



# EXTENDING OUR ROAD LIFESPAN

**WEIGH-IN-MOTION**

WEIGH-IN-MOTION  
AND DIRECT ENFORCEMENT  
**CROSSWIM**

SIZE MEASUREMENT SENSOR

LPR SYSTEM

← DIRECT ENFORCEMENT

PRE-SELECTION  
FOR CONSEQUENTIAL  
OFFENSE SOLUTION  
ON THE SPOT

Significant extension of the roads' lifespan  
and cost reduction during their repair

Protection from the road damage  
caused by overloaded vehicles

Higher safety levels on the roads

VMS



PRESELECTION →

CONTROL UNIT  
CROSSWIM

Toll-per-Tonne

**#OPTIWIM®**

DIRECT  
ENFORCEMENT

ROAD PROTECTION,  
A FAIR TOLL SYSTEM

ID	Date	Weight (kg)	Speed (km/h)
#150001	21.04.2017 16:08:04	1072 kg	54 km/h
#150002	21.04.2017 16:08:05	1067 kg	58 km/h
#150003	21.04.2017 16:08:05	1020 kg	53 km/h
#150004	21.04.2017 16:08:05	1075 kg	67 km/h
#150005	21.04.2017 16:07:56	1254 kg	58 km/h
#150006	21.04.2017 16:07:53	1044 kg	51 km/h
#150007	21.04.2017 16:07:51	930 kg	42 km/h
#150008	21.04.2017 16:07:51	1031 kg	48 km/h
#150009	21.04.2017 16:07:50	2087 kg	48 km/h
#150010	21.04.2017 16:07:49	1396 kg	51 km/h
#150011	21.04.2017 16:07:43	1344 kg	47 km/h



# THE MODULAR SYSTEM

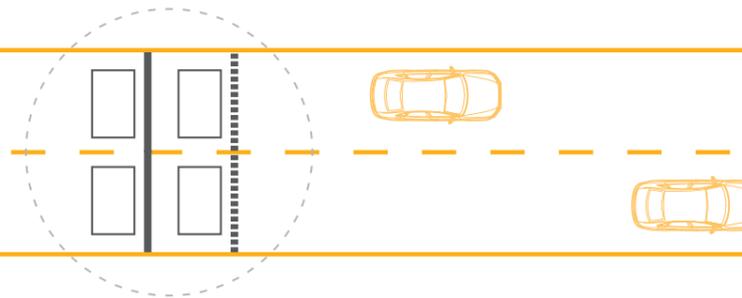
CrossWIM is designed as a modular system. According to the required precision, a corresponding layout and configuration can be selected. According to the levels of the equipment, different stations are suitable for particular applications - see the stations mentioned below.

## OPTIWIM TOLL-PER-TONNE

Weighing with the accuracy of **±3 %**

Typical installation:

- Two induction loops per one lane
- One or two rows of OptiWIM sensors per one lane
- Multi-tyre and underinflation detection
- Measurement of speed, number of axles, length and width of the vehicle, wheelbase and axle load
- Highly precise vehicle classification



## CROSSWIM STATISTICS

Weighing with the accuracy typically **±20 %**

In case of a need for higher precision of the measurement of the overall weight, it is possible to use QUARTZ or OptiWIM sensors.

## CROSSWIM PRE-SELECTION

Weighing with the accuracy typically **±7,5 %**

In case of a need for higher precision of the measurement, it is possible to increase the number of QUARTZ sensors rows (to get the precision level of ±5 % it is needed to use two rows of QUARTZ sensors) or to use OptiWIM sensors.

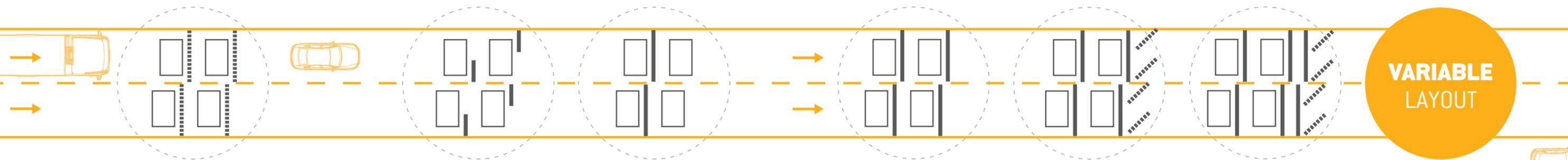
## CROSSWIM DIRECT ENFORCEMENT

Weighing with the accuracy typically **±5 %**

In case of a need for higher weight measurement precision, it is possible to increase the number of WIM sensors and include skewed PIEZO thresholds for a detection of other parameters.

Typical installation:

- Two induction loops per one lane
- One row of OptiWIM sensors and one row of PIEZO sensors per one lane (or, alternatively, two rows of QUARTZ sensors per one lane)
- Measurement of speed, number of axles, length of the vehicle, wheelbase and axle load
- Extended vehicle classification



Typical installation:

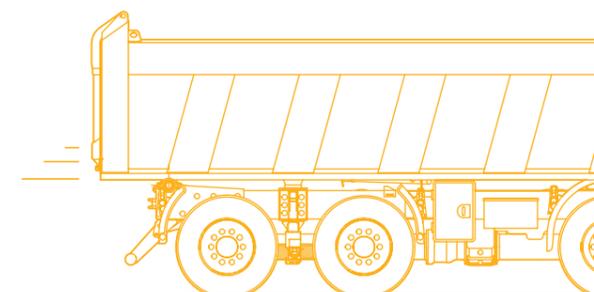
- Two induction loops per one lane
- Two rows of PIEZO sensors per one lane
- Indicative measurement of speed, number of axles, length of the vehicle, wheelbase and axle load
- Vehicle classification

Typical installation:

- Two induction loops per one lane
- One row of QUARTZ sensors per lane
- Measurement of speed, number of axles, length of the vehicle, wheelbase and axle load
- Vehicle classification

### Examples of other possible applications of CrossWIM:

- Movement monitoring and weighing trucks at the logistic centres and similar commercial areas
- Protecting city centres from overloaded vehicles
- Accurate statistical data for license fee payers



# CROSSWIM

CrossWIM is a cutting edge high-speed weigh-in-motion system. It meets the most demanding criteria for traffic detection and dynamic weighing. CrossWIM is used for traffic statistics, pre-selection, and direct enforcement.

The system was developed with an emphasis on accuracy, reliability and simplicity. It is suitable for basic single lane installations as well as for complex multi-lane free-flow environments with heavy traffic.



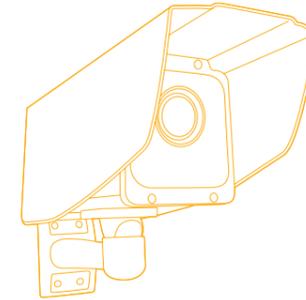
CrossWIM is compatible with third-party components (HW, SW)

The system can be adapted according to given conditions and traffic situation

## CROSSWIM CONTROL UNIT

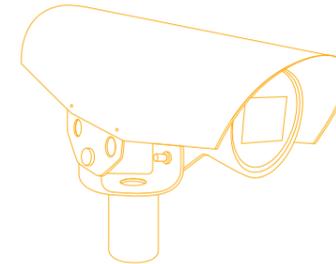
- Minimal recommended speed from 10 km/h
- Sensitivity weighing 10 kg
- Traffic intensity accuracy 98 %
- Classification accuracy 95 % (on average, depends on vehicle category)
- Ethernet interface
- Communication options GSM/GPRS, TCP/IP, Wi-Fi
- 120 GB SSD for data storage (higher capacity is an option)
- Max. cable length to loop: 300 m / WIM sensor: 100 m
- Designed for operations in extreme climatic conditions (standardised version ARCTIC, TROPIC and DESERT)
- One 3U rack up to 6 lanes, 6U racks up to 12 lanes

## TYPICAL ACCESSORIES



### License Plate Recognition (LPR)

CrossWIM can be equipped with a customized license plate recognition system. Measured data is available in real time and can be used for vehicle pre-selection or direct enforcement.



### Vehicle size measurement sensor

3D vehicle size measurement sensor is a further option. The sensor is most often used for height measurement, but can also be used for a more precise speed measurement or a more accurate vehicle classification.



### Variable Message Signs (VMS)

Variable Message Signs are mostly used in the pre-selection mode. They can display license plates, measured weight and can divert overloaded vehicles from the road.

### Overview cameras

Overview cameras capture colour photos or live-stream video and have night vision capability.

CrossWIM is compatible with various WIM sensors (PIEZO, QUARTZ, OptiWIM)

- Vehicle data (gross vehicle weight, axle load, wheel load, type/class of vehicle, vehicle speed, gap, vehicle dimensions)
- Measuring vehicle dimensions (height, width, length)
- Multi-tyre detection
- Underinflated tyre detection
- Vehicle speed measurement
- Monitoring of free-flow traffic on multi-lane roads
- High accuracy of vehicle classification
- Watchdog system monitoring
- Web API for third party data integration
- SQL database

## VEHICLE CLASSIFICATION

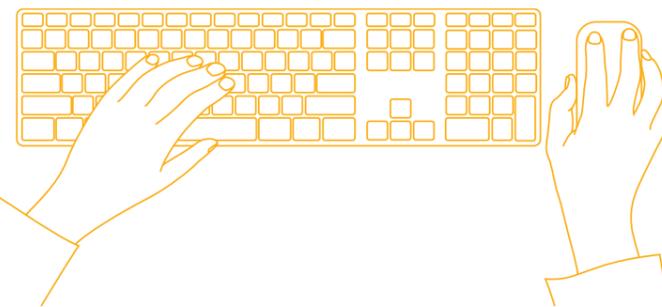
- Standard EN 8 + 1
- EUR 13, COST 323
- Full adaptation to specific national standards possible
- Custom categories reflecting specific customer/end user needs and requirements
- CrossWIM is also available as OEM

# CROSSWIM WEB INTERFACE

The input module of the online application is the so-called Watchdesk. It provides an easily manageable console which displays online the vehicles that have just passed, including a preview and violation indication. For each recorded vehicle it is possible to display detailed information, such as the number of axles or wheel weight and wheel speed. The system is also able to function in different languages which it learns automatically according to the language set in the browser.

ID	Category	Date/Time	Weight	Speed	Violation
#158096	OT3	21. 04. 2017 15:30:34	22440 kg	54 km/h	OT3
#158208	OT3	21. 04. 2017 15:48:13	20338 kg	52 km/h	
#158143	OT3	21. 04. 2017 15:40:52	22142 kg	47 km/h	
#158045	OT3	21. 04. 2017 15:35:12	20340 kg	46 km/h	
#157988	OT3	21. 04. 2017 15:02:18	20366 kg	46 km/h	
#157228	OT3	21. 04. 2017 14:45:33	24336 kg	46 km/h	
#157372	OT3	21. 04. 2017 14:42:17	23683 kg	51 km/h	
#157369	OT3	21. 04. 2017 14:41:59	26391 kg	58 km/h	OT3
#157090	OT3	21. 04. 2017 14:20:44	22202 kg	44 km/h	
#156988	ZL2	21. 04. 2017 14:31:21	33812 kg	41 km/h	OT3
#156942	OT3	21. 04. 2017 14:28:42	28710 kg	52 km/h	
#156783	OT3	21. 04. 2017 14:19:07	36324 kg	48 km/h	OT3
#156682	OT3	21. 04. 2017 14:12:06	20721 kg	48 km/h	
#156655	OT3	21. 04. 2017 14:11:25	34306 kg	62 km/h	OT3
#156636	OT3	21. 04. 2017 14:10:16	34300 kg	50 km/h	OT3
#156582	OT3	21. 04. 2017 14:07:04	22206 kg	40 km/h	
#156579	OT3	21. 04. 2017 14:07:01	20818 kg	50 km/h	
#156487	OT3	21. 04. 2017 14:00:51	20833 kg	50 km/h	
#156423	OT3	21. 04. 2017 13:56:48	30122 kg	46 km/h	OT3
#156393	OT3	21. 04. 2017 13:54:22	21303 kg	48 km/h	

Offences



## LINUX AND SQL DATABASE

- Real-time visualization of passing vehicles including LPR and overview camera snapshots
- Vehicle database access including search and filtering functions
- Detailed information of every recorded vehicle (e.g. total vehicle weight and even wheel and axle weight, overloaded indication, speed, validity of measurement)
- Traffic statistics (e.g. overloaded vehicles, vehicle classification, country of origin, weight and speed statistics)
- Display of measurement protocol in case of an offence
- Data export to Microsoft Excel and PDF
- Device calibration and configuration of operational parameters
- User accounts management, database management and regional settings
- Web API for data integration
- Calibration and maintenance tools

## STATISTICS

- Vehicle categories
- Overloaded vehicles
- Weight statistics

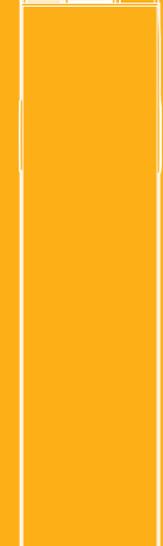
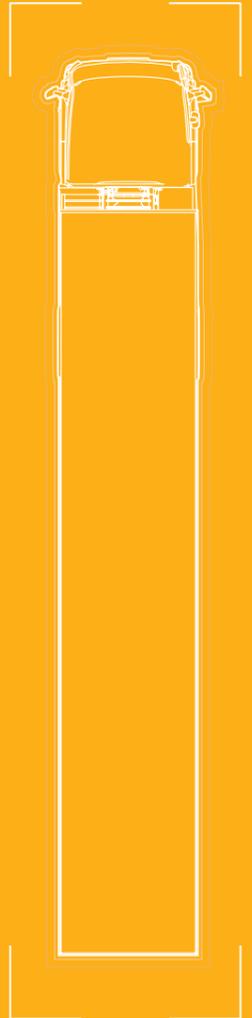


# CASE STUDY DIRECT ENFORCEMENT

In 2011 CROSS Zlín, a.s. as the first in the Czech Republic and the EU certified a station for high speed weighing for direct enforcement. The station is equipped with a unit for weigh-in-motion CrossWIM that is a certified measuring tool for automatic weighing of vehicles in motion with the accuracy of  $\pm 5\%$  for gross weight and  $\pm 11\%$  for individual axle weight.

Thanks to the system of automatic ticketing there has been a substantial improvement of the protection of roads from overloaded vehicle damage. This has dramatically increased the lifespan of roads and has led to significant savings on repairs.

*"The Czech legal regulation enabling the option of direct enforcement of overloaded vehicles based on high speed weigh-in-motion scales was accepted as the first of its kind in the world."*



# REFERENCES



**Mexico**  
Motorway network



**Poland**  
CrossWIM and vehicle size (height) measurement



**Lithuania, Vilnius**  
Motorway network



**Russia, Moscow**  
Motorway network



**Brazil, Floriano**  
CrossWIM for carriers check



**Czech Republic**  
CrossWIM for direct enforcement



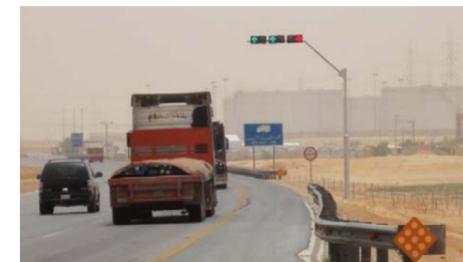
**Iran**  
Motorway network



**Japan, Osaka**  
CrossWIM to protect the bridges



**Qatar, Doha**  
Motorway network



**Saudi Arabia**  
Motorway network



**Korea**  
CrossWIM Extra



**United Arab Emirates, Dubai**  
Motorway network



**Vietnam**  
CrossWIM for tolling system



**Thailand**  
CrossWim for pre-selection



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