

ABC 1234



92 km/h

58.7 t

# CAMEA

Unique Customer Solutions for  
**INTELLIGENT TRANSPORTATION**

Weigh-In-Motion · Dimension-In-Motion · Smart Cameras

# CUSTOMER SOLUTIONS

Our team has a unique combination of ITS design expertise, OEM manufacturing know-how, R&D, custom design, and proficiency across a variety of traffic and industry applications required to make your next project a success.



## Custom Design

This may include integration of components from various vendors or custom SW and HW implementations and modifications, such as country-specific legislation issues, communication protocols or custom GUI.

## Turn-Key

This approach consists in providing fully featured solutions. The services range from civil engineering, component delivery, system installation and integration, staff training to maintenance and post-installation support by CAMEA directly or through authorized partners.



## CAMEA OEM

Our products can be provided as components to resellers or system integrators who need specific parts. It is possible to sell such products under the business partner's brand.



TOP QUALITY  
PRODUCTS



EXPERT  
INSTALLATION

CAMEA  
**Environment**



COMPLEX  
DATA

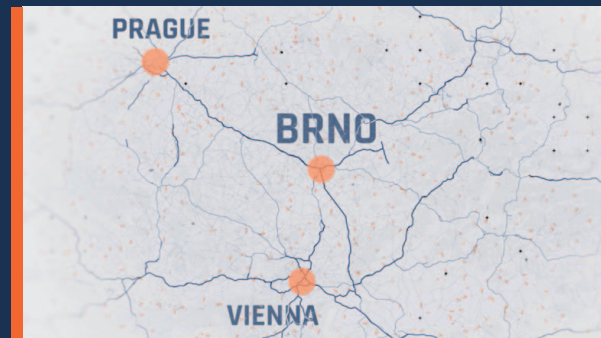


CONTINUOUS  
SUPPORT

# CAMEA CULTURE

## #BRNOREGION

We are based in the Czech Republic in the heart of Europe. It is a strategic location right at the source of talented university graduates in science and technology.



## Research & Development

The company was founded by university researchers. With this academic background, we are strongly oriented towards innovative R&D with 40 % employees in development.

## Improvement & Customization

The main goal is to meet the customers' diverse needs. We make sure that the solutions are continuously being improved with wide customization possibilities to provide top quality products.



## Complete Control

The products are developed, produced, assembled, sold, installed, and remotely monitored under our full control with a minimum of components outsourced.

# CAMEA PLATFORM KEY COMPONENTS

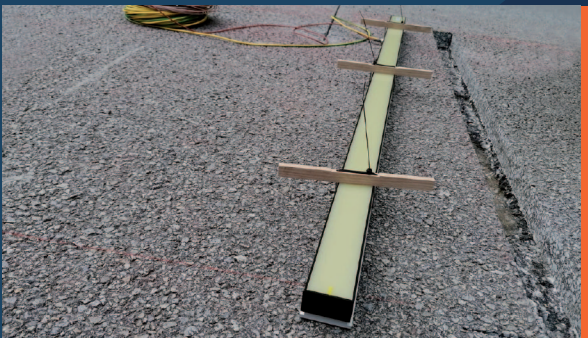


## Measurement Unit

The modular measurement unit with a system of boards is responsible for amplification, conversion and processing of signal. It is scalable, therefore it supports various sensor technologies, counts and combinations and enables performing on different levels.

## Smart Camera

Embedded artificial intelligence which is trainable using deep learning and edge computing enables reaching superb recognition accuracy. Compact design allows saving costs on installation of additional hardware. Suitable for numerous applications in transportation.



## Weighing Sensors

Our solution is sensor independent with the possibility to use most of the commonly installed brands in various setups and combinations. Using our rich experience, we developed WIMTRONIC, a digital sensor for high-speed weighing with top accuracy, innovative functions and cost saving design.

## Software

All our software is developed in-house and therefore is highly optimized for performance and customizable to meet most customer needs and tender requirements. It is continuously being improved based on our partner's suggestions, previous results, or region specifics with emphasis on enforcement-ready outputs.



# CAMEA PLATFORM FEATURES

## Complex Traffic Monitoring

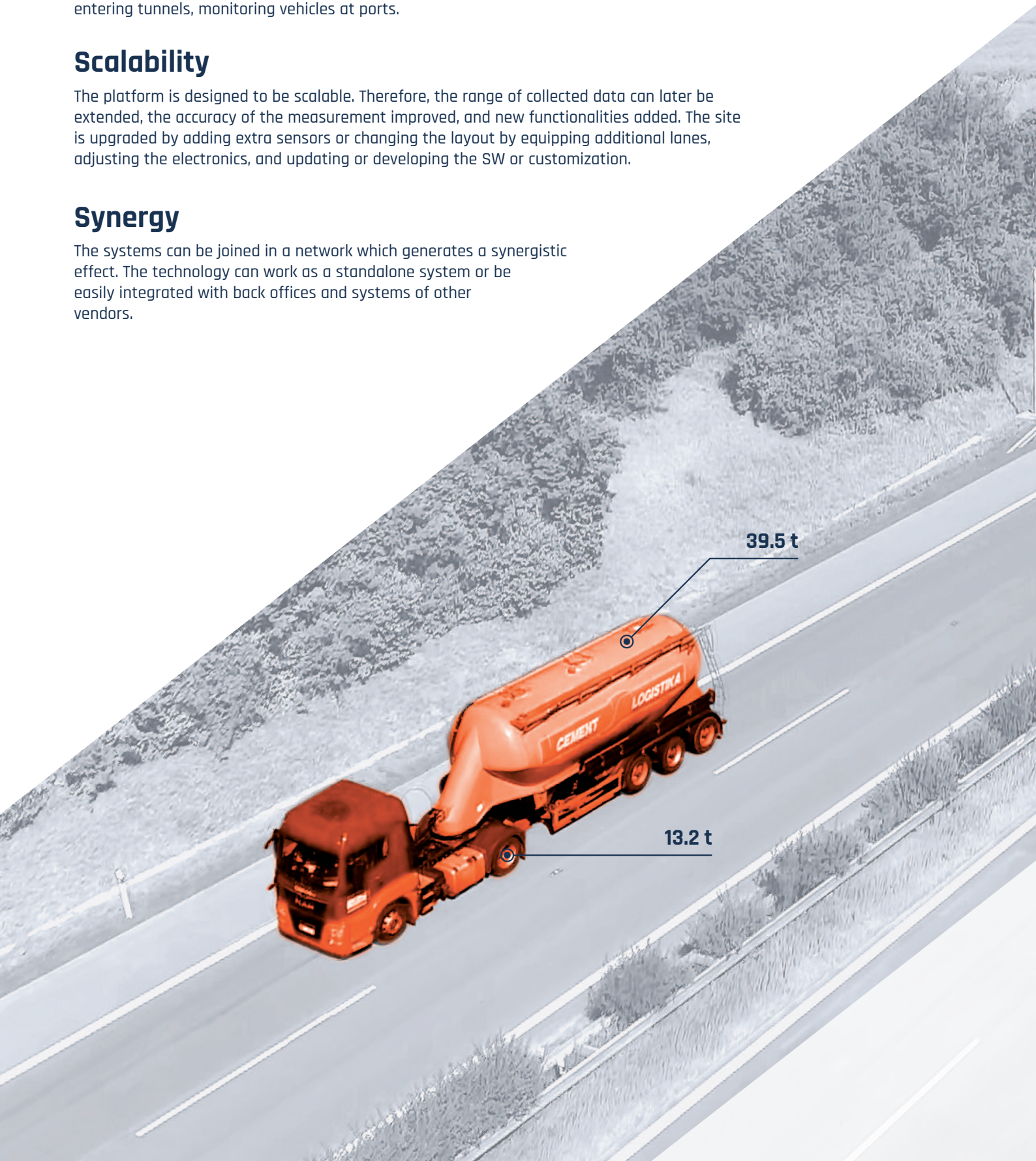
We provide various systems which help save costs and improve transportation. The collected data can be used for infrastructure protection and planning, for road safety, traffic fluency and data management to prevent noise pollution on highways near cities, protecting town centers by eliminating overweight vehicles, monitoring dangerous goods entering tunnels, monitoring vehicles at ports.

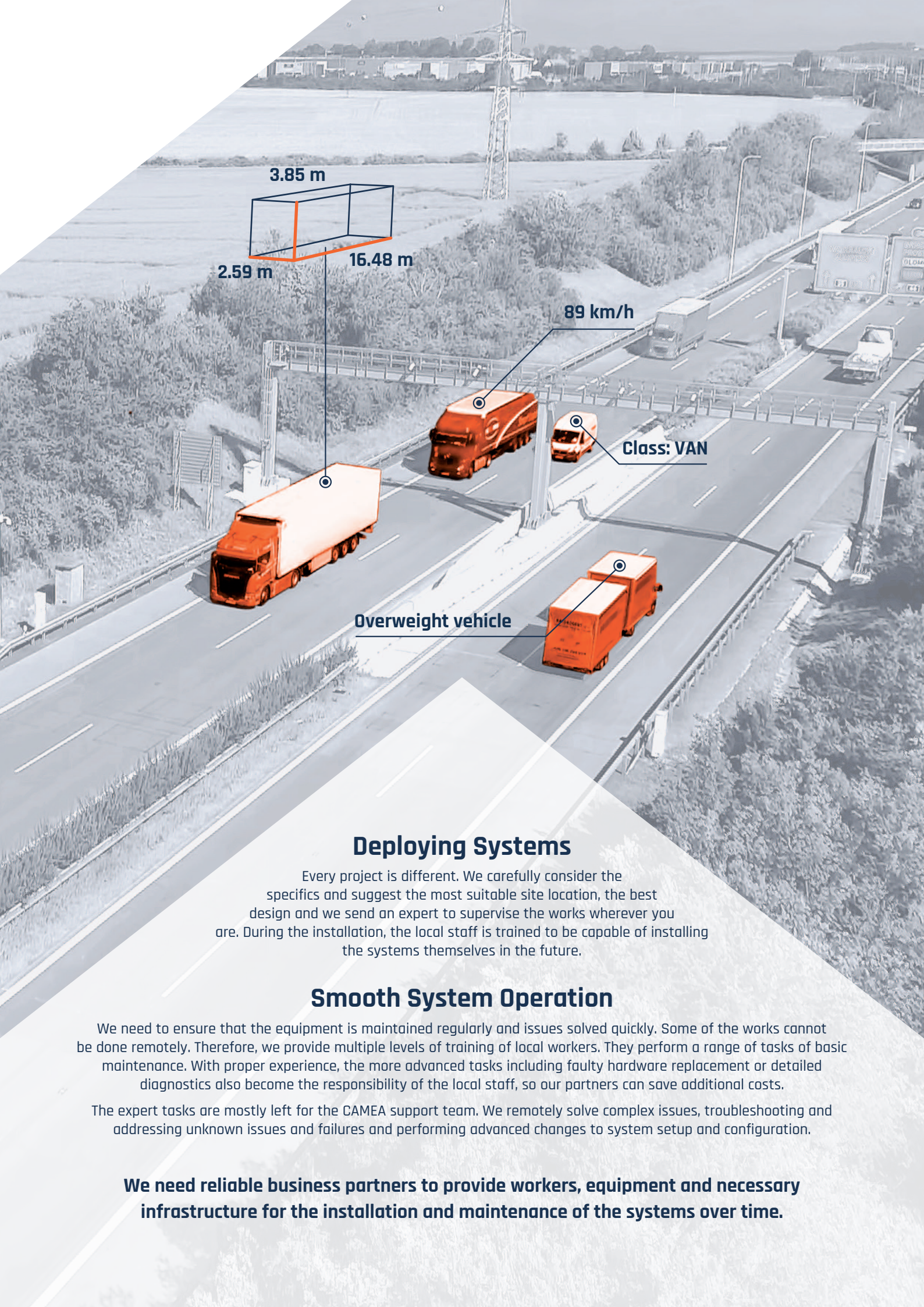
## Scalability

The platform is designed to be scalable. Therefore, the range of collected data can later be extended, the accuracy of the measurement improved, and new functionalities added. The site is upgraded by adding extra sensors or changing the layout by equipping additional lanes, adjusting the electronics, and updating or developing the SW or customization.

## Synergy

The systems can be joined in a network which generates a synergistic effect. The technology can work as a standalone system or be easily integrated with back offices and systems of other vendors.





## Deploying Systems

Every project is different. We carefully consider the specifics and suggest the most suitable site location, the best design and we send an expert to supervise the works wherever you are. During the installation, the local staff is trained to be capable of installing the systems themselves in the future.

## Smooth System Operation

We need to ensure that the equipment is maintained regularly and issues solved quickly. Some of the works cannot be done remotely. Therefore, we provide multiple levels of training of local workers. They perform a range of tasks of basic maintenance. With proper experience, the more advanced tasks including faulty hardware replacement or detailed diagnostics also become the responsibility of the local staff, so our partners can save additional costs.

The expert tasks are mostly left for the CAMEA support team. We remotely solve complex issues, troubleshooting and addressing unknown issues and failures and performing advanced changes to system setup and configuration.

**We need reliable business partners to provide workers, equipment and necessary infrastructure for the installation and maintenance of the systems over time.**

**Gross Weight: 58.7 t**  
**Axle Weight: 13.8 t**



# WEIGH-IN-MOTION

## Solution to road damage by getting rid of overloading

Weigh-In-Motion (WIM) is a system for weighing vehicles with no impact on traffic flow and the most complex solution for data collection in transportation. It helps with traffic management, road maintenance planning and can be applied to actively protect the road infrastructure.

Our solution was the first in the world certified for direct enforcement - another step towards elimination of costly and dangerous overloading. CAMEA WIM is a sensor independent solution and can satisfy the customer's needs and tender requirements in almost all cases.

## Features

- ✓ Most direct enforcement stations worldwide
- ✓ Weighing sensor independence
- ✓ Low-speed and high-speed package
- ✓ Speed and dimension enforcement
- ✓ Measuring between lanes, road shoulder, etc.
- ✓ Measuring in both directions
- ✓ Tire pressure measurement
- ✓ Axle weight enforcement
- ✓ SW-defined free-flow weighing
- ✓ Dual tire detection
- ✓ Wide range of recognized classes
- ✓ Multiple classification schemes
- ✓ Advanced validation process
- ✓ Centralized remote diagnostics
- ✓ Central data server support
- ✓ Tire footprint reconstruction

## Benefits



### Better Road Quality

Heavy vehicles are the most significant factor in damaging roads. Making sure they are loaded properly is key for road preservation.



### Fluent Traffic

Weighing in motion helps eliminate problems of long queuing on weigh stations and slow heavy vehicles influencing traffic flow.



### Better Road Safety

Overloaded trucks have worsened handling and a long braking distance, and therefore are a threat to other traffic participants.



# Applications

CAMEA WIM is deployed in order to collect traffic stats and to protect roads through enforcement. The applications vary in the system setup, resulting in different outputs and accuracies.



## Statistics

The system is a great source of valuable traffic data, such as the accurately calculated road stress. The application serves as a good information base for the next steps in infrastructure planning.



## Pre-Selection

To tackle time-wasting queues at static scales, all vehicles are first weighed at full speed. Only those that seem to be overloaded are subsequently diverted for further weight measurement.



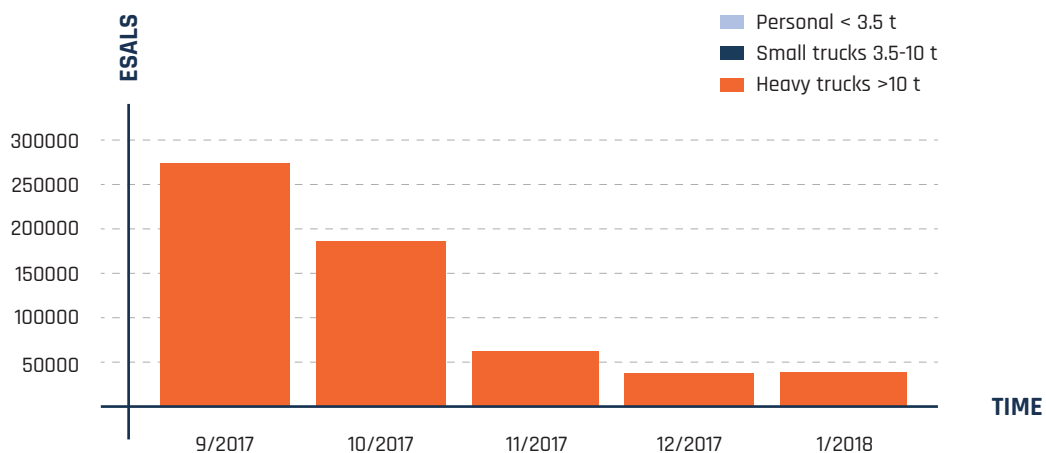
## Direct Enforcement

The most efficient tool in road protection is enforcing directly without any necessity to build a static scale and to employ its staff. Violators are fined without affecting traffic fluency at all.

# Effects

Traffic studies show there is a significant difference between planning road maintenance with and without the use of CAMEA WIM for direct enforcement. WIM enables to determine the level of road damage as accurately as possible by measuring Equivalent Single Axle Loads (ESALs) - the real cumulative road load. Small vehicles, such as personal cars or light trucks, are almost irrelevant to the road damage as can be seen in the graph. Fining results in a serious drop of violators, decreasing damage taken by the

road up to 5 times. Once used for enforcement, applying WIM extends the road lifespan significantly - the repairs can potentially be carried out at the optimal time and the original plan of costs and repairs can be met. By eliminating overloaded vehicles, it is possible to reach the originally planned road lifespan, or even extend it. They must either be loaded properly or use a different path. To prevent moving the overloaded traffic to other roads, building a dense web of WIM stations is recommended.



Road stress decrease in ESALs after deploying direct enforcement WIM

# Platform

The scalable platform enables extending the functionality very easily: simple traffic counters can be upgraded to WIM by adding extra sensors and software. Complex WIM stations may be equipped with laser scanners for dimension enforcement or even used as an entrance or exit point for section speed enforcement. All the while using the additional components and functionality to improve the operation of the WIM station.

License Plate: ABC 1234

Model: XYZ

Unauthorized Parking

# SMART CAMERA PLATFORM

## Top video detection built on 25+ years of enforcement experience

The smart camera system is a camera-based platform optimized for numerous traffic applications: using advanced visual recognition, license plates are read with superb accuracy and can be used to help search for stolen vehicles and other vehicles of interest, estimating journey time or generating origin-destination studies.

The cameras feature embedded artificial intelligence and compact design that saves costs on additional hardware. The AI uses deep learning and edge computing for training while in operation to enable on-board detection, recognition, evaluation, and to reach exceptional results: high ANPR accuracy or recognition of up to hundreds of vehicle manufacturers and specific models.

The compact design of the platform not only saves costs but enables the system to be mounted either on poles for static use or on vehicles for mobile monitoring. This brings a whole new range of applications in places where it is expensive or even impossible to cover the whole area: parking on streets, traffic sign inventory on whole road stretches, road condition monitoring, etc.

## Features

- ✔ Continuous improvement while in operation
- ✔ High recognition accuracy
- ✔ Customization for region specifics
- ✔ In-house developed low-power HW
- ✔ Compact design to save costs
- ✔ Highly optimized and low latency detectors
- ✔ Edge computing with artificial intelligence
- ✔ Deep learning using neural networks
- ✔ Endless applications in transportation
- ✔ Easy installation and maintenance

## Benefits



### Trainable

Deep learning and edge computing can improve operation with respect to regional specifics and customer requirements.



### Versatile

SW solutions range to such a degree that they can satisfy almost any requirements on visual detection of traffic situations.



### Cost Saving

Unique compact design features embedded components that reduce the volume of used HW and facilitate system installations.

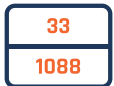
# Applications

Any ITS system providing vehicle measurement of any kind becomes more complex and suitable for enforcement when equipped with cameras. They transform the anonymous data into records that can be used to improve traffic safety or infrastructure protection.



## License Plate Reading (ANPR)

Top success rate in reading of vehicle license plates is essential for performance of any system used for traffic enforcement. The records can also be matched with different databases for various use. When in operation, cameras work with real results which enable reading accuracy improvement up to outstanding 99+ %.



## ADR Label Recognition

A complement to the ANPR software is an application for reading tags that specify nature of the dangerous material that the vehicle is carrying. A typical use is at the entrance of tunnels. In case of an accident, the information about the dangerous goods is shared with a fire department that can act accordingly.



## Monitoring of Parked Vehicles

Reading license plates of parked vehicles is done with real-time data processing by a mobile camera system anchored to a vehicle roof. We use it to verify authorized or correct parking, to detect parking violations or stolen vehicles, and for many other purposes. The carrying car can move through city streets up to 45 km/h and read any visible license plates of vehicles parked on both sides of the street.



## Vehicle Category Recognition

Recognizing vehicle types can be used to monitor dedicated lanes, enforce different speed limits, collect traffic statistics, check toll payments, for restrictions on entry of trucks into prohibited areas, etc. As different vehicles appear across the world, custom approach to new regions is desirable.



## Speed Measurement

Average vehicle speed in road stretches can be monitored by two or more cameras. We match records of passing vehicles based on their license plate and calculate the average velocity, knowing the distance between cameras and using precise time synchronization. The system is designed in a way that higher than real speeds cannot be calculated, and drivers therefore cannot be harmed by unjustified fines.



## Traffic Sign Mapping

Mobile mapping system for creating surveys and inventories of traffic signs, including their recognition, classification and exact location using convolutional neural networks and GPS coordinates. The system can also be used to monitor the state of the traffic signs (broken, missing, vandalized), which is particularly useful for monitoring of portable signs that can be placed on the road dynamically based on the current need.

# Partnership for Intelligent Transportation

We joined forces with top experts in artificial intelligence from the Brno University of Technology to form COGNITECHNA, a startup company which specializes in hardware design, computer vision algorithms, and deep-learning AI using convolutional neural networks. Together with our 25+ years of experience in ITS and enforcement, we developed a smart camera system for the best user experience.



**Current Speed: 87 km/h**  
**Average Speed: 83 km/h**  
**Decelerating**



# SPEED ENFORCEMENT

## Field-proven systems for safer roads and calmer environment

Spot and section speed enforcement are solutions for measuring speed to help keep roads safe by forcing drivers to slow down at specific places or drive fluently in whole sections. For enforcement purposes, the systems require a type approval. Thanks to our experience, we can provide support in the certification process.

The spot or current speed measurement is best deployed at specific places due to safety reasons: at busy pedestrian crossings, near schools, at the entrance of tunnels, etc. Our portfolio includes both non-intrusive measurement using a 3D/4D radar and a well verified solution using inductive loops.

The section or average speed enforcement is a camera-based solution used for monitoring typically a tunnel or an inhabited zone in which the noise needs to be kept down. As opposed to spot speed measurement, where the drivers usually accelerate once past the measurement, average speed measurement forces them to move fluently in the whole road stretch. Lower speed also allows tighter spacing, enabling more drivers to pass through the area and reach their destination in time. This is especially useful in rush hours in big cities.

## Features

- ✓ Rich experience with type approvals
- ✓ Both non-intrusive and intrusive technologies
- ✓ Measuring in multiple lanes
- ✓ Multiple speed limits based on class or time
- ✓ Cameras developed specifically for enforcement
- ✓ Precise and reliable time synchronization
- ✓ Detection of drivers' maneuvers using radars
- ✓ Easy integration with other ITS

## Benefits



### Lower Speed

Speed is a major contributor to deaths on roads worldwide. Enforcing speed limits is considered one of the most effective measures in reducing the number of accidents.



### Less Noise

Keeping the traffic fluent and speed down can help lower the noise levels significantly in some areas. This is especially necessary on highways near cities or in tunnels.



### Cleaner Air

Speed enforcement is an efficient way to reduce fuel consumption. Speeding and lack of fluency in driving negatively impact vehicle emissions and air dustiness.

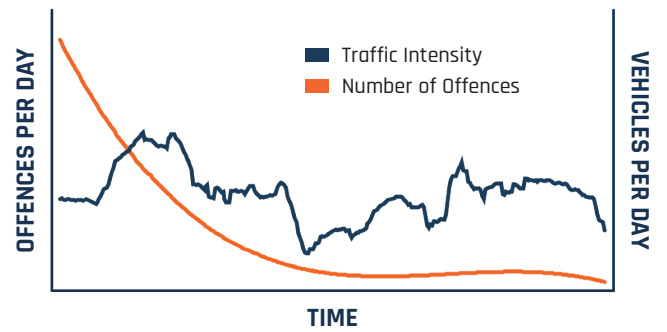
## Effects

After deploying section speed enforcement, the number of speeding drivers is typically reduced by around 80 % within a few months. It never drops down to zero which allows to collect money for the system operation. This was verified based on statistic from hundreds of CAMEA's installed systems.

This makes the system suitable for use even in villages on major routes. The primary purpose of the installation is met by the drop of violators and, at the same time, the local administration can afford the system operation.

The graph demonstrates the model evolution as described above. The data was collected at a road through a small

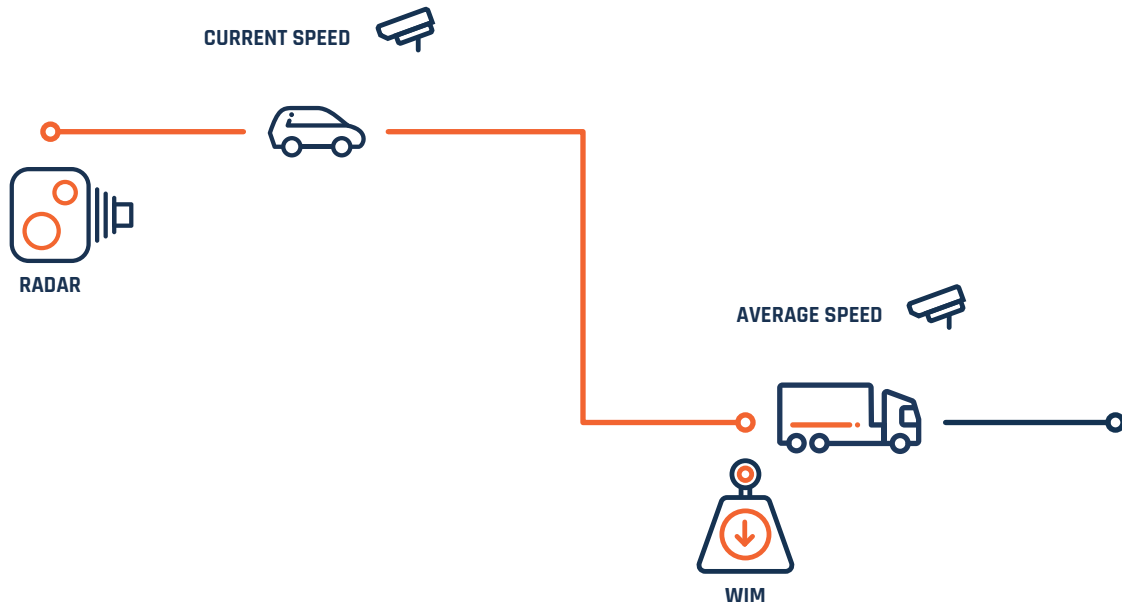
municipality in the Czech Republic. The life in the village is now safer with less noise.



## Platform


To reach both cost and enforcement efficiency, the equipment of already existing ITS can also be used for speed enforcement. Traffic classification technologies including WIM which use inductive loops, also measure the current speed of the vehicles. The stations can easily be extended for spot speed enforcement by adding software for generating speed violation protocols.

The sections between the systems equipped with cameras may be used to measure the average speed. By using a radar or inductive loops at the entry point to measure the current speed, we make sure that drivers don't enter the section at high speeds and compensate by slowing down later. The exit point can for example be an existing WIM station. Because the cameras are already installed, only additional software is necessary.



Section speed measurement can improve the WIM's performance as it is affected by driving fluency. Radars can be used at WIM sites to monitor the drivers' maneuvers. Knowing the changes in speed helps with validating the weight measurement.

Typically, there are different speed limits for trucks and passenger cars on highways or their sections. Based on information from counting and classification systems, these limits can be set for spot or section speed enforcement.



**Class: Truck**  
**Counts: 1,234**

# COUNTING AND CLASSIFICATION

## Data collection for better infrastructure and maintenance planning

Traffic counting and recognition of vehicle categories serve as a great tool for collecting traffic stats. It can be done with various non-intrusive technologies, such as cameras, radars, or laser scanners. To meet the highest requirements on accuracy and reliability, we provide solutions that use inductive loops and pressure sensors installed in the pavement.

A choice of the technology is made based on the customers' needs. Thanks to our wide portfolio of traffic solutions and the modularity of our systems, we can even use a combination of various technologies to achieve exceptional results.

## Features

- ✓ High accuracy using in-road technologies
- ✓ Custom defined classification schemes
- ✓ Fusion between technologies
- ✓ 200+ vehicle classes recognized
- ✓ Data can be exported in custom formats
- ✓ Scalable solution

## Platform

Our solutions are scalable. Deploying inductive loops and low-cost pressure sensors is a minor investment that can serve as a basis for deciding whether to enforce weight violations in the region. Such a system can be later upgraded by adding sensors in different layouts, as well as other components and software, all the way to WIM for the best data collection available and active road protection.

By adding cameras and software, the counters with inductive loops or radars can be used for speed enforcement purposes and the fusion of output data used to improve results of classification and speed measurement validation.

## Benefits



### Various Technologies

We provide the right technology for your needs. Some bring efficiency by serving more purposes, others feature more accurate output.




### Valuable Stats

Collected data enables deep analysis of the traffic flow and using the knowledge for infrastructure and investment planning.



### Reasonable Costs

Any local authority can afford collection of essential traffic data, possibly in a combination with speed enforcement.



**Height: 3.85 m**  
**Width: 2.59 m**  
**Length: 16.48 m**

# DIMENSION-IN-MOTION

## Controlling oversized vehicles with no impact on traffic flow

Dimension-In-Motion (DIM) is a system that uses a laser-scanner technology to create 3D models of passing vehicles. The dimensions and categories of these vehicles are used to prevent height, length, and width violations.

Our measurement and classification software is developed for enforcement purposes, taking advantage of our long experience with traffic enforcement through our various ITS. We continuously improve it based on the regional specifics and customers' requirements.

## Features

- ✓ Precise outline and dimension measurement
- ✓ Highly accurate classification using 3D shapes
- ✓ Possible replacement of intrusive technologies
- ✓ Improving measurement validation of WIM
- ✓ SW developed specifically for enforcement
- ✓ Customizable solution

## Platform

Dimension measurement can easily be added to the WIM site thanks to its non-intrusive nature and system compatibility within the CAMEA platform. These two solutions are often applied together, building the most complex tool for traffic data collection available.

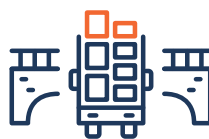
Equipping WIM sites with DIM helps solve issues with drivers who aim to avoid proper weighing. Their practice is to drive closely together with small vehicle gaps, so the weighing system fails to detect them separately and the measurement record must be marked as invalid. Laser scanners enable detection of individual vehicles in such cases and facilitate enforcement of these usually overloaded ones.

## Benefits



### Infrastructure Protection

Oversized vehicles are dangerous for bridges, tunnels, and other infrastructure. The system prevents them from causing vast damage.



### Class Recognition

Laser scanners are used to create a 3D profile. This enables a very precise classification not achievable by standard means.



### Traffic Safety

Exceeding allowed vehicle dimensions causes worsened stability, falling objects, or further threats. Such vehicles need to be excluded.



WEIGH-IN-MOTION



WIM DIRECT  
ENFORCEMENT



SPEED  
ENFORCEMENT



ITS  
WORLDWIDE

**4**

CONTINENTS

**20+**

COUNTRIES

**40%**

EMPLOYEES IN  
DEVELOPMENT

**25+**

YEARS OF  
ENFORCEMENT



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Developed in #BRNOREGION  
Version: EN20220315