



Sanral Field testing: R104 Trial Sections RPF 6 November 2013

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University of Pretoria



- R104 background
- R104 sensors and typical data

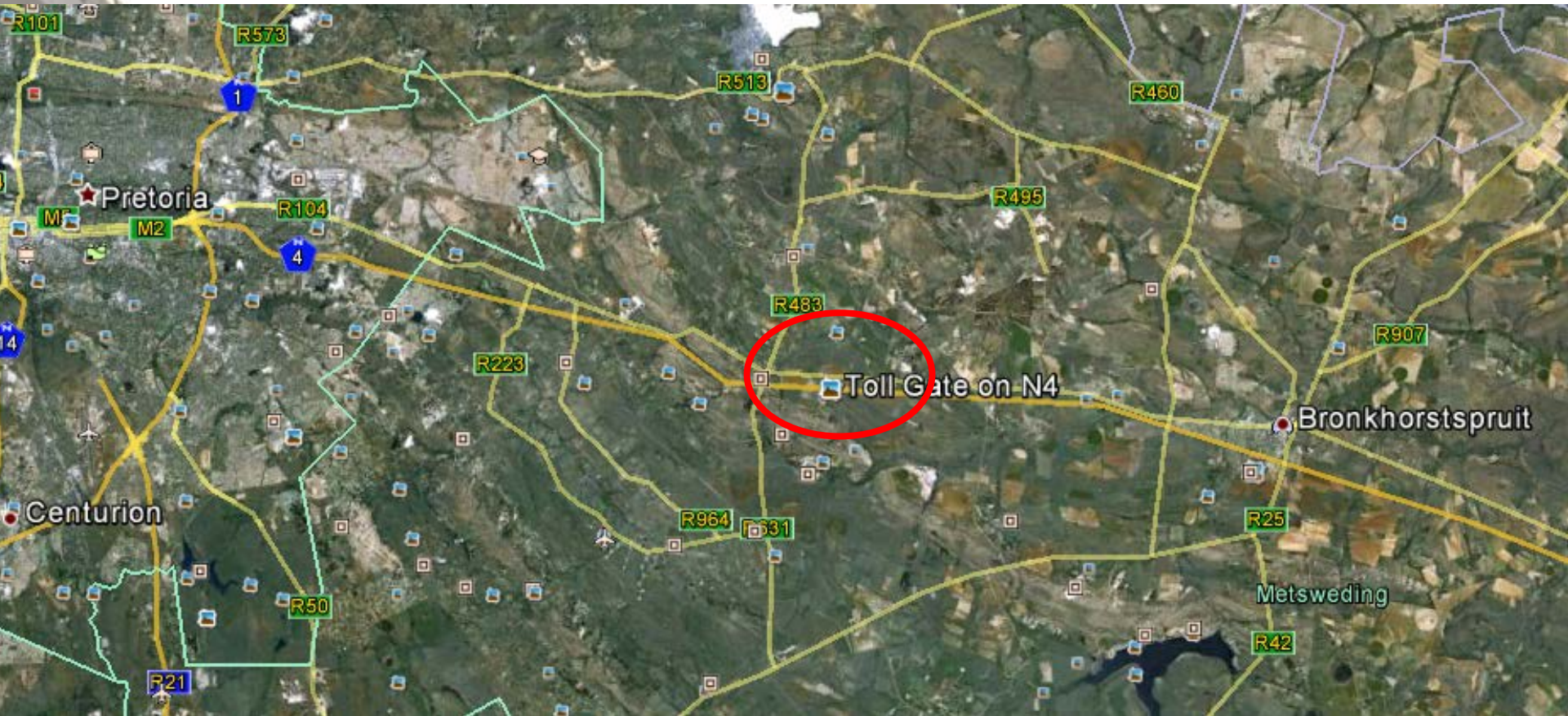
R104 background

- Objective:
 - Benchmark of pavement material parameters (σ , ϵ , δ)
 - Not calibration
- Place in Sanral project
 - After materials model developments
- Expected outcome
 - Verification of parameters predicted using materials models

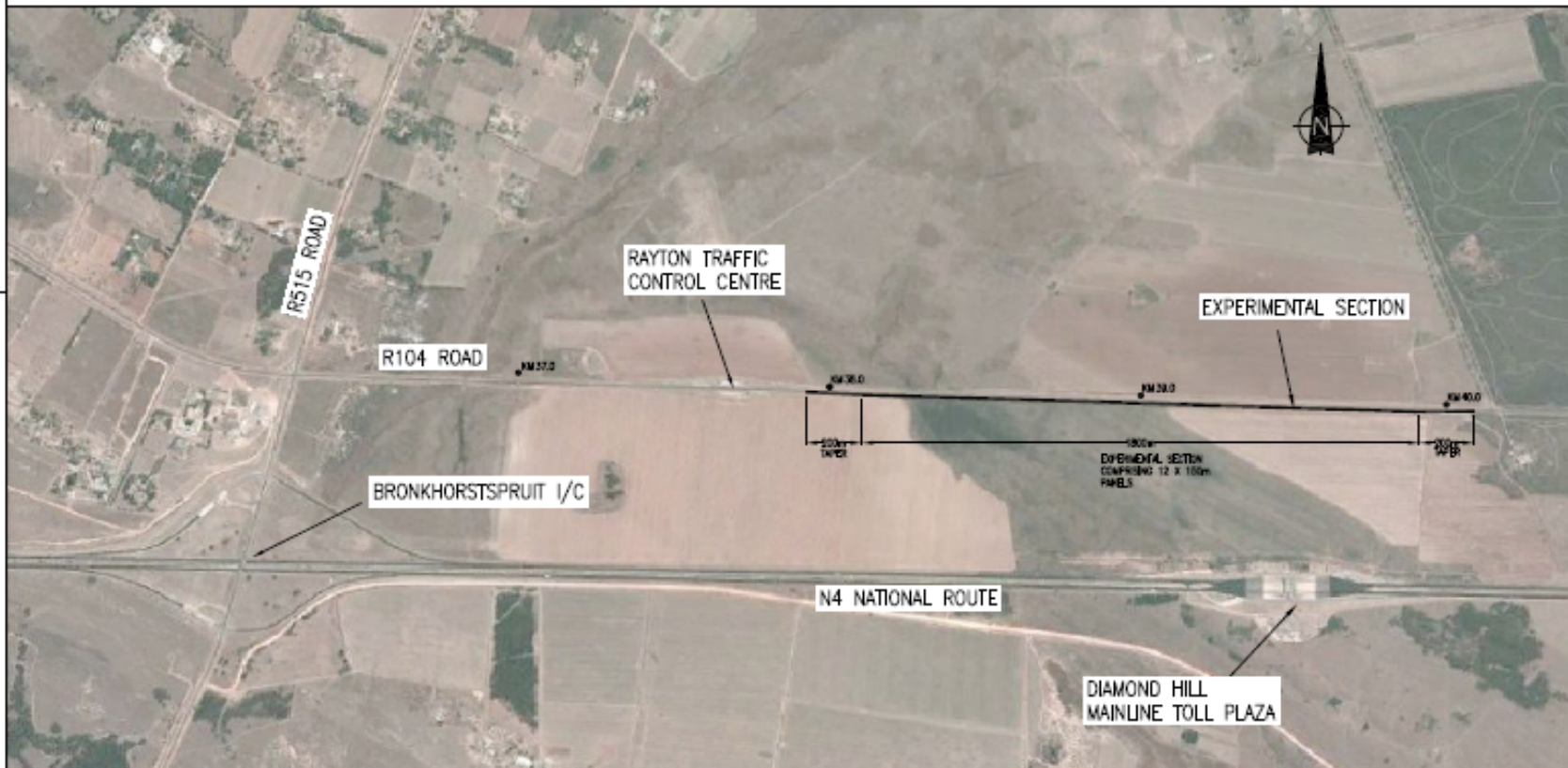
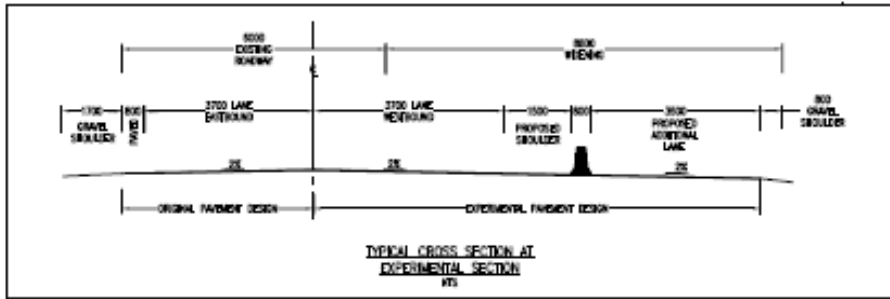




- Site layout
- Sensor selection
- Sensor data
- Current status
- Planned measurements

Location



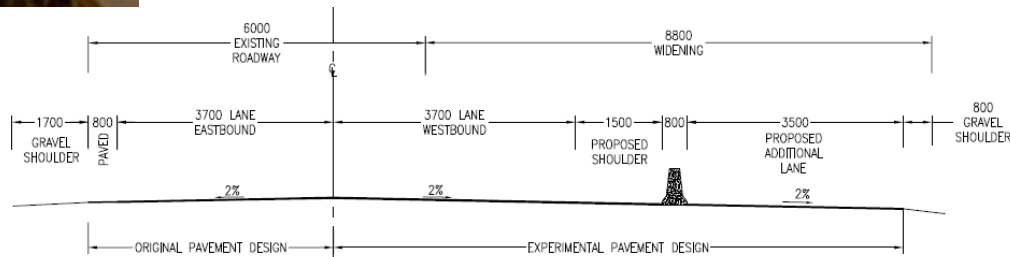
Location



Project Name: National Toll Plaza 2 Bank presentation		 SSI A SAN COMPANY Consulting, Project Management	P.O. Box 9900 Rosebank JHB 2195 Tel: 011-367 8800 Fax: 011-367 8880	<table border="1"> <tr><td>DATE</td><td>15/06/2011</td></tr> <tr><td>TIME</td><td>14:00</td></tr> <tr><td>BY</td><td>SSS</td></tr> <tr><td>FOR</td><td>SSS</td></tr> <tr><td>BY</td><td>SSS</td></tr> <tr><td>FOR</td><td>SSS</td></tr> </table>	DATE	15/06/2011	TIME	14:00	BY	SSS	FOR	SSS	BY	SSS	FOR	SSS	<table border="1"> <tr><td>DATE</td><td>15/06/2011</td></tr> <tr><td>TIME</td><td>14:00</td></tr> <tr><td>BY</td><td>SSS</td></tr> <tr><td>FOR</td><td>SSS</td></tr> <tr><td>BY</td><td>SSS</td></tr> <tr><td>FOR</td><td>SSS</td></tr> </table>	DATE	15/06/2011	TIME	14:00	BY	SSS	FOR	SSS	BY	SSS	FOR	SSS	 ROADS AGENCY P.O. Box 100 Sandown JHB 2013 Tel: 011-367 8800 Fax: 011-367 8880	PROJECT NUMBER: SA/10/010/01/1 PROJECT TITLE: NATIONAL TOLL PLAZA 2 DRAWING NUMBER: 101/101/01/1/1 DRAWING TITLE: PROPOSED LAYOUT OF HIGH EXPANDED SECTION SCALE: 1:1000 SHEET: 1 OF 1
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Location

- R104 Bronkhorstspuit
- 10 pavement types (21 sections)
- Between 16 m and 100 m long
- 2 lanes
 - 1 instrumented (outer)
 - 1 duplicate – normal traffic



TYPICAL CROSS SECTION AT
EXPERIMENTAL SECTION
NTS

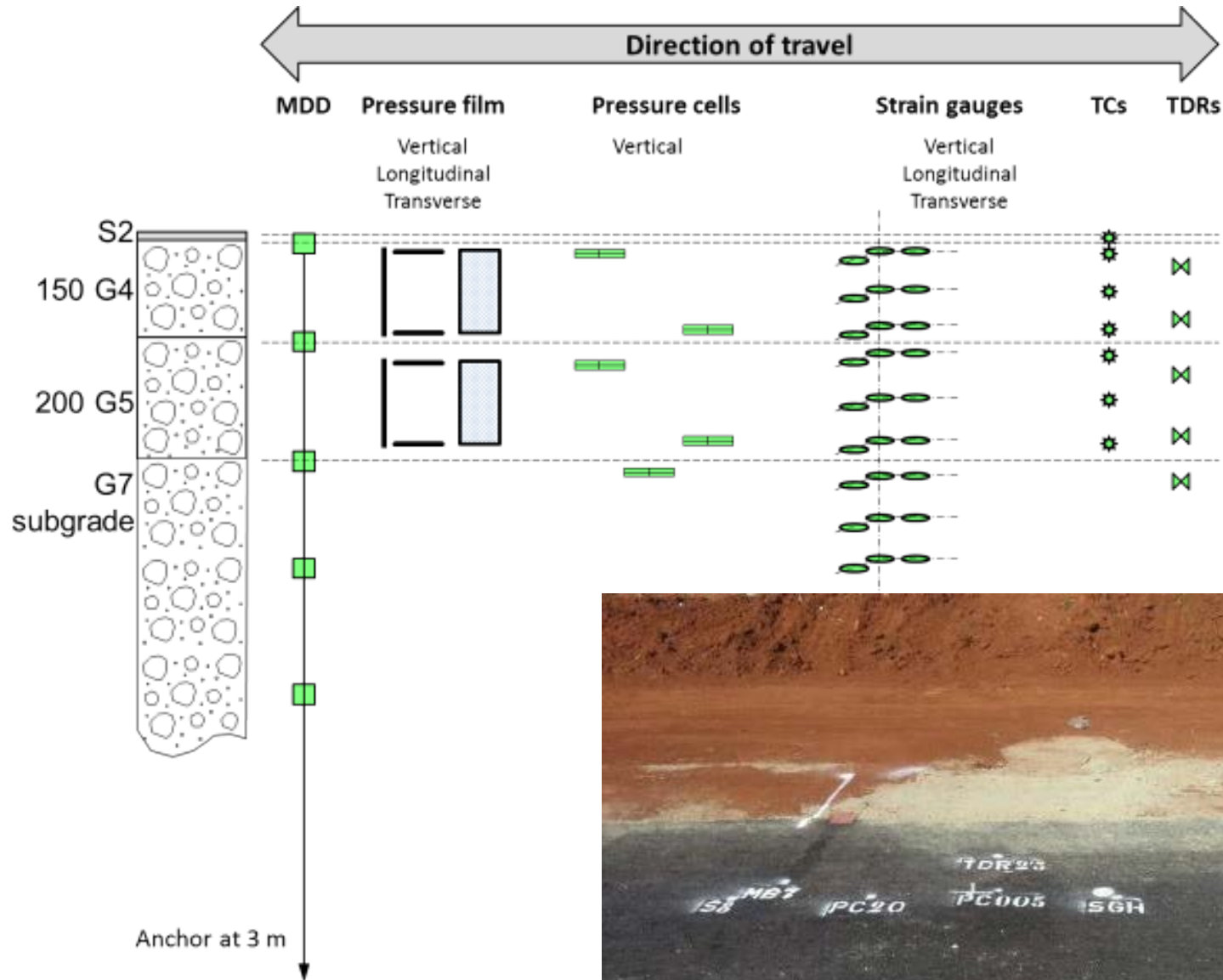
Test sections

- Natural gravel G4 base
- Inverted G1 base
- Foam Treated Base (FTB)
- Emulsion Treated Base (ETB)
- Cement Treated Base (CTB)
- High Modulus Asphalt base (HiMA)
- Bitumen Treated Base (BTB)
- Jointed Concrete (JCP)
- Ultra-Thin Continuously Reinforced Concrete Pavement (UTCRCRP)
- Block paving

Test sections

- At least 1.32 MESA
- Layout allows for
80 km/h truck speeds over sections
- Subgrade and subbase
Similar subgrade for all sections
Subbase
 - C4 – all except below
 - G5 / G7 – G4, FTB, ETB, CTB, JC1

Typical Test sections - Granular



Instrument selection

- 41 Pressure cells
- 42 Strain gauges
- 47 Pressure films
- 10 Accelerometers
- 14 Moisture sensors
- 80 Temperature sensors
- 40 Strain gauges on steel
- 8 MDDs
- 121 ϵ mu coils
- 36 JDMDs
- 1 Weather station





Construction tests

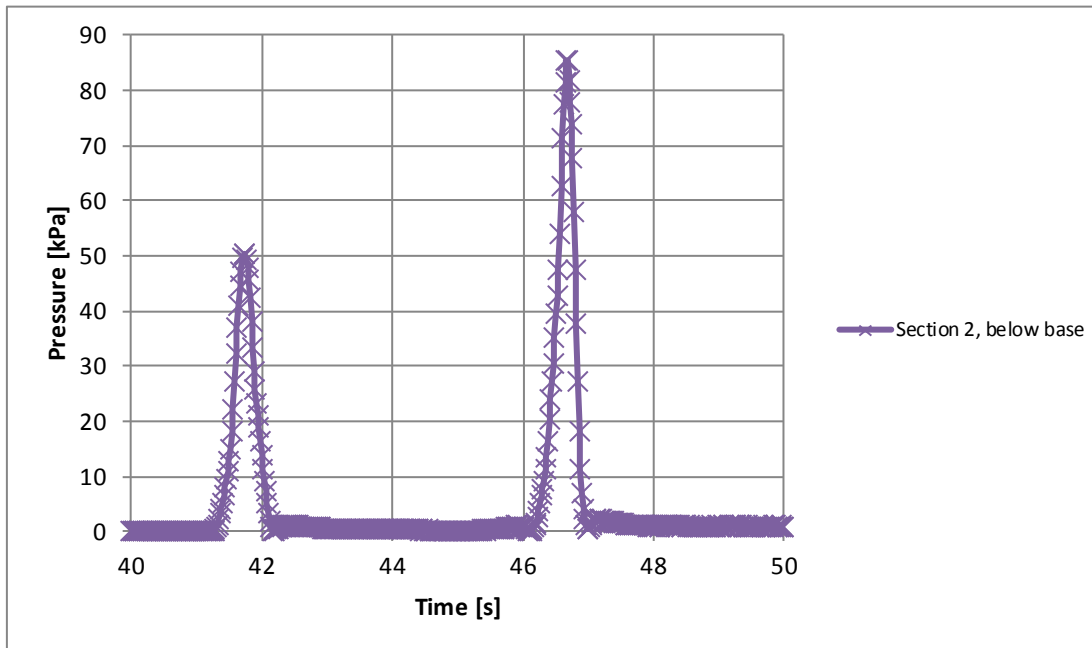
- Standard laboratory materials tests per material and layer
- Standard site tests per layer
- FWD, LFWD, DCP, In situ density, MC

Vertical pressure

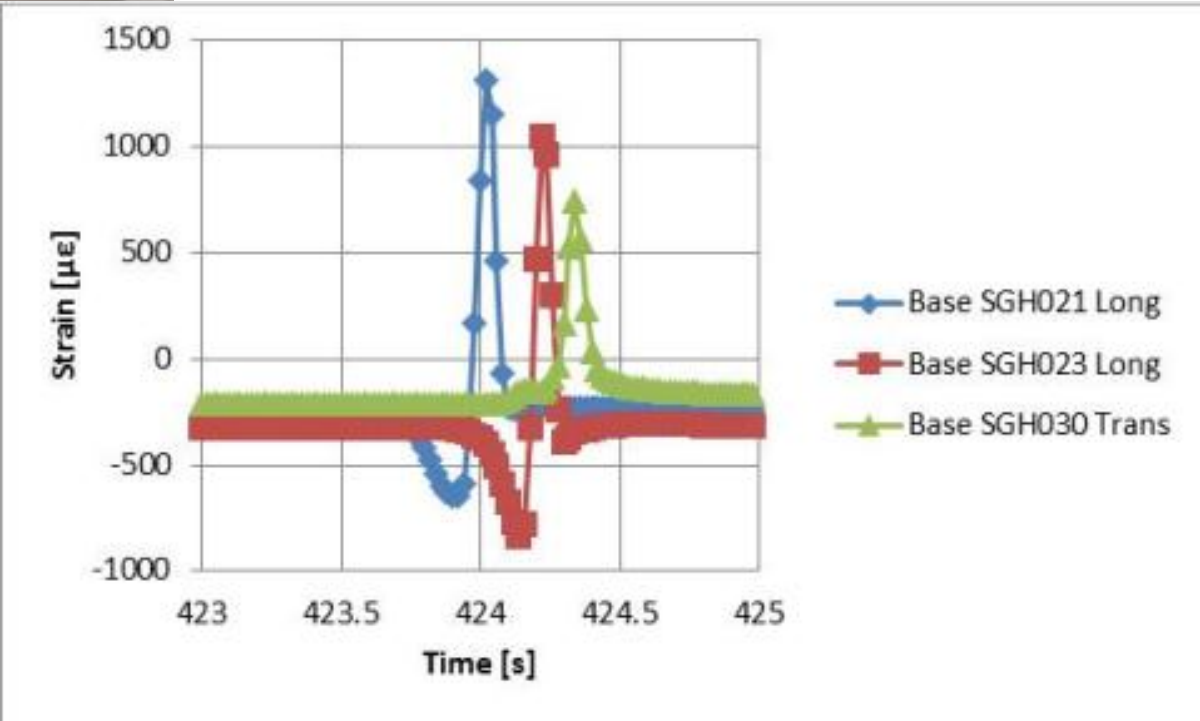


Vertical pressure

- Working with reasonable values
- Appreciate that presence of sensors will affect stresses – need to measure somewhere

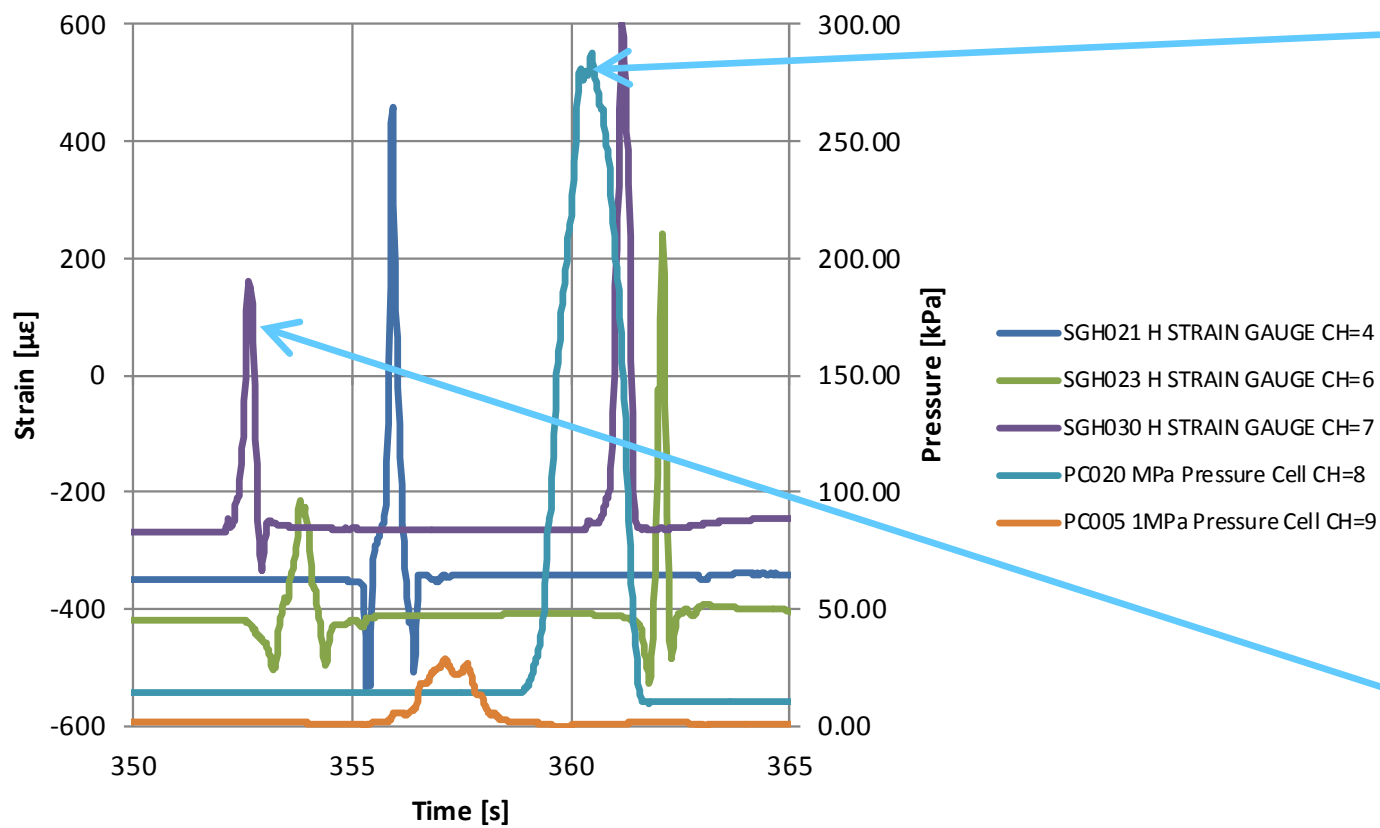


Horizontal strain



Strain and Pressure

Section 7



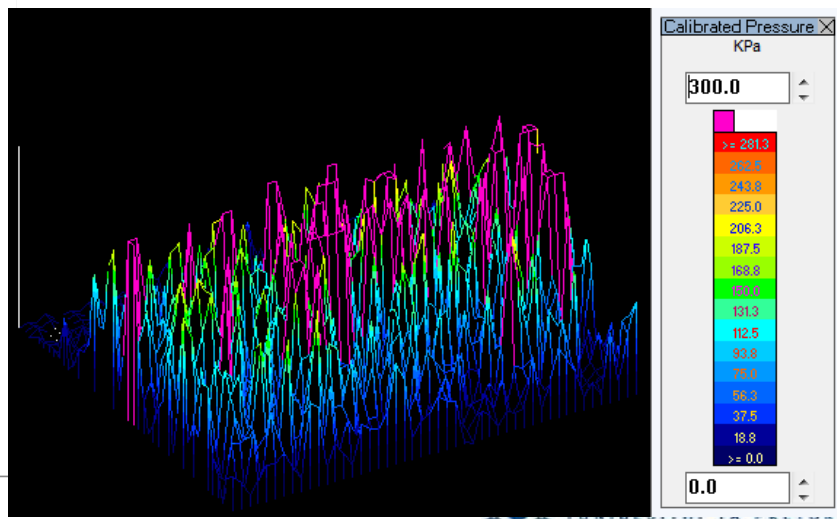
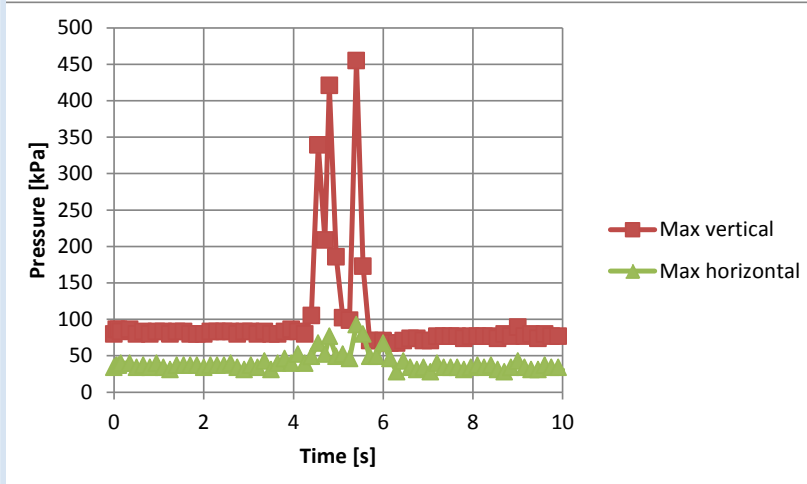
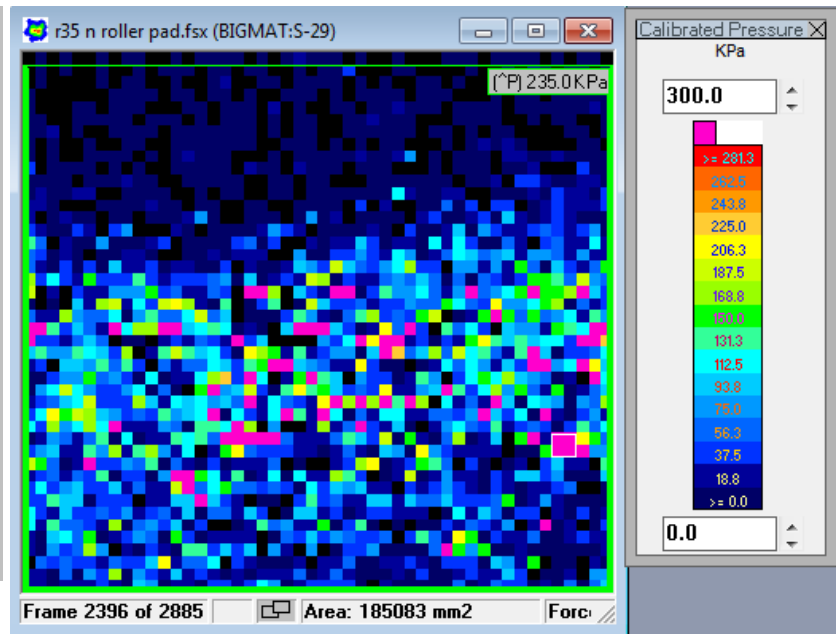
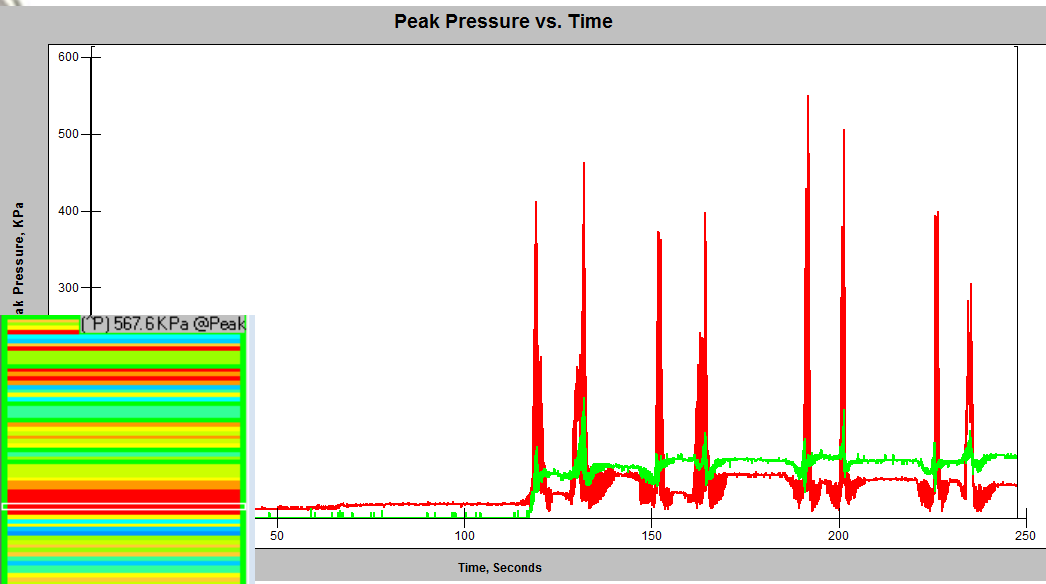
Pressure film



Pressure film



Pressure film



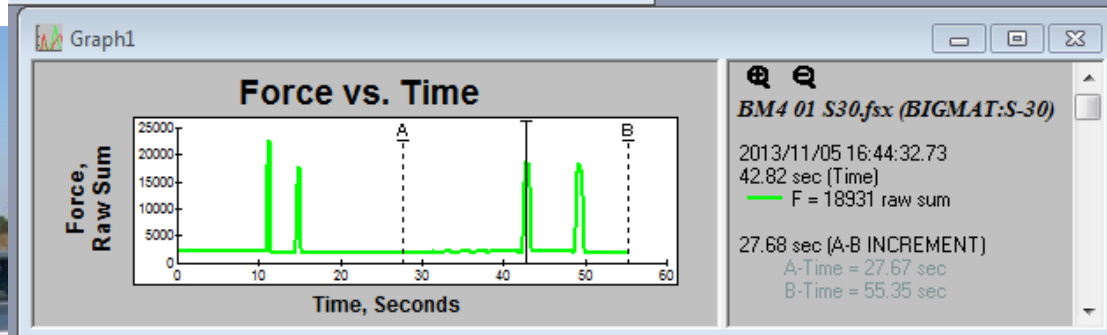
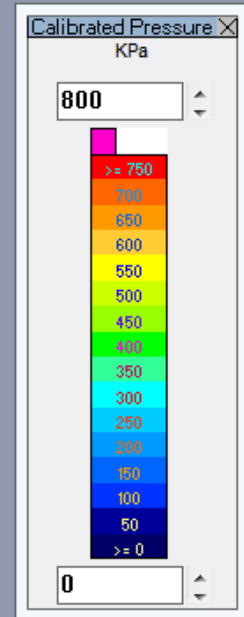
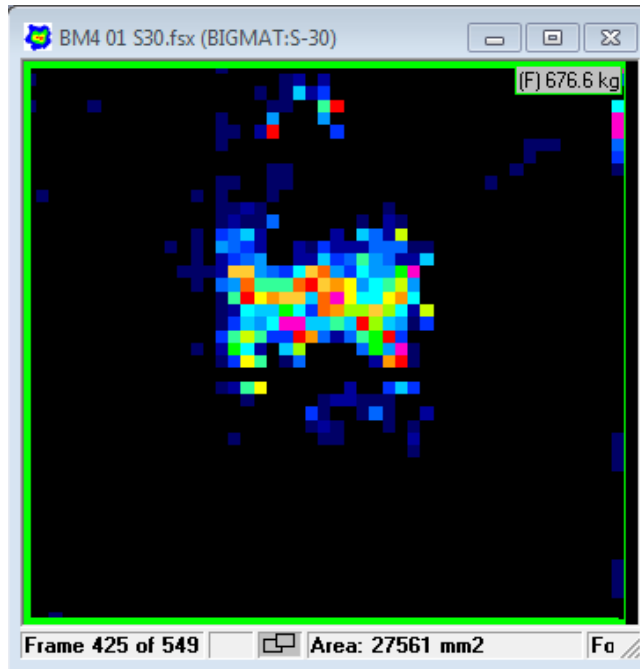
Pressure film

- BM4 – Section 2 (G1) under seal
- BM8 – Section 2 (G1) under base
- S13 – Section 2 (G1) base horizontal
- S15 – Section 2 (G1) base vertical



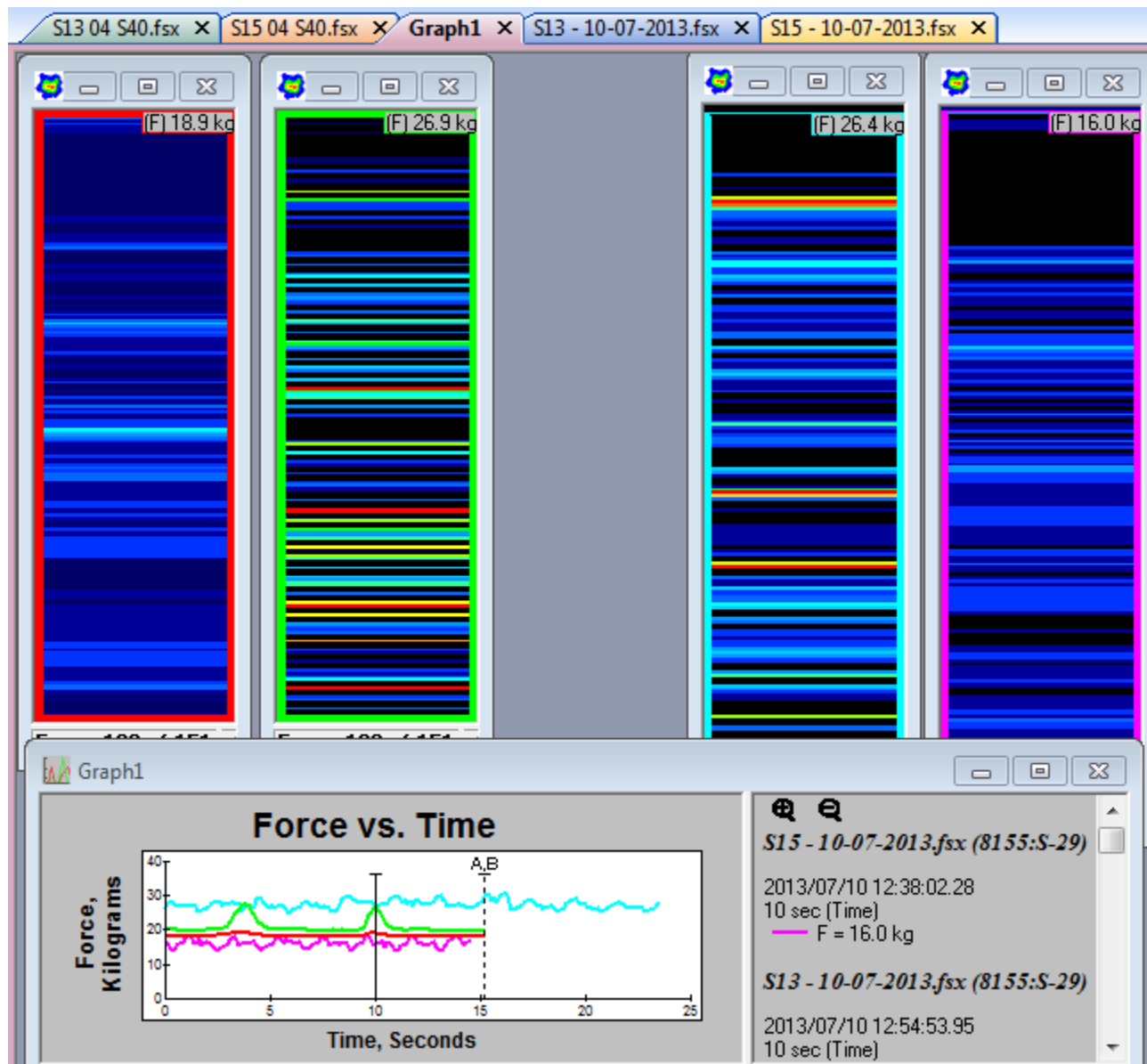
Pressure film

- Mahindra Xylo
- 10 Hz
- Slow speed



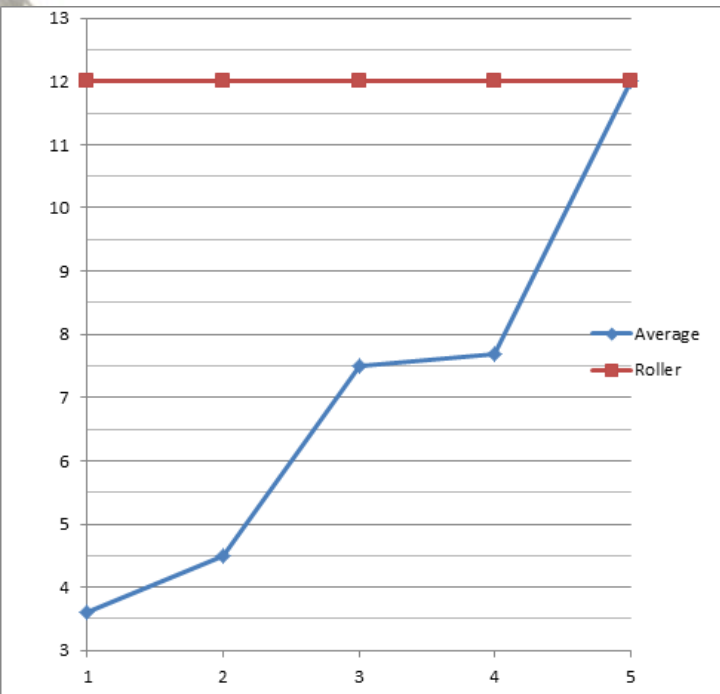
Pressure strips – H vs V

Residual stresses			
	S13 H	S15 V	S13H/S15V
Install	27	17	1.59
No load	18	20	0.90
Load	19.2	27.7	0.69

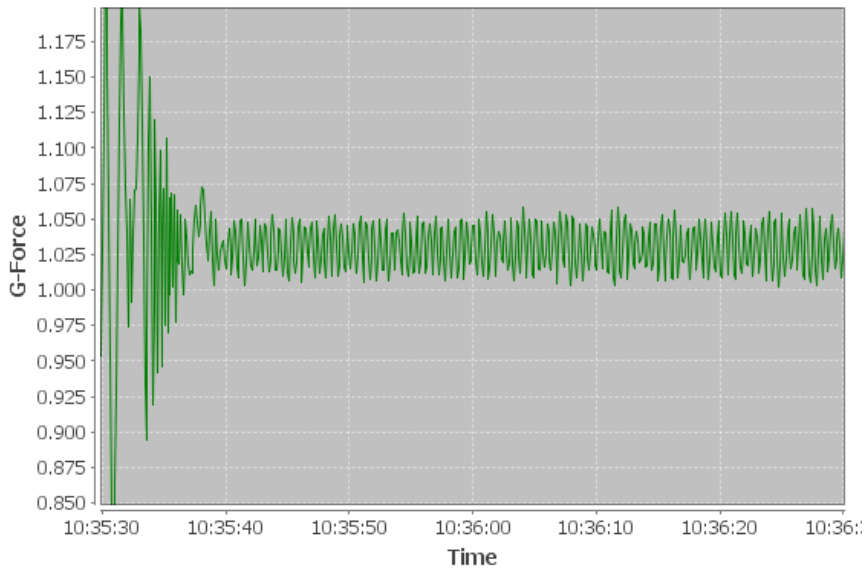




Accelerometers

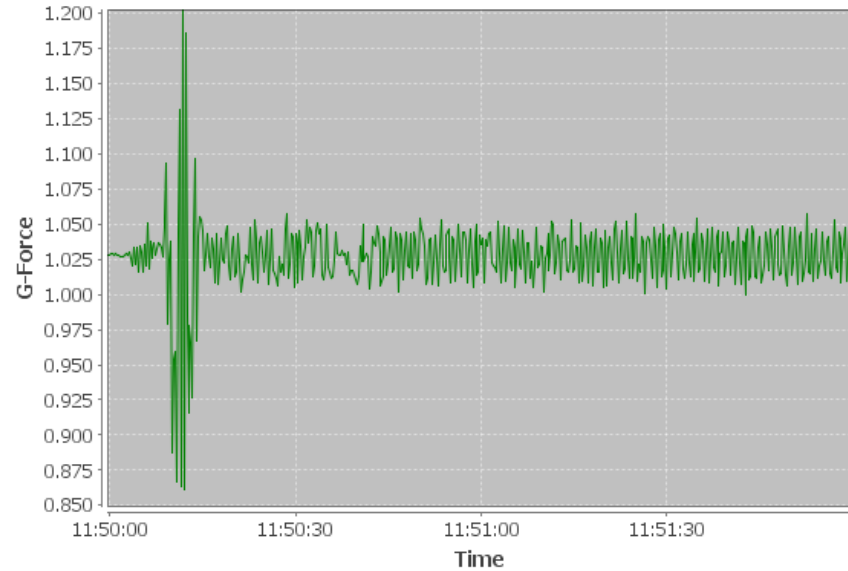


10:35 - loose

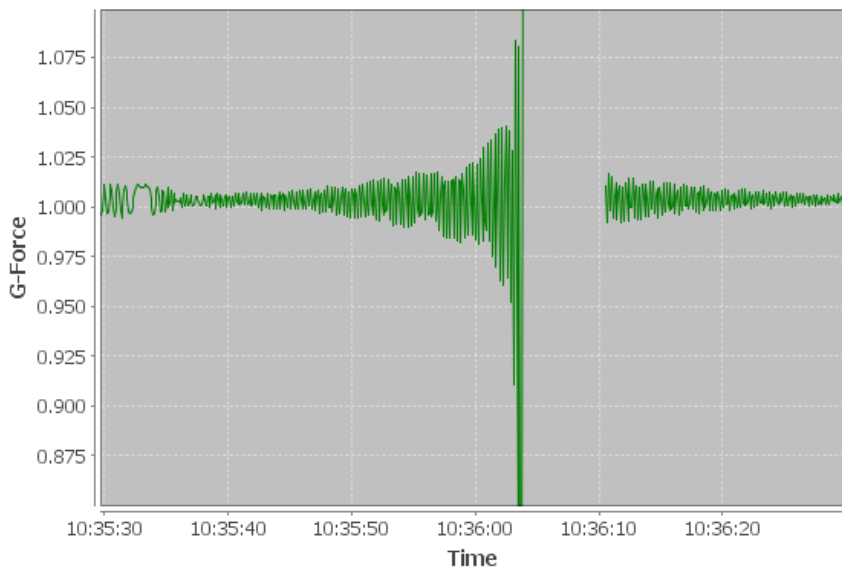


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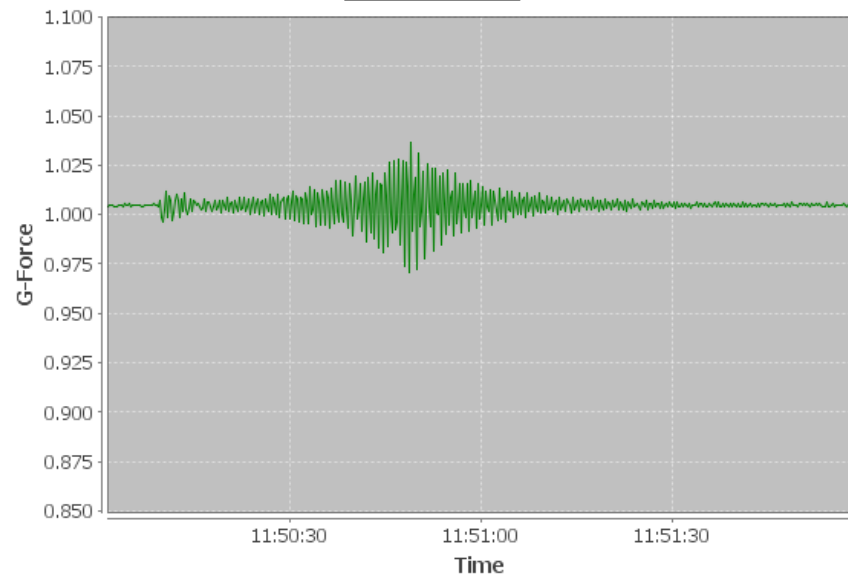
11:50 - compacted



Ax Ay Az



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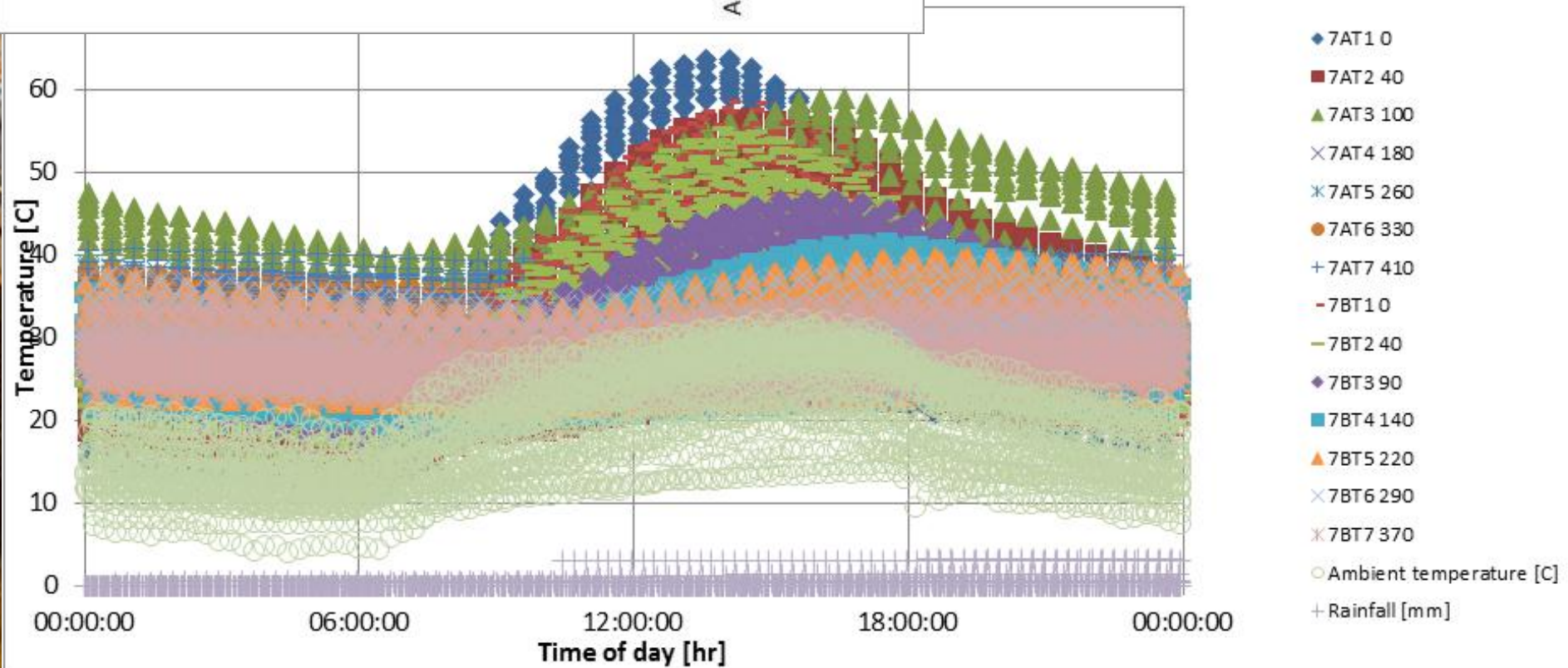
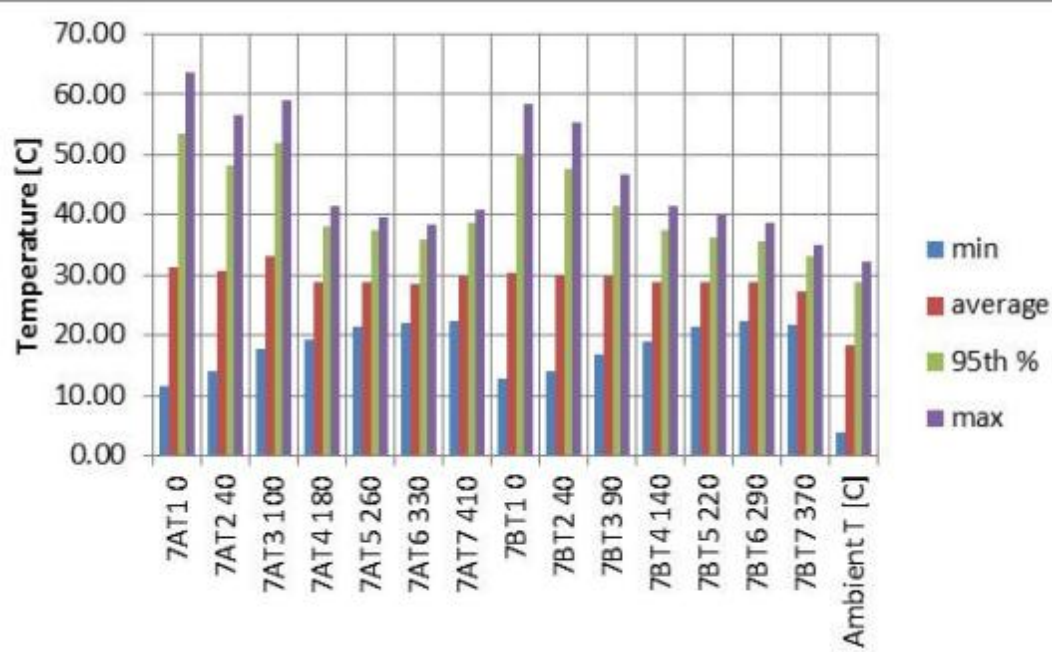


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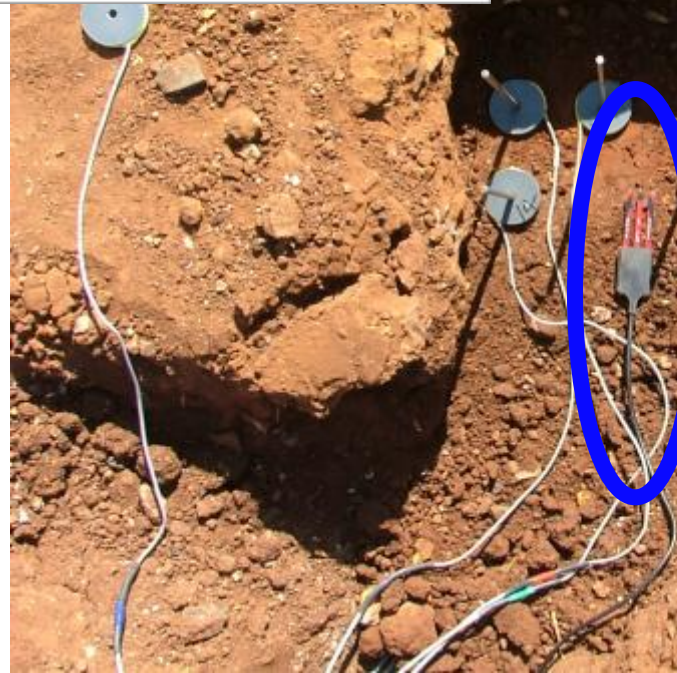
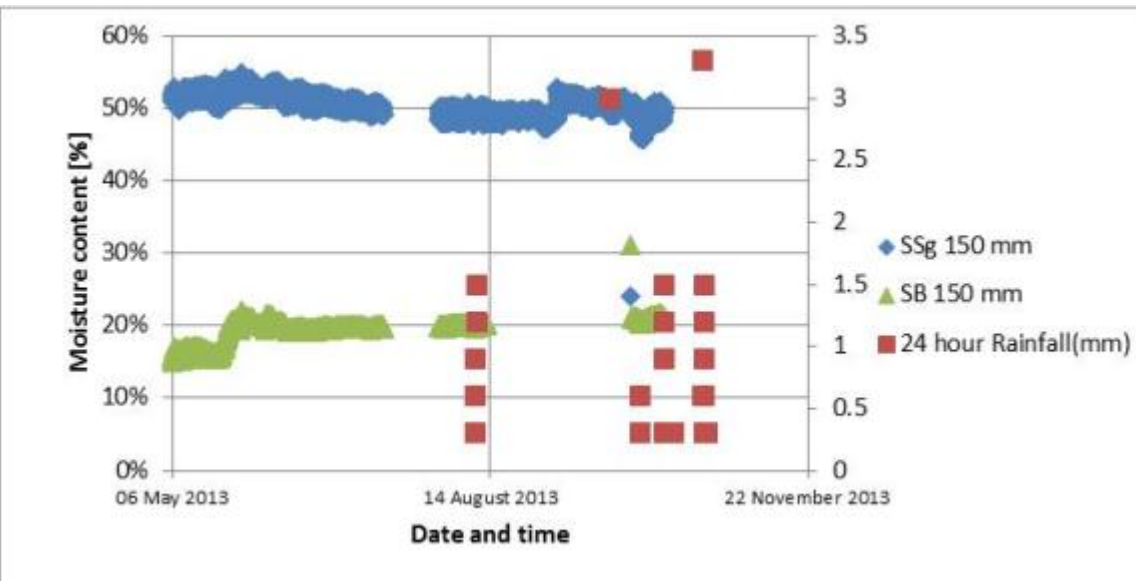
Temperature sensors

- Various locations
- Mainly bituminous and cemented layers
- Continuous data collection (15 / 30 minute intervals)

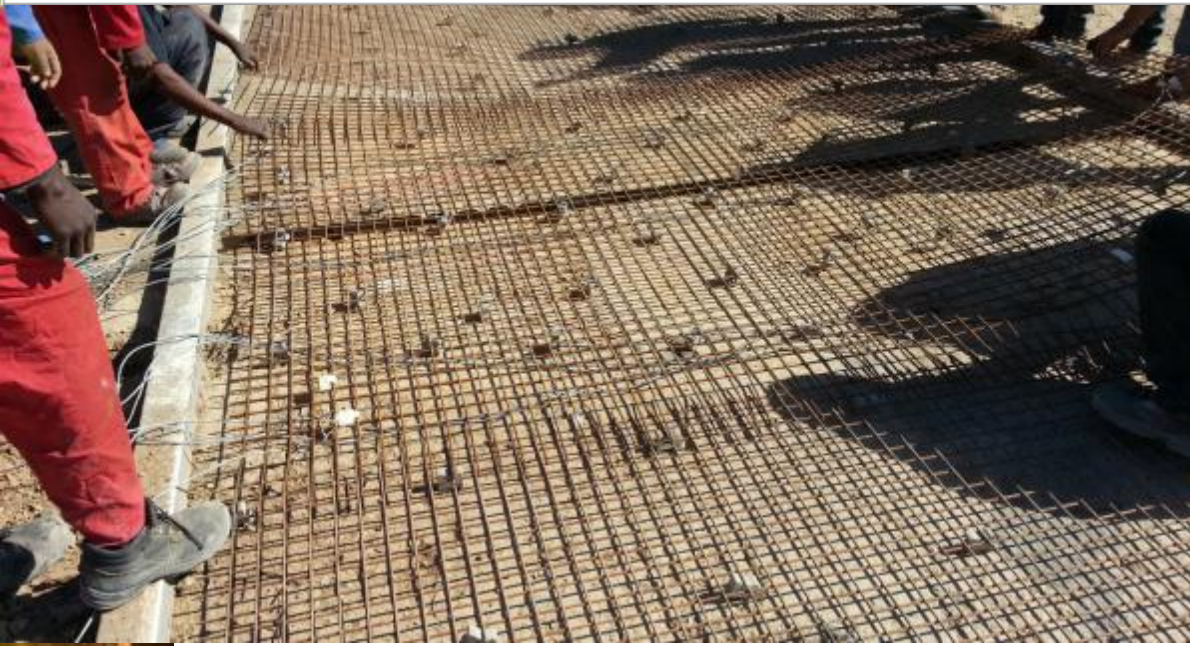
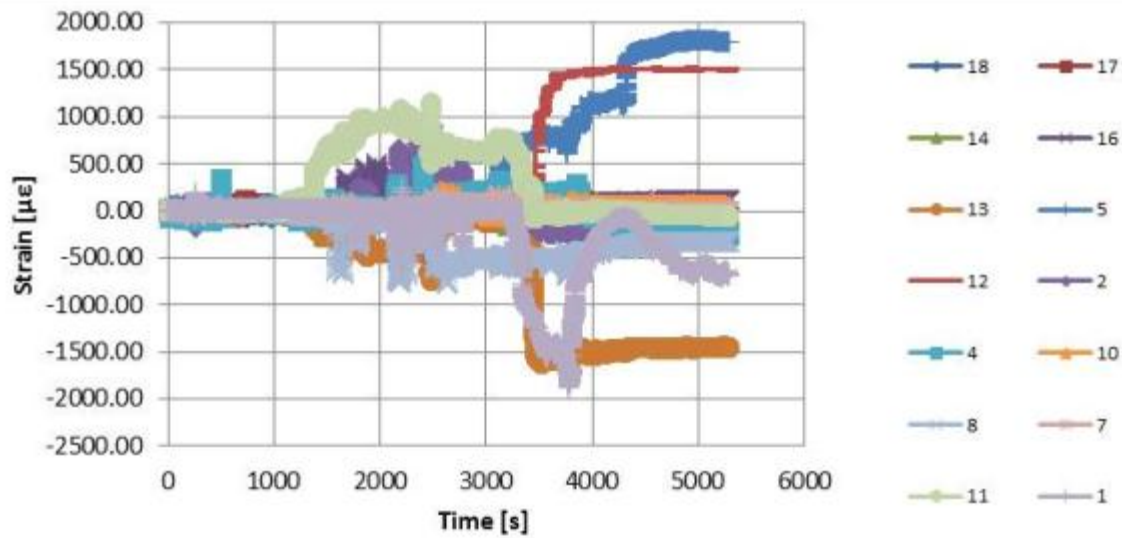




Moisture sensors



Strain on steel (UTCRCP)



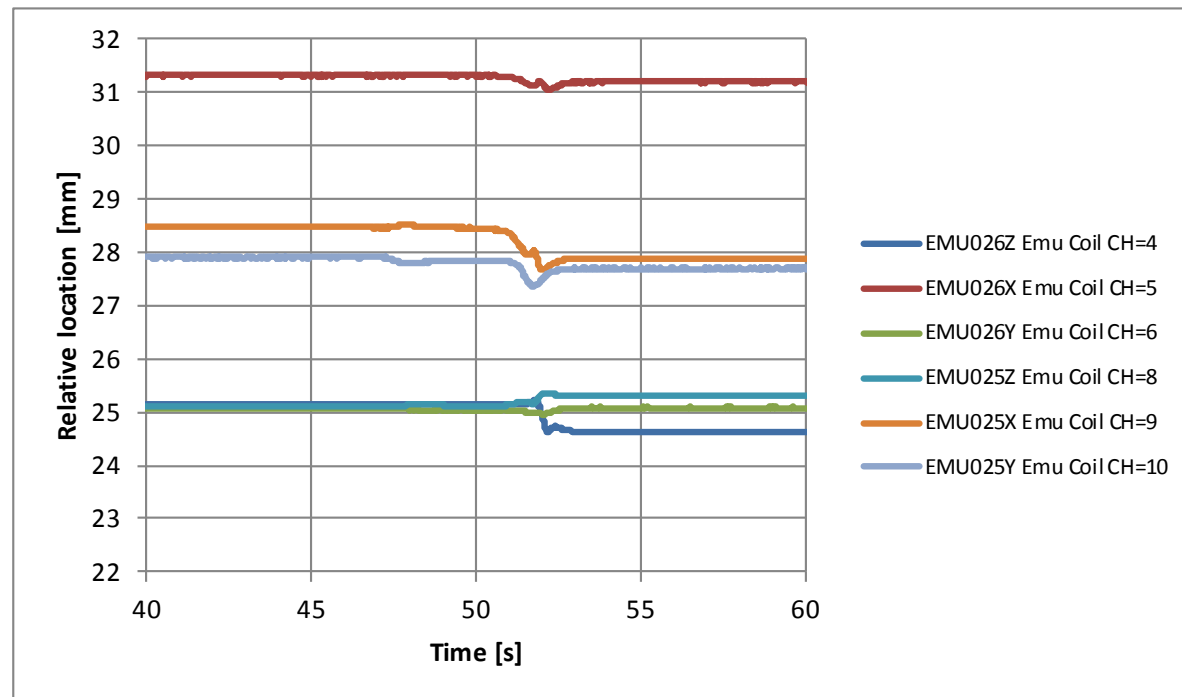
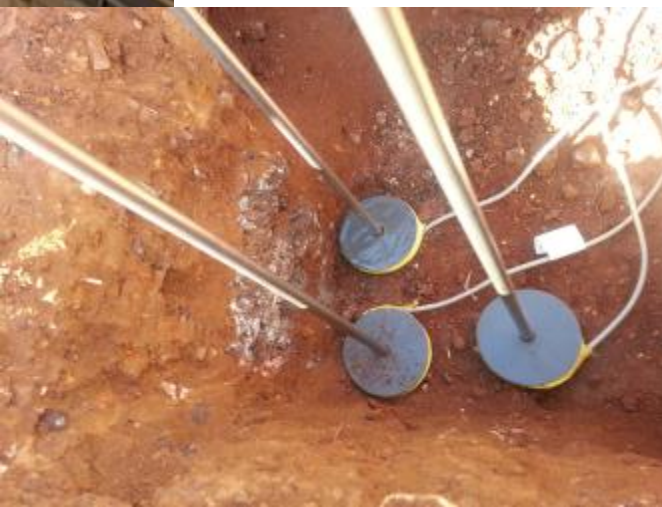
MDD

- Standard MDDs installed
- 1 per section

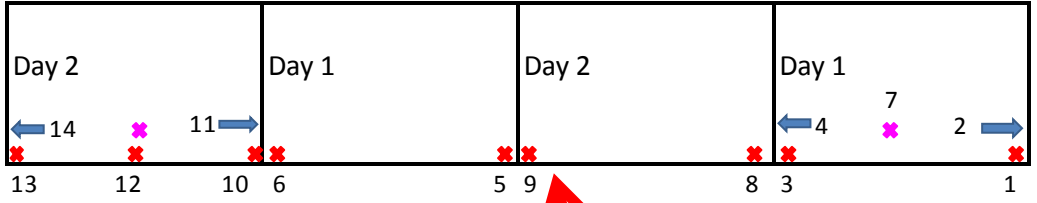
Section	Structure	REQUESTED Layer locations				
	1 Seal, G4, G5, G7	Top (0)	Bottom G4 (136)	Bottom G5 (338)	Into G7 (498)	900 mm
	2 Seal, G1, C4, G7	Top (0)	Bottom G1 (130)	Bottom C3 (346)	Into G7 (506)	900 mm
	3 Seal, FTB, G7, G7	Top (0)	Bottom FTB (197)	Bottom G7 (324)	Into G7 (484)	900 mm
	4 Seal, ETB, G7, G7	Top (0)	Bottom CTB (204)	Bottom G7 (333)	Into G7 (493)	900 mm
	5 Seal, CTB, G7, G7	Top (0)	Bottom CTB (195)	Bottom G7 (322)	Into G7 (482)	900 mm
	6 AC, BTB, C4, G7	Bottom BTB (173)	Bottom C4 (390)	Bottom C4 + 160 mm (550)	Bottom C4 + 320 mm (710)	900 mm
7A	AC, HiMA, C4, G7	Bottom HiMA (183)	Bottom C4 (396)	Bottom C4 + 160 mm (556)	Bottom C4 + 320 mm (716)	900 mm
7B	AC, HiMA, C4, G7	Bottom HiMA (131)	Bottom C4 (317)	Bottom C4 + 160 mm (477)	Bottom C4 + 320 mm (637)	900 mm

Emu Coils

- Measuring strain / displacement
- Organized in stacks to measure horizontal, vertical and longitudinal movement



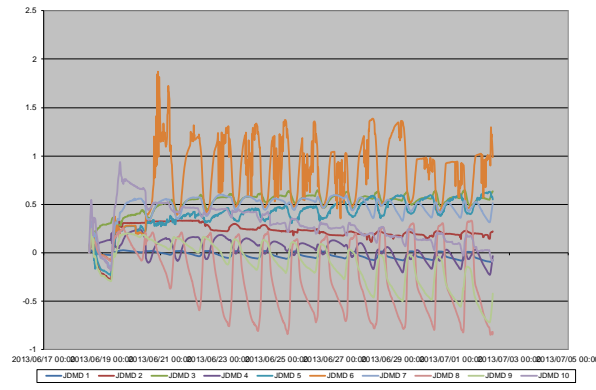
JDMD



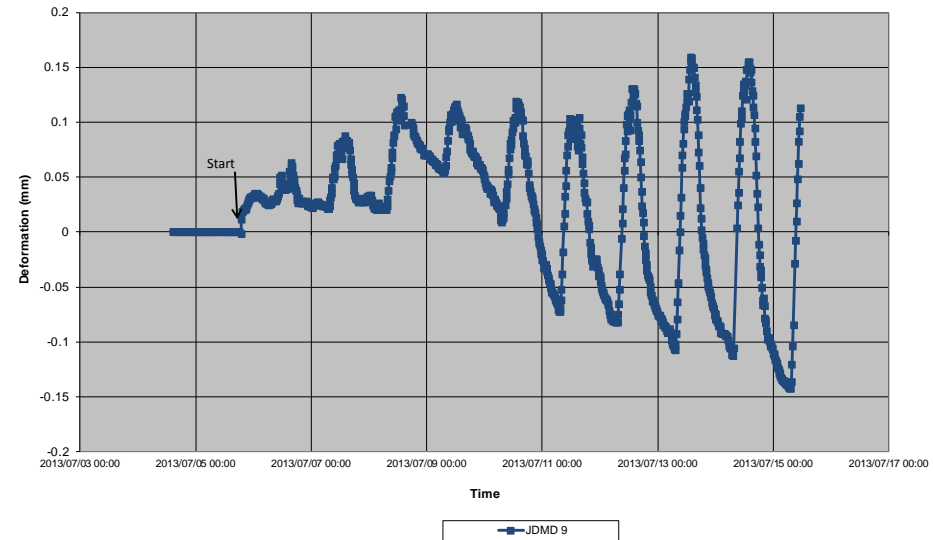
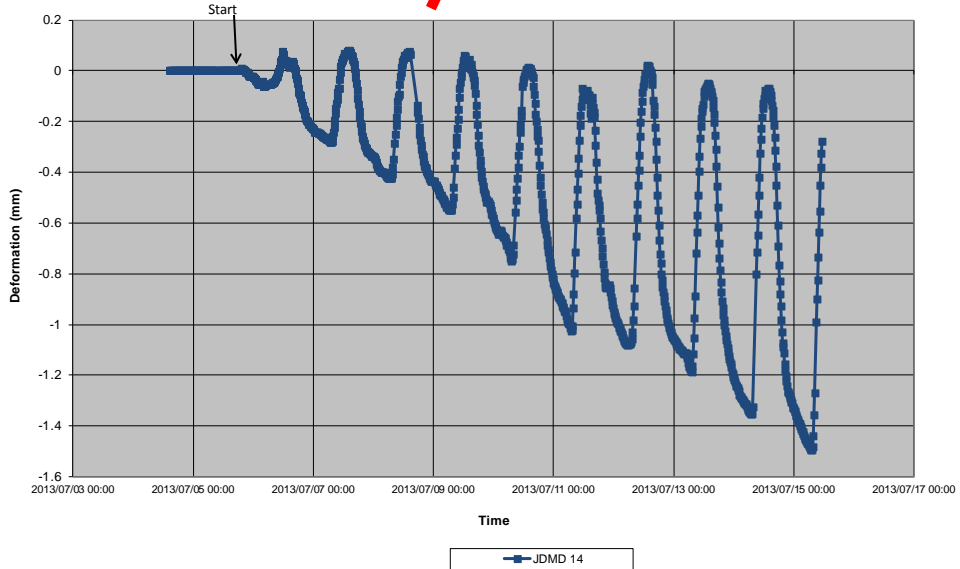
Sections 8 and 9 (JCP, UTCRCP)



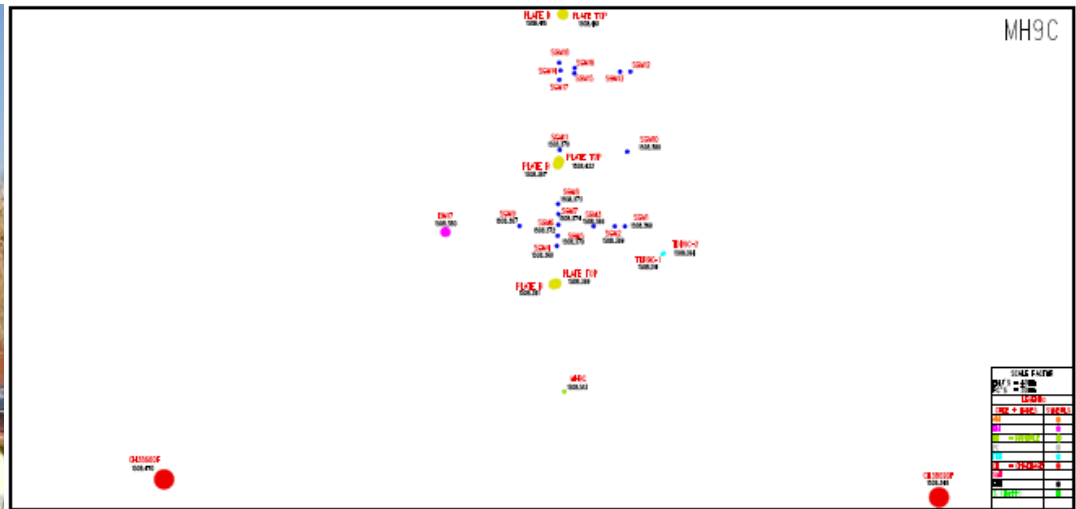
R104 Section 8



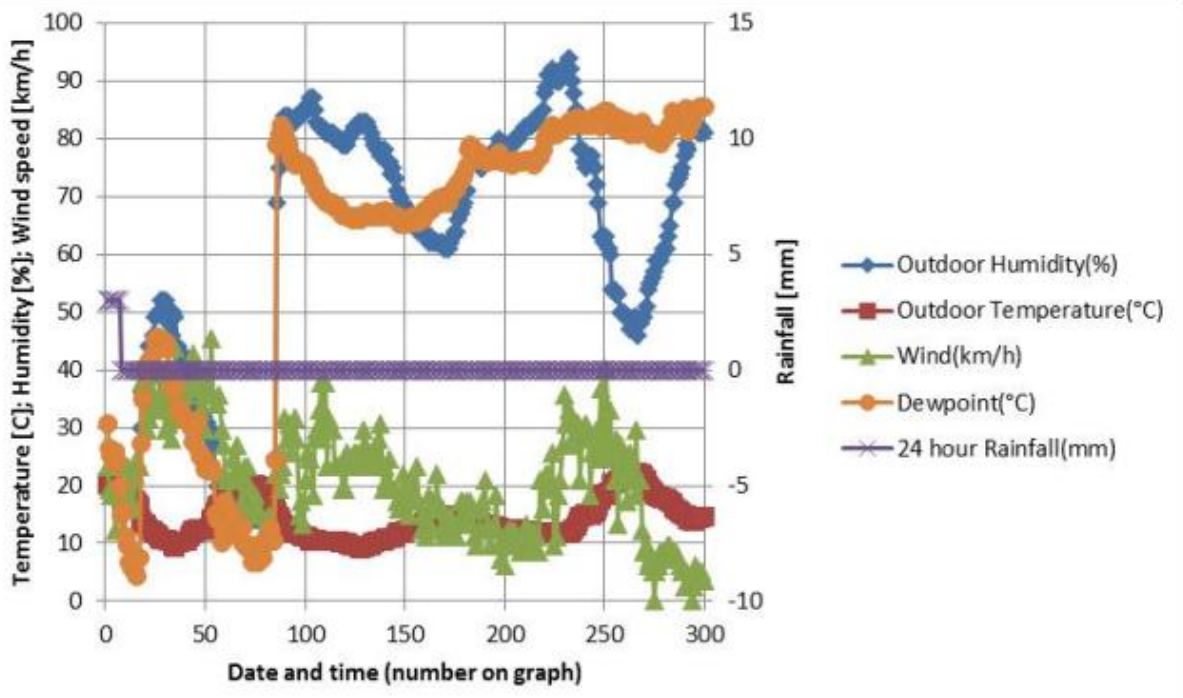
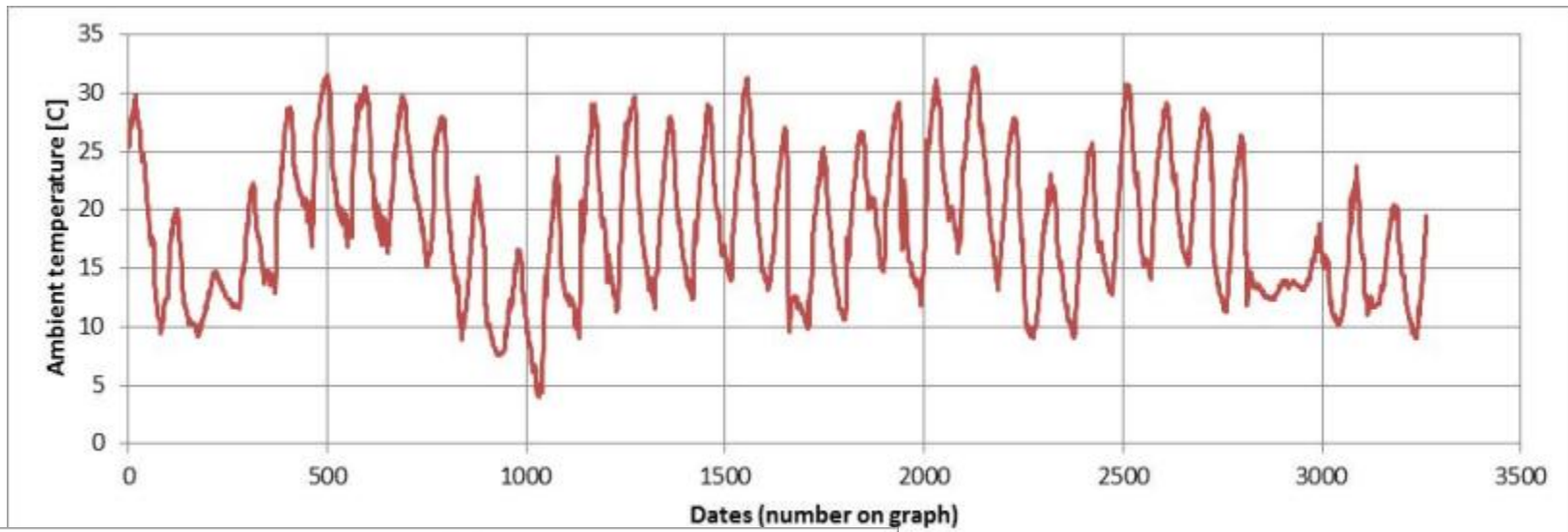
R104 Section 8



Sensor location



Weather station



Progress

- All sensors installed
- First measurements this week
(Thanks to Sarel and Rikus)
- Measurement schedule
Initial full set of data (range of speeds, loads etc)
Monthly measurements