Impact of ITS on driver’s safety: positive or negative?

9 May, 2014

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Transport fatalities

On all transport related fatalities, 94% are on the road

• Estimation of 1 171 000 deaths annually (Transport of Canada source)
Complexity of the driving task

Multilevel task to run under high time constraint
(in some cases, time scale of few seconds to avoid critical situations)

<table>
<thead>
<tr>
<th>Level</th>
<th>Type of Knowledge</th>
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<tbody>
<tr>
<td>Strategical Level</td>
<td>Knowledge based</td>
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<tr>
<td>Tactical Level</td>
<td>Rule based</td>
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<tr>
<td>Operational Level</td>
<td>Perceptivo-motor skill based</td>
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Diversified causes of road accidents: ITS can support Human?

- Distraction: 23%
- Obstructed Vision: 5%
- Excessive Speed: 6%
- Roadway Surface: 6%
- Drunk: 8%
- Msjudged gap/velocity: 10%
- Inattention: 19%

Total Errors of Situation Awareness: 43%
Active & Passive Safety: Various levels of potential ITS support

Diagram showing the relationship between driving conditions, safety levels, and ITS support stages.
From normal driving to crash
Positive impact of ITS on safety:

• Enhanced perception
• Increase in situation awareness
• Speed of decision taking
Positive impact of ITS on safety:

Vehicle to Vulnerable users
Positive impact of ITS on safety:

Vehicle to Infrastructure

Traffic signal, Traffic sign info. and Sensor info. of approaching pedestrians and vehicles

Receive info. from out side
Calculate the collision risks

Stop Sign Ahead

On board communicator
Positive impact of ITS on safety: night vision
Negative impact of ITS on safety

• Increase workload and attentional demand
• Create distraction

interference with the main driving task
Negative impact of ITS on safety

Example of a study on the impact of the mobile phone conversation

- 47% of the French population drive a car and use a mobile phone.
- 33% of them said that they could phone during driving at least sometimes.

Frequency of mobile phone use during driving

- Never or rarely: 67.4%
- Less than one call a day: 15.8%
- One call a day: 6.4%
- Between 2 and 5 calls a day: 4.2%
- Between 5 and 10 calls a day: 3.5%
- More than 10 calls a day: 2.8%
Aspects of system safety

• **System reliability**
  Reliability of hardware and software, propensity of mal function and potential to go into a dangerous and/or unanticipated safety mode

• **Overall traffic system**
  Aggregate effect on the traffic system as a whole

• **Human Centred Design**
  Key issues are function allocation, design of the interface and definition of dialogue between the driver and the system
Human centred design for ITS

Functional abilities, needs and requirements of traveller and driver

Iterative process

Design

Functional specifications
Ergonomic criteria

Concept, Mock-up, Prototype

Evaluation

Evaluation process
Indicators

Acceptability, Usability, Appropriation, Safety
HMI for guidance and navigation
HMI: Driver and rider information with (HUD - Head Up Display)
Safety distance: automated or informative?
Lane keeping: automated or informative?
ITS safety: technical solutions

Example of express delivery
ITS safety: The Adaptive Integrated Driver-vehicle Interface

- Advanced driver assistance systems (ADAS)
- In-vehicle information systems (IVIS)
- Driver-vehicle-environment (DVE) monitoring
- Nomad devices

Integrated interface

- Visual
- Auditory
- Tactile

Driver
ITS: Safety Impact Framework

- **Direct**
  - Positive: +
  - Negative: -

- **Indirect**
  - Positive: +
  - Negative: -
Direct Safety Benefits

- Reduction of crash risk through
  - on-board ITS systems
  - road-side ITS systems
  - tolerance for driver/system errors
- Mitigation of crash consequences through improved emergency response
Indirect Safety Benefits

- Reduced exposure (optimized routes and trip lengths, and greater choice of mode)
- Reduced exposure to unauthorized use (elicense)
- Reduced traffic variance and conflicts (through better traffic management and improved interaction between driver and other road users)
- Reduced driver stress and fatigue
Direct Safety Risks

- Driver distraction
- Driver overload
- Driver confusion
- Reduced situation awareness
- Lack of trust/acceptance due to false or nuisance alarms
- Increased discomfort, stress
- Command effect
Indirect Safety Risks

- Behavioural adaptation
- Increased travel (pleasurable)
- Loss of skill & negative transfer
- Violation of expectation (by non-users)
- Collision migration (Equipped Vehicle to Non Equipped Vehicle, to other users, etc.)
Fit to Drive
8th International Traffic Expert Congress
08 to 09 May, 2014
Warsaw

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