

Advanced measurement in motion

The core of intelligent transportation systems is the information that needs to be collected, transferred, integrated and provided

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Betamont Measure-in-Motion (MiM) is a new concept that can be flexibly implemented on roads and railways, which aims to obtain the largest possible set of relevant data on vehicles themselves, and the transport stream as a whole, without obstructing flow at the measuring site. It is a complex system consisting of several subsystems.

The concept of MiM is to integrate simple traffic counters with weigh-in-motion (WIM), automatic license plate recognition (ALPR) and vehicle dimension measurements. What started as the integration of third-party devices has evolved to a bespoke hardware solution – Betamont has established its own R&D department, one of the active focuses of which is the development of completely new WIM systems.

Why weigh?

Vehicle weight enforcement is of interest to road authorities, as it prevents road surface damage caused by heavy traffic and by doing so improves safety.

At an axle load inspection site, a vehicle gets measured dynamically by a high-speed WIM system and, if suspected of being overloaded, is diverted to a certified scale. High-speed WIM works in such situations as a pre-selection system. Nevertheless, such a solution is quite demanding in terms of required space.

Betamont set itself the goal of creating an accurate and reliable dynamic WIM system with results comparable to a static or low-speed system. It achieved this goal and its system is now certified in Russia, where six sites are using its enforcement system. On October 5, 2017, the Federal Road Agency Rosavtodor, on behalf of the Ministry of

Transport of the Russian Federation in cooperation with the Ministry of Internal Affairs, agreed that there was practically no difference between the accuracy of Betamont high-speed and other low-speed WIM systems. From the beginning of 2017, more than one million weight limit violations were recorded using the system, meaning that more than one-third of freight vehicles exceeded the standards.

As well as Russia, the system is also certified in the Kyrgyz Republic and the Czech Republic. The reason for this, first and foremost, is Betamont's intensive business activities in these countries, but it is also because of the modified legislation process that promotes dynamic weighing.

Beyond WIM

The MiM system has a wide range of functions – WIM is but one of the important subsystems. The ALPR subsystem, which currently works reliably with 98% accuracy, is an indispensable part of the traffic parameter measurement process. As well as reading plates to unequivocally identify a particular vehicle, the MiM system can work with images in a more advanced manner and use this data to identify all kinds of vehicle attributes (emissions, technical specifications, dangerous cargo, etc). It can also detect if belts are buckled, if a passenger is present, and identify the vehicle model and color.

The basic MiM configuration can be supplemented with additional non-contact measurement systems, such as high-speed lasers to measure the vehicle contours. A combination of radar, ultrasonic and infrared systems was used, for example, in



a national highway toll project in Slovakia. This case demonstrated well the modularity and adaptability of the MiM system. It also enabled Betamont to gain valuable experience of a complete electronic toll implementation project. This has led to an ambitious, but certainly feasible, idea – to charge tolls using just smartphones with dedicated apps, and to keep the MiM system only as a checkpoint.

Further development

Betamont is constantly working to improve and expand its MiM system. But since the system is operating only with the sensors currently available, it often encounters limits. These can be solved partly by software, but in terms of some specific customer requirements, Betamont has now started to develop its own WIM sensors. The company is doing this to improve accuracy and introduce new principles, while still being mindful of the acceptable financial limits of the solution. Simultaneously there are completely new possibilities

for the deployment of MiM applications for road management and beyond.

Advanced data-processing is a fundamental part of the MiM system. In-depth data analysis using artificial intelligence methods is carried out to identify, calculate and interpret traffic parameters, to discover the patterns and correlations they contain. This is compared with historical data, which contains a certain regularity that can aid the development of new models.

The data-processing system can also be upgraded by tailoring it for a specific application within a defined user environment, such as for a police officer, traffic manager or statistician.

In the future, data streams could be enriched even further with the monitoring of additional devices such as autonomous vehicles, C-ITS systems and weather stations. Other even more disparate elements could also be brought into the system, such as holidays and rest days, the current political situation, and even the oil market, all of which could have an effect on traffic and other geosocial patterns in a city. The goal of all active ITS should be to prevent unfavorable situations and not just to react to those that arise. 

Above: **Betamont high-speed WIM sensors can be seen outlined in red and yellow, embedded in a roadway.** Accuracy is equivalent to low-speed static sensors

Below: **ALPR and video enforcement technology mounted on a gantry**

