



WIM-E

Network of National ITS Associations Workshops

Prague 15.10.2009

Dr. Thomas Spindler

Overloaded Heavy Vehicles

Damages to road network, bridges and pavement

**Overloading contributes
to serious
road safety problems**



Problems caused by Overloading

- **less stable vehicle**
- **difficult to steer**
- **massive strain on vehicle tires**
- **insurance cover is void**
- **unfair on other operators**
- **more fuel consumption**

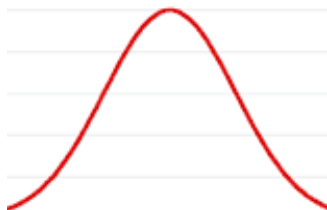
Weigh-in-Motion – Enforcement:

**doubtless identification with
digital image documentation**

Weight-In-Motion (WIM) Systems

WIM-S

Application
for
Statistics



WIM-P

Application
for
Preselection



WIM-E

Application for
Enforcement



Weight-In-Motion Preselection (WIM-P)

Main Purpose:

Identification and manual verification of over-loaded vehicles (WIM-S + camera and fast data transmission)

Disadvantage:

- Personnel and time consuming
- Very limited amount of trucks can be inspected
- Inspections published >> drivers avoid these roads



Weight-In-Motion Enforcement (WIM-E)

Weigh-In-Motion Enforcement (WIM-E)

Main Purpose:

Fully automated WIM system that weighs every passing vehicle, stores data of overloaded trucks and transmits data to enforcement authorities

Necessary Equipment:

- **WIM-E electronics**
- **Photo+video+ANPR camera, data storage and coding equipment**
- **Back office**

Advantages:

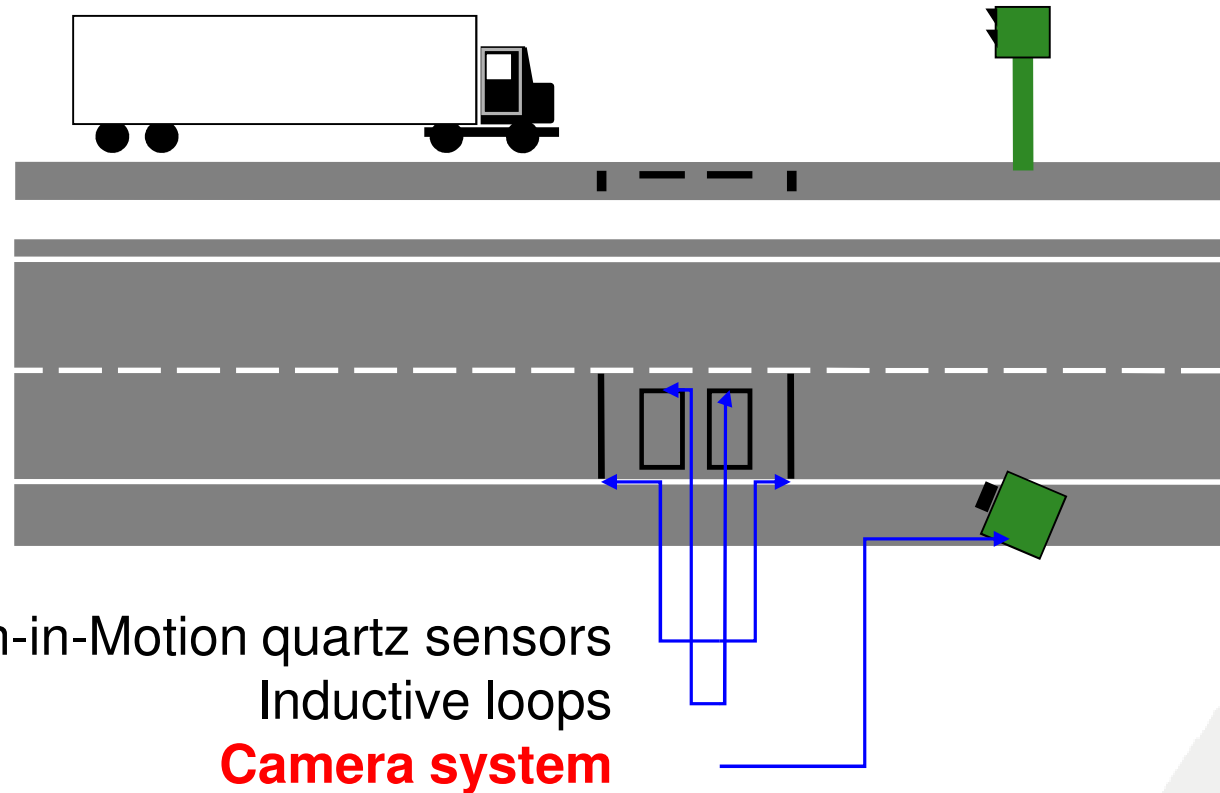
- **Permanent surveillance (24h / 7d)**
- **Near 100% acquisition of all overloaded trucks**
- **Prevent future incidents (learning process)**
- **Number plate 'Black List' feature**
- **Increase lifetime (lower maint. costs etc.)**

Pilot-Project in Czech Republic

- **first WIM-E system in December 2007**
- **proof inadequate use of road (weight limit: 12t)**
- **~500 events per month**



Weight-In-Motion - Enforcement



Weigh-in-Motion quartz sensors
Inductive loops
Camera system

Camera System



Violation camera

Sequence camera



Violation camera specifications

CCD sensor:	Monochrome or color
Scanning system:	Progressive scan
Effective pixels:	11 M pixels
AD converter:	14 bits / pixels
Shutter:	Electronic shutter 1/50 to 1/10,000 s
Lens connection:	ROBOT Mount
System connections:	Sync, Trigger, RS422/232 IEEE-1394
Temperature range:	-20° to +60°C, fan-less



Violation camera image (sample data)

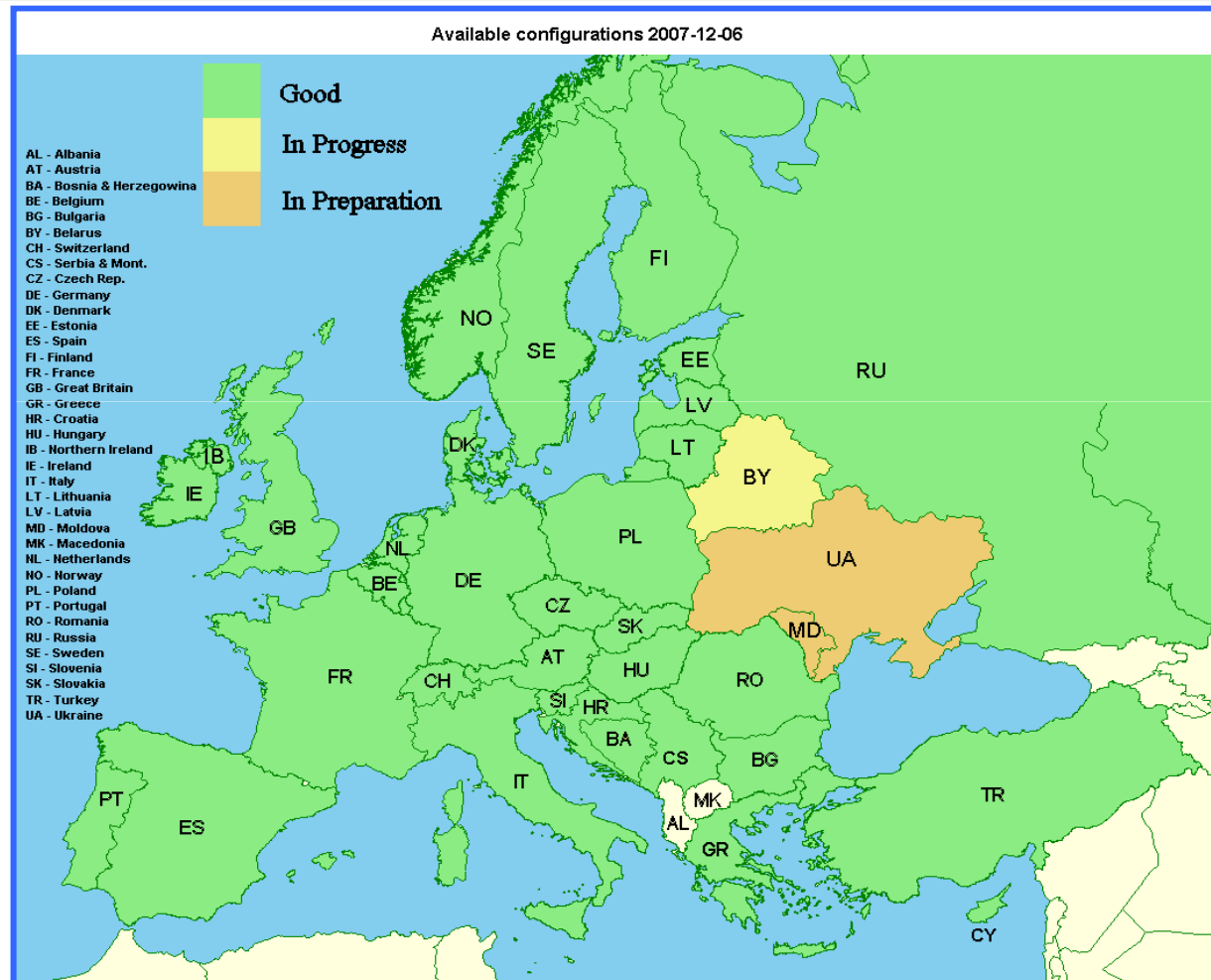
Date	Time	Weight	Speed	Code			
15.08.2006	17:24:36.015	11t	85 km/h	76548			
SPeed	Time	Date	Code	Photo L	Int	Fix Site	TraffiStar
056 km/h	16:31:05	19.06.2006		476	0	1	----- --- 050 9540



Sequence camera image



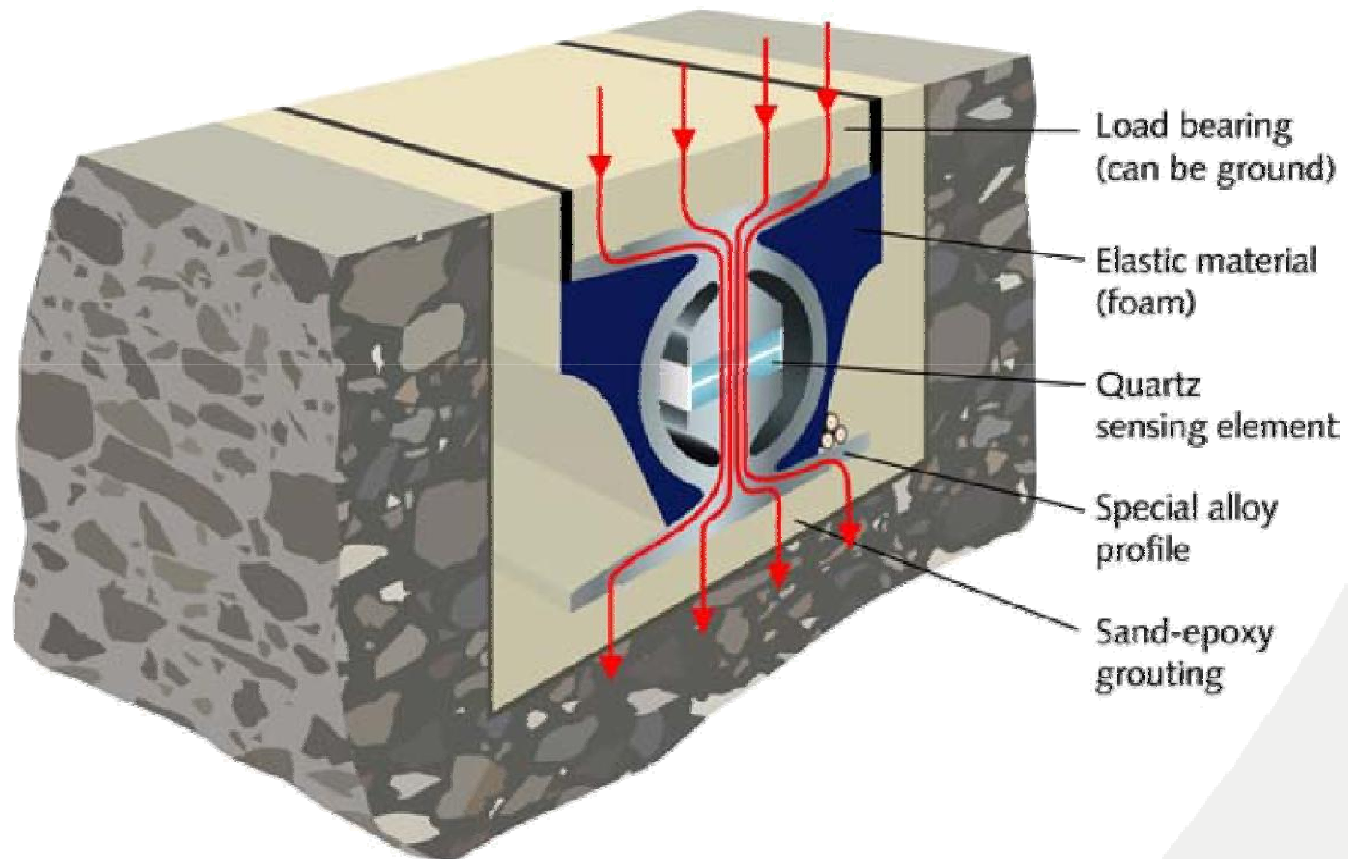
Coverage of OCR Algorithm



- **Weighing sensors installed in the road**
- **Forces penetrate sensors when wheels pass by**
- **Charges are generated through these forces**
- **Charges are amplified**
- **Analog signals are digitalized and processed**
- **Integration represent weight of wheel**
- **Results are class, weight, speed, length, gap**

- **WIM Accuracy ok**
 - **Photo Documentation ok**
- but**
- Court proven violations are required**
- **Fixed tolerance**
 - **Suppression of false events**

LINEAS[®] quartz sensor by Kistler



Advantages of the LINEAS® sensor

- **Little damage to road surface**
- **Long term stability**
- **Sensor needs no servicing**
- **No drainage / no frame**
- **Almost invisible for drivers**
- **Independent of temperature changes**



Advantages of the LINEAS® sensor

- **Independent of external forces**
- **Optimal surface adaption**
- **Entire road connection**
- **HS- and LS-WIM***



* HS=High speed LS=Low speed

WIM system specifications

- **Scanning rate: 4,000s/s/sensor (4/8 sensors per lane)**
- **16 single or 8 double loops, self tuning**
- **Up to 6 WIM lanes (double sensor lines)**
- **Up to 10 vehicle classes, up to 63 axle classes**
- **Integral GSM/GPRS modem**
- **Plug-in SD card**
- **SIM card front-accessible**
- **Integral graphic display**



WIM system specifications

- **Error of measurement: < 5% (2 rows)**
- **Lifetime is dependent on quality of roads**
- **Data volume: \approx 1 MByte/day/lane**
- **No temperature compensation necessary**
- **32-bit processor**
- **RS 232/RS485 interfaces**
- **WLAN**
- **Power 12V to 24V**



- **Total weight**
 - Wheel load**
 - Axle load**
 - Axle group load**
- **Classification**
- **Speed**
- **Headway/Gap**



WIM-P & WIM-E both improve traffic safety

WIM-E provides major benefits

- **no traffic disturbance**
- **close to 100% coverage**
- **reduced man power**
- **short term amortization**