camea

Intelligent Transportation Systems

EN

Unicam

CAMEA Unicam is a state-of-the-art and field-proven platform for creation of multifunctional and scalable intelligent transportation systems (ITS) dedicated to the road traffic market sector including traffic safety, operations, maintenance and information. All key technologies used for creating the most innovative products are continuously being developed by CAMEA. While OEM components are available for integration into current systems, fully-featured systems are also being provided. CAMEA closely cooperates with technological and business partners in engineering, installation, maintenance, staff training etc.

Weigh-in-motion helps road preservation and maintenance reduction due to significant elimination of overloaded vehicles without any traffic flow disturbance. Due to less overloaded vehicles on roads and optionally with speed enforcement functionality it also helps ensure safer traffic.

Spot speed enforcement ensures safer traffic by educating drivers to reduce speed to permitted limits in a monitored road spot (e.g. in intersections, weigh-in-motion stations etc.).

Section speed enforcement ensures safer traffic by educating drivers to reduce speed to permitted limits in an entire monitored road section (in front of schools, around playgrounds etc.). It also creates uniform traffic flow due to elimination of the kangaroo effect (sudden breaking and acceleration) which generally applies for spot speed enforcement (radar, LIDAR etc.). As a side effect environmental protection is achieved by reducing fuel consumption, noise and air pollution caused by traffic.

Red light enforcement objective is to decrease the number of red light violations, which cause some of the most dangerous traffic accidents, and thus increase motorists' road safety.

On-site enforcement sends notifications to police patrols about vehicles offending traffic rules, which helps improve traffic safety because the drivers can be stopped immediately.

Back office is available for easy and ergonomic processing of offence documents by appropriate persons.

Vehicle search helps prevent crime and ensure public safety by searching police databases for stolen or wanted vehicles.

Travel time prediction helps inform drivers about the length of a journey through a monitored section, possible delays or detours.

Dangerous goods control by detection and automatic reading of warning signs placed on vehicles which transport dangerous goods (ADR labels).

Road lane surveillance can monitor wrong way and shoulder driving as well as violation of closed and BUS and high occupancy vehicle road lanes etc.

Traffic classification and data collection with high accuracy can be obtained by using fusion of data from various sensors and applications.

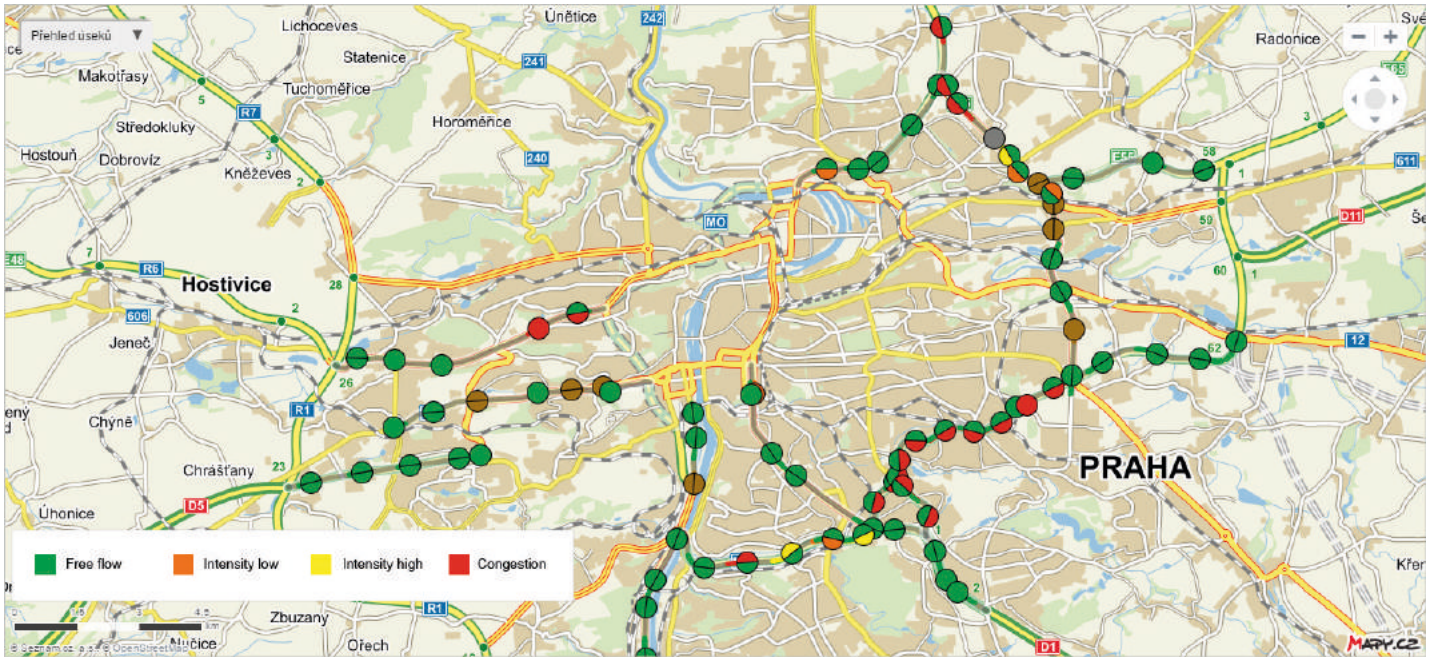
Dimension-in-motion uses a laser scanner to measure vehicle height, width and length as well as to provide a 3D vehicle shape and vehicle classification. It can also be used for over height violation detection.

Variable message signs can also be controlled for displaying speed, weight, height or license plate number of particular traffic rule violating vehicles etc.

Many other applications and technologies are available including ANPR/ADR software, make and model recognition, various traffic surveys (e.g. origin-distance), parking payment monitoring and police patrolling (using a vehicle with ANPR cameras) etc.

Integration

The system is scalable, so new functionality can be added later on when required. Isolated systems can be joined in a network which generates a synergistic effect by creating space for novel functionality like section speed measurement in chained road sections, tracking of stolen vehicles in an entire urban area etc. The system can also be easily integrated with back offices and systems of other vendors due to standard communication protocols (TCP/IP, SNMP etc.) and interfaces. Heterogeneous ITS applications can be integrated in one system.



Maintenance

The system offers remote system management with detailed system diagnostics and management (using standard protocols like SNMP). Extended malfunction codes are also provided for easy system diagnostics and maintenance planning (sensor replacement etc.).

The system is designed to require minimal maintenance. Still, basic service operations should be done on a regular basis including cleaning (e.g. cameras when installed) and removing road dirt (mud, slush, snow, sand, etc.) in locations where the sensors are installed.

Security

The system is ready for direct enforcement back office purposes by applying security rules such as prevention of making unauthorized changes to its configuration and measured data by protected access. All user actions are logged and can be read back and analyzed.

In direct enforcement system versions measured data and images of violating vehicles are electronically signed and encrypted. So only competent authorities can access the data and it cannot be undetectably modified.

Multi-functionality

There are many applications which can be created using the Unicam platform components. Different functionality can be integrated together to create multifunctional and scalable ITS solutions.

The applications can share components. For example, one camera for license plate reading can be used for vehicle documentation and identification purposes for spot speed measurement as well as for weigh-in-motion or red light violation systems. This can significantly reduce installation and maintenance costs.

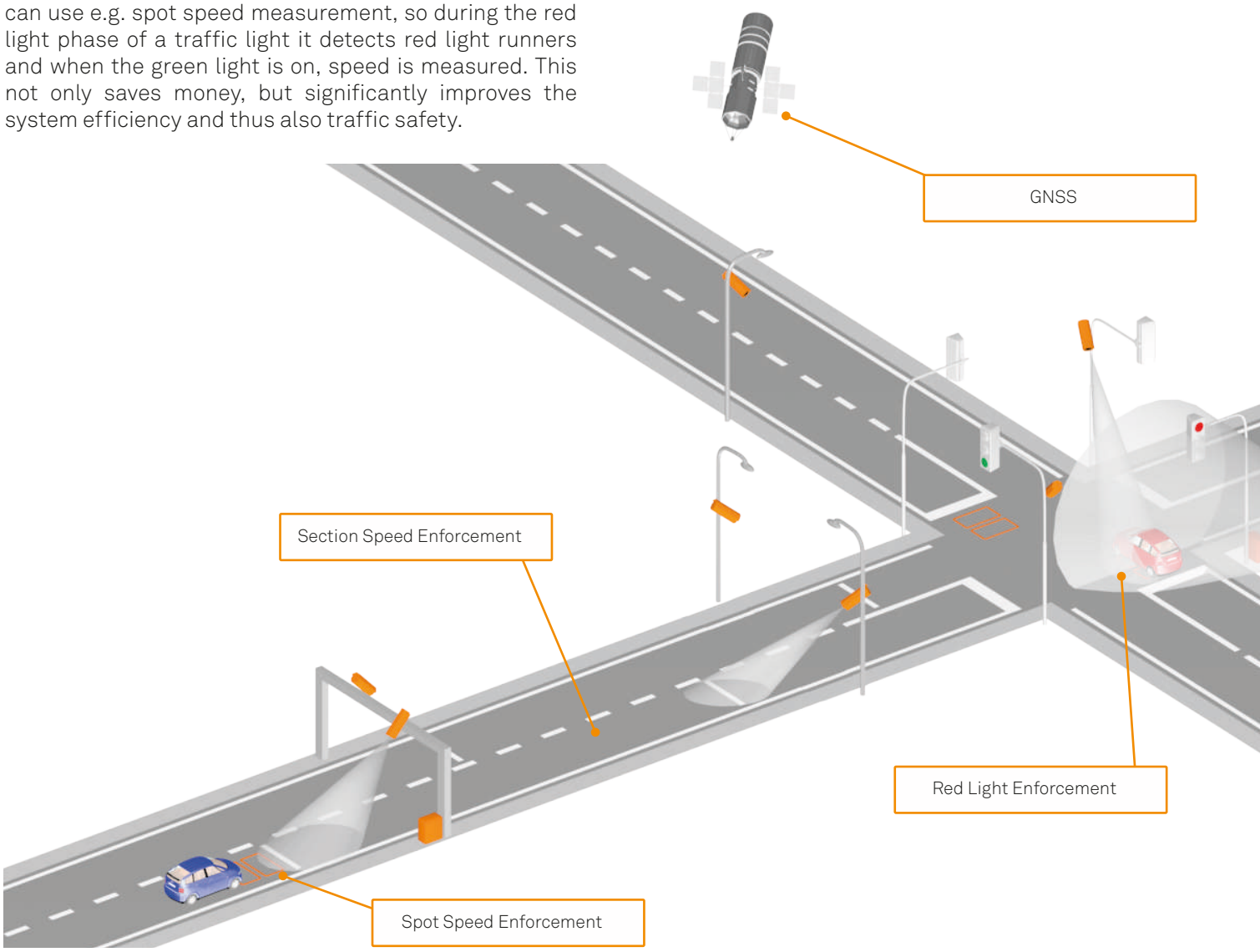
The applications can also be integrated together. For example weigh-in-motion can be joined with spot/section speed enforcement and high quality traffic counting and classification etc. Entry/exit point to section speed enforcement can be common with spot speed enforcement or weigh-in-motion. Red light enforcement can use e.g. spot speed measurement, so during the red light phase of a traffic light it detects red light runners and when the green light is on, speed is measured. This not only saves money, but significantly improves the system efficiency and thus also traffic safety.

Communication

The system uses both wired and wireless communication interfaces and is also equipped for direct control via configurable galvanically isolated inputs and outputs (e.g. variable message signs etc.). The wired interfaces include metallic/fiber optic Ethernet, RS232, RS485 etc.

Wireless communication interface usage depends on the distance between ITS systems. For example Wi-Fi data link can be used for on-line data communication between entry and exit stations of a section speed enforcement system or to send traffic offence documents to a police patrol in the field.

In case of systems which are separated by larger distances, mobile (cellular) networks (GSM, LTE, CDMA) can be used.



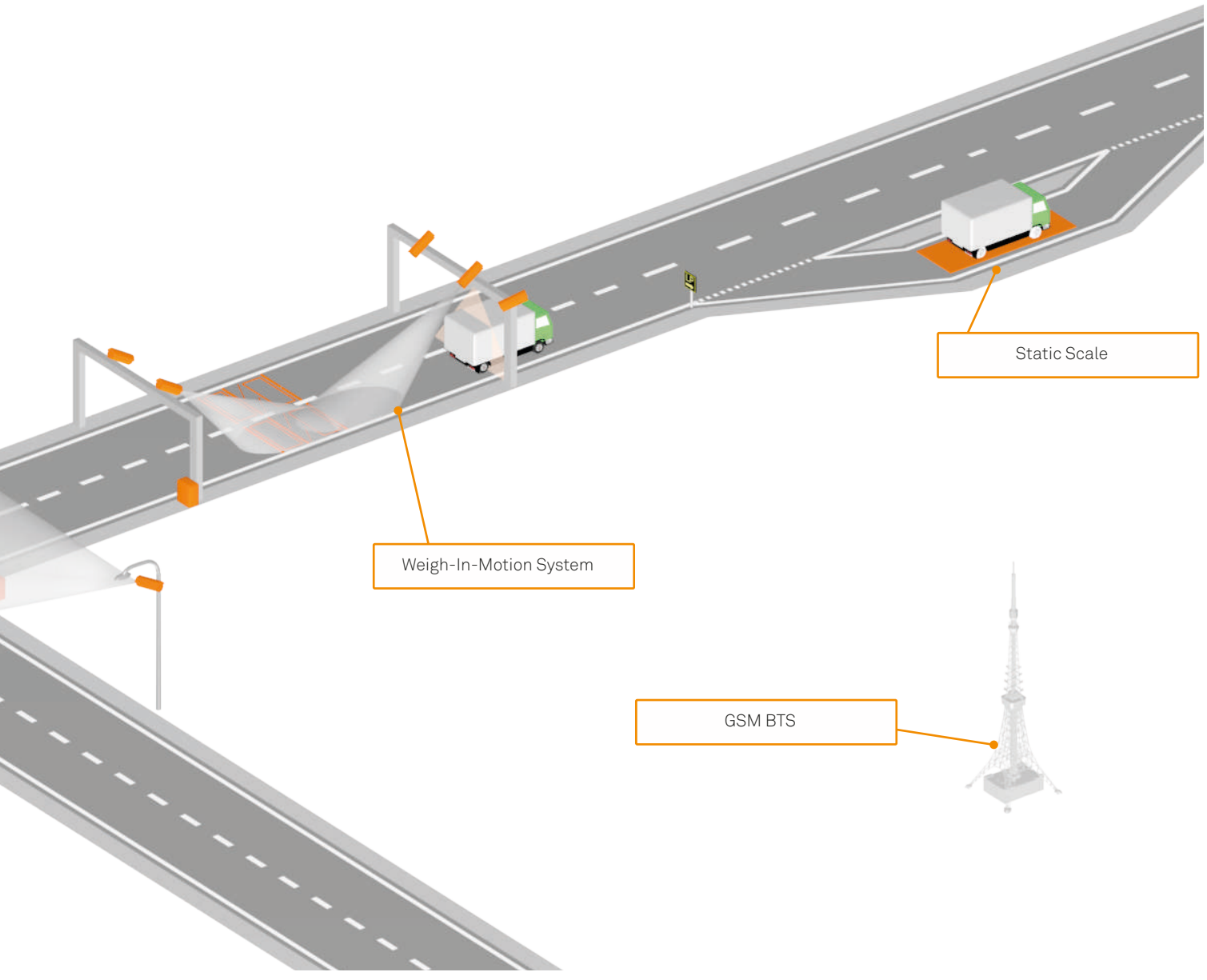
Installation

The system components allow installation in tunnels and highways using gantries or poles. In urban areas public lighting can be used for mounting the system components as well as providing power supply (using UPS).

Standard 110/230V lines can provide power supply to the system. Optionally it can be powered from public lighting, so it may be used in areas where a dedicated power line installation is prohibited or costly. At night, the public lighting provides power supply for system operation and accumulator charging. During the day it is powered from the accumulators.

Time Synchronization

Precise and reliable time synchronization is a key feature for creating geographically spread ITS systems. The system is synchronized to GNSS satellite systems (GPS, GLONASS) which ensures accurate data timestamping and time measurement in the entire network of isolated ITS systems such as section speed enforcement, travel time measurement, stolen vehicle search etc.



Components

The system key components are designed from scratch to ensure high reliability, compact and industrial grade design, high degree of environmental protection and wide operating temperature range. For example all measurement circuits for weigh-in-motion systems are embedded in a single unit including charge amplifiers for weighing and wheel position sensors, inductive loops and temperature sensors.

Cabinet UC-CAB

The Unicam platform 19” rack units can be housed in the UC-CAB cabinet. The cabinet is equipped with accessories including a heating unit, fans, protection circuits etc. The cabinet can be installed on poles, portals or walls using a proper mounting kit or can be set on the ground on metal legs or concrete support. Optionally it can be equipped with a sun shield.

Central Processing Unit UC-CPU

The UC-CPU is a 3U rack 19” size industrial grade computer (PC) with standard communication interfaces, removable SSD storage super capacitor backup etc.

Measurement Unit UC-WLU

The UC-WLU is a 3U rack 19” size unit responsible for amplification, fast and high-resolution analog to digital conversion and advanced digital signal processing of signals from up to 18 weighing/position sensors, 8 inductive loops and 2 road pavement thermometers. Several version are available (scalable using plug-in boards, rugged with IP65, equipped with only inductive loops for spot speed measurement etc).

Ethernet Switch Unit UC-ESU

The UC-ESU is a 1U/2U rack 19” size industrial grade 8/16-port, 1 Gb/s router and switch with Wi-Fi and 3G capability.

Power Supply Unit UC-PSU

The UC-PSU is a 3U rack 19” size power supply unit with embedded power line filters, lightning current arresters and AC/DC circuit breakers. It is remotely manageable with system watchdog capability, controlled voltage outputs, on/off/reset control and auxiliary power source input (e.g. from diesel generator). Optionally, it can be equipped with a UPS accumulator charger.

Synchronization Unit UC-SU

The UC-SU is a 3U rack 19”/9” size unit distributing precise time (taken from the satellite time unit) and power supply to up to 4 other system components including cameras and infrared illumination units. It is remotely manageable with embedded diagnostics and allows control of electronic fuses, triggers and inputs/outputs.

Satellite Time Unit UC-STU

The UC-STU is a remotely manageable time unit for precise and reliable time synchronization of the whole system. Accurate time is taken form GNSS satellites (GPS/GLONASS) verified and distributed by an NTP server and hardware signals.

ANPR/ADR Camera UC-D2

The camera is dedicated for capturing of detailed (with narrow field of view) black and white images of vehicles in one road lane (approx. 3.5 m + 60 cm overlap on each side). It has embedded IR LED-based light for license plates and ADR label illumination.

Infrared Illumination Unit UC-IRU

This high-performance LED-based illumination unit is used with ANPR/ADR cameras for improving illumination of vehicles (e.g. masks for video-based vehicle classification).

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Gantry, Streetlight...


Satellite Time Unit


ANPR/ADR Camera


Overview Camera


Infrared Illumination Unit


Laser Scanner...

Cabinet

Synchronization Unit

Ethernet Switch Unit

Central Processing Unit

Power Supply Unit, UPS

Measurement Unit...

Road

Inductive Loops

Weighing Sensors

Position Sensors

Temperature Sensors

Power Source

Data Link

A variety of third party components can be integrated within the CAMEA platform including high-resolution overview cameras, laser scanners, over height detectors, weighing sensors etc.

Weighing/Position Sensors

Different third party weighing sensors based on quartz/piezo principle or with voltage output can be used due to the fact that the measurement unit UC-WL has embedded adjustable charge amplifiers. Supported sensors are by KISTLER (Lineas with charge or current outputs), by MSI (BL Traffic sensor) etc.

Overview Camera

Third party high-resolution cameras can be used to capture colored overview images of vehicles and their surroundings (wide field of view). Supported cameras are e.g. by AXIS - P13 Series etc.

Laser Scanner

3D shape can be obtained and dimension measurement of passing vehicles can be done by third party laser scanners. Supported scanners are e.g. by SICK - LMS511 etc.

Over Height Detector

Third party laser beam gate can detect vehicles that violate height limits. Supported scanners are e.g. by SICK - HISIC450 etc.

ANPR/ADR Software

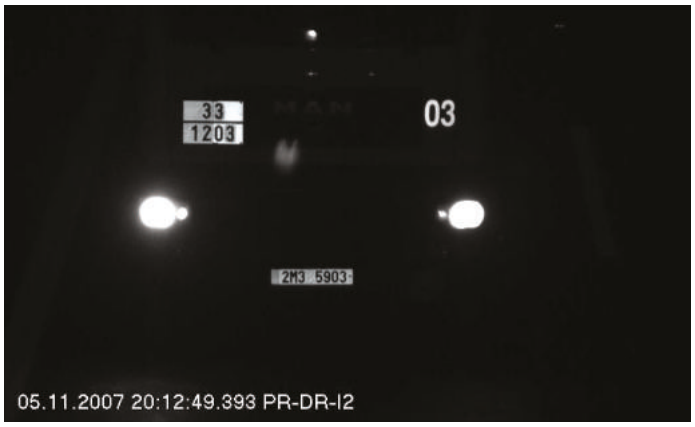
Vehicle images are captured by ANPR/ADR cameras which non-invasively monitor free flowing vehicles driving at speeds up to 250 km/h without the need to install any external triggers (inductive loops etc.). The cameras can be used for a large variety of traffic applications including spot and section speed enforcement, road lane surveillance, red light enforcement, dangerous goods control, stolen vehicle search etc.

Automatic number plate reading software (ANPR, also called automatic license plate recognition) processes images captured by ANPR/ADR cameras and allows automatic detection and reading of a vehicle's plates using optical character recognition (OCR).

ADR (Accord Dangereux Routier) label reading software also processes images captured by ANPR/ADR cameras during detection and automatically reads warning signs placed on vehicles which transport dangerous goods.

For license plate OCR rate of over 95 % the ANPR/ADR software requires more than approx. 2.7 pixels per license plate character strokes in the captured images. For example, if the ANPR cameras have a horizontal resolution of 1280 px and a license plate character stroke is approx. 1 cm wide, road lanes 1280 / 2.7 = 4.7 m wide can be monitored. Standard road lanes are approx. 3.5 m wide, so a 60 cm overlap on each side of the monitored road lanes still remains for license plate capturing and recognition of vehicles driving outside of the road lanes.

Assuming that ANPR/ADR cameras are properly installed, their front window is clean, and the weather conditions are suitable (no heavy rain, snow etc.), both detection rate and OCR rate can be better than 95 %. So the total success recognition rate can be 90 % (detection rate x OCR rate = 100 % x 0.95 x 0.95 = 90 %).



Make and Model Recognition

The MMR software processes images captured by ANPR/ADR cameras, recognizes front masks of vehicles and internally classifies them into more than 100 models. The internal models are then joined into 4 sets (classes) as follows: passenger car, bus, light truck and heavy truck. This information can be used in many applications including section/spot speed measurement where it can be applied to differentiate between vehicles with different speed limits (e.g. passenger cars and others).

Weigh-In-Motion

UnicamWIM

The UnicamWIM system is a state-of-the art solution for a variety of high and low speed Weigh-In-Motion (HS/LS-WIM) applications as defined by international standards (e.g. COST323, ASTM E1318). It measures and records weights of wheels, axles and vehicles (gross) passing over weighing sensors embedded in the road pavement. All measurements are done at normal traffic speeds, so complete vehicle weighing (wheels, axles, gross) can be performed without any traffic flow disturbances. The system has been certified for direct WIM enforcement (type approval certificate valid in the Czech Republic).

Additional Features

The system is designed for **true multi-lane bi-directional free flow** measurement and verifies the accuracy of all measured parameters of the vehicles in both road directions and also when driving between road lanes.

The accuracy of weighing may be lowered by non-standard vehicle behavior (acceleration, deceleration, lane traversing, shoulder driving etc.) or other influences (bad vehicle or road conditions, uneven weight distribution etc.). So to determine whether the measured values are in the defined accurate class, the system provides **advanced measurement validity** evaluation.

The system can be combined with other ITS systems such as spot/section **speed enforcement** systems, dimension-in-motion (using a 3D scanner), vehicle search etc.

Highly accurate **traffic classification and data collection** is available.

Estimation of road ruts and sensor surface wear can be calculated from the collected data, so **load equivalence factor** evaluation can be provided (ESAL, AASHTO).

Applications

The system applications are as follows (gross weight, confidence level π = 95 %):

Application	Tolerance δ [%]	Accuracy Class
Enforcement	5-7	A(5) or B+(7)
Pre-selection	10-15	B(10) or C(15)
Statistics	15-25	D+(20) or D(25)

Basic Specifications

The certified direct enforcement version of the system has the following parameters (Czech Republic):

Confidence Level	π = 95 %
Speed Range	20 – 100 km/h
Gross Weight	δ = 5 % (>3.5 t)
Group of Axles, Single Axle, Axle of a Group	δ = 11 % (1 – 20 t)

Low and High Speed WIM

Offence Documentation

Installation

At the WIM site, there are several sensors installed in the road. Inductive loops are used for vehicle presence detection. Weighing sensors are installed across the direction that the vehicles travel. Optionally, position sensors can determine the vehicles' position in the road lane, to measure the vehicles' width and detect twin (dual) tires. A road surface temperature sensor can also be used for precise temperature linearization and compensation.

The weighing sensors are installed into the road surface at a location which must comply with the defined characteristics. The selection of an appropriate site significantly affects accuracy and lifetime of the weighing sensors.

The number of valid measurements (with a defined accuracy class at a certain confidence level) depends directly on road conditions and the number of sensors (more is better).

- **Two-row sensor setup** of highly accurate quartz sensors (e.g. Lineas by KISTLER) ensures the highest accuracy of the system when the road conditions comply with Class I - Excellent as defined in the COST 323 specification.
- **Three-row sensor setup** is recommended for direct enforcement due to the fact that more sensors mean more individual wheel weighing which results in lower measurement uncertainty.
- **Two staggered sensor setup** with lower accuracy can also be used e.g. for pre-selection and statistic acquisition purposes.
- **Low-cost piezo weighing sensors** (e.g. BL Traffic by MSI) can also be used for applications where high accuracy classes are not required.

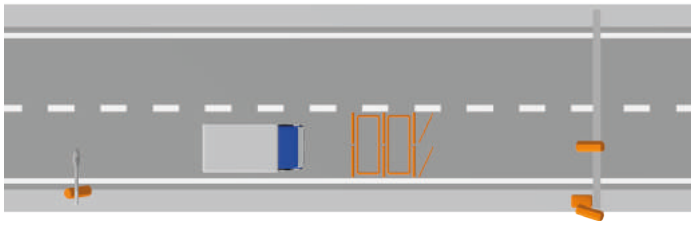
Maintenance

In case of road rut creation (depression, groove, erosion, road indentations etc.) the system cannot keep its accuracy class. The road surface should be then repaired which also can cause the need for system re-calibration and even sensor replacement.

During system operation the road conditions can change. This can affect the weighing sensor parameters and lower the system accuracy. To maintain the system accuracy a re-calibration procedure should be carried out on a regular basis. To simplify the system maintenance an in-the-field manual, semi-automatic and automatic calibration is available.

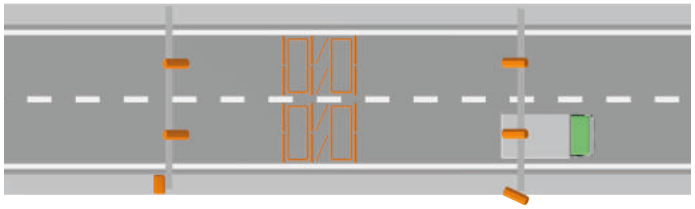
Standard Setup

Three-row sensor setup is recommended for direct enforcement.



Bi-directional Setup

To ensure bi-directional free flow measurement a special site setup is recommended.



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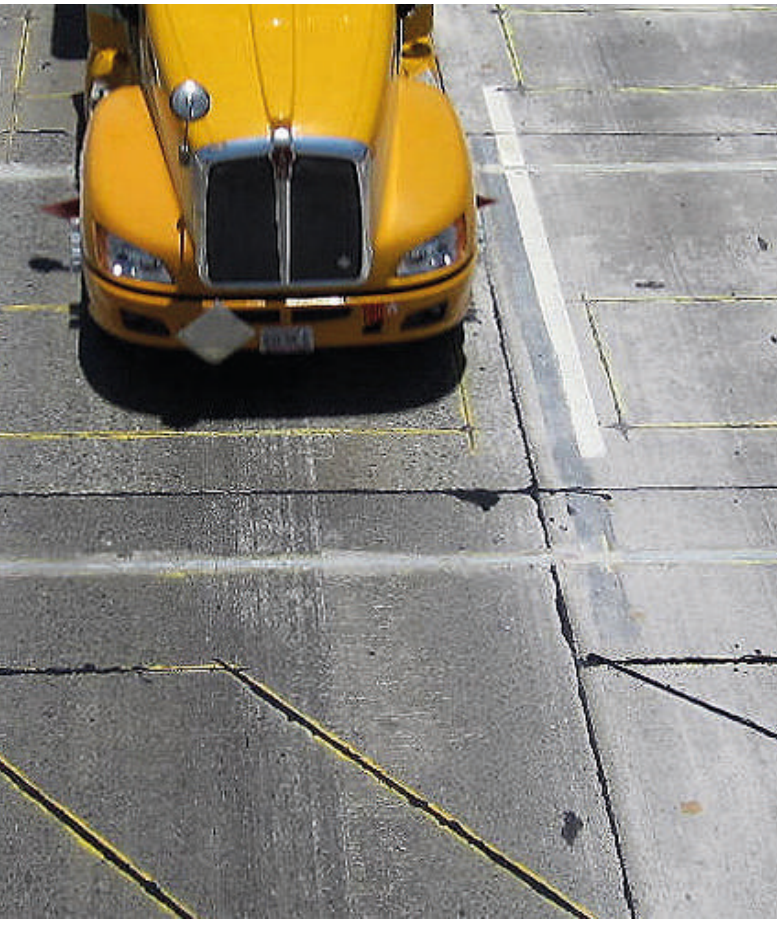
Output Data

The system provides complete vehicle data records including gross/axles/wheels weight, vehicle speed/class/length/direction, vehicle/axle count, wheel/axle bases, trailer presence, validity/error status, statistics and studies export generation etc.

Optionally, the system can provide the following: speed enforcement, vehicle position in the road lane, axle width, twin tire detection, road surface temperature, vehicle height, width and length measurement, vehicle 3D classification, over height violation etc.

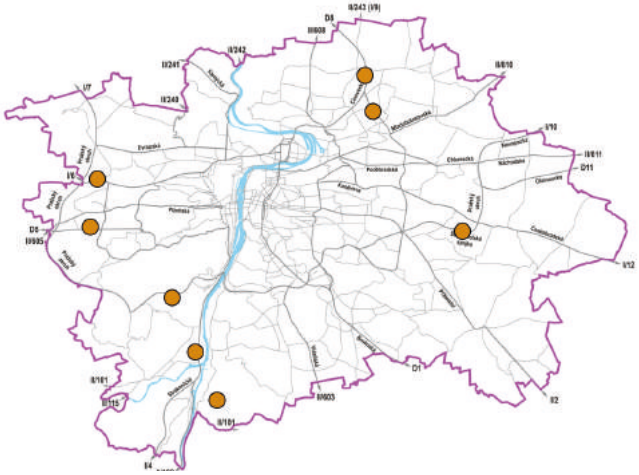
All data can be stored in a local or central database on a vehicle-by-vehicle basis. Various traffic data and studies can be exported via the Web interface or through direct database access (SOAP, file export - CSV, MS Excel, XML etc.).



Case Study

WIM stations can be connected to a central server and a back office to create a so-called CityWIM solution.

For example, in the city of Prague there are currently (2015) 8 centrally operated WIM stations installed with 17 monitored traffic lanes. The goal is to monitor all roads entering the city to prevent damage caused by overloaded vehicles.



Certificates

The systems has been type approved and holds the appropriate certificates.


Český metrologický institut

Type approval certificate

TCM 128/11 - 4831


СВИДЕТЕЛЬСТВО

Section Speed Enforcement

UnicamVELOCITY

The UnicamVELOCITY system is a solution for section speed enforcement (also called section, point-to-point or average speed control or check). When compared to spot speed enforcement systems (radars, inductive loops, LIDARs etc.) which only measure the actual speed in one place, the main extra feature is that the average speed of the vehicle is measured in the entire specified section. The system has been certified for speed enforcement.

Additional Features

Multiple speed limits can be set based on time (time of day etc.), vehicle classification (truck, car) using video detection, external source (traffic counter etc.) or external input (synchronized with actual limits displayed on variable message signs etc.).

It is also suitable for traffic data collection and classification.

The system can be combined with other ITS systems like weigh-in-motion, spot speed and red light enforcement systems, dimension-in-motion (3D scanner), vehicle search etc.

Various system architectures are available including bi-directional setup, daisy chain architecture for multiple consequent sections or a branched solution for sections with multiple departure options.

Basic Specifications

The certified direct enforcement version of the system has the following parameters:

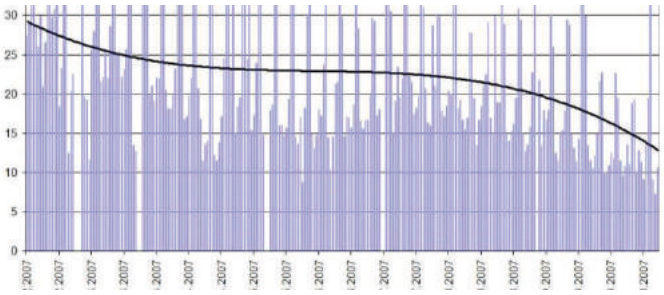
Speed Range	1 - 250 km/h
Accuracy	± 3 km/h (v < 100 km/h) ± 3 % (v ≥ 100 km/h)
Section Length Range	100 m – 10 km

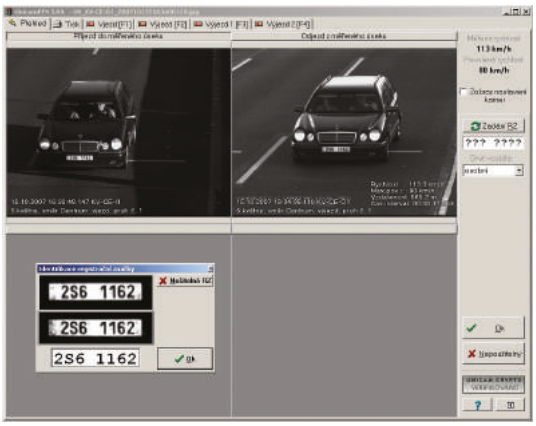
Case Study

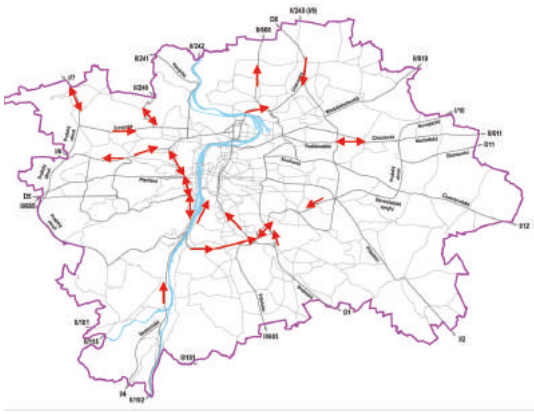
The map of Prague shows marked locations where section speed enforcement systems are installed (2015), an example of a large scale in-the-field proven ITS system application.

A significant decline in the number of offenses through publicity and effective fining as well as emission and noise reduction was reported. Source: City of Prague Metropolitan Police, Czech Republic. Year to year decrease of fatal injuries in Prague: 41 % total (source: MHMP, 26. 6. 2008), 66 % on controlled sections (source: BESIP, 31. 8. 2010).

Prague, 5. května street: decrease of the number of offenses in a period of nine months from the introduction and publicity of section speed enforcement. All offences dropped from 30% to 13%. Offences >10 km/h dropped from 15% to 5%.







Spot Speed Enforcement

UnicamSPEED

The UnicamSPEED system is a solution for spot speed enforcement (also called point or current control or check). The speed measurement is using inductive loops which are based on the principle of the change of inductance in a coil when its electro-magnetic field is modified by a passing metallic object. The system has been certified for speed enforcement.

Additional Features

Multiple speed limits can be set based on time (time of day etc.), vehicle classification (truck, car) using video detection, external source (traffic counter etc.) or external input (synchronized with actual limits displayed on variable message signs etc.).

It is also suitable for traffic data collection and classification. The system can be combined with other ITS systems like weigh-in-motion, section speed and red light enforcement systems, dimension-in-motion (3D scanner), vehicle search etc.

Case Study

For example in the city of Prague, one of the systems is installed in Střešovická street next to a public transportation stop with a pedestrian crossing. It is integrated with a variable message sign with limits dropping from 40 to 30 km/h at times with a high number of pedestrians (school, work starts, ends etc.).

Basic Specifications

The certified direct enforcement version of the system has the following parameters:

Speed Range	1 - 250 km/h
Accuracy	± 3 km/h (v < 100 km/h) ± 3 % (v ≥ 100 km/h)

ČESKÝ METROLOGICKÝ INSTITUT

Certifikát o schválení typu měřidla

č. 0111-CS-C26-08

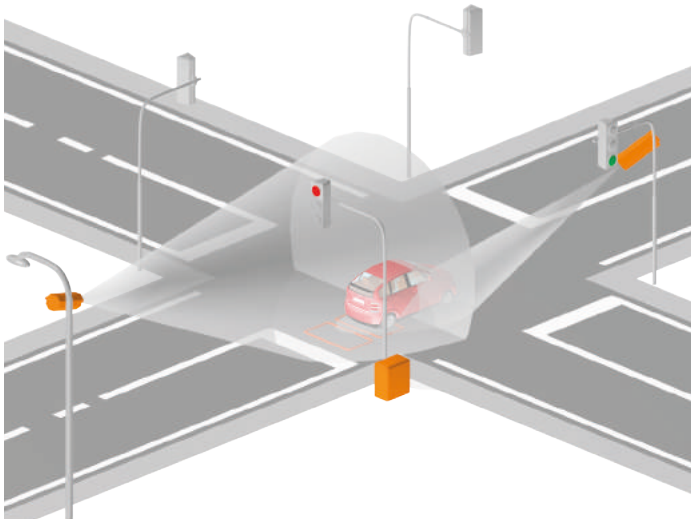
silniční rychloměr
typ UnicamSPEED

TCM 162/08 - 4634

Red Light Enforcement

UnicamREDLIGHT

The UnicamREDLIGHT system is a solution for obtaining documentation of vehicles that run the red light signal at intersections. The ANPR cameras capture red light running vehicles at the stop-line. The overview camera detects and documents the phase of the traffic light as well as records the situation in the intersection and the motion of vehicles into the intersection. Due its non-intrusive nature there is no connection to the traffic controller required and it can operate without inductive loops as well.



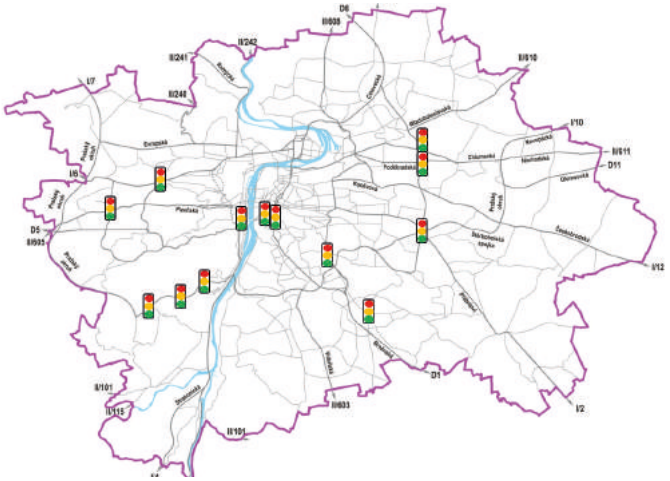
Additional Features

The system automatically eliminates false red-light violation detections – e.g. the vehicle passes the stop-line but is not continuing in driving into the intersection, turning on green or red-light (in countries when applicable) etc.

It is also suitable for traffic data collection and classification. The system can be combined with other ITS systems like spot and section speed enforcement, vehicle search etc.

Case Study

The map of Prague with marked locations where red-light speed enforcement systems are installed (2015) shows an example of a large scale in-the-file proven ITS system application.



On-Site Enforcement

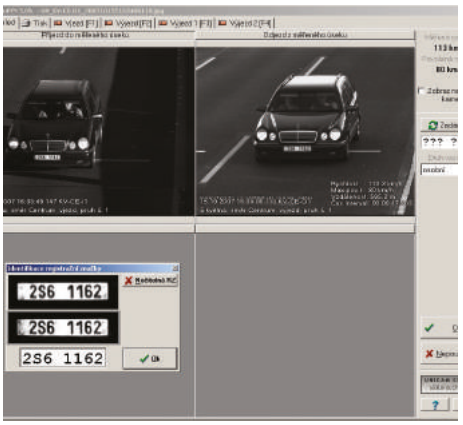
UnicamONSITE

The enforcement systems can wirelessly communicate with a police patrol in the field so the offender can be immediately fined. The police patrol vehicle is equipped with a wireless communication interface and a terminal which displays all violating vehicles in terms of seconds (depending on the speed of the wireless communication infrastructure).

Back Office

UnicamPEN

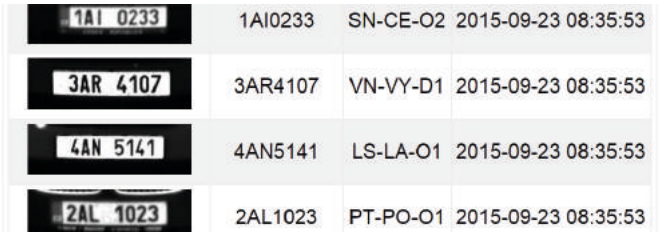
The UnicamPEN back office solution provides software for easy and ergonomic processing of offence documents by appropriate persons (police/municipality). It allows manual separation of questionable offence documents (e.g. incorrectly recognized dirty license plates), filling-in the forms (using ANPR software), enhanced image processing, digital signature, encryption, printing outputs etc. It can also be integrated into third party back office solutions.



Vehicle Search

UnicamSCAN

The UnicamSCAN system is dedicated to preventing crime and ensuring public safety. Thanks to automatic license plate reading, the system searches for stolen vehicles, vehicles of interest, monitors buildings near roads etc. Characters from all automatically read license plates are compared on-line to the official version of the police database of stolen vehicles. If the license plate is found in the database, an alarm is alerted. The daily database updates are automatic. The system is field proven and in a routine operation by the Czech Police.



For example, in 2011 in Prague the system captured 730 stolen vehicles and license plates in total which were then investigated by the Czech Police. A 10% drop in the number of stolen vehicles between the year when the system was installed and made public and the previous years was also reported.

Travel Time

UnicamTRAVELTIME

The UnicamTRAVELTIME system provides the user with accurate journey time prediction using hashed vehicle identification (based on license plate number, Bluetooth address etc.). The travel time estimation can be further improved by using data from sub-sections and actual traffic conditions (when available).

When more than one section is monitored on roadways, the driver can choose a section where the journey is faster.

Drivers can also be informed about the travel time and the delay when compared to free flow journey time.

Traffic Classification and Data Collection

Traffic classification and data collection can be done using different traffic Unicam sensors including cameras with video detection and ANPR/ADR software, radars, inductive loops, weighing/position sensors etc.

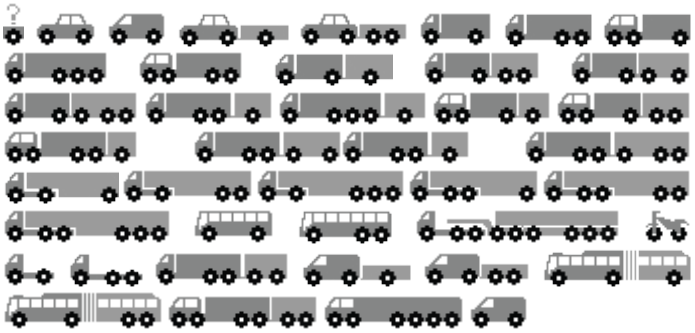
For most application traffic classifiers (e.g. UnicamTC using inductive loops) can be used. For applications where classification into many classes is required, advanced solutions are also available. Note that no sensor for complete traffic data measurement exists. Available sensors use various measurement principles with different accuracy, data availability and confidence levels. So to improve quality of traffic data collection, fusion of values from various sensors can be used. As a result highly accurate traffic classification and data collection can be obtained. System available for such high quality classifications include UnicamWIM and advanced traffic counter UnicamATC.

Classification Scheme Example

Traffic classification and data collection is done separately using measured values from various sources including inductive loops, weighing/position sensors and video detection. The separate vehicles classes are then fused together to get:

- standard classification schemes (EUR13, SWISS7, LPSIG09 etc.),
- more than 40 pre-set vehicle classes and user defined schemes.

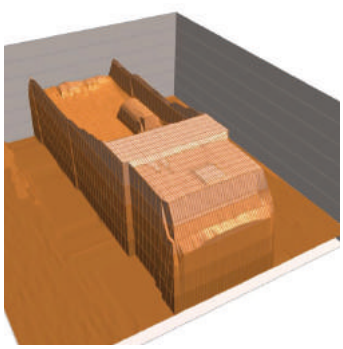
Also, very accurate traffic data is provided including headway, gap, average speed, occupancy, etc.

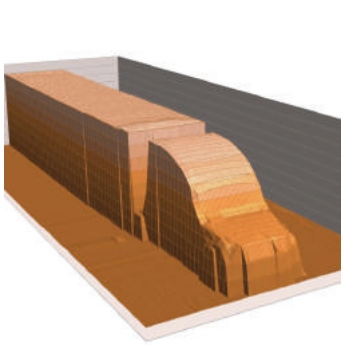


Dimension-In-Motion

UnicamDIM

Laser scanners (e.g. SICK - LMS511) mounted on gantries can be used for gathering 3D profiles of passing vehicles. Vehicle dimensions are then determined, over height violation can be detected and/or vehicle classification provided.





Traffic Classifier and Counter

UnicamTC-L | UnicamATC-LP

Two versions of traffic classifiers and counters are available: UnicamTC-L uses only inductive loops. It can be used for a wide-range of traffic monitoring purposes such as vehicle classification, count and intensity, speed and length measurement, travel direction, lane occupancy, congestion detection, precise passing vehicle timestamp, triggering etc. UnicamATC-LP uses inductive loops and piezo sensors. It provides the same data as UnicamTC-L, but due to recording of vehicle axle spacing and count, it provides classification into more than 40 pre-set vehicle classes as well as a large number of user defined schemes. The traffic classifiers and counters have high accuracy and reliability, simple installation, low cost and easy maintenance. They are remotely manageable using an ergonomic web user interface allowing quick and easy setup in the field.

Basic Specifications

Data Collection	Count, intensity, gap, headway, vehicle class, length and direction, lane occupancy, time of occupancy
Identification	Precise time stamps (UTC, ISO8601, 1 ms accuracy), site ID code, road lane number, validity and error codes
Traffic Flow	Normal, opposite and bi-directional
Power Supply	10 – 30 V DC, PoE IEEE 802.3af, 12W max
Protection	IP 40
Temperature	-40 to + 55 °C
Interfaces	2x Ethernet 1 Gb/s, RS232, 2xUSB, GSM modem
Protocols	UDP, TCP/IP, HTTP, SOAP, NTCIP, TLS compatible etc.
Storage	Up to 256 GB MicroSD/SDHC/SDXC, external USB flash disc
Loop Inductance	25 µH to 500 µH (50 µH to 200 µH recommended)
Loop Frequency	30 kHz to 150 kHz
Loop Resistance	20 Ω max
Loop Feeder Cable	100 m 300 m max with cable extender
Inductive Loops *	8 max 2 per lane, 1 m long, 1 - 4.3 m wide, spaced 1.5 - 3 m (road lane width 1 – 5 m)
Extra Features	LED indication of triggered sensors Ergonomic web user interface Real-time clock (RTC) with battery backup, NTP or TLS synchronization DIN rail module, 19” rack/table housing

* Other sensor and setup configurations are available upon request.

Output Data

The devices can be set up to record every passing vehicle individually or to create studies - configurable aggregations of passing vehicles. Up to tens of active studies can be created at the same time, the duration of the studies ranging from 1 s to several months. The studies can record data for one or more road lanes.

The classifiers also offer large data storage capacity. For example when UnicamTC-L is equipped with 32 GB of memory, it allows storage of over 200 million vehicle data records, enough to collect traffic data of 60,000 vehicles per day for more than 10 years (150 Bytes/vehicle).

Version Comparison

	UnicamTC-L	**UnicamATC-LP**
Classification	SWISS7, LPSIG09, 8+1	EUR13, SWISS7, LPSIG09, 8+1, 40+ predefined, dual tire detection, user definition available
Dimensions	67 x 133 x 179 mm	116 x 133 x 179 mm
Data Record	~150 Bytes/vehicle	~250 Bytes/vehicle
Thermometer	None	1
Availability	Available	Call
Piezo Sensor *	None	8 max, BL Traffic by MSI 2 per lane, 2 - 5 m long, spaced 3 - 5 m (road lane width 2 – 5 m)

CAMEA

The company was founded in 1995 by a group of technical university researchers. With more than 20 years of experience in image processing (algorithms, illumination units, camera design), signal processing (algorithms, sensors, signal conditioning), real-time processing, embedded computing and HW/SW development for various traffic and industry applications, CAMEA is creating state-of-the-art and field-proven platforms for industrial and multifunctional intelligent transportation solutions with hundreds of applications around the world.

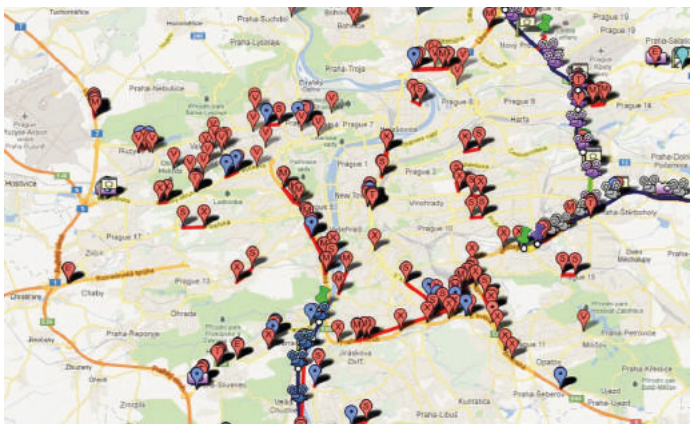
All key technologies used for designing the most innovative products are continuously being developed. While OEM components are available for integration into current systems, fully-featured systems are also being provided. CAMEA is a strongly customer-focused company, which creates individual and project oriented customizations of its technology portfolio, performs R&D of unique systems according to the customer's needs and closely cooperates with technological and business partners in engineering, installation, maintenance, staff training etc.

CAMEA has been certified with a quality management system according to ISO 9001:2001.

The enforcement ITS systems have been type approved and hold the appropriate certificates.

Unicam ITS systems are installed in many countries around the world.

For example in the city of Prague there are tens of systems integrated in a complex centrally operated ITS solution.



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