Update on ARRB's TSD program

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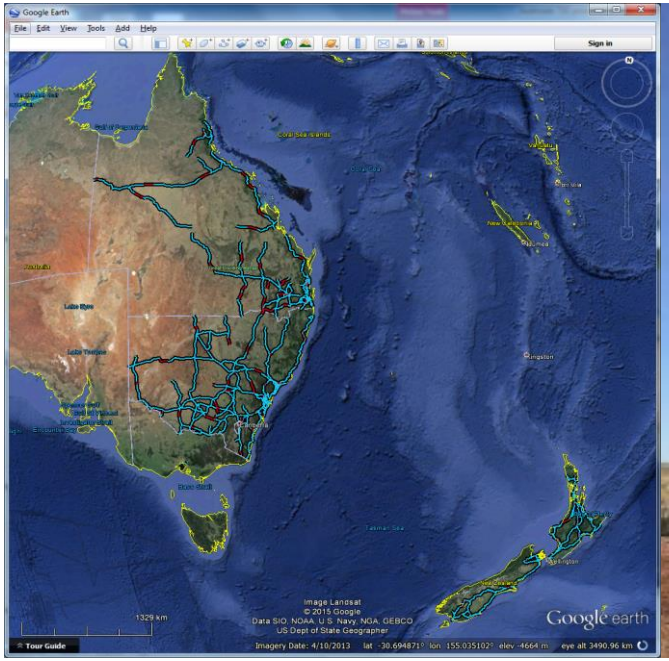
Trusted advisor to road agencies

TSD8

- Surveyed: 120,000 km (250,000 km)
- 12 million deflection bowls reported



Solved some problems

TSD9 (USA)

- New air cushioned independent servo system
- New generator and power system design
- New AC system design

TSD9 (USA)

Measuring your road network
Traffic Speed Deflectometer
GREENWOOD ENGINEERING
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TSD9

TSD9 (USA) Projects

- US Army ERDC Research testing – Mississippi
- NCAT Research testing – Alabama
- LTRC Research testing - Louisiana
- US20, I15, SH27 Geotechnical Project - Idaho
- I66 Project - Virginia
- Tennessee Trial
- Maryland Trial
- Utah Trial

New test method published

HiSPEQ7 SPECIFICATION FOR TRAFFIC SPEED PAVEMENT DEFLECTION MEASUREMENT

1 Measurement Data

1.1 Measurement requirements

1.1.1 Measurements should be conducted along the line of the nearside wheel path. The wheel path is defined to be xx m from the centreline of the lane.

1.1.2 Measurements should be conducted in Lane 1, in accordance with HISPEQ1: SPECIFICATION FOR PAVEMENT CONDITION MEASUREMENT.

1.1.3 Measurements should be conducted using at least 7 Doppler lasers.

1.1.4 Each Doppler sensor should deliver at least 800 samples per second.

1.1.5 Raw data should be reported for every x m.

1.1.6 Processed data should be reported for every x m.

1.1.7 Data should be delivered electronically in a Client specified format (at least comma separated or similar). It is recommended that TSD deflection data are delivered in a data format compatible with common FWD backcalculation programs.

1.1.8 Measurements should be conducted with an axle load of at least 8 tonnes on the load axle.

1.1.9 The longitudinal profile should be determined in the same line as the Doppler sensors

1.1.10 Determination of longitudinal profile for pavement assessment purposes should take place according to HISPEQ4: SPECIFICATION FOR LONGITUDINAL EVENNESS MEASUREMENT.

1.1.11 For other purposes than covered by 1.1.10, the longitudinal profile should be:
- Measured at a minimum spacing of 25mm and reported at a spacing of 100mm.
- Measured in mm and reported to 1 decimal place.

And should:
- Contain wavelengths between 0 and 100m.
- The wavelength response of the equipment should be flat in the range 0.5 to 50m.

1.1.12 The device should also be instrumented with sensors to continuously monitor
- Driving speed
- Static and dynamic load on ballast and load axle
- Tyre pressure and temperature
- Air and road surface temperature

1.1.13 In connection with each measurement, the following static information should be registered:
- Position of Doppler sensors
- Tyre and wheel configuration
- Tyre condition

AUSTROADS TEST METHOD AG:AM/T17

Austroads

Pavement data collection with a traffic speed deflectometer

1. Scope

This test method defines the procedure for measuring the deflection velocity of road pavements using a traffic speed deflectometer (TSD).

The TSD evaluates the structural capacity of a pavement by measuring the deflection velocity of a pavement under a load applied on a single axle through dual rear wheels. The magnitude of the load is typically 10 tonne but may vary according to need. These values are used to model the deflection bowl and report maximum deflection, curvature and other structural condition indexes. Testing is carried out continuously and reported at a 10 m interval with measurements being made in the outer wheelpath at speeds up to 85 km/h or greater.

This test method does not address all occupational health and safety issues associated with its use. It is the responsibility of the user to operate in accordance with appropriate legislation.

The values measured represent the deflection velocities of a pavement as obtained with the equipment and procedures stated herein. They do not necessarily agree or correlate directly with those obtained by other pavement deflection measuring methods.

This test method does not address all occupational health and safety issues associated with its use. It is the responsibility of the user to operate in accordance with appropriate legislation.

Annex 1 of this Test Method outlines, in general terms only, some of the hazards and precautions relevant to the use of lasers in road condition measurement. This information has been included to raise awareness of issues and does not override safety warnings/procedures specified by equipment suppliers or other relevant work practices or standards. Refer to equipment documentation and AS 2211:2004 (Standards Australia 2004) for further information.

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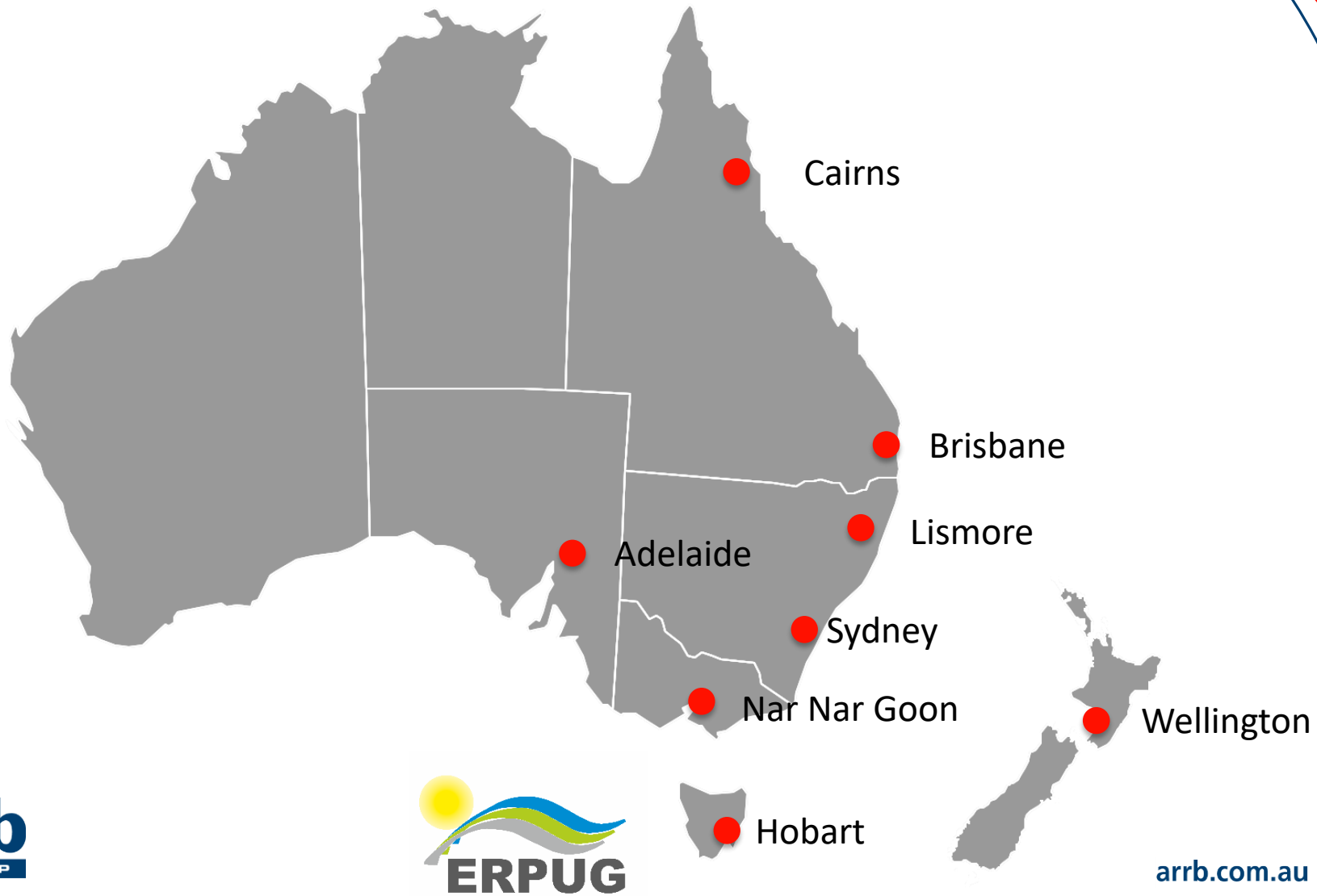
http://www.austroads.com.au/images/assets_test_methods/AGAM-T017-16_Pavement_Data_Collection_with_TSD.pdf

Validation sites & testing programs



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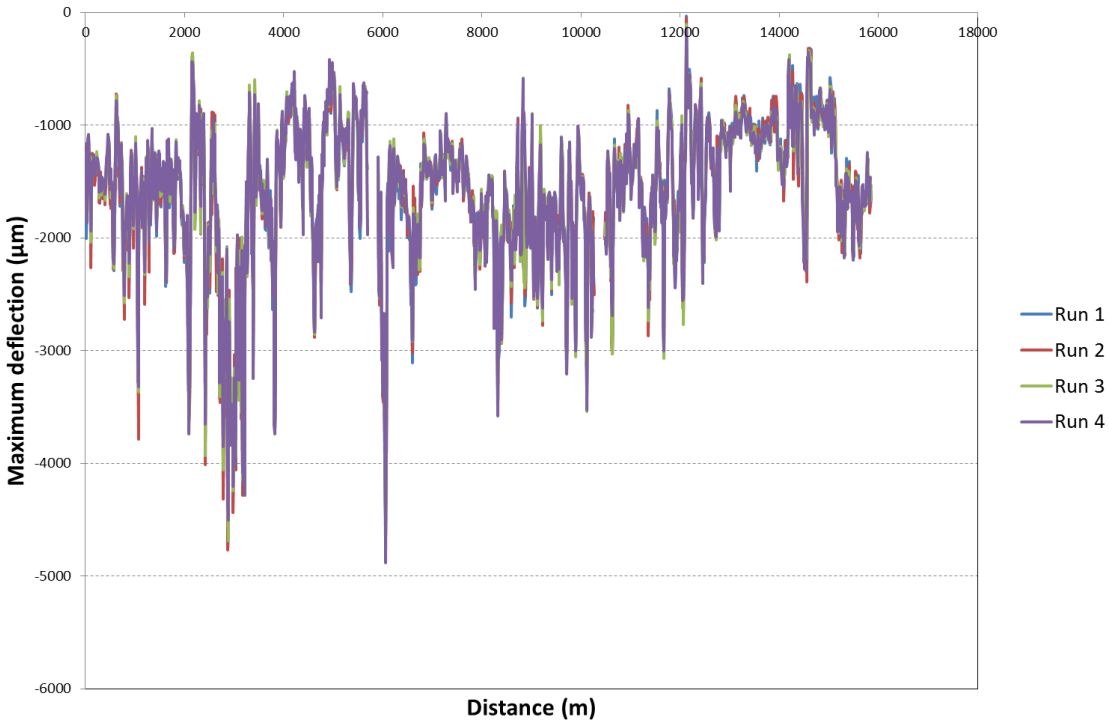
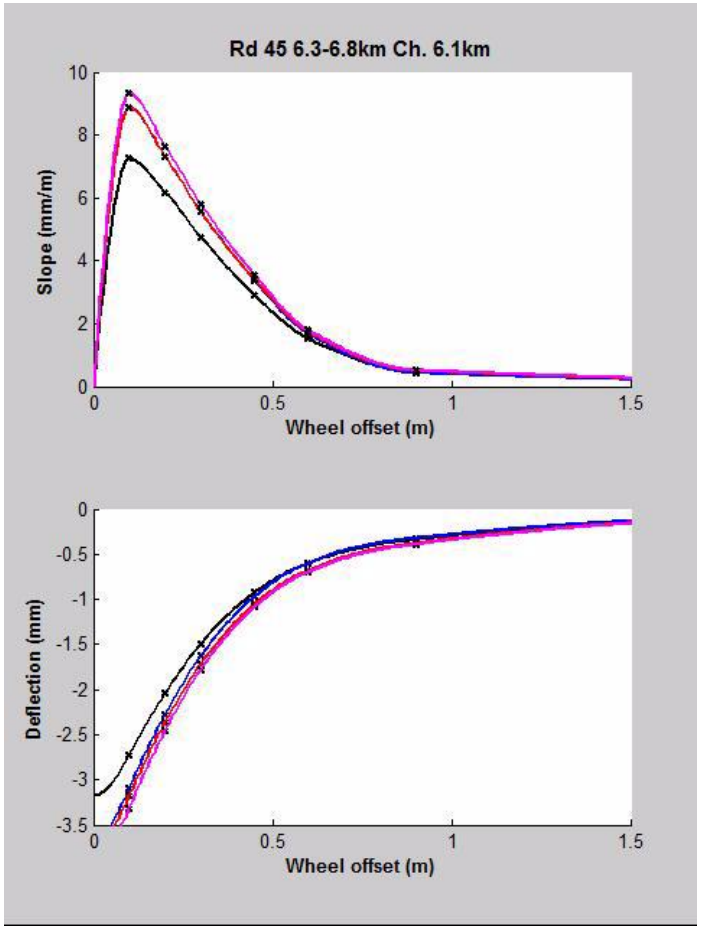
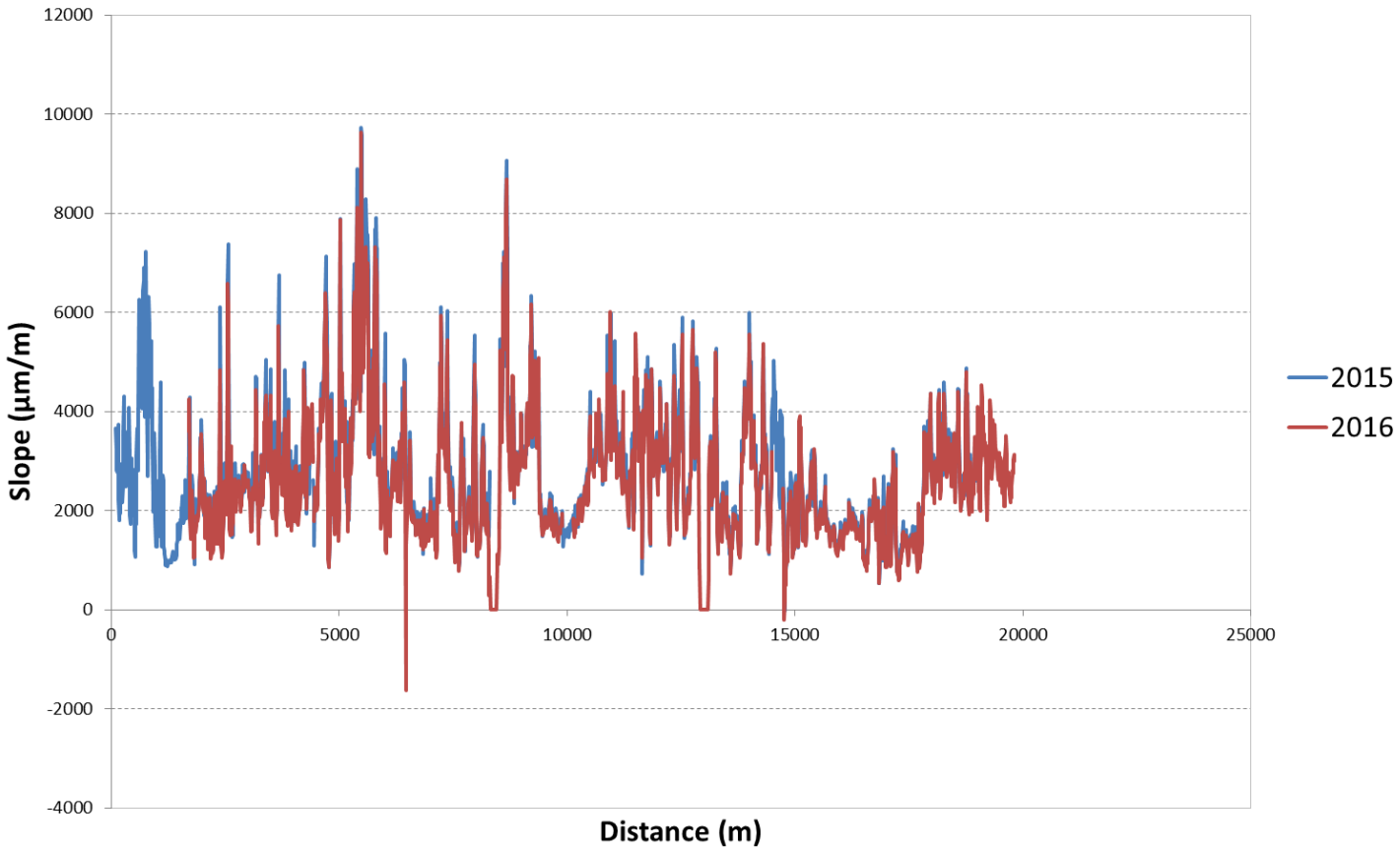
Repeatability

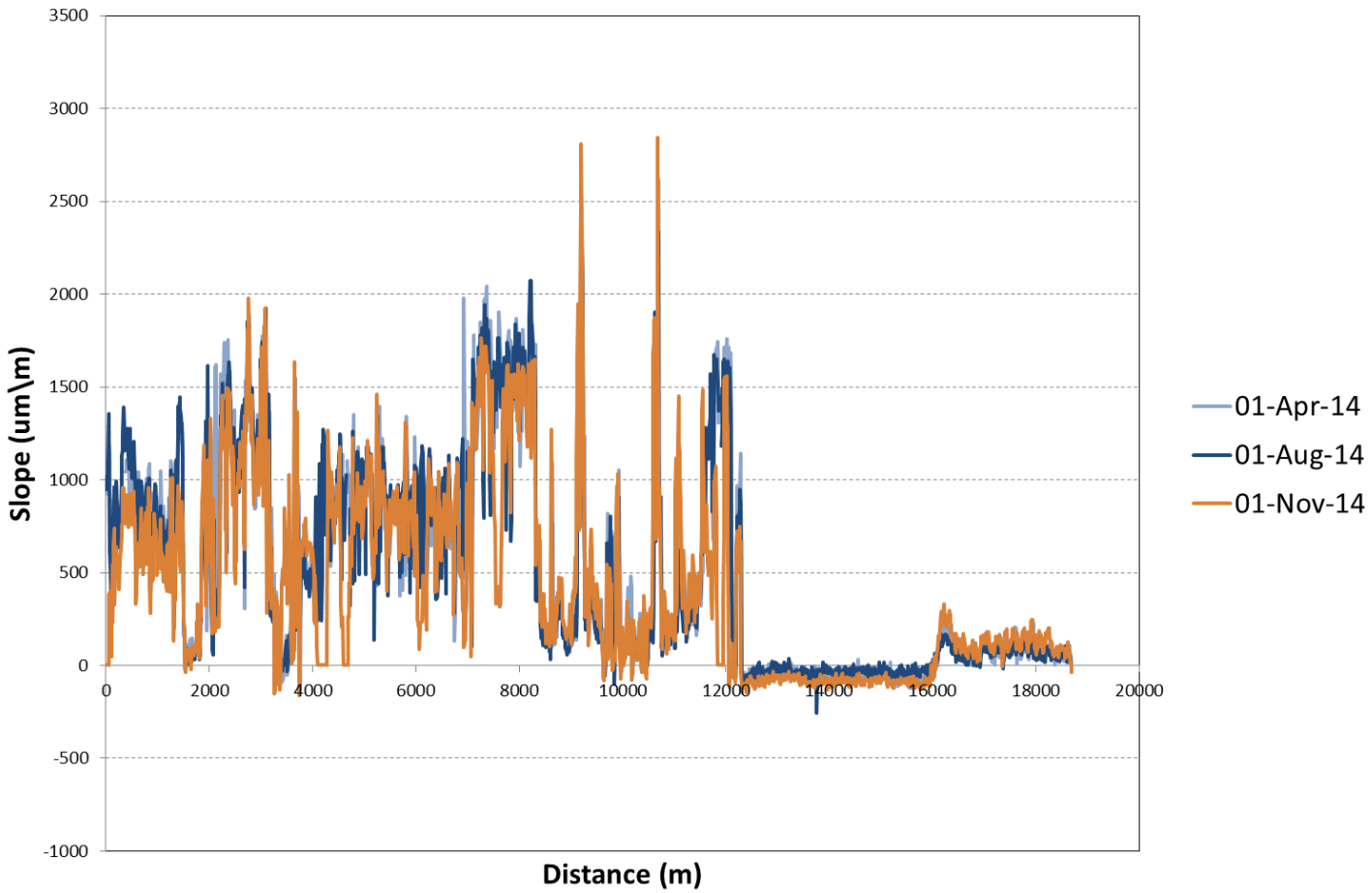




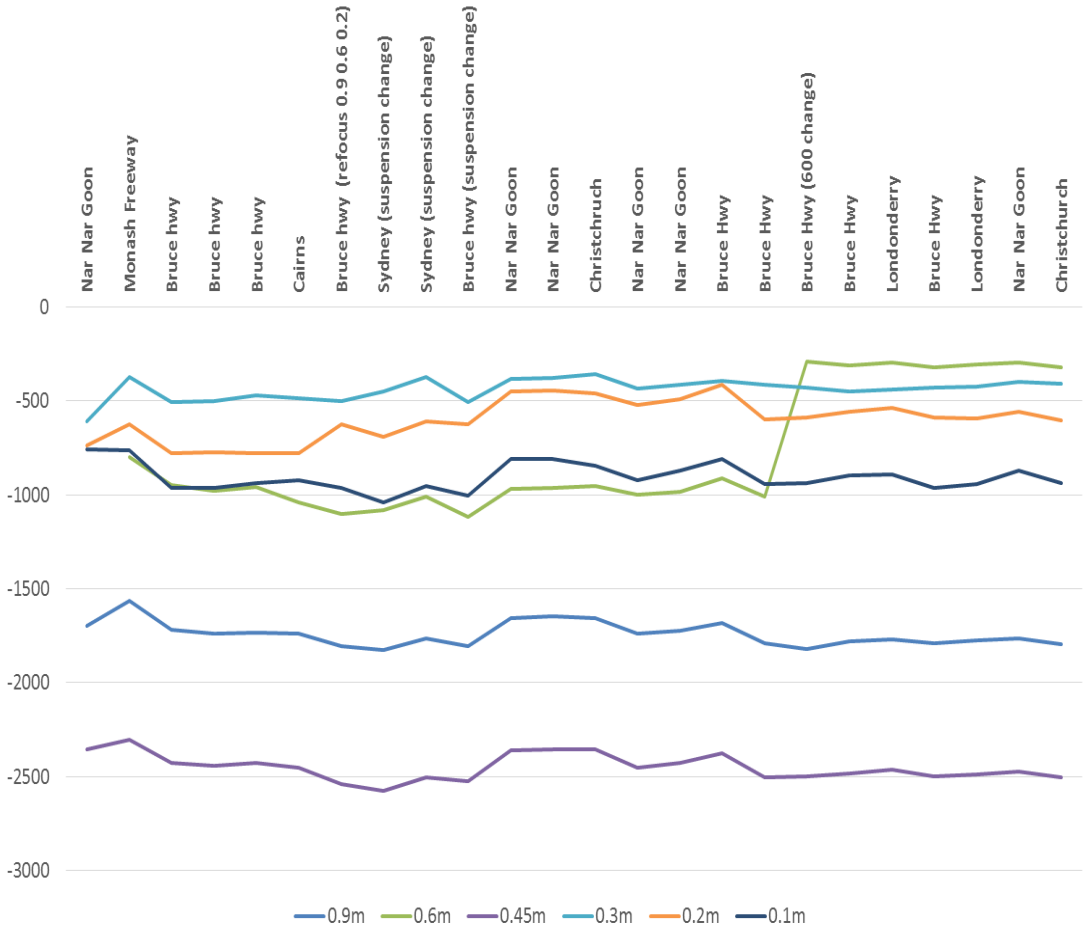
Long term repeatability



Stiffer pavement



Calibration



Combining functional & structural data

ERPUG

Combining functional & structural data

Pavement response under load

- **Velocity of deflecting road surface** → via Doppler lasers positioned ahead of loaded rear wheel

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Road surface characteristics

- Wheel-path roughness & texture → via **point lasers**
- Rutting & cracking → **Automatic Crack Detection (ACD)**
- **Asset cameras**
- Positioning: **Gipsi-Trac inertial & RTK-GPS**

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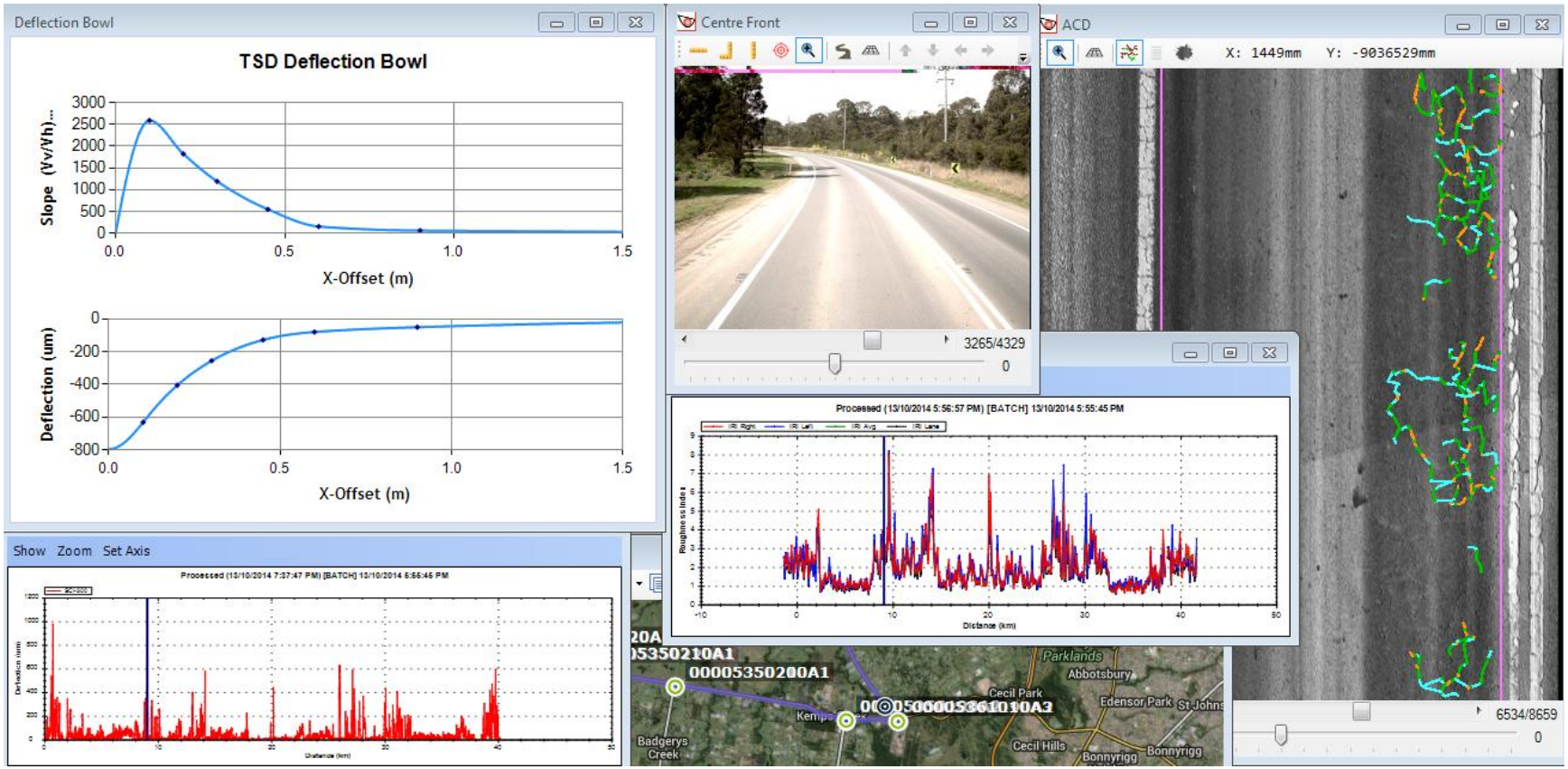
Efficient – multiple data sets is single pass

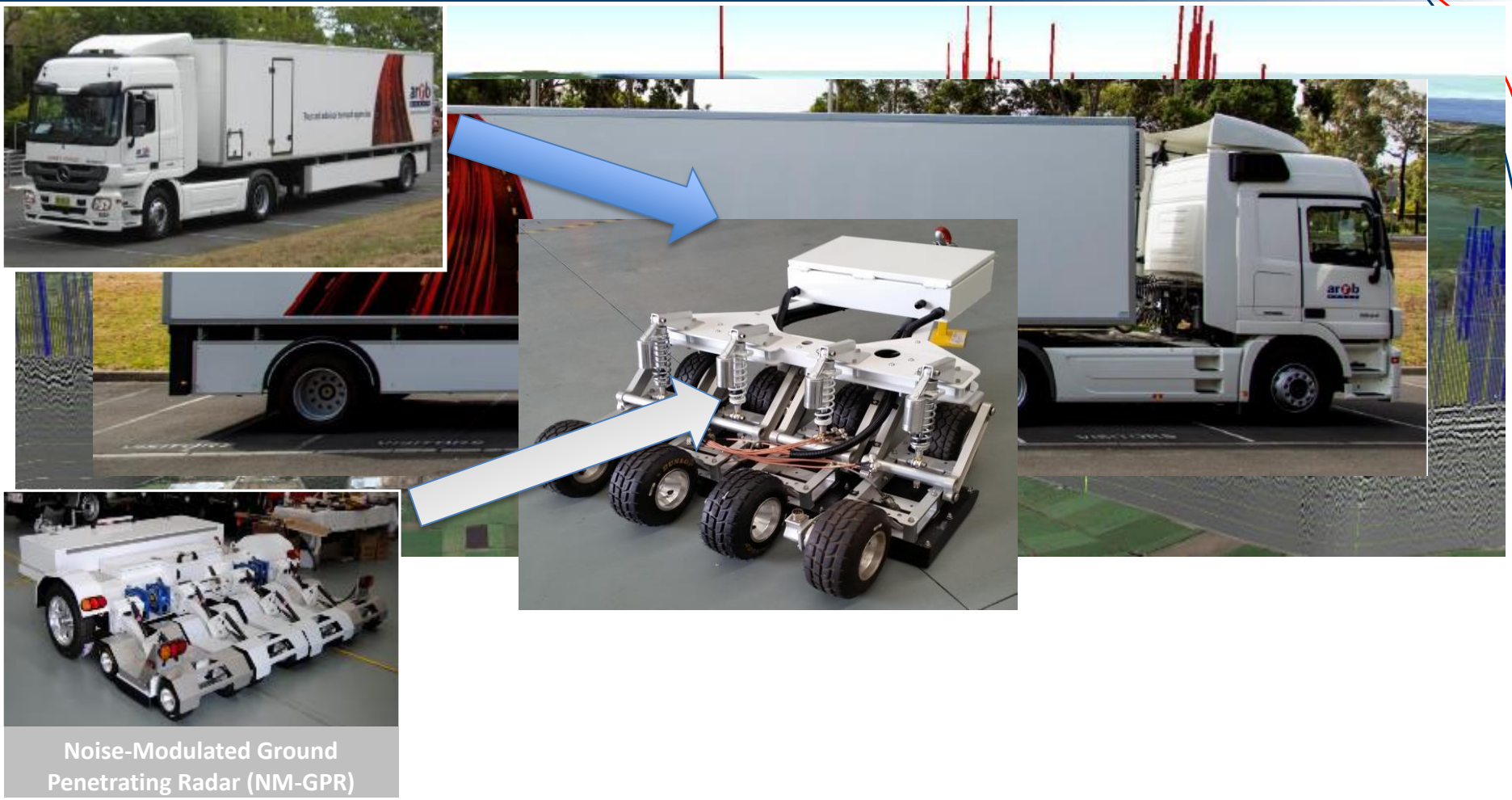


What condition is my network in?

- Automated surveys
- Reliable
- Repeatable
- Objective

- Roughness
- Rutting
- Texture
- Cracking etc.

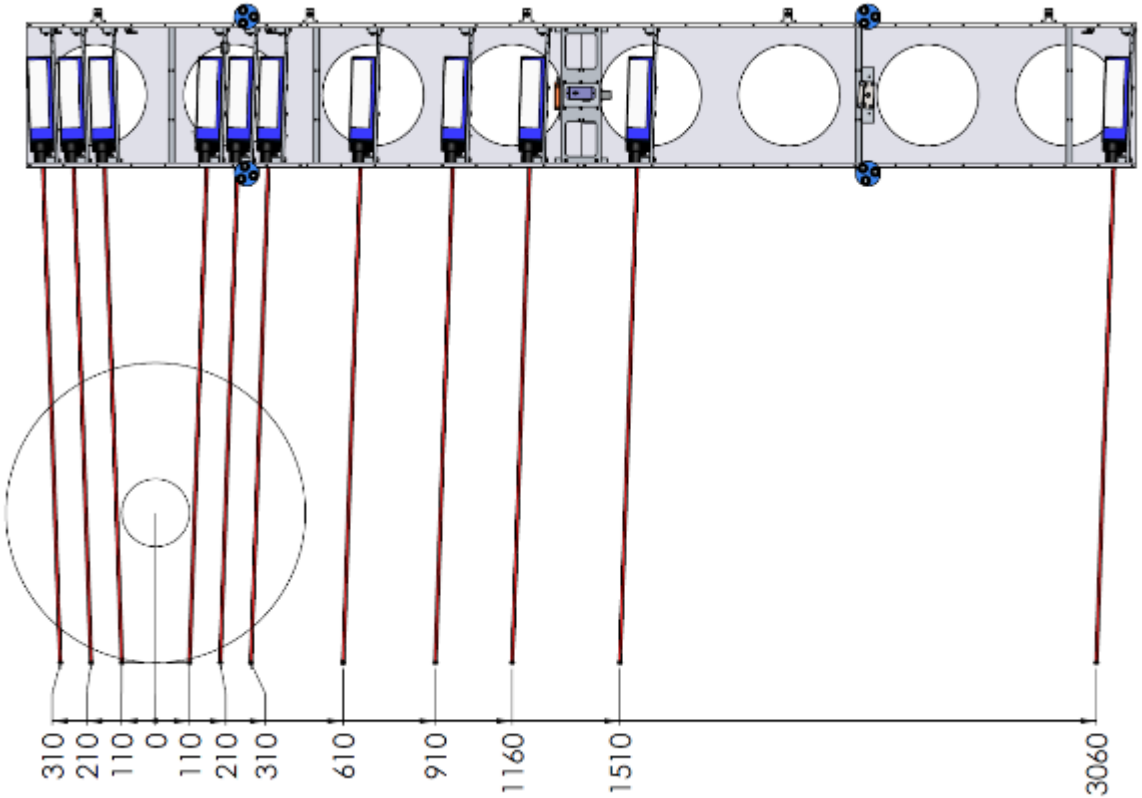
Future work - TSD GPR



Noise-Modulated Ground Penetrating Radar (NM-GPR)

Future work – TSD outputs

- Behind the load measurements
- Slab faulting/Joint efficiency



Some research

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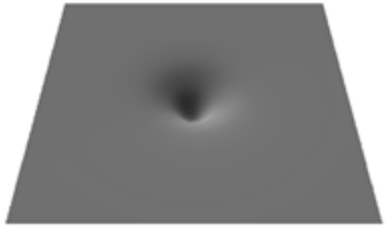
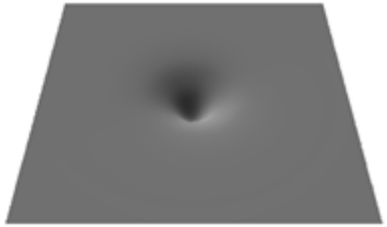
Comparing other deflection measuring devices



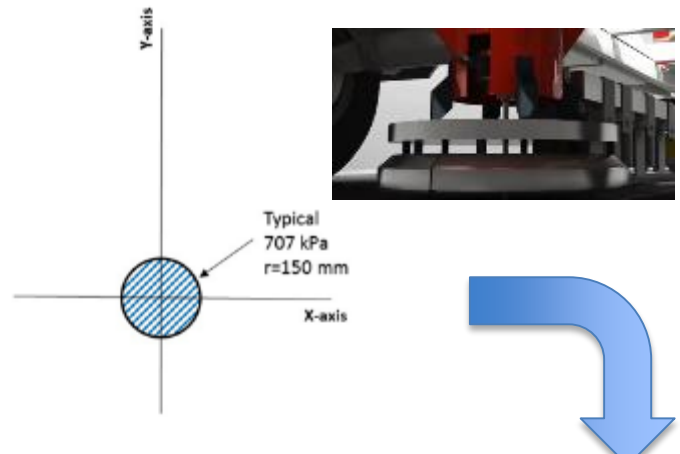


Deflection Response

Correlation of TSD and FWD Deflections for a range of pavements:

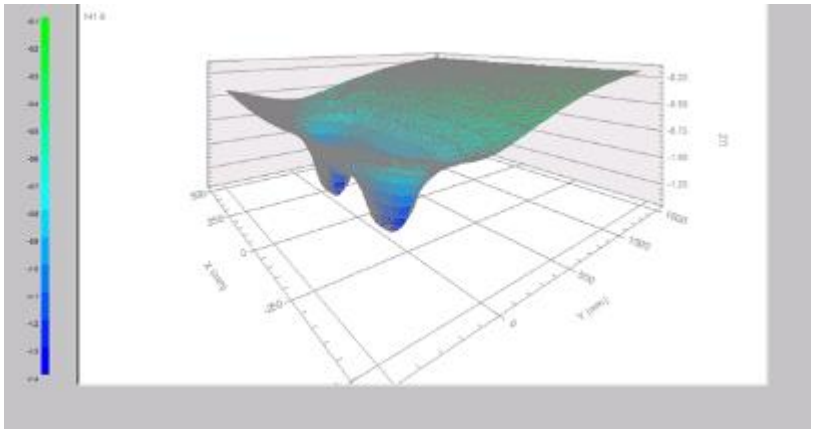
- Granular pavements
- Stabilised pavement
- Full-depth asphalt pavements
- Composite pavements

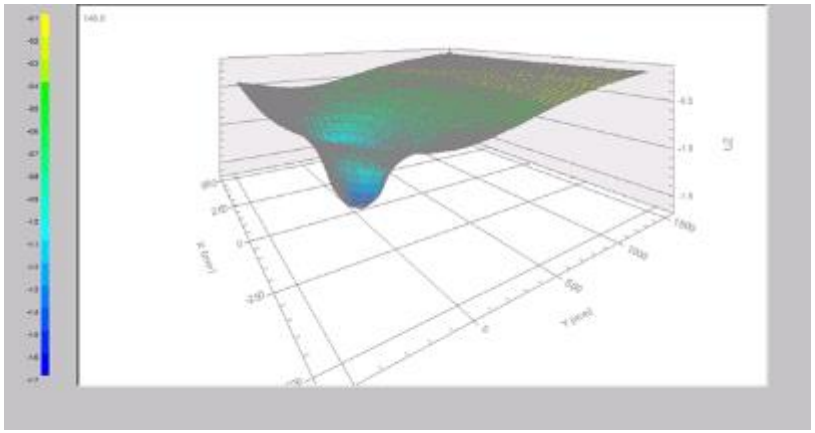
Loading profile



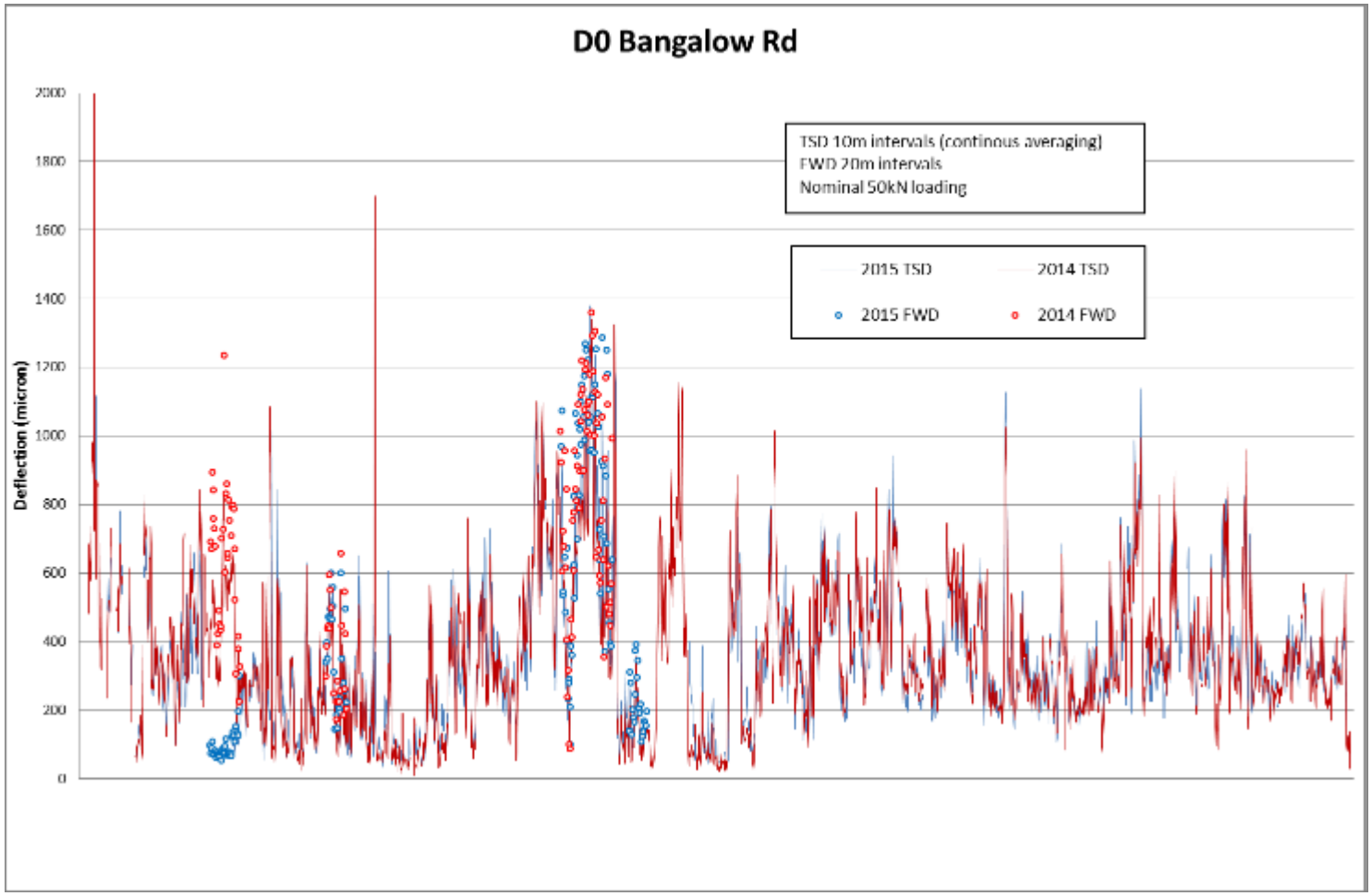
(a) Traffic speed deflectometer (half-dual axle)

(b) Falling weight deflectometer





TSD vs. FWD trials



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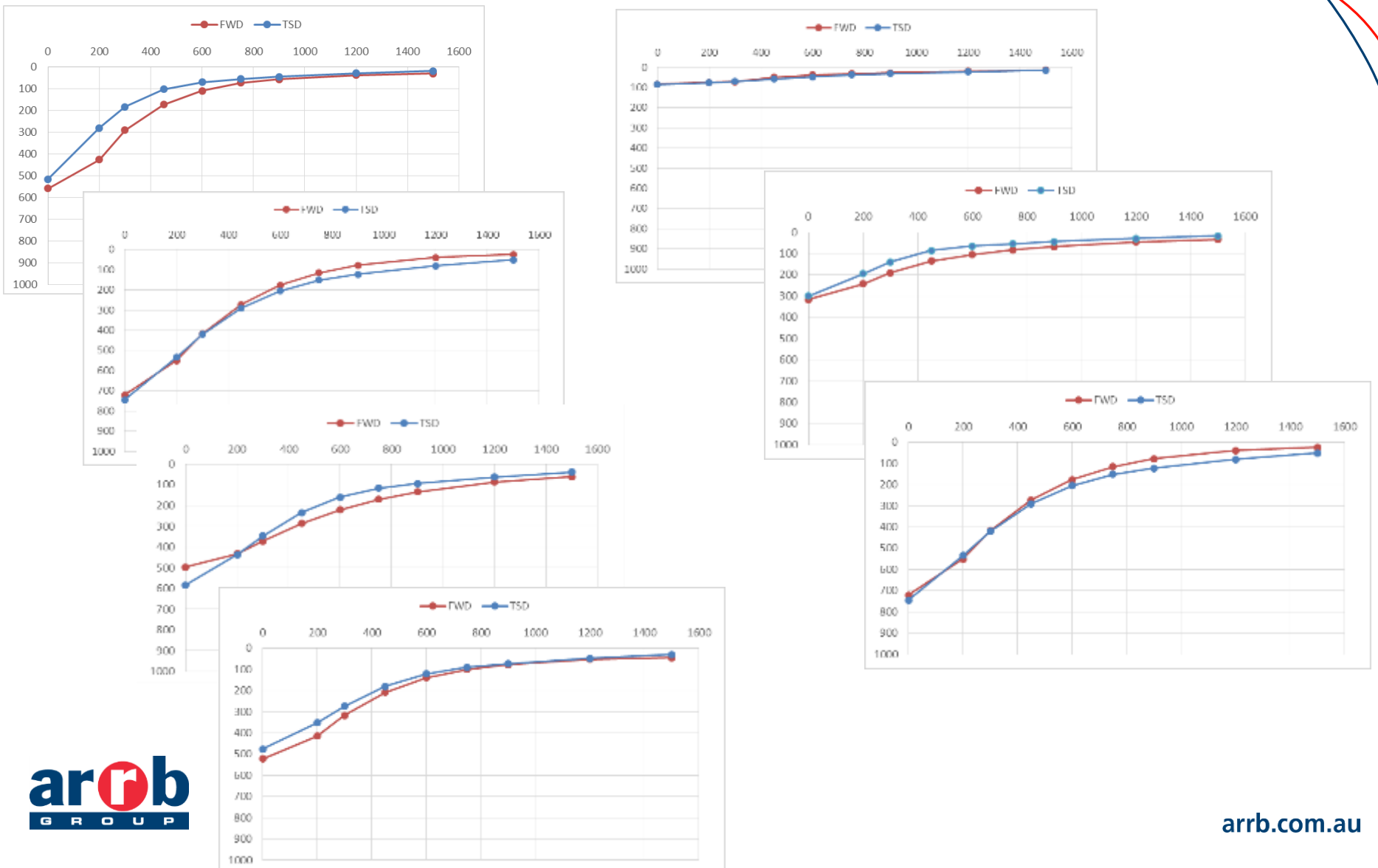

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It’s coming together piece by piece