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Press release

Sensor-driven breakthrough: Kistler enables India's first real-time road surface quality assessment system on the Ganga Expressway

Live road monitoring during construction is now a reality helping prevent costly rework

Winterthur, August 2025

For the first time in India, a real-time, cloud-based sensor technology system is being used to monitor road surface quality inspection during active construction. Together with Kistler, a global leader in dynamic measurement technology, and RTDT Laboratories AG, an ETH Zurich spin-off, the Uttar Pradesh Expressways Industrial Development Authority is equipping the ambitious Ganga Expressway project with an intelligent end-to-end system that detects road surface deviations as they occur. This reduces the need for rework, cuts costs, and improves long-term road safety, and supports monitoring and maintenance throughout the road's operational life. Following its initial use on the Ganga Expressway, the system is now being adopted on several other Indian expressways.

Spanning 594 kilometers across Uttar Pradesh, India, the Ganga Expressway is designed to connect millions of people and boost the regional economy. But alongside the sheer scale of the project, one of the most ambitious road infrastructure projects in Asia, comes a critical challenge: ensuring construction quality without slowing down progress.

Although road quality assessments have traditionally been conducted during construction in India, these methods required significant manual effort and lacked the speed and precision of integrated, sensor-based systems. The Uttar Pradesh Expressways Industrial Development Authority (UPEIDA) was seeking a more proactive and data-driven approach for a project of this magnitude: a system capable of detecting road quality deviations near real time, directly on-site during active construction. The solution also needs to provide objective assessments of ride comfort and safety based on international standards, while supporting long-term maintenance planning.

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The solution: end-to-end measuring system for road surface quality assessment from Kistler

To meet these requirements, Kistler delivered a complete sensor-to-cloud road quality assessment system together with RTDT Laboratories AG – a spin-off of ETH Zurich. This technology integrates advanced in-vehicle measurements, local data processing, cloud analytics, and visual reporting.

Mounted on test vehicles, the measuring system for road surface quality inspection uses high-dynamic acceleration sensors and HF-series laser height sensors to measure the road surface profile with high precision and spatial resolution. The HF sensors use optical triangulation with a red laser to deliver non-contact height measurements. Optoelectronic speed sensors, such as the Correvit S-Motion, are combined with inertial measurement units to capture synchronized movement and positioning data across each section of the roadway. These sensors provide low signal delay and integrate GPS and accelerometers to deliver reliable positional and dynamic data for each road segment.

Edge computing modules then pre-process this data locally, minimize latency and reduce bandwidth before securely transmitting it to the Kistler Cloud. The cloud-based analytics, developed by RTDT evaluate the raw data using domain-specific algorithms. This includes calculating the roughness of a road surface using the International Roughness Index (IRI) as well as assessing ride comfort and vibration in accordance with ISO 2631.

All results are made available through an interactive, map-based dashboard. Contractors, supervisors, and authorities can use the dashboard to visualize road quality per lane and per 100m road segment, providing actionable insights in near real time.

While the core technology was developed in Switzerland through collaborations with ETH Zurich and RTDT Laboratories, the rollout and local adaptation of the system are managed by Kistler Instruments India Pvt. Ltd. in close coordination with local infrastructure authorities. On the Swiss side, Kistler's Innovation Lab – a unit specializing in smart services that transform measurement data into practical applications – coordinated Kistler's contributions to the project. Working closely together, all partners completed the full implementation in just three months, bringing together technical innovations from multiple domains and making the project both a logistical success and an architectural milestone.

The result: early detection of road surface quality instead of expensive rework

Road surface quality deviations and vibration levels are objectively tracked and documented to help enforce safety standards and optimize construction quality at every stage. This proactive approach reduces long-term maintenance costs, ensures full traceability, and remains valuable once the road is operational. With continuous monitoring, infrastructure managers can track surface degradation,

detect emerging issues early, and schedule predictive maintenance. This helps preserve ride quality, uphold safety standards, and extend the road's lifespan.

After its successful implementation on the Ganga Expressway, the end-to-end sensor solution for road surface quality assessment from Kistler is now being deployed on other major India expressways, including the Gorakhpur Link Expressway, Agra-Lucknow Expressway, Purvanchal Expressway, and Bundelkhand Expressway.

Image material (please name the Kistler Group as picture source)

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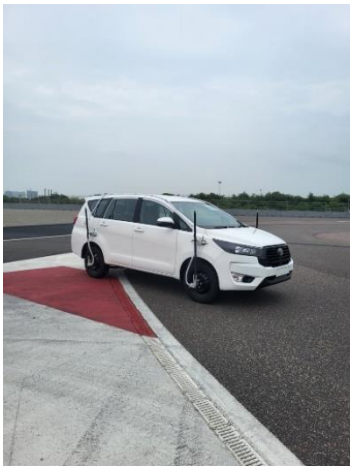

Kistler and Indian infrastructure authorities collaborated for the first time to implement real-time measuring system technology for road surface quality inspection during expressway construction, enabling immediate detection of road surface quality issues and ongoing monitoring once the road is in operation.

High-dynamic acceleration sensors and laser height sensors mounted on test vehicles capture road surface profiles with exceptional resolution, forming the foundation for accurate road surface quality assessment during construction.

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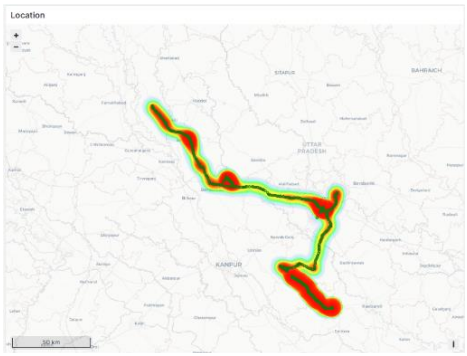
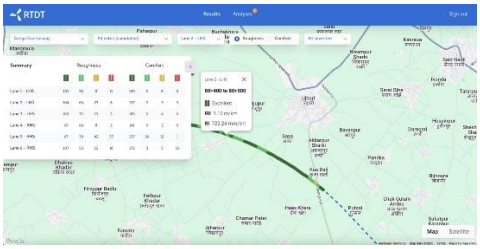
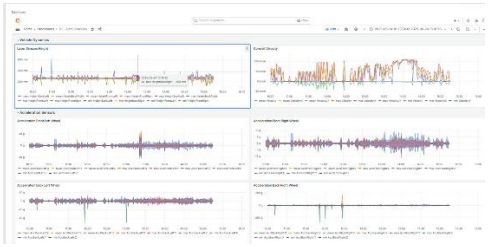
Combining optoelectronic speed sensors with inertial sensors provides precise movement and velocity data for every road segment, enabling context-aware analysis of road pavement quality.



Edge computing modules pre-process sensor data on site and securely transmit it to the Kistler Cloud. There, domain-specific algorithms from RTDT Laboratories AG – a spin-off of ETH Zurich – evaluate road quality metrics near real time.



A cloud-based dashboard developed by RTDT Laboratories AG displays lane-specific road surface quality inspection data supporting informed decisions during road construction and maintenance.



The dashboard presents reference profiles for road surface roughness and vibration levels, enabling precise comparison, including the International Roughness Index (IRI) and ISO 2631-based metrics, for quality control and assessment.

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Kistler is the global market leader for dynamic pressure, force, torque and acceleration measurement technology. Cutting-edge technologies provide the basis for Kistler's modular solutions. Customers in industry and scientific research benefit from Kistler's experience as a development partner, enabling them to optimize their products and processes so as to secure sustainable competitive edge. Unique sensor technology from this Swiss corporation helps to shape future innovations not only in automotive development and industrial automation but also in many newly emerging sectors. Drawing on our extensive application expertise, and always with an absolute commitment to quality, Kistler plays a key part in the ongoing development of the latest megatrends. The focus is on issues such as electrified drive technology, autonomous driving, emission reduction and Industry 4.0. Some 2,000 employees at more than 60 facilities across the globe are dedicated to the development of new solutions, and they offer application-specific services at the local level. Ever since it was founded in 1959, the Kistler Group has grown hand-in-hand with its customers and in 2024, it posted sales of mCHF 448. About 9 percent of this figure is reinvested in research and technology – with the aim of delivering innovative solutions for every customer.

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