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# NEW YORK CITY'S OVERLOADED TRUCK CHALLENGE

New York City Department of Transportation (NYC DOT) paves the way to direct enforcement with Weigh In Motion system from Kistler





Brooklyn-Queens Expressway (BQE) built more than 70 years ago with a triple-cantilever design, 2.4km long

**Trucks carrying loads over the legal weight limit are causing stress on an aging elevated roadway that serves as a vital connection between four out of five New York City boroughs. Amid growing concern for the aging structure's safety, the New York City Department of Transportation (NYC DOT) sought an automated solution for direct enforcement of overweight (OW) commercial vehicles that would enable citation of trucks without impacting operations and risking law officer safety. They chose a Kistler Weigh In Motion (WIM) solution with C2SMART Center as an integrator for this first-in-the-nation direct enforcement system.**

New York City is known for its unique structures. This reputation extends to the Brooklyn-Queens Expressway (BQE). Built more than 70 years ago with a triple-cantilever design, the BQE was constructed to provide an express bypass over the area that connects Brooklyn with major access points to Manhattan, Queens and Staten Island. Its express lanes are suspended above Furman Street to alleviate local traffic congestion.

As Brooklyn's only interstate highway, the BQE is a vital artery of the region's transportation system and a route for commercial vehicle traffic. It supports three westbound traffic lanes on the lower level, three eastbound lanes on the middle level and a pedestrian promenade on the upper level.

In the 70 years since the BQE was designed and built, legal truck weight limits have increased by 11%. Many OW trucks go undetected by law enforcement while leaving their marks on this aging cantilever structure.

In 2019, NYC DOT wanted to assess the number of OW trucks that crossed the BQE daily. Quantifying OW truck traffic frequency was the lead to creating a direct enforcement solution to issue citations to significantly reduce, or eliminate, OW trucks from BQE traffic.

NYC DOT contacted its traffic engineering partner, C2SMART Tier 1 Center and Rutgers University, and C2SMART brought in Kistler.

#### **Kistler Weigh In Motion: Steps to direct enforcement**

A Kistler WIM system, consisting of Kistler Linesas Quartz in-road sensors and a Kistler Data Logger (equipped with Kistler's own open-source software) was installed on the BQE's Queens-bound traffic lanes. This testbed would provide the foundational data – explicitly, how many trucks crossed the BQE daily and their OW status – to support the legislation required for automated enforcement.

Kistler's Linesas Quartz in-road sensors, which are specifically designed to measure wheel and axle loads of on-road vehicles, are highly durable and are installed level with the road surface.

The adhesive used to hold the sensors in place is poured and grouted level with the road surface so there is no disruption to the level or smoothness of the pavement. Kistler's robust sensors are designed for long-term durability and to withstand severe temperature fluctuations, especially in harsh outdoor weather conditions.

Kistler's Data Logger interfaces with its Lineas Quartz sensors to provide real-time traffic monitoring data. The Data Logger's enhanced processing and signal conditioning deliver optimal and consistent weighing accuracy and maximum reliability from low-to-high driving speeds for up to four lanes of traffic.

With Kistler's open-source software, the Data Logger can seamlessly interface with other technology solutions. For the BQE WIM system, C2SMART integrated automatic license-plate recognition (ALPR) cameras to identify each truck's owner/operator and vehicle class to assess whether it's operating within legal weight limits. Since Kistler's software is open source, the cameras were an easy addition to the system.

"We used three cameras to simultaneously capture and record identification information for overweight trucks: one positioned for the license plate, sideview of the vehicle and U.S. DOT number, which legally is required to create notice-of-liability," said Hani Nassif, Ph.D., professor of civil and environmental engineering at Rutgers University, associate director of C2SMART Center. "By integrating the feeds from three cameras with truck

weight information, the WIM system is able to provide the legal identification needed to issue direct-enforcement citations."

During the pilot phase, Kistler WIM data showed that 25,000 trucks cross the BQE daily, with 15% over the legal weight limit for their class. This crucial information provided a foundation for legislation to be passed enabling automated enforcement for overweight trucks on the BQE.



"With industry expertise and proprietary software, we were able to meet and exceed the system GVW accuracy requirements from legislation."

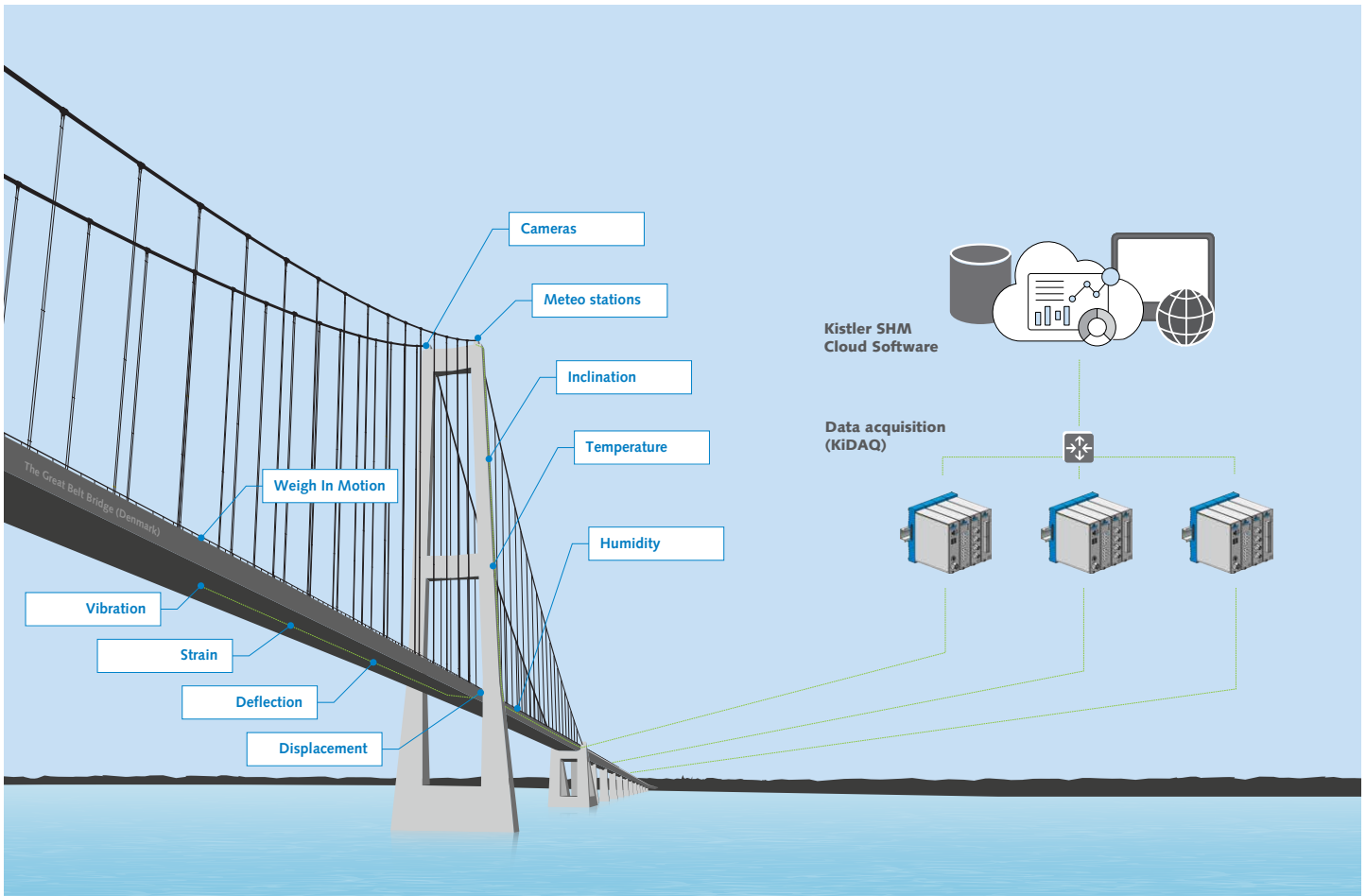
Alex Schumacher – Project Manager, Traffic Solutions North America – Kistler Instrument Corporation

"NYC DOT is developing a plan to address the BQE structure because of its age," said Tanvi Pandya, P.E. DBIA, executive director, BQE Design Build & Emergency Contracts. "Due to the complexity of the project, this effort could take some time. In the meantime, to extend the service life of the existing structure, we focused on reducing the damage from overweight trucks on the BQE. And, with Kistler and C2SMART, we're leveraging technology to do that."



Weigh In Motion solutions from Kistler, consisting of sensor technology, data acquisition and a user interface, protect bridges against overloading and provide accurate heavy traffic data.





Bridge protection with Kistler: Weigh In Motion for traffic data acquisition and preselection of overloaded vehicles, and Structural Health Monitoring of the structural condition.

### Updating the installation

With the overwhelming data on the OW commercial vehicles going over the BQE, New York State passed a special law to cover the very restricted geographical location of the BQE area. However, for the WIM system's unassailable data that would be used for direct law enforcement, the system needed to be certified using established procedures by the New York State Department of Agriculture Inspectors. These types of procedures are listed in the NIST Handbook 44 and need to be updated with consensus within the National Conference on Weights and Measures (NCWM) to prove the accuracy of the system prior to its use for direct enforcement.

The challenge for NCWM was that it had never certified a WIM system for the purposes of enforcement; its work had been achieved solely with static scales. The WIM technology that was poised to be the first-in-the-nation system for automated direct enforcement was also the first time OWM certified a non-scale measurement system.

Kistler worked with NCWM to prove the accuracy of the measurements. The team also is involved in updating NCWM's Handbook 44, which specifies technical standards for commercial measuring equipment used in law-enforcement



**"Kistler's technology and commitment to making the BQE direct enforcement initiative successful is second to none."**

Hani Nassif, PhD, PE – Professor of Civil and Environmental Engineering at Rutgers University, Associate Director of C2SMART Center

applications, with the standards for certifying sensor technology-driven measurements. Only when the WIM system earns certification from OWM can it legally be used for direct enforcement.

### Pre-enforcement testing

Due to the difficulty in scheduling construction and the need to work around events such as the New York City Marathon, Kistler installed the full WIM system during the week of Thanksgiving 2022. A few weeks later, due to a legislative requirement that the system be turned on in 2022, the week before Christmas, Kistler was on-site to optimize the system. Using three different truck classes: 9, 6 and 5, with two different load cases (full; empty) and at three different speeds, data was collected over a span of three days.

“Utilizing the data we collected with the test trucks, we optimized the system based on vehicle types and speeds,” observed Alex Schumacher, project manager of traffic solutions for North America, Kistler. “With industry expertise and proprietary software, we were able to meet and exceed the system GVW accuracy requirements from legislation.”

The optimization of the WIM system, as well as confirmation that 100% of weights were within the specified requirements, enabled Kistler to conduct real-world testing and verifications for the next several months.

### Enforcement certification

With nearly nine months of WIM system operation, during which any issues were properly resolved, the system was ready for the enforcement certification process. Based on the legislative requirement of a 90-day warning period, starting Aug. 10, 2023, based solely on WIM data and photo documentation, drivers of OW trucks received a warning letter in the mail from NYC DOT informing them of their OW infraction and that, as of Nov. 8, 2023, direct law enforcement would begin. Meaning, from that day forward, they would incur a \$650 fine for an OW violation.



New York City is known worldwide for its hustle-bustle – but the traffic is taking a harsh toll on the bridges and other infrastructure. Here the US Traffic Solutions Team visits the very first Quartz WIM system in NYC – Kistler sensors! Pictured from left to right: JT Kirkpatrick, Carlos Ortiz, Alex Schumacher, Chaekuk Na and Rolf Sonderegger

On Oct. 29, 2023, after two grueling nights of testing working with the officials from New York State’s Department of Agriculture, NYC DOT’s site with the Kistler WIM and C2SMART system earned certification as the first automated citation system for OW vehicles in the United States.

“Kistler’s technology and commitment to making the BQE direct enforcement initiative successful is second to none,” said Nassif. “One month after the WIM system went live, the number of overweight vehicles going over the BQE daily has been cut in half.”



“Working with our industry partners is critical to develop state-of-the-art solutions that contribute to the success of NYC DOT.”

Tanvi Pandya – P.E. DBIA, Executive Director, BQE Design Build & Emergency Contracts

### Future plans for WIM automated direct enforcement

In 2024, NYC DOT plans to implement the same WIM solution for direct enforcement on the BQE’s Staten Island-bound lanes. “Our collaboration with Kistler and C2SMART was key to bringing this first-in-the-nation automated direct enforcement system to life,” said Pandya. “Working with our industry partners is critical to develop state-of-the-art solutions that contribute to the success of NYC DOT.”

The BQE automated direct enforcement platform is only the beginning for this WIM-based traffic solution. Kistler contributed to the language upon which the state will be relying in the OWM’s Handbook 44 for compliance specifications, including testing and calibration.

With proof points from the deployment of Kistler’s WIM direct enforcement system for OW trucks in New York City, all other U.S. states will have the opportunity to adopt similar laws to protect aging infrastructure by using automated direct enforcement to ticket OW trucks.

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