

# South African Pavement Design Method (SAPDM)

## Revision Status Report

28<sup>th</sup> RPF Meeting

20 November 2014

L Kannemeyer

# Aka GODZILLA



# SAPDM Revision - Historical Overview

- Process initiated at RPF - **May 2005**
- R&R framework - **November 2005**
- Pavement Performance Information System (LTPP)
  - Material Classification Concept
  - Pavement Number Concept (PN)
  - 50 Projects Completed – **February 2008**
  - 11 Stabilized Projects Added – **February 2008**
- Mechanistic-Empirical Analysis System (MEAS)
  - Phase 1 – Develop Detailed Project Briefs – **November 2006**
  - Phase 2 - Inception Phase (22 Projects) – **July 2007**
  - Peer Review – Phase 2 Reports – **November 2007**
  - Additional SANRAL Requirements – **December 2007**
  - Appointment of Main Service Providers – **September 2008 (5 year)**
    - CSIR Built Environment
    - Pavement Modelling Corporation
    - SC Van As Traffic Engineering
- SAPDM Website ([www.sapdm.co.za](http://www.sapdm.co.za)) – **May 2009**

# SAPDM Revision - Progress To Date

## Reports

- Nov 2009 = 8 Reports
- May 2010 = 21 Reports
- Nov 2010 = 30 Reports
- May 2011 = 43 Reports
- Nov 2011 = 56 Reports
- Nov 2012 = 77 Reports
- May 2013 = 88 Reports
- Nov 2013 = 102 Reports
- May 2014 = 112 Reports
- Nov 2014 = 114 Reports

## Field Trials

- Environmental = 41 Sites - Completed
- Experimental Sections
  - R35 Stabilisation = Oct 2012 - Monitoring Ongoing
  - R104 Instrumented Typical Pavements = TSD Measurements

Surface Seals – In progress

Concrete / Block Integration – In Progress

Economic models/guideline – In Progress (HDM4)

# SARDS Detail Feedback

<b>Title</b>	<b>Presenter</b>
SARDS Software Portal	L Kannemeyer
SARDS Asphalt Models	H Theyse
SARDS Recursive Simulation	H Theyse



# **South African Road Design System (SARDS)**

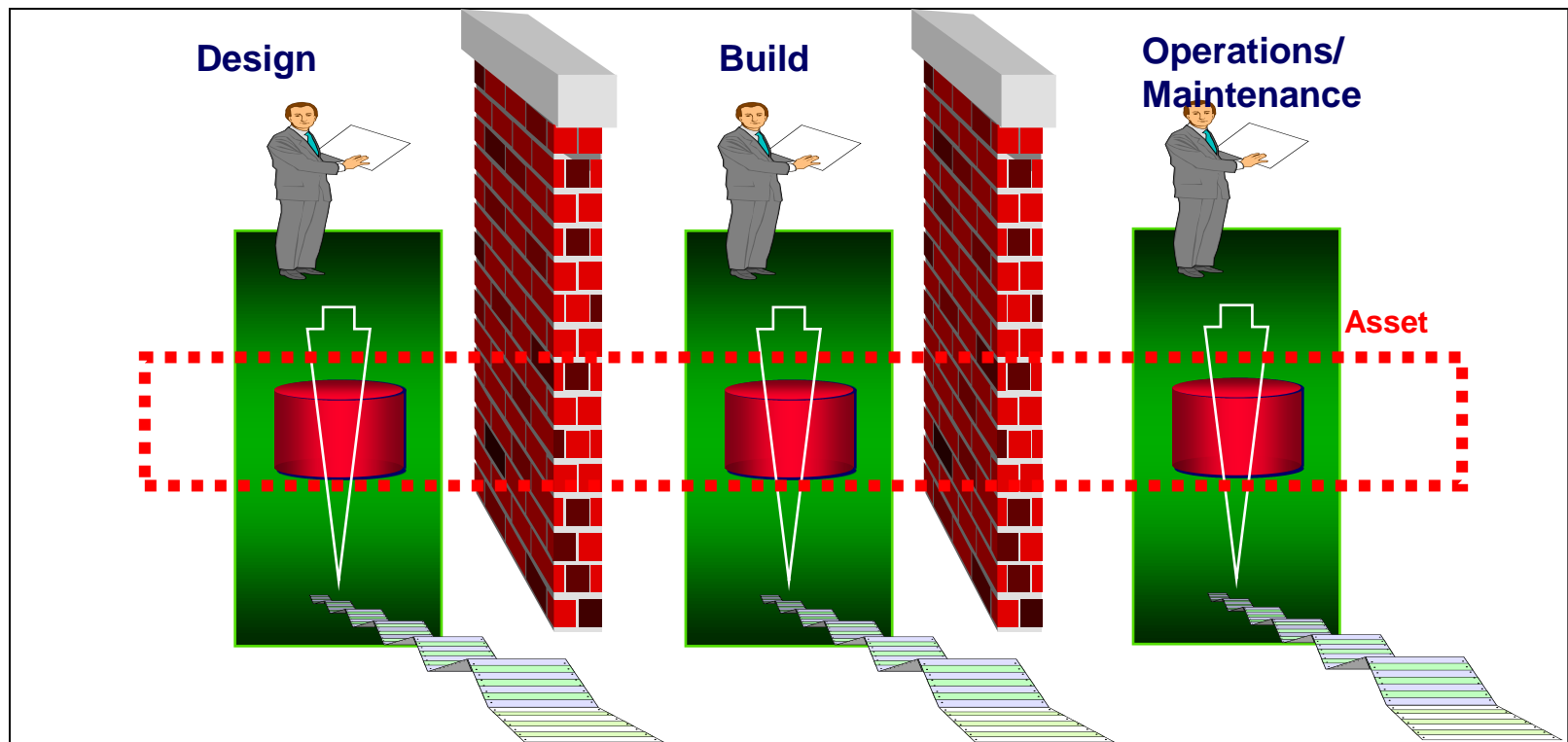
## **Portal**

### **Why Name Change?**

**Software is not only doing pavement  
design, but capacity, safety, etc as well  
!**



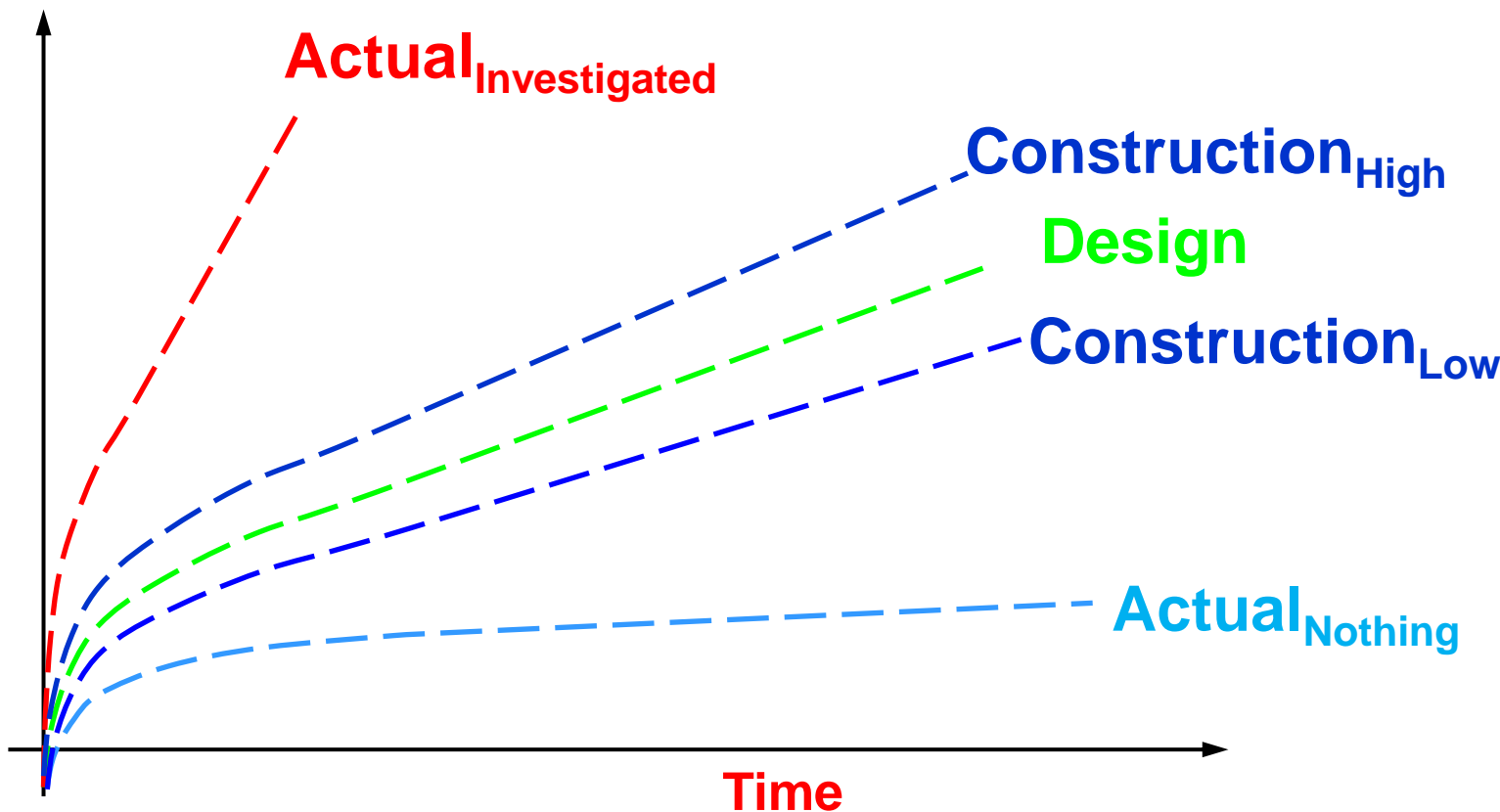
# SARDS Software Portal – Why ?



- Traditionally Road Authorities are organised according to vertical silos for administrative convenience, this results in vertical walls between silos resulting in authorities losing sight of the complete asset life cycle and focusing on delivery efficiency within each silo (doing the same thing quicker, cheaper).
- We need to ensure electronic flow of data through the life cycle

# SARDS Portal – Why ?

Damage





## WELCOME TO THE SOUTH AFRICAN ROAD DESIGN SYSTEM

### ABOUT THE SYSTEM

The South African Road Design System provides a comprehensive framework to facilitate the process of pavement design. The process is initiated with the registration of projects at the road authority for tender purpose. Projects listed for tender are open to view by accredited users and these projects are populated with available network level data. The SARDS portal provides convenient viewing capability for design engineers to gain insight into the design requirements of the project.

Once appointed for the design of a specific project, the design engineer is supported with an array of tools through the SARDS portal that incorporates the latest pavement engineering technology.

### 1. DESIGN INVESTIGATION

A data management system that allows for capturing, viewing and processing of vast volumes of data associated with the design investigation process. Data views are presented in a linear viewer format that is easy to navigate

State-of-the-art data analysis procedures including:

- Classification of visual condition data using the deduct point system
- Comprehensive deflection bowl analysis
- Dynamic homogenous section demarcation using automated change-point detection
- Point-by-point back-calculation of effective layer stiffness moduli using the latest multi-layer and numerical optimisation routines

A materials information system that:

- Allows for capturing materials test results from existing pavement layers as well as potential external material sources including borrow-pits and commercial sources
- Prepares the necessary materials related input for the performance simulation component of the SARDS

### 2. PERFORMANCE SIMULATION

Combined simulation of structural and functional pavement deterioration using rational empirical and mechanistic-empirical techniques

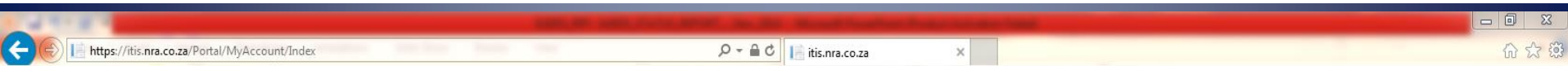
The first pavement performance simulation package intended for routine pavement design that utilises material cross-anisotropy in the primary pavement response model

A world-leading unique formulation of damage models that is based on the Markov principle and eliminates the need for the iterative, strain-hardening approach to damage modelling that is normally employed in recursive performance simulation

Economic assessment of different pavement design alternatives with consideration of road authority and road user cost

### 3. CONSTRUCTION QUALITY ASSURANCE

- Quality assurance material test units based on TMH1 and the latest SANS 3001 test methods
- Quality assurance adjudication schemes based on COLTO 8200 and 8300
- Automated quality assurance and as-built reporting



**ITIS** Louw Kannemeyer ▾

Modules / myACCOUNT

- User Details
- License Details
- License Request
- Download
- User Manuals
- Reports

## myACCOUNT - User Details

<b>USER :</b>	Louw Kannemeyer
<b>ORGANIZATION/S :</b>	• SANRAL
<b>EMAIL :</b>	louw.kannemeyer@gmail.com
<b>PHONE :</b>	27128448000
<b>MOBILE NUMBER :</b>	
<b>FAX NUMBER :</b>	27128448200
<b>RSA ID :</b>	

Photo





**ITIS** Louw Kannemeyer ▾

Modules / myACCOUNT / Download

- User Details
- License Details
- License Request
- Download**
- User Manuals
- Reports

## Download

ITIS Desktop    **SARDS Module**

### SARDS Module

Download instructions for SARDS.

**Step 1**

Download and install the prerequisites. This is required first before installing the SARDS software. However, it needs to be installed only once for future updates. Should this already be installed, you can proceed to Step 2.

**Step 2**

Download and install the SARDS software. This step must only be done once the prerequisites have been installed correctly.

Step 1:  
SARDS Prerequisites  
Size 781.6 MB  
November 2014

Step 2:  
SARDS Software  
Size 42.97 MB  
November 2014

**PLEASE NOTE!**  
You may require your IT Administrator to perform this installation as you will require administrator rights on your Windows Installation.

**ITIS** Philip Nobelis

Modules / Project Authority

04224FDF5082405DA8EEAA7A26A8A181

Search for a project:  All

- 04224FDF5082405DA8EEAA7A2...  
RRM N010 SECTION 5 TO 8
- 97D2934606EB4D6F8555210B27...  
RRM N010 SECTION 7 TO 8
- 7C906F1E006D4DFF9EA3AA86F...  
RRM N010 SECTION 5 TO 6

## Project Authority - RRM N010 SECTION 5 TO 8 (04224FDF5082405DA8EEAA7A26A8A181)

- General
- Project Timelines**
- Service Providers
- Sections
- Factors
- Maintenance Items

+ Add sub-project

### Authority

**Authority name**  
SANRAL

**Project code**  
MPROJ1

**Project number**  
04224FDF5082405DA8EEAA7A26A8A181

**Project name**  
RRM N010 SECTION 5 TO 8

**Discription**  
ROUTINE ROAD MAINTENANCE ON NATIONAL ROUTE 10 SECTION 5 TO 8, LUDLOW TO PRIES

**Project type**  
Please select

**Project office**  
Project office

### Project Functions

**Project function(s)**

- Authority Management
- Construction
- Design Investigation
- Incident Capture
- Project Information
- Routine Road Maintenance

**Project manager**

**Stand-in project manager**

Update functions



SANRAL - ITIS 5.0

itisqa.nra.co.za/itis/MyAccount/Index

Philip Nobelis

## Project Authority - RRM N010 SECTION 5 TO 8 (04224FDF5082405DA8EEAA7A26A8A181)

General | Project Timelines | Service Providers | Sections | Factors | Maintenance Items

+ Add sub-project

### Project Timeline

**Consultant tender open date**

**Consultant tender close date**

**Design appointment date**

**Construction tender open date**

**Construction tender close date**

**Construction period date**

**Construction period duration**

Update timeline

Modules / Project Authority  
04224FDF5082405DA8EEAA7A26A8A181

Search for a project All

- 04224FDF5082405DA8EEAA7A2...  
RRM N010 SECTION 5 TO 8
- 97D2934606EB4D6F855210B27...  
RRM N010 SECTION 7 TO 8
- 7C906F1E006D4DFF9EA3AA86F...  
RRM N010 SECTION 5 TO 6

Projects

Project Phases  
▸ Design Investigation  
▸ Construction

PROJECTS  
Please Select a Project

1 SELECT A PROJECT

FROM THE PROJECT DROP DOWN MENU, SELECT THE PROJECT YOU WANT TO LOAD.



THE SOUTH AFRICAN NATIONAL  
ROADS AGENCY SOC LTD  
Reg. No.1998/009584/30

User Name

Password

License Key

Login Close Login and Synchronise

2 SELECT A PHASE

FROM THE PROJECT PHASES TREE-VIEW, SELECT THE SECTION YOU WANT TO WORK IN.

3 SELECT A SECTION

SELECT A ROAD SECTION FROM THE LIST OF SECTIONS

13.590 km (56)  
53.025 km (59)

Hide Menu ▲

Projects

R.104-010-2011/1: DSCPR: Simon Vermc

Project Phases

- ▼ Design Investigation
  - ▼ LinearViewer
- ▼ Construction
  - ▼ Materials Quality Assurance
    - ▼ Asphalt
      - ▼ SANS3001
      - ▼ TMH1
    - ▼ Stabilised
      - ▼ SANS3001
      - ▼ TMH1
    - ▼ Unbound
      - ▼ SANS3001
      - ▼ TMH1

Sections

**N00122N-22-North**

0.000 km (0)  
40.838 km (40838)

**R10402E-02-East**

0.000 km (0)  
21.202 km (21202)

**N00121N-21-North**

0.000 km (0)  
43.659 km (43659)

**R10401E-01-East**

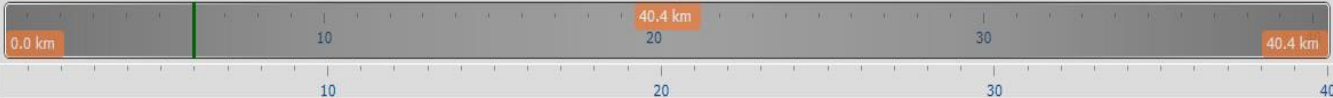
15.590 km (15590)  
42.423 km (58013)

Linear Viewer

5.75km

Workspace Print Export Reset Workspace

Road Overview



Video Player

Video Player controls: Play/Pause, Stop, Previous, Next, Full Screen, Exit Full Screen.



01-06-2010 Lane: 2

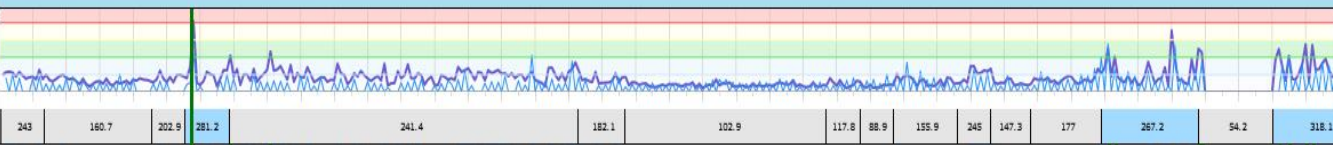
Video Road Viewer Asbuilt Visual Data Charts Heat Map Additional Data

Road Detail

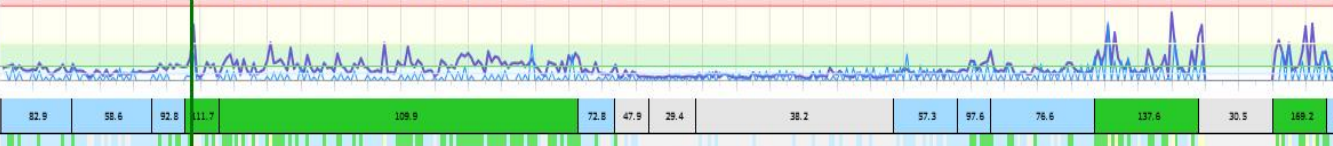
- Lane P3
- Lane P2
- Lane P1

Design Sections

- ▼ FWD D0
  - Data for 2009/03
  - Data for 2009/02



- ▼ FWD BLI
  - Data for 2009/03
  - Data for 2009/02



- ▼ FWD MLI
  - Data for 2009/03
  - Data for 2009/02





Projects

R.104-010-2011/1: DSCPR: Simon Vermc

Project Phases

- Design Investigation
  - LinearViewer
- Construction
  - Materials Quality Assurance
    - Asphalt
      - SANS3001
      - TMH1
    - Stabilised
      - SANS3001
      - TMH1
    - Unbound
      - SANS3001
      - TMH1

Sections

- N00122N-22-North**
  - 0.000 km (0)
  - 40.838 km (40838)
- R10402E-02-East
  - 0.000 km (0)
  - 21.202 km (21202)
- N00121N-21-North
  - 0.000 km (0)
  - 43.659 km (43659)
- R10401E-01-East
  - 15.590 km (15590)
  - 42.423 km (58013)

Linear Viewer

0.00km

Workspace Print Export Reset Workspace

Road Overview



Video Player



Video Road Viewer Asbuilt Visual Data Charts Heat Map Additional Data

Road Detail

- Lane P3
- Lane P2
- Lane P1

Design Sections

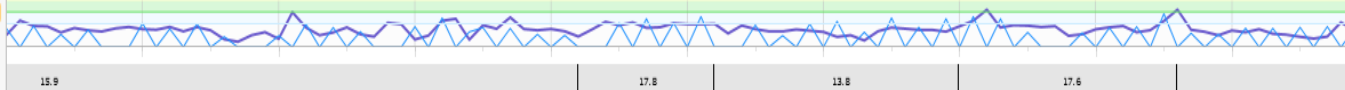
Data for 2009/02



FWD FSD

Data for 2009/03

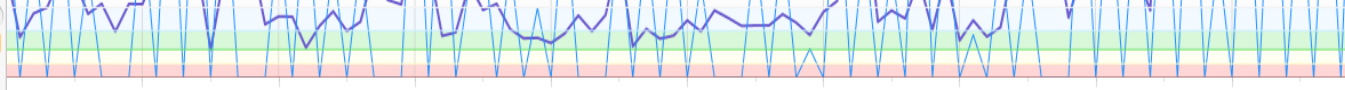
Data for 2009/02



FWD RoC

Data for 2009/03

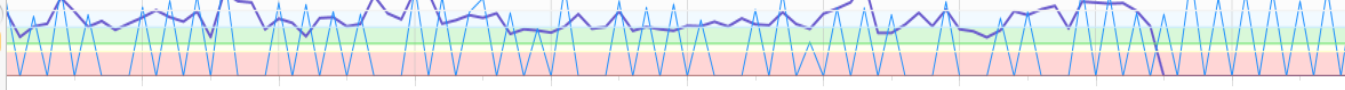
Data for 2009/02



FWD SNP Salt

Data for 2009/03

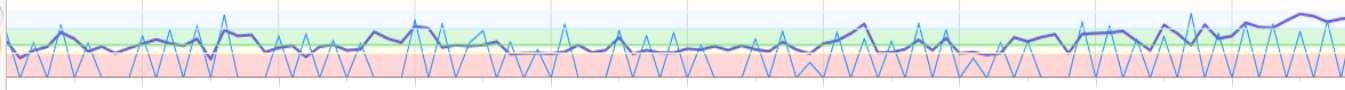
Data for 2009/02



FWD SNP Rhode

Data for 2009/03

Data for 2009/02



Surface

Projects

R.104-010-2011/1: DSCPR: Simon Vermc

Project Phases

- ▼ Design Investigation
  - ▼ LinearViewer
- ▼ Construction
  - ▼ Materials Quality Assurance
    - ▼ Asphalt
      - ▼ SANS3001
      - ▼ TMH1
    - ▼ Stabilised
      - ▼ SANS3001
      - ▼ TMH1
  - ▼ Unbound
    - ▼ SANS3001
    - ▼ TMH1

Sections

**N00122N-22-North**  
0.000 km (0)  
40.838 km (40838)

**R10402E-02-East**  
0.000 km (0)  
21.202 km (21202)

**N00121N-21-North**  
0.000 km (0)  
43.659 km (43659)

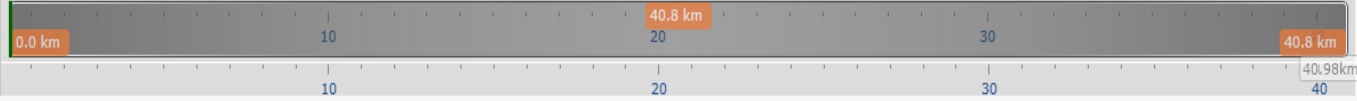
**R10401E-01-East**  
15.590 km (15590)  
42.423 km (58013)

Linear Viewer

0.00km

Workspace Print Export Reset Workspace

Road Overview



Video Player



Video Road Viewer Asbuilt Visual Data Charts Heat Map Additional Data

Road Detail

- Lane P3
- Lane P2
- Lane P1

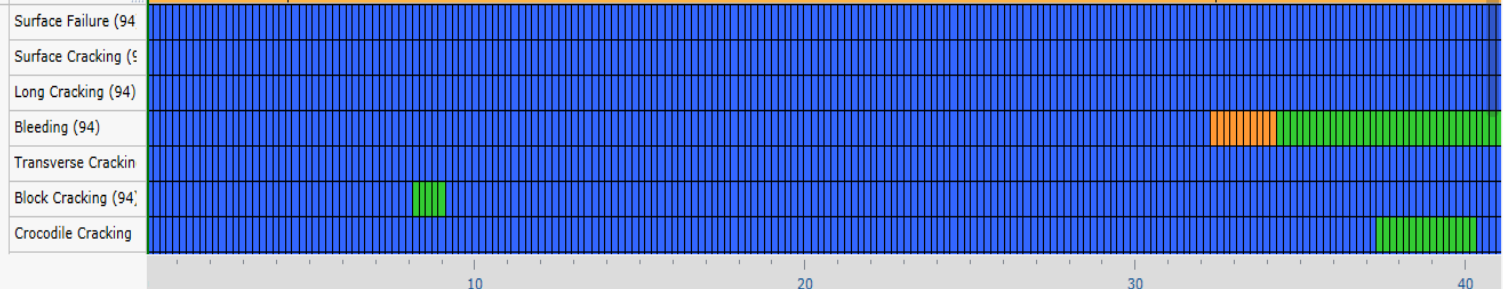
Design Sections



Asbuilt Viewer

Surface	60mm Surface (2002)	25mm Surface (1975)	40mm Surface (2002)
Base	200mm Base (2002)	125mm Base (1975)	300mm Base (2002)
Subbase	125mm Subbase (1975)		
Subbase	225mm Subbase (2002)	150mm Subbase (1975)	
Selected	150mm Selected (1975)		
Selected	150mm Selected (1975)	150mm Selected (1975)	100mm Selected (1975)

Visual Data



Hide Menu

Projects

R.104-010-2011/1: DSCPR: Simon Vermc

Project Phases

- ▼ Design Investigation
  - ▼ LinearViewer
- ▼ Construction
  - ▼ Materials Quality Assurance
    - ▼ Asphalt
      - ▼ SANS3001
      - ▼ TMH1
    - ▼ Stabilised
      - ▼ SANS3001
      - ▼ TMH1
  - ▼ Unbound
    - ▼ SANS3001
    - ▼ TMH1

Sections

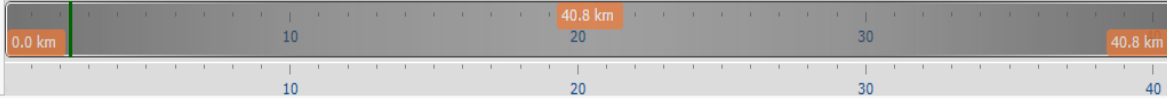
- N00122N-22-North**  
0.000 km (0)  
40.838 km (40838)
- R10402E-02-East  
0.000 km (0)  
21.202 km (21202)
- N00121N-21-North  
0.000 km (0)  
43.659 km (43659)
- R10401E-01-East  
15.590 km (15590)  
42.423 km (58013)

Linear Viewer

1.91km

Workspace Print Export Reset Workspace

Road Overview



Video Player



Video Road Viewer Asbuilt Visual Data Charts Heat Map Additional Data

Road Detail

- Lane P3
- Lane P2
- Lane P1

Design Sections

PV HS DS

FWD D0

**Graph Properties**

Data Sources: Homogenous

Homogenous Calculation

Moving Average: 55

Weight: 3.5

Outlier Factor: 10

Section Factor (km): 1

Min Length (km): 0.5

Apply



Projects

R.104-010-2011/1: DSCPR: Simon Vermc

Project Phases

- ▼ Design Investigation
  - ▼ LinearViewer
- ▼ Construction
  - ▼ Materials Quality Assurance
    - ▼ Asphalt
      - ▼ SANS3001
      - ▼ TMH1
    - ▼ Stabilised
      - ▼ SANS3001
      - ▼ TMH1
  - ▼ Unbound
    - ▼ SANS3001
    - ▼ TMH1

Sections

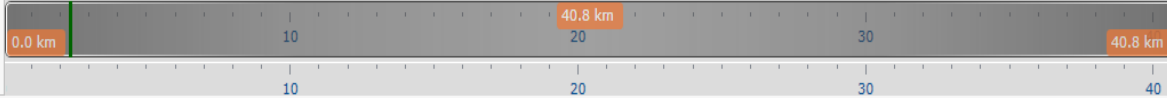
- N00122N-22-North**  
0.000 km (0)  
40.838 km (40838)
- R10402E-02-East**  
0.000 km (0)  
21.202 km (21202)
- N00121N-21-North**  
0.000 km (0)  
43.659 km (43659)
- R10401E-01-East**  
15.590 km (15590)  
42.423 km (58013)

Linear Viewer

1.91km

Workspace Print Export Reset Workspace

Road Overview



Video Player



Video Road Viewer Asbuilt Visual Data Charts Heat Map Additional Data

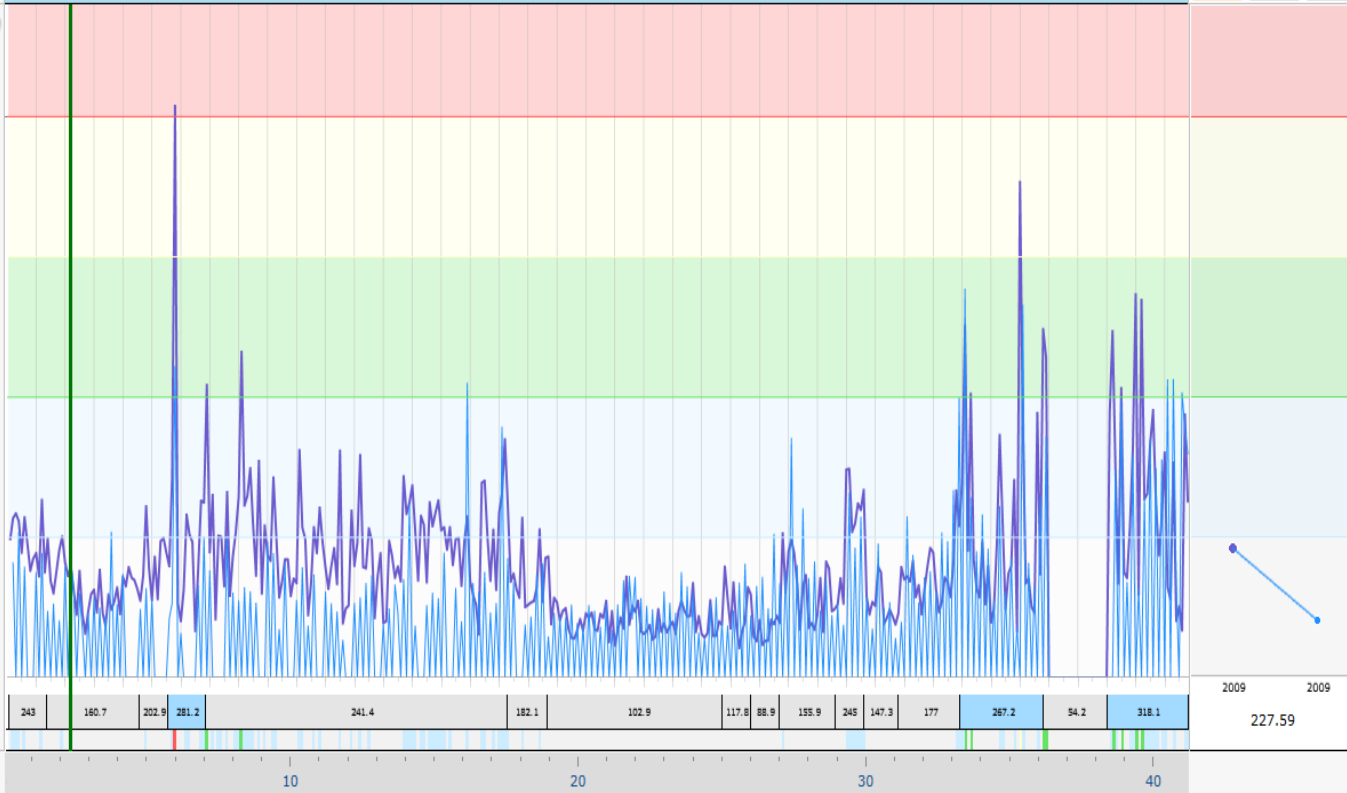
Road Detail

- Lane P3
- Lane P2
- Lane P1

Design Sections

- ▼ FWD D0
- Data for 2009/03
- Data for 2009/02

PV HS DS



Projects

R.104-010-2011/1: DSCPR: Simon Vermc ▾

Project Phases

- ▾ Design Investigation
  - ▾ LinearViewer
- ▾ Construction
  - ▾ Materials Quality Assurance
    - ▾ Asphalt
      - ▾ SANS3001
      - ▾ TMH1
    - ▾ Stabilised
      - ▾ SANS3001
      - ▾ TMH1
    - ▾ Unbound
      - ▾ SANS3001
      - ▾ TMH1

Sections

**N00122N-22-North**  
0.000 km (0)  
40.838 km (40838)

**R10402E-02-East**  
0.000 km (0)  
21.202 km (21202)

**N00121N-21-North**  
0.000 km (0)  
43.659 km (43659)

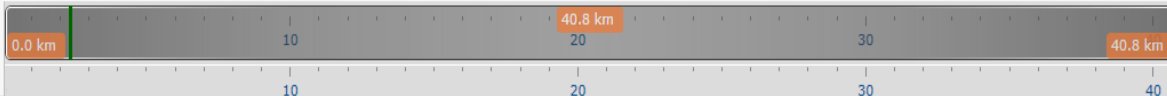
**R10401E-01-East**  
15.590 km (15590)  
42.423 km (58013)

Linear Viewer

1.91km

Workspace Print Export Reset Workspace

Road Overview



Video Player



Video Road Viewer Asbuilt Visual Data Charts Heat Map Additional Data

Road Detail

- Lane P3
- Lane P2
- Lane P1

Design Sections



Hide Menu ▲

Projects

R.104-010-2011/1: DSCPR: Simon Vermc ▾

Project Phases

- ▾ Design Investigation
  - ▾ LinearViewer
- ▾ Construction
  - ▾ Materials Quality Assurance
    - ▾ Asphalt
      - ▾ SANS3001
      - ▾ TMH1
    - ▾ Stabilised
      - ▾ SANS3001
      - ▾ TMH1
    - ▾ Unbound
      - ▾ SANS3001
      - ▾ TMH1

Sections

- N00122N-22-North**  
0.000 km (0)  
40.838 km (40838)
- R10402E-02-East  
0.000 km (0)  
21.202 km (21202)
- N00121N-21-North  
0.000 km (0)  
43.659 km (43659)
- R10401E-01-East  
15.590 km (15590)  
42.423 km (58013)

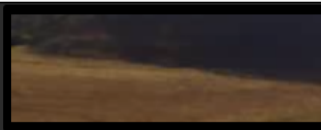
Linear Viewer

1.91km

Road Overview



Video Player



Road Detail

- Lane P3
- Lane P2
- Lane P1

Design Sections

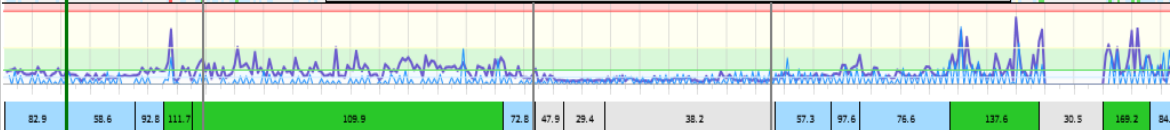
Data for 2009/02



FWD BLI

Data for 2009/03

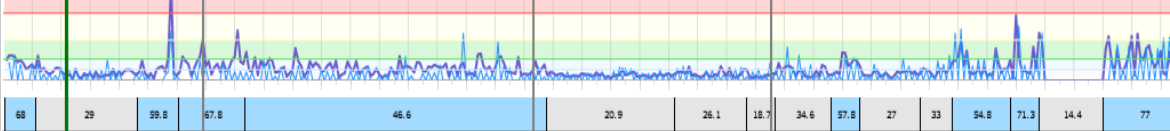
Data for 2009/02



FWD MLI

Data for 2009/03

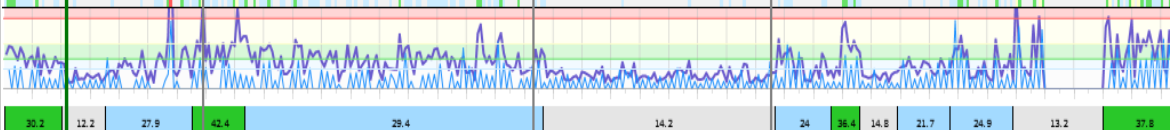
Data for 2009/02



FWD LLI

Data for 2009/03

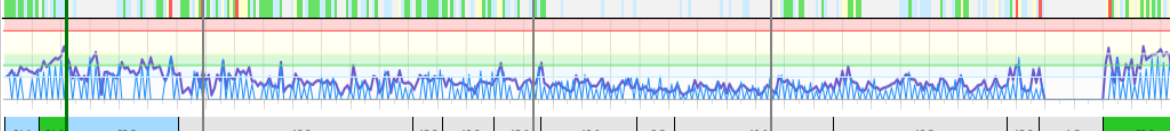
Data for 2009/02



FWD FSD

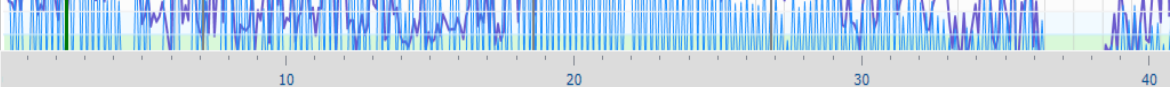
Data for 2009/03

Data for 2009/02



FWD RoC

Data for 2009/03



Workspace Configuration

Features Video Homogenous Sections

Video: N00122N2\_2010\_06.wmv

Partially Downloaded

Cancel All Changes Apply All Changes

Workspace Print Export Reset Workspace

0.0 km 10

40.8 km 40

Charts Heat Map Additional Data

PV HS DS

2009 2009

227.59

82.48

45.54

31.81

36.25

Hide Menu ▲



Projects

R.104-010-2011/1: DSCPR: Simon Vermc

Project Phases

- Design Investigation
  - LinearViewer
- Construction
  - Materials Quality Assurance
    - Asphalt
      - SANS3001
      - TMH1
    - Stabilised
      - SANS3001
      - TMH1
    - Unbound
      - SANS3001
      - TMH1

Sections

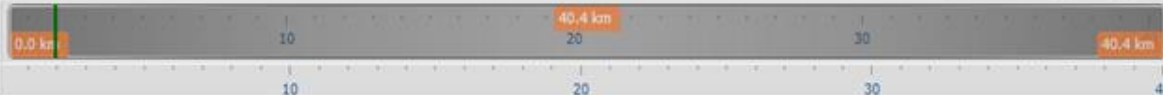
- N00122N-22-North**
  - 0.000 km (0)
  - 40.838 km (40838)
- R10402E-02-East
  - 0.000 km (0)
  - 21.202 km (21202)
- N00121N-21-North
  - 0.000 km (0)
  - 43.659 km (43659)
- R10401E-01-East
  - 15.590 km (15590)
  - 42.423 km (58013)

Linear Viewer

1.58km

Workspace Print Export Reset Workspace

Road Overview



Video Player



01-06-2010 Lane: 2

Video Road Viewer Asphalt Visual Data Charts Heat Map Additional Data

Road Detail

- Lane P3
- Lane P2
- Lane P1

Design Sections

- FWD D0
  - Data for 2009/03
  - Data for 2009/02
- FWD BLI
  - Data for 2009/03
  - Data for 2009/02
- FWD MLI
  - Data for 2009/03
  - Data for 2009/02



**Camtasia Studio Tip**  
 Press F9 to pause/resume recording.  
 Press F10 to stop recording.

Hide Menu





Innovation for Quality and Value - - - 16 - 19 August 2015 - - - Sun City - South Africa →

Contact Us

## SANRAL SARDM Workshop

South African Pavement Design Method Revision

Thursday 20 August 2015

### Overview

South Africa has a long pavement engineering history in terms of developing methodologies and solutions for supporting the local economy using available materials under specific environmental and socio-economic conditions. Over the past 5 years an improved mechanistic-empirical design method has been developed, based on the latest available local and international research and design trends. Improvements incorporate changes to traffic models (including follower density, tire contact stress and dynamic load models), materials models (unbound and stabilized granular materials - including chord modulus stiffness and shear strength models and suction pressure, density and saturation effects; asphalt - modified Witczak/Hirsh and ageing models; surfacing seals - a finite element model and recursive simulation), analysis techniques (incorporating sub-layering / overburden / residual compaction stress, an anisotropic approach to asphalt and stabilized layers and recursive simulation incorporating "memory-less" damage models), and overall management of the process (linking all aspects through a software portal incorporating design investigation / performance simulation / and economic analysis modules, construction quality assurance models and integration with asset management system). The responses of the new models are benchmarked using field sections based on the new design method. The workshop will focus on dissemination of these latest developments and enable sharing of the technology with a larger audience

### Tentative Programme

#### A: New Material Models: Unbound Granular Materials

- Chord modulus stiffness model