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Assessing Distraction Risks of Driver Interfaces

Developed by the Technology & Maintenance Council's (TMC)
Driver Distraction Assessment Task Force

ABSTRACT
Technological advancements in truck technology have increased driver distraction. This information report offers a process by which fleets may assess the potential for driver distraction associated with the acquisition of new technologies.

Technological advancements in truck technology have increased driver distraction. This information report offers a process by which fleets may assess the potential for driver distraction associated with the acquisition of new technologies. This document applies primarily to aftermarket devices which include some type of human- machine interface. It can, however, be applied to new original equipment manufacturer (OEM) interfaces as well.

INTRODUCTION
In order to assess whether a new device may pose an unacceptable risk of distracting the driver, one must first understand what attention *is*. For the purposes of this document, attention is defined as the observant consideration of an object or activity in order to accomplish a task.

When a driver attempts to attend to more than one thing at a time, his or her attention becomes divided. Of particular concern in the trucking industry is the primary task of driving. If a secondary task, such as communications, is too demanding, the driver may become distracted from his or her primary task of driving. In a different scenario, there is not a single distraction, but instead there are many smaller, specialized in-vehicle information systems (IVIS). The concern exists that the sum of many less significant systems could cause the driver to become fatigued and/or distracted and degrade his/her driving ability.

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There are several human-machine interface guidelines available for the manufacturers and designers of IVIS. This report attempts to help fleet managers ask the right questions to assess whether a proposed IVIS poses a significant risk of distracting the drivers in their particular operational environment. This document also includes some basic descriptions of tests that may be mentioned by suppliers and provides definitions for some terms commonly used in discussions of driver distraction.

This document can be applied to a wide variety of driver interfaces; therefore, it is general. There will be questions that do not apply to every system, just as there undoubtedly will be some important issues for your fleet, which are not specifically addressed. Consider your unique situation as well as the system under consideration, then select the questions that are relevant.

RECOMMENDED QUESTIONS PRIOR TO TECHNOLOGY PURCHASE

The Task

1. How do drivers meet this need now, without the system?
2. How does this system change the way the driver accomplishes the task?
3. What do drivers need or want this system to do? Service Technicians? If only one needs it, is it transparent to the other?
4. What changes in driving behavior should I expect as a result of adding this device to our fleet?
5. What are the likely conflicts between system use and normal/safe operation of the vehicle?

Attention Issues

6. What is the task(s) duration?
7. How much attention does this take away from the driving task?
8. Are there any potential negative consequences of using this device? (Risk escalation, increased driver fatigue, etc.)

Location Issues

9. Where do you recommend locating this device and why?
10. Where do you recommend locating the HMI (driver interface and service technicians' interface)? Are there alternative locations? Is the position adjustable?
11. Does this location interfere with access to any existing controls?
12. Will this location interfere with maintenance tasks?
13. Will this location interfere with popular convenience item locations? (e.g., cup holders: Are my drivers likely to spill coffee on it or because of it?)
14. Will this location interfere with entering and exiting the cab?
15. Will this location interfere with other driver activities?
16. Does the driver need to touch the device while driving? If so, can all drivers reach it without interfering with driving?
17. Will this device and location affect the crash worthiness of the vehicles?
18. Will this device and location affect the safety of the driver in the event of a crash? For example, is the driver's head likely to hit it during a crash? Will it stay in place during a rollover?
19. Does the device generate heat?
20. Can this device tolerate our cleaning practices (e.g., water spray or compressed air) in this location?

Visibility Issues

21. Will this location interfere with driving visibility?
22. Does this location interfere with the visibility of any other existing displays or controls?
23. Can my drivers read/use this display? (Drivers who need bifocals may have difficulty reading small or dim displays.)

24. Is the device readable in bright sunlight/ nighttime?
25. Is the display too bright or glaring at night?
26. Is the display dimmable?

Usability

27. Does this In-vehicle Information System (IVIS) have a human machine interface (HMI)? If so, what is it?
28. Can I modify the HMI in any way?
29. Can the driver modify the HMI in any way?
30. Can I limit access to any functions under specific operational conditions such as the vehicle moving at 5 mph? Which functions?
31. How do I limit access to functions?
32. Are any special tools or purchase options required to limit access to any functions?

Training

33. Are there icons or words my employees may not understand or recognize?
34. What kind of documentation is available for supervisors? For drivers? For Service Technicians? For IT?
35. What kind of training is necessary for drivers? For service technicians?
36. What kind of training is available for drivers? For service technicians?

Testing

37. Has this driver interface been tested for usability?
38. How has it been tested?
39. Who represented the drivers in the test?
40. If it was something other than heuristic evaluation, how do the drivers in the test compare to my drivers?
    a. Were the drivers similar in age?
    b. Were the drivers similar in driving experience?
    c. Were the drivers similar in physical size? Define the 5-95th percentile.
    d. Chart showing font size vs... focal length
41. What were the results?

Operational Issues

42. How do the evaluation results apply to my fleet situation?
43. Is the driver interface the same as or similar to a different system driver interface in my fleet? If multiple systems use the same type of display and/or input, consider whether they should be combined.
    a. Displays
        i. Visual
        ii. Audio
        iii. Haptic (touch, vibration)
    b. Input
        i. Voice
        ii. Hand
        iii. Foot
        iv. Other
44. Is there any possibility of con fusion or conflict between existing systems on my trucks and this new system?
    a. Driver interfaces
    b. Service interfaces and parts
    c. IT

COMMON EVALUATION METHODS FOR DRIVER INTERFACES

Heuristic Method: It is a part of the design process, not a test. It generally refers to a comparison of the driver interface characteristics to existing human factors design practices or human factors standards. There are several ways to do this that range from simple checklists of letter size, height, font, etc., to review by a team of technical and/or operational experts.

Paper Tests: Evaluation method using paper drawings, computer generated images, or mockups. Generally used early in the product

development cycle to evaluate user perception or to facilitate resolution of design questions.

Simulator Test: System usually installed on a buck, but could be a full vehicle. Environment and operational conditions are generated by computers. Conditions and users are highly controlled.

Track Testing: System installed on a vehicle and tested in an operational, but highly controlled environment.

On-road Testing: System installed on a vehicle and tested in an operational environment. The tasks, operators, and vehicle are usually controlled similar to track testing.

Field Testing: System installed in an operational fleet environment. Generally there are few or no controls on the tasks, operators, or environment. Vehicles are usually controlled to some extent.

GLOSSARY OF TERMS

Attention—The act of keeping one's mind closely on something.

Cognitive—Related to mental processes such as perception, thinking, and making judgments.

Distraction—Anything that takes the user's attention away from the current task.

Driver Interface—All aspects of the system through which the vehicle driver interacts with the system. These include controls (knobs, push-buttons, pedals, microphones, etc.) and displays (lights, screens, sounds, vibrations, etc.)

Gaze (time)—The time the eyes dwell on a given location. May also be called dwell time.

Haptic—Of or related to the sense of touch

Human-Machine Interface (HMI)—The portions of the IVIS through which the user interacts with the system. These include controls (knobs, push-buttons, pedals, microphones, etc.) and displays (lights, sounds, vibrations, etc.)

Inattention—In reference to driving, usually means not giving adequate attention to something without the presence of an identifiable distraction. Sometimes attributed to fatigue or inexperience.

IVIS—In-Vehicle Information System.

Naturalistic Study—Vehicle and operator are instrumented for observation, but no system is being tested or evaluated. The purpose is generally to learn about normal driver behavior.

Secondary Task—A less important function or operation. For example, adjusting the radio station is a task that is secondary to the driving task.

Service Interface—All aspects of the system through which the maintenance technician interacts with the system. These include controls (knobs, push-buttons, pedals, microphones, etc.) and displays (lights, screens, sounds, vibrations, etc.)

Situational Awareness—Awareness of the environment outside the vehicle, (e.g. the location and speed of other vehicles).

Software Controlled Interface—An HMI that can be modified through software. For example, some communication systems allow fleet management to activate an email lock-out feature while the vehicle is moving.

Perceived Risk—Perception of potential danger or hazard.

Population Stereotype—An expectation of the population that is based on mutual cultural

knowledge, such as the American expectation to flip a toggle switch up to turn "on" a system.

Risk Escalation—Increasing risky driving behavior as a result of introducing something new into the vehicle or environment, (e.g., driving faster because the roadway surface has been improved).

User—Person who will use the system, usually an operator, maintainer, or manager.

User-centered Design—Process in which the operator requirements, desires, and needs are determined at the beginning of the product development cycle and drive the product design.

Usability—Ease with which the system can be used by the intended operator.

Workload—Physical and/or cognitive demands made on an individual at any given moment.