



# Innovations for Traffic Management







## Welcome to CAT Traffic

In 2003 CAT Traffic took over PAT's Vehicle Weighing business activities in Europe as exclusive system partner of IRD International Road Dynamics Inc., Canada. The well known weigh-in-motion system **DAW100** – based on PAT's Bending Plate sensor and Kistler's LINEAS Quartz piezo sensor – has been extended by video registration, ANPR identification as well as 3G/UMTS communications composing the high-end **WIM-VIVER** Virtual Weigh Station Enforcement system. WIM-VIVER has been successfully deployed across Germany within the weigh-station network project of the Federal Highway Research Institute (BAST) and Federal Office For Goods Transport (BAG).

A wide range of further innovative products, like the **EasyCOUNT** series for non-intrusive vehicle counting/classifying as well as the high-performance automatic number plate/ADR plate recognition system **V-REX**, have been developed, successfully launched and deployed in several projects.

Outstanding references are the EasyCOUNT traffic data collection service contract with State of Lower Austria, where more than 1000 sites are monitored, as well as the V-REX Journey Time system covering more than 100 urban/motorway routes in Greater Munich and recently also in Poland, Luxembourg and Austria. V-REX is further used at all motorway toll gates in Austria for „Videomaut“ (video tolling) and truck ETC enforcement.

The turnkey supply of 30 mobile enforcement vehicles for the Slovak Toll Police with combined ANPR and DSRC/OBU check-in-motion functionality is another proof of CAT's competence.

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# Data Collection

## Traffic Data Collection

Accurate traffic data is required to evaluate construction projects and to monitor changes in traffic. Whether this requires stationary systems with the best possible accuracy (e. g. multi-lane systems with 8+1 classification) or mobile, non-intrusive traffic detectors, CAT has the appropriate solution.

**EasyCOUNT** is a non-intrusive single vehicle detector with speed and gap measurement as well as vehicle length classification. The sensor can be configured for uni- or bidirectional traffic detection. Besides the integrated radar sensor (for sidefire operation) several external sensors (for multi-lane overhead operation) can be connected.

### Main System Features

- high-end antenna for excellent detection and classification results
- single vehicle data recording (velocity, gap, vehicle type up to 5 length classes)
- intelligent GPRS communication for system configuration and automatic data upload
- remote control and online vehicle monitoring via Internet
- extensive alarm management: slow traffic, jam, low battery, theft (optional movement sensor) etc.
- real-time data
- power consumption: typ. 14 Ah/week
- solar power module (optional)
- 230VAC operation (optional)



EasyCOUNT Solar



Delineator EasyCOUNT

The system is completed by a comprehensive software tool (DataMANAGER) for site administration, remote system configuration, statistics generation and visualization as well as archivement of traffic data.



**EasyCOUNT-Bike** is a sophisticated bicycle counter developed on the basis of CAT's reliable EasyCOUNT detector with radar or induction loop sensor.

### Main System Features

- *bidirectional detection*
- *single bicycle data recording*
- *intelligent GPRS communication for system configuration and automatic data upload*
- *counter check and configuration via Internet*
- *real-time data*
- *particular induction loop design*
- *reliable detection of single or two adjacent bicycles*
- *12VDC or 230VAC operation*



*Bicycle Counting*



*Roadside Cabinet*

The **loop/piezo detector AVC** is a modular system for traffic flow evaluation, traffic census and vehicle categorization for storage, transfer and analysis of traffic data. The categorization of vehicles up to typical 15 classes is provided.

### Main System Features

- *modular 19" rack system*
- *recording of traffic data from up to eight lanes*
- *vehicle categorization can be expanded including axle configuration by a simple integration of piezoelectric sensors*
- *different types of hard- and software are available, e. g. according TLS specifications (BAST, Federal Highway Research Institute, Germany)*

**V-REX 100** is a mobile ANPR system for traffic flow analysis. With the aid of automatic number plate recognition especially large investigation areas can be reliably analyzed concerning origin and destination traffic as well as transit traffic.

### Main System Features

- *videotrigger, no additional sensor (e. g. radar, laser) is required*
- *reliable recognition of all European and Middle East license plate numbers*
- *compact ANPR camera with integrated IR flash (5 - 35 m range)*
- *simultaneous processing of up to 4 video signals*
- *vehicle tracing via „wanted list“ (data encrypted)*
- *update of „wanted list“ via GPRS (optional)*
- *12VDC power supply*



*ANPR Data Collection*

# Vehicle Weighing

## Weigh-in-Motion

Overloaded trucks are the major cause for road damage and represent a serious threat to traffic safety. CAT offers the entire range of products and systems for HGV (heavy goods vehicle) monitoring and enforcement of overweight vehicles.



Bending Plate Site



LINEAS Quartz Site

The most efficient method of axle load and gross weight measurement is carried out without affecting the traffic flow at all. The so called **High-Speed Weigh-in-Motion (HSWIM)** system consist of road-embedded sensors, data processing electronics and communication modules. Low cost basic sensor configurations, e. g. for traffic data collection and statistics, may use one wheel load sensor only. High-end performance HSWIM systems with double line sensor configuration are able to achieve down to 5 % gross weight error corresponding to COST-323 accuracy class A(5).

### Main Application Areas

- *overload detection (preselection for weight enforcement)*
- *statistic data collection*
- *road maintenance planning*
- *bridge protection*

### WIM-VIVER (Virtual Weigh Station)

WIM-VIVER is the fully automatic weighing of heavy goods vehicle in free-flow traffic with the aid of road embedded weighing sensors, in combination with a videobased system for vehicle registration (VIVER) and identification (Automatic Number Plate Recognition) to selectively sort out potentially overloaded trucks.



The vehicle data (axle loads, gross weight, overview image, license plate number) collected at the measurement site are transferred (by fibre optic, radio relay, GPRS/UMTS etc.) to the truck control station. With high efficiency, only overloaded vehicles are sorted out to the enforcement zone, where vehicles are weighed with homologated scales (statically or dynamically at low speed).

### Sensors

CAT utilizes the best sensor technologies available on the market.

- *Bending Plate Sensor (IRD/PAT Traffic)*
- *LINEAS Quartz Sensor (KISTLER)*

With both sensor technologies excellent weighing results in slow and fast moving traffic can be achieved, assured by highly skilled and certified service technicians and system engineers.



LINEAS Quartz Installation



Bending Plate Installation

### Weighbridge DAW 50

Due to its superior design the DAW 50 axle weighbridge achieves highly accurate truck weight data such as gross weight and axle load. The weighbridge is PTB approved for static and dynamic operation and delivers most accurate data in both cases.

The platform stability of the so called **Low-Speed Weigh-in-Motion (LSWIM)** system is achieved by horizontal and longitudinal stabilizing rods and a rugged platform design. Because of the dynamic operating mode an efficient enforcement of overweight vehicles is guaranteed. The system is used within the context of weight enforcement by road authorities and police, fleet operation/management, harbor management, border control and toll systems.

### Main System Features

- *highly accurate dynamic vehicle weighing*
- *high vehicle throughput in dynamic mode*
- *automatic vehicle classification during dynamic operation*
- *determination of axle loads*
- *law enforcement*
- *rugged bridge construction*
- *particular construction to avoid tilting moments or horizontal movements*



DAW 50 LSWIM

### SAW Wheel Load Scales

CAT offers a large variety of wheel load scales (capacities from 1t to 15t). Because of its robust design SAW wheel load scales are applicable in rough environments and on non-ideal, rough road surfaces. They are mainly used by police and other road authorities for weight enforcement.

The **DySAW** system extension enables the setup as **Mobile LSWIM System**, especially used for preselection operation.

### Main System Features

- *OIML certified and PTB approved*
- *rugged design, corrosion resistant*
- *twin tyre weighing possible*
- *integrated digital display (LCD)*

For measuring axle loads and the total weight of the vehicle, two or more wheel load scales can be combined by cable or multiplexer. The UniMUX (universal multiplexer) can be connected to a standard computer/laptop by cable (e.g. USB) or wireless (Bluetooth).

The weighing results can be displayed with the aid of the evaluation software LoadCAT.

LoadCAT displays the data of every wheel load scale as well as the axle loads and the total weight of the vehicle. All data is stored in a database for future use. Customer-specific measurement reports can be created and printed out.



SAW Portable Scale

# ANPR Systems

## ANPR Systems

Automatic Number Plate Recognition (ANPR) is one of CAT's core businesses. Known for innovative and customer-specific ANPR systems, CAT has realized numerous projects in wide application fields. **V-REX** is the core component for CAT ANPR systems whether these are stationary, mobile or even in-motion system solutions.

### Overall V-REX Features

- videotrigger mode for up to 4 cameras connected
- external trigger mode for up to 8 cameras connected
- utilization of versatile cameras and appropriate illuminators (IR/white LED)
- robust recognition of versatile type of number plates due to high-dynamic-range (HDR) operation mode
- field proven recognition of non-reflective plates (e.g. FL) and extreme small size plates (e.g. CH, IT)
- outstanding reading of all European and Middle East plates including type/colour code recognition (e.g. Abu Dhabi)
- detection of driving direction



ANPR Data Collection on Motorways

### V-REX Extensions

- additional sensor integration (radar, DSRC reader etc.)
- integrated GPRS/UMTS module for blacklist update
- GPS data integration
- data encryption and digital signature
- LP and overview image recording
- fault tolerant matching
- power supply for external devices (camera, radar etc.)
- in-car integration kit



V-REX for Slovak Toll Police Car with Back-Door Camera and DSRC Reader





### V-REX Journey Time

The system consists of at least two V-REX systems with video trigger, mounted at beginning and end of considered route. All vehicle's number plates are time/location stamped, encrypted for privacy reasons and transmitted via CAT's integrated GPRS module to the IP-Server where all data are processed and current journey time is evaluated. The system has proven its reliability while successful operating since many years on motorways and urban roads in Germany and abroad.

#### Main System Features

- outdoor system with video processor for up to 4 ANPR cameras
- camera with integrated IR illumination for 24h operation
- intelligent GPRS communication management to guarantee complete data transfer
- sophisticated encryption of license plate numbers
- remote control and alarm management



V-REX with 4 Cameras Mounted on a Motorway Gantry

### Electronic Toll Collection

Since many years CAT is a reliable supplier of ANPR systems and customer-specific software in the context of electronic toll collection. Whether this demands stationary systems or mobile enforcement units that require the integration of additional system components (e. g. OBU reader) CAT has the know-how and experience.



Video Toll Gates Austria

### Access Control and Parking Space Analysis

Furthermore, stationary V-REX systems are used for access control and for analysis of incoming and outgoing traffic (e.g. multi-storey car park). Because of the system's flexibility it can be adapted to almost any situation. It is completed by customer-specific software for access management and statistical evaluation.

Due to the tremendous increase of heavy goods vehicle (HGV) traffic it has become a necessity to monitor the changes in traffic volumes and especially analyze the usage of motorway truck parks. For this purpose semi-stationary systems are installed at the ramps of truck parking areas. The V-REX systems in use have integrated radar sensors for truck/car classification in order to provide accurate data (length of stay, frequency of use, occupancy, etc.) for truck traffic, separately.

#### Main System Features

- outdoor system with ANPR camera and vehicle detector for classification
- camera with integrated IR illumination for 24h operation
- GPRS data transfer to IP-server
- side-fire mounting
- for 12VDC or 230VAC operation

### Hazard/ADR Plate Recognition

In order to detect HGV traffic transporting hazardous material, the so called Hazard/ADR Plates can be automatically captured by highly developed video systems. The detection of the plates is usually realized in moving traffic at motorway speed (overhead installation on motorway gantries). In addition the system reliably identifies Neutral Plates (ADR plates without number code).



ADR Number/Neutral Plate Recognition

# References

## Traffic Data Collection

### Radar Detector Network Tirol, Austria

- more than 100 permanent EasyCOUNT sites, solar powered
- GSM/GPRS online traffic data

### Data Collection Services, Lower Austria

- long term evaluation at more than 1000 sites with mobile traffic counters
- site management by smart telematics (GPRS/GPS)

### Traffic Management on A4 Motorway Poland

- 60 traffic detector sites
- 6 HSWIM sites for statistics



Traffic Management on A4 Motorway Poland

### AVC Network Austria

- more than 100 AVC sites
- GSM/GPRS online traffic data

### Traffic Flow Analysis

- mobile ANPR for route analysis/vehicle classification
- numerous projects in Germany, Austria and Poland



Multilane EasyCOUNT Site Germany



## Vehicle Weighing

### Autobahn WIM Network Germany

- *HSWIM LINEAS quartz sensor technology*
- *UMTS video preselection enforcement*

### ASFINAG Weigh Station Network Austria

- *HSWIM BENDING PLATE sensor technology*
- *HSWIM preselection and LSWIM enforcement scale*

### Transalpine Weigh Stations Switzerland (Gotthard/San Bernardino)

- *HSWIM BENDING PLATE sensor technology*
- *dynamic height measurement with video registration*

### Weigh Station Network Poland

- *HSWIM BENDING PLATE sensor technology*
- *ANPR truck identification*

### Truck Weight Enforcement in Romania and Poland

- *more than 200 portable scales for road authorities*
- *LSWIM enforcement in Poland*

### Truck Weight Enforcement in Germany

- *more than 100 portable scales for police and BAG (Bundesamt für Güterverkehr – Federal Office for Goods Transport)*
- *weighing service for authorities and private companies*



Virtual Weigh Station Poland



Weight Enforcement Network Germany with UMTS-based Video Preselection



Journey Time System Greater Munich



ETC Truck Toll Enforcement and Videomaut Austria

## ANPR Systems

### ETC Slovakia

- *30 police vehicles for mobile toll enforcement*
- *check-in-motion of ANPR and DSRC/OBU*

### ETC Austria

- *more than 70 ANPR systems for „Videomaut“*
- *more than 50 ANPR systems for truck toll enforcement*

### Journey Time Systems

- *more than 100 road sections in Greater Munich*
- *traffic information system Luxembourg*

### Truck Parking Analysis Bavaria

- *vehicle identification and classification (combined ANPR/radar)*
- *comprehensive truck parking analysis*

### Hazard/ADR Plate Recognition

- *dangerous goods monitoring on motorways/tunnels*
- *including Neutral Plate recognition*

### Video Enforcement Switzerland

- *mobile system for undercover vehicle search*
- *mobile system for border control*

### Traffic Census

- *automated census of foreign transit traffic on motorways in Germany*
- *vehicle identification and classification (combined ANPR/radar)*



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