European Metrology Programme for Innovation and Research

Delivering Impact

Enforcing vehicle weight restrictions

The safety of our road infrastructure is being challenged by heavy lorries that exceed bridge load bearing capacities, so endangering the public. Traffic law enforcement agencies must identify and apprehend offenders and can issue heavy fines as a deterrent to further violations. Weighing-in-motion technologies embedded in the road surface offer a fast method for identifying overladen vehicles, but their weighing accuracy needs improvement for wider enforcement of vehicle weight limits.

Europe's National Measurement Institutes working together

The European Metrology Programme for Innovation and Research (EMPIR) has been developed as part of Horizon 2020, the EU Framework Programme for Research and Innovation. EMPIR funding is drawn from 28 participating EURAMET member states to support collaborative research between Measurement Institutes, academia and industry both within and outside Europe to address key metrology challenges and ensure that measurement science meets the future.

Challenge

Damage to rural bridges throughout the EU is being caused by lorries carrying heavy loads that may far exceed their design criteria. For example, in Estonia there is increasing concern over damage to the road infrastructure due to heavy lorries carrying felled trees from forests to saw-mills on country roads. Laws are in force to regulate vehicle loading and weighing-in-motion systems based on sensors embedded in a road's surface. These are helping to identify potential offenders for further investigation.

Operating at the speed of passing traffic these systems need to rapidly determine a vehicles total weight and that of each of its axels. Those over specified limits are then escorted to more accurate static weighbridges and wheel loading scales that conform to EU Directives are used to verify whether loads exceed regulations. Variation in vehicle type, suspension systems and the loads carried are all factors that affect weighing-in-motion assessment accuracy. Increasing the reliability of these dynamic measurements, which must operate at the speed of moving traffic, relies on faster systems with improved accuracy than that achieved by current technologies. To assist law enforcement agencies in making checks in moving traffic, whilst minimising journey disruption and reducing costs, requires the development of improved calibration methods underpinned by robust uncertainty evaluations.

Solution

The EMPIR project *Traceable calibration of automatic weighing instruments operating in the dynamic mode* brought together emerging EU member states in a collaboration to expand their knowledge and experience in calibrating automatic weighing instruments, including vehicle weighing-in-motion systems.

The project worked to improve calibrations for systems used to determine the axle loads and total weights of heavy goods vehicles measured in motion. In the project, various trucks were accurately weighed using static weighbridges both unloaded, then with heavy loads to determine axle and total loading. The trucks were then driven at different speeds, simulating on-road driving conditions, across weighing-in-motion dynamic measurement systems. The data recorded was used to validate measurement uncertainties and to derive robust links between the different weighing approaches. A Euramet calibration guide is being drafted that covers the project developed weighing method, which will provide a harmonised approach for calibration to the user community in this measurement area.

Impact

E&M Engineering Solutions OÜ (EMES), is an Estonian SME that offers measurement services to the civil engineering sector. It has developed a prototype automated weighing-in-motion system, the WIMEST that is currently being commercialised for use by enforcement agencies when issuing fines to vehicles travelling on public roads that exceed weight restrictions. Independent testing in the project confirmed the results of EMES in-house testing, so supplying them with the confidence to proceed with the more onerous legal certification process required before commercialisation. Once the system has passed this testing, Metrosert, the Estonian NMI, will provide the on-going 6-monthly re-verification required to ensure continuing accuracy, building on the measurement capabilities developed in this project.

The Estonian traffic police and other government agencies responsible for enforcing vehicle loading regulations have already expressed interest in installing the WIMEST weighing-in-motion system to reduce infrastructure damage. Improving the detection of overladen vehicles is essential for public safety as todays heavy loads frequently exceed the weight limits of our older bridges, as the bridge collapse near Toulouse, France, that killed two people demonstrated.

Building automated weighing capability

The EMPIR project *Traceable calibration of automatic weighing instruments operating in the dynamic mode* brought together NMIs from emerging EU Member States with more experienced colleagues to address a skills gap in the use, assessment and calibration of automatic weighing instruments that must weigh items that are moving. These types of measurements are needed to fulfil quality management requirements in the production of goods by establishing proof of measurement traceability. These are also important for ensuring regulatory compliance with the EU MID and Pre-packs Directives for consumer goods, which are underpinned by OIML recommendations R51 for automatic catchweighing instruments, R61 for automatic gravimetric filling instruments and R134 for automatic dynamic determination of vehicle mass on the road.

The project team developed calibration methods and measurement uncertainty models, validated on-site at manufacturing production lines or vehicle weighing stations. These measurement approaches are being incorporated into three EURAMET calibration guides for automatic weighing instruments that will form the basis for a more harmonised pan European approach for calibration of automatic weighing instruments in dynamic mode of operation.

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EMPIR EURAMET

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Matej Grum

MIRS, Slovenia
+ 386 1 24 42 706 | matej.grum@gov.si

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