The Role of Intelligent Transport Systems in Road Safety and Logistics

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WHAT ARE INTELLIGENT TRANSPORT SYSTEMS?

The definition used by the ITS Policy Committee of the IRF: *Intelligent Transport Systems (ITS) apply Information and Communication Technologies (ICT) that support and optimise all modes of transport by cost-effectively improving how they work, both individually and in cooperation with each other.*
WHAT ARE INTELLIGENT TRANSPORT SYSTEMS?

This concept of ITS is made up of broad fields of application with numerous stakeholders involved:

- **Infrastructure related ITS**: applications that focus on availability and quality of transport infrastructure and that can be used to intervene in traffic capacity, to enable paying for road use, to detect incidents or hazardous weather conditions, among others.

- **Vehicle related ITS**: applications that are put in the car to support in the driver task and/or to assist in management of a fleet of vehicles.

- **User related ITS**: applications that focus on convenience and efficiency for travellers, reducing barriers to switch transport modes and provide real-time and forecast information.
WHAT ARE INTELLIGENT TRANSPORT SYSTEMS?

• **Industry related ITS**: applications aimed at reducing costs and/or maximizing profits in the operation of transport.

• **Vehicle-to-infrastructure/vehicle-to-vehicle related ITS**: so called cooperative systems foresee the real-time interaction among vehicles and between vehicles and the road infrastructure, in order to enhance primarily traffic safety.

• **ITS back-office systems**: applications aimed at processing collected data, storing data for historic analysis, cross-application processing and system integration, providing the base for tailored, real time information flows to road managers and users.

‘IRF Manifesto on ITS – Smart Transport Policies for Sustainable Mobility’ 2012
WHAT ARE INTELLIGENT TRANSPORT SYSTEMS?
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Courtesy Kimley-Horn & Associates and INL
WHAT ARE INTELLIGENT TRANSPORT SYSTEMS?

Based on the above IRF definition and explanation, the key objectives of the use of ITS can thus be summarised as sustainability, efficiency and safety of a designated transportation network.

**Sustainability** is achieved through the optimal use of the existing transportation system, reducing demand for additional infrastructure and reducing the impact of the use of the transportation network on climate change.

**Efficiency** is achieved through the maximum use of the transportation system’s available capacity by reducing congestion and delays for an entire inter-modal journey from origin to destination on that transportation system.
WHAT ARE INTELLIGENT TRANSPORT SYSTEMS?

Safety is achieved through minimising the potential conflicts that cause incidents and accidents on the transportation system, minimising the seriousness of the incidents and accidents / crashes that do occur, and the early detection of and management of incidents and accidents once they have occurred in order to prevent fatalities and minimise the severity of injuries.

This presentation focuses more on the logistical efficiency and road safety objectives of ITS.
WHAT TYPES OF ITS CAN BE USED TO IMPROVE ROAD SAFETY?

The following lists the ITS that can be used to improve road safety:

• CCTV cameras
• Variable speed limits
• Lane management
• Incident detection
• Real time incident management
• Advanced warning systems
• Weather stations
• Intelligent speed adaptation
• Advanced driver assistance
WHAT TYPES OF ITS CAN BE USED TO IMPROVE ROAD SAFETY?

The following lists the ITS that can be used to improve road safety (cont’d):

- Automatic emergency vehicle despatch
- Spot speed enforcement
- Speed over distance enforcement
- Navigation systems
- Parking guidance
- Vehicle to vehicle communication
- Vehicle to infrastructure communication
- Emergency vehicle priority systems
- Animal and pedestrian presence detectors
HOW DO ITS IMPROVE ROAD SAFETY?

- **CCTV Systems** can be road or precinct based to monitor all aspects of the movement of vehicles and non-motorised transport on the road network. This is manual monitoring by operators in a traffic management centre as well as the use of video analytics on streaming imagery. Video analytics uses on-screen sensors to detect presence on video imagery for example.
  - Pedestrians and animals in roadway
  - Erratic vehicle movements
  - Early incident detection
  - Incident management and recording
  - Congestion detection
  - Weather detection
  - Road condition detection
Variable Message Signs can be used to provide advance warning to motorists of the following common driving conditions:

- weather
- congestion
- animals or pedestrians in the roadway,
- closed roads
HOW DO ITS IMPROVE ROAD SAFETY?

- **Variable Speed Signs** are used to control speeds by lane or section of freeway in response to approaching driving conditions. Gradual speed reduction to approaching congestion for example. **Read Your Speed Signs** to advise of speeds.
HOW DO ITS IMPROVE ROAD SAFETY?

- **Speed Enforcement**, spot speeds and average speed over distance can be enforced using automated non-intrusive technologies.
HOW DO ITS IMPROVE ROAD SAFETY?

• **Intelligent Speed Adaption and Advanced Driver Assistance Systems** read intelligent speed signs and automatically adjust the vehicle speed. Vehicle to vehicle and vehicle to infrastructure technology detects potential conflicts and collisions and automatically takes evasive action.

Image courtesy of Designnews
WHERE ARE LOGISTICS WITH THE USE OF ITS?

The crucial role that ITS play in achieving reliable, flexible, green, sustainable, safe and secure logistics has not been fully researched (Zomer and Anten, 2008).

Current and upcoming European freight transport action plans do not fully recognise the unique and crucial role that ITS plays in logistics (Zomer and Anten, 2008), as most of the present research on ITS is focused on traffic control, incident detection and accident prevention (AE Coronado Mondragon, 2012).
WHAT TYPES OF ITS ARE USED IN LOGISTICS?

The following lists the ITS that are currently being used in logistics:

• Fleet Management
• Real Time Vehicle Monitoring
• Cargo Security and Monitoring
• Automated Route Scheduling (Real time is not common)
• Weigh in Motion
• Measure in Motion
• Navigation Systems
• Parking / Loading Bay Assist
• Tolling Systems
WHAT TYPES OF ITS ARE USED IN LOGISTICS?

Image courtesy of traffictechnologytoday.com
HOW DO ITS IMPROVE LOGISTICS?

Fleet management, the most commonly used ITS in the freight industry to improve reliability, efficiency, sustainability and provide flexibility:

[Diagram showing various components involved in ITS, including GPS, Telecom, GPRS, GSM, Server, Treatment center, Cartography, and Internet.]
HOW DO ITS IMPROVE LOGISTICS?

Real time vehicle and cargo monitoring, commonly used in the freight industry for efficiency, customer relations, reliability, safety and security.

Image courtesy of FleetMind

Image courtesy of AVANTE
HOW DO ITS IMPROVE LOGISTICS?

Automated route scheduling, fixed route scheduling is common, real time, automated route scheduling is slowly being introduced to improve efficiency, safety, security, flexibility and reliability:

![Automated route scheduling](image1.png)

Image courtesy of cls-software

![Automated route scheduling](image2.png)

Image courtesy of CAN in Automation
HOW DO ITS IMPROVE LOGISTICS?

Navigation systems, commonly used by freight:

Image courtesy of Google
HOW DO ITS IMPROVE LOGISTICS?

Parking and loading guidance systems, more and more heavy vehicles are being manufactured with park and loading bay assist to improve efficiency and safety:

The Daimler autonomous truck may enter service by 2025. First autonomous highway run complete (Gizmag June 2014)
HOW DO ITS IMPROVE LOGISTICS?

Tolling systems, specifically for trucks are becoming increasingly used around the world, based on the user pay principles:
WHERE ARE WE HEADING WITH ITS?

• By 2020 Vehicles will Drive Themselves:

MAKE UP ON THE MOVE?: No problem! Volvo's Road Train will take over the driving while you spend that time catching up on other things. The Road Train project, with Volvo Cars as its participating automaker, has just completed its first demonstrations of a “multiple vehicle platoon” on a public road in Spain. The test fleet included a lead truck followed by three cars driven autonomously at speeds up to 90km/h. (June 2012).
WHERE ARE WE HEADING WITH ITS?

• By 2020 Vehicles will Drive Themselves:

On March 28, 2012, Google posted a YouTube video showing Steve Mahan, a Morgan Hill California resident, being taken on a ride in its self-driving Toyota Prius. In the video, Mahan states "Ninety-five percent of my vision is gone, I'm well past legally blind". In the description of the YouTube video, it is noted that the carefully programmed route takes him from his home to a drive-through restaurant, then to the dry cleaning shop, and finally back home.

In April 2014, the Google team announced that their vehicles have now logged nearly 1.1 Million autonomous kilometres. In late May 2014, Google revealed a new prototype of its driverless car, which had no steering wheel, gas pedal, or brakes, being 100% autonomous!
WHERE ARE WE HEADING WITH ITS?

• By 2020 Vehicles will Drive Themselves:

   Nowhere to park? Let your car decide

Nissan showed off its latest electric vehicle concept called the Pivo 3 at the Tokyo Motor 2011 Show. Automated Valet Parking (AVP) enables PIVO 3 to automatically drive, locate a parking space and park without driver assistance in specially equipped parking lots envisioned for the future. It can also charge itself and return to its driver at the AVP exit when called by a smartphone. In the latest development it can be remotely driven by a smartphone.
WHERE ARE WE HEADING WITH ITS?

- **Advanced Vehicle to Vehicle Communication:**

  Vehicles are able to ‘talk’ to each other while they are travelling, sharing information so that the advanced driver assistance systems can make informed decisions relating to efficiency and safety!

  ![Image](image1.png)  
  ![Image](image2.png)

  Image courtesy of automobile_innovations  
  Image courtesy of weheartit
WHERE ARE WE HEADING WITH ITS?

• Advanced Vehicle to Infrastructure Communication:

Vehicles are able to ‘talk’ to infrastructure to advise the infrastructure that the vehicle is approaching so that the infrastructure can assist the vehicle to travel efficiently and safely.
WHERE ARE WE HEADING WITH ITS?

- Full Vehicle and Driver Connectivity via Smart Phones:
HOW CAN WE USE ITS FOR SOUTH AFRICAN ROAD AND SAFETY CONDITIONS?

- High pedestrian crashes (alcohol / drugs)
- Overtaking related crashes
- Rural fatalities
- High speeds
- Reckless driver behaviour
- Unroadworthy vehicles
- Congestion affecting freight efficiency
- Oversized and overloading
- Vehicle and cargo security
HOW CAN WE USE ITS FOR SOUTH AFRICAN ROAD AND SAFETY CONDITIONS?

✓ **High pedestrian crashes** – the use of smart phones to alert motorists of pedestrians near the roadway and to alert pedestrians with smart phones of approaching vehicles.

*Image courtesy Honda*

*Image: An intelligent context filter detects which pedestrians will likely enter the road.*

*Image courtesy EE Times Europe*
HOW CAN WE USE ITS FOR SOUTH AFRICAN ROAD AND SAFETY CONDITIONS?

✓ **Smart Phone Technology** for speed alerts and pedestrian alerts even in rural areas for both drivers and pedestrians.
HOW CAN WE USE ITS FOR SOUTH AFRICAN ROAD AND SAFETY CONDITIONS?

✓ **Overtaking related crashes** The use of vehicle to vehicle technology and smart phone technology plus algorithms to detect, alert and avoid potential overtaking related crashes.
HOW CAN WE USE ITS FOR SOUTH AFRICAN ROAD AND SAFETY CONDITIONS?

✓ **Unroadworthy Vehicles** on-board and road side vehicle scanners, light readers, video analytics and number plate recognition technology used to automatically detect unroadworthy vehicles.
HOW CAN WE USE ITS FOR SOUTH AFRICAN ROAD AND SAFETY CONDITIONS?

✓ **Reckless Driver and Pedestrian Behaviour** use of video analytics on CCTV systems to identify reckless driver and pedestrian behaviour.

Image courtesy of PedestrianDetection.com

Image courtesy of King Communications and Security
HOW CAN WE USE ITS FOR SOUTH AFRICAN ROAD AND SAFETY CONDITIONS?

✓ Oversize and overloading monitoring using size measurement and weigh in motion.
HOW CAN WE USE ITS FOR SOUTH AFRICAN ROAD AND SAFETY CONDITIONS?

✓ Vehicle and cargo security real time tracking of vehicles and cargo.
Thank You!