There are more than 2,600 rail bridges and some 4,990 arterial road structures in the State of Victoria, Australia. As the owners of the rail transportation assets and infrastructure for the State of Victoria, VicTrack initiated a collaboration with PARC, along with the support of VicRoads and other state agencies and transport partners to deploy PARC’s predictive, condition-based maintenance technology (now referred to as MOXI™ IIoT System Analytics) and help improve the maintenance and management of the State’s rail and road assets.

**OBJECTIVE**
*Improve bridge maintenance and asset management*

VicTrack was faced with the challenge of costly annual inspections and repairs to maintain their rail bridges. Aside from being costly, traditional schedule-driven maintenance practices required physical on-site inspections which often caused a disruption for bridge commuters. Additionally, traditional inspection only captured data at discrete physical points, and did not provide a detailed and full representation of the structural integrity and safety condition of each bridge. VicTrack was in search of an innovative solution to address these challenges and help optimize their maintenance operations.

**WHY PARC?**
*PARC’s MOXI IIoT System Analytics suite*

With their proven track record of helping organizations manage and improve the health and reliability of critical systems across various sectors, PARC was the perfect fit for VicTrack. Unlike traditional maintenance practices, which can be costly, have limited accuracy and lead to
downtime, PARC’s MOXI technology suite allows for continuous and remote monitoring of system state. It also employs low-cost embedded sensors and model-based algorithms that enable greater than 90% accuracy with negligible false alarm rates and near-zero missed detections.

**SOLUTION**

*Low-cost fiber-optic sensors and model-based system analytics*

VicTrack initiated a phase 1, 2.5-month trial deployment of PARC’s MOXI technology suite, which included low-cost fiber-optic (FO) sensors and model-based system analytics for the continuous monitoring of critical bridge components. MOXI FO sensors were integrated over key structural sections of one of Victoria’s major highway bridges. The MOXI system measured the strain and stress exerted on the bridge from passing vehicle loads and assessed their effects on the bridge. It also estimated resulting degradation over time. Video streams of passing vehicles were captured on camera, providing visibility and comparable validity of the FO sensor output data. The FO strain measurements were also validated against commercially available sensors.

**RESULTS**

*High sensitivity; Estimated >50X return on investment*

Data captured by the MOXI system were demonstrated to correspond well with the vehicle traffic loads. The MOXI FO sensors also outperformed the commercially available sensors, demonstrating a much higher strain sensitivity. A preliminary business case analysis projected the MOXI system to yield a >50X return on investment (ROI) over the nominal lifetime of a bridge.

VicTrack and PARC have now initiated a phase 2 pilot trial that would scale up the MOXI solution to other bridge structures. A full-scale implementation of the MOXI solution has the potential to produce cost-savings by automating bridge inspections, predicting issues and providing recommendations, thereby reducing the need for accessing the structure. It could also provide VicTrack systematic alerts for incidents such as bridge strikes and damaging weather events. VicTrack could also view trends in asset conditions to better plan maintenance and renewals, and, ultimately, further improve bridge designs.