RESEARCH REPORT 617

# Transition from visual condition rating of cracking, shoving and ravelling to automatic data collection

Full report: www.nzta.govt.nz/resources/research/reports/617

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## Is New Zealand ready for automated pavement defect detection?

**New research recommends that road authorities should, where practicable, adopt laser scanning technologies to detect road defects. However, further work is needed before this can occur.**

At present, road authorities use road asset maintenance management (RAMM) survey data to inform their asset management processes. The RAMM survey method was developed in the 1980s to provide data to inform treatment selection algorithms. Over time, the data has come to be used for more sophisticated asset management processes, including deterioration modelling and advanced trend modelling, raising doubts about its suitability for this purpose. Both field inspectors and researchers have highlighted shortcomings in the quality and repeatability of the manually recorded RAMM data.

Overseas, automated defect data collection systems have been used successfully for over 20 years. Although early systems were well-suited to asphalt and concrete motorways, they proved less reliable when it came to providing robust data about chipseal surfaces; the main type of road surfacing used in New Zealand. However, advancements in technology have largely overcome these limitations. Automated defect data collection systems now rely solely on laser scanning, returning comprehensive 3D images of road profiles.

The research focused on the laser crack measurement system, as the most widely used parameter for maintenance planning in New Zealand. Earlier research had shown laser scanning to be capable of measuring cracks in chipseal pavements with satisfactory robustness. The technology is also currently available in New Zealand, with three operators capable of conducting laser crack measurement system surveys.

Adopting laser scanning technologies offers several benefits for the transport sector, and researchers from the University of Auckland and Opus enumerate several in this report. In contrast to manual surveys, automated detection and data collection systems:

- enable surveys of the entire road (as opposed to the 20 percent of the treatment length sample size covered by the RAMM surveys)
- capture all aspects of the surface condition data simultaneously
- take measurements at high speed (60 to 80 km/h), with clear benefits for safety and traffic management on the roads being surveyed
- enable repeatable and reproducible measurements of the same stretches of road over time.

Despite these benefits, there were areas of the technologies' suitability for New Zealand conditions that needed examining further.

Researcher, Theuns Henning, from the University of Auckland explains, 'Before a wide-spread adoption of the scanning technology is possible, we had to prove the accuracy of the measurements and determine the impact of new data items in the asset management processes. This research addressed both these items and has concluded the technology is ready for adoption in New Zealand.'

### A work in progress

During the project, the research focus shifted slightly to look at how ready the technology in its current state is for wider adoption into New Zealand. Although several international projects had confirmed the accuracy of the measurements collected by the laser scanner, the algorithms then used to interpret the data and identify defects were returning less accurate results.

The major shortfall was that the laser technology tended to identify a number of 'false positives' from the data: identifying defects in the road surface where none existed. Shoving, in particular, proved difficult to identify accurately. (Shoving is the permanent deflection and bulging of the road surface, or horizontal displacement of surfacing materials, usually caused by braking, turning and accelerating vehicles.)

A more detailed investigation into shoving, during the research, identified a number of road features that appear to trigger a finding of shoving, according to the defined algorithm used by the automated technology, where in reality a completely different road feature was being measured. There were also a number of instances where the rating simply 'missed the shove' as it was not very apparent for a number of reasons.

The research team developed and introduced a new algorithm for detecting shoving. They also recommended that, although automated scanning surveys were now sufficiently accurate for adoption in New Zealand, they should be supplemented, at least initially, by appropriate manual quality assurance processes. In their report, they caution:

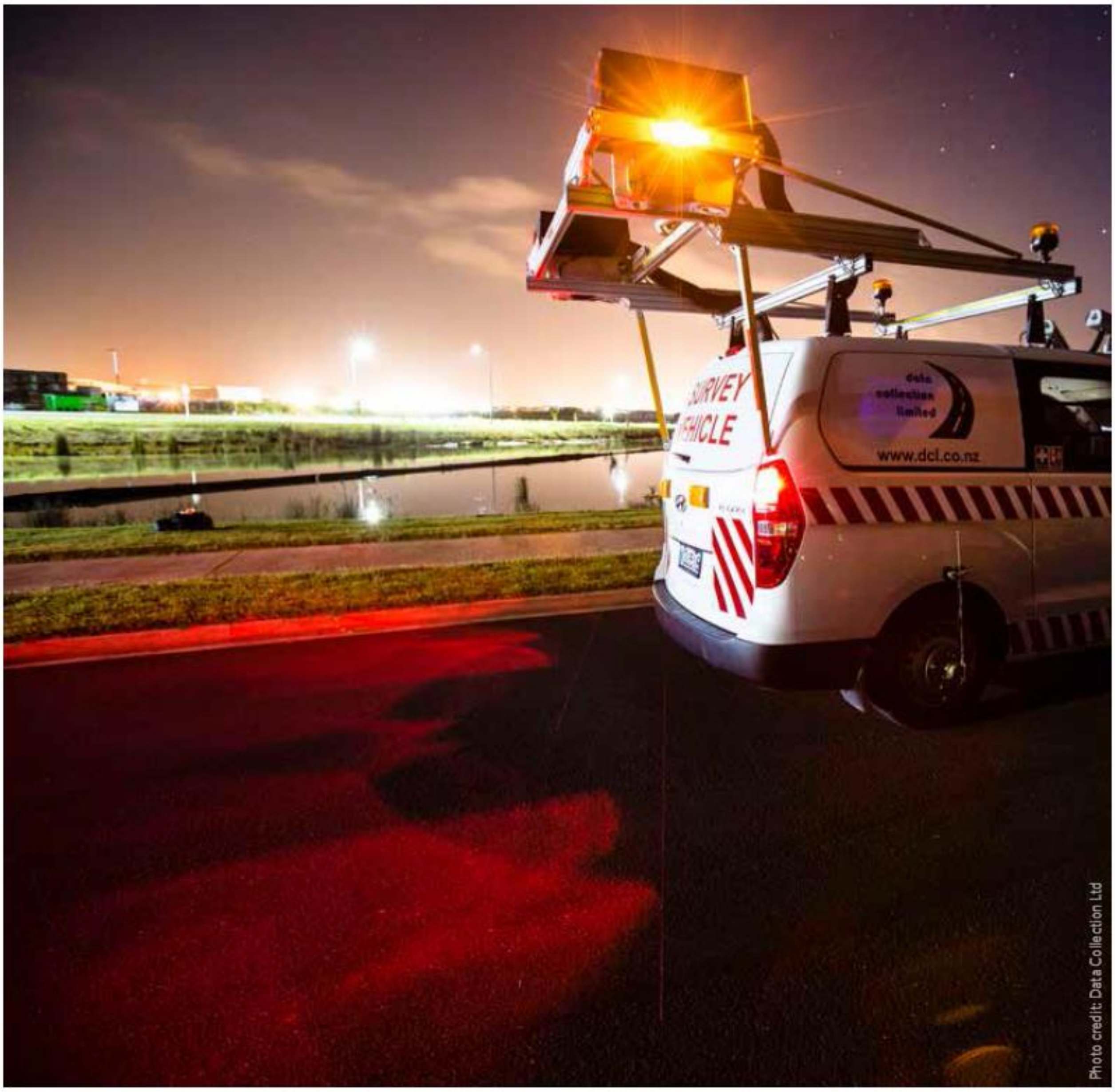
‘The laser technology, despite its accuracy, cannot be applied as a 100 percent automated process. The computer algorithms that analyse the data still need significant “learning” that can only be achieved if the technology is supplemented by manual validation of the outcome. Someone needs to work through the digital images to find erroneous identifications and feed this knowledge back to the algorithms. Once this is completed, business as normal survey contracts should include calibration procedures, validation and quality assurance protocols.’

Despite this need for further refinement, the researchers make a clear recommendation that all road agencies should, where practicable, adopt laser scanning for detecting road defects.

‘This recommendation is made on the basis of the significant benefits that can be realised from more accurate assessment, and more repeatable and greater coverage of the road network,’ they say.

The report sets out an implementation plan, detailing other areas where laser technologies, and the data and algorithms underpinning them, will require strengthening if and when they are adopted here. These include:

- a new definition of ‘defect’ – the current definition of defect needs to be updated and universally accepted by the industry, to maximise the potential benefits to be gained from laser scanning
- additional calibration of the algorithm for shoving data, as detailed above, followed by measures to make it freely and publicly available
- the inclusion of ravelling measurements in the surveys – ravelling is an important surface defect in New Zealand, and the ravelling identification algorithm needs to be calibrated to the different chipseals used here
- new data standards – industry consensus is needed in new data standards, for incorporation in best practice guidelines
- updated procurement processes – agreements with survey suppliers should specify the need for quality assurance validation and calibration.



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