VSS2008/205

Incident Detection in Road Tunnels

Ereignisdetektion im Tunnel

Funding: National (Switzerland)
Duration: Sep 2008 - Feb 2011
Status: Complete with results

Background & policy context:

Systems for incident detection are an integral part of the safety concept in road tunnels. They represent the first link in the chain of incident management and are therefore of great importance.

There are several works in the national and international levels about the incident detection in road tunnels. Among those which worth mentioning belong:

- Traffic Incident Management Systems Used in Road Tunnels, PIARC 2004
- Systems and Equipment For Fire And Smoke Control in Road Tunnels, PIARC 2007
- Video Detection in Road Tunnels, PIARC, completion planned in 2008
- Research for the two standards SN 671 971 "Automatic control systems with digital image technology in road traffic" and SN 671 972 "Automatic traffic condition detection in road traffic with digital image technology"
- VSS1999 / 265: Systems for automatic traffic surveillance (monitoring) with digital image processing

The presented project concentrates mostly on technical applications, in particular on digital imaging. Except for the work "Traffic Incident Management Systems Used in Road Tunnels", the focus is mostly limited to a specific event or technological process.

Objectives:

Incident detection is an important and vital means to achieve better safety in road tunnels. For the different kinds of incidents the detection, the verification and the response have to be taken into account. The project aims at a clear classification of the incidents, the evaluation of the different technical equipment and the standardisation of the used technologies.

Methodology:

The research project consisted from the following milestones:

1. Literature Research
   Analyses of the existing research programs, initiatives, thematic networks, etc. These issues have been intensively studied in recent years - but mostly with other focus (not only in the field of event detection). The major "networks" are for example the thematic network "Safe-T" (secure tunnel) or the European research program UPTUN (Upgrading of tunnel, improvement of tunnels). Both programs offer a hardly manageable amount of information, which are accessible via former employees in these programs; but not publicly available. Both programs have been completed yet. The research program FIT (Fire in Tunnels, fire in the tunnel) was specially focused on the fire issue. In addition to the above-mentioned documents of the PIARC (now all publicly available on the PIARC website) it is now also - as the actual successor organisation - the Committee COSUF (Committee on Safety for Underground Facilities), which is affiliated at the International Tunnel Association ITA. It focuses on safety equipment in tunnels, including also in rail tunnels. There are also the latest research reports involving BAST (the Swiss Federal Office for Roads), for example, the report 925/2005 relating to "Fire and fault detection in road tunnels - comparative
studies” or the currently study on video-detection. This milestone provides a basis for the transfer of this knowledge to Swiss conditions.

2. Event detection defining criteria using the example of the typical Swiss tunnel

Different types of event detection are examined in detail. In particular, a comparison of trustworthiness (“confidence level”) will be done and the link with the possibility of verification will be discussed. The video detection as a special case of event detection will be treated only briefly; an in-depth analysis and assessment is not considered necessary, since enough studies already exist on this topic.

3. Definition of the event process, implementation in an Event Matrix

An evaluation of the various event processes to outline what types of detection are best suited for what purpose. The event process points to the essential steps which should be based on the fundamental chain of events detection and verification action.

As a result of this step an event matrix will be developed (in the sense of reflection matrix), which is to serve as a basis for the best-

**Parent Programmes:**
ARAMIS - ARAMIS information system

**Institute type:** Public institution
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**Key Results:**

Findings / recommendations

Compared to the total risk in the tunnel, incident detection systems only obtain a small risk reduction for tunnel users. Especially with regard to systems installed to minimise the damage in case of fire, modern road tunnels in Switzerland appear to be equipped sufficiently. Fire is an important scenario in the road tunnel, but 90% of the risk for tunnel users is caused by accidents without fire. If one wants to further minimise the risk for tunnel users, measures that affect the probability of accidents have to be taken.

For the approval of incident detection systems there is need for clearly defined test guidelines. Good approaches can be seen for some specific products. The goal should be that for the approval each test can be performed based on a clear test guideline. Sampling tests for components in the tunnel generally give no reliable results and should not be applied therefore.

In order to minimise undetected events, incident detection systems need to be set at a sensitive level. The occurrence of false alarms is inevitable; therefore a high false alarm tolerance should be striven for (in the traffic control room). Depending on the design of the traffic control room, the acceptable level of false alarms can vary greatly. If for example each alarm triggers an acoustic signal, a high false alarm rate can be very tiring for the control room staff. In case of discrete and easily verifiable alarms also high false alarm rates can be tolerated. This should be considered in the design of control rooms.

Publication:
Welte, Urs (project manager); Frey, Samuel; Linn, Andreas van: Ereignisdetektion im Strassentunnel. Bern (Schweiz), Selbstverlag 2011, p. 68. Serie: Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation, Bundesamt für Strassen; 1323

Documents:
- Ereignisdetektion-strassen-tunnel.pdf (Final report)

STRIA Roadmaps:
Cooperative, connected and automated transport, Network and traffic management systems, Infrastructure

Transport mode: Road transport
Transport sectors: Passenger transport, Freight transport
Transport policies: Safety/Security, Digitalisation
Geo-spatial type: Network corridors