Intelligent System Offers Safer Tunnel Traffic For Europe

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A novel intelligent transport system to increase traffic safety provides a range of smart solutions to help reduce the risk of accidents in tunnels.

The average frequency of fires in tunnels is higher than 25 per 100 million vehicle kilometres and the frequency of fires involving heavy goods vehicles (HGV) is higher than that for passenger cars.

For example, last June, a truck hauling tyres burst into flames while travelling through the 12.8 km Frejus tunnel between Lyon, France and Turin, Italy, killing two and injuring more than a dozen. Each year about 2 million vehicles use the Frejus Tunnel, one of the main transport arteries across the Alps.

This underscores the need for projects such as the European Commission's IST programme-funded SAFE TUNNEL that ended in August 2004. Project partners developed an innovative system that could avoid such accidents by increasing traffic safety in road tunnels through preventative safety measures.

Accident prevention is a critical part of managing tunnel operations. SAFE TUNNEL is expected to contribute to the development of a future tunnel management concept for intelligent vehicles and intelligent infrastructures to improve driver safety.

This perspective is particularly interesting for the transportation of dangerous goods, the first issue that was addressed by the project.

The objective was to introduce measures to reduce the number of HGV incidents in the European tunnels by 40 per cent within 10 years and cut the frequency of fires by 50 per cent in tunnels within six years.

"Accidents such as the one that occurred last June could have been prevented using part of the SAFE TUNNEL solution," says project coordinator Paola Carrea of Centro Richerche Fiat.

She says successful SAFE TUNNEL demonstrations last December involved two trucks – Renault and CRF/IVECO. Each was equipped with preventive diagnosis devices, tele-control and a human machine interface.

Sensors measured brake and engine temperatures, as well as tyre pressure. A stretch of A32, the Frejus Tunnel motorway, from Susa to Oulx was chosen, involving three long tunnels.

Preventive measures aimed at control

Project partners analysed tunnel operators' needs for managing safety-related operations. They then developed a general architecture consisting of three levels: peripheral, communication and application.

Their system architecture uses onboard prognostics to detect existing or imminent faults and sends information to a Control Centre. Access Control can prohibit tunnel access to vehicles with detected or imminent faults either through messages to the driver and/or interacting with a barrier.

The speed and distance control system works as an Adaptive Cruise Control, which enables the Control Centre to transmit recommended speed and safety distances to vehicles. An onboard radar system measures the distance from the vehicle ahead and could be used to control engines and brakes to automatically achieve the recommended

speed and distance.

A thermal 'gate' system aims at identifying the overheated vehicle before it enters the tunnel. It is located before the toll station and is composed of an automatic gate with infrared sensors and a portable system for checking vehicles carrying certain dangerous goods with unusual heating situations. Such dangerous goods include explosives, compressed gases, flammable liquids and corrosives, among others.)

Emergency message dissemination enables a warning to be dispatched from the Control Centre directly to the onboard human machine interface. This concerns data about accidents and suggested escape strategies. It is connected by a fibre optic backbone to the main installations that manage the motorway and its tunnels. Diagnostic information is provided in real time.

The high bandwidth potential of SAFE TUNNEL's UMTS communication technologies allows vehicle-infrastructure communication through a public network, both for applications aimed at confined areas such as the Frejus tunnel, as well as to open area applications.

"We are working on a very simple adaptation of the project results to begin with," says Carrea. This solution involves equipping trucks with a telematic box before entering the Frejus tunnel that drivers return at the end of the passage.

This box will enable communication between the Control Centre and the vehicle using the human machine interface. It is being developed following the same architecture used during the demonstrations last December.

The demonstrations were followed by technical and impact analyses, as

well as a cost/benefit analysis. Eventually, project partners intend to propose the system to standardisation bodies.

Source: IST Results

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