CITATION:

Burns, P.C.. (2007). Driver distraction countermeasures. In: I.J. Faulks, M. Regan, M. Stevenson, J. Brown, A. Porter & J.D. Irwin (Eds.). Distracted driving. Sydney, NSW: Australasian College of Road Safety. Pages 99-137.

Driver distraction countermeasures

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In-vehicle telematics devices such as navigation systems, Internet access and cell phones are a potential threat to road safety because they can increase driver distraction and cause an increase in distraction-related crashes. These devices are becoming increasingly popular in vehicles and they are offering a greater number of features. As part of its ongoing commitment to vehicle safety, Transport Canada is investigating and developing countermeasures to protect drivers from unnecessarily distracting features on these devices. This paper describes the status of various approaches and efforts to deal with the problems of driver distraction from telematics. The first part focuses on Canadian efforts to develop distraction countermeasures and this is followed by a review of related international activities. It is concluded that a paradigm shift is required to prioritize safety and human factors rather than features during the development of these devices. Countermeasures should predominantly focus on safer design practices to ensure that the risks of driver distraction are systematically considered during the product design, development and testing process.

Introduction

Distraction countermeasures

There are effectively two broad approaches to tackling the problem driver distraction from in-vehicle devices: 1) target the distracted drivers or 2) target the distractions. There may be other indirect strategies such as making vehicles and the road traffic environment more tolerant to the impaired performance of distracted drivers, however these strategies tend to be less feasible.

Distracted drivers

There are a number of possible techniques for changing driver behaviour. With respect to distraction, the main options are to influence driver behaviour through social marketing/ education or enforcement.

<u>Social marketing/ education</u>
As the driving environment is becoming increasingly complex, there is now a pressing need to inform the public on how to avoid distraction and stay focussed on the driving task. A social marketing/ education campaign could cover both the traditional and the newer sources of driver distraction. It would warn the public to avoid certain distracting behaviours such as talking on the telephone, writing notes, and programming telematics devices. An effective campaign on the hazards of driver distraction would consist of extensive radio, television, and print advertisements; a video cassette and CD for distribution to schools, driver education programs, and public safety organizations; printed materials in the form of posters and a pamphlet; and information through a public authority's Web site. A fundamental message of the campaign would be that the ultimate responsibility for road safety rests with the individual driver, who must make informed decisions about what to attend to while driving. The use of common examples of distractions would be important in

sensitizing the public to the potential hazards.

Safety information on driver distraction is well suited to dissemination through a social marketing campaign because the dangers of driver distraction and advice on how to handle it can be effectively summarized in advertisements and pamphlets. In addition, specific safety messages could be tailored to different subsections of the population, such as young people, parents with children, and drivers who use telematics devices frequently.

On the other hand, social marketing campaigns can be costly and their effectiveness is not guaranteed. The problem of costs would be lessened if all stakeholder groups participated in the public campaigns. The issue of effectiveness remains. It would seem that a public campaign might alleviate some of the driver distraction problem, however it would be an incomplete and temporary measure. The problem of driver distraction from in-vehicle telematics devices relates more to device design than driver behaviour. Telematics devices such as navigation systems, Internet access and cell phones become a distraction when they divert the driver's attention away from the driving task. In some cases, the distraction is an instinctive response to stimuli that are designed to capture a driver's attention. No amount of social marketing could change the hard-wired human response to attend to things that are flashing and beeping.

Enforcement

Enforcement is perhaps a harsher strategy for changing driver behaviour. Legislation could be made to penalize drivers for being distracted from the driving task. At least 35 countries, and many more districts within countries, have prohibited using cell phones while driving, and several more countries are considering such legislation. There is some evidence that a ban on hand-held phone use in cars would be effective in reducing driver distraction and distraction related crashes. A study by the Insurance Institute for Highway Safety (www.iihs.org) reported that a 50% reduction in hand-held phone use was observed 3 months after New York's cell phone ban came into effect (2002). There was a 52% reduction in crashes caused by cell phones in Japan for the year after their ban in 1999. However, by 2003 the number of traffic accidents in Japan caused by cell phones had doubled. Japan's enforcement practices have recently changed in response to this increasing problem. Since November 2004, the ban on hand-held cell phones is strictly enforced. This is accompanied by a ban on visual distraction; glances to in-vehicle displays that are longer than 2 seconds are now prohibited. There is no available information yet on the effectiveness of the increased level of enforcement and the more general legislation against visual distraction.

An enforced restriction on driver behaviour might prove effective in limiting distraction from cell phones, however it is not certain that such a ban could be effectively extended to in-vehicle telematics devices. The situation with this broader category of devices is more complicated because they provide a diverse range of functions, some of which may be essential and entirely safe. Automatic crash notification systems are a good example of telematics devices that promise to make a significant contribution to road safety. If the devices, or certain telematics functions, were found to be too hazardous for driving, it would be more efficient and effective for manufacturers not to equip their vehicles with such devices rather than prohibit drivers from using them.

Distracting devices

The second approach to tackling the driver distraction problem is to target the countermeasures on the source of the distractions. Distraction is less of a problem if the

systems are designed in a way that makes their use support or be compatible with driving. For telematics devices to be compatible with driving, they must be properly integrated within the driver-vehicle system. It is evident from the research and available telematics devices that driver-system integration is not being widely or effectively practiced. For example, Tijerina, Parmer, and Goodman (1998) compared drivers' performance while using four commercially available route guidance systems. Drivers took over a minute on average to perform a destination entry task while driving on a test track. By way of comparison, a common task such as operating the wiper/washer controls takes approximately 4 seconds and it takes approximately 20-30 seconds to dial a cellular phone. Three of the four navigation systems controlled by manual input had significant visual demands. Approximately 75% of the 1-minute task was spent looking away from the road. An important impact on driving safety was observed with almost one lane departure per entry for several of the navigation systems. The authors point out that this unacceptably high value was 14 times greater than that for dialling a cellular phone. Although these results clearly demonstrate destination entry tasks on route guidance systems are an unsafe distraction, they also indicate it may be possible to limit distraction through improved interface design. The significant variations in distraction among the four route guidance systems were attributed to design differences in their interfaces. This emphasizes the essential need to consider human factors and the safety of driver-vehicle interactions when designing in-vehicle telematics devices.

Design, performance and process-based vehicle safety standards

Given that distractions from in-vehicle devices can be avoided for a large part with improved design, effective safety standards are needed to drive better design practices. Transport Canada has proposed a combination of these safety standards in its effort to tackle the driver distraction problem.

Broadly speaking, safety standards can be design-based, performance-based, or process-oriented in their approach. Design standards provide precise specifications for a vehicle or vehicle system in terms of, for example, physical attributes or geometry. Because they are design restrictive their use is limited to instances where compatibility or consistency is crucial, for example dimensional standards to ensure the proper fit of replacement tires and rims. Performance-based standards, as they apply to motor vehicles, set out the minimum level of performance that a vehicle or its components and equipment must meet when tested in accordance with the prescribed test method. The advantage of a performance-based standard is that it provides an objective basis for evaluating the safety of a product. Because this type of standard does not specify precise physical attributes, it allows design flexibility and, therefore, does not hinder innovation. However, performance-based standards rely on the existence of reliable and valid test procedures and criteria. Efforts to develop performance-based requirements to limit the potential for driver distraction are ongoing, for example limits on the amount of visual attention needed to perform an in-vehicle task.

A number of standards and guidelines that address the safety of telematics devices have already been published or are presently in development. These will be discussed later in the paper in the section on international initiatives. Since a limited scientific understanding exists for the objective and accurate valuation of driver distraction, few of these standards and guidelines attempt to set out performance-based requirements, and compliance with them is voluntary. The available guidelines and recommendations are not satisfactory at present. Many of them are unverifiable, incomplete and under-specified. Nonetheless, they offer some guidance to designers or evaluators of telematics devices and give direction for some initiatives to limit driver distraction.

Telematics devices can be more or less distracting, depending on the extent to which the system supports the driving task and is compatible with driver capabilities and limitations. However, there is a lack of suitable theoretical and quantitative models and empirical data that can be directly applied to the safe design of these devices and the limited theory and data that exist are not compiled in a way that is helpful to designers. As a result, human factors specialists are required to interpret available data and decide whether and to what extent the data apply to the design issues at hand. In the absence of quantitative models there is a need for assessments based on expert knowledge.

A further challenge is that device technology and functionality vary among manufacturers and are likely to be constantly changing in the foreseeable future. Even systems with similar purposes will vary in terms of functional characteristics and how they are integrated with other vehicle systems. This makes it difficult to formulate comprehensive safety criteria that are universally valid for the family of applications.

The interaction between the driver and an in-vehicle telematics device is vital to road safety because it affects driving performance. An appropriate balance amongst human factors, technological and driving considerations would help ensure these devices do not increase the risk of collision or injury to vehicle occupants or other road users. This balance requires a design process that allows technology and user needs to be integrated in the context of the driving environment.

In contrast to design and performance-based standards, a process-oriented safety standard does not set out requirements that apply to the end product, but rather it outlines the general principles and process elements that should underpin the product's design, development, evaluation, manufacture, and installation. This type of standard is concerned with the systems and procedures that a manufacturer should establish and follow during its development and implementation cycle in order to ensure that its products reflect best practice and minimize potential risk and likely misuse. Like their performance-based counterparts, process-oriented standards allow flexibility in product design and do not fetter innovation. An example of the process-oriented approach is the ISO 9000 family of standards, which represents an international consensus on good management practices that, when followed, can ensure consistent quality in an organization's products or services. Another example is the human-centred design process outlined in ISO 13407 that would apply to designing telematics devices.

Canadian activities

Transport Canada's Road Safety Directorate

Transport Canada's Road Safety Directorate was created in 1969 to ensure the federal government plays a significant leadership role to respond to the road safety problem in Canada. Our mandate is to reduce the number of deaths, injuries, damage to property and the health impairment resulting from the use of motor vehicles in Canada. Transport Canada, in cooperation with provincial governments and national safety organizations, continues its efforts to improve road safety in Canada. In 1971, the Canada Motor Vehicle Safety Act empowered the Directorate to establish national safety standards for the design and construction of motor vehicles.

Canada's national road safety plan is called Road Safety Vision 2010. The goal of Road Safety Vision 2010 is to make our roads the safest in the world. Road Safety Vision 2010 emphasizes the importance of partnerships and the use of a wide variety of initiatives that focus on road users, roadways and motor vehicles (CCMTA, 2002). The national target calls for a 30% decrease in the average number of road users killed and seriously injured. Achievement of these targets would reduce Canada's road fatality total to fewer than 2,100 by 2010.

In Canada, the federal government has responsibility over manufactured or imported motor vehicles, their original equipment, tires, infant and child restraint systems, restraint systems for the disabled, and restraint systems for infants with special needs. The provinces and territories are responsible for motor vehicle registration, the licensing of drivers, the conduct of drivers on the roadways, the testing of in-use vehicle emissions, and the regulation of equipment that is installed in the vehicle after its purchase. The latter equipment is usually referred to as “after-market”. Collision reporting is shared among police forces; however, statistical data are compiled by the provinces and territories and provided to Transport Canada for consolidation at the national level.

With regard to driver distraction, this division of responsibility gives the provinces and territories the authority to regulate driver behaviour and the use of aftermarket telematics devices, while that of the federal government is limited to telematics devices that are installed in the vehicle by the manufacturer as original equipment.

As part of its ongoing commitment to safety, Transport Canada is attempting to reduce driver distraction. The department is concerned In-vehicle telematics devices such as navigation systems, Internet access and cell phones are a threat to road safety because they can increase driver distraction and cause an increase in distraction-related crashes. This concern is based on a substantial and mounting body of evidence indicating that using these devices impairs driving performance (Transport Canada, 2003). Driver distraction is also a concern to Canadian road users. The extent of public concern is reflected in the results of recent surveys conducted by the Traffic Injury Research Foundation (Beirness, Simpson & Desmond, 2002). The latest survey found that 37% of Canadians currently believe that distracted drivers represent a “serious or extremely serious problem”. Not as significant a problem as alcohol or speeding, yet still a substantial concern.

Although provincial and territorial governments are responsible for regulations pertaining to the safe operation of vehicles, including the use of aftermarket equipment, many telematics devices will be offered as original vehicle equipment and, as such, subject to the federally administered Canadian Motor Vehicle Safety Act. Other sources of distraction in vehicles may also be unsafe (e.g., talking with passengers, eating), however these are not set to increase and are not within the jurisdiction of the federal government.

Stakeholder consultations

In the summer of 2003, the Standards Research and Development Branch of Transport Canada’s Road Safety and Motor Vehicle Regulations Directorate began a consultation process with industry stakeholders and the Canadian public regarding the issue of driver distraction from in-vehicle telematics devices. The main goal of the consultations was to solicit feedback regarding various potential initiatives that would limit driver distraction from in-vehicle telematics devices. Transport Canada invited industry, the provinces and territories, road safety interest groups and the public to comment on potential initiatives and to provide feedback on alternative approaches for reducing driver distraction.

The information obtained from the responses to the discussion document and follow-up consultations was expected to help Transport Canada understand the need for, and characteristics of, potential government intervention, enabling them to identify the most suitable and effective initiative.

Industry consultations began with the publication of a Transport Canada discussion document on driver distraction from in-vehicle telematics devices in Part 1 of the Canada Gazette (Transport Canada, 2003). The discussion document defined the problem, reviewed research and outlined possible regulatory and non-regulatory countermeasures, many of which were described earlier in this report. The discussion document was distributed to stakeholders, and made available to other industry and the public via the Road Safety website. In addition, a stakeholder workshop was held to further discuss the problem of driver distraction, and to explore various potential solutions.

Concurrently with industry consultations, Transport Canada used a 'deliberative democracy' methodology to explore the public opinion regarding driver distraction from telematics devices and possible solutions. The first phase comprised a short public opinion survey that looked at attitudes towards telematics and road safety. In May 2003, a telephone survey was conducted of a random sample of 1504 Canadians aged 16 years and older. Sixty Canadians chosen from the initial survey sample of later participated in in-depth focus groups, allowing TC to better understand the public perception regarding in-vehicle telematics, and what the public sees as the most effective type(s) of potential government intervention.

These consultations with industry stakeholders and the Canadian public indicated that a government-industry memorandum of understanding, which includes both performance and human factors design process requirements, was the preferred option to limit driver distraction from in-vehicle telematics devices. Both industry and public groups also expressed strong support for public awareness and education initiatives related to distracted driving in general, including that caused by in-vehicle telematics. Finally, more objective, carefully designed, scientific research into the issue was recommended, especially that which assesses the impact of telematics device use on collision frequency.

Memorandum of Understanding on telematics

With support from both industry and the Canadian public, Transport Canada has decided to pursue a memorandum of understanding with industry that is intended to limit driver distraction from in-vehicle telematics devices. In December 2004, a joint industry-government working group was created to negotiate the key elements of the memorandum of understanding. To date, two drafts of the memorandum of understanding have been put forth; however, details regarding the nature and scope of the memorandum remain to be determined. Transport Canada's main position for the memorandum of understanding is that manufacturers shall use a safety management system (SMS) process to ensure that the risks of driver distraction are systematically considered during product design, development and testing. It does not prescribe specific process steps for designing safer in-vehicle telematics devices. Instead, the emphasis is on a safety management system with organizational requirements to ensure manufacturers have the capacity needed to successfully integrate human factors input during their design and development process. Transport Canada is also evaluating the Alliance of Automobile Manufacturers's voluntary code of practice to determine if it has sufficient safety merit to also be included in the

memorandum of understanding.

Provincial legislation

The province of Quebec also has legislation to target the problem of driver distraction. According to Article 439 of the Quebec Highway Code, display screens are prohibited in vehicles. This legislation applies to display screens on original equipment as well as aftermarket and nomadic devices. There is a proposal underway now to amend Article 439 to allow for certain exemptions. There will be an exemption for emergency vehicles and for displays that meet specific design principles concerning their safe installation, content and use. Another proposed exemption is that displays will be permitted if they comply with federal standards (i.e., a memorandum of understanding on telematics).

International activities

North America - Alliance of Automobile Manufacturers (AAM)

A significant activity in North America has been the Alliance of Automobile Manufacturers (AAM) efforts to develop a voluntary code of practice to reduce distraction from telematics devices. The Alliance of Automobile Manufacturers has, since creating a working group in 2000, been developing principles intended to address the safety aspects of driver interactions with telematics systems. The “Statement of Principles, Criteria and Verification Procedures on Driver Interactions with Advanced In-Vehicle Information and Communication Systems” contains 24 principles, 18 of which specify information, measurement and/or performance criteria. The document was developed by consensus with industry stakeholders and continues to evolve. It was originally structured around the European Statement of Principles; however it also provides verification procedures and criteria. As of April 2002, Alliance member companies have voluntarily agreed to abide by these guidelines in their design process. These voluntary industry principles will apply to vehicles from the 2006 model year forward. Although this initiative promises to improve the safety of these systems, there is some uncertainty as to the level of safety and effectiveness of the Alliance of Automobile Manufacturers procedures and criteria. Thus, there is a need to thoroughly evaluate the Alliance's principles and to measure the compliance of current in-vehicle devices to these principles as a benchmark for change.

Transport Canada has evaluated four market-available original equipment navigation systems against the Statement of Principles. The first phase of the project, completed in April 2005, assessed the systems’ compliance to the alliance of Automobile Manufacturers principles that do not required dynamic testing. The second phase will involve dynamic testing of the same systems used in Phase 1, but will be conducted according to verification procedures outlined in the most recent version of the Alliance of automobile Manufacturers principles, which was anticipated for the end of 2004. Both phases will also evaluate the validity and reliability of the Alliance's verification procedures.

Japan – Japan Automobile Manufacturers Association

Since Japan has the longest and most extensive experience with the use of telematics devices by drivers, its approach to the problem of distraction is important to this report. In August 2004, the Japan Automobile Manufacturers Association (JAMA) published version 3.0 of the “Guideline for In-vehicle Display Systems,” which is a revision of the initial Guideline that was established in 1990. The Japanese Government has approved the

guidelines, which is sufficient to ensure that domestic automotive and telematics device manufacturers abide by its requirements.

The basic concept of the Japan Automobile Manufacturers Association guidelines is to establish safety principles for the information content, method and location of telematics displays in vehicles. These guidelines apply to original equipment display screens capable of displaying diagrams, letters, numbers and/ or images. They also apply to auditory information. There are four basic principles:

1. Display systems should be designed so as not to have adverse effect on safe driving is minimal.
2. Displays should be installed so they are visible to the driver and do not obstruct the drivers view.
3. The type of information displayed should not distract the driver
4. The driver's use of a display should not interfere with driving performance.

The Japan Automobile Manufacturers Association guidelines has 3 annexes; one on safe display placement, one on display content, and one on display use while the vehicle is moving. Annex 3 is of particular interest because it sets a stringent limit on visual distraction. According to Annex 3, "the total time of the driver's looking at the screen between the start and completion of operation task shall not exceed 8 seconds". There is also an appendix that provides some background, further explanations, design standards, verification procedures and definitions.

Europe – European Statement of Principles on HMI (ESOP)

On December 21, 1999, the Commission of the European Communities issued a five-page recommendation that set out 35 fundamental principles for the design of safe in-vehicle information and communication systems. This recommendation, which was published in the Official Journal of the European Communities, invited original equipment and after-market manufacturers to enter into a voluntary agreement to abide by these principles for all telematics devices to be used by the driver while driving. The recommendation also invited the Member States of the European Community "to encourage industry to adhere to this statement of principles and to investigate the adherence to these principles by industry, including after-sales system providers." In addition, Member States were requested, within 12 months, to report to the Commission what steps they and their industries had taken to implement the statement of principles and to provide, within 24 months, an evaluation of the efforts that had been made by their industries to follow them.

The principles cover the design, location, information presentation, interaction with displays and controls, system characteristics, and product information of telematics devices. They are clear, concise, and comprehensive; however, they are qualitative in nature and, therefore, lack a method for ascertaining whether a given telematics device complies with the requirements. In an attempt to provide such a method, the European Commission charged an independent expert group with expanding the principles "in sufficient detail for work to begin on procedures to test if a specific system conforms to the Principles". The result was a 52-page document called: "Report of an Independent Expert Group on the Expansion of the Principles laid down in the Commission Recommendation of 21 December 1999 on 'Safe and Efficient In-vehicle Information and Communication Systems' (2000/53/EC)". As the introduction to the report explains, "this expansion identifies research needs rather than specific solutions," and does not purport to be the basis of a safety regulation or standard governing telematics devices.

Currently experts are reviewing the European Statement of Principles as part of the eSafety initiative. The HMI working group are trying to specify objective assessment procedures for the principles. The group has avoided committing to any pass/fail criteria for these procedures. This would leave the decision of safety to policy makers rather than HMI experts. There is a good comparison of the Alliance of Automobile Manufacturers, Japan Automobile Manufacturers Association and European Statement of Principles guidelines documents in a report by the eSafety HMI working group (http://www.escope.info/index.html?page=37).

International research

International collaborative research is essential to develop standard valid and reliable test procedures or criteria for determining unsafe levels of distraction. Transport Canada has been actively investigating the issues of driver distraction for a number of years. Some of this work has been performed collaboratively with other governments through, for example, the International Harmonized Research Activities Working Group on Intelligent Transport Systems (IHRA-ITS). The primary goal of the International Harmonized Research Activities Intelligent Transport Systems (IHRA-ITS) Working Group is to develop test procedures to assess the safety potential of ITS crash avoidance and driving enhancement for in-vehicle systems. The WG participants exchange information on national safety-related interests in ITS and work to coordinate research and encourage collaborations to optimize the safety performance of ITS. The leading activity of this WG has been to develop harmonized safety evaluation methods for in-vehicle information, control, and communication systems with respect to human performance and behaviour. Several recent activities by WG members have targeted this priority. For example, this WG has several partners in the European research project HASTE.

The aim of HASTE (Human Machine Interface And the Safety of Traffic in Europe) is to develop methodologies and guidelines for the assessment of in-vehicle information systems. The final workshop was held in Brussels in March (2005). The WG has established links with similar efforts internationally. The Collision Avoidance Metrics Partnership (CAMP) in the United States of America has one research project concerned with driver workload metrics. There was a research meeting between CAMP and HASTE in 2004 to discuss methods and results.

Transport Canada is conducting a series of coordinated studies to follow on from the HASTE, CAMP and ADAM research. The ADAM (Advanced Driver Attention Metrics) project was a separate German research project funded by DaimlerChrysler and BMW and was looking into similar issues as CAMP and HASTE. A principle deliverable from the ADAM project was the lane change test, which is a relatively simple and low cost standardized test scenario. Canada ran a study to evaluate the lane change test, among other metrics. Early results show that the lane change test is sensitive to both visual and cognitive distraction. The next step will be to compare these results to the HASTE project, which ran multiple studies on the same set of navigation tasks using a variety of driving performance metrics. Plans are now underway to replicate these tests in other countries.

Conclusions

A significant amount of work is underway internationally to develop countermeasures for driver distraction. Despite the research, there are still no standard, objective, repeatable and meaningful test procedures or criteria for determining unsafe levels of distraction. Without

standard performance-based standards, countermeasures must focus on safer design practices to ensure that the risks of driver distraction are systematically considered during the product design, development and testing process. A paradigm shift is required to prioritize safety and human factors rather than features during the development of these devices.

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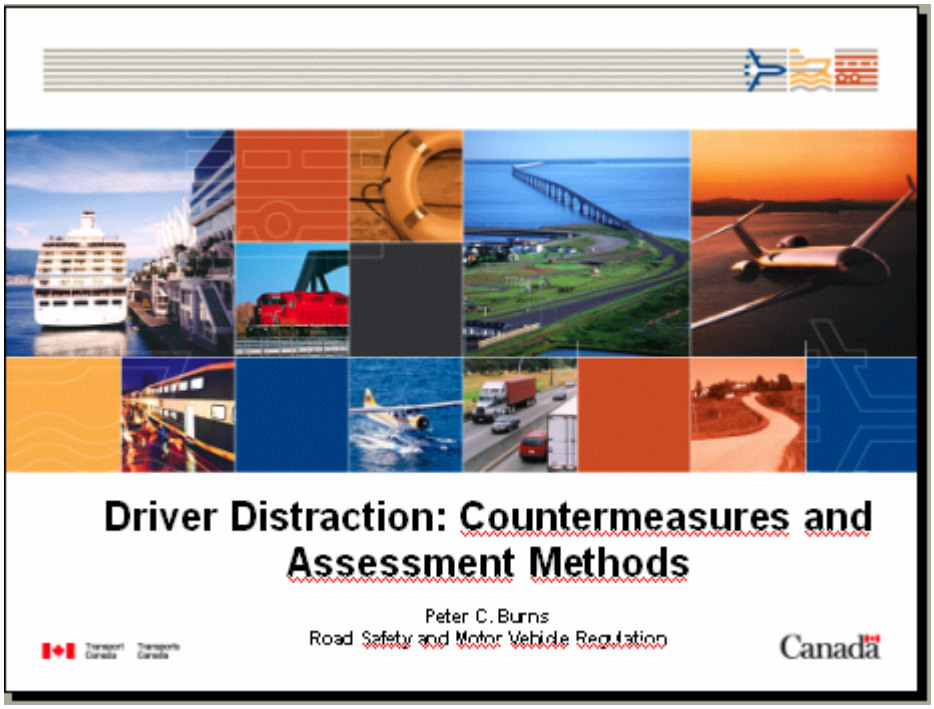
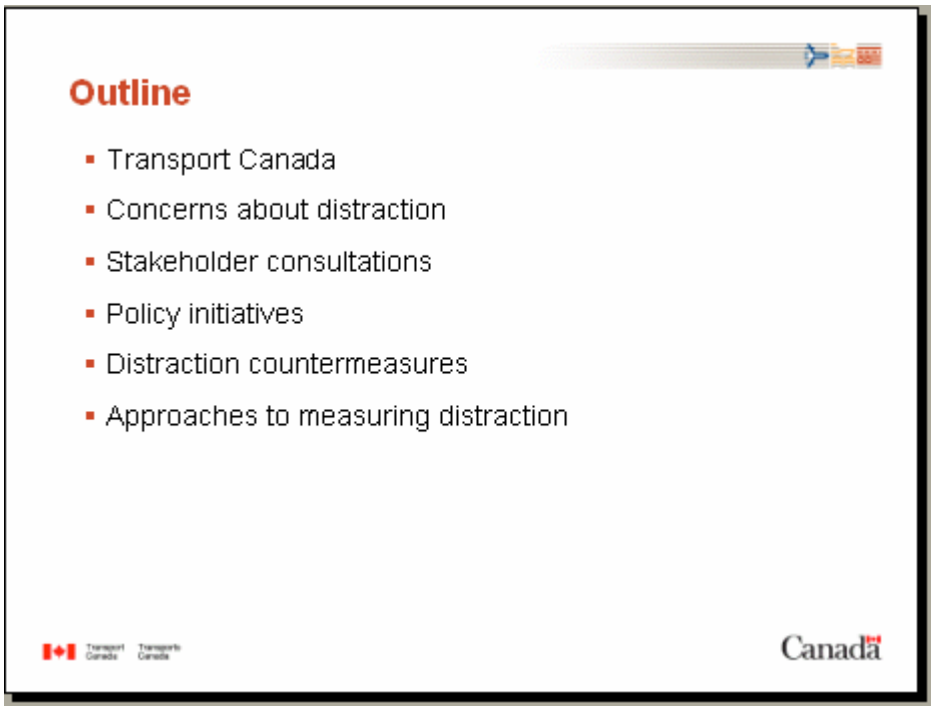
PRESENTATION SLIDES





Transport Canada's Road Safety Directorate

- Road safety is a shared responsibility between the federal and provincial jurisdictions in Canada.
- The federal government is responsible for original equipment vehicles and the provinces are responsible for how vehicles are used.
- Transport Canada also provides a leadership role for federal road safety programs and collecting national collision data.

Canada

Ergonomics and Crash Avoidance Division

- Research and share human factors knowledge relevant to motor vehicle safety.
- Assess performance characteristics and potential benefits of crash avoidance systems.
- Support the development of guidelines, standards and regulations.

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Focusing on Distraction

- Transport Canada has been investigating the issue of driver distraction for a number of years.
- This research was in response to trends in vehicle technology.

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Enter destination by:
Address
Intersection
Places
Map Input
Previous Destination
Today's Destinations
Personal Address
Go Home
AUTO
MODE
OFF
A/C
MAPV GUIDE
MENU
SETUP INFO
ZOOM
CANCEL
AUDIO
LOAD


GUIDANCE
REROUTE
12:38
00h02m
0.8M
0.6M
OLD WOKINGHAM ROAD
AM
FM
TAPE
CD
TRIP
AST
MENU
RTN
MODE
ENT/INFO
DISP
SCAN
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RAND
TOYOTA
LOGIC CONTROL DECK
PROG
RPT
SCAN
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Concerns about distraction

- Many different telematics devices are appearing in vehicles.
- They offer a wide variety of designs and features.
- Some of these devices do not appear to be suitable for use while driving.
- These devices will become standard equipment in vehicles.
- Difficult to capture data on the risks.
- Canadians are concerned about driver distraction - with 37% believing that distracted drivers represent a "serious or extremely serious problem" (2003).

Canada

Telematics Consultation

- Outline concerns about the issue of driver distraction.
- Obtain detailed information on what industry is currently doing or planning.
- Identify possible initiatives for limiting driver distraction.
- To invite input from the public and industry stakeholders on the various options for reducing driver distraction.

Canada

Distraction Countermeasures

Options		- Level of Intervention +		
Driver				
1. Awareness/ Education		Social marketing/ training		
2. Deterrence		Legislation and enforcement		
Distractor				
3. Design	*Status quo*	MOU	Advisory	Regulation
4. Performance				
5. Process				

Canada

Schedule for Consultation

- Survey of Canadians (N = 1504, April 2003).
- Published discussion document (June).
- Informed group discussions (August).
- Received comments on discussion document (September).
- Stakeholders workshop and meetings (ongoing from October).
- Publish results of consultations with recommended action plan.

Canada

Recommendations from Public

- Research and testing efforts should continue.
- Government should not assume that drivers will use telematics devices responsibly.
- Broad awareness campaigns should be undertaken.
- A purely voluntary, industry-developed approach to telematics is not perceived as able to provide sufficient protection to motorists.
- A regulatory approach is premature at this early stage.
- A cooperative approach should be adopted based on the signing of an MOU between the federal government and industry.

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Responses to Discussion Document

- Received 17 responses to the discussion document.
- Comments came from industry associations, transit associations, small businesses and consultants, other jurisdictions and a motoring organization.
- Length ranged from 1 paragraph to 22 pages.
- All respondents agreed that driver distraction is a concern.
- Many common opinions but limited consensus on solutions.

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Common Views

- Public awareness initiatives related to distracted driving in general, including that caused by in-vehicle telematics.
- More scientific research, particularly on the impact of telematics on collision frequency.
- A government-industry memorandum of understanding (MOU) was the preferred option.

Canada

Policy on Telematics

- MOU working group was established in November 2004 and aims to have an agreement negotiated by early 2006.
- Group includes Transport Canada (TC), Canadian Vehicle Manufacturer's Association (CVMA) and the Association of International Automobile Manufacturers of Canada (AIAMC).
- Transport Canada's proposed MOU consists of:
  - Statements of scope and recognition of key issues
  - Basic design principles
  - Safety design process for limiting driver distraction

Canada

Distraction Countermeasures

Options		- Level of Intervention +		
Driver				
1. Awareness/ Education		Social marketing/ training		
2. Deterrence		Legislation and enforcement		
Distractor				
3. Design	*Status quo*	MOU	Advisory	Regulation
4. Performance				
5. Process				

Canada

Target the Drivers: Deterrence

- Under current provincial/territorial legislation, drivers are required to be attentive and maintain safe control of their vehicle.
- Cell phone legislation (Newfoundland and Labrador).
- Reductions in cell phone use have been observed following legislation (e.g., New York, Japan).
- Japan has recently banned visual distraction; glances to in-vehicle displays that are longer than 2 seconds are now prohibited.
- Legislation can be effective when it is actively enforced and motorists understand the risks and know how to comply.
- The problems are that the benefits may become transient, enforcement may be difficult and it does little to prevent involuntary distraction.

Canada

Distraction Countermeasures

Options		- Level of Intervention +		
Driver				
1. Awareness/ Education		Social marketing/ training		
2. Deterrence		Legislation and enforcement		
Distractor				
3. Design	*Status quo*	MOU	Advisory	Regulation
4. Performance				
5. Process				

Canada

Design Standards

There are basic principles that can help designers limit distraction

- Principles to protect driving performance (e.g., 25° down angle requirement).
- Set basic restrictions (e.g., no TV/video entertainment when vehicle is in motion).
- Standardize (e.g., ISO symbols - the same everywhere for everybody).
- Although they provide clear criteria for design and assessment, design standards can restrict design and innovation.
- Many standards would be required for complex devices.
- Need to be continuously updated or they can become obsolete as technology changes.

Canada

Design Standards

There are a number of international efforts by industry and governments to develop best practice guides to designing telematics.

- European Statement of Principles (ESOP)
- Japanese Automobile Manufacturers Association (JAMA)
- Alliance of Automobile Manufacturers (AAM)

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Alliance of Automobile Manufacturers (AAM) Statement of Principles

- North American voluntary "best practices" document addressing safety aspects of driver interactions with telematics devices
- Applies to 2006 model vehicles and beyond.
- Based on the European Statement of Principles, but also has verification procedures and criteria.
- Annexes may be added in time (e.g., speech-user interfaces, ADAS).

Statement of Principles, Criteria and Verification Procedures on Driver Interactions with Advanced In-Vehicle Information and Communication Systems

Draft Version 3.0

Driver Focus-Telematics Working Group

June 17, 2003

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1. **Installation** - e.g., Principle 1.2 "no part of the system should obstruct the driver's field of view as defined by applicable regulations."
2. **Presentation** - e.g., Principle 2.1 "systems with visual displays should be designed such that the driver can complete the desired task with sequential glances that are brief enough not to adversely affect driving."
3. **Interaction** - e.g., Principle 3.1 "the system should allow the driver to leave at least one hand on the steering control."
4. **System Behaviour** - e.g., Principle 4.1 "visual information not related to driving that is likely to distract the driver significantly (e.g., TV, video, and continuously moving images and automatically scrolling text) 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."
5. **Instructions** - e.g., Principle 5.1 states that "the system should have adequate instructions for the driver covering proper use and safety-relevant aspects of installation and maintenance."

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Assessment of AAM Statement of Principles

- Transport Canada is conducting a study to:
  - evaluate the compliance of four vehicles to the AAM safety principles to see how current vehicles rate on the principles and to gather benchmark data on which to assess the impact of the principles.
  - evaluate the AAM principles and verification procedures
- Static testing was completed in March 2005 (Phase 1).
- Dynamic testing will be completed by September 2005 (Phase 2).

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Distraction Countermeasures

Options		- Level of Intervention +		
Driver				
1. Awareness/ Education		Social marketing/ training		
2. Deterrence		Legislation and enforcement		
Distractor				
3. Design 4. Performance 5. Process	*Status quo*	MOU	Advisory	Regulation

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Target the Distractions: Performance Standards

- Product development processes require performance standards to determine if targets have been achieved.
- Testing is a key part of product development
- This requires assessment methods and safety performance criteria.
- There are currently no methods or criteria that have been proven effective in setting limits on distraction across a range of technologies.

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What is needed in an performance standard?

- A practical assessment method for determining whether tasks are compatible with safe driving (cost effective, quick and flexible).
- A method that is also meaningful, objective and repeatable.

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Possible methods include:

- Secondary task performance
  - Static (e.g., total task time)
  - Dynamic (e.g., errors)
- Measuring the driver (e.g., glance behaviour)
- Driving performance (e.g., SDLP)
- Surrogate driving performance measures
  - Peripheral detection task (PDT)
  - Lane Change Test (ADAM, ISO)
  - Occlusion (ISO, SAE, AAM, JAMA)

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Recent Transport Canada Research: Comparing the HASTE, LCT and Occlusion

This research aimed to:

- Collect further data on the validity and reliability of these tests.
- Get more experience with using these procedures.
- Provide input to the further development of these procedures.

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HASTE

- Human Machine Interface And the Safety of Traffic in Europe
- Development of methodologies and performance measures to assess long term safety implications of new in-vehicle technologies including HMI for road transport.
- Final Workshop was held in March, 2005. Final report ...due soon.
- HASTE concentrated on conventional driving performance metrics across multiple sites and equipment (e.g., simulators, road, desktop).

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Transport Canada Driving Simulator

HASTE Tasks

- A sample of visual-manual tasks on an aftermarket navigation system (Blaupunkt Travelpilot).
- Two typical navigation system tasks , Point of Interest (POI) setting and Address Entry:

1) The simple POI task - input display category (e.g., gas station) for the map (8 button presses).
2) The complex POI task - input 6 categories (23 button presses).
3) The simple Address Entry task - enter a city (16 button presses).
4) The complex Address Entry task - enter both city and street information (27 button presses).

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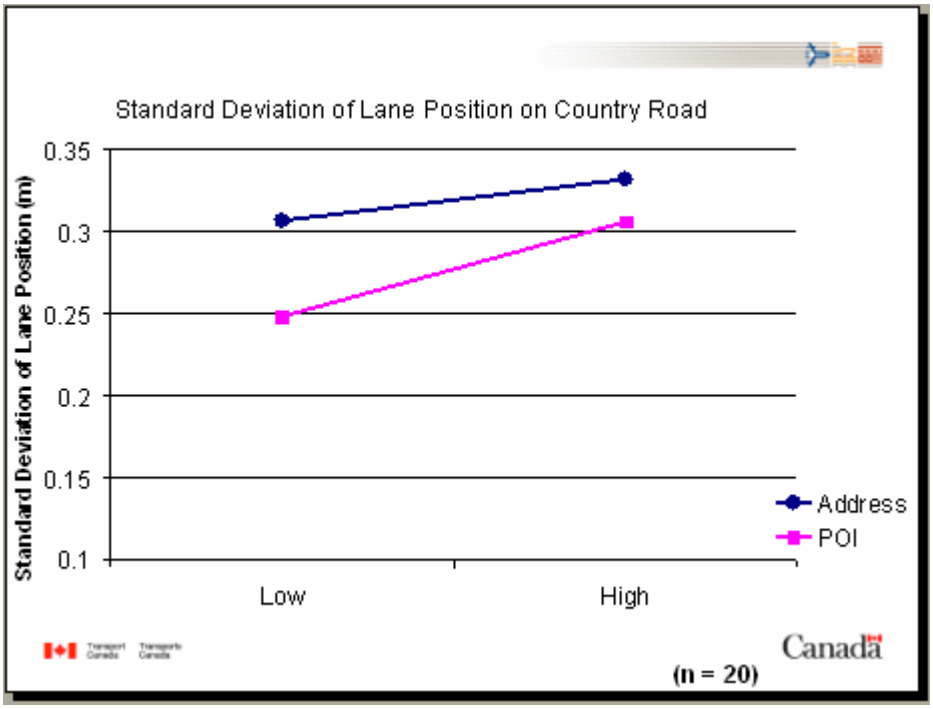
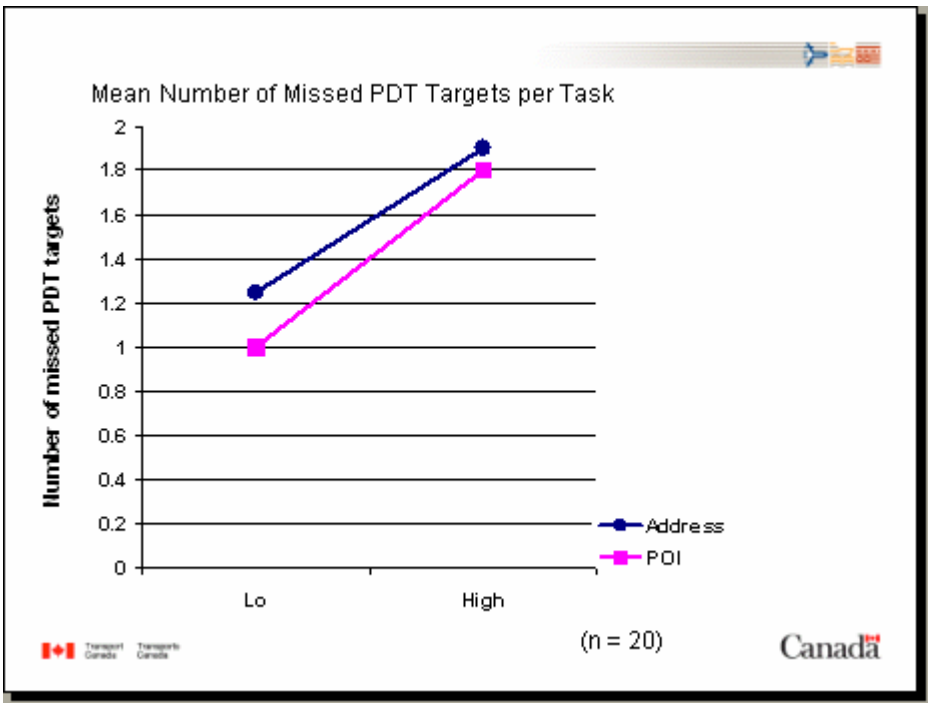

Standard Deviation of Lane Position on Country Road
Standard Deviation of Lane Position (m)
0.35
0.3
0.25
0.2
0.15
0.1
Low
High
Address
POI
(n = 20)
Canada


Mean Number of Missed PDT Targets per Task
Number of missed PDT targets
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Lo
High
Address
POI
(n = 20)
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Occlusion Technique

- The ISO draft standard was used (ISO/DIS 16673) with occlusion goggles set on a cycle of 1.5 seconds open and 2.0 seconds closed.
- 12 experienced drivers took part in this experiment (age M= 27, 5 males, 7 females).
- Participants performed the HASTE visual-manual tasks:

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Occlusion Measures

- Total task time (TTT) – time to complete task without occlusion
- Total shutter open time (TSOT) – sum of vision intervals
- Occlusion ratio (R = TSOT/TTT) – task interruptability

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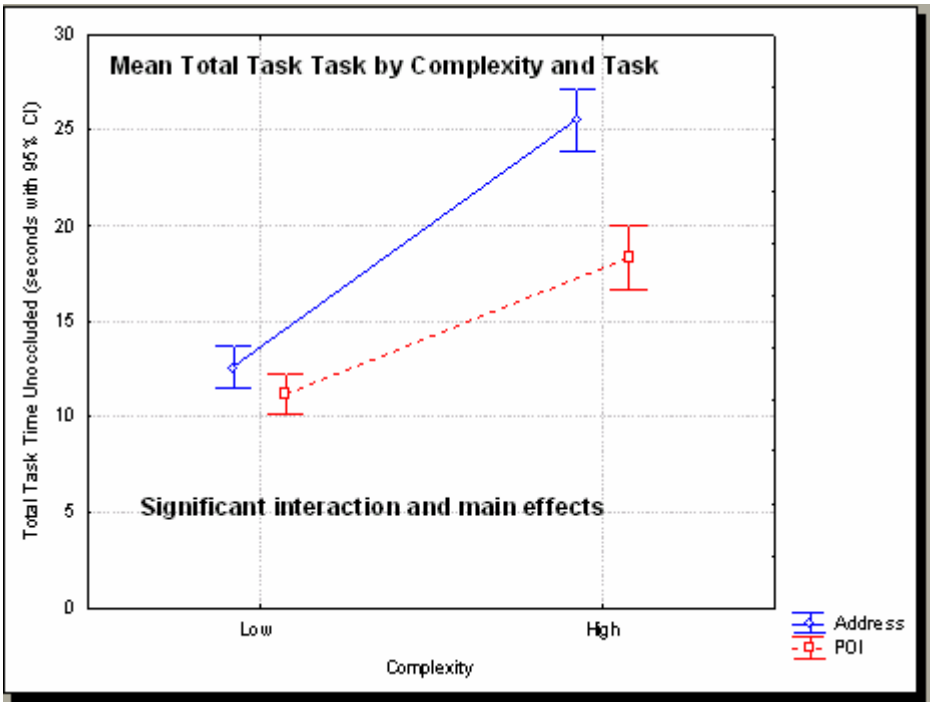
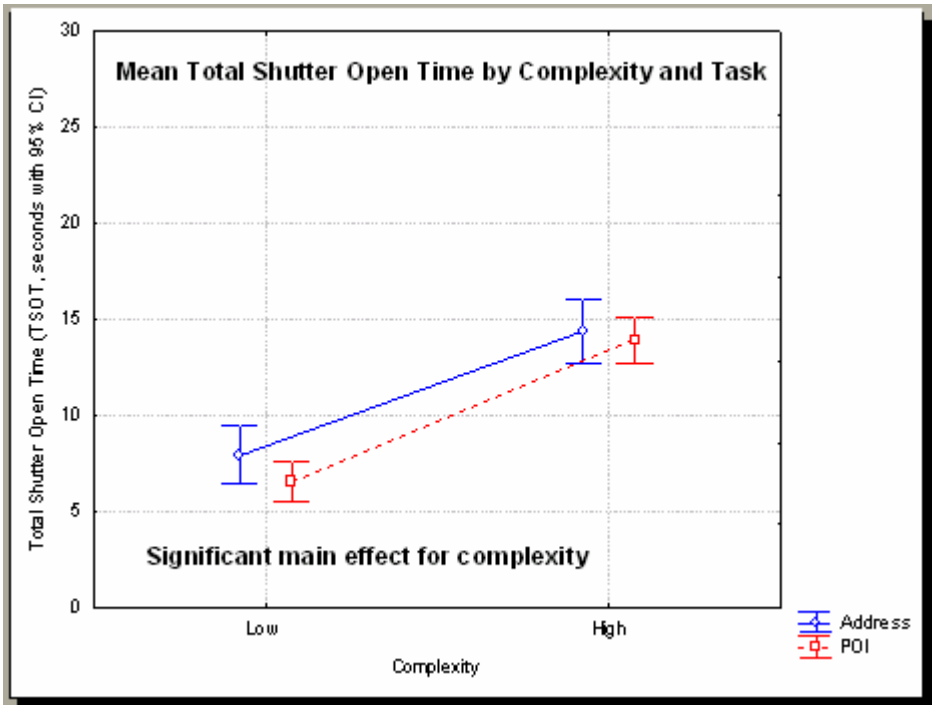
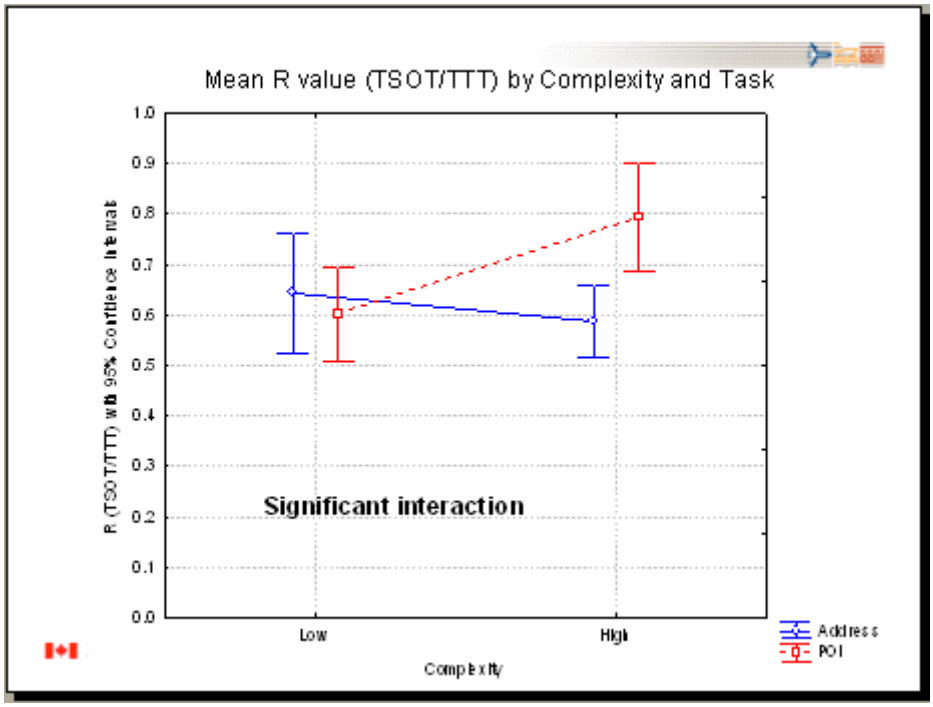

Mean Total Task Task by Complexity and Task
Total Task Time Unoccluded (seconds with 95% CI)
30
25
20
15
10
5
0
Significant interaction and main effects
Low
High
Complexity
Address
POI


Mean Total Shutter Open Time by Complexity and Task
Total Shutter Open Time (TSOT, seconds with 95% CI)
30
25
20
15
10
5
0
Significant main effect for complexity
Low
High
Complexity
Address
POI



Occlusion Summary

- Total Task Time (TTT) unoccluded showed significant effects for task and complexity.
- With TSOT, there was a significant main effect for task complexity but not task type.
- With R, a significant interaction of task type and complexity was observed.

  → likely due to less predictable menu content in the POI task. POI list had no obvious order whereas Addresses were listed alphabetically.

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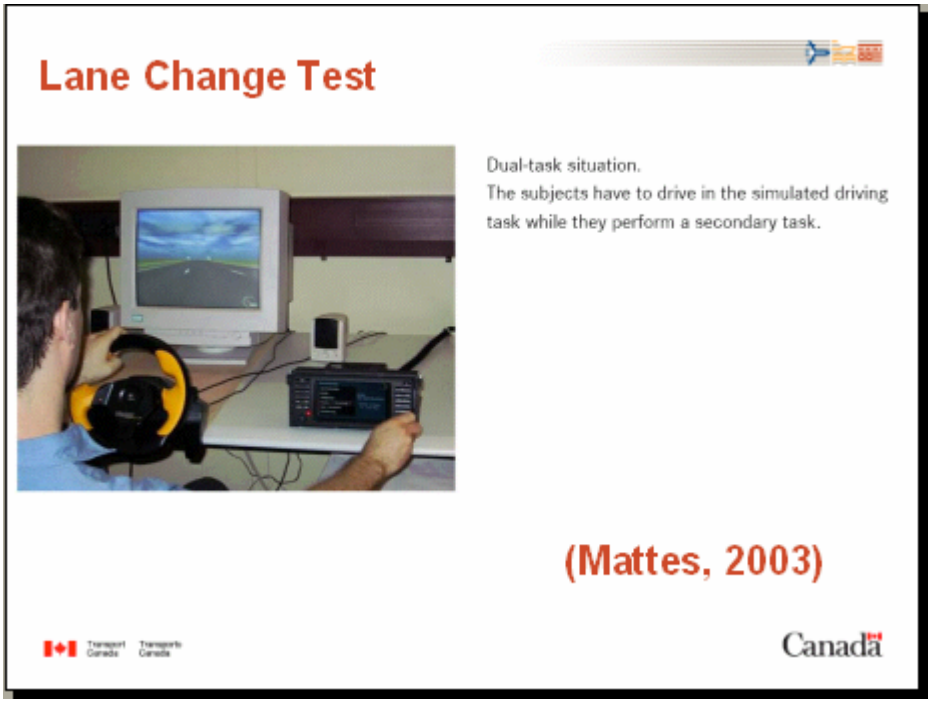
Lane Change Test
Dual-task situation.
The subjects have to drive in the simulated driving task while they perform a secondary task.
(Mattes, 2003)
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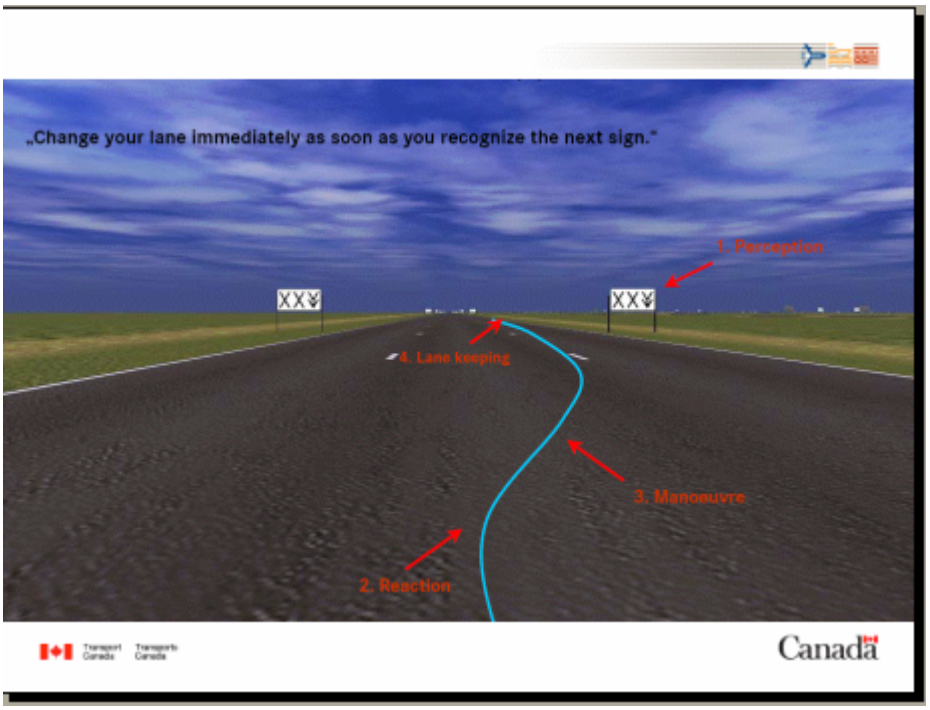
„Change your lane immediately as soon as you recognize the next sign."
1. Perception
4. Lane keeping
3. Manoeuvre
2. Reaction
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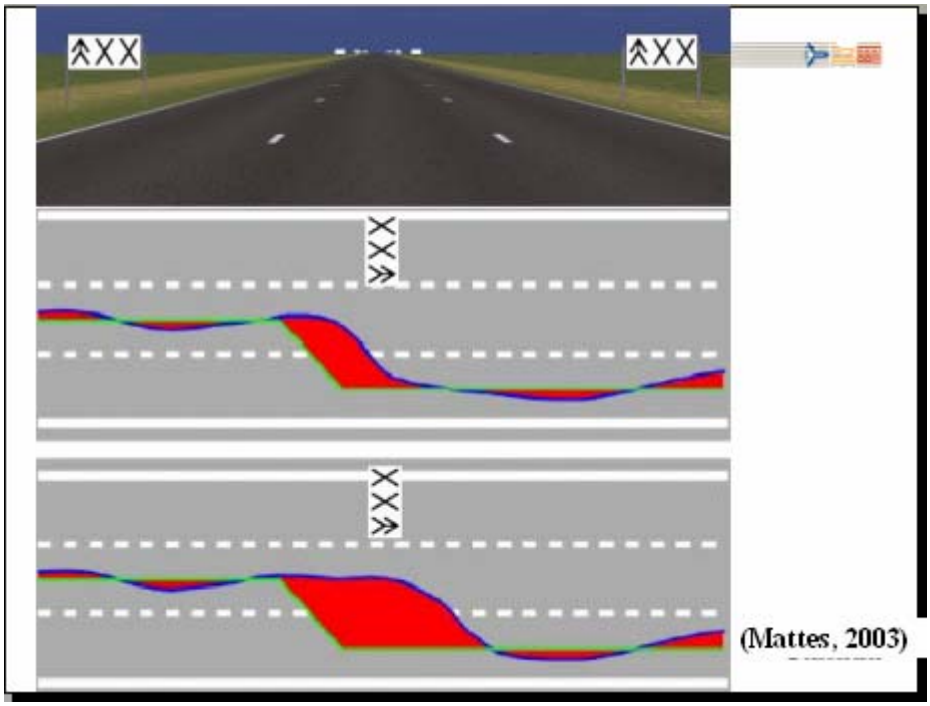

Lane Change Test

- The ISO draft standard for LCT was used.
- 21 experienced drivers took part in this experiment (age M= 29.5, 18 males, 3 females).
- Participants performed the HASTE visual-manual tasks:
  - practice trials without secondary task;
  - practice trials with similar secondary tasks;
  - 3 baseline drives;
  - 3 drives with calibration tasks (low, medium and high complexity Circles Task);
  - 4 drives with the HASTE visual-manual tasks.

counterbalanced

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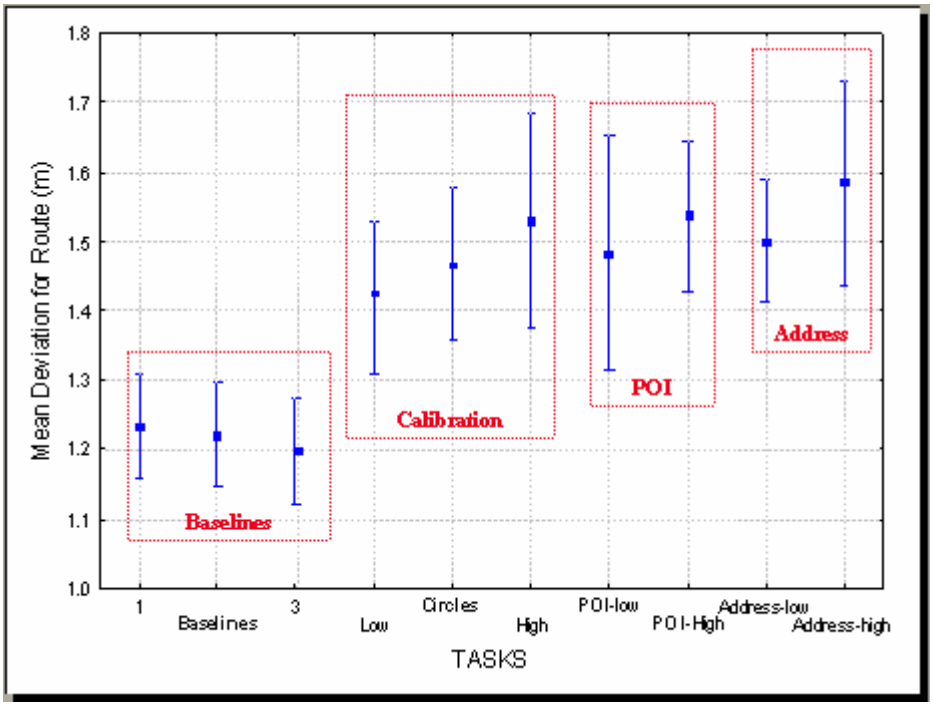
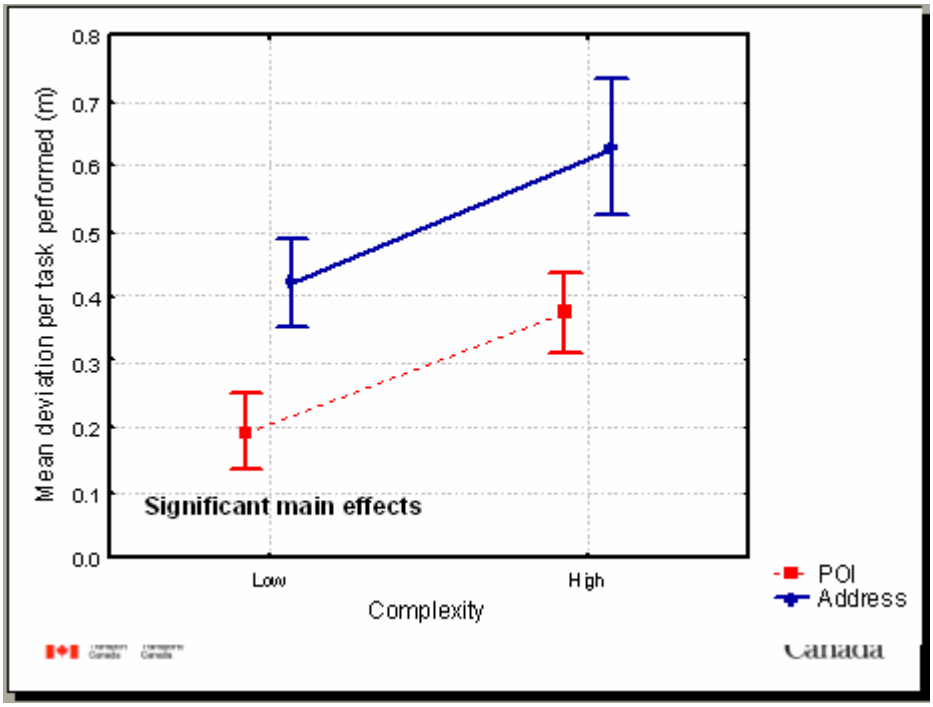

Mean Deviation for Route (m)
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
Baselines
Calibration
POI
Address
1
Baselines
3
Low
Circles
High
POI-low
POI-High
Address-low
Address-high
TASKS


Mean deviation per task performed (m)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Significant main effects
Low
High
Complexity
POI
Address

Summary from these Studies

- HASTE (TC), LCT and Occlusion discriminated between different task complexities.
- Task duration also discriminated between task type and complexity and must be considered as part of any assessment.
- The procedures show promise, however more research is needed to validate and refine them.
- The procedures still need criteria or references on which to set performance limits for safety.

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Safety Criteria for Performance Measures

If lower values on performance measure indicated less risk we could assess:

Relative Performance

- Task A < Unsafe reference task
- Task A ≤ Safe or conventional reference task
- Task A = Baseline driving

Performance to a criterion

- Task A < Safety criterion value (e.g., TSOT < 7.5 seconds)

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Distraction Countermeasures

Options		- Level of Intervention +		
Driver				
1. Awareness/ Education		Social marketing/ training		
2. Deterrence		Legislation and enforcement		
Distractor				
3. Design	*Status quo*	MOU	Advisory	Regulation
4. Performance				
5. Process				

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Target the Distractions: Process Standards

- Emphasis on the product design and development process rather than the end product itself and how it performs (e.g., ISO 9000, ANSI/AAMI HE48).
- Organizational requirements to address distraction considerations in the design and development process of telematics devices.
- Provides for the comprehensive, systematic and traceable application of human factors considerations throughout the product development cycle.
- Process standards are already being applied effectively by the manufacturers, but safety and usability now must be included as key elements within these processes.

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Conclusions

- Driver distraction is a significant road safety concern.
- There are no standard tests for distraction available yet.
- Feasible and effective countermeasures for distraction exist.
- Lastly, co-operative harmonized research efforts are needed to tackle this problem.

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