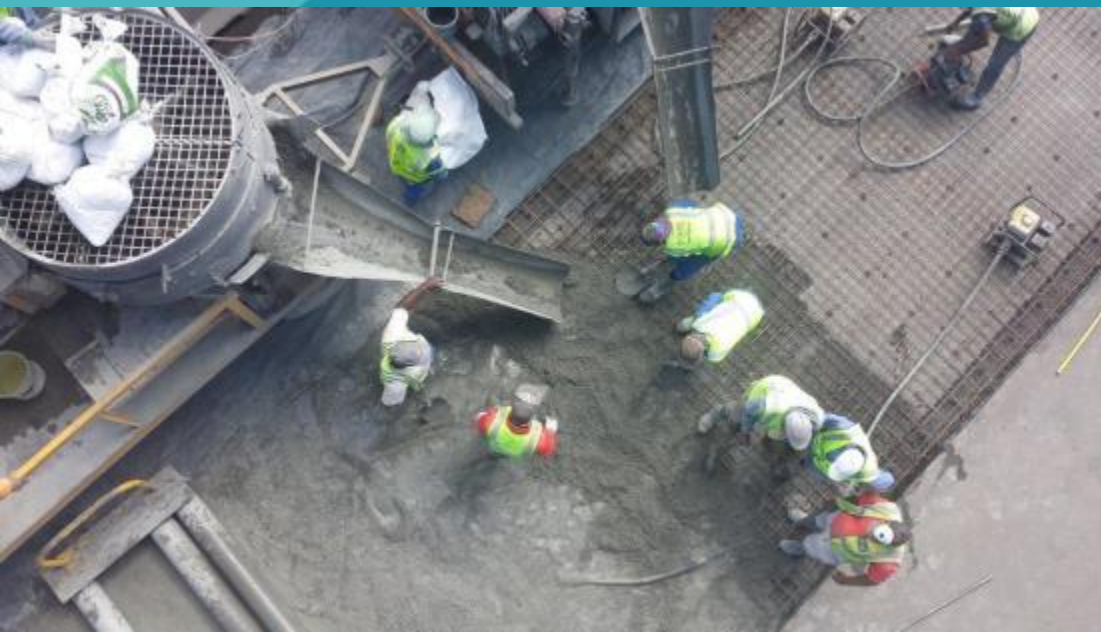


Road Pavements Forum (RPF)

Design and Construction of UTCRCP ON the N1/1 Highway near the Huguenot Tunnel



Philip Joubert

5 May 2016

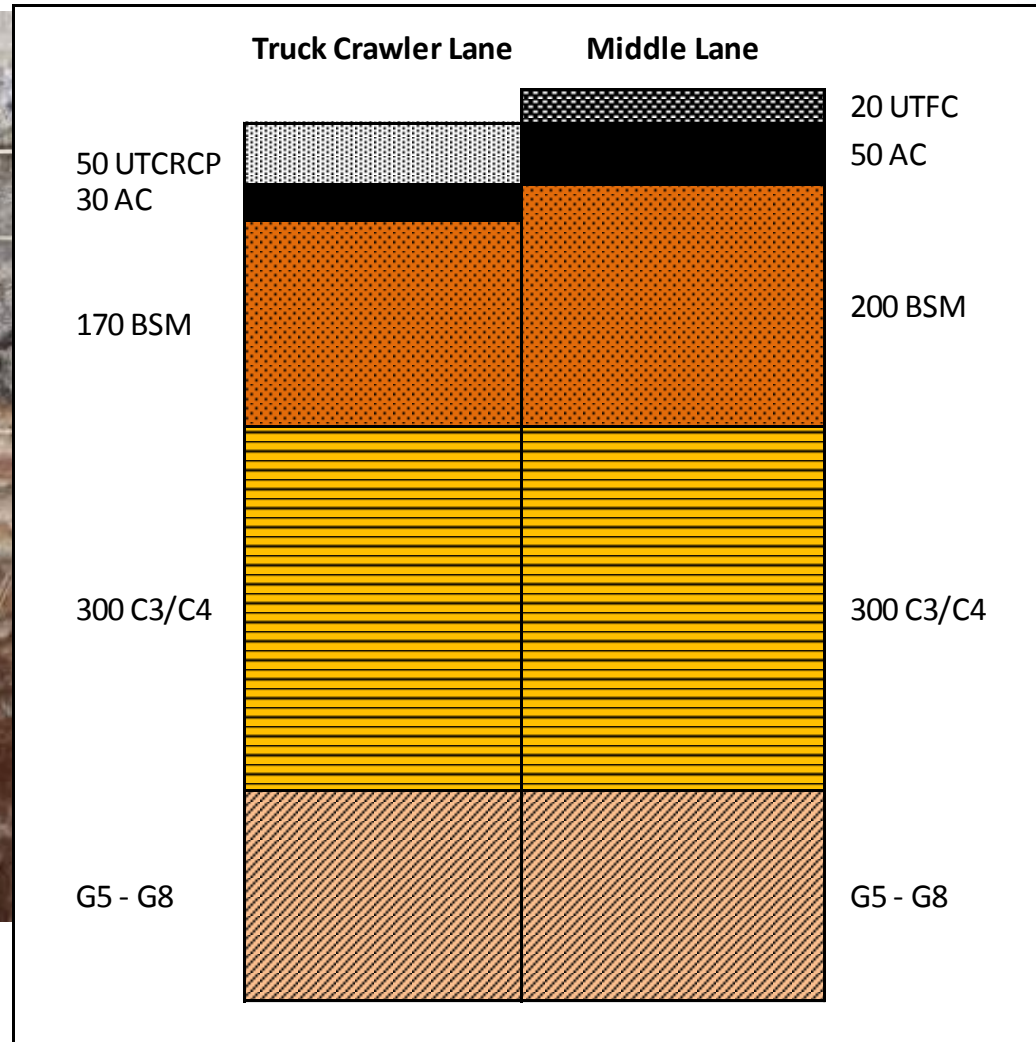
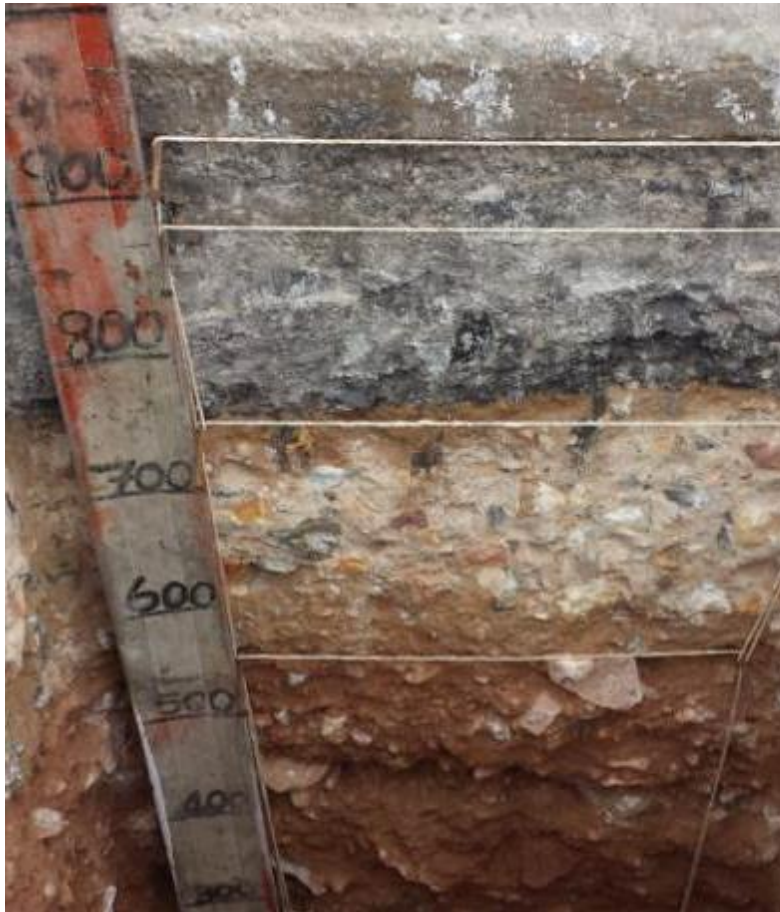
PROJECT BACKGROUND

ORIGINAL CONSTRUCTION (*R Burger RPF 2010*):

- 2009 - N1/1 Rehabilitation / Widening
- Truck crawler lane as an experimental UTCRCP section



PROJECT BACKGROUND



PROJECT BACKGROUND

UTCRCRP: Ultra Thin Continuous Reinforced Concrete Pavement



UTCRC P PERFORMANCE

UTCRCRP PERFORMANCE (Good Section)



UTCRCPC PERFORMANCE (Movement)



UTCRCPC PERFORMANCE (Movement)



UTCRCRP PERFORMANCE (Movement)



UTCRCRP PERFORMANCE (Transverse Mesh Cracking)



Mbongwa

Page 10

UTCRCRP PERFORMANCE (Block Mesh Cracking)



van Zyl

Page 11

UTCRCRP PERFORMANCE (Joint opening)



Mbongwa

Page 12

UTCRCRP PERFORMANCE (Transverse Joint Spalling)



UTCRCRP PERFORMANCE (Pumping of Fines)



UTCRCRP PERFORMANCE (Transverse Joints)



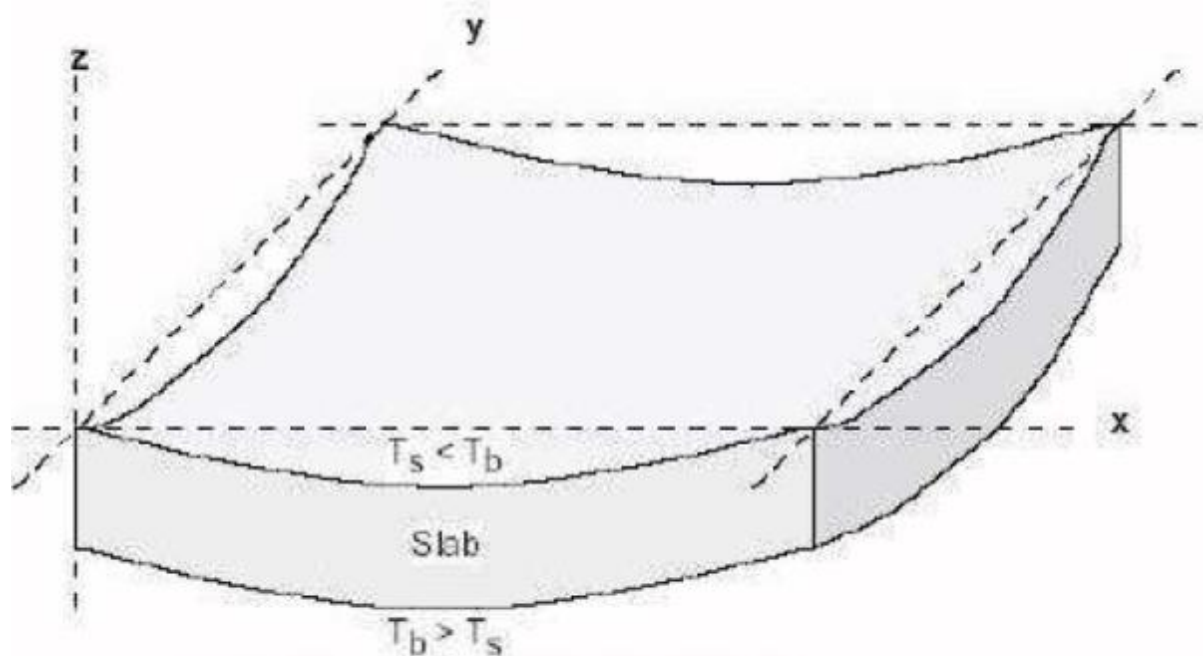
Van Zyl

Page 15

CONTRIBUTING FACTORS

CONTRIBUTING FACTORS

- **Warping**



(b) Night (slab bottom temp > surface temp)

Mbongwa

CONTRIBUTING FACTORS

- **Moisture Ingress**



CONTRIBUTING FACTORS

. Thermal Expansion

- Coefficient: $12.9 \times 10^{-6}/^{\circ}\text{C}$
- Typical day joints: 50 – 60m
- For temperature change:
 - from 20 to 50°C
 - 23mm movement



CONTRIBUTING FACTORS

. Traffic Loading Downhill Force



CONTRIBUTING FACTORS

. Delamination



REMEDIAL ACTIONS : CRAWLER LANE



AMENDED UTCRCP DESIGN

- **Design Objective**
 - **Address issues identified on the N1/1**
- **R104 Experimental Section**
 - **Aspects of the design implemented**

AMENDED UTCRCP DESIGN

- **Changes to Design:**
 - **Thickness:**
 - 100mm
 - 70mm with edge beams (150 x 300)
 - **Lower concrete strength (FS > 7.5MPa)**
 - **Reduction in % reinforcing:**
 - 67mm x 67mm @ 8mm diameter

AMENDED UTCRCP DESIGN

- **Changes to Design:**
 - **Key joints @ day joints**
 - **Tie bars @ day joints**
 - **Intermediate beams @ day joints (40m)**
 - **Improved longitudinal joint seals**

UTCRCRCP DESIGN REVIEW

UTCRCRP FEM DESIGN REVIEW

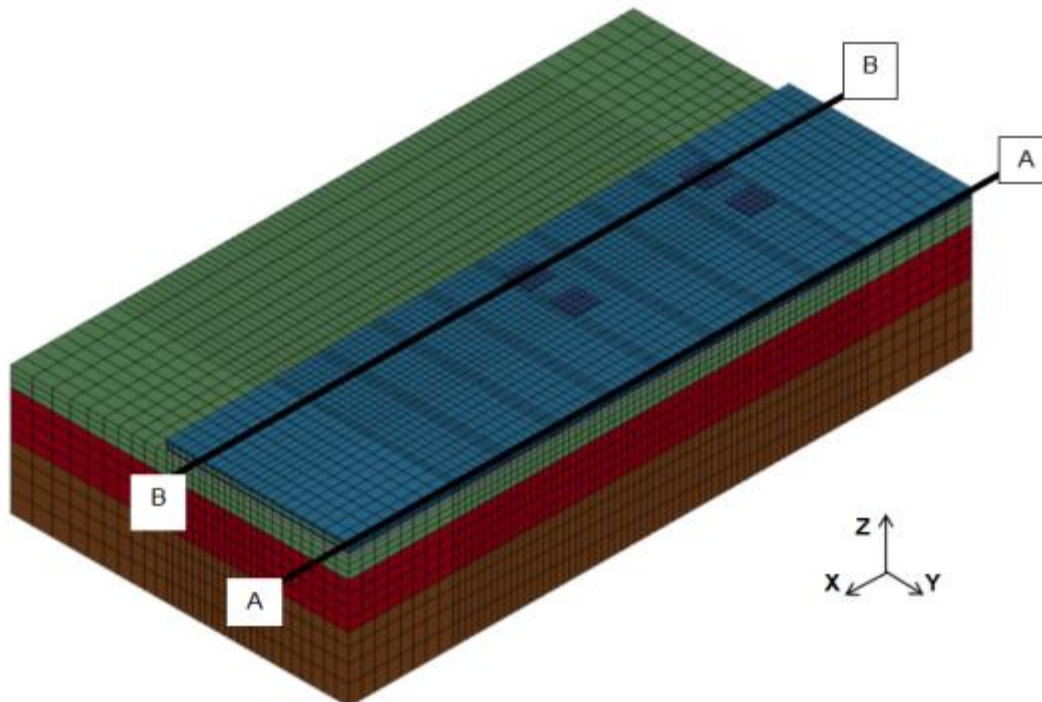
- **Material Characterization:**
 - **Support layers**
 - **New UTCRCRP**
 - **University Pretoria**
 - **University Stellenbosch**

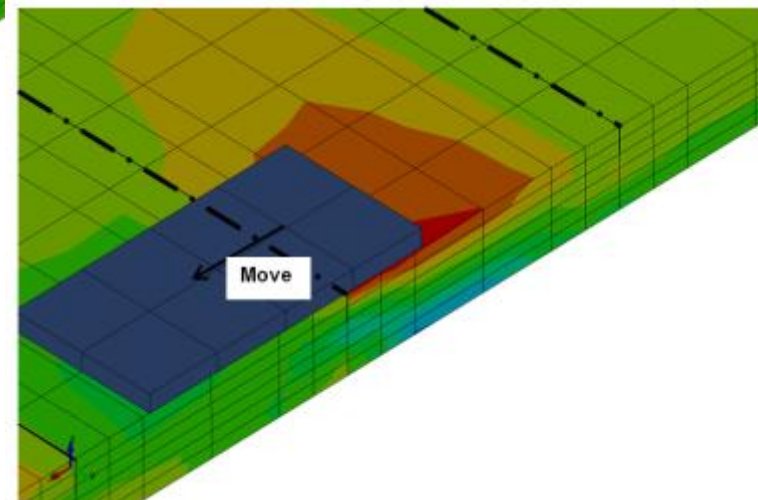
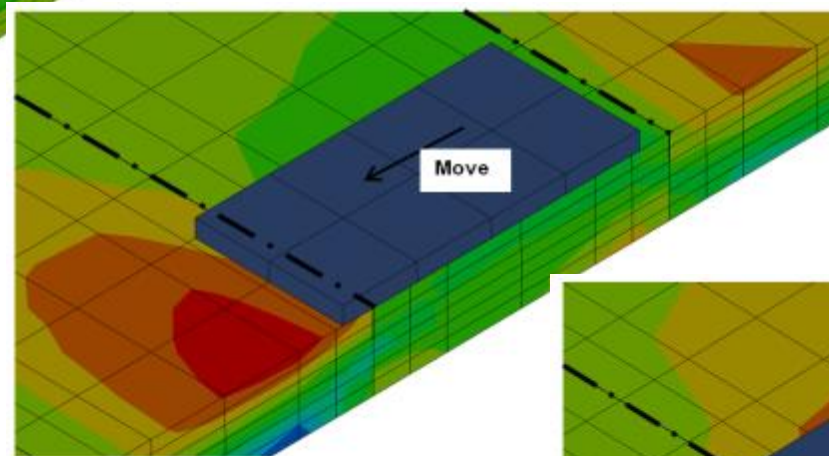
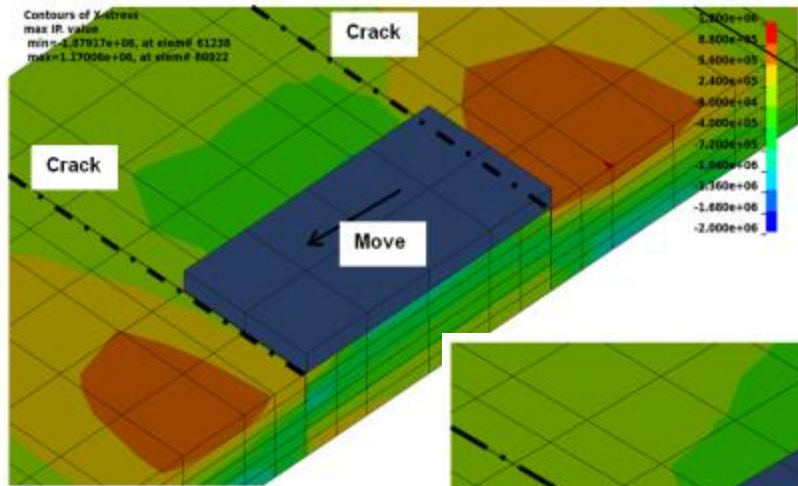
UTCRCRP FEM DESIGN REVIEW

- **FEM Analysis:**
 - **Existing UTCRCRP Pavement**
 - **New UTCRCRP**
 - **Model calibration**

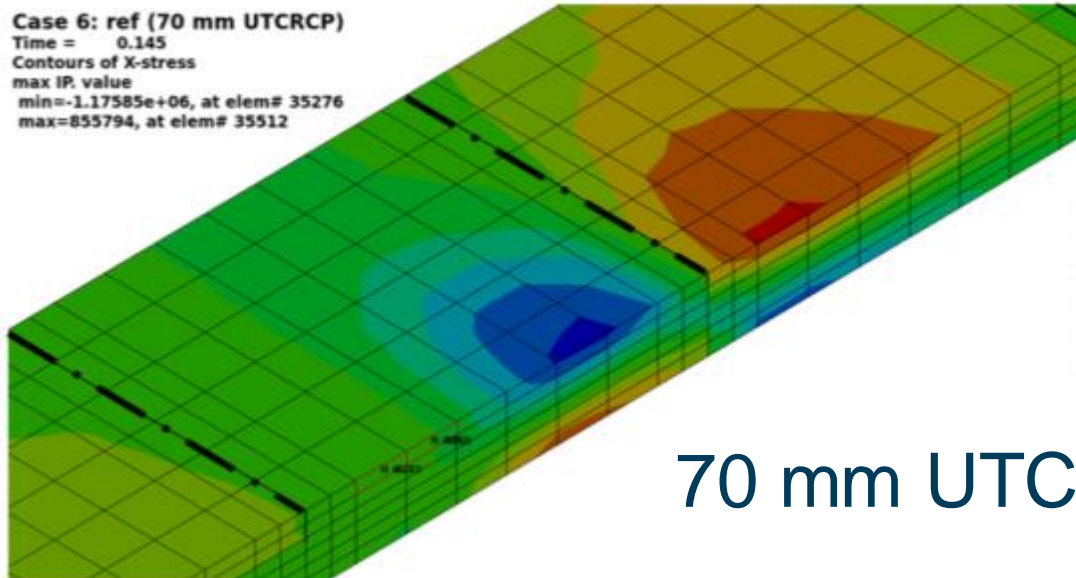
Current project

- Current FEA
 - Expanded model
 - Use moving wheel load



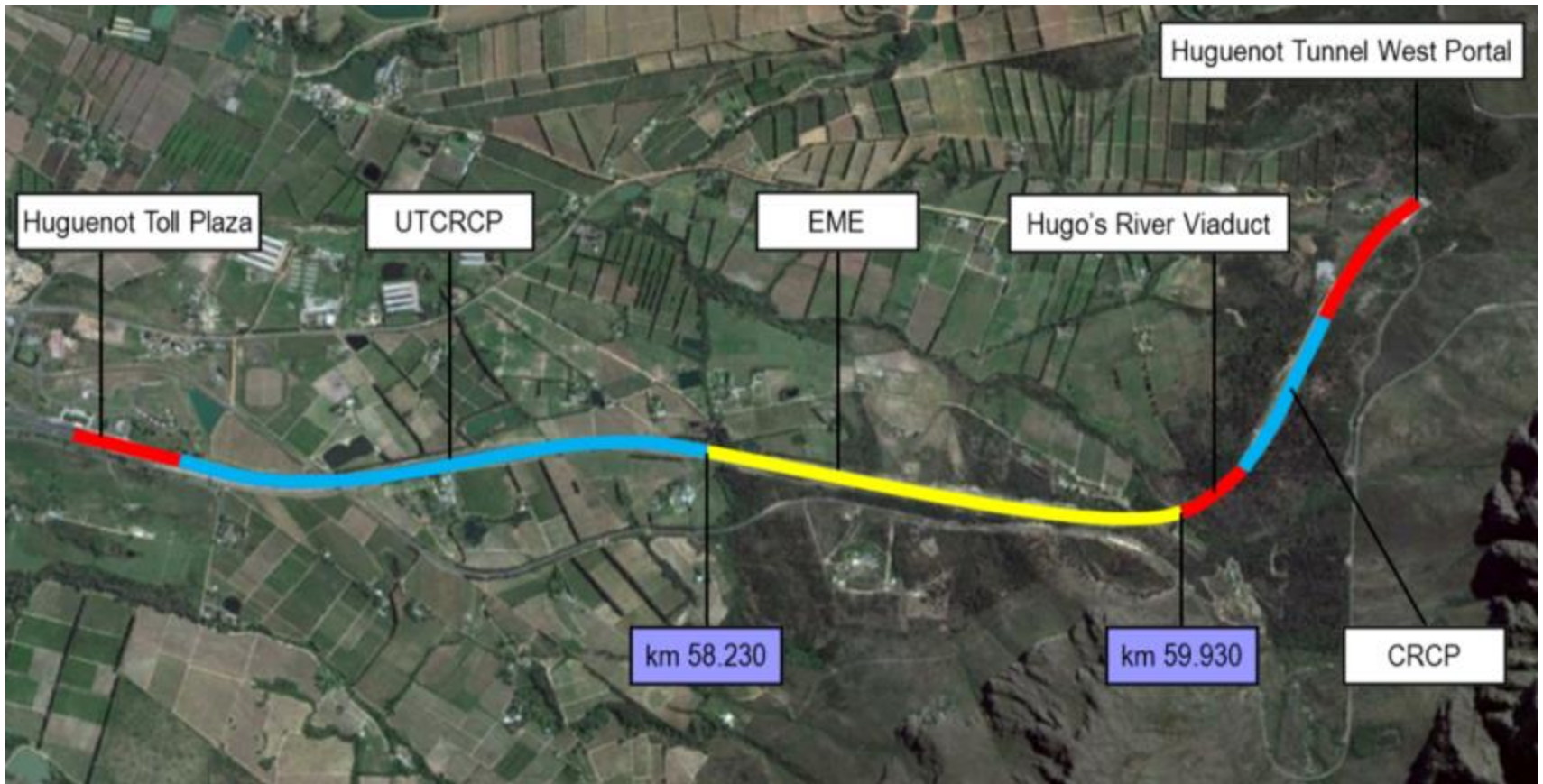


50 mm UTCRCP



70 mm UTCRCP

CONSTRUCTION



CONSTRUCTION - TRIAL



CONSTRUCTION



CONSTRUCTION



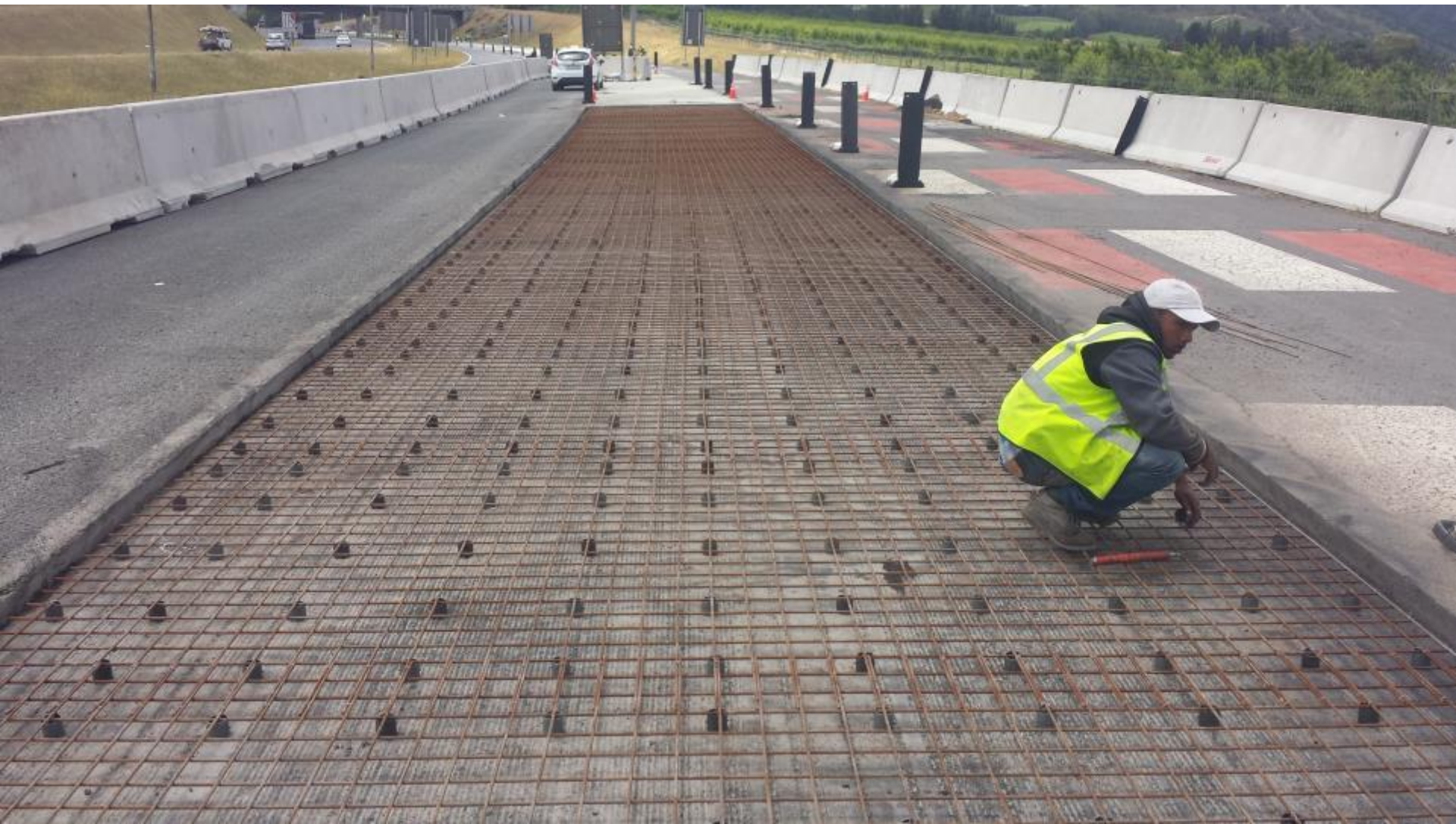
CONSTRUCTION



CONSTRUCTION



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CONSTRUCTION CHALLENGES



CONSTRUCTION CHALLENGES



CONSTRUCTION CHALLENGES



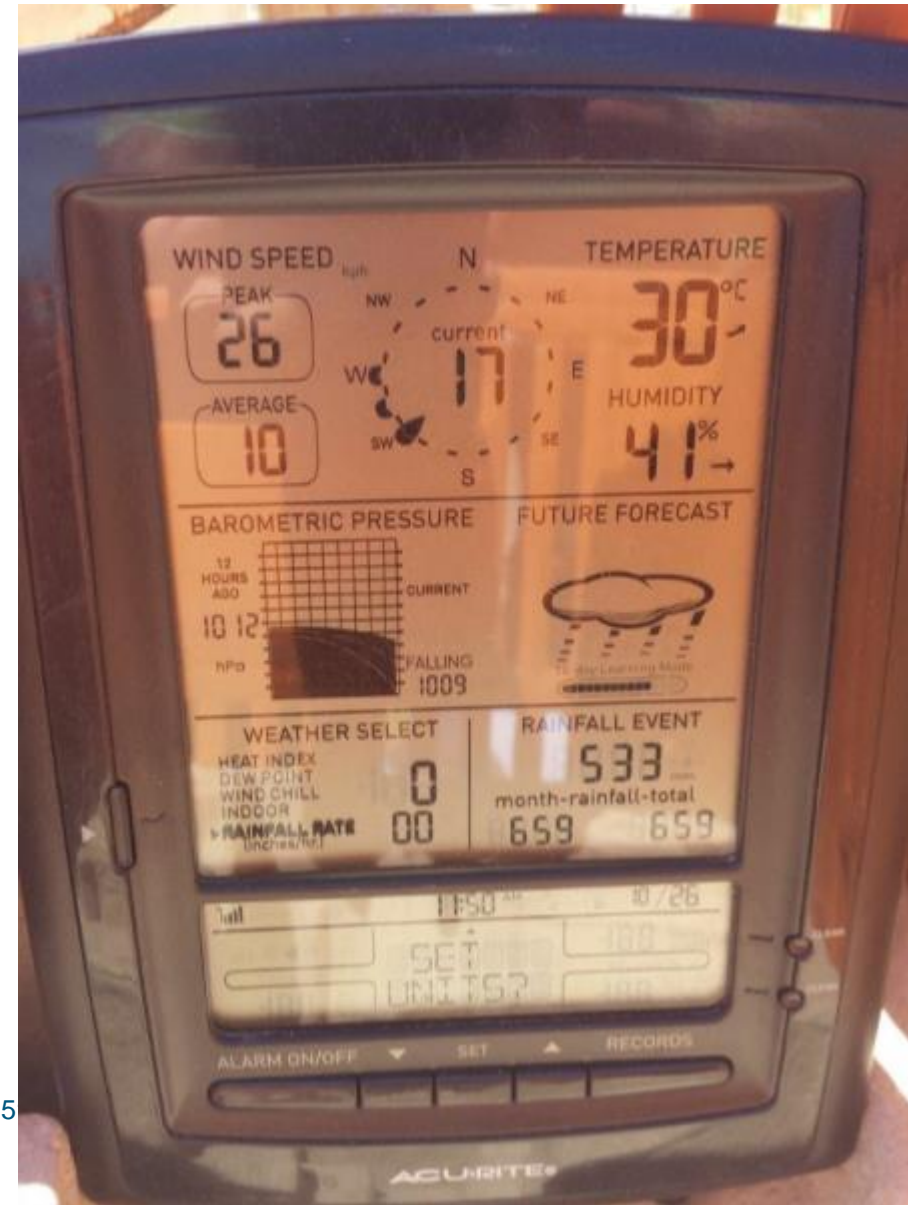
CONSTRUCTION CHALLENGES

- Wind



CONSTRUCTION CHALLENGES

- Wind
- Temperature



CONSTRUCTION CHALLENGES

- Harshness of mix



CONSTRUCTION CHALLENGES

- Harshness of mix



CONSTRUCTION CHALLENGES

- Harshness of mix



CONSTRUCTION CHALLENGES

- Harshness of mix



CONSTRUCTION CHALLENGES

- **Support layers**



CONSTRUCTION CHALLENGES

- **Joint**



RESEARCH



Testing of Fibre Reinforced Concrete for a Pavement Application

Compiled by Prof WP Boshoff, Dr R Combrinck

Report ISI-2016-10
21 April 2016



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