

Dynamic Bridge Monitoring in Chile – First Field Experience with the RIEGL VZ-600i Profile Scanning Mode at Puente Las Cucharas

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Key words: Bridge surveying; Deformation measurement; Engineering survey; Laser scanning; Risk management

SUMMARY

Recent developments in terrestrial laser scanning (TLS) technology enable measurements at unprecedented temporal resolutions, extending its application from static surveys towards dynamic monitoring of engineering structures. A key innovation is the profile scanning mode of the RIEGL VZ-600i terrestrial laser scanner, which allows the continuous acquisition of a single scan line at rates of up to 120 profiles per second. This high-frequency operation opens new possibilities for contactless observation of vibrations, transient deformations, and other short-term structural phenomena.

In September 2025, this functionality was tested for the first time under real-world conditions during a field experiment at the Puente Las Cucharas railway bridge of Metro Valparaíso, Chile. The objective was to evaluate the performance, stability, and operational feasibility of the profile scanning mode in a complex outdoor environment. Continuous profile sequences were recorded during regular train passages over several minutes, capturing the bridge under realistic dynamic excitation. The setup included synchronized triggering, reference scans, and stable mounting to ensure geometric consistency and precise temporal control.

The acquired datasets allow for an initial assessment of achievable precision, signal stability, and data completeness under dynamic conditions. The experiment focused on testing the measurement concept and data characteristics rather than on the interpretation of the bridge response. Early findings demonstrate that the system delivers stable, dense, and geometrically consistent range data even under varying environmental and motion conditions.

This contribution presents the experimental setup, acquisition strategy, and first technical observations from the Chilean field deployment. The results highlight the potential of the profile

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scanning mode as a valuable extension to existing monitoring concepts, complementing traditional sensor-based approaches such as accelerometers, GNSS, or fiber-optic systems. By combining the strengths of geodetic and structural monitoring methods, high-rate laser line scanning can significantly enhance the capability for detailed, non-invasive, and temporally dense observations in Structural Health Monitoring (SHM).

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