text to be read, the agency intends that these per se lock outs effectively render the activities of visual-manual text messaging, internet browsing, and social media browsing inaccessible to the driver while driving.

NHTSA emphasizes that the agency remains open to amending the NHTSA Guidelines, including the per se lock outs, in the future in response to new information.

In response to the comments on individual per se lock outs, NHTSA has revised the list of per se lock outs, clarified the descriptions of the per se lock outs, and added definitions as needed.

2. Per Se Lock Out Relating to Displaying Text to be Read

a. Summary of Comments

Multiple commenters stated that NHTSA misunderstood the recommended limit for the maximum amount of text to be displayed to the driver at one time that is contained in the Japan Automobile Manufacturers Association Guidelines for In-vehicle Display Systems—Version 3.0 (referred to as the ''JAMA Guidelines'').[130] Quoting from a typical comment, that submitted by the Alliance:

JAMA 30 Character Limits Were Inappropriately Applied to English Characters

The agency states that it based ''the 30 character limit in the NHTSA Guidelines on the amount of text that may be read comes from the JAMA Guidelines.'' However, the JAMA guidelines are referring to Japanese language symbols (Kanji) and not English language Roman characters. The Alliance recommends that systems be evaluated with performance criteria and that NHTSA eliminate the potentially redundant and overly restrictive concept of character limits.[131]

The Alliance also pointed out that the number of English language Roman characters corresponding to 30 Kanji characters may vary considerably:

30 Japanese symbols can have a widely varying amount of corresponding English text as shown below.

Example for traffic information message:

急カーブ速度注意、この先上り坂、速度注意、左から合流車に注意

30 characters in Japanese, 93 characters in English translation:

Speed attention Sharp curve, Speed attention Upslope ahead, Caution traffic merging from left

Example for news story:

温室効果ガス排出抑制に向け石油石炭税率を上乗せする環境税導入

30 characters in Japanese, 133 characters in English translation:

The introduction of a new environmental tax which contains the increased tax rate of oil and coal to reduce greenhouse effect gases.

However, as these examples show, the number of English language Roman characters corresponding to 30 Kanji characters greatly exceeds 30.[132]

The Alliance comments also state:

A recent driving simulator study conducted by Hoffman et al. (2005) provides glance data that can be used for engineering purposes. This study found that a display with 4 lines totaling 170 characters could be read in 11 seconds. Mean single glance time did not exceed 1.14 seconds, which is below the 2.0-second criterion set by the Alliance guidelines and adopted by the NHTSA guidelines. The CAMP DWM project sponsored by NHTSA found a similar result for an occlusion study with a similar experimental design. Both studies result in approximately 15.4 characters per second.

Based on these studies, the number of characters that a person can read per second is approximately 15 in a driving environment. However, it is important to put this into context; drivers do not typically read each letter in a sentence; rather, they extract meaning from the words presented (Campbell, Carney, & Kantowitz, 1998). Indeed, people can skim up to 700 words per minute and an 8th grade reading level is approximately 200 words per minute (Crowder, 1982). In other words, the number of characters in a message is a proxy for the actual amount of information in the message.[133]

The Alliance recommends that systems be evaluated with performance criteria and that NHTSA eliminate the potentially redundant and overly restrictive concept of character limits.[134]

[130] Japan Automobile Manufacturers Association, ''Guideline for In-Vehicle Display Systems, Version 3.0,'' Japan Automobile Manufacturers Association, Tokyo, Japan, August 2004.

[131] Comments received from the Alliance of Automobile Manufacturers, p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0104.

[132] Ibid, p. 11.

[133] Ibid, p. 12.

[134] Ibid, p. 2.

During the March 23, 2012 Technical Workshop on NHTSA's proposed Driver Distraction Guidelines, Mr. James Foley of Toyota showed a slide picturing a contemporary radio display showing several lines of text indicating satellite radio station program information (See Figure 2 below). He then asked:

How do we apply the 30-character limit to this display? If it means a whole display can only contain 30 characters, if you look at just the six preset buttons, each preset button has five characters. So once we have the presets presented to the user, we can't give them any other information about what the radio is doing. If you pick any one element within this display, you quickly exceed a 30-character limit * * * [135]

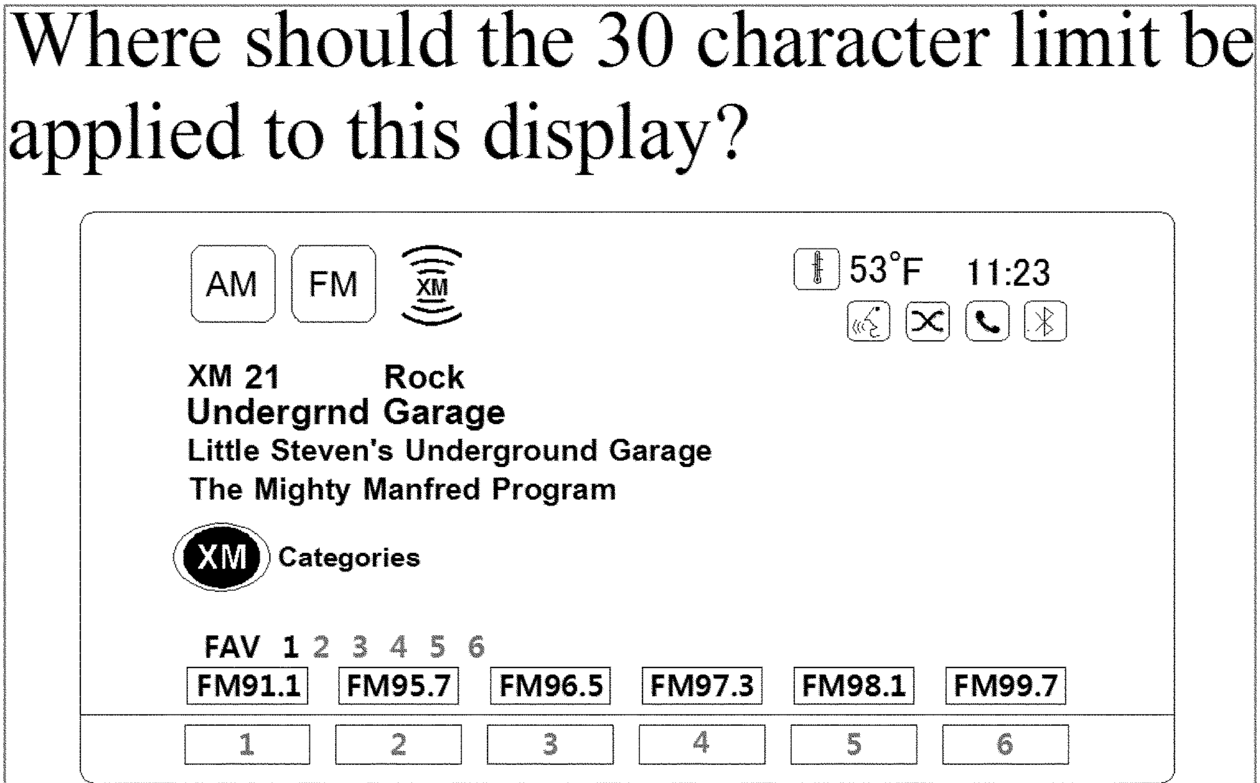

Figure 2: Drawing of Slide Presented by Toyota at NHTSA Technical Workshop[136]

Mr. Foley then pointed out that the information conveyed by this display is easily grasped and that drivers do not have to read each individual letter to understand what is being transmitted by this display.

Honda commented that research has shown that native English speakers achieve higher levels of comprehension and lower levels of critical confusion when most information is presented in text form, as opposed to symbols or icons.

b. NHTSA's Response

As stated in the Initial Notice, the JAMA Guidelines were the source of NHTSA's proposed 30-character limit for the maximum amount of text that should be read in one task. The JAMA Guidelines discuss the maximum amount of text that should be displayed to a driver at one time in two places. Quoting from the main portion of the JAMA Guidelines:

The number of letters (e.g., characters, kana, alphabets) displayed at a time shall not exceed 31, provided that a number such as ''120'' or a unit such as ''km/h'' is deemed to be a single letter irrespective of the number of digits. Punctuation marks are not included in the count of letters.[137]

Limits on the number of characters to be displayed to the driver, along with the reasons for the limits selected, are also discussed in the Appendix to the JAMA Guidelines:

The display of 31 or more letters at a time is also prohibited while the vehicle is in motion, for the following reasons:

a. The results of a test conducted in 1992 suggested that 30 is the maximum number of letters that drivers can read without feeling rushed.

b. The maximum number of letters contained in the level-1 dynamic information display is 30 per screen. To harmonize communication between level-1 FM multiplex broadcast and in-vehicle display systems it is necessary to set the maximum number of letters on in-vehicle display system screen at 30.

The letters are counted as follows according to the Guideline:

a. A number such as ''120'' or a unit such as ''km/h'' is deemed to be a single letter irrespective of the number of digits.

b. Punctuation marks are not included in the count of letters.[138]

The JAMA Guidelines seem to imply that their 30 character recommendation applies to both Japanese characters and English language Roman characters (''number of letters (e.g., characters, kana, alphabets) displayed''). However, NHTSA agrees that changes should be made to our per se lock out relating to reading.

In response to comments opposing the use of a 30-character limit for reading by

[135] Transcript of the Technical Workshop—March 23, 2012, p. 52. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0054.

[136] Materials presented at the Technical Workshop—March 23, 2012, p. 39. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0045.

[137] Japan Automobile Manufacturers Association, ''Guideline for In-Vehicle Display Systems, Version 3.0,'' Japan Automobile Manufacturers Association, Tokyo, Japan, August 2004, p. 7.

[138] Ibid, p. 13.

a driver as part of a non-driving-related task, NHTSA considered its options. NHTSA is not aware of another existing source of data on which to base a character limit for non-driving-related task reading by a driver. The per se lock out of all possible non-driving-related reading tasks is not reasonable, since this would impact existing displayed information such as the time of day and radio station identifiers.

While commenters suggested that instead of the 30-character limit NHTSA should recommend that tasks involving reading should be subject to the acceptance test protocol, that suggestion would not be easy to implement. For example, the definition of a ''testable'' task states that a ''typical or average length input should be used.'' Therefore, for reading to be considered a testable task, the average magnitude of possible reading associated with foreseeable non-driving-related tasks would need to be known. However, the average length of reading could differ greatly depending on the nature of the non-driving-related task. As a result, specifying how to test all possible reading-related tasks was not considered to be a reasonable option.

NHTSA believes that a per se lock out is necessary to address our concerns about non-driving-related tasks involving reading. NHTSA's concern primarily relates to non-driving-related tasks involving reading that could be considered to fall into the categories of either visually-perceived entertainment or communications not essential to safe driving. These activities interfere with a driver's ability to safely control a vehicle in that they encourage the driver to look away from the road in order to continue reading. These are also the types of activities that are difficult to classify as a testable task.

Based on the above-noted issues and consideration of submitted comments, in this notice NHTSA is revising our per se lock out of reading displayed text. The revised recommendation addresses certain types of textual information that is not related to driving, rather than specifying an allowable number of characters that may be read. The specific revised per se lock out language is as follows:

Displaying Text to Be Read. The visual presentation, within view of a driver properly restrained by a seat belt, of the following types of non-driving-related task textual information:

- Books
- Periodical publications (including newspapers, magazines, articles)
- Web page content
- Social media content
- Text-based advertising and marketing
- Text-based messages (see definition) and correspondence (not including standard, preset message menu content displayed in the context of a task that meets acceptance test criteria)

However, the visual presentation of limited amounts of other types of text during a testable task is acceptable. The maximum amount of text that should be visually presented during a single testable task should be determined by the task acceptance tests contained in these Guidelines.

This per se lock out is limited to text in the listed categories and is not intended to apply to text related to the safe operation of the vehicle, including text intended to notify the driver of an emergency situation that presents a safety risk to vehicle occupants, such as extreme weather.

In addition, this version of the NHTSA Guidelines incorporates the legibility criteria contained in ISO Standard 15008,[139] which provides:

> minimum specifications for the image quality and legibility of displays containing dynamic (changeable) visual information presented to the driver of a road vehicle by on-board transport information and control systems (TICS) used while the vehicle is in motion. These specifications are intended to be independent of display technologies * * *''

Incorporation of ISO 15008 criteria serves to ensure that text is presented with sufficient character size to allow easy reading by a driver with 20/20 or better vision and restrained by a seat belt.

In response to Toyota's question about what text should be included in a reading task; NHTSA believes that only the text relevant to the particular task being performed should be considered part of the task. Nearby text unrelated to the task being performed should not be included as part of the text that is read for a particular task. Control and display labels should generally not be considered text that is read during a task that involves the use of a labeled control or display.

3. Per Se Lock Out of Manual Text Entry

a. Summary of Comments

Comments from several parties expressed opposition to the proposed per se lock out of manual text entry greater than six button presses. These commenters included the Alliance, Global Automakers, BMW, Ford, General Motors, Mercedes-Benz, Toyota, and Volvo. Global Automakers, Ford, Mercedes-Benz, Toyota, and Volvo specifically recommended that tasks involving manual text entry be subject to the acceptance test rather than a per se lock out. The Alliance specifically commented that the ''*Per se* lock out of a specific number of button presses is inappropriate since 'button presses' can encompass many different interface technologies/designs that do not have the same levels of visual/manual distraction potential.'' General Motors recommended that text entry based tasks be subject to an acceptance test involving the Alliance acceptance criteria of 20-second eyes-off-road-time and 2-second mean glance duration.

Multiple commenters requested clarification on this per se lock out of manual text entry greater than six button presses. Chrysler asked whether the manual text entry limit applies to text or phone number inputs, but not to other task related button presses. The Alliance and Mercedes-Benz asked whether this task per se lock out covered push-button type interfaces or other types also, and whether the restriction was intended to apply only to manual text entry as part of an overall ''task'' or to button presses required for an entire task. Mercedes-Benz commented that the exclusion of tasks requiring more than 6 button presses, including 10-digit phone dialing, is too stringent and unnecessary or inappropriate if the task passes the acceptance test. BMW commented that NHTSA's proposed lock out of manual text entry greater than six button presses was not justified and ignores the concept of interruptibility.

MEMA asked for clarification of whether ''the utilization of an in-vehicle touch-pad sensor that reads finger-drawn letters and numbers would be considered restricted under the per se lockouts'' and whether the technology would ''fall under the agency's limits on button presses?''

b. NHTSA's Response

NHTSA wishes to clarify that the per se lock out of manual text entry contained in the Initial Notice encompasses input of both alphabetical and numeric characters entered individually, in the context of performing any non-driving-related task or part thereof, except numeric phone dialing which is subject to the acceptance test protocol. This provides compatibility with the treatment of phone dialing outlined in the Federal Motor Carrier Safety Regulation (FMCSR) 49 CFR 392.80, Prohibition

[139] Road vehicles—Ergonomic aspects of transport information and control systems—Specifications and compliance procedures for in-vehicle visual presentation. First edition, 2003–03–15

Against Texting (issued September 27, 2010).

The lock out does not apply to manual input actions by the driver for a purpose other than the entry of individual alphanumeric characters. For example, pressing a radio preset button would not be covered by this per se lock out.

With regard to what types of visual-manual interfaces may be covered by this per se lock out, NHTSA clarifies that it applies to manual text entry regardless of the type of visual-manual interface involved. Interface types affected would include those for which a driver would use his or her hand or a part thereof to input individual characters to a system in the context of performing a non-driving task. Examples of such interface types include, but are not limited to, those accepting inputs via hard button, soft (e.g., capacitive) button, touch screen, finger-drawn characters, and gestures.

NHTSA disagrees with BMW that the proposed per se lock out of manual text entry ignores the concept of interruptibility because there was no time limit for how long the driver could take to perform those six inputs. NHTSA recommended a limit on the amount of manual text entry because of concerns that manual text entry while driving affects safety (see Figure 1).

The intent of NHTSA's per se lock outs of manual text entry greater than six button presses and of reading more than 30 characters was to effectively prevent drivers from engaging in visual-manual tasks such as text-based messaging, internet browsing, and social media browsing while driving. The DOT believes that preventing drivers from engaging in text-based messaging or communications while driving is important for safety. Text-entry and reading are highly visual tasks that are likely to hinder a driver's safe maneuvering of the vehicle. As noted by the Alliance, no data were presented in the proposal to support the assertion that single button presses take 2 seconds to perform.

The language for the per se lock out of manual text entry has been revised to specifically recommend against the following:

Manual Text Entry. Manual text entry by the driver for the purpose of text-based messaging, other communication, or internet browsing.

4. Per Se Lock Out of Graphical and Photographic Images

a. Summary of Comments

Multiple commenters were opposed to the per se lock out of static graphical and photographic images. The Alliance, Ford, Honda, Toyota, and Volvo recommended that it be eliminated from NHTSA's Visual-Manual Driver Distraction Guidelines. Agero, BMW, and Toyota stated that NHTSA does not provide justification substantiating this recommended per se lock out. Global Automakers, Agero, Ford, and Nissan recommended that instead of a per se lock out, graphical and photographical image presentation should be subject to the acceptance test protocols. BMW commented that NHTSA did not sufficiently distinguish between driving-related images and non-driving-related images in the proposed Guidelines.

Global Automakers and Honda advocated for NHTSA's Guidelines to follow Alliance Guidelines Principle 2.2, which states:

> Where appropriate, internationally agreed upon standards or recognized industry practice relating to legibility, icons, symbols, words, acronyms, or abbreviations should be used. Where no standards exist, relevant design guidelines or empirical data should be used.

Chrysler requested clarification that the lock out of photorealistic images is not intended to apply to icons or logos. Similarly, the Alliance commented that:

> * * * the prohibition to display an image not related to driving appears to be too narrow in its definition and they believe would prohibit display of company logos, navigation screen images such as McDonald's arches, Starbucks' logo, Gasoline logos like Shell.

The Alliance, Garmin, Honda, Mercedes-Benz, and Nissan indicated that such images may improve comprehension and response times relative to text and should be permitted. MEMA commented that visual images generally should be less distracting than text.

Nissan stated that some images can provide functionality similar to an icon, to help discern information without reading (like album art versus a title) and requested that some static images be allowed if they meet acceptance criteria. Nissan stated that they specifically believe that some items "support a driver's ability to search for information, recognize system status, and identify goals and could be considered as providing the functionality of an icon" (e.g., album cover art, photo of person's face to identify a contact, photos of landmarks to support navigation functions).

Honda's comment included their own research data that they interpret as indicating that the display of static images such as album cover art did not significantly affect driving performance and met the Alliance Guidelines' Principle 2.1 criteria. Honda conducted a simulator-based study examining the eye glance behavior, lane position, and headway exhibited by 20 test participants while performing an album art recognition task. Drivers were shown a small album art image (that they were unfamiliar with) for 20 seconds and then asked to select the correct image from a set of 4 images. Honda's data showed that the 85th percentile of single glance duration was 1.73 seconds. Results showed no statistically significant effect of the album art task on time headway or average right side margin. Based on those data, Honda recommended that static images not related to driving (e.g., family photographs) should not be prohibited.

Honda also commented that research has shown that native English speakers achieve higher levels of comprehension and lower levels of critical confusion when most information is presented in text form, as opposed to symbols or icons.

b. NHTSA's Response

In response to commenters' requests for clarification of this recommendation, Guideline language relating to the display of static, visual non-driving-related images has been improved for clarity. NHTSA believes the language improvements will address some of the concerns related to this recommendation. In addition, a definition of non-driving-related graphical or photographic images [140] has been added to these Guidelines. For the purposes of these Guidelines, such images are defined as any graphical or photographic image that does not qualify as "video" and that is associated with a *non-driving-related task.* This notice clarifies driving-related tasks to include interactions with vehicle information centers, multi-function displays, emissions controls, fuel economy information displays, trip odometers, and route navigation systems. NHTSA has removed the word "static" from the per se lock out of graphical and photographic images and added the word "non-video" to the definition to clarify that non-video images that move or scroll are also not recommended.

NHTSA agrees with the suggestion by Global Automakers and Honda to follow Alliance Principle 2.2, which recommends the use of "internationally agreed upon standards or recognized

[140] Underlined terms are defined in Section IV. Definitions of the NHTSA Driver Distraction Guidelines.

industry practice relating to legibility, icons, symbols, words, acronyms, or abbreviations.'' NHTSA further suggests that in addition to internationally standardized symbols and icons, simple, well-known Trademark™ and Registered® symbols, such as company logos, may in some cases be useful in presenting information to a driver and are not encompassed by the per se lock out. Along these lines, company logos presented statically are also acceptable for display. The newly added definition of non-driving-related graphical or photographic images clarifies these symbols and icons as being acceptable by stating that ''Internationally standardized symbols and icons, as well as simple Trademark™ and Registered® symbols, are not considered graphical or photographic images.

NHTSA carefully reviewed submitted comments favoring presentation of visual images and found many of them to focus on the possible benefits afforded by such images in aiding a driver making a selection in the context of a task performed using an in-vehicle electronic device. Most notable is Nissan's suggestion that for some tasks, presentation of a visual image may ''support a driver's ability to search for information'' and Honda's description of research showing that an album art recognition task can meet the Alliance Guidelines 2-second maximum individual glance length criterion and 20-seconds total eyes-off-road-time criterion while having no significant impact on time headway or lane position maintenance.

NHTSA to date has not performed research addressing the issue of non-video, visual images or the impact of album art display on a secondary task involving music selection and appreciates Honda's submission of research data. We believe that Honda's research would have been more informative if a treatment condition involving a text description of music selections and no album art had been included. That may have helped to demonstrated how album art is superior to traditional text display of music selections. The album art task could have also been more relevant if the driver were prompted using words to search for a particular album or song, instead of matching album art images. Finally, while the results show no significant effect of Honda's album art task on time headway or lane position, the lack of an effect does not indicate that the album art task is associated with the same level of driving performance as that observed in a baseline condition (i.e., no secondary task).

NHTSA believes it is plausible that for certain tasks the display of a related static image may aid the driver in selecting an option that meets his or her task goal. However, NHTSA remains concerned that a driver unfamiliar with those images, or particularly fond of those images, may perform a selection task less efficiently when a static image is displayed or may choose to glance at the image frequently and for unsafe durations of time.

In general, NHTSA is concerned that non-driving-related graphical and photographic images not essential to the driving task could distract the driver by unnecessarily drawing his or her eyes away from the roadway, thereby increasing crash risk. Past analyses of naturalistic data have shown that a driver's glances away from the forward roadway of up to 2.0 seconds in duration have no statistically significant effect on the risk of a crash or near-crash event occurring. However, eyes-off-road times of greater than 2.0 seconds have been shown to increase risk at a statistically significant level. The risk of a crash or near-crash event increases rapidly as eyes-off-road time increases above 2.0 seconds.[141] NHTSA is concerned that unnecessary graphical and photographic images within view of the driver will increase the frequency and duration of a driver's eyes being averted from the forward roadway. NHTSA believes that an increase in visual entertainment for a driver is not worth a potential decrease in safety. Having said that, some images may be useful to drivers and NHTSA does not intend for the NHTSA Guidelines to hinder use of these helpful images.

After careful review of comments and submitted information, NHTSA has weighed the possible advantages and disadvantages of presenting such images and believes that an intermediate position between the original proposal and blanket allowance of such images is reasonable. To balance the potential advantages with the disadvantages with which NHTSA is concerned, the per se lock out has been revised in this notice to permit non-video images to be displayed during certain non-driving tasks to aid the driver in searching for an item of interest as long as the image is automatically extinguished upon completion of the selection task. Removing the task-related image upon completion of the task ensures that the image is not available to visually distract the driver.

[141] Klauer, S.G., Dingus, T.A., Neale, V.L., Sudweeks, J.D., and Ramsey, D.J., ''The Impact of Driver Inattention on Near-Crash/Crash Risk: An Analysis Using the 100-Car Naturalistic Driving Study Data,'' DOT HS 810 594, April 2006.

NHTSA has also replaced the proposed language regarding quasi-static and static maps with language clarifying that while the display of maps is acceptable under these Guidelines, maps that are displayed should only contain informational detail not critical to navigation and not have unnecessary complexity (i.e., photorealistic images, satellite images, or three-dimensional images are not recommended) that may cause too much distraction. This language better conveys NHTSA's original intentions regarding the display of maps: That the amount of time it takes the driver to extract information from the map should be minimized.

The specific revised Guideline language from Section V.F is as follows:

Displaying Images. Displaying (or permitting the display of) non-video graphical or photographic images.

Exceptions:

a. Displaying driving-related images including maps (assuming the presentation of this information conforms to all other recommendations of these Guidelines). However, the display of map informational detail not critical to navigation, such as photorealistic images, satellite images, or three-dimensional images is not recommended.

b. Static graphical and photographic images displayed for the purpose of aiding a driver to efficiently make a selection in the context of a non-driving-related task (e.g., music) is acceptable if the image automatically extinguishes from the display upon completion of the task. If appropriate, these images may be presented along with short text descriptions that conform to these Guidelines.

c. Internationally standardized symbols and icons, as well as Trademark™ and Registered® symbols, are not considered static graphical or photographic images.

The recommendation for a short text description to accompany the displayed images associated with non-driving-related tasks is in response to Honda's comment that research indicates ''that native English speakers achieve higher levels of comprehension and lower levels of critical confusion when most information is presented in text form, as opposed to symbols or icons.'' Text accompanying static images should meet other criteria recommended in NHTSA's Guidelines.

5. Per Se Lock Out of Displaying Video Images—Dynamic Maps

a. Summary of Comments

In response to proposed Section V.5.b ''Dynamic Moving Maps,'' multiple commenters opposed the per se lock out including the Alliance, BMW, Ford, GM, Nissan, Toyota, and Volvo. Global Automakers and Nissan advocated for a performance-based approach to determining the acceptability of moving map-related tasks. Multiple commenters, including Chrysler, Honda, and Nissan, asked for clarification regarding whether NHTSA intended this per se lock out to disallow conventional dynamic maps as used in navigation systems that are currently in vehicles.

Mercedes stated:

Dynamic maps: A dynamic map represents ''state-of-the-art'' for navigation systems and drivers expect a constantly moving map as their vehicle is also moving forward. Dynamic maps are not comparable to moving video imagery. These maps move slowly and smoothly, so the motion does not lead to unwanted attention capture. There is no data driven justification to prohibit the use of dynamic map displays. Dynamic maps should remain available while driving.

Honda requested that NHTSA provide criteria for use in determining the types of three-dimensional images that interfere with a driver's safe operation of the vehicle. Honda did not provide supporting data but indicated that they ''believe more realistic and life-like images of roadways and landmarks are more quickly correlated with the forward view, leading to quicker recognition and reduced driver workload.''

The Alliance commented that ''Photographic overlays provide enhanced details that aid the driver in locating entrances, parking lots or other landmarks.''

The Alliance requested the ability to provide drivers with flexible systems with ''multiple viewing and display modes with recognition that drivers have different needs, preferences and capabilities for use of map information.'' The Alliance further stated that ''Drivers should be given the choice as to the type and form of driving aid that best suits their needs in a given situation.''

b. NHTSA's Response

The Guidelines proposal notice including Section V.5.b did not clearly relate NHTSA's intent with respect to dynamic displays. The purpose of that per se lock out was to deter the introduction of unnecessarily complicated navigation system displays. The per se lock out was based on NHTSA's concern that navigation system enhancements being considered by the industry may lead to substantial unnecessary distraction and reduced safety.

Navigation systems are one of the more complex OE devices available to the driver to interact with. NHTSA is concerned about the addition of informational detail not critical to navigation and image complexity, such as three-dimensional, photographic, full location scenery, and/or satellite images that could tempt drivers to look at the navigation image more than necessary for route navigation.

NHTSA's preference for a basic, low-complexity map display stem from a December 1995 report [142], ''Preliminary Human Factors Design Guidelines for Driver Information Systems,'' published by the Federal Highway Administration, which outlines research-supported guidelines for navigation system display content. Chapter 7, titled ''Navigation Guidelines—Visual Displays,'' contains recommendations for ''presentation modality, turn display format (arrows vs. maps, etc.), turn display content (which information elements are required), labeling of details, and display orientation and placement.'' Some relevant excerpts from this chapter are summarized as follows:

i. Limit the amount of detail on maps.

Details fall into three categories. They include line graphics (roads, political boundaries, rivers, etc.), landmarks (buildings, etc.), and labels (street names, route numbers, road names, etc.). Line graphics will have a greater effect on response time than will the other factors. According to Stilitz and Yitzhaky, the time (in seconds) required to locate a street on a map with grids is (0.38 n) + 2.1, where n is the number of roads in the grid (range of 4 to 25). * * *

ii. Required information includes the road being driven, the name of the road for the next turn, the direction, and approximate angle of the next turn, and an indicator of distance to the turn.

These required items concerning the next turn should be shown even if the turn is distant. Additional clarifying information (i.e. landmarks, additional streets) should be limited to items that help drivers prepare for and execute the maneuver.

iii. Views of intersections should be plan (directly overhead) or aerial (as from a low flying airplane), but not perspective (from the driver's eye view).

Response times and errors in making decisions about intersections were examined by Green and Williams, and Williams and Green * * *. Differences between aerial and plan views were small. Response times and errors for both were significantly lower than those for perspective displays. Perspective displays were least preferred.

iv. Provide turn indications using either simple arrow displays or simple maps.

The literature suggests that drivers experience difficulty in reading detailed maps while driving * * * Turn displays should present the intersection ahead, the direction of the turn, and the distance to it. The Walker, et al. research indicates that showing only a turn arrow can result in reasonable performance * * *

v. Roads on map-like displays should be shown as single, solid lines, not multiple lines to represent each road edge.

This guideline is supported by the work of Green and Williams, and Williams and Green * * * Participants in experiments made more errors and took longer to make decisions in matching map displays with real-world scenes when the map graphics were outlines.[143]

After considering submitted comments and reviewing the noted research, NHTSA has decided to retain the per se lock out covering map displays, but with improved language:

Map displays. The visual presentation of dynamic map and/or location information in a two-dimensional format, with or without perspective, for the purpose of providing navigational information or driving directions when requested by the driver (assuming the presentation of this information conforms to all other recommendations of these Guidelines). However, the display of informational detail not critical to navigation, such as photorealistic images, satellite images, or three-dimensional images is not recommended.

NHTSA believes that this clarified per se lock out description for dynamics will provide a better understanding of the recommendations and guide map display design.

6. Per Se Lock Out of Watching Video—Trailer Hitching

a. Summary of Comments

Two comments were received with respect to the acceptability of displaying rearview images (i.e., live video images of the area directly behind a backing vehicle). Global Automakers asserted that since the FMVSS that would regulate rearview images is not yet finalized, all rearview image displays should be allowed under the Guidelines until that rulemaking action is complete. Chrysler advocated for the per se lock out relating to video to be revised to permit video images of truck bed and trailer contents, as well as the area behind the vehicle while a driver is attempting to hitch a trailer to his or her vehicle:

Some vehicles (trucks in particular) have a feature that permits customers to display the rear camera images so that they can monitor the status of a tower trailer and hitch or the contents in a pick-up truck bed while in forward motion. Chrysler believes the display of such images will enhance safety by allowing the customer to determine whether the contents of the truck bed are properly stowed or whether the trailer hitch chains are attached. Chrysler recommended that

[142] Publication No. FHWA–RD–94–087, December 1995.

[143] Ibid.

NHTSA's guidelines be harmonized with the Alliance's efforts to expand the scope of FMVSS 111 to permit images while in forward motion for the purposes of enhancing safety.

b. NHTSA's Response

NHTSA agrees that referring to a FMVSS that is not yet finalized is not appropriate and has revised the per se lock out in this notice. NHTSA also agrees that a driver can more efficiently hitch a trailer with the aid of a video image showing the area immediately behind his or her vehicle. As such, we have revised the language for the per se lock out of ''Displaying Video'' and included a limited exception that allows a video image to be presented for the purposes of aiding a driver to perform a hitching or backing maneuver. However, we believe that it is important for safety to ensure that a driver cannot view a rear video image while driving forward outside the context of a hitching or backing maneuver. To address this concern, the revised language includes limits on the display of video. The revised language for the per se lock out of ''displaying video'' is as follows:

Displaying Video. Displaying (or permitting the display of) *video* including, but not limited to, video-based entertainment and video-based communications including video phoning and videoconferencing.

Exceptions:

a. The display of video images when presented in accordance with the requirements of any FMVSS.

b. The display of a video image of the area directly behind a vehicle for the purpose of aiding a driver performing a maneuver in which the vehicle's transmission is in reverse gear (including parking, trailer hitching), until any of the following conditions occurs:

i. The vehicle reaches a maximum forward speed of 10 mph;

ii After the vehicle has shifted out of reverse, it has traveled a maximum of 10 meters; or

iii. After the vehicle has shifted out of reverse, a maximum of 10 seconds has elapsed.

The 10-mph limit specified in exception 'i' is based on the likelihood that a driver whose speed has increased to 10 mph has concluded his or her hitching maneuver. Likewise, when a vehicle has traveled forward a distance of 10 meters or more or 10 seconds have elapsed, the driver's intention to hitch a trailer has likely concluded. NHTSA believes that these limits will reasonably accommodate any typical backing or hitching maneuver while ensuring that drivers cannot view video of the area behind the car while driving forward.

Regarding Chrysler's comments as to the ''Alliance's efforts to expand the scope of FMVSS 111,'' NHTSA is unaware of such activity. However, the Guidelines contain an exception that allows presentation of video required by a FMVSS.

7. Per Se Lock Out of Automatically Scrolling Lists and Text

a. Summary of Comments

Commenters opposed to the per se lock out of automatically scrolling lists included Global Automakers, Mercedes-Benz, and Volvo. For example, Global Automakers stated:

> We suggest that the following items should NOT be subject to per se lockouts and should be allowable if the system is able to meet the evaluation criteria:
>
> * * * Continuously scrolling text (for example, the Radio Broadcast Data System (RBDS)/Radio Data System (RDS) has been available for many years and should continue to be allowed).

Mercedes-Benz likewise commented

> Short scrolling lists: There should be no ''per se'' limitation of the length of scrolling lists. There are methods (e.g. search algorithms) which enable drivers to smoothly navigate lists. If a specific scrolling list execution passes performance testing then it should be available for use while driving.

b. NHTSA's Response

The per se lock-out of automatically scrolling text is based on several of the guiding principles of NHTSA's Guidelines including the principle that ''the driver's eyes should usually be looking at the road ahead,'' and the principle that ''the driver should control the pace of task interactions, not the system/device.'' Automatically scrolling text can violate one or both of these principles. Specifically, automatically scrolling text is generally likely to distract the driver and is among the types of visual information that the Alliance Guidelines recommend disabling while driving. Additionally, when used as part of a task (e.g., selecting an item from an automatically scrolling list) automatically scrolling text requires the driver to receive and process information without the ability to control the rate of information display. NHTSA thus rejects commenters' recommendations to not include the per se lock out of automatically scrolling text.

With regard to the specific example of automatically scrolling text referenced by Global Automakers, Radio Broadcast Data System (RBDS)/Radio Data System (RDS), it was not NHTSA's intention to lock out the display of such information. Rather, NHTSA's Guidelines are meant to encourage the display of such information in ways that are not excessively distracting. NHTSA notes that there are alternative ways of displaying RBDS/RDS data that do not involve automatically scrolling text.

NHTSA is uncertain what Mercedes-Benz was referring to in its comment about list length and ''methods that enable drivers to smoothly navigate lists.'' The per se lockout applies only to automatically scrolling text. There are alternative ways to display lists of varying lengths that do not involve automatically scrolling text.

8. Clarify Acceptability of Technology That Allows the Driver and Passenger To See Different Content From Same Visual Display

a. Summary of Comments

Nissan requested clarification regarding whether NHTSA's proposed per se lock outs of static graphical or photographic images and video apply only to display content visible to a person seated in a normal driving position. Nissan noted that:

> emerging technology will make it possible for two viewers to see different content in the same screen depending on their locations and viewing angles.

Nissan also requested that NHTSA clarify the intent of the per se lock out of static images and video by adding the phrase, ''which are visible to a driver restrained by a seat belt.''

b. NHTSA's Response

Nissan is correct that the intent of the per se lock outs for static graphical or photographic images and video were intended by NHTSA to apply only to images within view of a driver properly restrained by a seat belt. To clarify this, the recommendations against displaying video and images have been revised in the Guidelines to apply only if the video or images are ''within view of the driver properly restrained by a seat belt.''

F. Task Acceptance Test Protocol Issues

1. Suggestions for Other Acceptance Test Protocols

a. Summary of Comments

Several commenters recommended inclusion of a particular method of testing in the final version of the NHTSA Guidelines. Some suggestions were directed at options as presented in the proposal while others were directed at inclusion of different methods not proposed as test procedures in the Initial Notice. In his comments, Professor Richard A. Young assessed the various testing options and provided the following conclusion:

A test using fixed criteria that measures glance properties, as well as event detection, in the same test of driver performance while doing a secondary visual-manual task, is therefore the minimum test that I would recommend for final validation of a task.[144]

He underscored the importance of including a detection task as part of the test protocol:

* * * any of the NHTSA proposed tests for visual-manual distraction which do not include some sort of peripheral detection task (PDT) as part of the test will not address the attention dimension as it relates to detection and response of on-road events, and are therefore likely to produce false negative errors.[145]

Professor Young discussed the *Option DFD–FC: Dynamic Following and Detection Protocol with Fixed Acceptance Criteria* test procedure proposed in the Initial Notice and identified the attributes that he considered essential to a suitable test procedure:

It should minimize both false negative and false positive errors compared to the other tests because it has the most comprehensive set of metrics. The test uses fixed criteria, and does not use the radio tuning test as a benchmark * * * so the relatively poor event detection associated with the radio tuning test need not lead to false negative errors.[146]

Two commenters (Mercedes-Benz and the Alliance) requested the inclusion of driving performance-based acceptance test protocols in addition to the eye glance-related driving protocols that NHTSA preferred in the Initial Notice. The following comment was submitted by Mercedes-Benz:

The driver's ability to maintain headway and keep their vehicle within lane boundaries are fundamental elements of safe driving performance. Laboratory eye glance assessment provides a simplified measure to infer such safe driving performance under dynamic conditions. However, if drivers are actually observed reacting to changes in a dynamic driving environment by maintaining headway and keeping within lane boundaries, assessment of eye glance behavior is superfluous. Evaluation of headway variance and lane keeping performance measures provide an accurate and sufficient assessment of driving performance. The proposed addition of eye glance measure to driving performance evaluation is unwarranted.[147]

Based on this argument, Mercedes-Benz provided the following recommendation for a test protocol:

Therefore we recommend using the DS–BM (Driving Test Protocol with Benchmark) approach as defined in Alliance Guideline Option 2.1(B) as the driving test verification protocol.[148]

Comments from the Alliance were very similar to those provided by Mercedes. They echoed the conclusion that the Alliance Guideline Option 2.1(B) should be included in the final guidelines. They provided the following rationale for this recommendation:

The agency has not provided any research demonstrating how the proposed changes to the driving procedure relate to real world crash risk. Thus, NHTSA should adopt the Alliance Guidelines Option 2.1(b) criteria until a defined safety benefit for different procedures and criteria can be demonstrated and validated through analysis of SHRP–2 naturalistic driving data.[149]

As part of their comments, the Alliance requested inclusion of an option focused directly on driving performance:

* * * it should always be an option to directly evaluate the impact of a new information or communication system on driving performance, instead of using the surrogate measure of eye glance behavior.[150]

Chrysler provided extensive commentary on both the Eye Glance and Occlusion methods that NHTSA indicated were preferred over the others described in the proposed Guidelines. Chrysler provided the following commentary in support of the Lane Change Test (LCT):

Chrysler supports LCT testing due to participants frequently commenting on the impact that familiarity with a task made on their ability to perform the secondary task well. During LCT testing, participants were more likely to comment on becoming familiar with the driving simulator, while during occlusion testing participants commented on memorizing button locations, screen layout and the steps involved in task completion.[151]

* * * the LCT method offers clear feedback as to performance. During the Occlusion testing, a participant has no way of knowing if he or she is failing the test. However during the LCT testing people are clearly aware of the extent to which their driving performance is degrading based on their use of the system. In summary, we believe the LCT method most closely represents the driving task which is the very focus of these guidelines. It is Chrysler's recommendation that LCT testing be included in the final publication of NTHSA's proposed guidelines.[152]

Dr. Paul Green commented that the proposed NHTSA Guidelines' acceptance test protocols do not have enough emphasis on prediction and calculation to determine device interface acceptability. He went on to state:

It is critical that methods to quickly estimate compliance exist, and those methods be recommended and used early in design. Often they do not need to be perfect as many of the interface functions proposed have task times of 30 or 40 s, far in excess of any limit, be it 15 s, 10 s, or 8s. It is a waste of resources to test them if one can be confident they will not pass a guideline test. * * * Keep in mind that contemporary engineering practice is based on calculation and estimation, and tests of mockups are only used as a final check where there is uncertainty.

Given the need for a calculation method, the requirements of PL 104–113, and the research support for it, DOT should include SAE J2365 in its guidelines. Furthermore, given NHTSA's acceptance of occlusion as a test procedure, NHTSA should adopt Pettitt's method, which estimates occlusion task time, as an acceptable calculation procedure as well.[153]

b. NHTSA's Response

NHTSA greatly appreciates the thoughtful comments received regarding the acceptance test protocols that NHTSA will use to assess conformance with these Guidelines. Following careful consideration of comments received, NHTSA has decided to maintain our plan to assess non-driving task conformance with acceptance criteria using the two preferred acceptance test protocols noted in the Initial Notice:

- *Option EGDS: Eye Glance Testing Using a Driving Simulator,* and
- *Option OCC: Occlusion Testing.*

NHTSA reiterates that while these acceptance test protocols are the ones we intend to use to assess task conformance with these Guidelines; other organizations are free to use alternative protocols that they deem suitable for assessing tasks' ability to meet the acceptance criteria.

A detailed explanation of our reasons for limiting the acceptance protocols to the two noted ones follows.

NHTSA's testing experience with *Option EGDS: Eye Glance Testing Using*

[144] Comments received from Professor Richard A. Young, p. 8. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0106.

[145] Ibid, p.7.

[146] Ibid.

[147] Comments received from Mercedes-Benz USA, p. 5. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0093.

[148] Ibid, p. 5.

[149] Comments received from The Alliance of Automobile Manufacturers, Technical Appendix, p. 3. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0104.

[150] Ibid. Technical Appendix, p. 15.

[151] Comments received from Chrysler Group, p.4. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0095.

[152] Ibid. pp. 4–5.

[153] Comments received from Dr. Paul Green, p.4. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0052.

a Driving Simulator,[154] and *Option OCC: Occlusion Testing*[155] has been positive. Both test protocols were practicable, straightforward to run, and produced robust, sensitive, and repeatable data. Although some commenters questioned whether eye glance metrics were sufficient to ensure safe driving, NHTSA believes that the underlying theme of both of these acceptance test protocols—keeping the driver's eyes on the forward road scene as much as possible—is good for motor vehicle safety. A clear relationship between eye glance-related metrics and driving safety exists—a driver's vigilant monitoring of the road and nearby vehicles is essential to safe driving.

Furthermore, as was stated in the Initial Notice, both of these eye glance-related test protocols have a number of advantages. These include:

- Based on analyses of past naturalistic data, we know that looking away from the forward roadway for up to 2.0 seconds has a minimal effect on the risk of a crash or near-crash event occurring. However, eyes-off-road times greater than 2.0 seconds have been shown to increase risk at a statistically significant level. The risk of a crash or near-crash event increases rapidly as eyes-off-road time increases above 2.0 seconds.[156]
- An obvious relationship between visual-manual distraction and eye glance measures exists. Visual-manual distraction strongly implies that the driver is looking away from the forward road scene.
- Eyes-off-road time is measureable. Researchers have been working for more than 30 years to develop better techniques for measuring driver eyes-off-road times. A large amount of effort has focused on such topics as the best ways to ensure coding reliability when reducing eye glance video and the development of automated eye trackers.
- Commercially available occlusion goggles allow occlusion testing to be performed without having to develop new hardware.
- ISO standards exist for both eye glance measurement (ISO 15007–1 and ISO 15007–2) and occlusion testing (ISO 16673). This allows us to take advantage of years of test development effort by the research community.

In summary, proven, robust acceptance test protocols for measuring visual-manual distraction based on eye glance metrics and acceptance criteria are available. While these eye glance-based acceptance test protocols may not be perfect, their widespread adoption would be a major step towards limiting and reducing visual-manual distraction. Therefore, NHTSA believes that acceptance test protocols based on eye glance metrics are most appropriate at this time for assessment of distraction due to visual-manual tasks. However, NHTSA remains open to amending the Guidelines test protocols in the future in response to new information.

Professor Young recommended the inclusion of a peripheral detection task (PDT; more generically a detection-response task or DRT) as part of the task acceptance test protocols necessary to address the attentional dimension as it relates to a driver's detection and response to on-road events. He did not advocate for the replacement of NHTSA's preferred task acceptance test options (*Option EGDS: Eye Glance Testing Using a Driving Simulator* and *Option OCC: Occlusion Testing*) with a PDT-based test but recommended supplementing these options with the addition of a PDT-based test.

NHTSA believes that inclusion of a DRT/PDT-based test would be premature at this time. To date, there has been some lack of consensus amongst researchers (U.S. and foreign) regarding the meaning, appropriate use, and preferred implementation type of the DRT/PDT. However, the International Organization for Standardization (ISO) has made significant progress in this area and is currently nearing consensus on a draft standard outlining the use of a detection-response task for assessing selective attention in driving. We believe that this draft standard will greatly inform our consideration of incorporating a DRT as part of an acceptance test protocol for the NHTSA Guidelines in the future, though additional research would be required to develop appropriate criteria for task acceptance.

Several commenters advocated for inclusion of acceptance test protocols based on driving performance measures (e.g., lane exceedances and headway variability). The Initial Notice contained two of these protocols, both of which were based on the Alliance 2.1 Alternative B test protocol, (referred to in the Initial Notice as *Option DS–BM: Driving Test Protocol with Benchmark* and *Option DS–FC: Driving Test Protocol with Fixed Acceptance Criteria*).

NHTSA is not including this protocol in the Phase 1 Guidelines because the performance measures evaluated by these protocols to assess visual-manual distraction (i.e., lane exceedances and headway variability) do not have an established link to crash risk, whereas the visual attention-based measures selected by NHTSA do have an established link to crash risk. Additionally, although the Alliance 2.1 Alternative B test protocol produces results similar to the EGDS protocol, the Alliance 2.1 Alternative B test protocol is more complex and requires a larger number of participants.

Specifically, the benchmark task requirement in the Alliance 2.1 Alternative B test protocol adds considerable complexity (i.e., development of benchmark task for each test, additional test trials). In contrast, the EGDS and OCC protocols use fixed task acceptance criteria that do not require the use of a benchmark task, resulting in fewer test trials that need to be run to assess a vehicle's conformance. Additionally, although NHTSA's research using the Alliance 2.1 Alternative B test protocol[157] found that this test protocol produced essentially the same results as did the EGDS protocol, more test participants were required for the results to attain adequate statistical power than were needed for the EGDS protocol (24 test participants is adequate for EGDS protocol). NHTSA's research showed that 60 or more test participants needed to be tested to obtain similar statistical power using the Alliance 2.1 Alternative B test protocol. One of the reasons for the need for a larger sample size when using the Alliance 2.1 Alternative B test protocol is its use of lane exceedances as a measure of driving performance. Lane exceedances are low frequency events, particularly during straight line driving, and secondary tasks can be performed with no lane exceedances. Conversely, lane exceedances may happen when the driver is not performing a secondary task. The relative rarity of lane exceedances means that a large amount of testing has

[154] Some of NHTSA's experience using the *Option EGDS: Eye Glance Testing Using a Driving Simulator* test protocol is documented in Ranney, T.A., Baldwin, G.H.S., Parmer, E., Martin, J., and Mazzae, E. N., ''Distraction Effects of Manual Number and Text Entry While Driving,'' DOT HS 811 510, August 2011.

[155] NHTSA's experience using the *Option OCC: Occlusion Testing* test protocol is documented in Ranney, T.A., Baldwin, G.H.S., Smith, L.A., Martin, J., and Mazzae, E. N., ''Driver Behavior During Visual-Manual Secondary Task Performance: Occlusion Method Versus Simulated Driving,'' DOT HS number not yet available, April 2012, accessible at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0077.

[156] Klauer, S.G., Dingus, T.A., Neale, V.L., Sudweeks, J.D., and Ramsey, D.J., ''The Impact of Driver Inattention on Near-Crash/Crash Risk: An Analysis Using the 100-Car Naturalistic Driving Study Data,'' DOT HS 810 594, April 2006.

[157] Ranney, T.A., Baldwin, G.H.S., Parmer, E., Martin, J., and Mazzae, E. N., ''Distraction Effects of In-Vehicle Tasks Requiring Number and Text Entry Using Auto Alliance's Principle 2.1B Verification Procedure,'' DOT HS 811 571, February 2012.

to be performed to observe a statistically stable number of these events. Therefore, an additional reason why NHTSA did not retain either of the Alliance 2.1 Alternative B test protocol-based acceptance test options in these Guidelines is because eye glance based acceptance test protocols provide statistically significant results with the fewest number of test participants.

Chrysler advocated for the inclusion of an acceptance test protocol based on the European Lane Change Test (LCT) specified in ISO 26022:2010 [158] that was not proposed as an option in the Initial Notice. This ISO standard describes a testing method that quantitatively measures human performance degradation on a primary driving-like task while a secondary task is being performed. The result is an estimate of secondary task demand. While not proposed, NHTSA had performed limited research on the diagnostic properties of the LCT method during 2006.[159] Twenty-six participants, aged 25 to 50 years, performed the LCT in a driving simulator while performing selected secondary tasks. Results from this testing found that the LCT's metrics were sensitive to differences between secondary tasks. However, the data were insufficient to suggest whether the Lane Change Test approach was superior, or equivalent, to NHTSA's selected test approaches. Additionally, as stated throughout the notice, NHTSA's strategy for the Phase 1 Guidelines for visual-manual distraction has been to focus on test methods that measure visual attention and eye glances rather than driving performance because the strongest crash risk data is associated with visual attention. Therefore, NHTSA is not including in the Guidelines an LCT-based acceptance test at this time.

Dr. Green commented that he thought the NHTSA Guidelines acceptance test protocols should emphasize prediction and calculation to estimate which tasks would meet the acceptance criteria prior to the completion of device interface design (for example, by the use of SAE J2365). While NHTSA supports designers using such tools early in the design process, this is not NHTSA's focus. NHTSA generally tests vehicles and equipment (including electronic devices) after they have been fully designed, placed into production, and are being sold to the general public. Pre-production vehicles or systems are generally not available for testing by NHTSA. It is up to individual companies, industry organizations, or human factors organizations to develop appropriate prediction and calculation methods and to develop appropriate tools to assist device designers who design devices that conform to the NHTSA Guidelines.

2. Concerns About the Use of Radio Tuning as Reference Task

a. Summary of Comments

The NHTSA Guidelines propose using manual radio tuning as a benchmark task to represent a level of distraction considered reasonable for a driver to experience while driving. Several comments were critical of the proposed benchmark task.

The Alliance and multiple vehicle manufacturers provided comments in support of their recommendation to retain the use of the older radio-tuning task that was defined in the Alliance Guidelines. Their position is summarized in the following excerpts from the Alliance comments:

> The point of selecting a 1980s radio-tuning task as a ''socially-acceptable'' benchmark task was to prescribe a common, routine task that had remained more-or-less constant for many decades prior to the ''digital age.'' Tuning an analog radio requires a user to manually adjust to a particular frequency, based on sound quality feedback. In contrast, modern digital radios ''auto-tune'' to each successive radio station frequency with each activation of the tuning control (usually a push-button control).[160]
>
> The Alliance therefore recommends that the benchmark radio tuning task be specified as it is in the Alliance DFT guidelines, namely as an analog radio tuning task using a circa-1980s radio.[161]

The implications of the differences between using newer versus older radios to establish benchmark levels according to the Alliance is revealed in the following Alliance comments:

> * * * manual tuning of an older analog style radio requires more manual and visual effort than does tuning newer digital radios.[162]
>
> * * * the use of contemporary radios to conduct the benchmarking studies calls into question the validity of the data, both in the case of the two studies conducted by NHTSA and VTTI used to derive the more stringent visual dwell criteria (12 seconds TEORT or 9 seconds TSOT), and in the case of using radio tuning as a benchmark task for determining acceptability of a task under test. In the former case, at least some of the difference found by NHTSA and VTTI between the Alliance's visual dwell criteria of 20 seconds TGT or 15 second TSOT and NHTSA's lower equivalent values is attributable to the use of newer radios that are easier to tune.[163]

The Alliance offered to work with NHTSA to improve the Alliance Guidelines' specifications of the 1980s-era radio or to develop a different standardized test apparatus:

> We note that NHTSA does not take issue with the use of a circa-1980s radio, but rather with the lack of sufficient specificity provided in the description of the test apparatus provided in the Alliance guidelines. * * * This is a concern that could be easily addressed by developing a standardized test apparatus representative of a circa-1980s analog radio and specifying its use.[164]

Referring to the way in which data from a number of vehicles with different radios was used by NHTSA to establish benchmark parameter values; Professor Young offered the following comments:

> The wide range of different types of interfaces used in the radios tested by NHTSA compound the problem of coming up with a benchmark value for radio tuning.[165]

Professor Richard A. Young suggested that the use of radio tuning as a benchmark task is inappropriate because ''radio tuning variability [is] too high.'' [166] Professor Young also pointed out that the associated distributions of eye glance durations during manual radio tuning contain some glances longer than 2.0 seconds in duration. According to him, glances longer than 2.0 seconds have recently been identified in several new analyses of 100-Car naturalistic data as having higher risk ratios than the eyes-off-road time metric traditionally used to compute risk ratios. The essence of the problem perceived by Professor Young is revealed in the following comments:

> * * * the radio tuning reference task * * * has a long single glance duration * * *, which may contribute to crash causation.[167]
>
> * * * the long maximum single glance that tends to be associated with radio tuning at least some of the time in some subjects * * * may not be ''benign'' for event detection and response.[168]

[158] ISO 26022, ''Road vehicles—Ergonomic aspects of transport information and control systems—Simulated lane change test to assess in-vehicle demand,'' issued September 2010.

[159] Ranney, T.A., Baldwin, G.H.S., Vasko, S.M., and Mazzae, E.N., ''Measuring Distraction Potential of Operating In-Vehicle Devices,'' DOT HS 811 231, December 2009.

[160] Comments received from the Alliance of Automobile Manufacturers, Technical Appendix, p. 16. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0104.

[161] Ibid.

[162] Ibid.

[163] Ibid, p. 19.

[164] Comments received from the Alliance of Automobile Manufacturers, Technical Appendix, p. 19. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0104.

[165] Ibid.

[166] Ibid, Attachment 4, p. 12.

[167] Ibid, p 7.

[168] Ibid, p. 8.

The implication of the recent findings is suggested in the following comment from Professor Young:

> * * * when the radio tuning task was selected for use as a reference task by the Alliance, it was before the finding that there is an attentional element to driver performance for visual-manual tasks that goes beyond what is reflected in eyes-off-road time or mean single glance duration metrics.[169]
>
> Tests using a radio benchmark (DS–BM, DFD–BM) should be removed from the list of recommended tests because the radio tuning reference task is associated with poor attentional processes (poor event detection and long maximum single glance).[170]

b. NHTSA's Response

NHTSA carefully reviewed comments critical of NHTSA's proposal to use manual radio tuning as a benchmark for acceptance testing. Comments focused on the choice of radio tuning as a benchmark task as well as the vehicles used in research performed by NHTSA to develop eye glance criteria associated with the proposed manual radio tuning benchmark task.

As discussed in the Initial Notice, NHTSA's decision to use the radio tuning benchmark task to determine an acceptable TEORT threshold is based upon the fundamental idea that secondary tasks should not be performed while driving if they are more distracting than performing a reference task, specifically radio tuning. NHTSA took this concept from the Alliance Guidelines. The following excerpt from the Alliance Guidelines explains their justification for using manual radio tuning as the reference task:

> The criteria for alternative A [basing task acceptability for performance while driving upon eye glance metrics] are defined by means of a "reference task" approach to acceptability. In this approach, reference tasks that reflect typical in-vehicle device interactions or current practice are used as a benchmark. In particular, the 85th percentile of driving performance effects associated with manually tuning a radio is chosen as a first key criterion. This is because manual radio tuning has a long history in the research literature and its impacts on driver eye glance behavior, vehicle control, and object-and-event detection are reasonably well understood. More specifically, radio tuning:
>
> • is a distraction source that exists in the crash record (see Stutts, et al, 2001; Wang, Knipling, and Goodman, 1999; Wierwille and Tijerina, 1998) and so has established safety-relevance (see Table 1);
>
> • is a typical in-vehicle device interaction; and
>
> • represents the high end of conventional in-vehicle systems in terms of technological complexity as well as in terms of impacts on driver performance;
>
> • it represents a plausible benchmark of driver distraction potential beyond which new systems, functions, and features should not go;
>
> • the radio is a device that is most likely to be supplanted or augmented by new technology in terms of functions and services. News, weather, traffic advisories, entertainment (music, stories), and advertisements currently broadcast in audio to the general public via the radio will be tailored to the individual driver's needs and interests by emerging technology.
>
> • the 85th percentile response characteristics or capability represent a common design standard in traffic engineering.[171]

NHTSA agrees with this approach to establishing a recommended threshold for total eyes off road time to complete a task. NHTSA also adopted the Alliance's technique of using the 85th percentile of driver eye glance measures while performing manual radio tuning as a way to set acceptance criteria for testing to determine if a task is unreasonably distracting. In addition to the 85th percentile being a common design standard in traffic engineering, use of the 85th percentile ensures that a task can be performed with acceptable levels of distraction by the vast majority of drivers.

As explained in NHTSA's Initial Notice and subsequent technical correction,[172] to obtain data about driver performance during manual radio tuning, NHTSA performed two studies, one with testing performed by NHTSA [173] and one with testing performed by VTTI.[174] The first study tested 90 test participants performing 541 instances of manual radio tuning in a 2010 Toyota Prius (trim level V) connected to VRTC's fixed-base driving simulator. Each test participant was instructed to follow a lead vehicle moving at a varying rate of speed and to perform the manual radio tuning reference task when prompted. Data from the first trial for each participant were analyzed separately because the first trial was typically associated with the longest TEORT. The 85th percentile total eyes-off-road time (TEORT) based on the first radio tuning trial by each test participant was 11.97 seconds. The 85th percentile TEORT value for all radio tuning trials was 11.10 seconds.

The second study had two testing phases. During Phase I, test participants drove each of four vehicles on the VTTI Smart Road while following a lead vehicle traveling at a constant speed of 45 mph, similar to the driving scenario used in the NHTSA driving simulator study discussed above. During Phase II, test participants drove each of two vehicles on the VTTI Smart Road while following a lead vehicle traveling during one lap at a constant speed of 45 mph and during another lap at a variable speed. A total of 43 participants between the ages of 45 and 65 took part in this study. This participant sample was composed of two separate participant groups, as data collection occurred in two phases as noted above. Data for a total of 218 manual radio tuning trials were obtained and analyzed. The 85th percentile TEORT for all of the VTTI radio tuning data was 12.1 seconds.

Based on the 85th percentile TEORT values from the two studies, NHTSA proposed, and is now adopting, a TEORT acceptance threshold of 12 seconds.

Regarding comments suggesting that NHTSA did not use the Alliance Guidelines' manual radio tuning task when the agency conducted its own research, NHTSA believes that we used the Alliance-specified task. Multiple reasons support this position, as explained below.

First, consider the actual radio tuning apparatus. The Alliance Guidelines contain a description of the apparatus to be used for manual radio tuning including minimum specifications for the radio's controls, display, and positioning in the vehicle.[175] They clearly indicate that either a simulated radio or an actual production radio may be used. The apparatus specifications conclude with the statement "If a real radio is used, it should provide a reasonable approximation to these

[169] Comments received from Richard A. Young, Attachment 2, p. 13. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0106.

[170] Ibid, Attachment 2, p. 26.

[171] Driver Focus-Telematics Working Group, "Statement of Principles, Criteria and Verification Procedures on Driver-Interactions With Advanced In-Vehicle Information and Communication Systems," p. 40, June 26, 2006 version, Alliance of Automobile Manufacturers, Washington, DC.

[172] 77 FR 11227–11229; U.S. DOT/NHTSA—Technical Correction to 77 FR 11200, February 24, 2012, Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices, Notice of Proposed Federal Guidelines, posted 05/09/2012, accessible at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0079.

[173] Ranney, T.A., Baldwin, G.H.S., Parmer, E., Martin, J., and Mazzae, E.N., "Distraction Effects of Number and Text Entry Using the Alliance of Automotive Manufacturers' Principle 2.1B Verification Procedure," NHTSA Technical Report number DOT HS 811 571, November 2011.

[174] Garrott, W.R., Perez, M., Baldwin, G.H.S, Ranney, T.A., Mazzae, E.N., Owens, J., Viita, D., Angell, L., Parmer, E., and Martin, J., "Summary of Radio Tuning Effects on Visual and Driving Performance Measures—Simulator and Test Track Studies," Docket NHTSA–2010–0053, Document 0076, April 2012.

[175] Ibid, pp. 46–49.

features.'' [176] This statement appears to indicate that the authors of the Alliance Guidelines do not anticipate that the precise details of the radio tested should have a substantial effect on test results. As summarized in the Initial Notice, NHTSA's 2/12 criteria was developed in part based on research performed using five different vehicles and their original-equipment, production radios that met the apparatus specifications contained in the Alliance Guidelines. These vehicles included:

- 2005 Mercedes Benz R350
- 2006 Cadillac STS with premium infotainment system
- 2006 Infiniti M35
- 2010 Chevrolet Impala
- 2010 Toyota Prius with premium infotainment system

Second, commenters expressed concerns that the manual radio tuning task used by NHTSA to obtain the data that formed the basis of the proposed eye glance criteria differs from the manual radio tuning task used as a reference task in the Alliance Guidelines. For the NHTSA radio tuning testing, each of these five vehicles' radios was tested using the Alliance Guidelines' procedure for manual radio tuning with no deviations.[177]

Third, commenters suggested that radio designs might have changed so as to make radio tuning using 2005 through 2010 model radios less distracting than it had been using 1980s radios. They further suggested that this accounted for the difference between the Alliance Guideline's task acceptance criteria of 2 seconds maximum single eye glance length—20 seconds maximum TEORT for a single task (referred to as the 2/20 criteria) and the NHTSA Guideline's 2/12 criteria. NHTSA does not believe that the selection of more modern radios is responsible for the difference between the Alliance and NHTSA acceptance criteria. This is shown by the similarities between the Dingus/Rockwell data (used as the basis for the Alliance Guidelines criteria) which was collected during the 1980's and the more recently-collected NHTSA data.

The Alliance 2.1 Alternative A test protocol determines task acceptability for performance while driving based on the 2/20 eye glance metric criteria. The Alliance 2.1 Alternative A test protocol's acceptance criteria were developed in earlier Alliance research involving the performance of the manual radio tuning reference task. Actual performance of the manual radio tuning task (as opposed to use of related criteria) described in the Alliance Guidelines technically applies only to Alliance 2.1 Alternative B testing (which examines vehicle-control-related driving performance metrics). NHTSA used the manual radio tuning task specified by the Alliance Guidelines to collect the data that led to NHTSA's 2/12 eye glance metric criteria. The Alliance intended their 2/20 task acceptance criteria to be 85th percentile values for single glance duration to the radio and TGT, respectively, for performance of the manual radio tuning reference task. They developed estimates of these 85th percentile values by analyzing data collected during two 1980s driving studies involving manual radio tuning: A 1987 study performed by Dingus [178] and a 1988 study performed by Rockwell.[179]

The discrepancy between NHTSA's Total Eyes Off Road Time (TEORT) and the Total Glance Time (TGT) used in the Alliance Guidelines (i.e., 12.0 seconds vs. 20.0 seconds) is rooted in how each group derived its respective value. NHTSA's research determined 85th percentile TEORT by directly measuring participant visual attention to the road ahead, which allowed direct calculation of TEORT. In contrast, the Alliance used data from studies that did not directly measure TEORT or TGT, and, therefore, it relied on a calculated estimate of TGT determined by multiplying the 85th percentile individual glance duration and the 85th percentile number of glances. Upon examining the differences between NHTSA's TEORT (12.0 seconds) and the Alliance's TGT (20.0 seconds), NHTSA identified a flaw in how the Alliance calculated its estimated TGT. This flaw is discussed in detail below. Basically, multiplying the 85th percentile glance duration by the 85th percentile number of glances overestimates TGT for three reasons. First, these two values are not independent. Multiplying non-independent numbers is inappropriate because the resulting value is confounded. For example, it is plausible that drivers who used longer eye glances during radio tuning took fewer glances. Second, statistically, to estimate the 85th percentile of a product of two numbers, the 50th percentile of one value times the 85th percentile of the other value should be used (multiplying the two 85th percentiles together yields an estimate of the 97.75th percentile). Third, manual radio tuning requires multiple eye glances. From the NHTSA data, the 85th percentile number of eye glances was 17. The probability of 17 glances all being above the 85th percentile duration is infinitesimal. When NHTSA adjusted for these flaws, the results closely matched NHTSA's 12.0 second TEORT value. NHTSA believes the outcomes of its own research and the corrected calculations of the Alliance's numbers are converging evidence that the 12.0 second TEORT value has a strong empirical basis.

As noted above, the Dingus and Rockwell data used by the Alliance did not allow direct computation of TGT. Rather, the Alliance used an aggregate distribution of radio tuning glance durations from Rockwell to determine the 85th percentile glance duration (1.9 seconds per glance which was rounded up to 2.0 seconds per glance). The mean and standard deviation of the number of driver eye glances to the radio during the task were obtained from the Dingus study and were used to create estimates of the 85th percentile number of glances required for manual radio tuning (9.4 glances which was rounded up to 10.0 glances). These two values were multiplied together resulting in the 20-second TGT criterion contained in the Alliance Guidelines.

NHTSA reviewed the Alliance's analyses and has found what we believe are statistical problems that led to the Alliance's 20-second TGT criterion.[180] Three specific problems with the analysis are:

- If the 85th percentile length for one glance is 2.0 seconds, then the 85th percentile length for ten glances is not 20.0 seconds but instead less than 20.0 seconds.
- The 85th percentile length for one glance cannot be multiplied by the 85th percentile number of glances to obtain an 85th percentile TGT.
- Eye glance lengths and number of eye glances are not statistically independent. It is entirely plausible that drivers who used longer eye glances during radio tuning took fewer glances.

The logic above denotes how multiplying the non-independent 85th percentile glance duration by the 85th percentile number of glances *results in*

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[176] Ibid, p. 47.

[177] Ibid, pp. 47–48.

[178] Dingus, T.A., *Attentional Demand Evaluation for an Automobile Moving-Map Navigation System,* unpublished doctoral dissertation, Virginia Polytechnic Institute and State University, Blacksburg, VA, 1987.

[179] Rockwell, T.H., ''Spare Visual Capacity in Driving Revisited: New Empirical Results for an Old Idea,'' in A. G. Gale et al (editors), *Vision in Vehicles II* (pp. 317–324), Amsterdam: Elsevier, 1988.

[180] Ranney, T.A., Baldwin, G.H.S., Smith, L.A., Martin, J. & Mazzae, E.N. Driver Behavior During Visual-Manual Secondary Task Performance: Occlusion Method Versus Simulated Driving, Appendix A. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0077.

an overestimate of TGT. This is the flaw in the Alliance's calculations identified by NHTSA. While it is not possible to calculate a precisely correct 85th percentile TEORT with the information in these studies because eye glance durations and number of eye glances are not statistically independent, NHTSA analyzed the Dingus and Rockwell data to approximate their 85th percentile TGT in an effort to correct for the flaw in the Alliance's analysis. The 85th percentile TGT can be estimated in a variety of ways.

1. Multiply the mean glance duration determined in the Dingus study (1.10 seconds per glance) times the 85th percentile number of glances for radio tuning from the Dingus study (9.4 glances). This yields an estimated 85th percentile TGT of 10.34 seconds.

2. Multiply the mean glance duration determined in the Rockwell study (1.44 seconds per glance) by the 85th percentile number of glances from the Dingus study (9.4 glances). This yields an estimated 85th percentile TGT of 13.54 seconds.

3. Multiply the 85th percentile glance duration determined in the Rockwell study (1.90 seconds per glance) by the mean number of glances from the Dingus study (6.9 glances). This gives an estimated 85th percentile TGT of 13.11 seconds.

Unfortunately, information is not available to permit calculation of a fourth estimate, that given by the 85th percentile glance duration determined in the Dingus study times the mean number of glances for radio tuning from the Dingus study.

It is impossible to know which of these three estimated 85th percentile TGT values provides the best estimate. A reasonable way to proceed is to average the three values which gives NHTSA's best estimate of the 85th percentile TEORT from the Dingus and Rockwell data of 12.33 seconds.

Rounding NHTSA's best estimate of the 85th percentile TGT from the Dingus and Rockwell data of 12.33 seconds to the nearest 1.5 seconds gives a TGT acceptance criterion of 12 seconds. This is identical to the maximum TEORT acceptance criterion of 12 seconds that NHTSA developed based on manual radio tuning data from its own research, which measured TEORT directly and therefore avoided the problem of multiplying non-independent glance duration and number. (Rounding to the nearest 1.5-second increment in the TEORT value provides compatibility with occlusion testing, since for a TSOT to TEORT ratio of 1:1, each 1.5-second unoccluded period corresponds to 1.5 seconds of driving simulator eyes-off-road time.)

Even if the rounded 85th percentile TEORT value from the Dingus and Rockwell data was not identical to the rounded 85th percentile TEORT value from recent NHTSA testing, NHTSA would still be inclined to base its guidance on more recent data. The recent NHTSA testing had the following advantages:

- More vehicles/radios tested,
- More test participants involved,
- More modern radio designs evaluated, and
- It better allows for recent improvements in driver skills due to more frequent driver usage of electronic devices.

Based on the above discussion, NHTSA believes the specified manual radio tuning task and related acceptance criteria proposed in the NHTSA Guidelines are reasonable and valid. We believe that the difference between the Alliance Guideline's 2/20 task acceptance criteria and the NHTSA Guideline's 2/12 criteria is solely due to a statistical error made during development of the Alliance Guideline's 2/20 criteria. While we appreciate the Alliance's offer to work with NHTSA to improve the Alliance Guidelines' specifications of the 1980s-era radio or to develop a different standardized test apparatus, we think that such an effort is unnecessary because we are already using the exact same apparatus and procedure.

NHTSA disagrees with the comment that radio tuning is inappropriate for use as a benchmark task because it is too variable and its associated distributions of eye glance durations contain some glances longer than 2.0 seconds in duration. As stated in the Initial Notice, NHTSA wanted a reference task with a long history of being societally acceptable for drivers to perform while driving. While it is true that manual radio tuning has vehicle-to-vehicle variability, this is why we tested five vehicles' radios to determine our task acceptance criteria. We have also included task acceptance criteria specifically aimed at preventing too many long eye glances from being made during any acceptable task (our criteria that, for 21 out of 24 test participants, the mean eye glance duration must be less than or equal to 2.0 seconds long plus 85 percent of eye glances must be less than or equal to 2.0 seconds long).

3. NHTSA Has Not Shown That Tasks With TEORT Values Longer Than 12 Seconds are Less Safe

a. Summary of Comments

Manufacturers were consistently opposed to the adoption of the proposed 12-second Total Eyes-Off-Road Time (TEORT) criterion value, which is more stringent than the value contained in the Alliance Guidelines. Manufacturers provided several different reasons to support their position.

One set of arguments asserted that NHTSA should demonstrate a safety need and/or benefit to justify the stricter criterion. The following comment was submitted by Toyota:

> Toyota believes NHTSA should continue its practice of demonstrating a defined safety benefit to new regulations and guidelines. There needs to be evidence of a safety benefit with the change from the current Alliance guideline criterion of 20 seconds to the NHTSA proposal of 12 seconds. Proposing a 40% reduction in the criterion does not seem to be appropriate and should wait until more empirical evidence of a benefit is ascertained, possibly through naturalistic driving studies.[181]

Ford encouraged NHTSA to use naturalistic data to support any such proposed change:

> Ford firmly believes all guidelines must be based on the most complete and current data, with special emphasis on real-world crash data and naturalistic driving studies. We find that neither the crash problem size potentially attributable to integrated in-vehicle systems nor the latest naturalistic driving data support the stringency levels contained in the proposed NHTSA guidelines, particularly the reduction in the total-eyes-off-road time (and associated occlusion metric) that a permitted task can require.[182]

Volkswagen noted a lack of customer complaint data supporting the need for a more stringent criterion:

> Current crash and customer complaint data do not support the need for expanding the scope and stringency of the existing voluntary industry distraction guidelines [commonly referred to as the Alliance Driver Focus-Telematics (DFT) Guidelines] for in-vehicle telematics systems with visual-manual interfaces, such as proposed by NHTSA in the subject draft guidelines.[183]

A second set of reasons for opposing the adoption of the proposed 12-second

[181] Comments received from Toyota Motor North America, Inc. Attachment, p. 6. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0092.

[182] Comments received from Ford Motor Company, Technical Appendix, p. 13. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0097.

[183] Comments received from Volkswagen Group of America, Inc., Attachment, p. 1. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0101.

TEORT criterion value was based on not understanding how the 12-second value was determined. For example, the following comments were received from Toyota Motor North America, Inc.:

Due to the lack of supporting data or detailed reports, we are uncertain how the 12-second value was calculated.[184]

General Motors made the same argument in the following comment:

The rationale for reducing the 20 second limit to 12 seconds is unclear and appears to be relatively unsupported.[185]

A third set of arguments questioned the nature of the relationship between TEORT and poor driving/crash risk. Dr. Paul Green commented:

Given the relationship is unstated; one could assume it is linear. However, some early research by Wierwille and the research of Godthelp concerning TLC and occlusion leads one to a power function, with the power being greater than 1. There is a need for more and more compelling evidence to support the maximum time off the road and the effect of single long glances.[186]

Another reason given repeatedly to support the recommendation to abandon the adoption of a more stringent TEORT criterion value is based on the results of two recent studies that reanalyzed video data from the 100-car naturalistic study. In the following comment, the Alliance argues that the assertions on which NHTSA based the new criterion values may no longer be valid:

In contradiction of NHTSA's statement, two very recent and independently conducted in-depth analyses of the 100-Car naturalistic driving data suggest that it is the last single glance that is significantly associated with increased odds of crash and near-crash involvement (Liang, 2009; Victor and Dozza, 2011). Reasonable arguments can be mustered to explain both why TEORT should not matter and why it must matter. Because of the ambiguous nature of these findings, further understanding of the interaction of eye glance and crash causation based on real-world results is needed. Analysis of the SHRP 2 naturalistic driving data will provide an opportunity to develop this better understanding before more stringent criteria are imposed.[187]

Some commenters suggested elimination of the TEORT criterion entirely, but most recommended that NHTSA adopt the Alliance criterion value of 20 seconds. This comment came from Ford Motor Company:

Accordingly, we recommend that NHTSA adopt the 20 second total eyes off road time, and the corresponding 15 second total shutter open time criteria from the Alliance Guidelines, rather than the 12 and 9 seconds values proposed in the notice.[188]

Several commenters questioned NHTSA's proposed use of the 85th percentile radio tuning TEORT for setting the proposed TEORT criterion value. The Alliance made the following comment about using the 85th percentile as a criterion value.

The 'consolidated' 85th percentile of 11.3 [seconds] is a consequence of the mixing of arbitrary sample sizes and arbitrarily selected vehicles. Table 5 presented data from N = 90 participants in a fixed-base driving simulator working with a Toyota Prius radio. Table 7 presented data taken from closed course testing of radio tuning in 9 different passenger cars with samples ranging in size from 20 to 41. The data as aggregated appear to be an arbitrary mixture of trials rather than a representative sample. For example, if only the vehicle that had an 85th percentile of 8.1 s had been used, then 8.1 s would appear to be the 'correct' value. On the other hand if only the vehicle that had an 85th percentile value of 17.6 s had been used, then 17.6 s would appear to be the 'correct' value. Other vehicles and participant samples not tested might produce results even more extreme than either of these two vehicles produced. Thus, a 'consolidated' 85th percentile value could be made to turn out arbitrarily higher or lower simply by changing the mixture. No rationale is provided as to how the varying sample sizes, vehicles, and venues chosen comprise a representative sample of the United States motor vehicle population.[189]

Most importantly, NHTSA provides no evidence that vehicles with longer 85th percentile TEORT values are less safe than those vehicles with shorter 85th percentile values, specifically with regard to crashes uniquely attributable to radio tuning or other, similar visual-manual tasks.[190]

Dr. Green made the following comment:

* * * the [guidelines] section focuses on the use of the 85th [percentile] as a criteria [sic] because it is used as a criteria for setting speed thresholds. How does that make it an acceptable criterion here? Why is 85th [percentile] used for speed? [191]

One commenter expressed concern that the 12-second TEORT criterion was too long. The Advocates for Highway and Auto Safety (Advocates) provided the following comment:

* * * the agency's recommendation that tasks be accessible while driving if they can be performed with 12.0 seconds of ''total eyes-off-road time'' is too long and will allow features that require too great a diversion of attention from the driving task. A test procedure limit of up to 12.0 seconds permits too many repeated eye glances away from the road and traffic.[192]

Advocates refers to the 8.0 second limit adopted by the Japan Automobile Manufacturers Association (JAMA) Guidelines [193] in the following comment:

Advocates believes that JAMA is taking a more prudent approach to safety by limiting the complexity of built-in electronics that can be accessed by drivers while operating a motor vehicle. For these reasons, Advocates opposes the proposed NHTSA guidelines to the extent that they would allow non-safety electronic devices and applications that require considerable glances and manipulations to access, select or engage while operating a motor vehicle, and we recommend that a limit of no more than the JAMA specification of 8.0 seconds be adopted by the agency.[194]

b. NHTSA's Response

For the reasons described below, NHTSA has decided to retain the 12-second acceptance threshold for TEORT.

NHTSA determined its 12.0-second recommended maximum value for TEORT based upon the fundamental idea that secondary tasks should not be performed while driving if they are more distracting than performing a reference task, specifically manual radio tuning. NHTSA took this concept from the Alliance Guidelines. NHTSA maintains that this is a fundamentally sound approach. As explained earlier in this notice, NHTSA contends that the difference between the Alliance Guideline's 2/20 task acceptance criteria and the NHTSA Guideline's 2/12

[184] Comments received from Toyota Motor North America, Inc. Attachment, pp. 6–7. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0092.

[185] Comments received from General Motors LLC, Attachment, p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0103.

[186] Comments received from Dr. Paul Green, p. 6. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0052.

[187] Comments received from Alliance, Technical Appendix, p. 13. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0104.

[188] Comments received from Ford Motor Company, p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0097.

[189] Comments received from the Alliance, Technical Appendix, p. 14. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0104.

[190] Ibid. p. 14.

[191] Comments received from Dr. Paul Green, p. 6. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0052.

[192] Comments received from the Advocates for Highway and Auto Safety, p. 4. Accessed at Docket NHTSA–2010–0053, Document Number 0069.

[193] Japanese Automobile Manufacturers Association, ''Guideline for In-Vehicle Display Systems, Version 3.0,'' Japanese Automobile Manufacturers Association, Tokyo, Japan, August 2004.

[194] Comments received from the Advocates for Highway and Auto Safety, p. 4. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0069.

criteria is due to a statistics error made during development of the Alliance Guideline's 2/20 criteria. NHTSA believes that the two sets of guidelines would have identical task acceptance criteria, had the Alliance not made this statistics error.

The basis for NHTSA's reducing its maximum recommended TEORT for task acceptability while driving is fully set out in the Initial Notice, this notice, and in a NHTSA technical report about its radio tuning research.[195] It is well supported since the recent NHTSA testing had the following advantages over the testing measuring the data used by the Alliance to establish their TEORT criterion:

• More vehicles/radios tested,
• More test participants involved, and
• Better allows for recent improvements in driver skills due to more frequent driver usage of electronic devices.

The fact that both the testing that measured the data used by the Alliance to establish their TEORT criterion established (when re-analyzed) and the recent NHTSA testing established the exact same TEORT criterion further shows the appropriateness of the value determined.

The vehicles tested during NHTSA's radio tuning testing were selected randomly. We point out that Dingus and Rockwell also used randomly selected vehicles for their testing, but the NHTSA study had advantages that were noted in the previous paragraph. None of the commenters presented data showing what sample of vehicles would have been more representative of U.S. OE radio interfaces or data indicating that a more representative sample would have produced a different TEORT value.

NHTSA does not claim that there is a linear relationship between TEORT and poor driving/crash risk. Nor do we see that it matters whether the relationship is linear or not. NHTSA is firmly convinced that what does matter, and all studies indicate as valid, is that there is a monotonically increasing relationship between TEORT and poor driving/crash risk (i.e., having drivers look away from the forward road scene increases driving risk). Recent analyses of the 100-Car Study data by Victor and Dozza[196] also found that minimizing the time that drivers look away from the road maximizes safety.

In response to Dr. Green's comment, NHTSA chose the 85th percentile for compatibility with the Alliance Guidelines and because it offers several advantages. We did not want to use the 100th percentile because that would reduce the stability of test results by making our task acceptance criteria highly susceptible to the effects of testing outliers. We could have based our task acceptance criteria upon either mean or median values, but use of the 85th percentile ensures that a task can be performed with acceptable levels of distraction by the vast majority of drivers. Use of the 85th percentile can also reduce the amount of testing needed to determine that a task is unacceptable for performance while driving. If testing begins with the anticipated ''worst case'' drivers and they have problems meeting the task acceptance criteria, additional testing may well be superfluous.

The Advocates' suggested that NHTSA use the 8.0-second TEORT criterion contained in the JAMA Guidelines rather than 12.0 seconds maximum TEORT contained in the NHTSA Guidelines. The JAMA Guidelines state that when testing to determine task acceptability:

> * * * use the *average value* of their operation time to judge compliance with the total gazing time standard. [emphasis added by NHTSA][197]

In other words, for a task to be acceptable for performance while driving, the JAMA Guidelines recommend that the average TEORT be less than or equal to 8.0 seconds while the NHTSA Guidelines recommended that the 85th percentile TEORT be less than or equal to 12.0 seconds. However, for the reasons previously stated above, NHTSA believes that the 85th percentile TEORT is a better threshold criterion than average TEORT. The difference between the mean (approximately 50th percentile for typical eye glance distributions) and the 85th percentile is responsible for much of the apparent difference between the JAMA and NHTSA Guidelines.

NHTSA's manual radio tuning research with a 2010 Toyota Prius found an 85th percentile TEORT of 11.97 seconds and an average TEORT of 8.80 seconds.[198] While other methods for measuring distraction during performance of a secondary task have been developed (including those used in the JAMA Guidelines), no general consensus exists as to the threshold at which an absolute level of distraction due to a driver performing a task becomes unacceptably high. However, a relative limit can be developed by comparing the distraction level associated with a driver performing an ''acceptable'' reference task with the distraction level associated with a driver performing new tasks.

Based on NHTSA's testing, NHTSA determined a task acceptability criterion of a maximum of 12.0 seconds for the 85th percentile TEORT. This is slightly less stringent than the task acceptability criterion contained in the JAMA Guidelines, i.e., an average TEORT of 8.0 seconds or less which would correspond to a maximum 85th percentile TEORT of approximately 10.5 seconds.

Unlike the Alliance and NHTSA Guidelines, the JAMA Guidelines only include a TEORT criterion and do not contain any task acceptability criteria related to individual glance time (i.e., a task could be associated with one single glance lasting 8 seconds and still meet the criteria in the JAMA Guidelines). As the agency indicated in both the Initial Notice and this notice, the agency believes that both long eye glances from the forward road scene and longer TEORT have negative effects on driving safety. Accordingly, the agency has included long-eye-glance-based task acceptability criterion in the NHTSA Guidelines (i.e., for at least 21 of 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 a task one time), making the NHTSA Guidelines more stringent than the JAMA Guidelines with respect to certain tasks. For example, some tasks that would meet the JAMA Guidelines (e.g., those tasks associated with a single glance lasting 8 seconds) would not meet the acceptance criteria of the NHTSA Guidelines. Given the different approaches taken in the JAMA Guidelines and the NHTSA Guidelines, the agency does not believe it is

[195] Perez, M., Owens, J, Viita, D., Angell, L., Ranney, T.A., Baldwin, G.H.S., Parmer, E., Martin, J., Garrott, W.R., and Mazzae, E.N., ''Summary of Radio Tuning Effects on Visual and Driving Performance Measures—Simulator and Test Track Studies,'' DOT HS number not yet available, April 2012, accessible at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0076.

[196] Victor, Trent; Dozza, Marco: Timing Matters: Visual behaviour and crash risk in the 100-car on-line data. Proceedings of the Driver Distraction and Inattention International Conference, Göteborg, 5–7 September, 2011.

[197] Japanese Automobile Manufacturers Association, ''Guideline for In-Vehicle Display Systems, Version 3.0,'' p. 14, Japanese Automobile Manufacturers Association, Tokyo, Japan, August 2004.

[198] U.S. DOT/NHTSA—Technical Correction to 77 FR 11200, February 24, 2012, Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices, Notice of Proposed Federal Guidelines, posted 05/09/2012, accessible at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0079.

necessarily appropriate to use the TEORT criterion in the JAMA Guidelines, which is meant to be a standalone criterion, as the NHTSA TEORT criterion, which is one of several glance acceptance criteria used to assess distraction potential.

4. Suggestions for More Stringent Task Acceptance Criteria

a. Summary of Comments

Several commenters supported stricter task acceptance criteria. Comments received from Focus Driven criticized the guidelines for allowing any engagement in entertainment tasks.

* * * the suggestion of the ''2–12'' rule (i.e.: designing infotainment applications that require no more than 2 seconds of visual distraction at a time for various user inputs and not more than 12 seconds of total time to complete a specific function) are themselves recommendations that support distracted driving which is completely counterintuitive to safety.[199]

We would never set voluntary guidelines to install devices to enable alcohol impaired driving, so to do the same for the temporary impairment associated with electronics that have nothing to do with the safe operation of a vehicle is a large step in the wrong direction if our intent is to prevent crashes (saving property, injury, and lives.)[200]

The National Transportation Safety Board (NTSB) also suggested adopting stricter acceptance test criteria:

The proposed guidelines are somewhat stronger than current industry guidelines, but NHTSA should set the safety bar even higher. The NTSB urges NHTSA to go beyond its stated expectation of ''interfaces that do not exceed a reasonable level of complexity for visual-manual secondary tasks'' and strive for more than ''discouraging the introduction of egregiously distracting non-driving tasks performed using integrated devices.'' Instead, NHTSA should be promoting integrated devices that provide a safety benefit, or that at least do not increase the risk in any measureable way.[201]

b. NHTSA's Response

NTSB and some safety advocacy groups, including Focus Driven, recommended that NHTSA should set a stricter benchmark than the proposed acceptance criteria based on the manual radio tuning task. Comments suggested the criteria be modified to recommend providing drivers access to only integrated devices that provide a safety benefit, or that at least do not increase driving risk in any measureable way. NHTSA believes that such stricter criteria than were proposed could not be justified for the reasons discussed below.

First, driving is frequently monotonous. Part of the reason why drivers perform distracting tasks is to create sufficient mental stimulation. If drivers are insufficiently stimulated while driving, they may become drowsy with known, negative safety consequences. This effect is indicated by naturalistic driving data. Examining Figure 1, the only tasks that had the same or lower crash/near-crash odds ratios as average driving were interacting with passengers (both for passenger vehicles and heavy trucks) and talking/listening on a hands-free cell phone (only for heavy trucks; there was insufficient hands free cell phone data in the 100-Car Study to generate a meaningful odds ratio for this activity for passenger vehicles). The lower odds ratio for interacting with passengers may be explainable due to the passenger acting, in part, as an extra set of eyes for the driver. The lower odds ratio for talking/listening on a hands-free cell phone for heavy trucks is thought to be due to this activity providing stimulation to the driver and reducing their likelihood of being drowsy.

Second, the performance of some secondary tasks using electronic devices can reduce distraction. An example of this is route navigation. The performance of some secondary tasks with a route navigation system (e.g., destination entry) does increase driving risk. However, if drivers cannot use route navigation systems while driving, they may rely on more distracting alternatives such as memorized directions, paper maps, or written directions while driving. These alternatives create distraction associated with handling paper and looking away from the roadway to look at the paper and are likely to increase cognitive distraction and driver workload[202] as the driver concentrates on looking for particular streets or landmarks and not on the driving task.

Devices like route navigation systems may not be safer than ''just driving'' (i.e., driving while not performing any secondary tasks), but they can be a less distracting option to perform certain tasks that drivers have to perform. By recommending that the distraction potential of electronic devices be kept below a certain threshold but not locked out altogether, the agency believes that conformance to the NHTSA Guidelines can minimize driver distraction.

For these reasons, NHTSA believes that more stringent Guideline acceptance criteria recommendations may have disadvantages and that limiting secondary tasks that increase driving risk relative to ordinary, average driving in any measureable way would not maximize overall driving safety. Therefore, NHTSA has not adopted this suggestion from commenters for increased stringency.

5. Concerns Expressed About Long Eye Glances

a. Summary of Comments

Many commenters cited the results of two recent studies that reanalyzed video data from the 100-Car naturalistic study. The major finding of these new studies is that when video data from the 5 seconds immediately before an event identified as a crash or near crash are compared with video data from control-group episodes, the crash/near-crash episodes have higher incidence of single long-duration glances than the control-group episodes. While previous analyses have shown a similar relation between Total Eyes-Off-Road Time (TEORT) and crash/near-crash risk, these new analyses show a stronger relation between single glance duration and increased risk of an adverse outcome.

These new findings were cited repeatedly in the docket comments as the basis for various recommendations about the use of glance metrics in the proposed guidelines. Several commenters concluded that TEORT may be less important as a criterion for assessing the distraction potential of tasks performed with integrated in-vehicle systems than had been previously thought and consequently that emphasis should be shifted to metrics that focus on single glance duration. A comment from Agero, Inc. made this point:

Further consideration should be devoted to determining whether longest glance time is a more effective HMI measurement of event detection than total glance time or average glance time.[203]

The reference to ''event detection'' in comments about glance metrics reflects the influence of work done by Professor Richard A. Young, who provided

[199] Comments received from Focus Driven: Advocates for Cell-Free Driving, p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0111.

[200] Ibid.

[201] Comments received from National Transportation Safety Board (NTSB), p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0066.

[202] Srinivasan, K.S. and Jovanis, P.P, ''Effect of In-Vehicle Route Guidance Systems of Driver Workload and Choice of Vehicle Speed: Findings from a Driving Simulator Experiment,'' in *Ergonomics and Safety of Intelligent Driver Interfaces,* edited by Ian Noy, Transport Canada, Ottawa, ON, published by Lawrence Eribaum Associates, May 1997. Accessed at: *http://pubs.its.ucdavis.edu/publication_detail.php?id=560.*

[203] Comments received from Agero, Inc., p. 8. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0090.

extensive commentary on the importance of single glance duration. Professor Young presented the results of several analyses to support an argument that went beyond the recommendations presented by the auto manufacturers on this topic. The following excerpts summarize the main components of his argument. In the first excerpt, Professor Young uses the new 100-Car Study findings to argue that long-duration glances are more likely to reflect involvement of attentional processes than shorter-duration glances:

> Long single glances may reflect an underlying attentional process in attention shifts. These [new] analyses indicate it is not just the mechanistic aspect of eyes off the road that is the sole problem in missed events or crash causation. The attentional processes underlying long single glances play an independent role in event detection and probably in crash causation as well. It is therefore important to ensure that long single glances are adequately covered by the criteria in the NHTSA (2010) Guidelines.[204]

Elsewhere, Professor Young attempts further to explain why long single glances may be a concern. He offers the following:

> Long single glances may reflect *attention capture,* a prolonged engagement of attention at an in-vehicle location. When there is no subjective cue or external cue to interrupt attention to a secondary task, a glance to the task can linger if processing is not complete. * * * Hence drivers can maintain a long single glance without being aware of it during relatively short, low workload tasks. These long single glances are associated with poor event detection and response, even more so than eyes off-road time or other driver workload metrics.[205]

Professor Young presents analyses of the Crash Avoidance Metrics Partnership Driver Workload Metrics project data and of Virginia Tech Transportation Institute Smart Road data to demonstrate that event detection metrics provide information independent of the information provided by glance-based metrics (TEORT, number of glances) and driving performance metrics (lane keeping, headway maintenance). He offers the following summary:

> Event detection explains about one-third of the variance in driver performance, orthogonal to the variance in driver workload metrics, including eyes-off-road time (EORT), number of glances, lane keeping, speed maintenance, headway or any other conventional driver workload metric.[206]

On the question of how to incorporate the long-duration glances into an assessment protocol, Professor Young offers the following:

> The draft NHTSA (2012) Guidelines have attempted an important advancement over the Alliance Guidelines in this regard, by adding a third glance criterion intending to limit long glances, * * * Unfortunately, a question remains about whether the NHTSA proposed method and criterion is, by itself, adequate to limit long single glances.[207]

Professor Young presents hypothetical data to create a scenario, demonstrating that the combined effects of the three eye glance criteria proposed by NHTSA (mean glance duration, TEORT, and proportion of long glances) allow for the possibility of single glances as long as 3–6 seconds in duration.

> If the criteria above are applied to hypothetical data, it becomes apparent that, in theory, tasks with 7 to 10 average glances of 1 sec each could have one single glance as long as 3–6 sec and still meet NHTSA glance criteria.[208]

Although the inclusion of a long-glance criterion is positive, Professor Young argues that because of the hypothesized connection between long glances and attention shifts, a separate criterion is needed:

> Simply tightening the single glance duration limit to be lower than the 15% criterion is not recommended because it does not address the underlying problem of the attentional shifts that give rise to long single glance durations. Instead, it is recommended that an additional event detection and response test (above and beyond glance measures) is required to evaluate the effect that a device or task has on the underlying attentional processes which contribute to controlling long single glances.[209]

To summarize, Professor Young is making the following arguments:

1. Long-duration glances are implicated in crash causation.
2. Long-duration glances are more likely to reflect attentional processing than shorter-duration glances.
3. Glance-based metrics do not provide all the information necessary to determine where the driver's attention is directed.
4. Proposed NHTSA criteria still permit occurrence of single long-duration glances.
5. An event-detection metric, which requires responses to targets, provides better information about where a driver's attention is directed than any of the glance-based metrics.

Evidence of Professor Young's influence is evident in comments received from the Motor & Equipment Manufacturers Association.

> He [Professor Young] notes that the longest glance time—not the total glance time or the average glance time—plays a different role in ''event detection' and, thus, requires more coverage in the guidelines. * * * MEMA urges the agency to consider event detection in the applicable performance tests.[210]

b. NHTSA's Response

NHTSA shares these commenters' concerns about the negative effects of long eye glances away from the forward road scene on driving safety. Accordingly, NHTSA included a long eye glance-based task acceptability criterion to its Driver Distraction Guidelines not present in the Alliance Guidelines: that, for at least 21 of 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 a task one time. Professor Young points out[211] that a task can have one single long glance (in the 3 to 6 second range) and still meet all of NHTSA's task acceptance criteria. This is correct; NHTSA agrees that our current long eye glance criterion does not completely resolve this issue. While we think that it is a step in the right direction, secondary tasks that involve short term levels of high cognitive distraction are not screened out by our current task acceptance criteria.

Some commenters thought that long eye glances away from the forward road scene might have a greater effect on driving safety than does a longer TEORT. NHTSA does not know whether this is the case but suspects that both long eye glances away from the forward road scene and a longer TEORT have negative effects on driving safety. Fortunately, NHTSA does not have to resolve this question since our task acceptance tests can (and do) have multiple acceptance criteria.

6. Eye Glance Measurement Issues

a. Summary of Comments

Two comments were received addressing procedural details of the collection and use of eye glance data for determining the total eyes-off-road time. Comments provided by the Swedish Road and Transport Research Institute (VTI) addressed the precision and

[204] Comments received from Professor Richard A. Young, Attachment 2, p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0106.

[205] Ibid, p. 6.

[206] Ibid.

[207] Ibid, p. 4.

[208] Ibid.

[209] Ibid, p. 12.

[210] Comments received from Motor & Equipment Manufacturers Association, p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0091.

[211] Comments received from Professor Richard A. Young, Attachment 2, p. 4. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0106.

repeatability of recording gaze direction, recommending that a well-calibrated eye tracker would be preferable to manual coding of gaze direction from face video:

To ensure sufficient accuracy, precision, and repeatability of an eye tracker, it is not sufficient to use manual coding of gaze direction. A more objective way of doing this is to use a number of fixed gaze targets (for example on the simulation screen) that the driver is instructed to look at. It is then an easy task to measure the deviation between the location of the gaze target and the eye trackers estimate of the drivers gaze. This procedure is commonly used in head mounted eye trackers, and could easily be adopted for remote eye trackers as well. Crisp thresholds for accuracy and precision could then be established instead of the soft boundaries that follow from manual coding.[212]

The following comment from Volvo was directed at the level of effort required to accomplish manual reduction of video data to obtain glance information required by the guideline metrics:

* * * reduction of eye glance location from full motion video is very time consuming, especially considering the vast number of tests that would need to be conducted if following the recommended test procedures.[213]

b. NHTSA's Response

While NHTSA shares many of VTI's concerns about the accuracy of manual coding of gaze direction from face video, we also have concerns about eye tracker accuracy. NHTSA has had extensive experience with eye trackers during driver distraction testing performed by its Vehicle Research and Test Center (VRTC) over the last five years. Unfortunately, VRTC's work has found numerous eye tracker accuracy issues.

Therefore, NHTSA is not prepared to recommend the use of an eye tracker as the sole method for eye glance data reduction. In VRTC's experience, both methods of eye glance data reduction are resource intensive and have reasonable, but not excellent, accuracy. For this reason, NHTSA has included both eye tracker and manual coding of gaze direction from face video as acceptable methods for eye glance data reduction in its Guidelines.

NHTSA shares many of Volvo's concerns about the resources need to reduce eye glance data either with an eye tracker or through manual coding of gaze direction from face video. This is one reason that we have included Occlusion testing in NHTSA's list of recommended task acceptance test protocols. In our experience, Occlusion testing provides comparable results but uses fewer resources.

7. Occlusion Acceptance Test Criteria Issues

a. Summary of Comments

Comments were provided about the Occlusion Task Acceptance Test protocol contained in the proposed NHTSA Guidelines. Some comments raised more general concerns about the method, while others addressed the specific criterion value proposed by NHTSA.

Chrysler presented comments that were critical of the occlusion method. After acknowledging some benefits of occlusion, including the fact that no simulator is required, the relatively low effort and cost, and harmonization with the Alliance Guidelines, Chrysler identified several problems with the procedure, which were discovered in their own use of the procedure:

* * * the occlusion apparatus forcibly restricts single glance duration which does not reflect real world conditions. This was noted by the participant's lack of peripheral vision during the occlusion intervals. Because the individual is temporarily blinded when the shutters on the goggles close, there is a tendency for some individuals to lose kinesthetic awareness. The individual's body and hands have tendency to drift while the shutters are closed, something that doesn't normally happen during actual driving. For these reasons, the OCC method has not been and continues to not be preferred by Chrysler.[214]

Volkswagen Group of America (VW) provided detailed comments on the proposed 9-second Total Shutter Open Time (TSOT) criterion value, referring extensively to the results of a report[215] released by NHTSA in support of the guidelines proposal:

The report found that the 9 second TSOT criterion was too stringent, in that both radio tuning and destination entry did not meet the criterion. The 9 second TSOT criterion was derived from the 12-second TEORT [Total Eyes-Off-Road Time] criterion established based on testing in another study. * * * NHTSA refers to the assumed 3:4 relationship between TSOT and TEORT as the ''75 percent field factor.'' However, this assumed ''field factor'' proves to be unsupported by the data in the subject report which finds that both a regression analysis and a comparison of mean values showed that the relationship between TSOT and TEORT was near 1:1. In spite of this contrary finding, and the fact that the Prius radio tuning task did not meet the NHTSA criterion of 9 seconds TSOT, NHTSA nevertheless put forward a final acceptance criteria of 9 seconds for TSOT.[216]

Volkswagen was critical of a re-analysis of TSOT data that was described in the above-mentioned technical report:

* * * the analysis of TSOT data was redone using a subset of the data collected, re-stratified into different age groupings, and discarding the older test subjects. Only after discarding the data from the older subjects was it possible to claim support for the finding that the Prius radio tuning task met the 9-second TSOT criterion, while the destination entry task did not. This type of data manipulation to support a desired result is not consistent with sound scientific or engineering practices. We also note that the contradicted assumption that there is a 3:4 relationship between TSOT and TEORT has yet to be addressed by NHTSA.[217]

Volkswagen also cited the findings of a separate study presenting results of a survey of experts on various issues relating to the guidelines proposal. They cite the following finding from that report:

The experts agree that the 15 seconds total shutter open time was not excessive and seemed a good value to use.[218]

b. NHTSA's Response

Initially, NHTSA shared Chrysler's concerns about occlusion testing. However, based on NHTSA experience using this protocol in its own research and a careful review of the occlusion literature, we think that these concerns are more theoretical than real. Occlusion testing has substantial advantages: no driving simulator is required, relatively low effort is involved in implementing the protocol, the protocol is easy for test participants to comply with, testing cost is lower than other available methods such as driving simulation based methods, and results are repeatable. While NHTSA has learned that many manufacturers currently perform occlusion testing to support their product development research, NHTSA notes that groups who do not prefer the occlusion method are free to use the Eye Glance Measurement

[212] Comments received from the Swedish Road and Transport Research Institute, pp. 3–4. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 056.

[213] Comments received from Volvo Car Corporation, p. 5. Accessed at w*ww.regulations.gov*, Docket NHTSA–2010–0053, Document Number 108.

[214] Comments received from Chrysler Group LLC, p. 5. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0095.

[215] Ranney, T.A., Baldwin, G.H.S., Smith, L.A., Martin, J. & Mazzae, E.N. Driver Behavior During Visual-Manual Secondary Task Performance: Occlusion Method Versus Simulated Driving. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0077.

[216] Comments received from Volkswagen Group of America, Attachment, p. 4. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0101.

[217] Ibid.

[218] Ibid, p. 2.

Using Driving Simulator Testing protocol to assess their products' conformance to the NHTSA Guidelines.

In response to Volkswagen's comments critical of NHTSA's Occlusion Testing acceptability criterion, NHTSA revisited its basis for the specific value proposed. NHTSA agrees with Volkswagen that its 2011 study did not support a 75 percent field factor relating occlusion testing TSOT to TEORT for driving glances. The 2011 NHTSA study showed, both through regression analysis and a comparison of mean values that the relationship between TSOT and TEORT was near 1:1.

In addition to the 2011 NHTSA study, other sources of information consulted in determining the Occlusion Testing criterion included:

- Occlusion testing theory: assumes that every time a driver looks away from the forward roadway (for occlusion testing, each such eye glance is assumed to be 2.0-seconds long), the first approximately 0.50 seconds is spent transitioning the driver's eyes from the roadway to the object being looked at.[219] As a result, only 1.5 seconds of a 2.0-second eye glance are actually focused on the device being used.
- ISO Standard 16673:2007 specifies an occlusion vision interval (shutter open time) of 1.5 seconds.
  - Based on occlusion testing theory that the 1.5-second shutter open time is equivalent to an off-road glance duration of 2.0 seconds, this would give a ratio of 0.75 (i.e., 1.5/2.0 = 0.75). Applying this ratio to the TSOT/TEORT relationship results in a field factor of 75 percent.
- JAMA Guidelines: These Guidelines specify a maximum TSOT value of 7.5 seconds and a maximum TEORT value of 8 seconds.
  - These values give a TSOT/TEORT ratio of 0.8875.
- Hashimoto and Atsumi (2001), cited by the Alliance in explaining their basis for an occlusion TSOT criterion, found that a TEORT value (they refer to as ''TGT'' or total glance time) of 8 seconds was equivalent to a TSOT value of 7.1 s.
  - These values give a TSOT/TEORT ratio of 0.9375.

These sources suggest a TSOT to TEORT ratio ranging from 0.75 to 1. In the proposed NHTSA Guidelines, NHTSA relied on occlusion testing theory and ISO 16673:(2007) for the 75 percent field factor. Accordingly, NHTSA determined an initial occlusion TSOT criterion of 9 seconds based on the driving glance TEORT criterion of 12 seconds.

Since publication of the proposed NHTSA Guidelines, additional research has found the TSOT/TEORT ratio to be closer to 1.0. In addition to the April 2012 research report cited by Volkswagen, recently completed NHTSA-sponsored research conducted by the University of Washington and University of Wisconsin[220] directly compared secondary tasks using both driving simulator and occlusion protocols and found that use of a 12-second criterion for occlusion TSOT provided task acceptability results that were more consistent with results based on a 12-second TEORT criterion for driving glances. Consistency of the outcomes of these two protocols is important, since the NHTSA Guidelines specify both of these protocols as options for assessing conformance. Given that two research studies now cast doubt on the equivalency of the originally proposed 9-second occlusion TSOT criterion value with the 12-second TEORT for driving glances, NHTSA believes that reconsideration of the TSOT criterion is warranted. Based on the results of the two recent NHTSA research studies, NHTSA believes that a TSOT criterion value of 12 seconds is more appropriate based on the current state of knowledge in this area and anticipates that a 12-second TSOT criterion will be more likely to provide comparable results for task acceptability as compared to outcomes obtained using the Eye Glance Measurement Using Driving Simulator Testing protocol and its associated 12-second TEORT criterion.

Although the TSOT criterion has been amended, we are retaining the 1.5-second unoccluded viewing interval for occlusion testing. Given NHTSA's research showing a 1:1 relationship between TSOT and TEORT, a 1.5-second viewing interval corresponds to 1.5 seconds of driving simulator eyes-off-road time. The 1.5-second viewing interval duration is specified in ISO 16673:2007 and is generally consistent with data showing mean glance durations for radio tuning of between 0.9 and 1.4 seconds. Specifically, the Dingus[221] and Rockwell[222] studies cited in the Alliance Guidelines indicated mean glance durations of 1.10 seconds and 1.44 seconds, respectively. NHTSA's studies indicated radio tuning mean glance durations of 0.92 seconds[223] and 1.00 second.[224]

8. Suggestions To Include Effects of Workload Managers in Task Acceptance Criteria

a. Summary of Comments

Several commenters warned that the NHTSA Guidelines' requirements could discourage the pursuit of new technological solutions to mitigate driver distraction. Dr. Paul A. Green described the impending emergence of workload managers and how the proposed guidelines could stifle development:

> * * * the guidelines ignore the fact that what a driver can safely do at any given time depends on the workload of the primary task. On a straight section of an expressway, with no traffic nearby, in daylight, in clear weather, a driver could conceivably do a great deal more safely than the proposed guidelines allow. However, in adverse conditions much less could be advisable. Thus, if the primary task workload is known, information provided by a workload manager, then what the driver can do becomes a set of values for each situation, not a single set of values as they are now. Vehicles with workload managers are currently being sold in Europe, and there is interest in selling them in the U.S. Providing this flexibility, recognizing what drivers can safely do, will make the guidelines more sensible and acceptable to the driving public.[225]

Dr. Green continues, presenting his assessment of the implication of failing to build flexibility into the guidelines:

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[219] Perez, M., Hulse, M., and Angell, L., ''Support for NHTSA Visual-Manual Guidelines: Expert Review of the Visual Occlusion Method and How It Compares to Driver Eye Glance Behavior,'' p. 12, DOT HS number not yet available, April 2012, accessible at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0075.

[220] Boyle, L., Lee, J., Peng, Y., Ghazizadeh, M., Miller, E., Wu, Y., Huimin, X, and Chrysler, S., Text Reading and Text Input Assessment in Support of the NHTSA Distraction Guidelines: Final Report. DOT HS (number not yet available), October 2012, accessible at *www.regulations.gov*, Docket NHTSA–2010–0053.

[221] Dingus, T.A., Attentional Demand Evaluation for an Automobile Moving-Map Navigation System, unpublished doctoral dissertation, Virginia Polytechnic Institute and State University, Blacksburg, VA, 1987.

[222] Rockwell, T.H., ''Spare Visual Capacity in Driving Revisited: New Empirical Results for an Old Idea,'' in A. G. Gale et al (editors), Vision in Vehicles II (pp. 317–324, Amsterdam: Elsevier, 1988.

[223] Ranney, T.A., Baldwin, G.H.S., Mazzae, E.N., Martin, J., and Smith, L.A., ''Driver Behavior During Visual-Manual Secondary Task Performance: Occlusion Method Versus Simulated Driving,'' NHTSA Technical Report (in press), accessible at *http://www.regulations.gov/#!documentDetail;D=NHTSA-2010-0053-0077*, April 2012.

[224] Perez, M., Owens, J., Viita, D, Angell, L, Ranney, T.A., Baldwin, G.H.S., Parmer, E., Martin, J., Garrott, W.R., and Mazzae, E.N., ''Summary of Radio Tuning Effects on Visual and Driving Performance Measures—Simulator and Test Track Studies,'' NHTSA Technical Report in press. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0076, April 2012.

[225] Comments received from Dr. Paul Green, p. 7. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0052.

Inflexible guidelines discourage further development [of] workload managers, a potentially lifesaving technology.[226]

While not addressing the issue of workload managers directly, the Global Automakers described the same concern more broadly:

* * * it is important to recognize the limitations of the proposed Guidelines as a means of addressing the distraction matter over the coming years, so that the Guidelines do not become an impediment to technological innovation.[227]

American Honda Motor Co. offered similar sentiments, referring to the table in the proposal listing tasks for which the proposed guidelines are intended to be applicable:

The restrictions on the items listed in Table 9 may also hamper research and development of other systems that can be beneficial to safety. For example, automakers are beginning to bring the first workload management systems to market, combining crash avoidance systems with driver monitoring systems in a manner that offers the ability to shed in-vehicle tasks while alerting the driver of the need to focus their attention on the road. Future iterations of workload management systems offer the promise of keeping the driver engaged in the act of driving (helping to prevent disengagement that can lead to drowsiness), while keeping the driver in the optimal engagement range on the Yerkes-Dodson curve by discouraging overstimulation to the point of distraction.[228]

As suggested by Honda in the previous comment, workload managers can potentially involve integration with other driver support systems. Several comments referred to these systems and made recommendations on how they should be accommodated in the proposed guidelines. Volvo Car Corporation offered the following comment:

Driver state assessment is critical in determining the attention level of the driver and thus, critical to determining the potential to perform further secondary non-driving-related tasks. The development of driver state assessment systems is happening rapidly and these systems in combination with driving control support systems will have an impact in assisting drivers in managing the real-time workload for each instant in time. The potential of these systems for assisting drivers should be reflected in the test procedures by allowing them to be active during the tests.[229]

Honda provided the following comment on driver assist and crash avoidance systems:

* * * automakers and suppliers are continuing to research and develop advanced methods of displays that minimize distraction while satisfying consumer demand for in-vehicle technologies and features. One example of this is the rapid application of various driver assist and crash avoidance technologies. These technologies may offset some risks of driver distraction by monitoring roadways for impending crashes and help focus the driver's attention to an impending risk.[230]

b. NHTSA's Response

Unfortunately, workload managers and/or other means for driver state assessment have not yet reached a state of maturity where NHTSA can determine how they should affect task acceptance criteria. NHTSA cannot address workload management systems until research has further progressed.

As explained elsewhere in this notice, NHTSA's Driver Distraction Guidelines will be revised as needed. The issuance with this notice of the Phase 1 NHTSA Guidelines, while significant, is only one step in the process of the development of NHTSA's Guidelines. The issuance of Phases 2 and 3 of the Guidelines covering portable and aftermarket devices, and auditory-vocal human-machine interfaces, respectively, will provide additional guidance. NHTSA also intends to provide Guideline Interpretation letters as needed.

Definition of Goal, Dependent Task, and Subtask

a. Summary of Comments

Several comments requested clarification of the definition of the goal of a task. Nissan North America offered the following comment:

It is unclear how to apply this definition of 'goal' for some types of tasks. It can be easy to define the goal for tasks which have a clear intention, such as destination entry. However, it is difficult to quantify the ''driver's intended state'' for tasks which may depend on the driver's ''mood'' or ''feelings,'' such as browsing radio stations or audio inputs for a song the driver likes.[231]

Nissan asserts that the need for clarification of the definition of a goal depends on the protocols selected for the final guidelines.

Nissan believes clarification may be necessary depending on the evaluation protocols provided for in the final guidelines. If the final guidelines were limited to a single secondary task evaluation method such as occlusion testing, the proposed definition of 'goal' would need to be adjusted to limit its scope to tasks which can be evaluated using the recommended tests and criteria. Alternatively, a general definition of 'goal' is acceptable if a variety of evaluation methods are provided.[232]

Global Automakers provided the following comment:

In some cases, it is difficult to determine the driver's ''goal.'' Tasks which depend on drivers' clear intention, such as destination entry, are easier to determine. On the other hand, for tasks which depend upon the driver's mood or feelings, such as browsing audio, it can be difficult to determine precisely the driver's goal.[233]

Several comments were posted on the definition of a dependent task. American Honda Motor Co., Inc. provided the following comment:

Honda recommends that the definition and examples of dependent tasks be enhanced to further clarify the distinction between a dependent task and an independent task.[234]

Honda cites passages from the proposed Guidelines, which lead them to the following conclusion:

The aforementioned text indicates that dependent tasks are contingent upon antecedent tasks and suggests a subtask could be dependent upon other tasks or subtasks. Therefore, examples in which dependent and independent tasks and subtasks are identified would be helpful.[235]

Honda provides the following example, for which they seek clarification:

As an example, we seek clarification on the task of listening to the radio that appears to be comprised of the following:

1. Turning the radio on (an independent subtask),
2. Selecting AM or FM (a dependent subtask), and
3. Selecting the frequency (a dependent subtask).

Further clarification and examples would help us establish our procedures, and help to assure that exercising the guidelines will yield consistent results. To enhance our understanding of the dependent and independent task definitions, additional

[226] Ibid.

[227] Comments received from Global Automakers. Attachment, p. 1. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0099.

[228] Comments received from American Honda Motor Co, Inc., p. 4. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 112.

[229] Comments received from Volvo Car Corporation, p. 5. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 108.

[230] Comments received from American Honda Motor Co, Inc., p. 3. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 112.

[231] Comments received from Nissan North America, Attachment, p. 1. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0096.

[232] Ibid, p. 2.

[233] Comments received from Global Automakers, Attachment, p. 4. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0099.

[234] Comments received from American Honda Motor Co., Inc., Attachment, p. 7. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0112.

[235] Ibid, p. 7.

examples of each type of task would be helpful, as would descriptions of how these definitions apply within specific sequences of events. Examples should include the amount of time that may pass before a subtask is considered an independent task and a discussion of whether the rate or frequency at which a driver performs a task should be taken into consideration.[236]

Nissan cited the definition of a subtask, which appeared in the proposed guidelines and provided the following comment:

This definition may be interpreted differently depending on the task being evaluated and may be difficult to apply consistently. The example NHTSA provided in the preamble of the notice which describes how this definition would apply to entering a street name and street number during destination entry helps clarify this definition, however we request that NHTSA provide additional examples.[237]

An almost identical comment was provided by Global Automakers.

b. NHTSA's Response

Due to the large number of possible electronic device-related secondary tasks, and the large number of possible inputs that can be made for many tasks, there are a number of difficult problems in defining such terms as task goals, subtasks, and dependent tasks. To try to make clearer the definitions of these terms, NHTSA has prepared and placed in the Driver Distraction Guidelines docket,[238] a report titled ''Explanatory Material About the Definition of a Task Used in NHTSA's Driver Distraction Guidelines, and Task Examples.''[239] Persons interested in this issue are encouraged to read this report which contains much information about task-related definitions beyond what could be included in the NHTSA Guidelines (including numerous detailed examples of tasks). Portions of this report have been relied upon in this notice to clarify the definitions of goal, dependent task, and subtask.

In these NHTSA Guidelines, *Goal* is defined as a device state sought by a driver. Goal achievement is defined as achieving a device state that meets the driver's intended state, independent of the particular device being executed or method of execution.

The above mentioned NHTSA report expands on this with the following:

In the definition of ''goal'' used in the Phase 1 NHTSA Distraction Guidelines, the state sought by a driver is defined in terms of a ''device state.'' This means the goal is defined in terms of a state that can be observed objectively on the HMI. The individual who has the goal is the ''participant in the test.'' All the participants in a test will be given the goal by a tester (and goals for testable tasks will typically be meaningful ones, which might be performed by real drivers on the devices). More will be said about this later; suffice it to say now that planning prior to testing will identify the ''goals'' and ''tasks'' given to participants during testing. An example of a goal that is a ''device state'' would be ''radio on'' (as in, ''Your goal is to turn the radio on. Please begin now.''). This is a state of a device that can be objectively verified, perhaps in several ways, depending on the design. For example, a radio in the ''on'' state will produce ''sound'' (if its volume is set to an audible level), it may generate visual messages on the associated display, and its associated control may have an indicator which will identify the state to which it is set.

Goals (unlike sub-goals) typically are hardware-*independent,* and may be achieved in virtually any vehicle. Their achievement can be verified regardless of the particular method used to achieve the goal. For example, ''turn the radio on'' is a goal that typically could be achieved in *any* vehicle equipped with a radio. Also, *regardless* of whether it is turned on with a push-button, a rotary knob control, or with a voice command, achievement of the goal state (of the radio being ''on'') can be verified objectively from the state of the device itself.[240]

In these NHTSA Guidelines, *Dependent Task* is defined as a task that cannot be initiated until another task (the antecedent task) is completed. The task's start state is thus dependent upon the end state of another, antecedent, task.

An antecedent task followed by a dependent task can be distinguished from a task that contains two subtasks by examining the end states of both the antecedent task and the dependent task. For the antecedent task-dependent task case, both tasks will end with the achievement of a driver goal (i.e., two driver goals will be achieved, one for the antecedent task and one for the dependent task). In contrast, for a task composed of two subtasks, only one driver goal will be achieved.

For example, after choosing a restaurant from a navigation system's point-of-interest list (antecedent task), a driver is offered an internet function option of making a reservation at the restaurant (dependent task). The dependent task of making a reservation can only be initiated following the task of selecting a restaurant from within the navigation system.

The above mentioned NHTSA report contains several examples of dependent tasks (see Examples 2A, 2B, and 2M, as well as 4A.1–A.5.)[241]

In these NHTSA Guidelines, *Subtask* is defined as a sub-sequence of control operations that is part of a larger testable task sequence—and which leads to a sub-goal that represents an intermediate state in the path to the larger goal toward which a driver is working.

Subtasks should not be treated as separate dependent tasks. For example, entering the street name as part of navigation destination entry is not a separate task from entering the street number; rather, these are subtasks of the same task.

The above mentioned NHTSA report expands on this with the following:

* * * subtasks are sub-sequences of activity that represent achievement of only an intermediate step along the path to goal achievement, namely the sequence of activity required to reach a sub-goal. Drivers typically will persist beyond a sub-goal and continue with task activity through to the next sub-goal (and beyond), until the task is completed. And, like sub-goals or tasks, subtasks may be hardware or HMI dependent. They may vary in their details and in their order within a task, depending on the device, its functionality, and/or its HMI. * * * When entering a destination in a navigation system, one system may require entry of the STATE first and another may require its entry last. This is an indication that the subtask sequence of entering the STATE portion of the destination is a subtask within the entire task of entering a destination. The nature and order of the subtasks (done to reach sub-goals) depends upon the particular navigation system being used.[242]

In answer to Honda's request for clarification, the task of tuning a radio in preparation for listening to it would be comprised of three subtasks. As Honda states, these would be:

1. Turning the radio on (subtask),
2. Selecting AM or FM (subtask), and
3. Selecting the frequency (subtask).

Subtasks after the initial one during a task frequently depend upon the prior subtasks that comprise a task. NHTSA has not designated these non-initial subtasks as dependent subtasks since we do not think that it helps people understand the task decomposition.

As stated earlier, due to the large number of possible electronic device-related secondary tasks, and the large

[236] Ibid, pp. 7–8.

[237] Comments received from Nissan North America, Attachment, p. 2. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0096.

[238] Docket NHTSA–2010–0053. The docket is accessible at: *http://www.regulations.gov/.*

[239] Angell, L., Perez, M., and Garrott, W.R., ''Explanatory Material About the Definition of a Task Used in NHTSA's Driver Distraction Guidelines, and Task Examples,'' accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0088, posted May 18, 2012. Soon to be released as a NHTSA technical report.

[240] Ibid, p. 20.

[241] Ibid, pp. 78–82, 112–113, and 153–164.

[242] Ibid, p. 29.

number of possible inputs that can be made for many tasks, it is difficult to give clear, all-encompassing definitions of such terms as task goals, subtasks, and dependent tasks. NHTSA has tried to make our task-related definitions as clear as we can, but there may well be some situations for which application of these definitions is difficult. Organizations should feel free to bring these specific cases to NHTSA's attention via the previously-mentioned interpretation letter process and NHTSA will try to consistently apply its definitions to these difficult cases.

H. Driving Simulator Issues

1. Driving Simulator Specifications

a. Summary of Comments

Several organizations provided comments requesting clarification about and/or making suggestions for specifications of simulators that can be used for testing under the proposed guidelines. Commenters included auto manufacturers (Volvo and BMW), research organizations (VTI [Swedish Road and Transport Research Institute] and the University of Iowa [National Advanced Driving Simulator and Simulation Center or NADS]), and a simulator development company (Realtime Technologies Inc.).

The NADS provided the following general comments:

There are many different kinds of driving simulators used by the human factors research community today and we feel some additional clarification in the guidelines as to what NHTSA intends to include and exclude in its testing protocols is needed.[243]

Volvo provided the following general comment:

Simulator dimensions are dependent on the simulator software, the kind of simulator (fixed or moving base) and the kind of projection screen used (flat or 180 [degrees, presumably in a wrap-around configuration]). Volvo Cars has modern car simulator test facilities that are suitable for the recommended test procedures; however, it does not meet some specific recommendations when it comes to locations and placements. Thus, we believe that the simulator specifications should be more flexible.[244]

BMW offered the following general comment:

BMW has a state of the art driving simulator that is used for purposes of testing any effect of current and new features on the performance of the driver. BMW therefore considers the proposed driving simulator specifications in the Federal Guidelines as suggested minimum criteria.[245]

In addition to these general comments, specific comments were submitted pertaining to details of the simulator specifications contained in the proposed guidelines. Comments regarding the projection system were prevalent, including the following comments from VTI:

Screen locations ranging from 2.5 m and more from the driver eye point are quite sufficient.[246]

The resolution of the computer generated image seems to be quite under specified and should also benefit to be calculate using the driver's eye point as references.[247]

The resolution should be given in dpi, to make the value independent of the screen size.[248]

On this same topic, the following comments were provided by the NADS group:

As currently specified [the guidelines] would exclude those systems which use computer display monitors rather than projectors. * * * there is no research evidence of which we are aware to support the use of projected imaged over monitor displays. Indeed, in order for these guidelines to be useful in the future, it may be best to avoid any reference to a single display method as the technology in this industry is rapidly changing. In addition to a resolution specification, the guidelines should also include some specification for field-of-view of the display. * * * it is unclear if the intent was to recommend only front-projection single-screen systems to the exclusion of other display technologies.[249]

Realtime Technologies cited research results supporting the following specific suggestions on this topic:

* * * the minimum screen distance should be 3000 mm rather than 4700 mm.[250]

Drivers do not get additional accommodation depth cues for distances beyond 2000 mm while convergence depth cues can be used to 10000 mm (Andersen, 2011). The literature states that for comfortable viewing (both accommodation and convergence) the distance should be at least 3000 mm (Lambooij, IJsselsteijn, Heynderickx, 2007). Comfortable accommodation distances start at 2000 mm (Andersen, 2011).[251]

The resolution for the simulator should be specified in arc minutes per pixel rather than a particular screen size and resolution. This allows for a variety of screen configurations. The FAA requires their aviation training simulators to have an effective resolution of 3 arc-min/pixel or less (Stoner, Fisher, Mollenhauer, 2011). The simulator described in the guidelines meets this requirement with a value of 1.7 arc-min/pixel. While visual acuity can be as high as 0.5 arc-min/pixel, looming cues are the most important aspect for car following and therefore driver distraction (Andersen, 2011). Plotkin's research (1984) suggests, at a visual update rate of 30 times per second (as specified in the guidelines), the effective resolution where a human can detect any looming cue will be 3.11 arc-min/pixel. Therefore we recommend that the minimum resolution for these tasks be set at 3 arc-min/pixel.[252]

Questions about other simulator specifications were raised by NADS:

It is not clear if NHTSA intends to exclude driving simulators which use open cabs, partial cabs, and/or non-automotive seating and dashboard arrangements.[253]

Section V12.b included some description of the vehicle controls. This statement could be interpreted to exclude many simulators in use by University and Industry researchers which utilize gaming controls for steering and pedal driver inputs.[254]

Further information on whether or not force feedback must be present on the steering wheel and pedals is also needed.[255]

It is not clear if NHTSA's intent was to exclude simulators with motion.[256] VTI raised a concern about the driving simulator's vehicle dynamics simulation:

The guidelines lack a description of the vehicle's behavior on the road, i.e. the vehicle dynamics.[257]

b. NHTSA's Response

NHTSA appreciates the helpful comments that we have received on this issue. In response, we have modified our recommended driving simulator specifications so that task acceptance testing may be performed on a broader variety of driving simulators.

[243] Comments received from the University of Iowa, National Advanced Driving Simulator and Simulation Center, p. 1. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0071.

[244] Comments received from Volvo Cars, p. 4. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0104.

[245] Comments received from BMW Group, p. 6. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0094.

[246] Comments received from Swedish National Road Transport Institute (VTI), p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0056.

[247] Ibid.

[248] Ibid.

[249] Comments received from the University of Iowa, National Advanced Driving Simulator and Simulation Center, p. 1. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0071.

[250] Comments received from Realtime Technologies, Inc., p. 1. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0053.

[251] Ibid.

[252] Ibid.

[253] Comments received from the University of Iowa, National Advanced Driving Simulator and Simulation Center, p. 1. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0071.

[254] Ibid.

[255] Ibid.

[256] Ibid.

[257] Comments received from the Swedish National Road Transport Institute (VTI), p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0056.

Before explaining the individual changes that we have made in response to comments to the recommended NHTSA driving simulator specifications, it may help to first explain NHTSA's goals for driving simulators.

NHTSA believes task acceptance testing should be performable with very simple, inexpensive, driving simulators. We recognize that not every organization can afford to use the extremely high fidelity National Advanced Driving Simulator or even higher fidelity, moving base, driving simulators. We have deliberately tried to design our task acceptance test so it can be run on a low-end driving simulator. This does not preclude the use of a high-end simulator for task acceptance testing, but merely acknowledges that a low-end simulator is adequate.

While we want testing to be performable with low-end driving simulators, NHTSA thinks that the driving simulators used for task acceptance testing should generate a pattern of eye glances similar to that seen when performing the same secondary task while driving an actual motor vehicle. One of the key consequences of this belief is that the roadway display should be far enough in front of the simulator's driver that visual accommodation must occur when the driver switches her gaze between the device interface and the roadway. In other words, the driver's eyes should be focused approximately at infinity when looking at the roadway and at the correct, much closer, distance when looking at the device display.

Focusing on specific comments, first of all, as BMW suggests, the driving simulator specifications in the NHTSA Guidelines are suggested minimum criteria. We certainly have no problems with better driving simulators than specified in the NHTSA Guidelines but we do not want ones with less fidelity. Similarly, NHTSA's Guideline recommendations are not intended to exclude simulators with motion. Statements have been added to the NHTSA Guidelines clarifying both of these points.

In response to VTI's comment, the NHTSA Guidelines do not contain a description of the vehicle dynamics because we believe the driving scenario being simulated is extremely simple—straight line, constant speed driving. Clearly the simulated vehicle needs to react appropriately if the driver turns the steering wheel, presses the brake pedal, or presses the throttle pedal. However, we do not think that an elaborate vehicle dynamics model is necessary; something along the lines of a linear three degree of freedom (lateral velocity, longitudinal velocity, and yaw rate) vehicle model should be quite sufficient. Again, if desired, more complex and accurate vehicle dynamics may be used, but they are not necessary. Statements have been added to the NHTSA Guidelines clarifying this point.

In response to the NADS comments, NHTSA does not intend to exclude driving simulators using open or partial cabs. While NHTSA intends to perform its driving simulator based monitoring testing using actual production vehicles and actual copies of the electronic devices being tested, we do not think that every organization wanting to perform Guideline conformance testing has to use such a driving simulator. The important thing is that the driving simulator has a seating and dashboard arrangement similar to an actual production vehicle so that realistic eye glance behavior will occur. We do not think that non-automotive seating and dashboard arrangements are adequate for task acceptance testing.

NHTSA does not think that gaming controls for driver steering will provide an adequate level of realism. We believe an actual vehicle steering wheel mounted in a typical vehicle arrangement is necessary. Otherwise driver hand motions may not be realistic. For similar reasons, we think that force feedback should be present on the driving simulator's steering wheel. However, a linear feel (i.e., the restoring force is directly proportional to the amount of steering) should be adequate.

Gaming style pedal controls are adequate since current task acceptance tests do not use any metrics that will be affected by the movement of the driver's feet. However, we do think that pedal force feedback should be provided to assist the driver in maintaining a constant speed. Again, very simple but realistic pedal force feedback should be adequate.

Statements clarifying all of these points have been added to the NHTSA Guidelines.

NHTSA did not intend to exclude driving simulators using computer display monitors rather than projectors. Similarly, multiple screen visual displays and rear-project display technologies are perfectly acceptable.

As suggested by the commenters, we have modified the NHTSA Guidelines to permit any display technology to be used. NHTSA's goal is to have the driving simulator display full-color, true-perspective, three-dimensional scenes (as viewed by the driver) free from distracting anomalies, such as abrupt changes in scene content, aliasing problems in image processing, and abrupt changes in illumination, color, or intensity (i.e., no flickering or flashing). NHTSA's Guideline recommendations do not show preference toward one display technology over others.

NHTSA has decided to accept the suggestion offered by NADS and Realtime Technologies that the NHTSA Guidelines should specify the field-of-view of the display. We have set the minimum recommended field-of-view to have a width of 30 degrees. Of course, wider fields-of-view may be used.

NHTSA has also decided to accept the suggestion offered by NADS and Realtime Technologies that the NHTSA Guidelines should specify the resolution for the simulator in arc minutes per pixel rather than a particular screen size and resolution. The supporting research offered by Realtime Technologies [258, 259, 260] is quite convincing. Therefore, the recommended screen resolution is being set to 3 arc minutes per pixel or better.

NHTSA received recommendations from NADS to reduce driver eye point to screen distance minimum distance from the 4.7 meters originally proposed in the NHTSA Guidelines to either 2.5 meters (NADS) or 3.0 meters (Realtime Technologies). The original 4.7 meter distance was based on nothing more than the driver eye point to screen distance of the NHTSA driving simulator located at NHTSA's Vehicle Research and Test Center and the perception that this distance provides adequate visual accommodation.

To attempt to determine the minimum driver eye point to screen distance in a more scientific manner, depth of field calculations were used.

As previously stated, the roadway display should be far enough in front of the simulator's driver that visual accommodation must occur when the driver switches his gaze between the device interface and the roadway. NHTSA wants the driver's eyes to be focused approximately at infinity when looking at the roadway and at the correct, much closer, distance when looking at the device display. In terms

[258] Stoner, H. A., Fisher, D. L., Mollenhauer, M. A., ''Simulator and Scenario Factors Influencing Simulator Sickness,'' in Fisher, D. L., Rizzo, M., Caird, J. K., and Lee, J. D. (Editors). Handbook of Driving Simulation for Engineering, Medicine, and Psychology, Boca Raton, FL, CRC Press, 2011.

[259] Andersen, G. J., ''Sensor and Perceptual Factors in the Design of Driving Simulation Displays,'' in Fisher, D. L., Rizzo, M., Caird, J. K., and Lee, J. D. (Editors)., Handbook of Driving Simulation for Engineering, Medicine, and Psychology, Boca Raton, FL, CRC Press, 2011.

[260] Plotkin, S., ''Multiple Causation,'' Automotive Engineering and Litigation, 1, pp. 215–228, New York, Garland Law Publishing, 1984.

of depth of field, NHTSA translated this into having the ''far'' edge of the depth of field at infinity.

In order to perform a depth of field calculation, we needed values for the image focal length of the human eye, the lowest f-stop to be used in the calculation, and the permissible circle of confusion. According to ''The Physics Factbook'' [261] article on ''Focal Length of a Human Eye'' a good value for the image focal length of the eye is 22.3 mm. The lowest achievable f-stop is equal to the image focal length divided by the maximum eye pupil size. Human eye pupil size data was obtained from a paper by Winn, Whitaker, Elliot, and Phillips.[262] According to this, the maximum eye pupil size is approximately 9 mm giving a minimum f-stop of 2.4 (rounded down to the nearest ''standard'' f-stop of f-2 for subsequent calculations).

An acceptable value for circle of confusion was obtained from the internet posting ''DOF—Demystifying the Confusion.'' [263] According to this posting, the normal human eye can determine 5 line pairs per millimeter at a distance of 25 cm. Therefore, an acceptable circle of confusion value is 0.2 mm.

Inputting all of this data into a depth of field calculator [264] a hyperfocal distance (the distance beyond which all objects can be brought into an acceptable focus) of 1.27 meters was calculated. The minimum driver eye point to screen distance determined in this manner would be 1.27 meters.

NHTSA has decided to round this 1.27 meter value up to 2.0 meters. This takes NHTSA to the same value that, in their comments, Realtime Technologies pointed out had been arrived at by other researchers.[265] Based on the preceding analysis, we believe that having a minimum driver eye point to screen distance will provide adequate visual accommodation. This change has been incorporated into the NHTSA Guidelines.

2. Suggestions To Improve the Driving Scenario

a. Summary of Comments

Several comments were directed at the simulator scenario proposed for use in the testing. Specifically, the Swedish Road and Transport Research Institute (VTI) asked:

> In general, is the specified scenario difficult enough? [266]
>
> Are the results generalizable to more complex traffic environments? If not, the test will only show that it is 'safe' to perform the secondary task on straight road segments with one lead vehicle. What happens when the device is used in urban traffic? [267]

In contrast, several organizations advocated the use of the Alliance driving task. As the basis for this recommendation, Mercedes-Benz provided the following comment:

> The Alliance driving task was designed to mimic the relatively benign conditions associated with distraction related crashes based on real world data. NHTSA proposes altering this procedure * * * It is unclear how the proposed changes to the driving procedure relate to real world crash risk.[268]

Several commenters suggested that data collection should include curved in addition to straight road segments to ensure that steering corrections are required.

Numerous comments pertaining to scenario details were provided. VTI pointed out that the guidelines lack specification of basic geometries, including lane width, road markings, and road surface properties (color, brightness, grain). They also noted that:

> * * * objects beside the road will influence the driver's performance in navigating as these also provide sensation about speed and heading as examples.[269]

Several comments asked for more detailed information about the proposed car-following task, including more detail about the speed of the lead vehicle and its appearance, including size, shape, color, and the way in which it appears in the driving scene.

Additional detail was also requested about the proposed visual detection task. The following comment was submitted by the University of Iowa:

> Section VI.2.f.i specifies a ''filled-in, red circle'' but does not specify the surrounding or background visual features. A red circle will be nearly invisible against a dark sky. The guidelines would be improved if this specification was expressed as a minimum and maximum contrast ratio as used by the Federal Highway Administration's Minimum Retroreflectivity Levels for traffic signs (FHWA Docket No. FHWA–2003–15149).[270]

b. NHTSA's Response

NHTSA has deliberately recommended a very simple driving scenario for the Eye Glance Measurement Using a Driving Simulator acceptance test protocol—straight line, constant speed driving. This does mimic the Alliance Guidelines driving simulator scenario; the Mercedes-Benz comment was made about NHTSA's proposed Dynamic Following and Detection acceptance test options which, as previously discussed, are not being carried forward at this time.

The very simple driving simulator scenario proposed by NHTSA in the Initial Notice was chosen for two reasons:

- Its simplicity should accommodate organizations that only have low fidelity, low cost, driving simulators. Not everyone can afford to use the extremely high fidelity National Advanced Driving Simulator or even higher fidelity, moving base, driving simulators. However, since the acceptance test protocol uses a straight line, constant speed, drive and all of the criteria used to determine task acceptance are based on driver eye glances, we do not believe it is necessary to have a high fidelity driving simulator to perform this testing. A low-fidelity driving simulator is sufficient.
- Since NHTSA has based its acceptance test criteria on test participant performance while performing the reference task (manual radio tuning) while driving this simple scenario, the effects of scenario difficulty level are expected not to matter. If NHTSA were to recommend a more complex scenario, with curving roads and more traffic, it might degrade test participant performance while performing a candidate task. However, it would also degrade test participant performance while performing manual radio tuning, probably by about the same amount. Therefore, tasks that meet the current acceptance test criteria would probably also meet the

[261] ''The Physics Factbook,'' edited by Glen Elert—written by his students, accessed at: *http://hypertextbook.com/facts/2002/JuliaKhutoretskaya.shtml* on July 20, 2012.

[262] Winn, B., Whitaker, D., Elliot, D.B., and Phillips, N.J., ''Factors Affecting Light-Adapted Pupil Size in Normal Human Subjects,'' Journal of Investigative Ophthalmology and Visual Science, March 1994, Vol. 35, No. 3, accessed at: *http://www.iovs.org/content/35/3/1132.full.pdf* on July 20, 2012.

[263] Accessed at: *http://www.rags-int-inc.com/PhotoTechStuff/DoF/* on July 20, 2012.

[264] The one used was called DOFMaster and accessed at: *http://www.dofmaster.com/doftable.html* on July 20, 2012.

[265] Andersen, G. J., ''Sensor and Perceptual Factors in the Design of Driving Simulation Displays,'' in Fisher, D. L., Rizzo, M., Caird, J. K., and Lee, J. D. (Editors)., Handbook of Driving Simulation for Engineering, Medicine, and Psychology, Boca Raton, FL, CRC Press, 2011.

[266] Comments received from the Swedish National Road Transport Institute (VTI), p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0056.

[267] Ibid.

[268] Comments received from Mercedes-Benz USA, LLC, p. 9. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0093.

[269] Comments received from the Swedish National Road Transport Institute (VTI), p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0056.

[270] Comments received from the University of Iowa, p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0071.

requirements of an acceptance test protocol that used a more complex driving scenario. While NHTSA recognizes that its acceptance test scenario is not typical of urban traffic environments, based on the above logic, we believe the results to be generalizable to more complex traffic environments.

NHTSA also does not think that segments of the simulated road driven during data collection should include curved road segments.[271] While the inclusion of curved road segments would ensure that driver steering corrections are required during testing, once again any effects are expected to be present during both candidate task acceptance testing and the testing used to determine the acceptance criteria. Therefore, the effects are expected to cancel each other out. Using straight roads during testing has one advantage: it reduces the complexity of the needed driving simulator.

In response to the comments that were received, NHTSA has added recommendations for road environment, road material and color, lane and shoulder widths, and road markings to the Recommended Driving Simulator Scenario subsection of the NHTSA Guidelines. The road markings portion of these recommendations was taken from Section 3A.05, *Widths and Patterns of Longitudinal Pavement Markings* contained in the ''California Manual on Uniform Traffic Control Devices for Streets and Highways: Part 3—Markings.'' [272] We have also added additional recommendations about the lead vehicle appearance and that it suddenly appears in the driving scene.

Finally, the request for additional details about the proposed visual detection task is only relevant to NHTSA's proposed Dynamic Following and Detection acceptance test options which, as previously discussed, are not being carried forward at this time.

I. Test Participant Issues

1. Test Participant Demographics

a. Summary of Comments

Comments on this topic referred to the age groupings proposed by NHTSA. The following comment from Global Automakers suggested that the sample composition should better reflect the overall distribution of drivers.

> Global Automakers does not believe that specific driver populations should be over-weighted or underweighted during subject selection, compared to the distribution of the driving population. For example, while specific age groups may presently use technology at different frequencies, those use patterns may change over time. Therefore, we do not support increased representation of younger drivers (18 through 24 age range) based on anecdotal indications that this group currently uses electronic technology more frequently.[273]

Mercedes-Benz expressed concern with the practical difficulties of adhering to the proposed age/gender requirements:

> The proposed requirement for 24 participants, even mix of genders and divided in 4 groups with each 6 human subjects in the age range of 18–24, 25–39, 40–54 and 55–75 is extremely aggressive and will make filling the subject pool difficult.[274]

Mercedes-Benz also suggested that the sample be composed of individuals that reflect the population of drivers most likely to use a technology being tested:

> * * * it can be concluded that the applications or functions to be tested should be evaluated by those age groups which are most likely to buy the new features.[275]

Hyundai provided the following comment:

> Hyundai requests NHTSA provide justification for the sample size and demographic requirements. Hyundai proposes the agency change the distribution of the participants based on current research.[276]

They cited two experimental studies to support the following recommendation:

> Hyundai recommends the agency combine the 18–24, and 25–39 age group and distribute the participant age groups into three groups of 8 participants: Young (18–40), Middle (41–64), and Mature (65 and older). The proposed age groups will focus on the performance effect among the age groups where differences have been seen in previous research.[277]

According to Dr. Paul Green, ''The guidelines do not pay adequate attention to elderly drivers.'' [278] Although Dr. Green agreed with NHTSA's assertion that older drivers are less frequent users of electronic technology than younger drivers, he adds:

> * * * they take far longer to complete tasks and have much greater difficulty with them, in particular the distracting visual-manual tasks that are the topic of this docket. Furthermore, over time, use by older individuals of all sorts of electronic devices is increasing. Therefore, it is recommended that an additional group be added to the sample, drivers ages 65 to 75 and equal in size to the other groups.[279]

The following comment was received from GM:

> GM concentrates on a worst-case age group: 45 to 65 years old. Subjects in this age bracket generally have greater mean glance times and longer total eyes-off-road times than younger subjects. Consequently, findings base on this age group are generally more conservative.[280]

b. NHTSA's Response

As the above comments indicate, probably the most controversial question about test participant demographics is whether to underweight older drivers in the NHTSA Guidelines sampling plan.

As set forth in the Initial Notice, the NHTSA Guidelines recommended that out of each group of 24 test participants used for testing, there should be:

- Six test participants 18 through 24 years old, inclusive, and
- Six test participants 25 through 39 years old, inclusive, and
- Six test participants 40 through 54 years old, inclusive, and
- Six test participants 55 or more years old.

As stated in the Initial Notice, based on 2009 statistics,[281] the percentage of licensed drivers aged 18 years or older contained in each of these four groups are:

- 11.4 percent are 18 through 24 years old, inclusive, and
- 26.8 percent are 25 through 39 years old, inclusive, and
- 29.7 percent are 40 through 54 years old, inclusive, and
- 32.1 percent are 55 or more years old.

To have an unweighted sample we would have to have 25 percent of

[271] NHTSA believes that it is a good idea to include curving road segments during non-test portions of the drive that occur between the straight segments of simulated road that are used during testing.

[272] ''California Manual on Uniform Traffic Control Devices for Streets and Highways: Part 3 (FHWA's MUTCD 2003 Edition, as amended for use in California)—Markings,'' pp. 3A–2—3A–3, State of California, Business, Transportation and Housing Agency, Department of Transportation, accessed at *http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/pdf/camutcd/CAMUTCD-Part3.pdf* on July 10, 2012.

[273] Comments received from Global Automakers, p. 6. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0099.

[274] Comments received from Mercedes-Benz, p. 10. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0093.

[275] Ibid, p. 10.

[276] Comments received from Hyundai Motor Group, p. 2. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0102.

[277] Ibid, p. 3.

[278] Comments received from Dr. Paul Green, p. 7. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0052.

[279] Ibid, p. 7.

[280] Comments received from General Motors LLC, Attachment, p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0103.

[281] *http://www.fhwa.dot.gov/policyinformation/statistics/2009/dl20.cfm.*

licensed drivers aged 18 years or older contained in each of these four groups. Therefore, NHTSA's sampling method: over represents drivers 18 through 24 years old, inclusive; approximately correctly represents drivers 25 through 39 years old, inclusive; approximately correctly represents drivers 40 through 54 years old, inclusive; and under represents drivers 55 or more years old.

There are two reasons for this. First, drivers in the 18 through 24 age range have a higher rate of fatalities (per 100,000 drivers in that age range [282] or per 100 million vehicle miles traveled [283]) than drivers that are 25 years of age or older. Second, at least anecdotally, younger drivers are more frequent users of electronic technology than are older drivers. Therefore, NHTSA believes that this age range should be overrepresented in each test participant sample.

The 55 years and older age range is underrepresented in test samples relative to their numbers in the general driving population. While NHTSA considers it important that advanced electronic device tasks be tested using drivers in this age range, as mentioned above, older drivers are less frequent users of electronic technology than younger drivers. Therefore, NHTSA is proposing to underweight this age range with six test participants rather than the eight called for by their numbers in the general driving population.

Clearly there were diverse opinions as to the best sampling method to use. Global Automakers suggested using an unweighted sample. Mercedes-Benz essentially agreed with NHTSA that the sample be composed of individuals that reflect the population of drivers most likely to use a technology being tested, resulting in an over representation of younger test participants. General Motors, Dr. Green, and Hyundai all advocated changing to a sampling plan that would over represent, instead of under represent, older drivers.

NHTSA has worked out what the age ranges would be for a test participant sampling method that equally represented all age groups. Such a sampling method would have:

- Six test participants 18 through 32 years old, inclusive, and
- Six test participants 33 through 44 years old, inclusive, and
- Six test participants 45 through 57 years old, inclusive, and
- Six test participants 58 or more years old.

Clearly there are many other possible test participant sampling methods that are possible by subdividing the licensed driver population in different ways and overweighting or underweighting selected groups.

After careful consideration of the comments received, NHTSA continues to think that the best test participant sampling method for driver distraction testing (although not necessarily for other topics) over represents younger (ages 18 through 24, inclusive) drivers. We continue to believe that the higher crash rates seen for this age group of drivers and their more frequent use of advanced electronic technology justify this over representation. Therefore, we are keeping our proposed test participant age groupings in the NHTSA Guidelines.

In response to Mercedes-Benz's concerns that there will be practical difficulties in adhering to the proposed age/gender requirements, NHTSA's experience shows that the most difficult age range in which to recruit test participants for driver distraction studies is the older age range. However, NHTSA is already underweighting this age range. A number of commenters suggested that we increase the number of older test participants. While NHTSA has rejected doing this, we do not think it appropriate to reduce the number of older test participants to make recruiting easier.

2. Test Participant Impartiality

a. Summary of Comments

Automakers generally advocated the use of company employees for testing. The following comment was provided by Volvo:

> Recruiting completely naïve and unbiased test participants, even from the general public can be difficult to arrange in an area near an automotive industry. Considering the vast number of tests that will need to be done, it is not feasible to arrange tests with people from other parts of the country/world.[284]

Global Automakers agreed with Volvo:

> There are categories of employees who are not involved in technology development, such as those working in accounting and other administrative areas. Such employees should be allowed to participate in a pilot study when critical design features cannot be shared outside the company. This approach would avoid the release of proprietary information and allow for development of critical systems without the concern that new technologies and features might be exposed before product launch. The Guidelines should allow the participants in such tests to be manufacturer employees who are not involved in technology matters.[285]

Similar concerns were expressed by Hyundai, Mercedes-Benz, and Nissan. However, VTI, based on their research experiences, suggested the opposite: ''* * * do not use OEM employees.'' [286]

b. NHTSA's Response

To preserve the appearance of test participant impartiality, NHTSA has decided that it will not use automaker employees during its research and/or monitoring testing to determine conformance with the NHTSA Guidelines. While automobile manufacturers do have multiple categories of employees, many of whom are not involved in vehicle systems or component development, NHTSA believes that automaker employees will tend to be generally more knowledgeable about vehicles and their current features than the average member of the public. With this additional knowledge of vehicles and their latest features, the employees may perform better in testing due to this exposure to the automotive industry.

That said, NHTSA is not opposed to manufacturers using their own employees during their own testing. The reasons given above by Global Automakers and Volvo are certainly valid as are those given by other commenters. We believe that manufacturers can obtain valid, impartial results from testing their own employees as long as the employees are unfamiliar with the product being tested. However, NHTSA's testing will not involve automobile manufacturer employees as participants.

3. Other Test Participant Qualifications

a. Summary of Comments

GM felt that the guidelines were generally too restrictive in the specification of test participant qualifications. They submitted the following comment:

> [The] inclusion of sampling particulars and other language in the proposal suggests expectation or presumption that OEMs would test systems using the specified

[282] National Highway Traffic Safety Administration, ''Traffic Safety Facts 2008,'' NHTSA Technical Report DOT HS 811 170, 2010.

[283] United States Government Accountability Office, ''Older Driver Safety, Knowledge Sharing Should Help States Prepare for Increase in Older Driver Population,'' Report to the Special Committee on Aging of the United States Senate, GAO–07–413, April 2007.

[284] Comments received from Volvo Car Corporation, p. 5. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0108.

[285] Comments received from Global Automakers, p. 6. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0099.

[286] Comments received from the Swedish Road and Transport Research Institute (VTI), p. 3. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0056.

sample. GM believes this to be overly prescriptive.[287]

GM proposed that NHTSA be more flexible about the number of test participants required:

GM's practice for evaluating tasks related to in-vehicle electronics requires that at least 85% of the test sample complete the task with a mean glance time less than two seconds and a total eyes-off road time under 20 seconds. * * * In cases when the test sample is fewer than 24, a sufficient percentage of the test sample must pass validation criteria so that Type I errors are no more common than if a 24 person sample was used. * * * GM believes this method allows flexibility and expediency, while maintaining the 85% threshold limit established in the Alliance Guidelines. Therefore, GM recommends the proposed guideline adopt the 85% threshold limit in the Alliance Guidelines, and not adopt specific sample requirements.[288]

A comment from Mercedes-Benz addressed the mileage requirement for test participants:

The required mileage of 7,000 miles per year is too high. This requirement limits the potential group of people which are qualified as test participants without adding a necessary benefit. We believe a minimum mileage requirement of 3,000 miles per year is sufficient.[289]

Mercedes-Benz also questioned the need for prospective participants to be comfortable communicating via text messages:

Regarding subject's comfort level with technology, we find that average subjects are appropriate for evaluating systems such as navigation or phoning based on social media. The requirement for the test participants to be comfortable communicating via text messages is too specific. It's based on the specific tests that NHTSA has performed focusing on text entry with nomadic devices. If NHTSA's intention is to have tech-savvy test participants, then only considering text messaging experience as a criterion is too narrow.[290]

Researchers from VTI suggested that the guidelines testing should:

Use participants from different social groups and with different education. We [VTI] once ran a study with a group of engineers vs. a random selection of citizens, and secondary task performance was strikingly higher for the engineers.[291]

b. NHTSA's Response

In response to GM's concerns that the guidelines were generally too restrictive in the specification of test participant qualifications, as discussed earlier in this notice, NHTSA plans to perform future monitoring to see what design revisions occur and find out how vehicle makes/models conform to these Phase 1 Driver Distraction Guidelines. Such monitoring testing by NHTSA or its contractors will adhere to the test procedures set forth in the NHTSA Guidelines. However, this only sets forth how NHTSA will test for conformance to these Guidelines; manufacturers are free to use any test procedures that they prefer.

Regarding GM's concerns that the NHTSA Guidelines recommended testing too many test participants, manufacturers are free to assess conformance to NHTSA's voluntary Guidelines through any means they determine is appropriate. If there is a certain test protocol that a manufacturer believes is more effective in assessing conformance with these Guidelines using fewer participants, they are certainly free to use that protocol.

NHTSA has decided to adopt Mercedes-Benz's suggestion about the mileage requirement for test participants. Reducing the required mileage of 7,000 miles per year to 3,000 miles per year will make it easier to recruit test participants while still testing people who drive regularly. Appropriate changes have been made to the NHTSA Guidelines.

After careful consideration, NHTSA has also decided to remove the recommendation that test participants be comfortable communicating via text messages from its Guidelines. This recommendation was originally included in the Guidelines based on NHTSA's testing experience. We occasionally had test participants who were very uncomfortable using any advanced electronic technology. This recommendation was intended to screen out such test participants. However, upon reconsideration, NHTSA thinks that such drivers who are part of the driving population and should not be screened out. The Guidelines recommendation that test participants have experience using a cell phone while driving is sufficient to screen out technology novices or non-users.

Regarding VTI's recommendation to include test participants from different social groups and with different educational backgrounds, for the reasons explained below, NHTSA does not believe there is sufficient empirical data to support the need to add socioeconomic class and education criteria to the test participant selection criteria in the NHTSA Guidelines. Furthermore, adding such criteria would likely increase the difficulty of test participant recruitment and may require increasing the minimum number of required test participants.

There is no NHTSA-generated data showing different eye glance behavior while performing secondary tasks across different social groups or different education levels. While VTI's concerns are plausible, and the organization indicated that it has supporting experimental data (although none were submitted along with their comments), NHTSA does not believe there is a sufficient basis to warrant balancing of these factors in task acceptance testing performed in association with the NHTSA Guidelines. A test participant's eye glance behavior while performing secondary tasks depends, at least in part, on the psychological and physical capabilities of the test participant. While these are known to change with test participant age (part of the reason why the NHTSA Guidelines recommend testing a broad age range of test participants), little is known about whether these psychological and physical capabilities vary with socioeconomic class or education level. In addition, it is unclear whether the differing secondary task performance between engineers and randomly selected citizens mentioned by VTI was due to factors like socioeconomic status or education level or whether it was due to the engineers' additional experience and expertise with vehicle technologies.

For all of NHTSA's human factors testing, the agency attempts to recruit test participants from a broad range of socioeconomic classes by recruiting test participants through multiple outlets, such as printed newspapers and internet postings. Therefore, any research and/or monitoring testing to determine conformance with the NHTSA Guidelines can be expected to use test participants from different social groups and with different education levels. The agency's goal in the NHTSA Guidelines is to specify suitable, robust test protocols that are not unnecessarily complicated or costly. This includes the participant recruitment aspects of the test protocols. Because there is insufficient data to support adding socioeconomic and education criteria to the NHTSA Guidelines, the agency is refraining from doing so at this time. However, nothing in the NHTSA Guidelines prevents a manufacturer from including additional test participant selection criteria as part of its own test protocols.

[287] Comments received from General Motors LLC, Attachment, p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0103.

[288] Ibid.

[289] Comments received from Mercedes-Benz, p. 9. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0093.

[290] Ibid.

[291] Comments received from the Swedish Road and Transport Research Institute (VTI), p. 3. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0056.

4. Test Participant Instructions, Training, and Practice

a. Summary of Comments

VTI questioned the potential effect of the test instruction that the driver' primary responsibility is to drive safely at all times:

With such an instruction, drivers could refrain from executing the secondary task at all, which would render the evaluation impossible. Instead, we suggest that the instructions be that participants should prioritize the secondary task. The performance can then be put in relation to the performance on the secondary task while standing still. Having the participants focus on the secondary task is most likely to have higher external validity, as drivers often feel a high motivation to complete the secondary task at hand. Thus, testing under such circumstances also reflects a ''worst-case'' scenario, which probably is not uncommon.[292]

VTI also provided the following comment about the car-following task instruction:

The driver is instructed to 'keep a constant following distance' to the lead vehicle. Here one should consider to instruct the driver to 'keep a constant time headway' to the lead vehicle, as this is better associated with a 'safe' distance. Keeping a constant time headway will also work when the lead vehicle has a variable speed.[293]

b. NHTSA's Response

After careful consideration, NHTSA believes that it is essential that test participants be instructed that the drivers' primary responsibly is to drive safely at all times and therefore is keeping the test participant instructions as they were proposed in the Initial Notice. Since there is no risk of physical injury associated with driving in a simulator, NHTSA is concerned that some test participants may treat it like a video game and drive unsafely and atypically. NHTSA believes that specific driving instructions help prevent this problem (as does having properly trained in-simulator experimenters who take appropriate corrective action if such happens). In NHTSA's entire driving simulator testing, we have never had a test participant refuse to perform a secondary task on the grounds of it being too complicated to perform while driving.

NHTSA prefers the test instruction of ''keep a constant following distance to the lead vehicle'' to the one of ''keep a constant time headway to the lead vehicle'' because we believe that the first instruction is easier for participants to understand. Since NHTSA's driving simulator acceptance test protocol involves only driving at constant speeds, the two instructions have the same practical effect. NHTSA acknowledges that we will need to modify this instruction if we shift to a test where the lead vehicle has a variable speed.

J. Device Response Time Recommendations

a. Summary of Comments

Several commenters addressed the proposed 0.25-second device response time. One commenter asserted that the proposed maximum of 0.25 seconds is too stringent. The following comment was provided by Mercedes-Benz

The proposed maximum response time to a device input of 250 ms is too stringent. While a system response within 250 ms after driver input is likely, there may be certain applications or system functions which respond slightly after 250 ms. Providing an indication that the device is responding (like showing an hour glass) if a system response is expected to occur slightly after 250 ms (e.g. 300–400 ms) is more distractive for the driver because she/he can't even recognize the indication until it disappears again.[294]

Mercedes-Benz suggested the following alternative:

The requirement provided in Alliance Guidelines Principle 3.5 comprehends this possibility and should be used instead: ''The maximum system response time for a system input should not exceed 250 msec. If system response time is expected to exceed 2 seconds, a message should be displayed indicating that the system is responding.'' [295]

Two commenters raised concerns about possible adverse effects. The following comment was provided by Global Automakers:

Devices that require a longer response time would necessitate provision of response indicators, which could clutter the display area.[296]

Nissan North America, Inc. requested clarification of the application of the 0.25 second response time and used the task of programming radio presets as an example. They provided the following comment:

Nissan requests that NHTSA clarify how the 0.25-second response time proposed in Section V.10 applies to driver input actions which by design take longer than 0.25 seconds. For example, the common industry practice for programming radio station presets is to hold down the programmed button (in excess of 0.25 seconds) until a chime signifies that the button has been successfully programmed.'' [297]

The proposal appears to either recommend against this practice or at least require that ''clearly perceptible indication'' be given to the driver while the driver is pressing and holding the programmed button. Providing additional ''clearly perceptible indication ''during this action would appear to be redundant and could lead to confusion.[298]

Nissan also provided the following recommendation:

We request that NHTSA use the 2-second response time recommended in the AAM guidelines to allow such functionality, or clarify how the response time is measured and in what situations it applies.''[299]

Another commenter requested examples of the types of indicators that would be considered acceptable. Global Automakers provided the following comment:

This provision specifies a minimum 0.25-second response time for devices, unless a clearly perceptible indication'' is provided that the device is responding. We request that the agency provide examples of what would qualify as ''clearly acceptable'' indications of device response. We also request that the agency provide a higher minimum response time than 0.25 second.[300]

b. NHTSA's Response

With this recommendation, NHTSA intended to match the recommendations of the Alliance Guidelines Principle 3.5 and ISO 15005: 2002.[301] The *Criterion/ Criteria* section of Alliance Guidelines Principle 3.5 reads:

Criterion/Criteria:
The maximum system response time for a system input should not exceed 250 msec. If system response time is expected to exceed 2 seconds, a message should be displayed indicating that the system is responding.[302]

Following the receipt of these comments, NHTSA again carefully

[292] Ibid.

[293] Ibid.

[294] Comments received from Mercedes-Benz USA, LLC, p. 8. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0093.

[295] Ibid.

[296] Comments received from Global Automakers, Inc., Attachment, p. 6. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0099.

[297] Comments received from Nissan North America, Attachment, p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0096.

[298] Comments received from Nissan North America, Attachment, p. 3. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 096.

[299] Ibid.

[300] Comments received from Global Automakers, Inc., Attachment, p. 6. Accessed at *www.regulations.gov,* Docket NHTSA–2010–0053, Document Number 0099.

[301] International Standard 15005:2002, ''Road Vehicles—Ergonomic Aspects of Transport Information and Control Systems—Dialogue Management Principles and Compliance Procedures.''

[302] Driver Focus-Telematics Working Group, ''Statement of Principles, Criteria and Verification Procedures on Driver-Interactions with Advanced In-Vehicle Information and Communication Systems,'' p. 74, June 26, 2006 version, Alliance of Automobile Manufacturers, Washington, DC.

reviewed this principle and researched the Alliance's rationale for this criterion. NHTSA learned that the first sentence of the above paragraph means that, as a ''best practice,'' an electronic device should respond to a driver's input within 0.25 seconds. The second sentence means that if the electronic device cannot conform to this ''best practice'' then after 2.0 seconds the device should provide an indication to the driver that the device is in the process of responding. We have changed the language of the NHTSA Guidelines to reflect our improved understanding of this principle.

In response to Nissan's comment about the common industry practice of programming radio station presets by holding down the programmed button until an auditory chime signifies that the button has been successfully programmed, we have added language to the NHTSA Guidelines indicating that the measurement of device response time should not begin until the driver has completed her input (i.e., for radio preset programming, response time measurement should only begin when the driver releases the button).

In response to Global Automakers' request that NHTSA provide examples of what would qualify as ''clearly acceptable'' indications of device response, we have decided to add a slightly modified version of the following paragraph from the Alliance Guidelines to the NHTSA Guidelines (in which the word ''system'' has been changed to ''device''):

> The *system*'s response is clearly perceptible if it is obvious for the driver that a change has occurred in the system and that this change is the consequence of the input. If the change within the system resulting from a given input is not systematically the same but depends on one or more previous steps of the sequence, it would be advisable to provide help (on driver request).[303]

Since there may be multiple ways to meet the above recommendation depending upon the precise details of the device interface, NHTSA is unable to provide more precise guidance than that stated above.

K. Downward Viewing Angle Issues

a. Summary of Comments

Numerous comments were received in reference to a discrepancy between the versions of SAE J941, ''Motor Vehicle Drivers' Eye Locations,'' used to determine the driver eye point when calculating the downward display viewing angle. The Alliance Guidelines used the 1997 version of SAE J941 while the Initial Notice proposed that the NHTSA Guidelines use the 2010 version. The Alliance explained the discrepancy and its possible implications in the following comment:

> In the preamble to the [NHTSA Guidelines] proposal, the agency acknowledges that its reference to the latest revision of SAE J941 is different than that referenced in the Alliance guidelines (2010 vs. 1997). Although the Alliance agrees that the differences between the two versions are small, it is possible that some displays that are on the boundary of the permissible zone might not comply with the down angle requirements when measured using the revised (2010) version of the standard. FMVSS requirements (and ISO requirements that reference FMVSS) currently reference the old eyellipse. As a result, OEMs would have to conduct CAD analyses multiple ways at significant cost and no real safety benefit.[304]

In their comments, Global Automakers made reference to a much earlier version of SAE J941 in their summary of the problem:

> The proposed Guidelines use the March 2010 version of SAE Recommended Practice J941 in determining the driver's eye point, for purposes of determining the downward viewing angle to device displays. The agency states that this eye point height is similar to that used in the Alliance guidelines, which relies on the June 1997 version of J941 with 8.4 mm added to that height. For purposes of compliance with safety standards (see, e.g., FMVSS 104 and by reference FMVSS 111), a much earlier version of J941 is specified (November 1965) and remains in use.[305]

The Global Automakers' recommended solution is:

> Since manufacturers' compliance systems are established on the basis of these earlier versions we request that the Guidelines allow determination of the downward viewing angle using any of these versions of J941.[306]

The Alliance offered the following recommendation for how to deal with the implications of adopting a new eyellipse:

> If the Agency wants to migrate to the new eyellipse, then all FMVSS referencing the eyellipse and these guidelines should be revised to allow the use of the new eyellipse, but should not yet require it. Manufacturers would then be able to declare which eyellipse they have used for each vehicle line during some interim period of time, similar to the way the use of the Hybrid III dummy replaced the Hybrid II over a number of years. This will allow manufacturers to switch to the new eyellipse in an orderly fashion as each vehicle line is redesigned. It will also allow each vehicle design to utilize only one version of the eyellipse, and not require that one be used for certain requirements and the other for different requirements. Since most vehicle lines are redesigned within a five to seven-year cycle, at least seven years should be allowed once the new eyellipse is permitted, before it becomes mandatory.[307]

Toyota Motor North America, Inc. provided specific detail about another issue it (and other commenters) noticed in regards to the maximum display downward viewing angle equations and proposed a remedy:

> The NHTSA Driver Distraction Guidelines correctly utilize the Alliance equations for maximum display downward viewing angle on page 11237, but use slightly different equations on page 11220. Toyota requests NHTSA to correct the equations on page 11220 to match those on page 11237 and the Alliance DF–T Guidelines.[308]
>
> Toyota is making this request under the assumption that the equations on page 11220 were a misprint, and not intended to adjust the equations to account for the new reference eye point.[309]

Additionally, Toyota and Ford Motor Company requested:

> NHTSA to include notations regarding measurement of eye height to ground in grid coordinates for 2D, and SAE curb ground line coordinates in 3D, per the Alliance DF–T guidelines.[310]

Toyota further suggested that:

> * * * considering future display technology that may include large multi-task displays or non-planar display surfaces, Toyota proposes removing the definition for ''Active Display Area'' and merging it into a new definition for ''Display Geometric Center.'' Display Geometric Center is a point on the active display area that is the intersection of all lines that divide the display into two parts of equal moment. Informally, one could imagine this as the point where the active display area could balance on the point of a needle. The active display area includes only the regions of the display containing in-scope information subject to these guidelines, and excludes portions of the display containing out-of-scope information, unused display surface, and hard switches. For reconfigurable displays, all possible display configurations must meet the downward viewing angle criterion. Non-planar displays shall define geometric center as the point on the display

[303] Ibid, p. 73.

[304] Comments received from the Alliance, Technical Appendix, p. 23. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0104.

[305] Comments received from Global Automakers, Attachment, p. 4. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0099.

[306] Ibid.

[307] Comments received from the Alliance, Technical Appendix, p. 23. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0104.

[308] Comments received from Toyota Motor North America, Inc., Attachment, p. 13. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0092.

[309] Ibid.

[310] Ibid.

surface nearest the actual display geometric center.[311]

On the related topic of obstruction of view, Ford and Toyota recommended that NHTSA add Alliance Guideline's Principle 1.1 to the NHTSA Guidelines:

The Alliance DF–T Principle 1.1 states that the system should be located and fitted in accordance with relevant regulations, standards, and the vehicle and component manufacturers' instructions for installing the systems in vehicles. The guidelines provide a verification method to confirm that the location and fit conform to applicable standards, e.g., SAE, ISO and regulations, e.g., FMVSS, CMVSS, and manufacturer-specific installation instructions.[312]

We recommend that the NHTSA guidelines adopt the language specified in the Alliance DF–T Guidelines and provide a verification method as a confirmation test.[313]

b. NHTSA's Response

After careful consideration of all of the various comments received on the issue of which version of SAE J941 should be used by the NHTSA Guidelines, NHTSA has decided to partially adopt Global Automakers' suggestion and allow the use of any one of several versions of SAE J941 which can be used to calculate the driver eye point.

The effects of the version of SAE J941 used on the driver's downward viewing angle when viewing displays are expected to be minimal. Therefore, it is impossible to justify on a safety basis the use of one version of SAE J941 instead of another. Without a safety basis for choosing one version of SAE J941 instead of another, NHTSA examined the research basis for the maximum display downward angle recommendations.

The research that forms the basis for the NHTSA Guidelines maximum display downward angle recommendations is the research that underlies the JAMA Guidelines[314] recommendations on downward viewing angle. As explained in the Alliance Guidelines:

* * * these criteria are based on a reference point called the Japanese eye point. In order to apply these practices in North America in a way that is consistent with Japanese criteria, it is necessary to establish a corresponding point in terms of North American practice. In this principle, therefore, the term 'eye point' is the SAE equivalent of the JIS (Japanese Industrial Standard) eye point,[315] which is the SAE J941[316] 2D eyellipse side view intersection of XX and ZZ locator (datum) lines. This corresponding point is located 8.4 mm up and 22.9 mm rearward of the mid-eye centroid of the SAE eyellipse.[317]

As indicated in the preceding paragraph, certain offsets are used to determine the JIS eyepoint from the mid-eye centroid of the SAE eyellipse. The Alliance Guidelines provide the offsets when the 1997 version of SAE J941 is used (8.4 mm up and 22.9 mm rearward), but, for the purposes of the NHTSA Guidelines, any version of SAE J941 for which NHTSA knows how to obtain the JIS eye point could be used. Accordingly, NHTSA has examined various versions of SAE J941 and is specifying in the NHTSA Guidelines those versions from which the JIS eye point can be calculated.

The June 1992, September 2002, and October 2008 versions of SAE J941 use the same equations as the June 1997 version to calculate the mid-eye centroid of the SAE eyellipse, and accordingly, the same offset is used to obtain the JIS eye point (8.4 mm up and 22.9 mm rearward). Therefore, all three of these versions of SAE J941 are acceptable for use with the NHTSA Guidelines.

The March 2010 version of SAE J941 is also acceptable for use with the NHTSA Guidelines but with a different offset to obtain the JIS eye point. When using the March 2010 version of SAE J941, the JIS eye point is at the mid-eye centroid of the SAE eyellipse.

NHTSA examined several earlier versions of SAE J941, including the November 1965 version referenced in FMVSS No. 104 and in Global Automakers' comments, but was unable to determine the JIS eye point from the mid-eye centroid of the eyellipse specified in those standards. Accordingly, the agency is not specifying any earlier versions of SAE J941 in the NHTSA Guidelines.

In summary, NHTSA has modified its Guidelines so that any version of SAE J941 from June 1992 or later is acceptable for use. The NHTSA Guidelines specify the offsets used to calculate the JIS eye point for each specific version of SAE J941.

Turning to other issues raised in the above quoted comments, NHTSA acknowledges that the equations in the preamble of the Initial Notice (on Page 11220) were incorrect. The equations in the actual proposed Guidelines, on Page 11237 of the Initial Notice, which are identical to the ones in the Alliance Guidelines, are the correct equations. The version of the Guidelines issued with this notice contains the correct equations.

When commenters requested that NHTSA include notations regarding measurement of eye height to ground in grid coordinates for 2D, and SAE curb ground line coordinates in 3D, we think that they are requesting the addition of figures similar to Figures 1, 2, 5, and 6 in the Alliance Guidelines. These figures are intended to clarify coordinates and measurements used when calculating a display's downward viewing angle. NHTSA intends to add similar figures to its Guidelines in the future.

NHTSA is deferring action on Toyota's suggestion that we remove the definition for ''Active Display Area'' and merge it into a new definition for ''Display Geometric Center.'' While it may be a viable idea, NHTSA would like to further consider this issue and the potential implications before acting upon it.

Finally, the recommendation by Ford and Toyota that NHTSA add Alliance Guideline's Principle 1.1 to the NHTSA Guidelines will be considered in future Guidelines revisions.

The subsection titled ''No Obstruction of View'' in the version of the NHTSA Guidelines published with the Initial Notice contained slightly reworded versions of Alliance Guideline's Principles 1.2 and 1.3. We did not include Alliance Guideline's Principle 1.1 in this subsection because it seemed unnecessary.

Alliance Guideline's Principle 1.1 reads:

The system should be located and fitted in accordance with relevant regulations, standards, and the vehicle and component manufacturers' instructions for installing the systems in vehicles.

While NHTSA certainly agrees with the contents of this principle, NHTSA expects and assumes that everything in the design and manufacture of a vehicle is done in accordance with relevant regulations and standards. We also assume that OE electronic devices are installed in vehicles as per the component manufacturers' instructions. Therefore, we do not believe this principle adds anything to Phase 1 of NHTSA's Guidelines. However, NHTSA

[311] Ibid, p. 14.

[312] Comments received from Ford Motor Company, Appendix p. 9. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0097.

[313] Ibid.

[314] Japanese Automobile Manufacturers Association, ''Guideline for In-Vehicle Display Systems, Version 3.0, Annex 1: Display Monitor Location,'' p. 5, Japanese Automobile Manufacturers Association, Tokyo, Japan, August 2004.

[315] JIS Eye Point is defined by JIS D0021 and JIS D1702.

[316] SAE J941 June 1997 revision.

[317] Driver Focus-Telematics Working Group, ''Statement of Principles, Criteria and Verification Procedures on Driver-Interactions with Advanced In-Vehicle Information and Communication Systems,'' p. 16, June 26, 2006 version, Alliance of Automobile Manufacturers, Washington, DC.

will keep this principle in mind when it develops its Guidelines for portable and aftermarket devices (Phase 2 of NHTSA's Driver Distraction Guidelines).

L. Miscellaneous Issues

1. Concerns About Recommendation That Drivers Should Have One Free Hand

a. Summary of Comments

Several organizations made comments on the proposal that when device controls are located on the steering wheel that no task should require simultaneous manual input from both hands. The following comment was provided by Global Automakers:

The proposed Guidelines state that when device controls are located on the steering wheel and both hands are on the steering wheel, no device tasks should require simultaneous manual inputs from both hands. We are concerned that this limitation may block technical progress in developing new functions that have the potential to enhance safety. For example, this requirement would prohibit the use of paddle shifters which in some instances require simultaneous input from both hands to operate. We recommend that the agency include in this provision the exception in Principle 3.1, page 67, Criterion/Criteria 3.1(b) of the Alliance Guidelines for simultaneous manual inputs.[318]

A similar comment was provided by the Hyundai Motor Group:

Hyundai is concerned that simultaneous manual inputs from both hands are not permitted for device controls located on the steering wheel. Hyundai is concerned this recommendation will not allow the use of paddle switches, and could limit future safety innovation. Hyundai recommends that agency reconsider simultaneous manual inputs as a method for device control.[319]

In contrast to these concerns about the potential limiting effect of this provision, Consumers Union provided the following comment in support:

We also support NHTSA's recommendation that all device functions accessed via visual-manual interaction by the driver should be operable by using, at most, one of the driver's hands. In particular, we agree with NHTSA's modification of the Alliance of Automobile Manufacturers guidelines, which would have allowed simultaneous input from both hands for steering wheel device controls, as long as one of the two hands maintains only a single finger input. Controls that require simultaneous use of both hands can create unsafe driving situations and should not be utilized.[320]

b. NHTSA's Response

After careful consideration of the comments received, NHTSA continues to be concerned that tasks requiring the simultaneous use of both hands, even one for which only a single finger input is required from one hand (as per Principle 3.1, page 67, Criterion/Criteria 3.1(b) of the Alliance Guidelines [321]), will result in an unsafe situation. We continue to think that it overloads the driver's hands and makes them less available (albeit not for very long) in the event that a sudden emergency occurs. Therefore, the NHTSA Guidelines will continue to recommend against driver interfaces that utilize this special case of two-handed control.

Having said the above, we can alleviate Global Automakers and Hyundai's concerns about the use of two hands to operate paddle shifters or paddle switches. Vehicle controls, including paddle shifters or paddle switches, are not within the scope of the NHTSA Guidelines. We have added language to the NHTSA Guidelines to make this point more clearly.

2. Concerns About Device Sound Level Control Recommendations

a. Summary of Comments

Both Ford Motor Company and Toyota Motor North America, Inc. submitted essentially identical comments about the device sound level recommendation contained in the Initial Notice version of the NHTSA Guidelines. Ford's comment is:

The Alliance DF–T [the Alliance Guidelines] principle 2.4 states that the system should not produce uncontrollable sound levels liable to mask warnings from within the vehicle or outside or to cause distraction or irritation. Our understanding is that it was the Agency's intent to use the DF–T principle as written for the NHTSA guidelines; however, the NHTSA guidelines do not offer a verification method crucial to determine consistent application of these guidelines. Also the term ''irritation'' is too subjective for guidelines or verification.[322]

Ford recommends that the NHTSA guidelines adopt the language specified in the Alliance DF–T Guidelines, and provide a verification method as a confirmation test. The Alliance DF–T Guidelines verification method for this principle states that system sound level shall demonstrate adjustability down to a fully muted level or demonstrate that there is no significant masking of audible warnings concerning road and vehicle safety.[323]

b. NHTSA's Response

After careful consideration, NHTSA has decided that it agrees with these comments. The word ''irritation'' is too subjective for use in the NHTSA Guidelines. NHTSA believes that highly irritating sounds are inherently distracting. Therefore, the modified version of this recommendation would screen out highly irritating device sounds.

NHTSA has included in the NHTSA Guidelines information about how to verify that a device conforms to this recommendation. Therefore, we have added (with minor wording changes to improve clarity) portions of the paragraph under *Criterion/Criteria* in Principle 2.4 of the Alliance Guidelines [324] into the NHTSA Guidelines.

3. Suggestion That the NHTSA Guidelines Should Recommend That All Devices can be Disabled

a. Summary of Comments

In their commentary, automakers consistently argued that their customers generally demand that they have the ability to perform an increasing variety of secondary tasks while driving. The National Safety Council (NSC) provided an opposing perspective in the following comments:

Some comments submitted to NHTSA advocate for making it easy for drivers to conduct information-gathering, social media and other communication tasks in their vehicles because there's a belief that consumers demand and expect this. Consumers who know better may demand the opposite. The National Safety Council's employer members who have implemented total cell phone bans when their employees are driving understand the risks of cognitive distraction. There are individuals and organizations that may not want the distraction of in-vehicle systems.[325]

Based on the foregoing, the NSC recommended that NHTSA incorporate

[318] Comments received from Global Automakers, Inc., Attachment, p. 6. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0099.

[319] Comments received from Hyundai Motor Group, p. 3. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0102.

[320] Comments received from the Consumers Union, p. 3. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0063.

[321] Driver Focus-Telematics Working Group, ''Statement of Principles, Criteria and Verification Procedures on Driver-Interactions with Advanced In-Vehicle Information and Communication Systems,'' p. 67, June 26, 2006 version, Alliance of Automobile Manufacturers, Washington, DC.

[322] Comments received from Ford Motor Company, p. 9. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0097.

[323] Ibid.

[324] Driver Focus-Telematics Working Group, ''Statement of Principles, Criteria and Verification Procedures on Driver-Interactions with Advanced In-Vehicle Information and Communication Systems,'' p. 63, June 26, 2006 version, Alliance of Automobile Manufacturers, Washington, DC.

[325] Comments received from The National Safety Council, p. 5. Accessed at *www.regulations.gov*, Docket NHTSA–2010–0053, Document Number 0085.

the following additions to the guidelines:

A requirement that vehicle owners be able to turn off all systems not essential to the driving task or the safe operation of the vehicle.[326]

An encouragement or requirement for the auto industry to install technologies that prevents cell phones and other electronic devices that are brought into the vehicle from being used by the driver while the vehicle is [in] motion.[327]

b. NHTSA's Response

In response to NSC's suggestion, NHTSA has added a recommendation to its Driver Distraction Guidelines that every electronic device not essential to the driving task or the safe operation of the vehicle have a means for turning off or otherwise disabling the device. While the vast majority of electronic devices already have an on/off control or some other means of disablement, NHTSA thinks that all devices providing non-safety-related information should have such a feature.

NHTSA is not prepared at this time to expand this recommendation to one that vehicle owners be able to turn ''Off'' all electronic devices not essential to the driving task or the safe operation of the vehicle (and driver is not able to turn the devices back on). This idea is not unlike that of Ford Motor Company's MyKey® system. MyKey® allows parents to program their teenage driver's car key with settings that limit the vehicle's speed, prevent safety systems from being disabled, and beginning in 2012 on some vehicles, cause incoming phone calls to be sent automatically to voicemail and incoming text messages to be saved for later reading. While NSC's idea may have merit, NHTSA is not prepared to act on it at this time.

Finally, establishing a requirement to install technologies to prevent cell phones and other technologies from being used by the driver will need further research before NHTSA can consider adding such a recommendation to the NHTSA Guidelines.

V. Statutory Considerations

Under the National Technology Transfer and Advancement Act of 1995 (NTTAA) (Pub. L. 104–113), ''all Federal agencies and departments shall use technical standards that are developed or adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments.'' Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies, such as SAE and ISO. The NTTAA directs us to provide Congress, through OMB, explanations when we decide not to use available and applicable voluntary consensus standards.

Pursuant to these requirements, NHTSA, with the help of commenters, has identified a number of voluntary consensus standards related to distracted driving. After careful consideration, the agency is incorporating several of these standards into the test methods contained in the NHTSA Guidelines: ISO International Standard 15008:2003, ''Road vehicles—Ergonomic aspects of transport information and control systems—Specifications and compliance procedures for in-vehicle visual presentation''; ISO International Standard 16673:2007(E), ''Road Vehicles—Ergonomic Aspects of Transport Information and Control Systems—Occlusion Method to Assess Visual Demand due to the use of In-Vehicle Systems''; and multiple versions of SAE Recommended Practice J941, ''Motor Vehicle Drivers' Eye Locations,'' including SAE J941 (June 1992), SAE J941 (June 1997), SAE J941 (September 2002), SAE J941 (October 2008), and SAE J941 (March 2010). The agency has included an explanation for its decision to use these standards in the discussions on the per se lock out related to reading, the occlusion field factor, and the downward viewing angle recommendations.

The agency considered the possibility of using other voluntary consensus standards cited by commenters. However, we have found these standards to be unsuitable for the NHTSA Guidelines. Our analysis of these voluntary consensus standards can be found in Section IV.A.4 of this preamble.

Guidelines for Reducing Visual-Manual Driver Distraction during Interactions with Integrated, In-Vehicle, Electronic Devices

I. *PURPOSE.*

The purpose of these Guidelines is to reduce the number of motor vehicle crashes and the resulting deaths and injuries that occur due to a driver being distracted from the primary driving task while performing secondary tasks involving the use of an in-vehicle electronic device. The Guidelines are presented as an aid to manufacturers in designing in-vehicle devices that do not allow the performance of tasks that negatively impact a driver's ability to safely control his or her vehicle. Vehicle and electronic device manufacturers that choose to adhere to these Guidelines do so voluntarily. Compliance with these Guidelines is not required.

A. Driver Responsibilities.

These Guidelines do not alter the driver's primary responsibility to ensure the safe operation of a vehicle as governed by the state laws under which it is being operated, both while driving and when interacting with in-vehicle electronic devices. This includes following all traffic laws, obeying traffic control devices, and driving in a safe manner under all operating conditions.

B. Protection Against Unreasonable Risks to Safety.

The National Highway Traffic Safety Administration (NHTSA) does not evaluate the safety implications of every new device before it is introduced into vehicles. However, the Safety Act authorizes NHTSA to initiate enforcement action when a motor vehicle or item of motor vehicle equipment, including original equipment in-vehicle electronic devices, contains a safety-related defect. (49 U.S.C. 30118–30121).

II. *SCOPE.*

These Guidelines are applicable to the human-machine interfaces of electronic devices used for performing all *non-driving-related tasks*[328] as well as for performing some driving-related tasks.

Table 2 contains a non-exhaustive list of the types of non-driving-related tasks and electronic devices to which these Guidelines are applicable.

[326] Ibid, p. 10.

[327] Ibid, p. 10.

[328] Underlined terms are defined in Section IV. Definitions.

TABLE 2—NON-DRIVING-RELATED TASKS/DEVICES TO WHICH THESE GUIDELINES APPLY

Type of task	Task/Device
Communications	Caller Identification Incoming Call Management Initiating and Terminating Phone Calls Conference Phoning Two-Way Radio Communications Paging Address Book Reminders Text-Based Communications Social Media Messaging or Posting
Entertainment	Radio (including but not limited to AM, FM, and Satellite) Pre-recorded Music Players, All Formats Television Video Displays Advertising Internet Browsing News Directory Services
Information	Clock Temperature

These Guidelines are applicable to driving-related tasks that are neither related to the safe operation and control of the vehicle nor involve the use of a system required by law. Examples of driving-related tasks to which these Guidelines are applicable include interacting with vehicle information centers, emissions controls, fuel economy information displays, trip odometers, and route navigation systems. These Guidelines are not applicable to the following general categories of driving-related tasks, which involve activities performed by the driver as part of the safe operation and control of the vehicle or involve systems required by law:

- Operating the driving controls (steering wheel, throttle pedal, brake pedal, etc.) of the vehicle,
- Any task relating to proper use of a driver safety warning system,
- Using any other electronic device that has a function, control, and/or display specified by either a Federal Motor Vehicle Safety Standard, another United States Government law or regulation, or a state or local Government law or regulation.

A non-exhaustive list of *driving-related task* categories, along with whether these Guidelines apply to each category, is contained in Table 3.

TABLE 3—DRIVING-RELATED TASKS

Categories of driving-related tasks	Guidelines applicable?	
	Yes	No
Manipulating the steering handwheel		X
Applying the brake, throttle, and clutch pedal (if present)		X
Operating the transmission shift lever		X
Operation of paddle shifters on steering wheel		X
Operation of the parking brake		X
Turning headlights on or off		X
Adjustment of instrument panel brightness		X
Turning turn signals on or off		X
Operation of windshield wipers		X
Operation of the horn		X
Locking and/or unlocking doors		X
Operation of moveable windows		X
Adjustment of moveable mirrors		X
Looking at inside and outside rearview mirrors		X
Turning blind spot detector on or off		X
Operation of moveable seats and headrests		X
Operation of seat belts		X
Checking the speedometer, fuel gauge, engine temperature gauge and any other gauges or digital displays presenting information that is necessary for the safe operation of the vehicle		X
Checking telltale and malfunction indicators		X
Turning electronic stability control and/or traction control on or off		X
Adjustment of climate controls not required by a Federal Motor Vehicle Safety Standard (e.g., temperature and fan adjustment)	X	
Operation of cruise control	X	
Performance of a task via multi-function display interface	X	
Resetting trip odometers and/or trip computers	X	
Navigation of the vehicle—Destination entry	X	
Navigation of the vehicle—Route following	X	
Real-Time Traffic Advisory	X	
Trip Computer Information	X	
Observation of vehicle information centers	X	
Observation of emissions controls	X	

TABLE 3—DRIVING-RELATED TASKS—Continued

Categories of driving-related tasks	Guidelines applicable?	
	Yes	No
Observation of fuel economy displays	X	
Adjusting vehicle suspension and/or ride	X	

A. Guidelines Intended for Human-Machine Interfaces

These Guidelines are applicable primarily to human-machine interfaces of in-vehicle electronic devices intended for use by a driver. They are applicable to a limited extent (see Section VII) to devices intended for use by front seat passengers of a vehicle. They are not applicable to devices that are located solely rearward of the front seat of a vehicle.

B. Only Device Interfaces Covered

These Guidelines are not applicable to any aspect of covered electronic devices other than their interfaces. Specifically, they do not cover a device's electrical characteristics, material properties, or performance.

C. Original Equipment Electronic Devices Covered

These Guidelines are applicable to the human-machine interfaces of original equipment electronic devices (i.e., those built into a vehicle at the time of manufacture). These Guidelines are applicable to such devices even when linked with aftermarket or portable devices, i.e., original equipment devices should control all aftermarket and portable devices linked to them (i.e., electronically connected with some type of data exchange) in accordance with these principles.

D. Aftermarket and Portable Devices Not Covered

These Guidelines are currently not applicable to the human-machine interfaces of electronic devices that are either installed into a vehicle after it is manufactured (aftermarket devices) or are brought into the vehicle on a temporary basis by the driver or passengers (portable devices).

E. Device Tasks Performed Via Auditory-Vocal Means Not Covered

These Guidelines are currently not applicable to the auditory-vocal portions of human-machine interfaces of electronic devices.

F. Intended Vehicle Types

These Guidelines are applicable to passenger cars, multipurpose passenger vehicles, and trucks and buses with a Gross Vehicle Weight Rating (GVWR) of not more than 10,000 pounds. However, these guidelines are not applicable to:

1. Ambulances or combination ambulance-hearses,
2. Firefighting vehicles,
3. Military vehicles,
4. Vehicles manufactured for use by the United States Government or a State or local government for law enforcement, or
5. Vehicles manufactured for other emergency uses as prescribed by regulation by the Secretary of Transportation.

III. *STANDARDS INCLUDED BY REFERENCE*

The following standards and all of their provisions are used in these Guidelines.

A. International Organization for Standardization (ISO) Standards

ISO 15008:2003, ''Road vehicles—Ergonomic aspects of transport information and control systems—Specifications and compliance procedures for in-vehicle visual presentation,'' March 2003.

ISO 16673:2007(E), ''Road vehicles—Ergonomic aspects of transport information and control Systems—Occlusion method to assess visual demand due to the use of in-vehicle systems,'' April 2007.

B. SAE International (SAE) Standards.

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).

IV. *DEFINITIONS.*

A. General Definitions.

1. *Active Display Area* means the portion of a visual display used to present information to the driver in the context of any task that makes use of that display. It excludes unused display surface and any area containing physically-manipulatable controls.

2. *Device* means all components that a driver uses to perform secondary tasks (i.e., tasks other than the primary task of safe operation and control of the vehicle); whether stand-alone or integrated into another device.

3. *Distraction* means the diversion of a driver's attention from activities critical for safe operation and control of a vehicle to a competing activity.

4. *Downward Viewing Angle* means the angle by which a driver has to look down from the horizontal to directly glance at a device's visual display. Both a three-dimensional downward viewing angle and a two-dimensional approximation are used in these Guidelines.

5. *Driver's Field of View* means the forward view acquired directly through the windshield, rear, and side views acquired through the other vehicle windows, as well as the indirect side and rear views provided by the vehicle's mirrors.

6. *Driving* means whenever the vehicle's means of propulsion (engine and/or motor) is activated unless one of the following conditions is met:

a. For a vehicle equipped with a transmission with a ''Park'' position—The vehicle's transmission is in the ''Park'' position.

b. For a vehicle equipped with a transmission without a ''Park'' position—All three of the following conditions are met:

i. The vehicle's parking brake is engaged, and

ii. The vehicle's transmission is known (via direct measurement with a sensor) or inferred (by calculating that the rotational speed of the engine divided by the rotational speed of the driven wheels does not equal, allowing for production and measurement tolerances, one of the overall gear ratios of the transmission/vehicle) to be in the neutral position, and

iii. The vehicle's speed is less than 5 mph.

7. *Driving-Related Task* means:

a. Any activity performed by a driver as part of the safe operation and control of the vehicle (not covered by these Guidelines),

b. Any activity performed by a driver that relates to use of a vehicle system required by Federal or State law or regulation (not covered by these Guidelines), or

c. Any other activity performed by a driver that aids the driver in performing the driving task but is not essential to the safe operation or control of the vehicle (covered by these Guidelines).

8. *Function* means an individual purpose which the device is designed to fulfill. A device may have one or more functions.

9. *Glance* means a single ocular fixation by a driver. If the eye glance characterization method being used cannot distinguish between different nearby locations of individual fixations, ''glance'' may also be used to refer to multiple fixations to a single area that are registered as one ocular fixation.

10. *Glance Duration* means the time the gaze moves towards a target (the transition time) and the dwell time (the time fixated on a particular point) on the target. *Glance duration* does not include the transition time away from the target. (This is part of the next glance.)

11. *Graphical or Photographic Image* means any non-video graphical or photographic image. Internationally standardized symbols and icons, as well as Trademark™ and Registered® symbols, are not considered graphical or photographic images.

12. *Interaction* means an input by a driver to a device, either at the driver's initiative or as a response to displayed information. Interactions include control inputs and data inputs (information that a driver sends or receives from the device that is not intended to control the device). Depending on the type of task and the goal, interactions may be

elementary or more complex. For the visual-manual interfaces covered by this version of these Guidelines, interactions are restricted to physical (manual or visual) actions.

13. *Lock Out* means the disabling of one or more functions or features of a device so that the related task cannot be performed by the driver while driving.

14. *Manual Text Entry* means manually inputting individual alphanumeric characters into an electronic device. For the purposes of these Guidelines, digit-based phone dialing is not considered manual text entry.

15. *Nominal Driver Eye Point* means the assumed (for these Guidelines) location of the center of the driver's eyes.

16. *Non-Driving-Related Task* means any activity performed by a driver other than those related to the driving task. A non-exhaustive list of non-driving-related tasks is contained in Table 2. These Guidelines are applicable to all non-driving-related tasks performed using electronic devices.

17. *Per Se Lock Out* means the lock out of a function or feature due to its inherent interference with a driver's ability to operate and control a vehicle safely.

18. *Reading* means the driver's act of perceiving visually presented textual information. *Reading* does not include a driver's perception of auditorily presented text.

19. *Subtend* means, in a geometrical sense, to be opposite to and delimit (an angle or side).

20. *Text-Based Messaging* means manually inputting individual alphanumeric characters into, or reading from, an electronic device for the purpose of present or future communication. This action includes, but is not limited to, the composition or reading of messages transmitted via short message service, email, instant messaging service, internet-based messaging, or social media internet-based applications (including posting). *Text-based messaging* does not include:

a. *Reading,* selecting, or entering a phone number, an extension number, or voice-mail retrieval codes and commands into an electronic device for the purpose of initiating or receiving a phone call or using voice commands to initiate or receive a phone call; or

b. Using a device capable of performing fleet management functions (e.g., dispatching services) for a purpose that is not otherwise prohibited by law.

21. *Video* means full-motion visual information presented through electronic means. This includes entertainment, advertising, and other visual content not related to driving that is obtained from pre-recorded images, live images, video games, broadcasts (such as by television or over the internet), and/or closed-circuit television.

B. Task-Related Definitions.

1. *Control Input* means a driver action to the human-machine interface of an electronic device that is intended to affect the state of that device. *Control inputs* may be initiated either by a driver or as a driver's response to displayed information initiated by a device. For the visual-manual interfaces covered by these Guidelines, control inputs are restricted to manual control actions.

2. *Dependent Task* means a task that cannot be initiated until a prior task (the antecedent task) is first completed. The task's start state is thus dependent upon the end state of the antecedent task.

An antecedent task followed by a dependent task can be distinguished from a single task that contains two subtasks by examining the end states of the two tasks or subtasks. For the antecedent task-dependent task case, both tasks' goals can be achieved (i.e., one goal for the antecedent task and one goal for the dependent task). In contrast, for a task composed of two subtasks, only one goal will be achieved.

An example of an antecedent task-dependent task: after choosing a restaurant from a navigation system's point-of-interest list (antecedent task with goal of choosing a restaurant), a driver is offered an internet function option of making a reservation at the restaurant (dependent task with goal of making reservation). Since there are two goals, this is an antecedent task followed by a dependent task. The dependent task of making a reservation can only be initiated following the task of selecting a restaurant from within the navigation system.

An example of multiple subtasks: entering an address into a route navigation system. The driver enters first the state, then the city, then the street, and finally the street number into the navigation system. However, the driver only has one goal for all of these actions: to enter the complete address. The entry of the state, city, street, and street number are all subtasks since they each form a part of achieving this one goal.

3. *End of Data Collection* means the time at which a test participant informs the experimenter they have completed a testable task either by speaking the word, ''done'' or, by a non-verbal means (such as a button press) indicating the same thing. Test participant eye glances are not examined after the end of data collection. If a test participant eye glance was in progress at the end of data collection, only the portion that occurred before the end of data collection is used. Successful task completion requires that the device is in the desired end state at the end of data collection.

4. *End State for a Testable Task* means the pre-defined device state sought by a test participant to achieve the goal of that testable task.

5. *Error* means that a test participant has made a significant incorrect input when performing a testable task during a test trial. An error has occurred if the test participant has to backtrack during performance of the task or delete already entered inputs. If the device can accommodate an incorrect entry without requiring backtracking and extra inputs beyond those necessary to reach the desired end state of the task, then no error is deemed to have occurred.

6. *Error-Free Trial* means a test trial in which no errors are made by the test participant while completing the task.

7. *Goal* means a device state sought by a driver. Goal achievement is defined as achieving a device state that is the driver's intended state. Goals are frequently independent of the particular device hardware and software being used to execute the task or the method of task execution.

8. *Secondary Task* means any interaction a driver has with an in-vehicle device that is not directly related to the primary task of the safe operation and control of a vehicle. These tasks may relate to driver comfort, convenience, communications, entertainment, information seeking, or navigation.

9. *Start of Data Collection* means the time when the experimenter instructs a test participant to begin a task using a verbal cue, ''begin'' (or issues a non-verbal command indicating the same thing). Test participant eye glances are examined only after the start of data collection. If a test participant eye glance was in progress at the start of data collection, only use the segment after the start of data collection. The start of data collection should occur when the device is at the pre-defined start state for a testable task.

10. *Start State for a Testable Task* means the pre-defined device state from which testing of a *testable task* always begins. This is frequently the ''home'' screen, default visual display state, or other default human-machine interface state from which a driver initiates performance of the testable task. For dependent tasks, the start state would be the end state of the previous testable task.

For a testable task for which there is only one point (e.g., screen, visual prompt, step) from which the task can be initiated, that point would correspond to the start state. For a testable task which can be initiated from more than one point, one of these options is selected as the start state. If it can be determined which start state occurs most often during normal driving, testing should commence from that start state. (The desire here is to reduce the amount of testing needed to ensure adherence with these Guidelines. It is generally not necessary to test all possible transitions into a testable task.)

11. *Sub-goal* means an intermediate state on the path to the driver's goal. A sub-goal is often distinguishable from a goal in two ways: (1) it is usually not a state at which a driver would be satisfied stopping; and (2) it may vary in its characteristics and/or sequential order with other sub-goals across hardware/interface functions, and thus is system dependent.

12. *Subtask* means a sub-sequence of control operations that is part of a larger testable task sequence—and which leads to a sub-goal representing an intermediate state in the path to the larger goal toward which a driver is working.

Subtasks should not be treated as separate dependent tasks. For example, entering the street name as part of navigation destination entry is not a separate task from entering the street number; rather, these are subtasks of the same testable task.

Data collection should only be undertaken for all subtasks as a group, which comprises a testable task. Separate data collection for individual subtasks is not appropriate.

13. *Successful Task Completion* means that a test participant has performed a testable task without significant deviations from the correct sequence(s) of inputs (i.e., made an error) and achieved the desired end state. As explained earlier, an error has occurred if the

test participant has to backtrack during performance of the task or delete already entered inputs. If the device can accommodate an incorrect entry without requiring backtracking and extra inputs beyond those necessary to reach the desired end state of the task, then no error is deemed to have occurred.

14. *Testable Task* means a pre-defined sequence of interactions performed using a specific method leading to a goal toward which a driver will normally persist until the goal is reached. A testable task begins with the device at a previously defined start state and proceeds, if successfully completed, until the device attains a previously defined end state. It is called a *testable task* because it is a completely defined *secondary task* that can be tested for adherence with these Guidelines.

C. Task-Related Explanatory Material.

1. *Testable tasks* should be completely defined prior to any testing to determine whether they are suitable to perform while driving under these Guidelines. The task's goal, start state, end state, specific method to be used, and inputs should all be specified.

2. For *testable tasks* with a variety of possible inputs of different lengths (e.g., city names for navigation systems), a typical or average length input should be used. Precise mean values need not be used and there may be some variation in length from input-to-input. For example, for the input of city names into a navigation system, lengths of 9 through 12 letters might be used.

3. For *testable tasks* that involve reading, nearby text unrelated to the task being performed should not be considered part of the text that is to be read during the *testable task.*

4. For the purposes of acceptance testing, text unrelated to the task and the labels of buttons or controls need not be included as part of the text that is read during a *testable task.*

V. *DEVICE INTERFACE RECOMMENDATIONS.*

Each device's human-machine interface should meet the recommendations specified below.

A. No Obstruction of View.

1. No part of the physical device, when mounted in the manner intended by the manufacturer, should obstruct a driver's view of the roadway.

2. No part of the physical device, when mounted in the manner intended by the manufacturer, should obstruct a driver's view of any vehicle controls or displays required for driving.

B. Easy to See and Reach.

The mounting location for a device should be in a location that is easy to see and/or reach (as appropriate) while driving.

C. Maximum Display Downward Angle.

Each device's display(s) should be mounted in a position where the downward viewing angle, measured at the geometric center of each active display area, is less than at least one of the following two angles:

- The 2D Maximum Downward Angle, or
- The 3D Maximum Downward Angle.

The values of these maximum angles depend upon the location of the nominal driver eye point as follows:

1. Location of the nominal driver eye point. The method used for calculating the location of the nominal driver eye point varies depending upon which version of SAE Recommended Practice J941 ''Motor Vehicle Drivers' Eye Locations'' is being used. If the June 1992, June 1997, September 2002, or October 2008 version of SAE J941 is being used, then the nominal driver eye point is located 8.4 mm above and 22.9 mm rearward of the mid-eye centroid of the SAE eyellipse. If the March 2010 version of SAE J941 is being used, then the nominal driver eye point is located at the mid-eye centroid of the SAE eyellipse.

2. The 2D Maximum Downward Angle is equal to 30.00 degrees for a vehicle with the height of the nominal driver eye point less than or equal to 1700 millimeters above the ground.

3. The 2D Maximum Downward Angle is given by the following equation for nominal driver eye point heights greater than 1700 millimeters above the ground:

$$\theta_{2DMax} = 0.01303\ h_{Eye} + 15.07$$

where

θ_{2DMax} is the 2D Maximum Downward Angle (in degrees), and

h_{Eye} is the height above the ground of the nominal driver eye point (in millimeters).

4. The 3D Maximum Downward Angle is equal to 28.16 degrees for a vehicle with the height of the nominal driver eye point less than or equal to 1146.2 millimeters above the ground.

5. The 3D Maximum Downward Angle is given by the following equation for nominal driver eye point heights greater than 1146.2 millimeters above the ground:

$$\theta_{2DMax} = 57.2958 \tan^{-1} [0.829722 \tan(0.263021 + 0.000227416\ h_{Eye})]$$

where

θ_{2DMax} is the 3D Maximum Downward Angle (in degrees), and

h_{Eye} is the height above the ground of the *nominal driver eye point* (in millimeters).

6. The downward viewing angle of each display is determined in two ways, two dimensionally (the 2D Downward Viewing Angle) and three dimensionally (the 3D Downward Viewing Angle).

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.

9. Visual displays that present frequently needed and/or important information during the driving task and/or visually-intensive information should have downward viewing angles that are as close as practicable to a driver's forward line of sight. Visual displays that present less frequently needed or less important information should have lower priority, when it comes to locating them to minimize their downward viewing angles, than displays that present frequently needed and/or used information.

D. Lateral Position of Visual Displays.

Visual displays that present information relevant to the driving task and/or visually-intensive information should be laterally positioned as close as practicable to a driver's forward line of sight.

E. Minimum Size of Displayed Textual Information.

Visually presented text should meet the legibility recommendations contained in ISO International Standard 15008:2003, ''Road vehicles—Ergonomic aspects of transport information and control systems—Specifications and compliance procedures for in-vehicle visual presentation.''

F. Per Se Lock Outs.

The following electronic device tasks are recommended for per se *lock out* and should always be inaccessible for performance by the driver while driving:

1. Device functions and tasks not intended to be used by a driver while driving.

2. *Manual Text Entry. Manual text entry* by the driver for the purpose of text-based messaging, other communication, or internet browsing.

The following electronic device tasks are recommended for per se lock out and should always be a) inaccessible for performance by the driver while driving and b) inaccessible for performance by a passenger if the related display is within view of the driver properly restrained by a seat belt:

3. Displaying Video. Displaying (or permitting the display of) *video* including, but not limited to, video-based entertainment and video-based communications including video phoning and videoconferencing.

Exceptions:

a. The display of video images when presented in accordance with the requirements of any FMVSS.

b. The display of a video image of the area directly behind a vehicle for the purpose of aiding a driver performing a maneuver in which the vehicle's transmission is in reverse gear (including parking, trailer hitching), until any of the following conditions occurs:

i. The vehicle reaches a maximum forward speed of 10 mph;

ii After the vehicle has shifted out of reverse, it has traveled a maximum of 10 meters; or

iii. After the vehicle has shifted out of reverse, a maximum of 10 seconds has elapsed.

c. Map displays. The visual presentation of dynamic map and/or location information in a two-dimensional format, with or without perspective, for the purpose of providing navigational information or driving directions when requested by the driver (assuming the presentation of this information conforms to all other recommendations of these Guidelines). However, the display of informational detail not critical to navigation, such as photorealistic images, satellite images, or three-dimensional images is not recommended.

4. Displaying Images. Displaying (or permitting the display of) non-video graphical or photographic images.

Exceptions:

a. Displaying driving-related images including maps (assuming the presentation of this information conforms to all other recommendations of these Guidelines). However, the display of map informational detail not critical to navigation, such as photorealistic images, satellite images, or three-dimensional images is not recommended.

b. Static graphical and photographic images displayed for the purpose of aiding a driver to efficiently make a selection in the context of a non-driving-related task (e.g., music) is acceptable if the image automatically extinguishes from the display upon completion of the task. If appropriate, these images may be presented along with short text descriptions that conform to these Guidelines.

c. Internationally standardized symbols and icons, as well as Trademark™ and Registered® symbols, are not considered static graphical or photographic images.

5. Automatically Scrolling Text. The display of scrolling (either horizontally or vertically) text that is moving at a pace not controlled by the driver.

6. Displaying Text to Be Read. The visual presentation of the following types of non-driving-related task textual information:

- Books
- Periodical publications (including newspapers, magazines, articles)
- Web page content
- Social media content
- Text-based advertising and marketing
- *Text-based messages* (see definition) and correspondence

However, the visual presentation of limited amounts of other types of text during a testable task is acceptable. The maximum amount of text that should be visually presented during a single testable task is determined by the task acceptance test protocols contained in these Guidelines.

G. Acceptance Test-Based Lock Out of Tasks.

Any non-driving-related task or within-scope (identified as Guidelines Applicable in Table 3 of Section II), driving-related task that diverts a driver's attention from the primary driving task to the point it does not conform with one of the task acceptance methods contained in Section VI, should be locked out while driving.

H. Sound Level.

Devices should not produce sound levels likely to mask warnings either from within or from outside the vehicle, or that cause distraction. The device sound level control should demonstrate its ability to adjust sound levels down to a fully muted level.

I. Single-Handed Operation.

Devices should allow a driver to maintain at least one hand on the vehicle's steering control. All tasks that require manual control inputs (and can be performed with the device while the vehicle is in motion) should be executable by a driver in a way that meets all of the following criteria:

1. When manual device controls are placed in locations other than on the steering control, no more than one hand should be required for manual input to the device at any given time during driving.

2. When device controls are located on the steering wheel and both hands are on the steering wheel, no device tasks should require simultaneous manual inputs from both hands.

3. A driver's reach to the device's controls should allow one hand to remain on the steering control at all times.

4. Reach of the whole hand through steering wheel openings should not be required for operation of any device controls.

J. Interruptibility.

Devices should not require uninterruptible sequences of visual-manual interactions by a driver. A driver should be able to resume an operator-interrupted sequence of visual-manual interactions with a device at the point of interruption or at another logical point in the sequence.

1. Except as stated in Subsection V.J.5, below, no device-initiated loss of partial driver input (either data or command inputs) should occur automatically.

2. Drivers should be able to initiate commands that erase driver inputs.

3. A visual display of previously-entered data or current device state should be provided to remind a driver of where the task was left off.

4. If feasible, necessary, and appropriate, the device should offer to aid a driver in finding the point to resume the input sequence or in determining the next action to be taken. Possible aids include, but are not limited to:

a. A visually displayed indication of where a driver left off,

b. A visually displayed indication of input required to complete the task, or

c. An indication to aid a driver in finding where to resume the task.

5. Devices may revert automatically to a previous or default state without the necessity of further driver input after a device defined time-out period, provided:

a. It is a low priority device state (one that does not affect safety-related functions or way finding), and

b. The state being left can be reached again with low driver effort. In this context, low driver effort is defined as either a single driver input or not more than four presses of one button.

6. This subsection is not applicable to device output of dynamically changing data. The device should control the display of information related to dynamic events that are not within the driver's direct control (e.g., distance to the next turn).

K. Device Response Time.

1. A device's response (e.g., feedback, confirmation) following driver input should be timely and clearly perceptible.

2. As a ''best practice,'' the maximum device response time to a device input should not exceed 0.25 seconds. The measurement of this time should begin starting at the completion of the driver's control input.

3. If a device's response time exceeds 2.00 seconds, a clearly perceptible indication should be given indicating that the device is responding. Again, the measurement of this time should begin starting at the completion of the driver's control input.

4. The device's response is clearly perceptible if it is obvious to the driver that a change has occurred in the device and that this change is the consequence of the input. If this change in the device resulting from an input is not always the same but depends on one or more previous inputs, it would be advisable to offer help (i.e., provide help if requested by the driver).

L. Disablement.

1. Devices providing non-safety-related information should provide a means by which the device can be turned off or otherwise disabled.

2. Devices providing dynamic (i.e., moving) non-safety-related visual information should provide a means by which that information cannot be seen by the driver. A device visually presenting dynamic non-safety-related information should make the information not visible by the driver through at least one of the following mechanisms:

a. Dimming the displayed information,

b. Turning off or blanking the displayed information,

c. Changing the state of the display so that the dynamic, non-safety-related information cannot be seen by a driver while driving, or

d. Positioning or moving the display so that the dynamic, non-safety-related information cannot be seen while driving.

M. Distinguish Tasks or Functions Not Intended for Use While Driving.

Devices should clearly distinguish between those aspects of a device that are intended for use by a driver while driving, and those aspects (e.g., specific functions, menus, etc.) that are not intended to be used while driving.

N. Device Status.

Information about current status and any detected malfunction within the device that is likely to have an adverse impact on safety should be presented to the driver.

VI. *TASK ACCEPTANCE TESTING.*

One of the following methods is recommended for task acceptance testing:

- Eye Glance Measurement Using Driving Simulator Testing (described in Subsection VI.E, below), or

• Occlusion Testing (described in Subsection VI.G, below).

A. Test Participant Recommendations.

1. These Test Participant recommendations apply to both Eye Glance Measurement Using Driving Simulator Testing and Occlusion Testing.

2. General Criteria. Each test participant should meet the following general criteria:

a. Be in good general health,

b. Be an active driver with a valid driver's license,

c. Drive a minimum of 3,000 miles per year,

d. Have experience using a cell phone while driving,

e. Be unfamiliar with the device(s) being tested.

3. Test Participant Impartiality. Test participants should be impartial with regard to the testing. To ensure fairness, test participants should not have any direct interest, financial or otherwise, in whether any of the devices being tested meets or does not meet the acceptance criteria.

a. NHTSA will not use any vehicle manufacturer employees in its Guidelines monitoring testing.

b. NHTSA considers it acceptable for vehicle manufacturers to test their own employees as long as the employees are unfamiliar with the product being tested.

4. Mix of Ages in Each Test Participant Sample. Out of each group of 24 test participants used for testing a particular in-vehicle device task, there should be:

a. Six test participants 18 through 24 years old, inclusive,

b. Six test participants 25 through 39 years old, inclusive,

c. Six test participants 40 through 54 years old, inclusive, and

d. Six test participants 55 years old or older.

5. Even Mix of Genders in Each Test Participant Sample. Each sample of 24 test participants used for testing a particular in-vehicle device task, should contain:

a. Twelve men and twelve women overall, and

b. An equal balance of men and women in each of the age ranges 18 through 24 years old, 25 through 39 years old, 40 through 54 years old, and 55 years old and older.

B. Test Participant Training Recommendations.

Each test participant should be given training as to how to operate the driving simulator or occlusion apparatus and how to perform each of the desired testable tasks using the electronic devices being evaluated.

1. These Test Participant Training recommendations apply to both Eye Glance Measurement Using Driving Simulator Testing and Occlusion Testing.

2. Test instructions should be standardized and be presented either orally or in writing. The display and controls of the interface should be visible during instruction. An instruction may be repeated at the request of a test participant.

3. Test participants should be given specific detailed instructions and practice as to how to perform each testable task of interest on each device being studied. A test participant should practice a task as many times as needed until they think that they have become comfortable in performing the task.

4. Test participants should practice each testable task on each device of interest first without using the acceptance test apparatus and then using the acceptance test apparatus.

C. Driving Simulator Recommendations.

1. A driving simulator is used for the Eye Glance Measurement Using Driving Simulator Testing option to determine whether driver operation of a device while performing a testable task produces an acceptable level of distraction. At a minimum, the driving simulator used for distraction testing should conform to the following recommendations. However, any driving simulator with better fidelity than recommended below is acceptable for performing task acceptance testing.

2. The driving simulator should be capable of testing using a substantial portion (the entire area that can be reached by a driver) of a full-size vehicle cab. Open cabs, partial cabs, and/or non-production cabs are fine to use for this testing as long as the driving simulator has a seating and dashboard arrangement similar to that of an actual production vehicle so that realistic eye glance behavior and control movements will occur.

3. To set up this portion of a vehicle cab for testing, no modifications should be made to the dashboard or human-machine interface other than:

a. The addition of sensors to determine steering wheel angle, brake pedal position, throttle pedal position, driver gaze location, and other desired data.

b. The addition of equipment to provide force feedback on the driving simulator's steering wheel, brake pedal, and throttle pedal. Linear feel steering and pedal feels are adequate.

c. The addition of equipment to display the forward speed to the driver. This may be accomplished either through use of the vehicle's speedometer or through a separate display. If forward speed is provided to the driver through a separate display, this display may be mounted:

• On the image display in front of the simulated vehicle, or

• On or above the dashboard.

4. The driving simulator should use information collected by the steering wheel angle, brake pedal position, and throttle pedal position sensors, along with an appropriate vehicle dynamics simulation, to predict vehicle orientation and position, angular and linear velocities, and angular and linear accelerations. A vehicle dynamics model with three degrees of freedom (lateral velocity, longitudinal velocity, and yaw rate) may be used. If more complex and accurate vehicle dynamics are desired, this is fine but not necessary.

5. The driving simulator should determine eye glance locations in one of two ways:

a. Through the use of an eye tracker, or

b. By collecting full-motion video data for each test participant's face and, subsequent to testing, a human data reducer determines from the video data the direction of a test participant's gaze at each instant in time.

Additional details about eye glance characterization are presented below.

6. The driving simulator should generate and display full-color (16 bit minimum color depth), true-perspective, three-dimensional (as viewed by the driver) computer-generated imagery of the forward road scene free from distracting anomalies, such as abrupt changes in scene content, aliasing problems in image processing, and abrupt changes in illumination, color, or intensity (i.e., no flickering or flashing).

7. This computer-generated imagery should be displayed in front of the simulated vehicle. The minimum recommended field-of-view should have a width of at least 30 degrees.

8. The recommended screen resolution should be no greater than 3 arc minutes per pixel.

9. The recommended driver eye point to screen distance should be at least 2.0 meters.

10. The computer generated image should be updated at least 30 times per second.

11. The time lag to calculate the computer generated imagery should not be more than 0.10 second. As a ''best practice,'' lead compensation should be provided to bring the driving simulator display into phase with the driver's perception.

12. The driving simulator should be capable of simulating the driving scenario described below.

D. Recommended Driving Simulator Scenario.

The driving simulator scenario described below is used for the Eye Glance Measurement Using Driving Simulator Testing option.

1. The road being simulated should:

a. Traverse generally open, flat terrain with occasional trees or buildings,

b. Be made of asphalt,

c. Be light gray in color,

d. Be undivided, four lanes wide, and have at least 1.0 meter (3.3 feet) of paved shoulders on each side of the traffic lanes,

e. Each lane should be 3.7 meters (12 feet) wide,

f. Have a solid double yellow line down the center of the road,

g. Have solid white lines on the outside edges of the road,

h. Have dashed white lines separating the two lanes that go in the same direction on each side of the road,

i. Be flat (no grade or road crown), and

j. Have a speed limit of 50 mph.

k. Each of the above white and yellow lines on the road should be from approximately 100 mm to approximately 150 mm (4 to 6 inches) wide.

l. For the solid double yellow line, the spacing between the two yellow lines should be from approximately 50 mm to approximately 100 mm (2 to 4 inches) wide.

m. The dashed white lines should each consist of a white/asphalt pattern consisting of approximately a 3 meter (10 foot) white line segment followed by approximately a 9 meter (30 foot) gap of asphalt before the beginning of the next white segment.

n. All test data collection is performed on straight road segments. However, the road being simulated may, if desired, contain occasional curved segments not in the area used for data collection.

2. The lead vehicle should look like a typical, production, passenger vehicle (automobile or light truck) and be of a color that contrasts with the background.

3. The driving scenario should proceed as follows:

a. The subject vehicle begins motionless in the right lane of the road.

b. Test participant accelerates vehicle up to approximately the speed limit.

c. After approximately 360 meters (1,200 feet) of travel, the lead vehicle, which is initially traveling at the speed limit, suddenly appears in the travel lane in front of the subject vehicle at a distance of approximately 70 meters (220 feet).

d. The subject vehicle then follows the lead vehicle for the remainder of the test. This is defined as the car following portion of the test.

e. During the car following portion of the test, the driver of the subject vehicle should try to maintain a following distance of approximately 70 meters (220 feet).

4. All testing is performed while driving in the right lane of the simulated road.

5. A test participant should begin performing testable tasks as soon as feasible after the start of the car following portion of the test.

6. The speed of the lead vehicle should be a constant 50 mph throughout the car following period of the test.

E. Eye Glance Measurement Using Driving Simulator Test Procedure.

1. Test Device. The electronic device under evaluation should be operational and fitted to a vehicle, driving simulator, or vehicle mock-up in a design which duplicates the intended location of the interface in the vehicle (i.e., the viewing angle and control placement relationships should be maintained).

2. Test Participants. Twenty-four test participants should be enrolled using the previously described (Subsection VI.A) criteria.

3. Each test participant should have the driving simulator's controls and displays explained to him or her, and be shown how to adjust the seat.

4. Each test participant should be given instructions on the driving scenario that he or she is to perform. These should include:

a. That he or she should drive in the right lane, and

b. That, as a driver, his or her primary responsibility is to drive safely at all times.

5. Each test participant should be told to drive at a speed of 50 mph prior to the beginning of car following. Each test participant should be told that, once in car following mode, he or she should try to follow the lead vehicle at as close to the initial following distance (approximately 70 meters or 220 feet) as he or she can manage.

6. Each test participant should be given training and practice as follows:

a. How to perform each testable task on each device of interest with the simulated vehicle parked. This training and practice may also be performed in a separate parked vehicle.

b. How to drive the driving simulator while not performing a testable task.

c. How to perform each testable task on each device of interest while driving the simulated vehicle on the driving simulator.

7. Each test participant should practice each testable task and simulator driving as many times as needed until he or she become comfortable in performing the task and driving the simulator.

8. Different task stimuli (e.g., addresses, phone numbers, etc.) should be used for each instance of testable task performance for a particular test participant. Task stimuli should be provided to a test participant immediately prior to the beginning of each instance of testable task performance.

9. Following the completion of training, each test participant should drive the driving scenario one final time while performing a single instance of the *testable task* being studied (the Data Trial). Eye glance data should be collected during this trial. Data from this performance of the testable task is used to determine whether a task meets the acceptance criteria.

10. Results from individual testable task trials are only removed from analysis if:

- A test participant refuses to complete a trial,
- A test participant says he or she is done with a trial but is not, or
- The experimenter judges that the participant cannot successfully complete a trial.
- The experimenter judges that the participant is not genuinely doing their best to perform the protocol and related tasks as instructed.

When any of the above occurs, it is treated as a task performance error and handled as discussed in Subsection VI.H.

11. There should be a means of determining the exact time of the start and end of each testable task that is performed.

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.

13. Eye Glance Characterization. Eye glances are determined for each test participant's Data Trials using the techniques described below.

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.

c. For at least 21 of the 24 test participants, the sum of the durations of each individual participant's eye glances away from the forward road scene is less than or equal to 12.0 seconds while performing the testable task one time.

F. Eye Glance Characterization.

While driving the simulator and performing the testable task, the duration of each test participant's eye glances away from the forward roadway should be recorded and determined.

1. The duration of an individual glance is determined as the time associated with any eye glances away from the forward roadway. Due to the driving scenario, eye glances to the side of the roadway or to the vehicle's mirrors are expected to be minimal.

2. Eye glance durations should be determined in one of two ways:

a. Through the use of an eye tracker, or

b. By collecting full-motion video data for each test participant's face and, subsequent to testing, a data reducer determines from the video data the direction of a test participant's gaze at each instant in time.

3. Ensuring Eye Tracker Accuracy and Repeatability. If an eye tracker is used, the testing organization should have a procedure for ensuring the accuracy and repeatability of eye glance durations. This will require collecting relatively short segment(s) of full-motion video data and having a data reducer determine from this video data the duration of a test participant's eye glances. The testing organization should also have a written procedure for setting up and calibrating the eye tracker.

4. Ensuring Full-Motion Video Reduction Accuracy and Repeatability. If full-motion video is used, the testing organization should have a procedure for ensuring the accuracy and repeatability of eye glance durations. This will involve having multiple data reducers analyze the same, relatively short segment(s) of full-motion video data and checking that they obtained the same glance durations. The testing organization should also have a written procedure for instructing and training data reducers as to how to determine eye glance durations. To the extent possible, data reducers should not have an interest as to whether a testable task or device being tested meets the acceptance criteria. Data reducers should not be closely involved with the development of a device.

G. Occlusion Testing.

1. Test Apparatus. Intermittent viewing of an electronic device interface can be provided by a variety of means such as commercially-available occlusion goggles, a shutter in front of the interface, or other means.

a. The occlusion apparatus used should be transparent during the viewing interval and opaque during the occlusion interval.

b. The occlusion apparatus should be electronically controlled.

c. During the occlusion interval, neither the electronic device interface displays nor the device controls should be visible to a test participant.

d. During the occlusion interval, operation of the device controls by a test participant should be permitted.

e. The switching process between the viewing interval and the occlusion interval should occur in less than 20 milliseconds and vice versa.

2. Test Device. The electronic device under evaluation should be operational and fitted to

a vehicle, driving simulator, or vehicle mock-up in a design which duplicates the intended location of the interface in the vehicle (i.e., the viewing angle and control placement relationships should be maintained).

3. Test Participants. Twenty-four test participants should be enrolled using the previously described (Subsection VI.A) criteria.

4. Each test participant should be given training and practice as follows:

a. How to perform each testable task on each device of interest without using the occlusion apparatus.

b. How to drive the occlusion apparatus while not performing a testable task.

c. How to perform each testable task on each device of interest while using the occlusion apparatus.

5. Each test participant should practice each testable task and use of the occlusion apparatus as many times as needed until he or she becomes comfortable in performing the task and using the occlusion apparatus.

6. Different task stimuli (e.g., addresses, phone numbers, etc.) should be used for each instance of testable task performance for a particular test participant. Task stimuli should be provided to a test participant immediately prior to the beginning of each instance of testable task performance.

7. Test Procedure. Testing is performed in accordance with ISO International Standard 16673:2007(E), ''Road vehicles—Ergonomic aspects of transport information and control systems—Occlusion method to assess visual demand due to the use of in-vehicle systems'' with the following exceptions:

a. Where the ISO Standard states that at least 10 participants are to be tested, the NHTSA Guidelines recommend that 24 participants be tested.

b. Where the ISO Standard states that each test participant should be given at least two and up to five practice trials for each testable task, the NHTSA Guidelines recommend that each test participant receive as many practice trials as needed to become comfortable in performing the task.

8. The viewing interval (shutter open time) should be 1.5 seconds followed by a 1.5-second occlusion interval (shutter closed time). The sequence of viewing intervals followed by occlusion intervals should occur automatically without interruption until the task is completed or the trial is terminated.

9. Task stimuli (e.g., addresses, phone numbers, etc.) are provided to a test participant prior to the start of testing. When the task stimuli are given to a test participant, the device should be occluded (i.e., a test participant cannot see the device interface) and it should remain occluded until after testing has begun.

11. Testing starts when a test participant informs the experimenter that he or she is ready to begin the trial. The experimenter then triggers the alternating sequence of viewing intervals followed by occlusion intervals.

12. When a test participant has completed the task, he or she verbally instructs the experimenter that the task has been completed with the word, ''done'' (or other standardized word). The experimenter stops the occlusion apparatus operation.

13. There should be an automatic means of recording the number of unoccluded intervals a test participant needed to complete the task.

14. Each test participant performs each task being tested five times to determine whether that task meets the acceptance criterion.

15. As per ISO 16673:2007, invalid trials are removed. Note that unoccluded total task time is not determined as part of this test procedure. Therefore, the occluded total task time greater than four times the average unoccluded total task time trial exclusion case in ISO 16673:2007 cannot be used. Individual trials are considered invalid and removed if:

- A test participant refuses to complete a trial,
- A test participant says he or she is done with a trial but is not,
- The experimenter judges that the participant cannot successfully complete a trial,
- The experimenter judges that the participant is not genuinely attempting to perform the protocol and related tasks as instructed, or
- A task performance *error* is made by the test participant. The handling of task performance *errors* is discussed in Subsection VI.H.

16. As per ISO 16673:2007, the mean Total Shutter Open Time (TSOT) for each test participant is calculated.

17. Acceptance Criterion. A task should be locked out for performance by drivers while driving unless the mean TSOT calculated above is 12.0 seconds or less for at least 21 of the 24 test participants.

H. Task Performance Errors During Testing.

1. ''Error-Free'' Performance During Testing. During testing, only data from ''error-free'' test trials (as defined in section IV.B.5 and IV.B.6) performed by test participants should be used for determining whether a task is suitable for performance while driving.

2. *Error* means that a test participant has made an incorrect input when performing a requested task during a test trial. An error has occurred if the test participant has to backtrack during performance of the task or delete already entered inputs. If the device can accommodate an incorrect entry without requiring backtracking and extra inputs beyond those necessary to reach the desired end state of the task, then no error is deemed to have occurred.

3. For driving simulator testing, when an error is made, data from that test participant should not be used to determine task acceptability for performance while driving. This data would be retained for the determination as to whether a task was unreasonably difficult. An additional test participant in the correct demographic group should be added. Testing should continue until 24 test participants have completed the task without errors (or until four test participants do not meet the acceptance criteria).

4. For occlusion testing, when an error is made, data from that trial should not be used to compute a test participant's mean TSOT to determine task acceptability for performance while driving. This data would be retained for the determination as to whether a task was unreasonably difficult. If a test participant makes errors on two or fewer of their five trials, then their average Total Shutter Open Time (TSOT) can still be computed and used to determine task acceptability for performance while driving. If a test participant makes errors on three or more of their five trials, then none of his or her data should be used to determine task acceptability (but all of it retained to determine whether a task was unreasonably difficult). In this situation, an additional test participant in the correct demographic group should be added. Testing should continue until 24 test participants have completed the task with two or less trials with errors (or until four test participants do not meet the acceptance criteria).

5. Unreasonably Difficult Tasks. A record should be kept during testing as to whether one or more errors occurred during each test trial. If errors occur during more than 50 percent of test trials while testing to determine a task's acceptability for performance while driving, then that task is deemed an ''unreasonably difficult task'' for performance by a driver while driving. Unreasonably difficult tasks are not recommended for performance while driving and should be locked out.

VII. *RECOMMENDATIONS FOR PASSENGER OPERATED DEVICES.*

These Guidelines primarily are applicable to human-machine interfaces of devices intended for use by a driver. They are applicable to a limited extent to devices intended for use by front seat passengers.

A. Apply if Within Reach or View of Driver.

These Guidelines are applicable to devices that can reasonably be reached and seen by a driver who is properly restrained by a seat belt even if they are intended for use solely by front seat passengers.

B. Not for Rear Seat Devices.

These Guidelines are not applicable to devices that are located solely behind the front seat of the vehicle.

VIII. *DRIVER DISTRACTION GUIDELINES INTERPRETATION LETTERS.*

NHTSA intends to clarify the meaning of its Guidelines in response to questions that are asked through the issuance of interpretation letters.

A. Guideline Interpretation Letter Procedure.

1. Guidelines interpretation letters will only be issued in response to specific written requests for interpretation of the NHTSA Guidelines.

2. Requests for Guidelines interpretation letters may be submitted to the National Highway Traffic Safety Administration. The mailing address is:

Chief Counsel
National Highway Traffic Safety Administration
1200 New Jersey Ave., SE.
Washington, DC 20590

3. Responses will be mailed to requestors, published in the docket, and posted in a designated area on the NHTSA Web site.

Issued in Washington, DC, on: April 19, 2013. Under authority delegated in 49 CFR 1.95.

David L. Strickland,

Administrator.

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