Intelligent vehicle based traffic monitoring – exploring application in South Africa

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Outline

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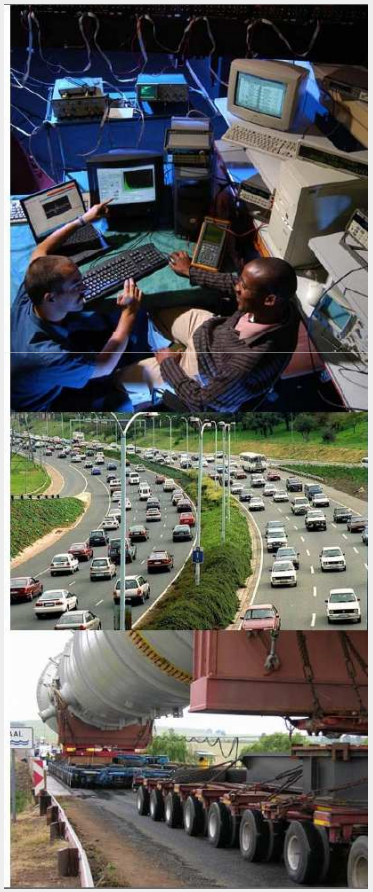
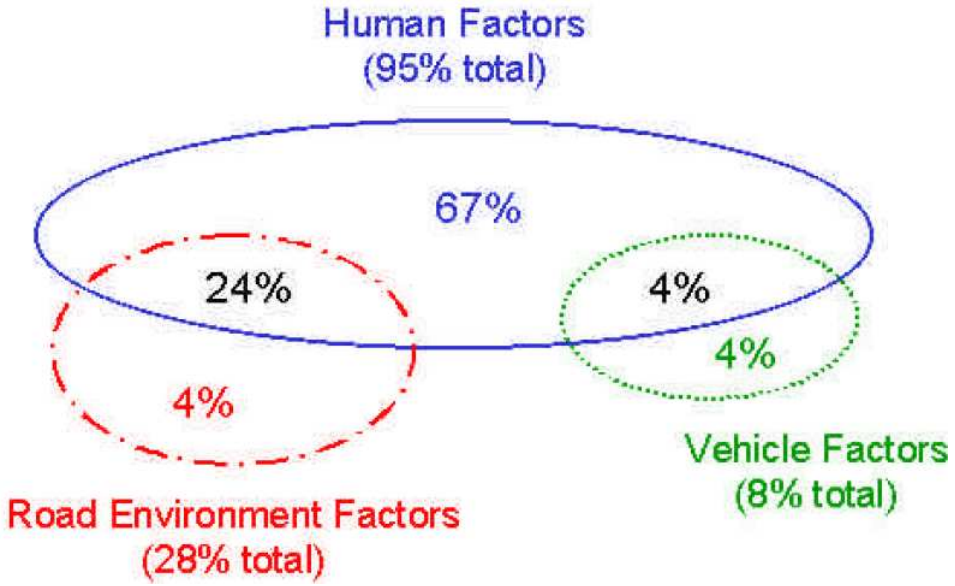
- Technologies in road safety investigation
- Relevance of vehicle monitoring technology
- Example of in-vehicle monitoring technology
- Potential of in-vehicle data logger technology in SA road safety R&D
- Conclusions



Introduction

- **The three main themes to improve road safety:**
  - Safe drivers/users
  - Safe vehicles
  - Safe roads



Introduction

- The use of on board devices to attain exact crash points, reconstruction of crashes, including data on other vehicle's and obstruction's involvement in terms of speed, acceleration, deceleration, angle and impact points;
- The mapping of crash data to identify high crash risk roads in terms of frequency of crashes, road attributes any other vehicle- and human-related parameters, and
- The use of on board devices for the monitoring of traffic speeds and flows on all types of roads in relation to traffic light timings, speed limits to determine trends on a regional basis, etc.

Technology advancements

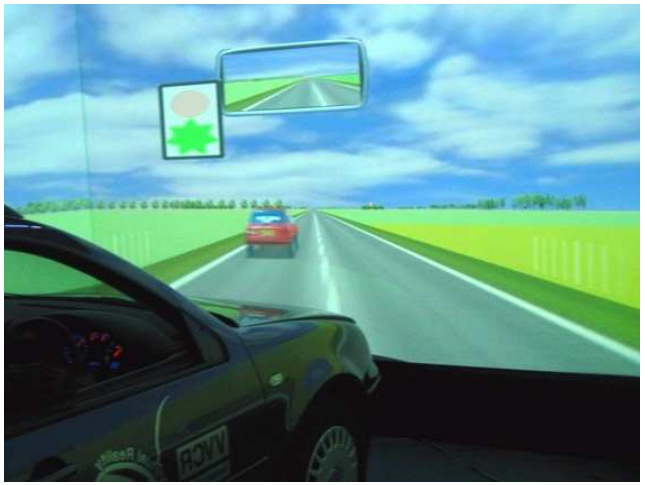
- Vehicle
  - Driver assistance systems
  - Ergonomics and human-machine interface
  - Exchange of information among the driver, the vehicle and the road
- Traffic operations
  - Better information on traffic operations and system failures
  - Clearing of incidents
  - Traffic management systems
- Infrastructure design
  - Simulation and modelling
  - Road safety audit

Relevance of technology advancements

- **Intelligent Transport Systems**

"ITS refers to efforts to add ICT to transport infrastructure and vehicles that promise to improve the management of factors that typically are at odds with each other, such as vehicles, loads, and routes with the objective to improve safety and reduce vehicle wear, travel times, and fuel consumption

…use advanced communications, sensors, and information processing technologies with a broad range of wireless and wire-line communications-based information and electronics."



- **In-vehicle systems for R&D – building the "zero fatality" vision**
  - SHRP2 NDS
    - Gaining a better understanding of driver behaviour
  - euroFOT
    - Efficacy of in-vehicle systems – driver and vehicle system
  - EuroRAP
    - Road network risk assessment – simple engineering measures pay high dividends

SA's ITS development

- SANRAL: ITS country-wide scale and one of the largest electronic tolling systems
  - These systems will be contributing to the efficient operation of the national road network and also towards various aspects of the improvement of road safety
- Fleet management systems
- Vehicle and other security solutions
- Navigation systems, etc

- Not specifically aimed at applying technology for road safety R&D
- Seemingly not delivering tangible results

Technology to support safety R&D?

- Focus of the paper
  - After-market on-board devices that have managed to penetrate the market to some levels
  - GPS- based navigation studies show significant benefits

- It improves driver behaviour in unknown areas, heightens alertness and reduces stress levels
- reduces the amount of miles driven by 16 % and reduces travel time in unknown areas by 18 %
- Motorists are alerted through a constantly updated database of crash blackspots, primary school zones, safety camera locations and other hazardous stretches of road
- Motorists also receive information on the current speed, average speed, maximum speed reached and estimated time to reach the destination
- Real time traffic information is available and not dependent on road or weather conditions, etc.

Vehicle monitoring technology

- Road safety that can be assisted by technology through:
  - assistance to the driver to be a safer driver, and
  - capturing the in-operation data to learn more about the workload of the driver that relates to the driver's aptitude and the conditions in which driving takes place
- High end vehicles are well equipped
  - aftermarket systems probably not pervasive enough to be useful for wide-spectrum risk profiling of drivers and the road infrastructure
- There are other technologies – "black box"
  - trip logging-devices
  - passive GPS tracking devices
  - crash data recording devices
  - telematic devices
- Studies show that the simple presence of data recorders may reduce crashes by some 20%

Example of in-vehicle technology

- Installing in vehicle systems with monitoring technology has a positive impact on driver behaviour.

Norwich Union: 30% frequency reduction

GreenRoads: 54% improvement in fleet crash rate

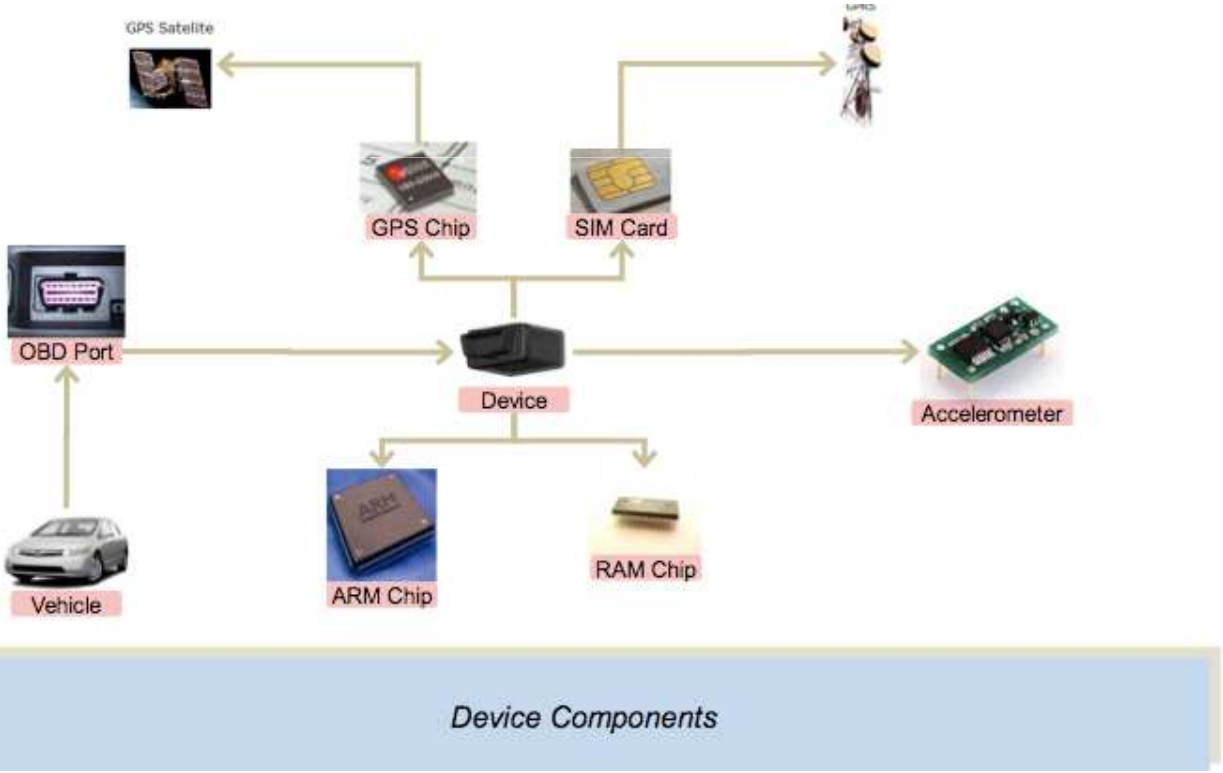
Iceland postal service reduced crash rate by 56%

Progressive offers discounts up to 61%

Pepsi (Iceland) reduced fleet crash rates by over 80%

Feasible OBD

- With new advanced and cheaper hardware it is feasible to adapt some model to a South African context
- Hardware prices have now significantly reduced compared to 2 to 3 years ago to <1000 Rand

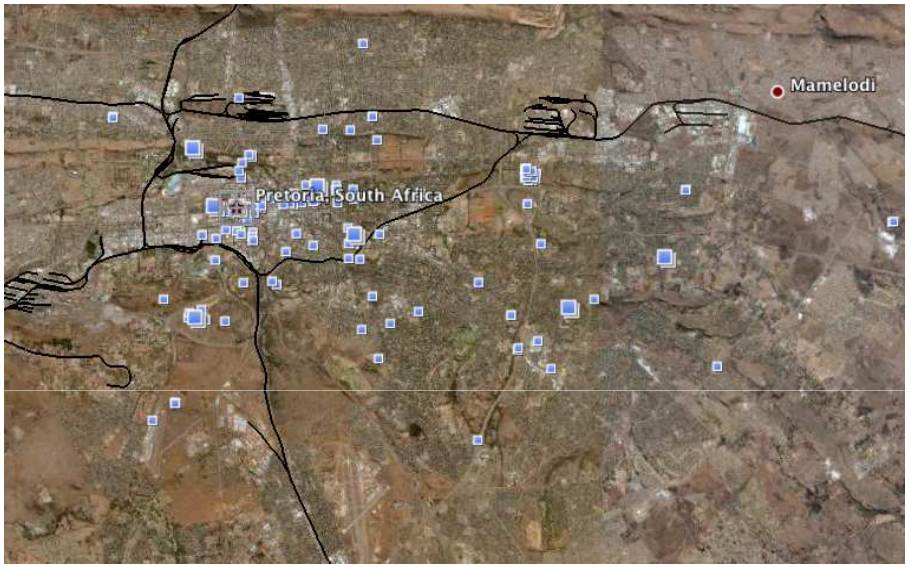


Data sets utilised from OBU

- Data Sets utilised:
  - Driven mileage and speed
  - Time of driven mileage
  - Road Types (Urban, Rural or Highway)
  - Acceleration categories (normal, hard braking, harsh braking)
  - Shock points (crash location, time and shock point)
  - Impact shock measurement in G force
  - Non fitted vehicle speed in relation to collision point
  - 3 second analysis prior to accident and shock point

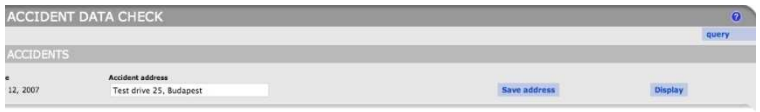
- Ability to calculate 3rd parties non fitted vehicles speed and angle at shock point
- This allows opportunity to use these data sets for use in 2 key areas
  - Accident Monitoring, Assessment and Reconstruction
  - Network Speed Flow Monitoring

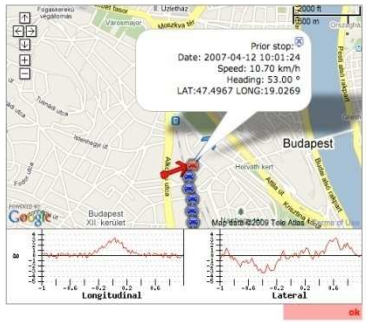
Accident Monitoring & Reconstruction



An ability to identify clusters and shock points where accidents are continually occurring to less than a 5m accuracy

A further drill down ability to determine the cause of accidents within clusters

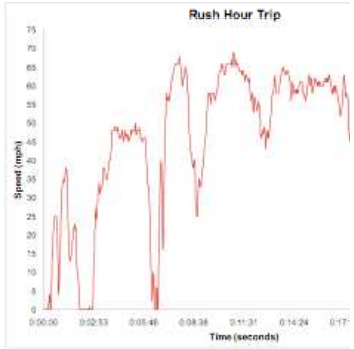


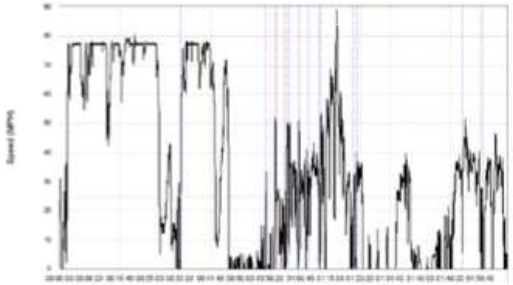


This will allow the identification where relevant, to identify new remedies such as possible new road layouts or possible new speed limit enforcement to reduce accident numbers at high density points

Speed Flow Monitoring

- Using the same data sets from the unit a wider area of traffic flow can be formulated across the whole road network
- Whole network roving data collected from the region enabling the identification of speed profiles from all road types, road geometry and other road features.





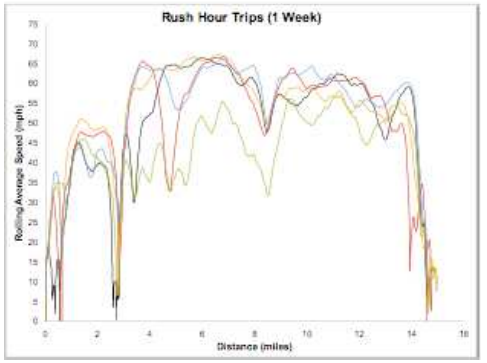
Start Time 16/03/2009 07:40
End Time 16/03/2009 09:45
Duration 02:04:07
Idle 00:23:33
0 to 25 MPH 00:30:29
26 to 50 MPH 00:31:08
51 to 80 MPH 00:38:35
Over 81 MPH 00:00:19

Distance 70.2 Miles
Average Speed 34 MPH
Maximum Speed 89 MPH

Hard Brakes 2 (Between 0.59 G and 0.79 G)
Extreme Brakes 0 (Over 0.79 G)

Hard Accelerations 16 (Between 0.31 G and 0.45 G)
Extreme Accelerations 0 (Over 0.45 G)

Parameters
Parameter 1 Vehicle Speed Every 1 Seconds
Parameter 2 Engine Speed Every 5 Seconds



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How can it work?

- It is estimated that only about 33% of registered vehicles are insured – making it difficult for the insurance industry to play a key role through broad based risk profiling as a basis for insurance premium calculations
- Maybe owners of large fleets, including gFleeT, could take the initiative with a demonstration project – there are inexpensive solutions with real returns in a relative short term
- It makes sense from fleet management perspective since:
  - Knowledge of vehicle use in time and distance terms
  - Knowledge of driver behaviour
  - Knowledge and correlation of fuel used in the working day and identify high fuel usage by driver, vehicle and depot
  - Evidence of fleet vehicles involved in accidents
- Plethora of other benefits
- To cut the fatalities by 50% 2014 requires drastic action

Conclusions

- Technological advancements here is a great opportunity to implement cost-effective telematic devices that can dramatically improve the knowledge about driver workload and risk profiles
- It also appears that there is a feasible opportunity to implement a system in a controlled vehicle environment, gFleet that will create an opportunity to intensify the investigation and analysis of the South African road safety context.
- A demonstration project will significantly aid understanding of how, why and when traffic crashes occur - larger fleets could reap direct benefits from a demonstration project
- Public transport and heavy goods vehicles are other sectors that can be targeted for utilising technology to generate and collect data to assist in the intensified analyses of crash contributory factors - and it may be particularly necessary with respect to public transport vehicles.
- **Most importantly: in-vehicle monitoring systems provide ongoing monitoring – the impacts of road safety programmes and interventions can be measured**

END

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