Potential Expansion of the 15-Second Rule

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Introduction

SAE Recommended Practice J2364, commonly known as the 15-Second Rule for Total Task Time or the 15-Second Rule, specifies the maximum time allowed (15 seconds) for completing a navigation system task involving manual controls and visual displays when the task is performed statically. The scope of the rule (Society of Automotive Engineers, 2000) reads as follows:

"This Recommended Practice applies to both Original Equipment Manufacturer and aftermarket route-guidance and navigation system functions for passenger vehicles. It establishes a design limit for the total task time for the presentation of visual information and the manual control inputs associated with navigation functions accessible by the driver while the vehicle is in motion. The Recommended Practice does not apply to voice-activated controls or to passenger operation." Section 4 (function accessibility criterion) states, "Any navigation function that is accessible by the driver while a vehicle is in motion shall have a static total task time of less than 15 seconds."

Recently, Tijerina, Johnston, Parmer, Winterbottom, and Goodman (2000) have presented research results pertaining to that rule along with a commentary. They are to be commended for their effort to collect data relating to the 15-second total task time rule and provide a stronger scientific basis for safety standards. However, they have drawn conclusions about the rule that go beyond its stated scope, though their thoughts provide useful insights into how the standard might be expanded.

How broadly can the rule be applied to other systems (and how can it be extended)?

The scope of the rule specifically states it is limited to navigation systems. The data on which the rule was based (see Green, 1999b) involved the analysis of tasks concerned with the operation of controls that required visual guidance. Typically, the eyes-off-the-road time for those tasks was approximately 60% to 75% of the total task time, or roughly 10 seconds (2/3 of 15 seconds). These tasks are structurally similar to navigation system data entry, though the navigation task sequences are much longer. The rule could be applied to other systems that have similar task characteristics and use the same modalities, but cannot be applied to any task. The 10 second total for eyes-off-the-road time, however, can be applied more broadly.

As an approximation, many of the common tasks of interest fall into 3 basic categories: (1) tasks that are predominantly visual, such as reading a map, (2) tasks that are predominantly manual but have significant visual components, such as destination entry, and (3) tasks that are predominantly manual, but have some visual aspects, such as dialing a hand-held cellular phone or operating a turn signal.

For the predominantly visual tasks, there may be single terminating switch operation, but some situations may only involve visual search. In those cases, the total eyes-off-the-road time and the total task time are approximately equal. Given the fundamental difference between those types of tasks and those covered by the 15-second rule, and the concept on which the 15-second rule was based (10 seconds of eyes-off-the-road time), a maximum task time on the order of 10 seconds could be reasonable in that case. This time, and others offered in this note should <u>not</u> be viewed as precise values supported by an extensive literature review, but reasonable first-cut engineering estimates useful for design and values that can serve as a starting point for broadening the maximum task time rule.

For tasks that are highly manual and well learned, much of the data entry is performed without looking at the device, though there are occasional glances to check that manual operations are correct. For example, the author's impression is that for thumb dialing of a hand-held cell phone, eyes-off-the-road time is about half or less of the static total task time. Consistent with the prior logic, this suggests a maximum allowable task time of double or more the 10 second limit on eyes-off-the-road time, or roughly 20 seconds, though a more careful examination of the literature might support other values (say 18 seconds or 25 seconds). For other mounting locations of cell phones, where the task could be performed differently, other limits may be appropriate.

Clearly, the appropriate times for these situations deserves further investigation, and based on those investigations, the times should be refined. However, the key point is that the 15-second limit was specifically intended for navigation systems (with visual displays and manual controls), and application to interfaces and tasks with dissimilar visual demands, such as cell phone dialing, is inappropriate. But, there are extensions of the 15-Second Rule to fit other situations.

How broadly can the rule be applied to other modalities?

The rule was developed because of concerns that interacting with manual controls and visual displays impose visual demands that distract drivers from looking at the road. In contrast, the visual distraction of voice systems is relatively low, and for them use of the 15-second rule is inappropriate. However, as Tijerina, Parmer, and Goodman (1998) have shown (for the case of the Clarion voice-operated navigation system), eyes-off-the-road time is about 1/3 of total task time. One possible interpretation of this rule would be that a maximum allowable task time for voice-entry tasks should be 30 seconds (3 times 10 seconds). However, the Tijerina, et al. (1998) data also shows that the mean glance times are much shorter than those for manual entries, suggesting that the 30 second limit could be low.

Thus, extension of the 15-second limit to beyond navigation systems with manual controls and visual displays should be done with great care, and if anything, the limited literature available suggests that other time limits may be appropriate.

Given these comments, how should one view the findings presented in Tijerina, Johnston, Parmer, Winterbottom, and Goodman (2000). In brief, they conducted an experiment on a test track in which 10 drivers matching the demographics of the test protocol specified in SAE J2364 entered destinations using various methods (some manual, some voice), tuned a radio, and dialed a cell phone. Based on a signal detection analysis of the data, they reported "the diagonostic sensitivity of the static completion time measures is close to nil" (page 57). This comment is based on the selection of lanekeeping as a perfectly predictive safety criterion, a selection deserving further debate. Table 1 below shows the data used to arrive at that conclusion. If the voice entry (VAAN) task and cell phone task are removed from the table, interfaces to which the 15-second rule does not apply, the classification capability of the rule looks even better. If strictly applied (in which case the HVAC adjust and radio tuning tasks are deleted), the predictions are perfect, but of course this assumes that the lane keeping data sampled are the ultimate truth.

Table 1. Tijerina, et al. (2000) Findings-Tasks Within the Scope of J2364 Are Shown in Bold

		Lanekeeping problems on track	
		No	yes
15-Second Rule violated	no	True negatives HVAC adjust	False negatives Radio tune, AM
	yes	False positives Cell phone dial, home VAAN address entry VAAN intersection entry VAAN POI entry Radio tune, FM	True positives Cell phone dial **Alpine address entry** **Alpine interesection entry** **Alpine POI entry** **Delco POI entry** **Zexel address entry** **Zexel intersection entry** **Zexel POI entry**

Is the collection of eye glance data feasible and what will be its impact on product design?

Tijerina, et al. (2000) argue that obtaining data on the number of eye glances by direct recording of the driver's face is not that difficult, an approach that is much easier than using a typical corneal reflection eye fixation recording system. However, even the direct recording approach requires a fully operational navigation system or a high fidelity simulation of one, something that might not be available until late in the design phase (at best). For many manufacturers, the devices used for testing are preproduction prototypes, interfaces so close to production that only minimal changes can be made and for which a commitment to production has already been made. Hence, in many situations, data collected using eye glance schemes occur too late in production to have any immediate impact, though they can be of value in the long term. In contrast, compliance with the 15-Second Task Time Rule could be checked using the calculations procedures in SAE J2365 (Green, 1995a), calculations that only require a description of the design, a paper prototype, or even a back-of-the-envelope sketch. Such information is available very early in design, when changes are easy to make. Furthermore, such calculations can be made fairly quickly, and in situations where the task sequence has been coded in a spreadsheet, some interface modifications potentially could be evaluated in minutes.

How good are the modified GOMS estimates?

Quite correctly, Tijerina, et al. (2000) point out that there are assumptions of GOMS analysis that may not be true for driver interfaces such as error-free performance, though they provide no supporting data. Should correcting for errors be a common occurrence, completion times for those sequences can be computed, and based on their probability, used to compute a weighted mean time. A simpler computational solution is to add an error correction overhead, say 25%. The author's experience in using J2365 estimates have been positive but limited. In recent work for 1 sponsor (1 test case so far, currently proprietary), calculations made using the J2365 gave accurate estimates of task times measured using the empirical procedure in J2364. Pending sponsor approval, this analysis (and others) could be released in the near future.

Conclusions

The author believes that the 15-Second Total Task Time Rule is supported by the literature for the purpose for which it was intended, using manual controls and visual displays associated with navigation systems. Limited experience to date shows that task time estimates determined using the procedures in J2365, a modified GOMS model, are reasonable for determining compliance with the 15-Second Rule. Thus, SAE J2364 and J2365 make sense as they are now and should be used to evaluate the safety and usability of navigation systems.

There is clear interest in expanding the scope of J2364 to cover other types of interfaces and tasks. For tasks that are visually intensive, a 10-Second Total Task Time Rule may be appropriate. For tasks that are highly manual, a 20-Second Rule might be appropriate. For tasks involving voice input, a 30-Second Rule may be appropriate. However, before proceeding with these suggestions, further review of the literature and additional research are desired.

As a practical matter, the development of an expanded SAE recommended practice, especially without a funded consultant to complete the background work, could take as long as the development of the current version of J2364, close to 4 years. Waiting an additional 4 years before releasing a driver interface safety standard presents an unacceptable risk to the driving public. Therefore, SAE J2364 should be published as is, with enhancements broadening the scope (such as those described here) to be included in a future revision.

References

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