



SURFACE VEHICLE RECOMMENDED PRACTICE

J2678™

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Superseding J2678 AUG2004

Navigation and Route Guidance Function Accessibility While Driving Rationale

RATIONALE

On June 18th, 2015, SAE document, J2364 – *Navigation and Route Guidance Function Accessibility While Driving* was stabilized, and will serve as a historical reference.

Since then, J2365 – *Calculation and Measurement of the Time to Complete In-Vehicle Navigation and Route Guidance Tasks* was recently updated, balloted, and published on July 12th, 2016. In this extensive revision of J2365, the static measurement method from J2364 was added, as well as the inclusion of all the rationale material from J2678.

Therefore, there is no need for SAE to maintain J2678 any longer. Once this document is 'cancelled,' then SAE can refer anyone interested in J2678 to instead to the newly revised J2365 document.

CANCELLATION NOTICE

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Introduction

This document provides the rationale used by the Navigation Function Accessibility Subcommittee (the Subcommittee) for the development and content of the SAE J2364 Recommended Practice: Navigation and Route Guidance Function Accessibility While Driving. It provides both the reasoning for the overall recommended practice as well as each of its elements.

Why Does the ITS Safety and Human Factors Committee Develop In-Vehicle Navigation Practices?

Scope of ITS SHF Committee

The scope of this standard activity is clearly within the purview of this committee. This section explains how the committee fits into the larger SAE structure. The Society of Automotive Engineers has a number of missions that are represented by the 7 primary boards reporting to the Executive Board. One is the Technical Standards Board. Its mission is described in the SAE Technical Standards Board Governance Policy (revision of April 18, 2002 (<http://www.sae.org/technicalcommittees/tsbpolicy.pdf>)). On page 6, item 2.1, Job Products are defined as: Globally accepted standards and related products, recommended practices, information reports, draft technical reports, and aerospace materials specifications, reference materials, and engineering aids.

Reporting to the Technical Standards Board is the ITS Council. “The ITS Council is responsible for leading and coordinating SAE's industry consensus standards development in the area of Intelligent Transportation Systems. Council activities focus primarily on ITS standards topics related to road vehicles. This includes ITS standards related to in-vehicle hardware, software, and data; to the safe and effective operation of in-vehicle ITS applications and devices; and to the vehicle's operational and communications environment.”

The SAE ITS Safety and Human Factors Committee (the Committee) is under the ITS Council and Technical Standards Board. It develops ITS standards as delineated in the Committee scope statement, "Human Factors is a cross-cutting discipline that has applications to the design, operation, and evaluation of the human-machine interface elements in vehicle and infrastructure systems. The ITS Safety & Human Factors Committee considers methods for defining, developing, and evaluating human-machine operating characteristics for advanced vehicle systems. The Committee addresses issues of interface design, driver workload, safety, system complexity, ease of use, and the response of drivers to automatic control systems, especially with regard to risk compensation. This Committee also provides input to the work of ISO/TC22/SC13" (http://forums.sae.org/access/dispatch.cgi/_team/tHomePage/TEITSSHF).

Brief background of this Recommended Practice

In 1997 the ITS Safety and Human Factors Committee identified Navigation Function Accessibility as a high priority for standard development. The Subcommittee was formed to create a standard (i.e., Recommended Practice) to define the boundaries of safe operation and usability for driver interaction with a navigation system. U.S. DOT via SAE funded a report (Green, 1999c) to analyze and summarize the literature, contribute to the overall rationale for the development of SAE J2364 and create a draft document. In addition, at the request of the Chair of the SAE ITS Safety and Human Factors Committee, a proceedings paper was written (Green, 1999d) summarizing the then current draft of J2364 and its rationales.

The creation of this Rationale document has been the result of subsequent debate within the Subcommittee over several years, as well as input from the Safety and Human Factors Committee. As part of that process, new research results have been incorporated in J2364 and the requirements have been enhanced. In late 2002, a draft of J2364 was circulated to the entire Committee for comment and those written comments have been responded to point by point. Those comments led to further improvements in both the J2364 draft and Rationale. The development of the Rationale was beneficial in establishing consensus support for J2364 within the Subcommittee. Furthermore, the Rationale was intended to assist members of the full Committee when voting on the ballot of J2364.

In parallel with the development of J2364 a companion Recommended Practice, J2365 Calculation of the Time to Complete In-Vehicle Navigation and Route Guidance Tasks, was developed and approved.

How Does Recommended Practice J2364 Relate to the Alliance Guidelines and the ISO TC22/SC13/WG8 New Work Item?

As shown in the table that follows, Recommended Practice J2364 provides a useful supplement to the principles and procedures in Article 2 of the Alliance of Automobile Manufacturers (the Alliance) Guidelines Version 3.0 (Driver-Focus Working Group, 2003). It should also assist the U.S. in providing input to an ongoing ISO TC 22/SC13/WG 8 work item ("Occlusion method to assess visual distraction due to the use of in-vehicle information and communication systems") which parallels the Interrupted Vision Method in the draft of J2364.

The four methods shown in Table 1 are generally complementary yet each has unique contributions. J2364 is limited to visual-manual navigation systems, while the The Alliance Guidelines apply to all visual-manual Telematics systems. The Static Method proposed in J2364 is intended to be used early in the design stage, together with other human factors methods and assessment procedures. J2365 can be used to estimate the static task time used in J2364. Three of the four methods incorporated the interrupted vision procedure. In addition, the Alliance guidelines have alternative principle 2.1b which involves operating the complete driver interface in a driving simulator or on the road, and comparing driver/vehicle response and performance to that with an alternative reference task which has "a comparable number of required, sequential interactions". This latter procedure (2.1b) could be used when a working model or prototype is available for evaluation.

TABLE 1—RELATIONSHIP OF METHODS

Development phase	J2365	J2364 (draft)	Alliance Guidelines Version 2.1	WG8 New Work Item
Preliminary (concept only) ↓	Calculation to predict static task time			
Early (first mockup or computer simulation) ↓		Static Method		
Mockup or prototype ↓		Interrupted Vision Method	2.1a, Glance Behavior	Occlusion Method
Mature design			2.1b, Reference Task	

General Principles

#	Principle	Requirement	Comment
1	Comply with U.S. and State laws	Must	All SAE Standards and Recommended Practices must be consistent with regulations.
2	Achieve a consensus in the Subcommittee and the S&HF committee.	Must	SAE develops consensual standards, thus all viewpoints were heard and deliberated.
3	Comply with SAE rules for document format (TSB 101).	Must	This includes section numbers and titles, the content of sections, referencing SAE documents, etc. Existing literature was critical to the development of this Recommended Practice. However the deliberations did lead to additional research by interested organizations and that was helpful to the development of this Recommended Practice.
4	Minimize driving risk	Should	There were several different perspectives considered by the Subcommittee: (1) to do no harm or (2) to do no additional harm or (3) to not increase risk from that generated by a conventional in-vehicle secondary task that is assumed to be commonly accepted, i.e., a normally acceptable risk as with current in-vehicle devices (e.g., radio). Other options discussed included do minimal harm, be absolutely safe, be generally safe, do more good than harm, etc. (The SAE Technical Board, as matter of SAE policy, should consider further clarification of the criteria for Standard of Care to be used by SAE standards developers. Clarity on this matter by SAE might have accelerated the development of J2364.) Much consideration was given to defining an acceptable level of risk consistent with currently available in-vehicle devices.
5	Be consistent with safety and human factors design practices	Should	For example, design for largest practical proportion of the population. Example: motor vehicle occupant packaging accommodating at least the 5th percentile female to the 95th percentile male (Reynolds, 1993).
6	Be consistent with good automotive engineering practice	Should	Good engineering practice includes other SAE standards, recommended practices, and information reports, ISO standards, industry guidelines and other documents. For example: ISO/IEC Guide 51 (ISO/IEC TAB Safety N31 draft January 1997), Safety Aspects-Guidelines for their inclusion in standards, section 6 (the risk reduction process) states the following, "When developing a standard, it is the task of a committee, to consider both the intended use and the reasonably foreseeable misuse of a product, process, or service." (Emphasis in the original document).
7	Be consistent with the safety and human factors literature	Should	Key decisions should be supported by research and data where they exist.
8	Do not make the test procedure unduly difficult to accomplish	Should	This includes not requiring sophisticated test equipment (e.g., instrumented vehicles), or highly trained test administrators when a suitable alternative can be developed. A complex and costly procedure is more difficult to incorporate in design development and is less likely to be completed.
9	Make the document easy to understand	Should	Understandable procedures are more likely to be carried out correctly.
10	Make the document complete	Should	The Recommended Practice should stand alone and contain all the pertinent information for the practitioner.
11	Do not unduly restrict product development	Should	To maximize flexibility and creativity in product design, a performance standard, not a design standard, was created.

Specific Criteria

1. Scope

This Recommended Practice applies to both Original Equipment Manufacturer and aftermarket route-guidance and navigation system functions for passenger vehicles. It establishes two alternative procedures, a static method and an interrupted vision method, for determining which navigation and route guidance functions should be accessible to the driver while the vehicle is in motion. These methods apply only to the presentation of visual information and the use of manual control inputs to accomplish a navigation or route guidance task. There are currently no compelling data that would support the extension of this recommended practice to in-vehicle systems other than navigation systems.	Why both OEM and aftermarket?	Consistent with SAE practice, if a driver uses a system, its origin of manufacture does not matter. There is widespread agreement for standards not to distinguish between OEM and aftermarket products.
	Why only route guidance and navigation systems?	There has been a great deal of debate about the scope of this document. At this point, the preponderance of research used to develop this recommended practice concerns use of navigation and route guidance systems. There is much less data available on other applications. The approach is to develop J2364 for navigation at this time. As more data become available, the applicability of J2364 to other systems should be reviewed.
	Why total task time?	Task time is easily understood and easily measured. There is a logical argument that the longer a driver is engaged in a secondary task, the greater the likelihood that the secondary task will interfere with driving (exposure to risk). There is considerable evidence (Green 1999; Farber, et. al. 2000; Curry, Greenberg & Blanco, 2002; Bhise, Dowd & Smid, 2003) that there is a strong correlation between task time and total glance time. Total glance time is an accepted surrogate of driver workload (Zwahlen, Adams, and DeBald, 1986; Wierwille, 1993). Task time is the most widely cited metric for usability (Rubin, 1994).
	Why is visual monitoring excluded?	Visual monitoring does not require a control input and the focus of the recommended practice is on interaction with a navigation system's controls and displays. In addition it is difficult to define the beginning and end of a visual monitoring task as there is no required overt movement to either initiate or terminate the monitoring.
	Why is voice excluded?	Evidence (e.g., Tijerina, Parmer, and Goodman, 1998; Garrott, Mazzae, and Ranney, 2002; Tsimhoni, Smith, and Green, 2002) indicates that the visual demands of voice interfaces are quantitatively different. Driver use of voice systems is not as well understood as visual-manual systems.
	Why is passenger operation excluded?	Since the passenger is not driving the vehicle, distraction of a passenger by a navigation system interaction has no major safety implications for vehicle operation.

2. Normative References Applicable Publications

The following Standards and Recommended Practices contain provisions that are referenced in this text and therefore are provisions of SAE J2364. At the time of publication, the editions listed were current. All recommended practices are subject to revision, and parties to agreements based on this section of J2364 are encouraged to investigate the possibility of applying the most recent editions of the standards listed in this section.	SAE requirement
SAE J287—Driver Hand Controls Reach, Volume 3 SAE J1050—Describing and Measuring the Driver's Field of View, Volume 3 SAE J2396—Definitions and Experimental Measures Related to the Specification of Driver Visual Behavior Using Video Based Techniques SAE J2365—Calculation of the Time to Complete In-Vehicle Navigation and Route Guidance Tasks	These are the cited SAE practices.

3. Definitions

3.1 Accessible by the Driver Feature is accessible by a driver when: 1. the controls to complete the task are within reach of the unconstrained driver as defined by SAE J287; and 2. the display is visible with head movement as defined by SAE J1050; and 3. the system is operable by the driver.	The recommended practice concerns the driver engaging in a secondary task while driving.
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3.2 Computationally-Interrupted Task Task where the driver must wait 1.5 seconds or more for the driver interface to respond to a driver input in order to complete a task such as when an off-board computer is queried. (See Section 5 for measurement procedure.)	This is the same definition used in the companion calculation procedure, SAE Recommended Practice J2365. Task completion times should reflect the time drivers actually attend to a task. There are at least 2 instances in which computational interrupts are an issue: waiting for an on-board system to complete a computation (e.g., a route), or waiting for routing criteria to be communicated to a remote computer, determined, and communicated back (often by a radio or cell phone link). During those time periods, it is unlikely that drivers will continue to stare at a display waiting for feedback. The 1.5 seconds is a compromise time that may be sufficient for the driver to interpret as simple feedback that it is processing data. Also, the 1.5 second time can represent a single glance or possibly 2 sub-maximum check glances. Experience has shown that people check in-vehicle displays for task progress even when the task can be accomplished using auditory feedback alone.
3.3 Control Device used to enter information into a vehicle system.	A similar definition is used in the companion calculation procedure, SAE Recommended Practice J2365.
3.4 Display Device that presents information to a driver, typically by visual or auditory means	This is the same definition used in the companion calculation procedure, SAE Recommended Practice J2365.
3.5 Driver Interface Means by which a driver interacts with a vehicle or vehicle subsystem. Note: The driver interface typically includes one or more controls and/or displays, as well as the system's operating logic.	A similar definition is used in the companion calculation procedure, SAE Recommended Practice J2365.
3.6 Glance Duration Time from the moment at which the direction of gaze moves towards a target (e.g., the interior mirror) to the moment it moves away from it. Note: This includes transition time to that target per J2396.	Same definition used in J2396.

3.7 Goal System end state sought by a driver. Examples include: obtaining guidance to a particular destination; providing greater magnification of a map display; determining the location of a point of interest; and canceling route guidance. Example of what is not a goal: Entering part of a destination address without having the route calculated for that does not achieve the system end state of being provided with route guidance.	This is the same definition used in the companion calculation procedure, SAE Recommended Practice J2365. This definition is consistent with the standard citation in the human factors literature (John and Kieras, 1996, p 322) “1.2.1 Goals. Goals are what the user has to accomplish. The common sense meaning of the term applies here; a goal is the ‘end toward which effort is directed.’” A system end state is the completion of an entire sequence and not the completion of an intermediate state of the sequence of steps which together define the task. To treat an intermediate state of a sequence of actions as a goal misrepresents the task. If the intermediate states are short enough, then the driver cannot be overloaded, a premise contrary to the crash data and the human factors literature.
3.8 Navigation System System that identifies the current position of a vehicle on the earth’s surface and may provide guidance to a destination. Note: Information that may be provided includes the road being driven, the location of cross roads, the heading or compass directions, the distance to a destination, and other items.	This is the same definition used in the companion calculation procedure, SAE Recommended Practice J2365.
3.9 Occlusion Interval Time a driver display or interface is not visible. Note: This can be the shutter closed time using occlusion goggles, or the time the display is not available if display blanking is used.	The definition is consistent with the occlusion literature (Goujon, 2001; Krems, et al., 2000; and Weir, Chiang, & Brooks 2003).
3.10 Occlusion Total Shutter Closed Time Total time that the view of the display is occluded. Note: Occlusion can be either by physical means or display blanking, during a trial. Note: This is the sum of the total shutter closed times during a trial.	The definition is consistent with the occlusion literature (Goujon, 2001; Krems, et al., 2000; and Weir, Chiang, & Brooks 2003).
3.11 Occlusion Total Shutter Open Time Sum of the total shutter open times during a trial.	The definition is consistent with the occlusion literature (Goujon, 2001; Krems, et al., 2000; and Weir, Chiang, & Brooks 2003).
3.12 Occlusion Total Task Time Total time required to complete a given task using the Interrupted Vision method.	The definition is consistent with the occlusion literature (Goujon, 2001; Krems, et al., 2000; and Weir, Chiang, & Brooks 2003).