Mr. Josef A. Czako

Kapsch

First Class Road Safety with ITS

6th IRF Conference on Road Safety, and Intertraffic India
New Delhi
October 4th, 2011

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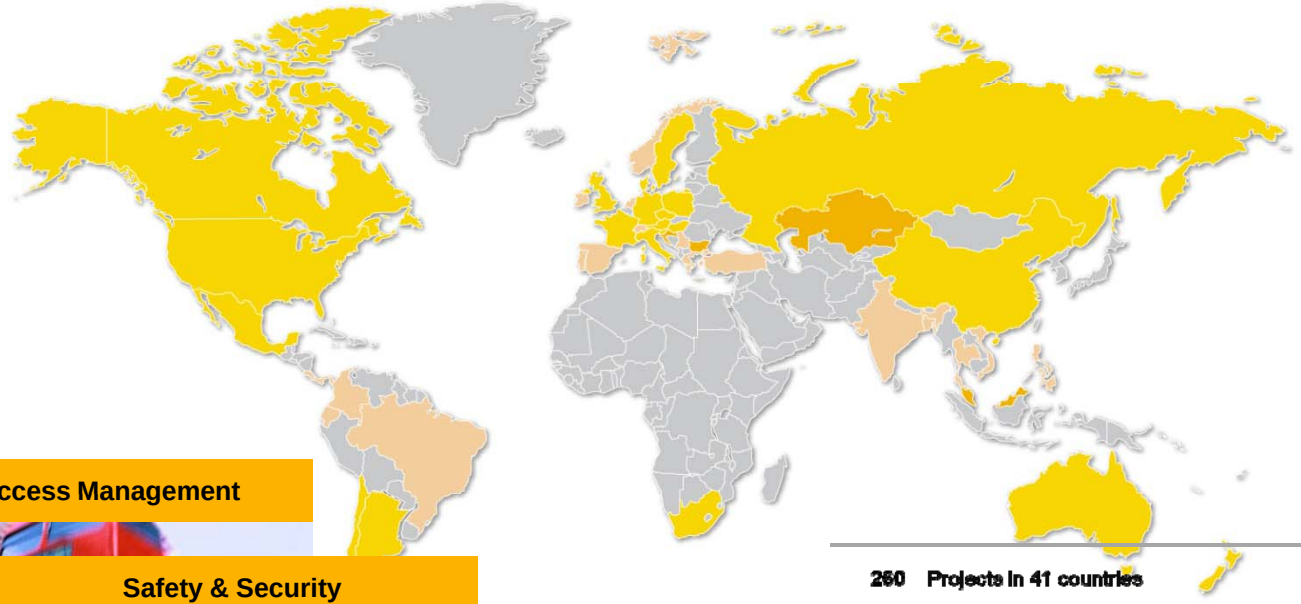
Kapsch TrafficCom

Agenda

- **Who is Kapsch TrafficCom?**
- **The challenge to make roads safer**
- **First Class Road Safety**
- **Project Examples**
- **Kapsch TrafficCom Incident Detection System**
- **Conclusions**

What is Kapsch TrafficCom actually doing?

Kapsch TrafficCom Group



Urban Access Management

Safety & Security

Road User Charging

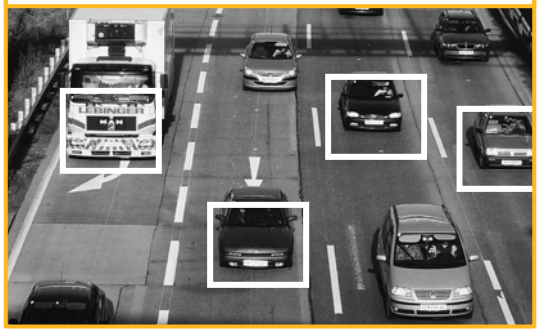
260	Projects in 41 countries
80%	Of Multi Lane Free Flow (MLFF) Systems worldwide are supplied by Kapsch TrafficCom
100	Cars per second are passing through Kapsch TrafficCom's MLFF tolling points
44	Million drivers that use our OBUs (On Board Units) as a means of payment
3 of 5	National truck tolling schemes in Europe use Kapsch TrafficCom's technology and services
12	Months (average) to deliver complete national truck tolling schemes (for the Czech Republic and Austria)

Kapsch TrafficCom Products and Services

Tolling Systems

Urban Traffic Solutions

Safety & Security



ITS - Components

Operations & Finance

Kapsch TrafficCom Safety & Security Solutions

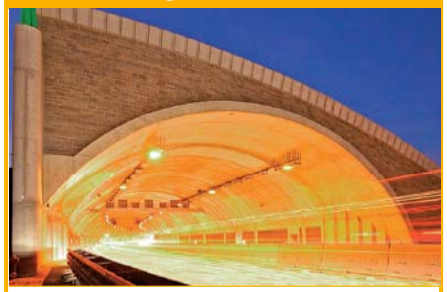
Speed Monitoring

- Average speed over distance measurement
- Single sections & section networks
- Red Light Enforcement

Traffic Surveillance Systems

- ANPR checks of vehicles
- Mobile and stationary version

Incident Detection Systems



- Wrong way drivers
- Lost cargo
- Smoke
- Break down
- Slow/stopped cars
- Traffic data

Cooperative Systems

- 5.9 GHz WAVE products
- Standardization
- Research
- Trial applications

Back Office System

Add-on Applications

Kapsch TrafficCom ITS Integration

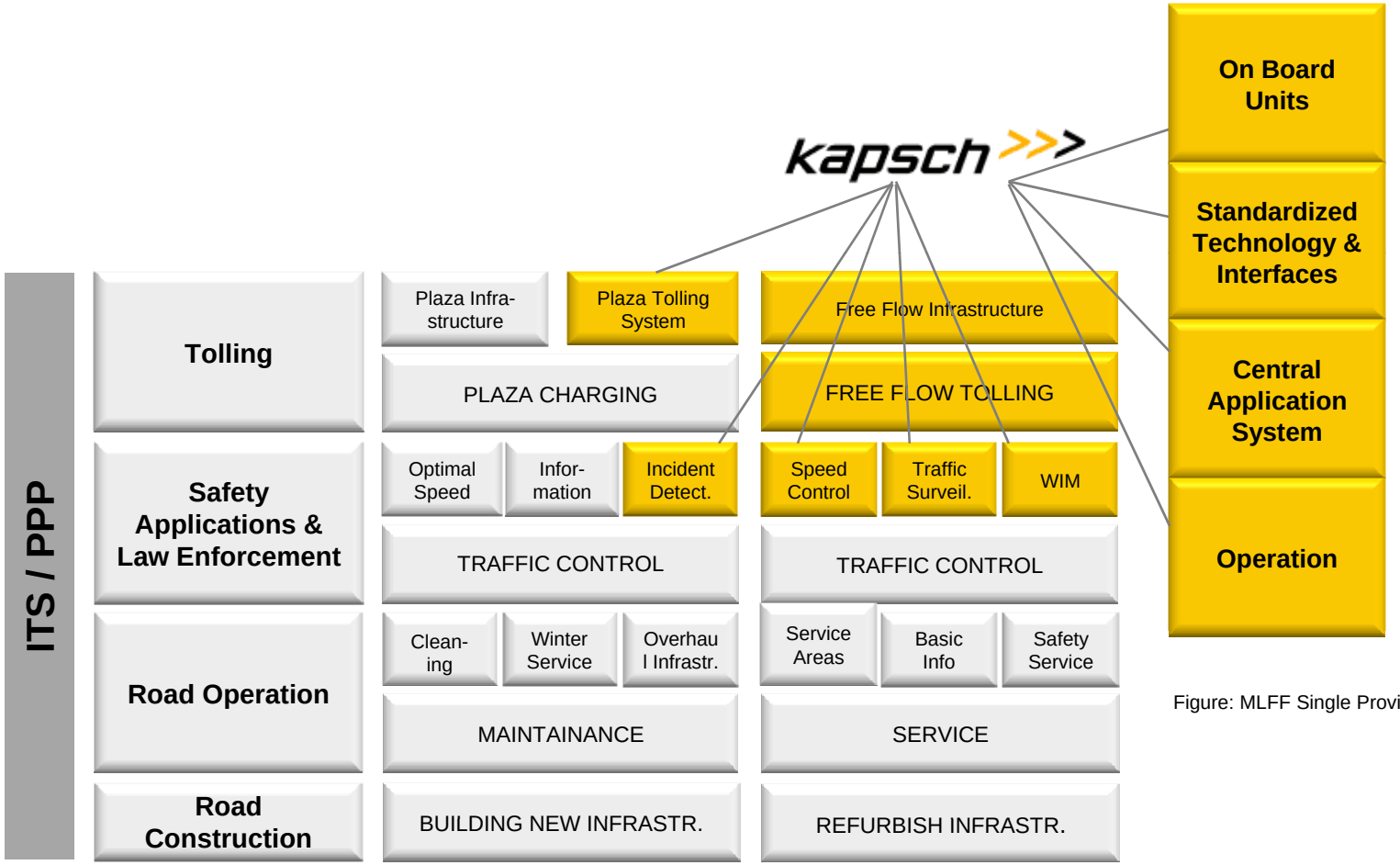
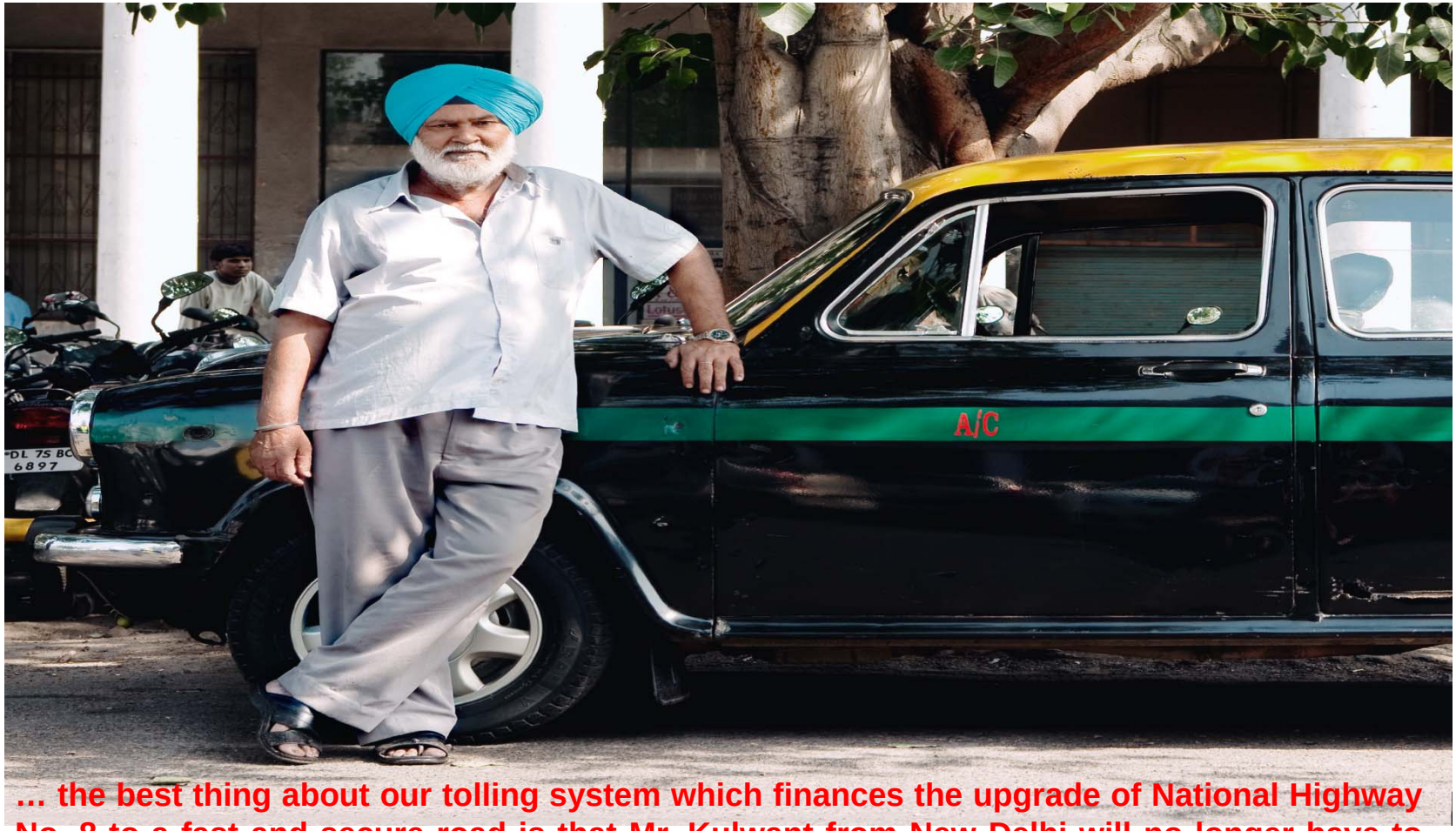


Figure: MLFF Single Provider

Figure: Concessionaire

Kapsch TrafficCom in India



… the best thing about our tolling system which finances the upgrade of National Highway No. 8 to a fast and secure road is that Mr. Kulwant from New Delhi will no longer have to miss a single one of his grandson's cricket games …

The challenge to make roads safer

Vulnerability in figures (Snapshot)

Road fatalities worldwide:	▪ At present, estimated **1.2 million road users killed every year** ▪ **Vulnerable Road Users (VRU)** account for **46% of road traffic deaths** (WHO)
Trends:	▪ If current trends continue, the estimated annual number of **deaths and disabilities** due to traffic collision **would increase by more than 60% by 2020** (same risk factors projected from 1990 to 2020) ▪ In 1990, road traffic injuries ranked as 9th leading contributor to the global burden of disease and injury. By 2020, they are expected to be **ranked 3rd** (*)
Characteristic:	▪ **Gap** in between developed countries and developing countries – in East Asia over 80% of those killed are VRU – in America the corresponding figure is around 20%. ▪ Aging population

(*) Global epidemical study: The global burden of disease.

Reported deaths by type of road user, by WHO region group

•WHO data 2010

Who are the Vulnerable Road Users & Measurement Units

Vulnerable Road Users subdivided by mode of transport or by age	▪ Pedestrians, Cyclists, Moped riders, motor cyclists, Users of Public Transport in developing countries (overcrowding, riding on the bus, …) ▪ Aspects of task capability - inexperience of children, declining task capability of the elderly
Measurement units of Vulnerability	▪ Inequality factor – large difference between protected and unprotected modes of transport ▪ Casualty rate – expresses the task (in)capability of the young and the elderly ▪ Crash severity

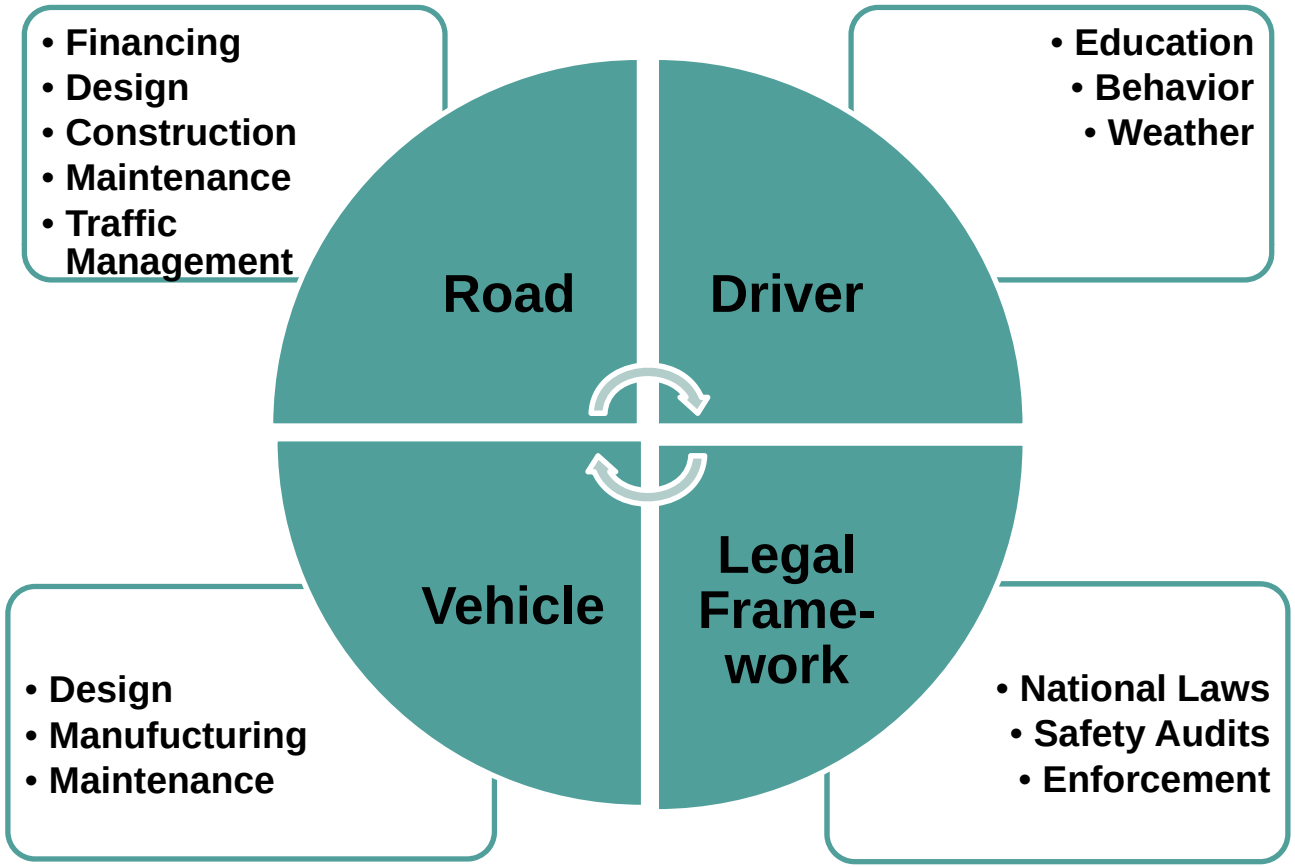
Inequality factor in serious two-vehicle chrashes

Transport mode of casualty	Crash opponent transport mode				
	Bicycle	(Light-) moped	Motorcycle	Car or van	Lorry
Pedestrian	1.7	3.8	3.9	202.6	-
Bicycle	1	1.8	2.4	126.2	245.0
(Light) moped		1	1.8	120.6	101.0
Motorcycle			1	37.9	127.0
Van & Car				1	18.6
Lorry					1

•Inequality factor in serious two-vehicle crashes, 2004 – 2008 (Source: Dutch Research Institute on Road Safety, Figures shown for the Netherlands)

1st Class Road Safety?

Strategic Elements of Road Safety

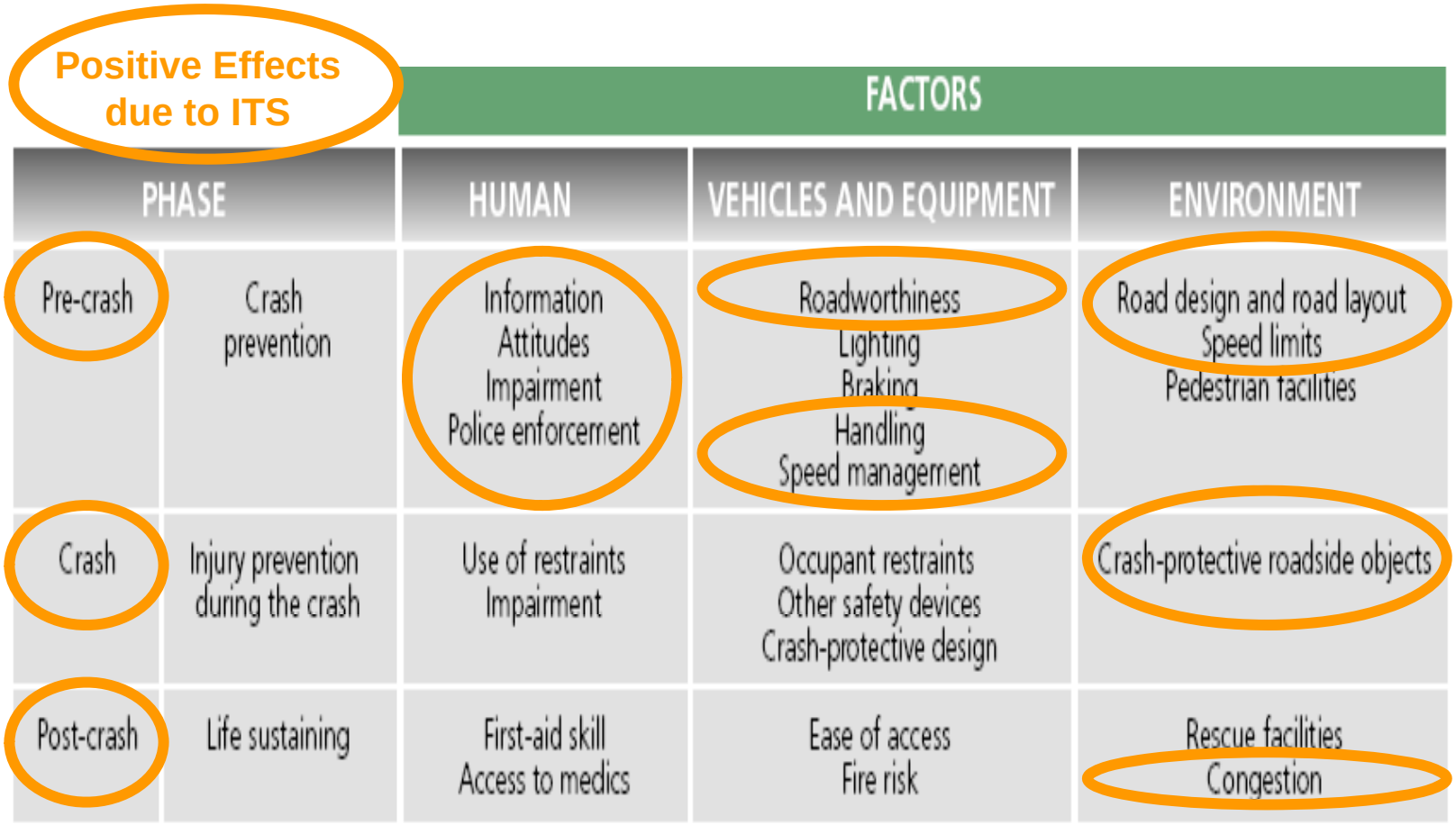


The Haddon Crash Matrix

		FACTORS		
PHASE		HUMAN	VEHICLES AND EQUIPMENT	ENVIRONMENT
Pre-crash	Crash prevention	Information Attitudes Impairment Police enforcement	Roadworthiness Lighting Braking Handling Speed management	Road design and road layout Speed limits Pedestrian facilities
Crash	Injury prevention during the crash	Use of restraints Impairment	Occupant restraints Other safety devices Crash-protective design	Crash-protective roadside objects
Post-crash	Life sustaining	First-aid skill Access to medics	Ease of access Fire risk	Rescue facilities Congestion

Source: WHO World report on road traffic injury prevention 2004

Crash Mitigation with ITS

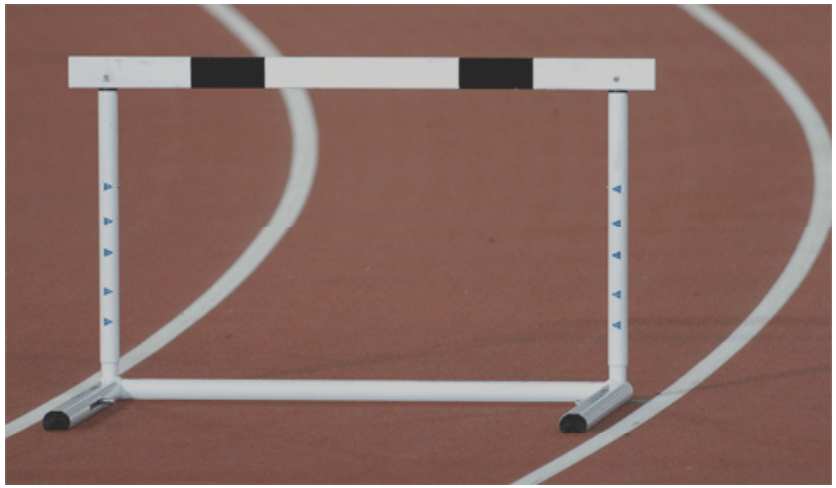


Road Safety as an integrated approach (3 E's)

- **E**ducation and change of User behavior)
  - > Educate all potential road users – start in school or even earlier
  - > Campaigns

- **E**ngineering
  - > Vehicle Safety
  - > Road infrastructure Safety
- **E**nforcement
  - > Enforce traffic rules and therefore discipline drivers that violate these rules and jeopardize others
  - > Earn money which helps to increase road safety

Hurdles to overcome to improve Road Safety



- Lack of national policies & standards
- Insufficient legal framework and thus lack of enforcement
- Isolated and fragmented applications
- Interagency disconnections at federal, regional and municipal levels
- Short term thinking as well as mental and national boundaries
- Poor communication on benefits

Project Examples

#1 Section Speed Control
#2 Wrong Way Driving Detection
#3 Red Light Enforcement System

Traditional Speed Measurement – Fixed and Mobile

Laser based

Mobile systems based on radar

Video based speed measurement

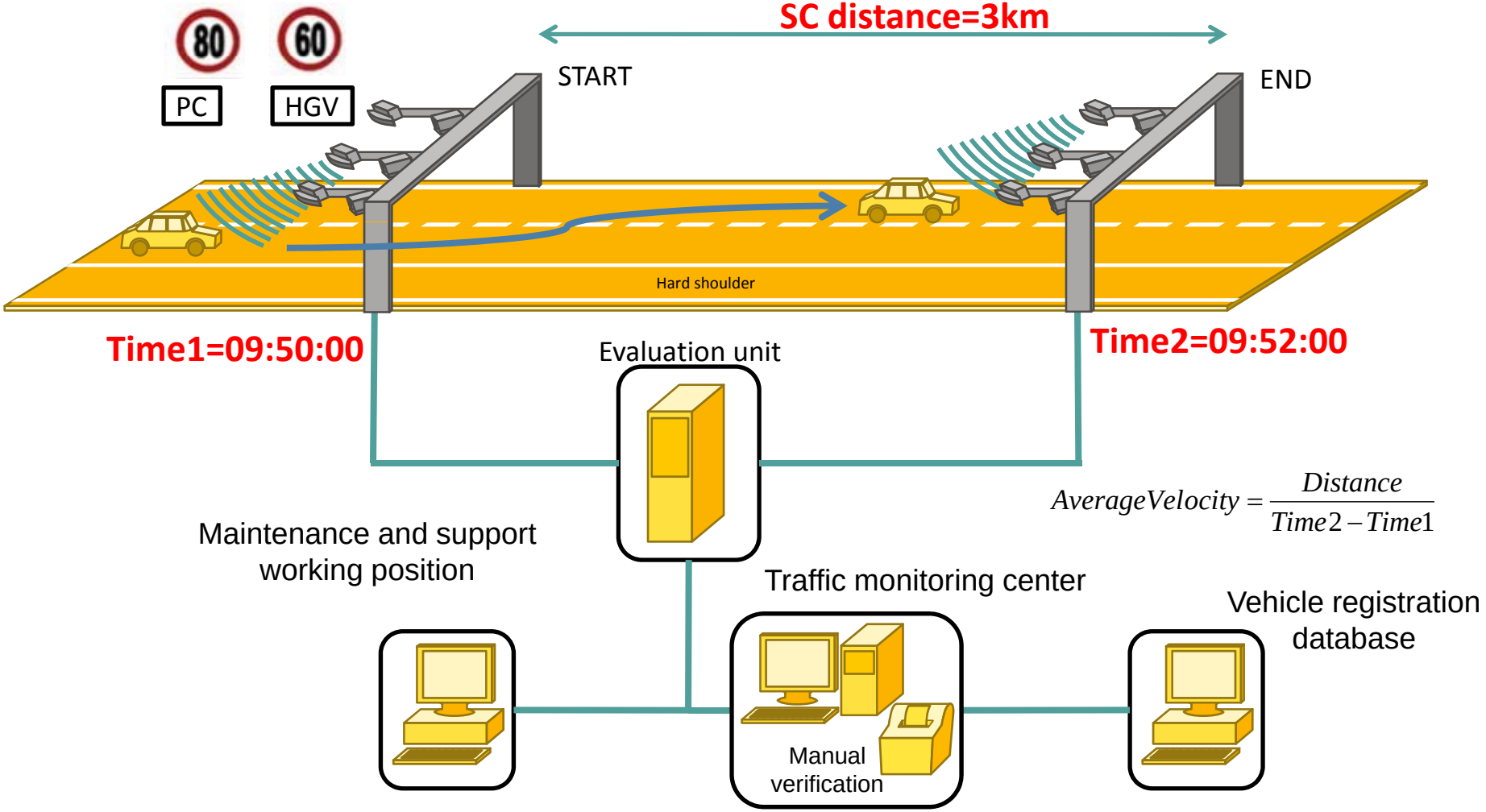
Stationary radar systems

mobile systems ⟷ **fixed systems**

Very efficient due to the surprise effect. A disadvantage is that they are personnel-intensive and a continuous operation is not possible.

Effect of such systems is very local

#1 Section Speed Control (SSC) - Principle



Advantages of Section Speed Control (SSC)

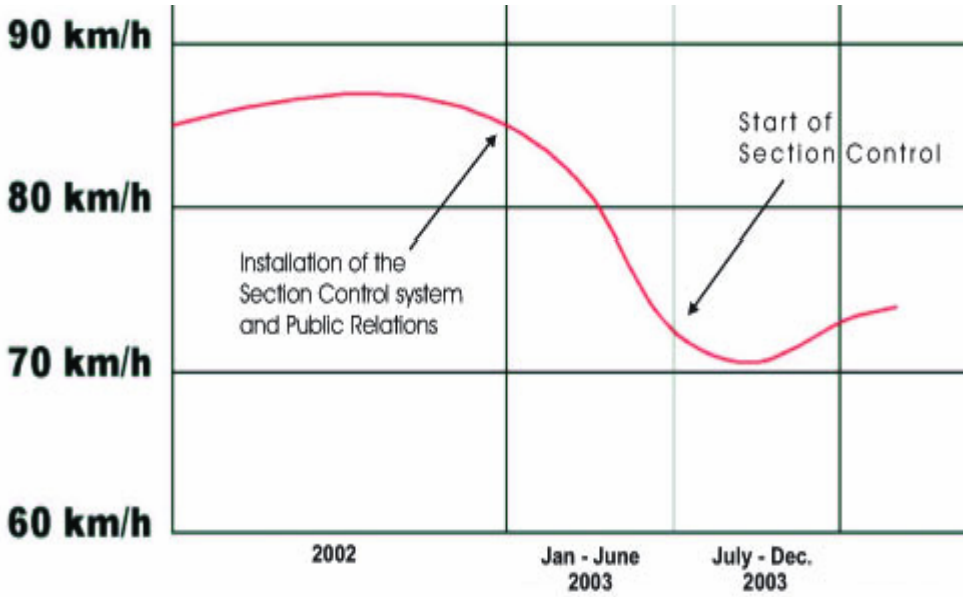
- Reduce accidents and severity (due to reduced average speed)
- Harmonize the traffic flow, thus less congestion
- No abrupt braking at single speed cameras (→additional reduction of accidents)
- Reduction of environmental pollution and noise

SSC Project Examples and Results : UK, Italy, Austria

- **England (Nottingham)**
  - Dead or seriously injured **- 55%**
- **Italy**
  - Amount of accidents **- 22%**
  - Slightly injured **- 34.7%**
  - Dead persons **- 50.8%**
- **Austria (Kaisermühlentunnel)**
  - Slightly injured **- 33.3%**
  - Dead/ seriously inj. **- 48.8%**

SSC Effects : Austria – Tunnel Kaisermühlen

Reduction of the average velocity in
the Kaisermühlentunnel (Vienna)
from 85km/h to 75km/h.



Source: Kuratorium für Verkehrssicherheit (Austria)

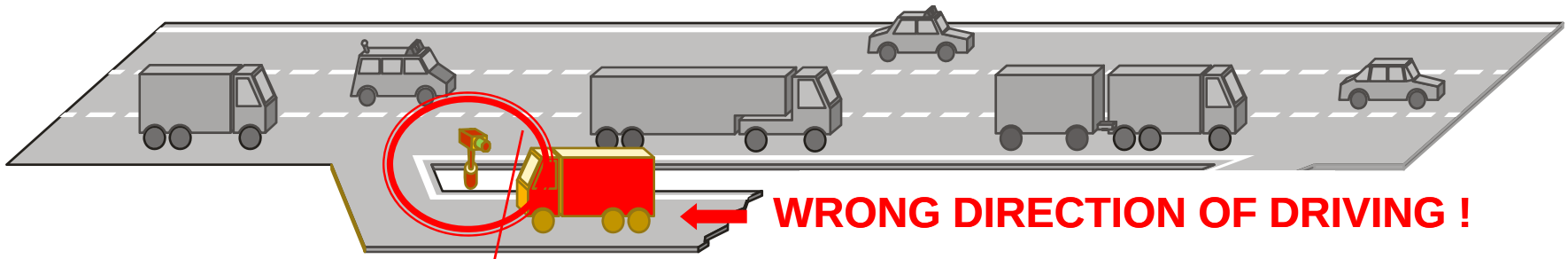
“SSC Rule”

Rule: Reduction of the average velocity by 1% leads to:

- **2% less slightly injured,**
- **3% less seriously injured, and**
- **4% less killed persons !!!!!**

#2 Detection of Wrong Way Drivers by Digital Image Processing

- Intelligent digital video camera installed at exits
- If a vehicle with wrong driving direction is detected, the following actions are started:
- **report to a traffic control centre**
- **alarming police**
- **warning of drivers on that particular stretch of the road**



Intelligent Digital Video Camera

Example: Detection of Wrong Way Driver at Strenger Tunnel in Austria

The situation is alerted immediately and the following tunnel reflex is released :

- Minimise the negative effects of traffic disturbances like accidents or congestions
- Shorten the reaction time to incidents

Automatically triggered proceedings :

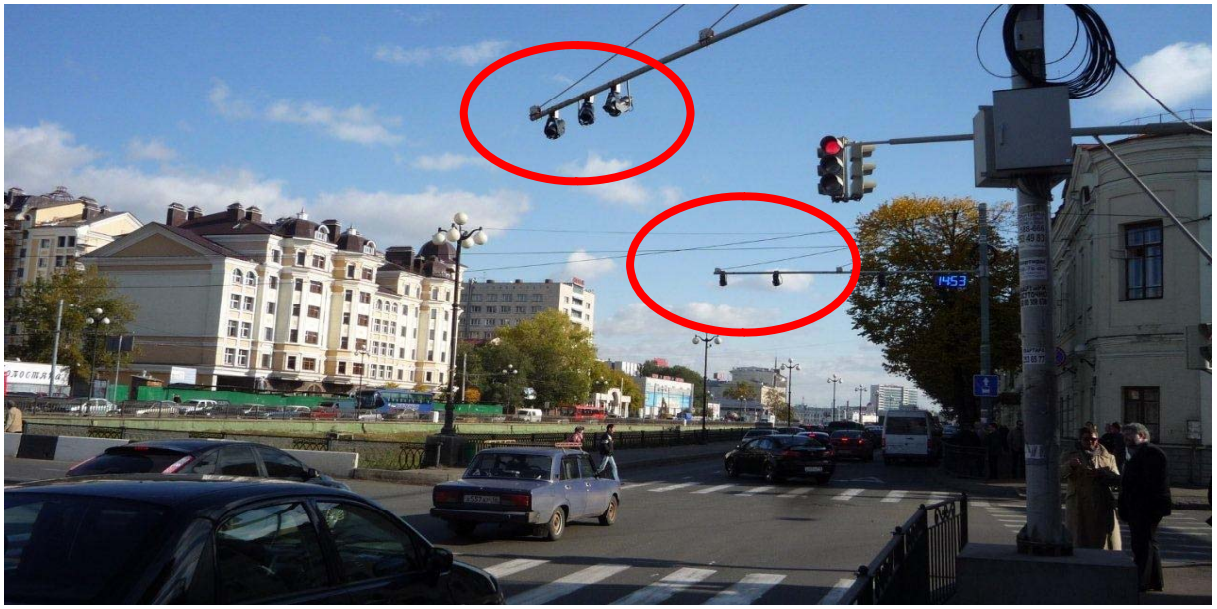
- The tunnel entrance traffic light turns red
- Real-time traffic management information signs limit speed to 60 km/h
- Text signs in emergency bays and portals indicate “Attention: Wrong Way Driver”.

http://oesterreich.orf.at/tirol/stories/234654

#3 Project Red Light Enforcement System in Kazan, Russia

Strategy:

1. No driving on red light
2. No blocking of intersection
3. No turns if not allowed
4. No speeding between intersections



#3 Red Light Enforcement Systems (RLES)

Detection

> Vehicles are detected and identified by their license plates when entering the crossing with infra red cameras generating a front image.

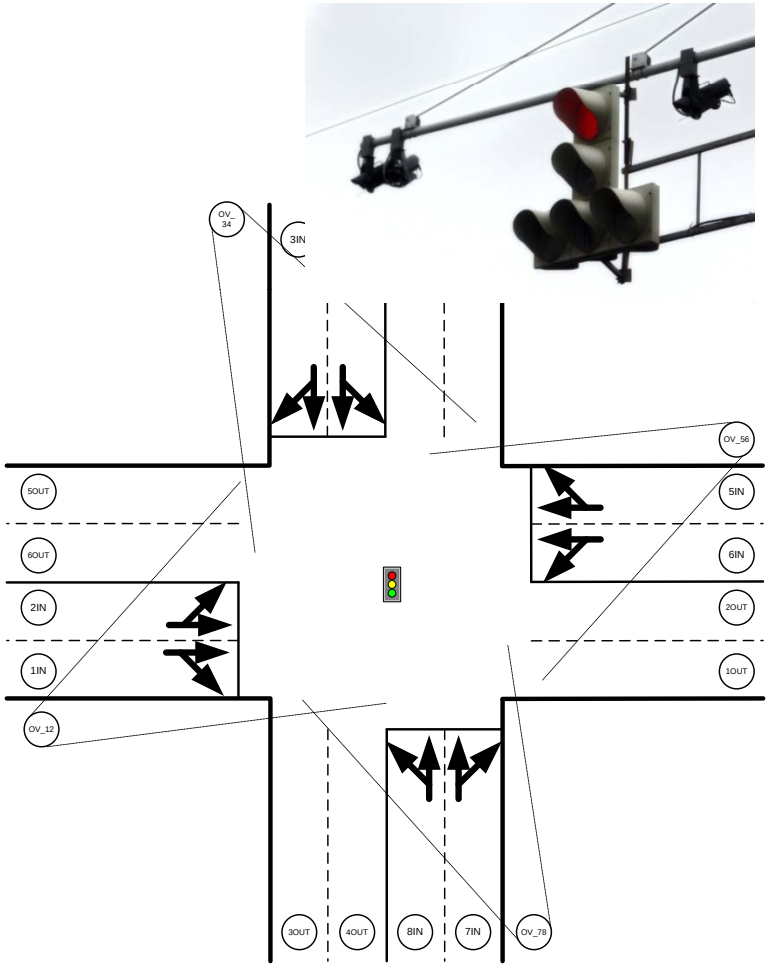
> When the vehicle leaves the crossing again it is detected and identified a second time by another infra red camera.

Identification

> Identification of vehicles is done automatically by extracting the license plate string with a high performance Automatic Number Plate Recognition (ANPR) engine.

Verification

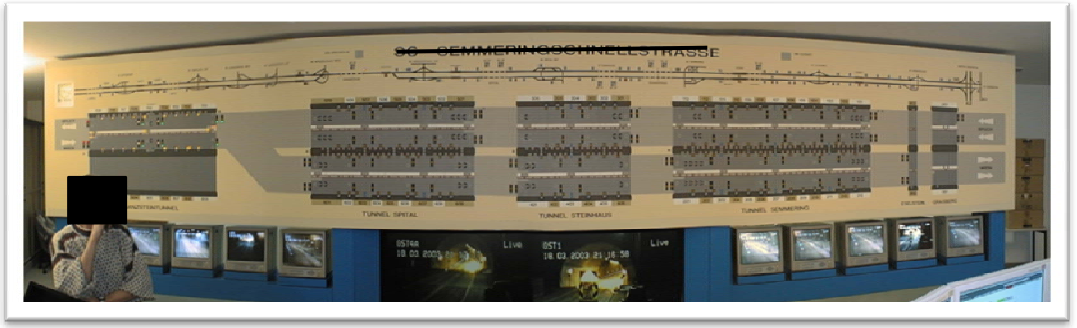
> A comparison of the ANPR results of vehicles entering and leaving the crossing can be outlined to determine the vehicle path and to decide if a violation of traffic rules exists or not



Kapsch TrafficCom
Incident Detection System (IDS)
Overview

Goals for Incident Detection

- **Help to keep your roads reliable**
  - Minimise the negative effects of traffic disturbances (accidents/congestions)
  - Shorten the reaction time for prevention / intervention
- **Significantly enhance the safety / security on your roads**
  - Rapid alerting, gain time in the race of setting the right measures
  - Real Time Decision support
- **Secure your investment**
  - It is for refurbish and new sites (cost of ownership balance - capex/opex)



IDS - References

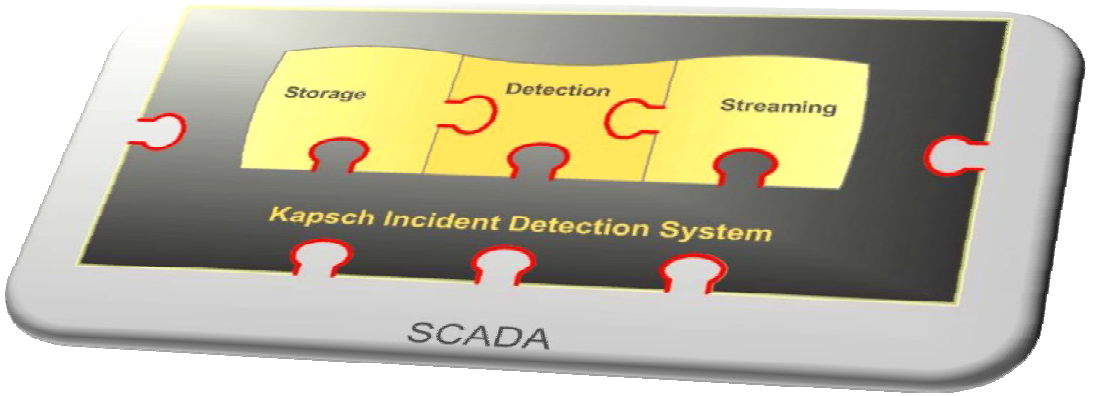
- **> 35 projects**
- **> 20 customers**
- **> 140 km tunnels & roads**

- **special projects**

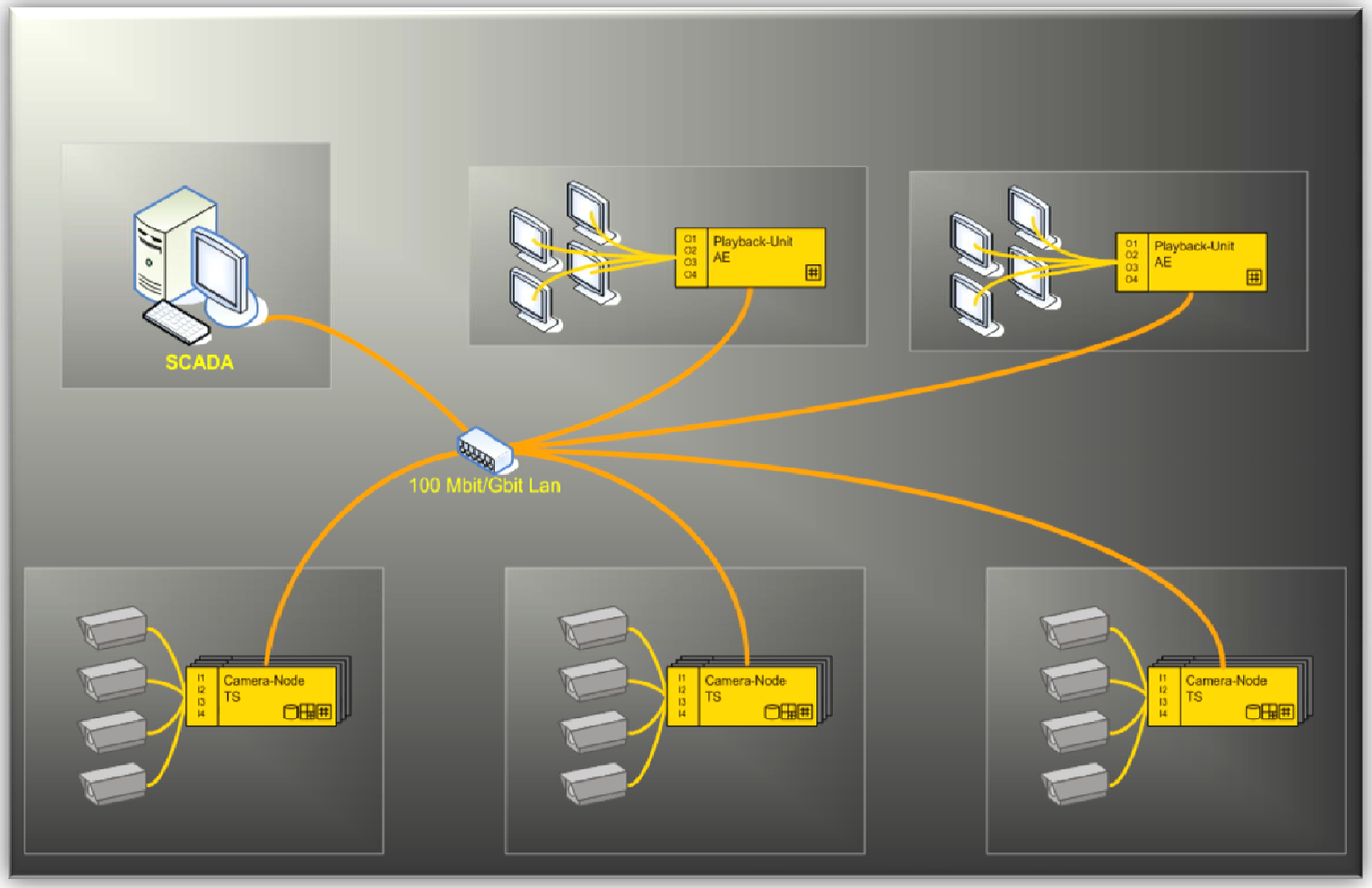
  (e.g. Military, immersed, tram)

IDS Overview

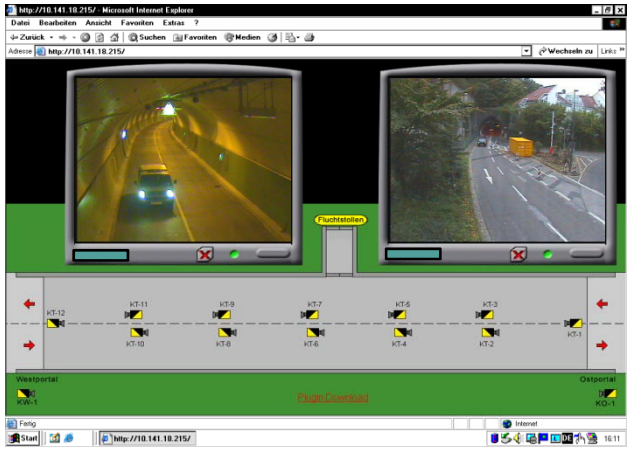
- **CCTV, streaming of the picture/video**
- **Storage / Archive - Digital Video Recorder**
- **Incident detection (AID) / Traffic Data generation**
- **Integration within KTC-IDS and into control systems (SCADA)**



IDS System Design



IDS User Functions – GUI based



IDS Portfolio


Speed Measurement


Distance Measurement


Vehicle Classification


Counting (Virtual Loops)


Traffic Jam & Stopped Car


Slow Driving Vehicle


Wrong Way Driver


Wrong Lane Driver


Movement in Non-Traffic Area


Breakdown-Bay Occupancy


Pedestrian on the Road


Smoke


Lost Cargo


Hazardous Goods Plate

Kapsch Incident Detection System.

IDS Example – Truck Wrong Way Driving in Strenger Tunnel

The IDS system alerts immediately.

Actions:

- Tunnel entrance traffic light automatically on red !
- The complete tunnel is operated under „yellow flash“ traffic
- VMS shows „overtaking is prohibited“ and the maximum allowed speed is set to 60km/h
- Info signs in the emergency bays and portals shows „Attention Ghostdriver“

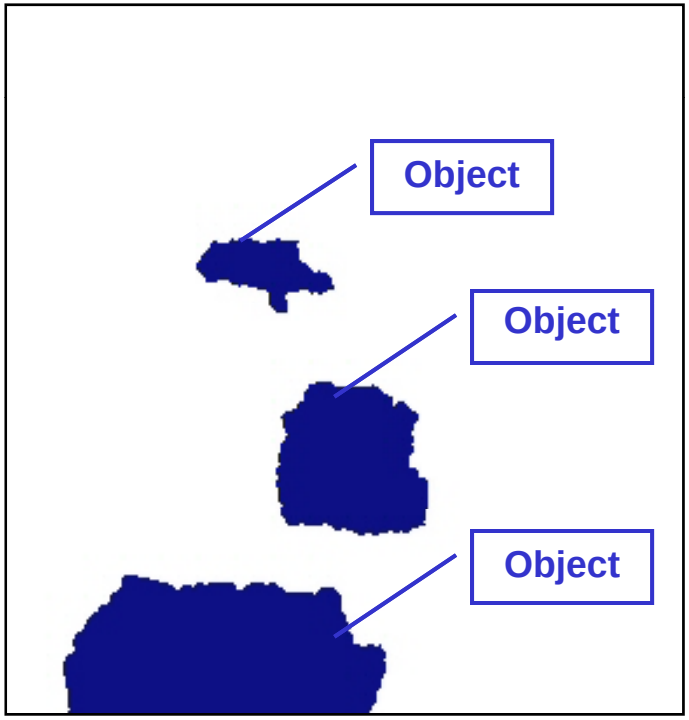
From those measures ASFINAG expects increased Traffic safety.

http://oesterreich.orf.at/tirol/stories/234654/

Conventional detection

- filter for unwanted elements
- object-detection with the remaining motion-elements

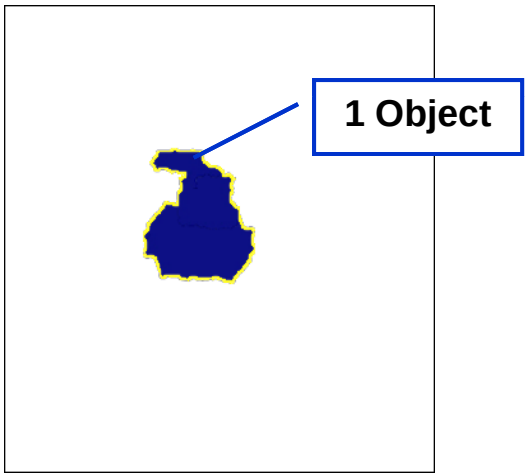
- Motion-Analysis through difference-evaluation



Conventional detection

- detection-range is limited due to overlapping of objects
- increasing false alarms with higher range

- different objects merge to one object



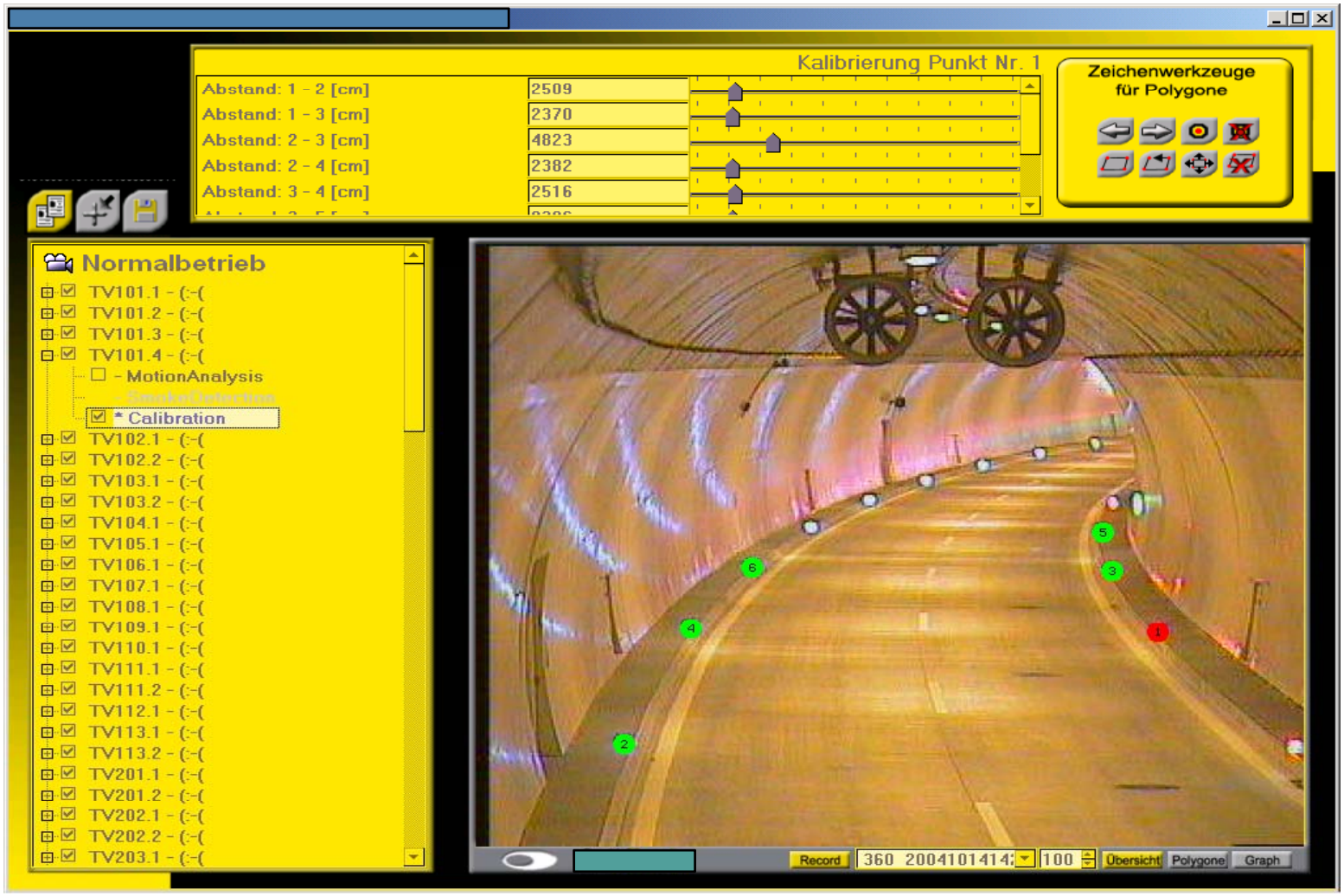
IDS solution - Object tracking

- characterisation of objects by means of clear features
- exact retrievement of the features
- object tracking leads to movement vector

IDS solution - Object tracking

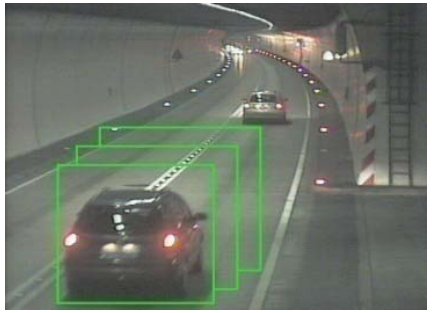
- accurate retrievement of the features due to position-prediction
- accurate retrievement of the object despite overlapping
- detection up to 150m ! [under good conditions]

IDS Detection – 3D configuration client



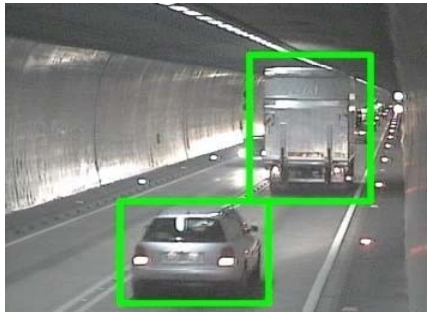
IDS Detection - Traffic analysis

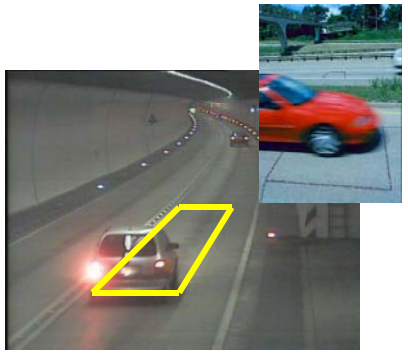
- **speed measurement**



- **distance measurement**

- **classification into 2 classes car / truck**
- **counting (virtual loops)**



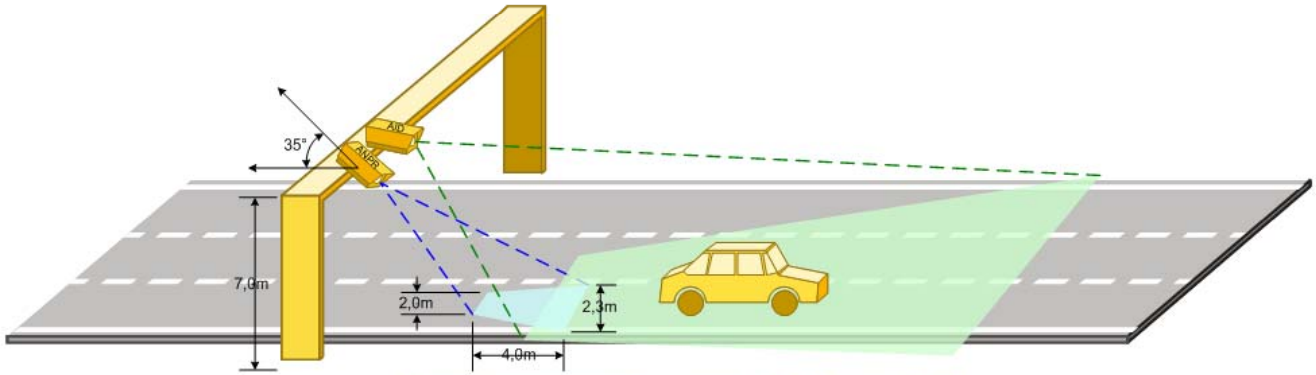


Measurement accuracy

- **high accuracy**
  - certified by the Austrian BEV - Federal Office of Metrology and Surveying
- **speed measurement**
  - average relative error <2,12%
- **distance measurement**
  - average error <1/10 seconds
- **vehicle counter**
  - >98% accuracy (also below 30km/h)

IDS Detection - Traffic analysis cont.

- **Licence Plate Recognition**



IDS Event detection

- **traffic jam & stopped car**

- **slow driving vehicle**

- **wrong way driver / wrong lane driver**

IDS Event detection cont.

- movement non-traffic-areas
- pedestrian on the road

- breakdown-bay occupancy

- lost carriage / debris

IDS Event Detection cont.

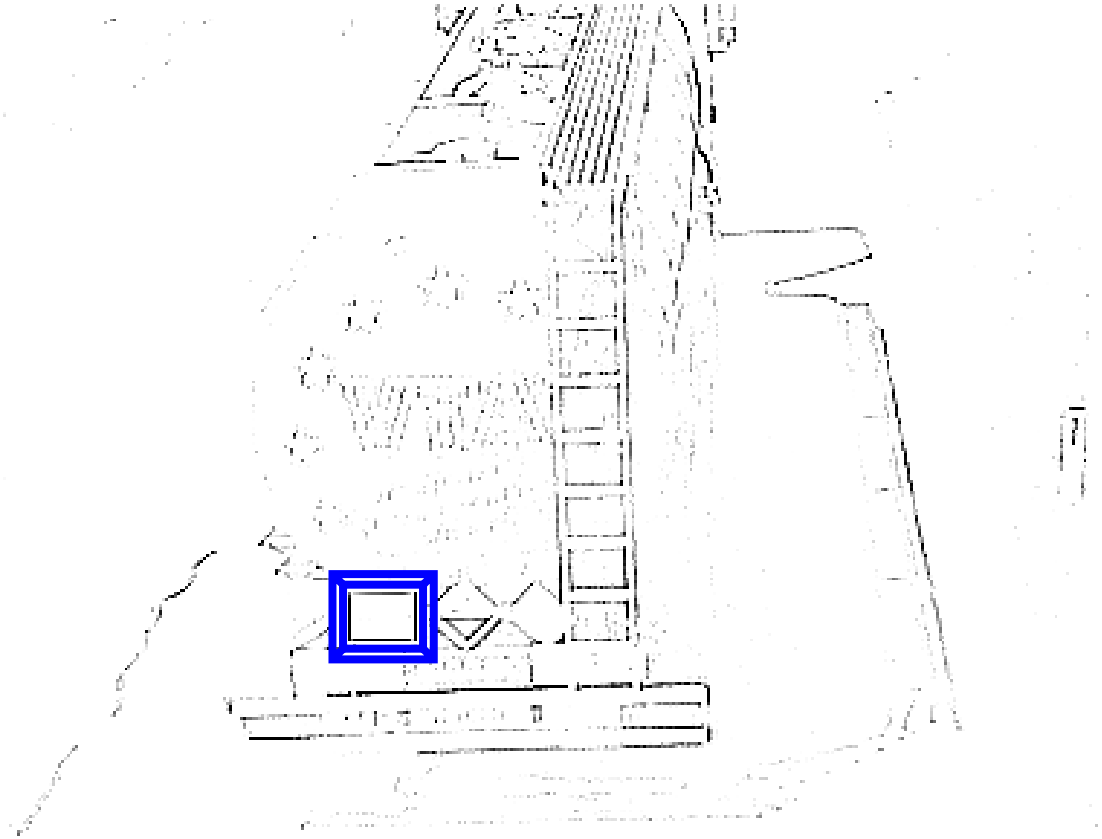
- ADR
- Hazardous goods (HGV)
- Dangerous goods (DGT)
- UN-code (Kemler-code)

IDS Detection - hazardous goods

- **Method**

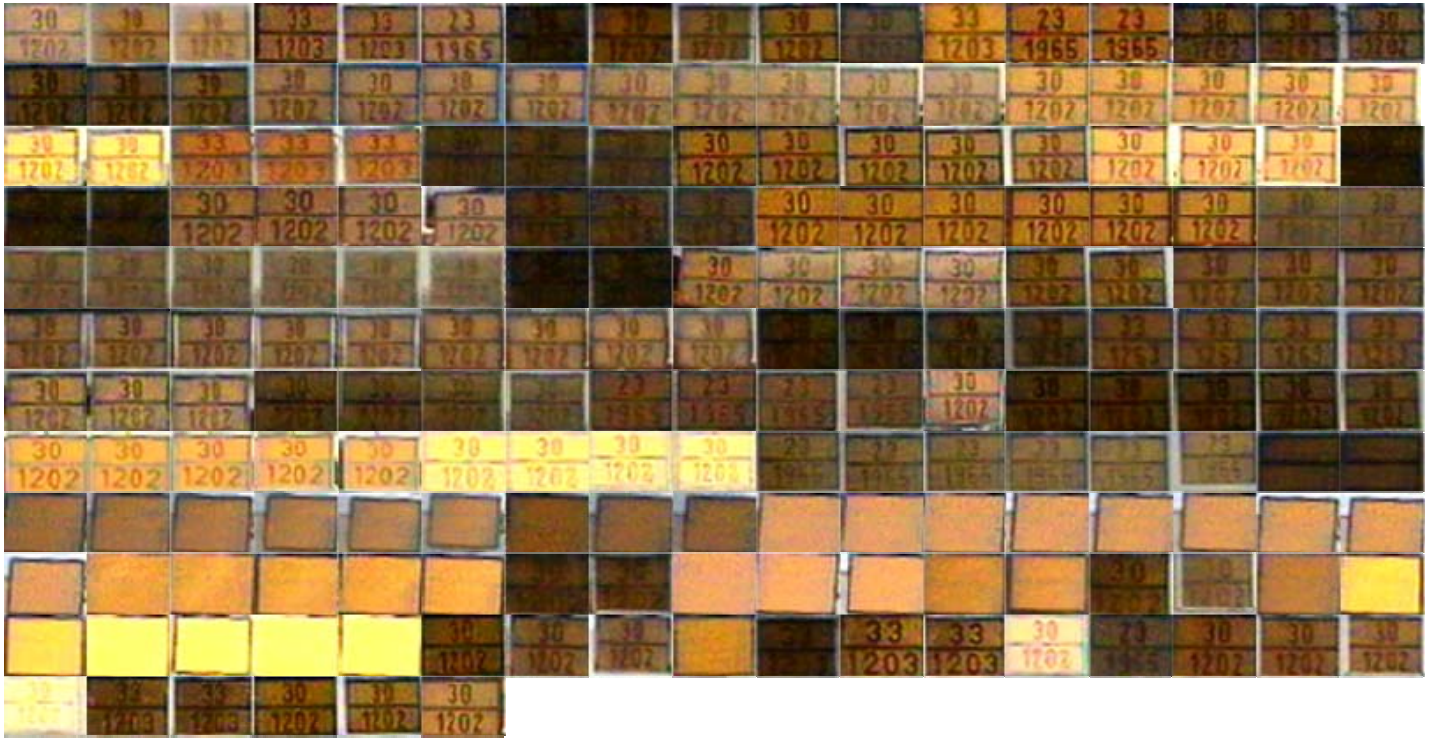
IDS Detection - hazardous goods

- **analysis of shape and color**



IDS Detection - Hazardous Goods

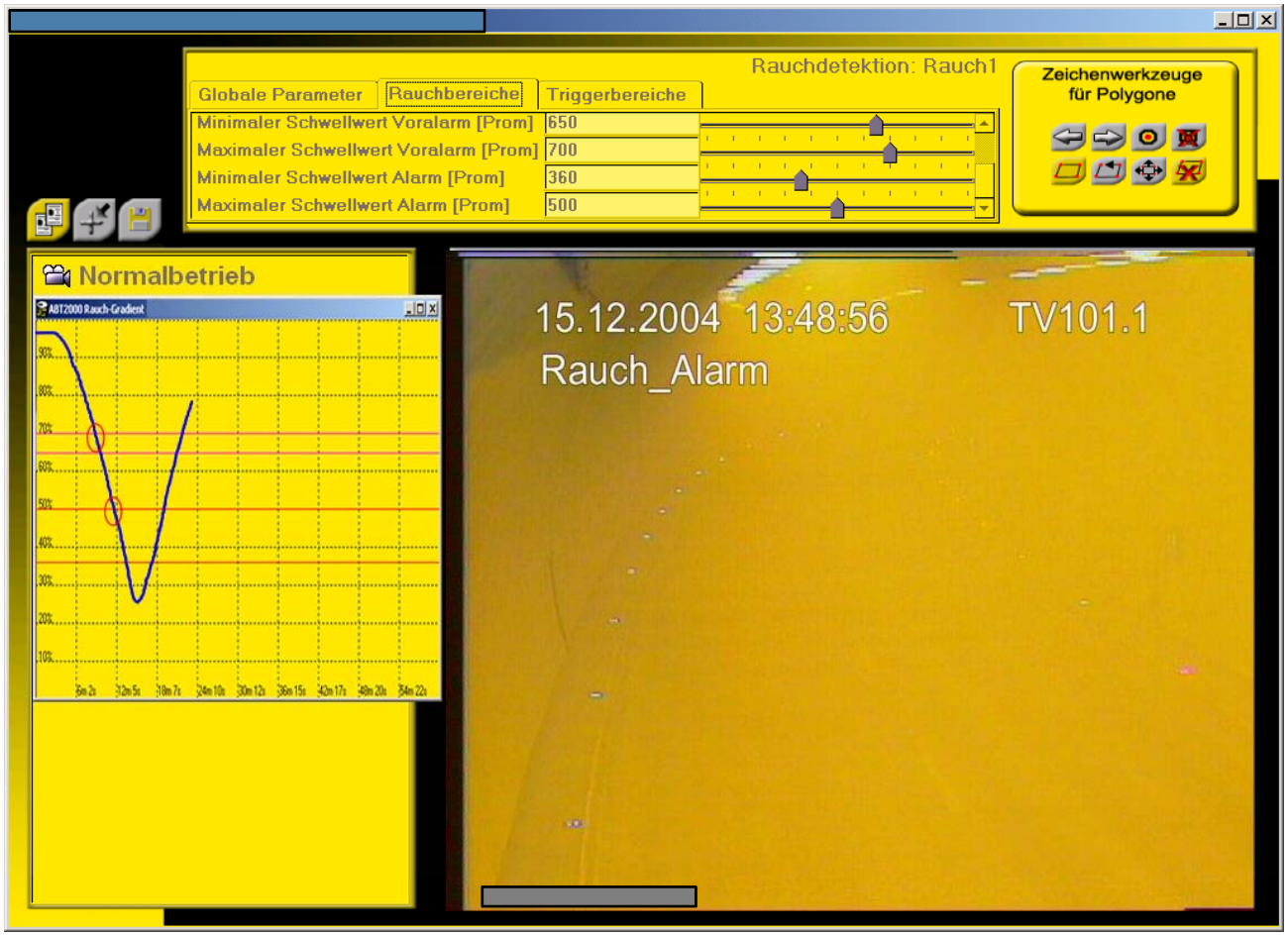
- **colour-range in practise !!!**



IDS Detection - Smoke

- **smoke**

IDS Detection – Smoke



Detection – smoke via traditional heat cables

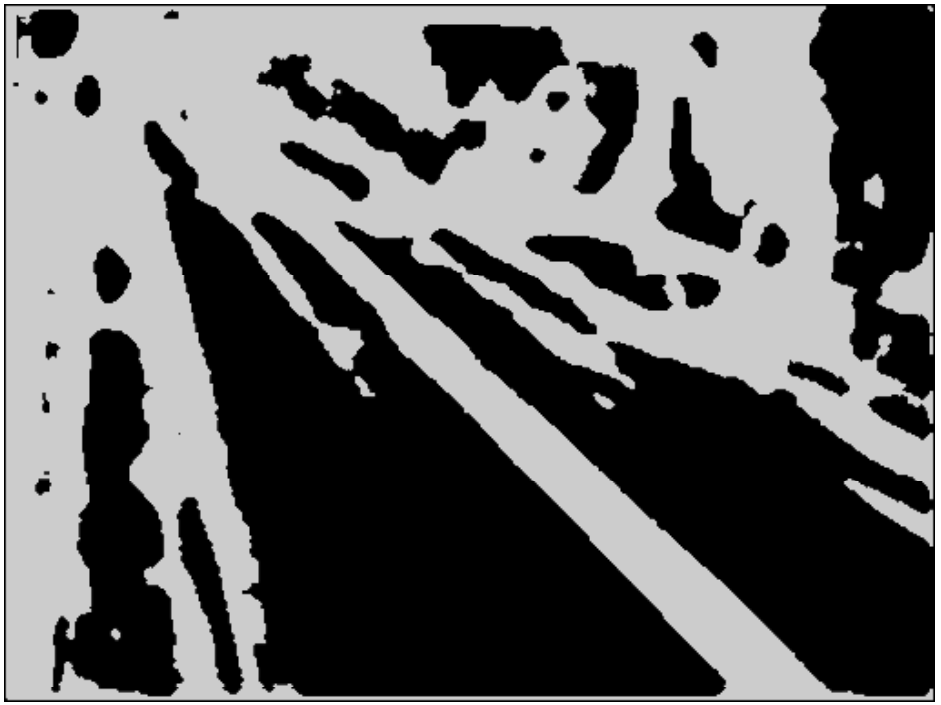
Heat detection only in the green field area!

IDS Detection – Smoke

Detection over entire tunnel cross section!

IDS Detection – Smoke

- detection takes place over whole picture
- no longer limitation to single polygons



IDS **automatically** distinguishes:

- good detection areas
- non-analysable areas

IDS Detection – Smoke

- each pixel is valuated as smoke or non-smoke
- smoke-alarm is raised by predefined amount of smoke
- quality of sight is computed over whole picture

IDS Detection – Smoke

Video

Smoke Detection by IDS – Semmering Tunnel

Semmering-Tunnel: Lkw in Flammen

Explosionsgefahr / Großeinsatz der Feuerwehr

Alarmstufe „Rot" herrschte Mittwoch kurz vor 14 Uhr im Semmering-Tunnel. 700 Meter nach der Einfahrt bei Maria Schutz hatte ein Lenker an seinem Tankfahrzeug Flammen und Rauch bemerkt. Der Fahrer hielt an. Löschversuche mit einem Handfeuerlöscher scheiterten. In der Tunnelwarte wurden die Szenen auf dem Videobildschirm erkannt und ein Großalarm für die Feuerwehren ausgelöst.

Binnen weniger Minuten war Hilfe vor Ort, der Brand rasch eingedämmt. Die Tunnelkette wurde für den Verkehr komplett gesperrt.

Wie sich herausstellte, hatte der Batteriekasten vermutlich durch einen Kurzschluss zu brennen begonnen. Da es sich um einen Gefahrengut-Transporter handelte, der zuvor explosives Eisenchlorid geladen hatte, war der Einsatz gefährlich. „Es bestand Explosionsgefahr durch Dämpfe, weil der Tank zwar leer aber nicht gereinigt war", so Feuerwehrkommandant Werner Hanl.

Die Fahrbahndecke wurde durch die Hitze stark beschädigt. In Fahrtrichtung Steiermark blieb die Sperre bis zum Abend aufrecht.

PATRICK WAMMERL

Die Feuerwehr war rasch vor Ort und löschte den Brand

IDS Detection – people tracking

Detection – people recognition

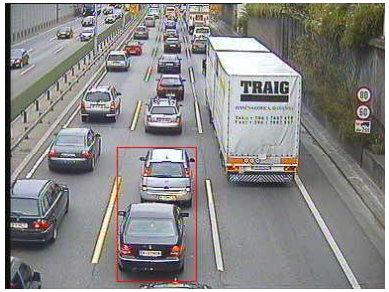
IDS Detection – person detection (in tunnel)

IDS - Roadside

- **Different Site-Setup‘s possible!**

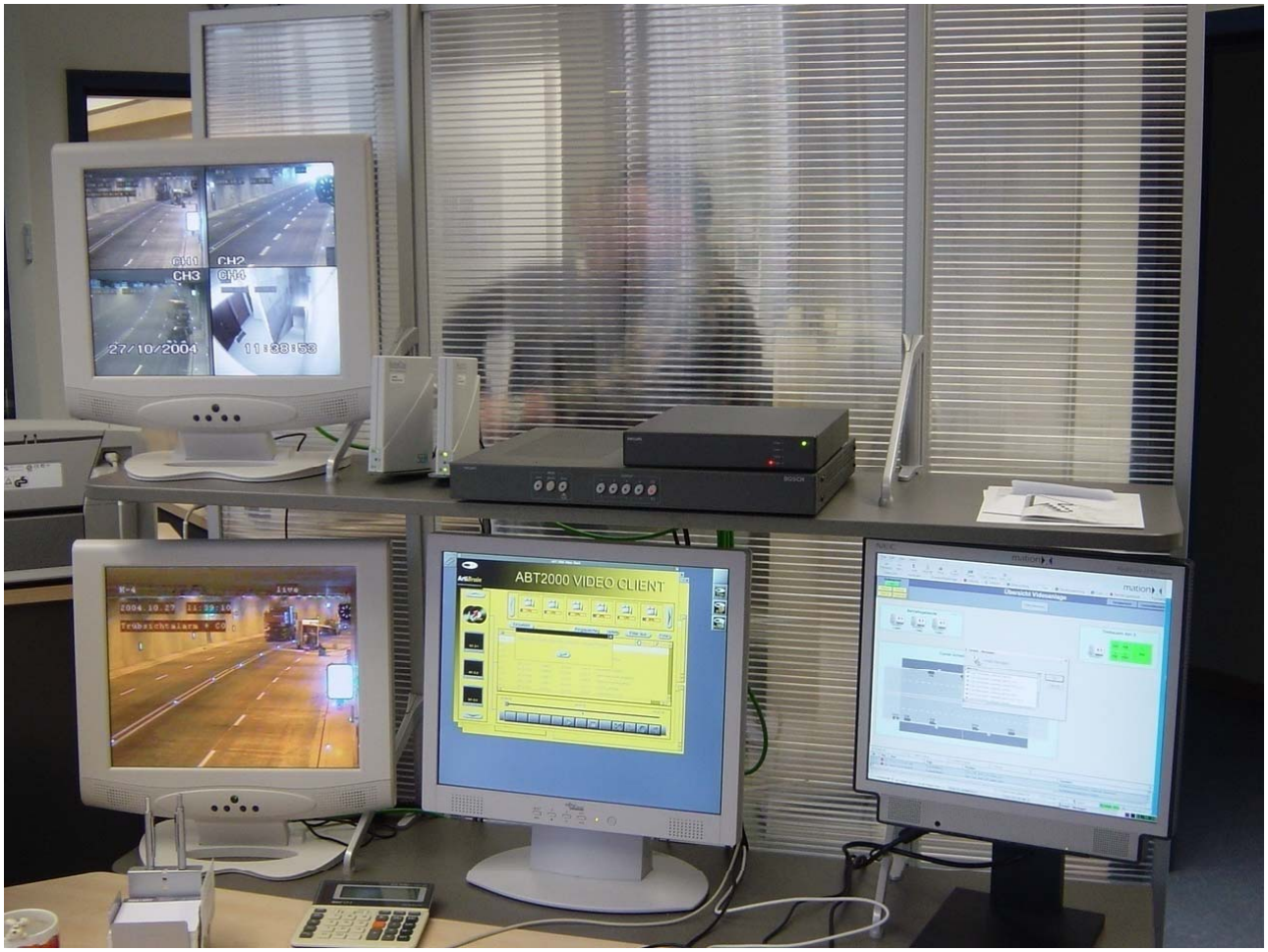
IDS – Roadside Functions

- Traffic jam / stopped car
- Classify / Counting
- Speed / Distance
- Slow Driver
- Licence Plate Recognition
- **Hard Shoulder Lane**
- Lost Carriage
- Hazardous Goods
- **Sight Degradation**
- Non Traffic Area
- Wrong way/lane
- Traffic Mgmt. Integration



Full Control-Center - Semmering Tunnel / Austria

Small Control-Center - Augsburg / Germany



Conclusion

Conclusion

- **Road Safety: shared responsibility and integrated approach**
  - “Institutionalized dialogue” between the Public and the Private
  - Public awareness and education are essential
- **Applied modern ITS Technologies support Road Safety successfully.**
- **Laws, Enforcement and Education are strong elements in Road Safety.**

Better Road Safety results in

positive social and economic benefits

because of

less accidents, less fatalities and less congestion !

Thank you for your attention!

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