ESIMAS

REAL TIME SAFETY MANAGEMENT SYSTEM FOR ROAD TUNNELS

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Source: ABDNB

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ESIMAS – Organization and funding

Echtzeit Sicherheits-Management System für Straßentunnel (ESIMAS)

Real Time Safety Management System for Road Tunnels

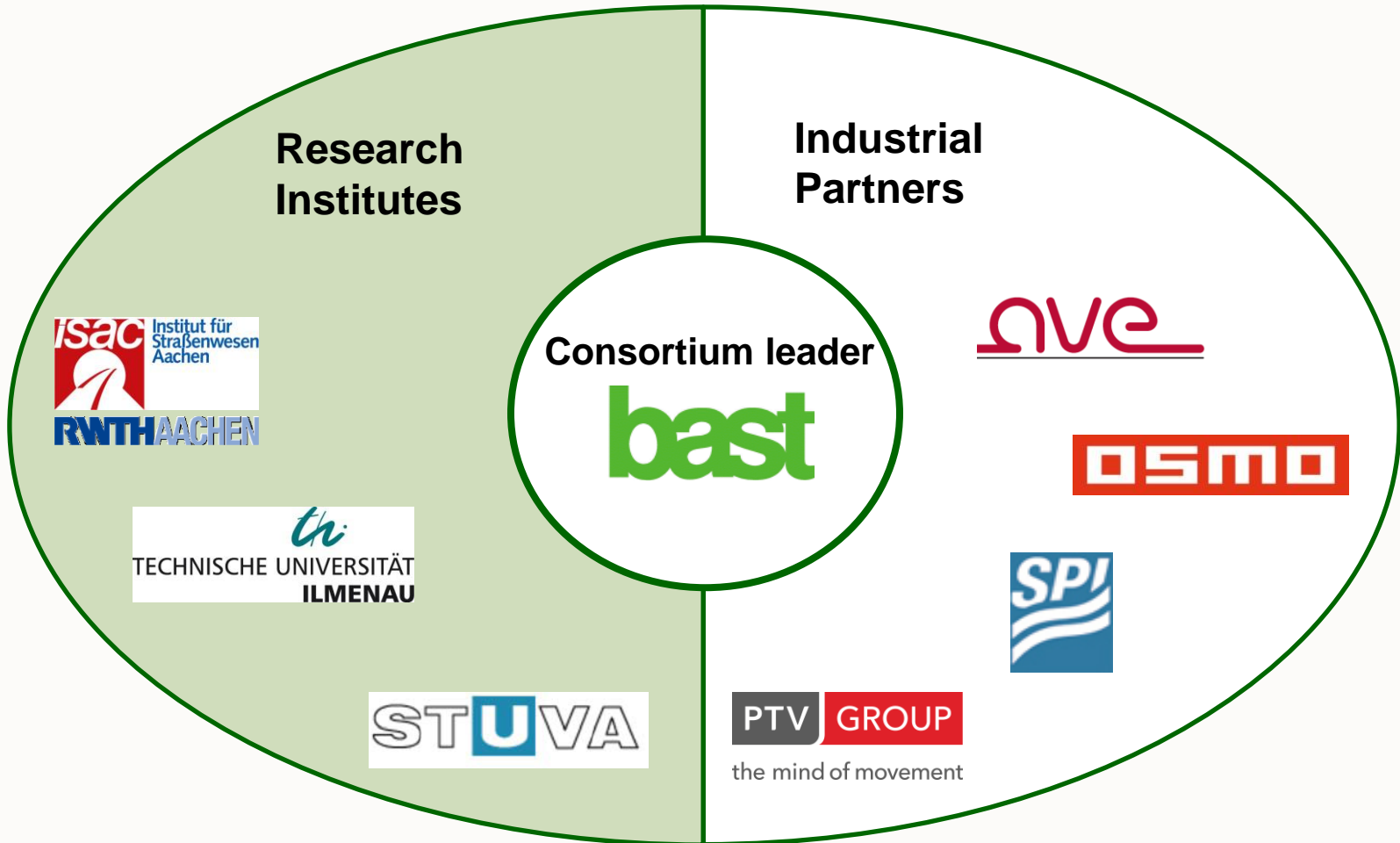| Funded by:	3rd Traffic Research Program of the German Federal Government: „Mobility and Transport Technology"	Promoted by:
Federal Ministry for Economic Affairs and Energy		TÜVRheinland® Genau. Richtig.
Duration 3 years: 12/2011 – 11/2014		Joint project: Interdisciplinary venture with several project partners

ESIMAS – Organization and funding

Joint Project

Safety in road tunnels

- Effective and safe transport infrastructure is essential to guarantee the mobility and supply of the population.

- Road tunnels have here a special meaning, as compared to the open road, where even smaller incidents such as overheated vehicle parts can cause major impacts, such as devastating fires with many casualties.

- Several fires in the Alpine tunnels have indicated this fact.

- To ensure the safety of road tunnels in Germany, tunnels with a certain length have to be monitored permanently by a tunnel control center (RABT 2006 & Directive 2004/54/EG).

Safety in road tunnels – Fire in a tunnel


Source: Bild

Source: BASt

Example: Tunnel Königshainer Berge 18.05.2013

- 3,3 km long

- One-way traffic tunnel

- A burning truck damaged the tunnel

Consequences of the event:

- Closure of the tunnel caused an accident
  resulting in one death

- Property damage: 2 Mio. €

- Tunnel stayed closed for repairs until October
  18, 2013

Incidents in road tunnels in Germany
(2009-2011)

- 1,3%
- 41,0%
- 40,7%
- 16,9%

■ Breakdown
■ Accident
■ Other incidents
■ Fire
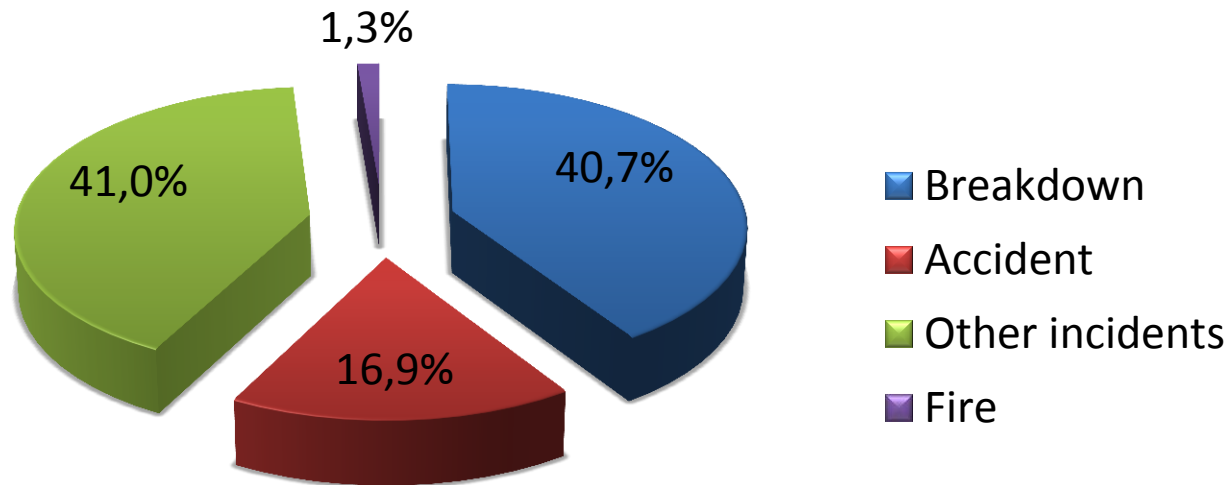
EMB 2009-2011,
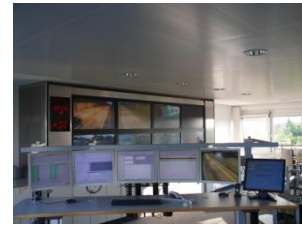Hauptereignisse aus 6701 Datensätzen

Safety in road tunnels

Video surveillance (static)

Incident detection (Fire, Smoke, CO, Emergency Call, Alarm)

In case of an incident:

Evaluation of the safety situation by the Operator

Specified instructions for action (AGAP)

Measures

Safety in road tunnels

Increasing demands on operators

An example: Central Control Center in Thuringia

- Number of tunnels under surveillance: 13

- Total length: 41 km

- Number of operators on duty: 2 per shift

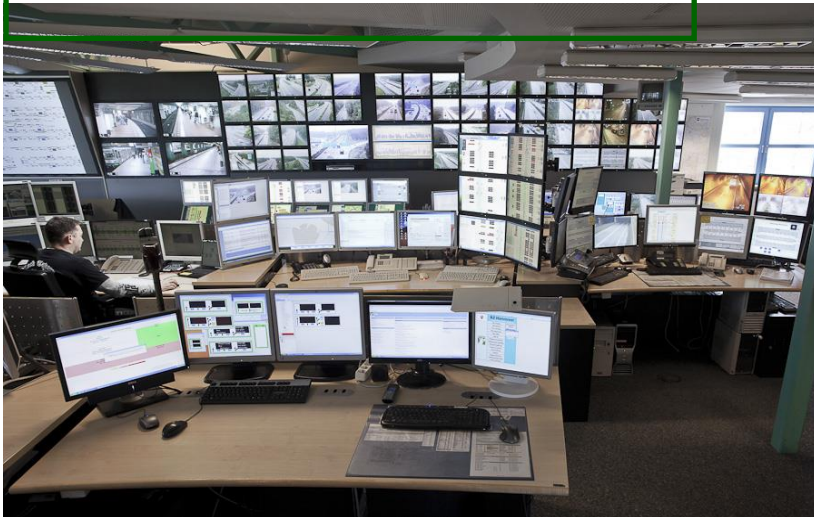**Large numbers of equipment and sensors in the tunnel**

- 600 video cameras

- 265 induction loops

- 361 emergency phones

- 700 road signs

Research objectives

- Increasing number of tunnels that have to be monitored

- Increasing traffic density
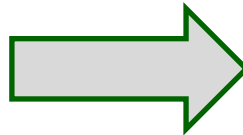
- Increasing need for safety

- New technologies

Research objectives

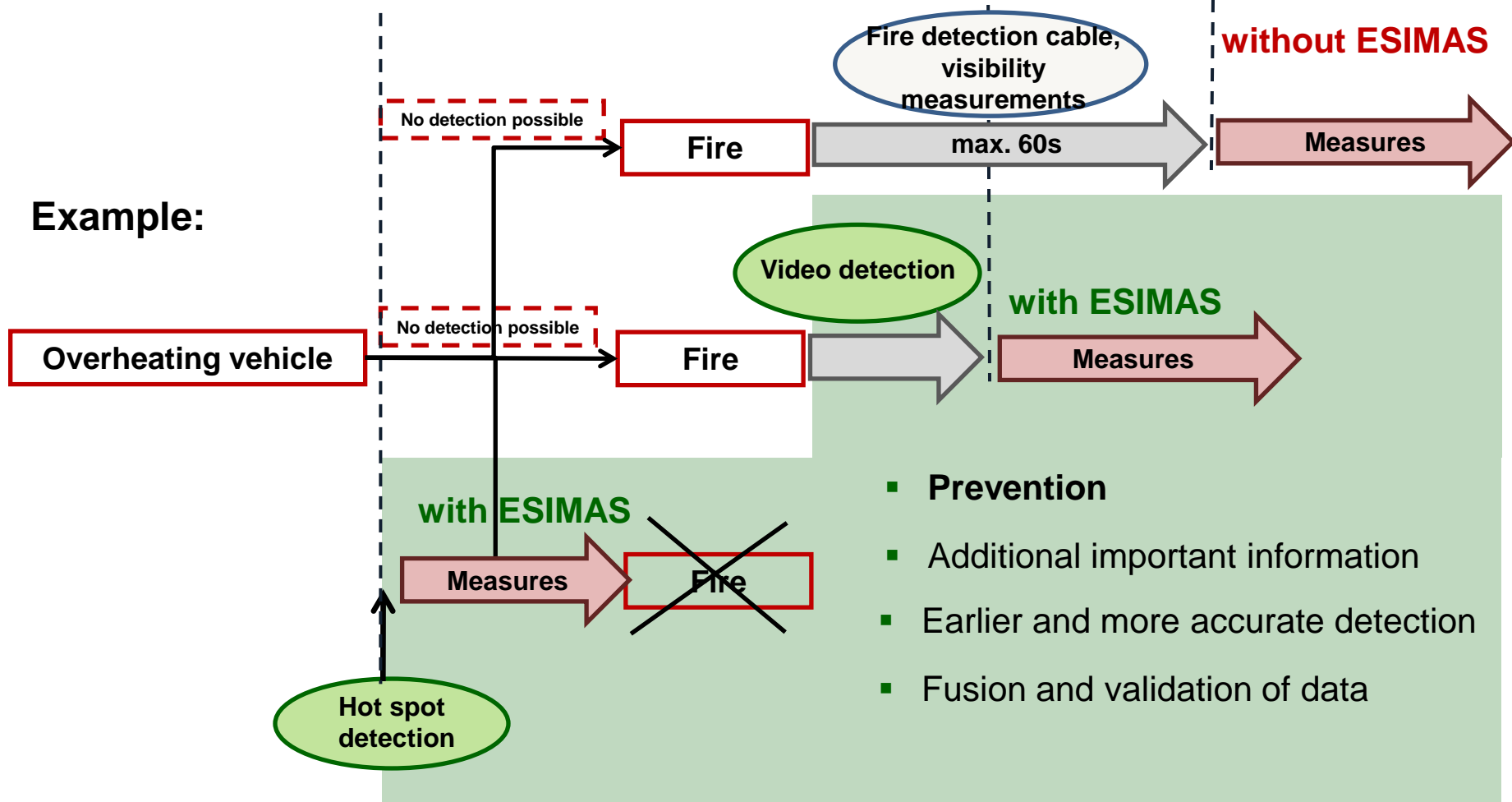What do we want to achieve with this project?

With ESMAS we want to detect **the risk of an event** in time

- Additional preventative measures

- Online risk analysis and evaluation

- Data Fusion und plausibility check

- Special design of a graphic user interface

- Reactive measures for risk situations

➔ Increase in traffic safety

Factor: Time

Example:

Fire detection cable, visibility measurements

without ESIMAS

No detection possible

Fire

max. 60s

Measures

No detection possible

Video detection

with ESIMAS

Overheating vehicle

Fire

Measures

with ESIMAS

Measures
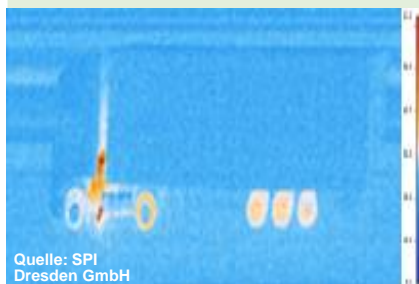
~~**Fire**~~

Hot spot detection

- **Prevention**
- Additional important information
- Earlier and more accurate detection
- Fusion and validation of data
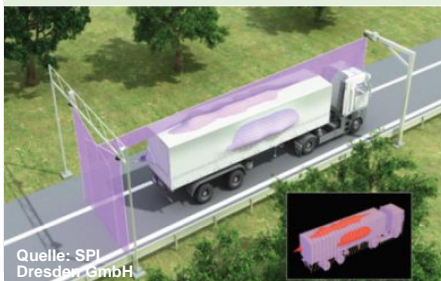
Innovative Detection Systems

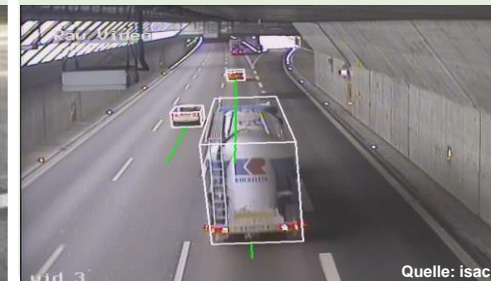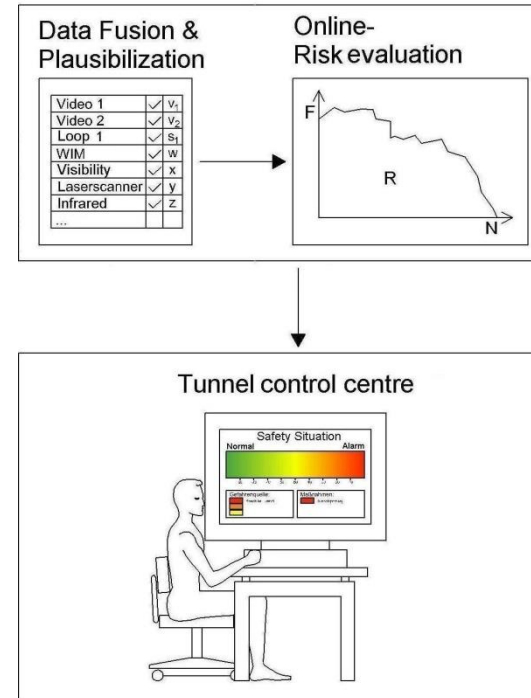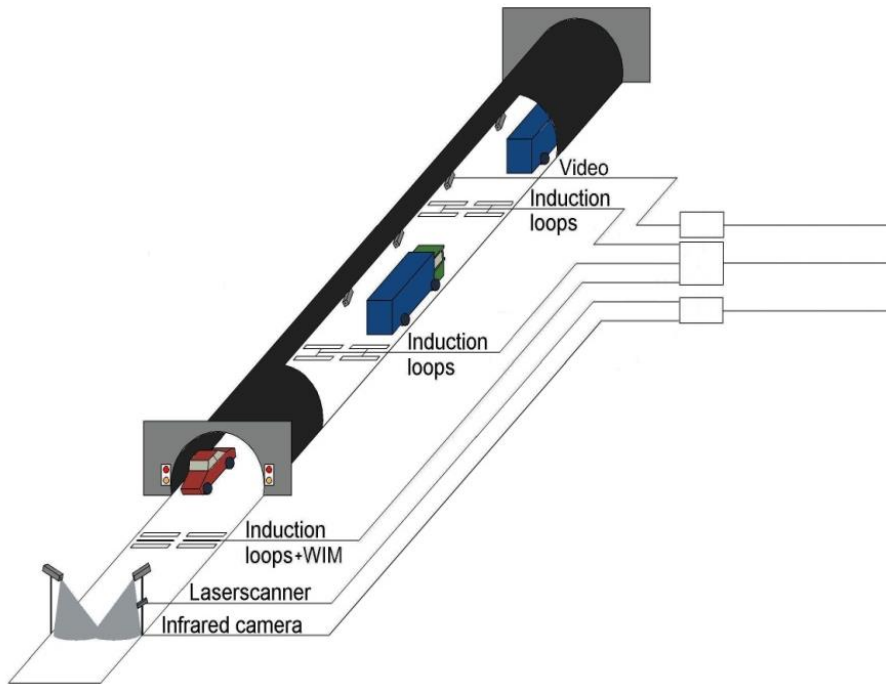| Infrared camera	Laser scanner	Automatic incident detection (Induction loop & WIM)	Video detection
▪ Detection of hot spots due to overheated brakes, or turbo chargers	▪ Vehicle shape recognition ▪ Height control ▪ Classification of vehicles ▪ Composition of traffic flow ▪ Estimation of number of persons in the tunnel	▪ Vehicle identification ▪ Low velocity ▪ Vehicle break-down/stop of a vehicle ▪ Congestion ▪ Wrong-way driver ▪ Traffic data	▪ Congestion ▪ Broken down vehicles ▪ Slow driver ▪ Objects/ People on the road ▪ Occupied shoulder ▪ Wrong-way driver ▪ Smoke ▪ Accident ▪ Fire

Quelle: SPI Dresden GmbH

Quelle: SPI Dresden GmbH

Quelle: BASt

Quelle: isac

SPI Dresden GmbH

SPI Dresden GmbH

ave ave Verkehrs- und Informationstechnik GmbH

isac Institut für Straßenwesen, Aachen Institut für Straßenwesen, RWTH Aachen

RWTH AACHEN

bast
Bundesanstalt für Straßenwesen

ESIMAS

| Conventional detection systems | **+** | New innovative detection systems | **➡** | Increase in Safety |

Visual Concept

Development of a graphic user interface to illustrate relevant safety information

Focus on:

- Incident prevention

- Detection of events

- Managing events

Main aspects and technological components
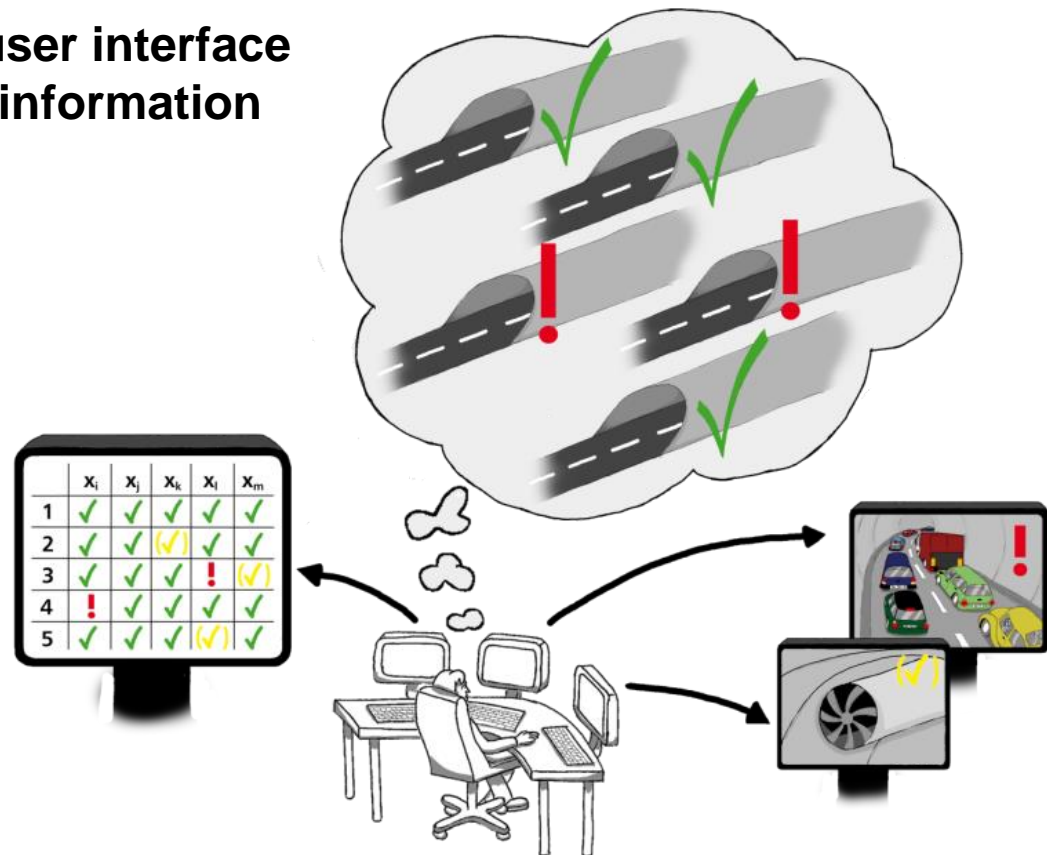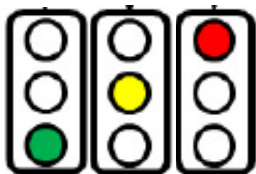
- Modular Components

- Adaptation of further detection system is possible

- Combination of different technologies

- Redundant systems to detect incidents faster

- Validation und data fusion ➔ reduction of false alerts

- Adapted graphic user interface

Prototype at Goldbach-Hösbach (BAB 3)

- Length >1,3 km

- Average daily traffic >80.000 vehicles

- Specific construction characteristics

- Tunnel sector of the north tube towards Frankfurt

- Steep slope ahead of the tunnel

- Access ramp and exit in the tunnel

- Change in tunnel cross section

- 1.440 hydraulic windows

Prototype at Goldbach-Hösbach

Video cameras

+WIM

Laser scanner
Infrared cameras
Video cameras
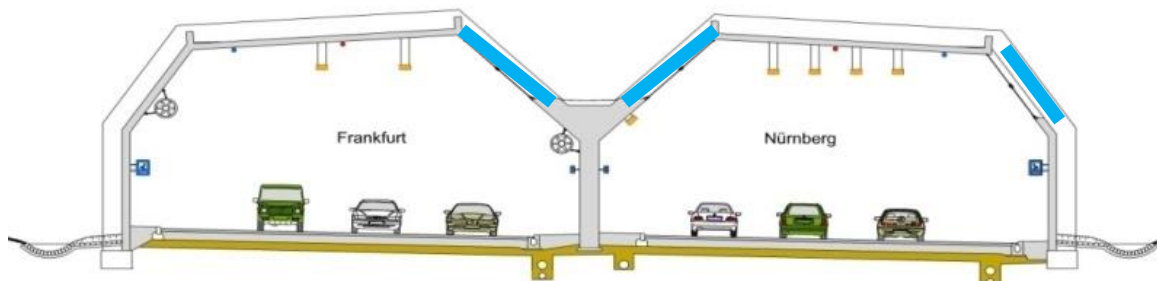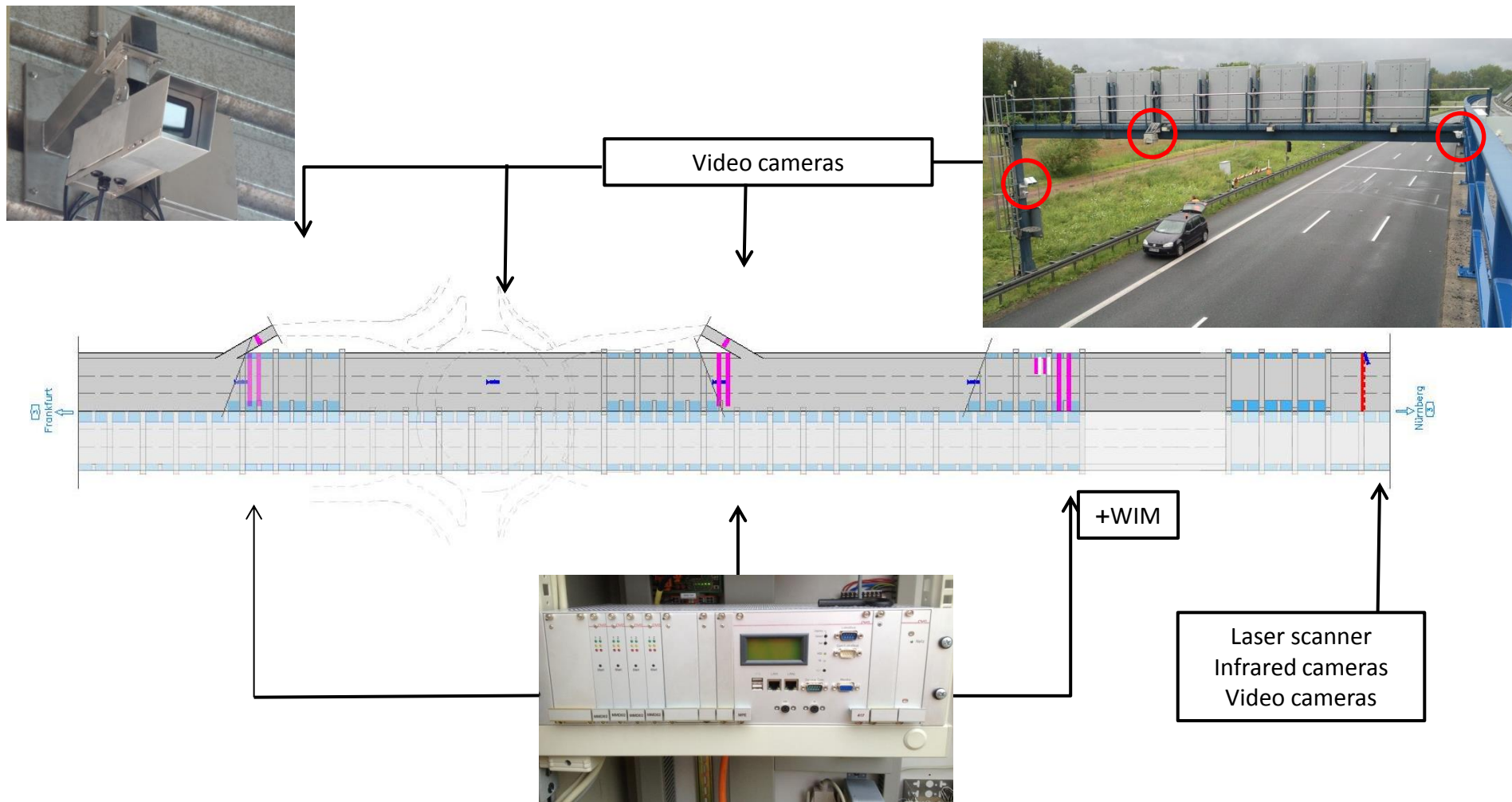
Advantages of ESIMAS

✓ Online risk analyses in real time

✓ Risk analysis is based on real data, not on predictions alone

✓ Application of new technologies

✓ Benefit for the operators (prioritization of information)

✓ Reduction of false alarms through plausibility check of data

✓ Integration of operators needs through feedback

✓ Counter measures can be applied sooner (prevention)

✓ Increase in traffic safety

Results and recommendations

ESIMAS is focused on prevention and suitable for tunnels with features such as:

✓ Structures behind steep slopes

✓ Structures with special characteristics

✓ Long tunnels

✓ Tunnel chains

✓ Tunnel Control Centers responsible for several tunnels

Thank you for your attention.

More informartion:
www.esimas.de

Contact & Questions:
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