

South African Pavement Design Method (SAPDM)

Revision Update

Louw Kannemeyer
29th RPF
13th May 2015

Aka GODZILLA



Current South African Pavement Design Procedure

GRANULAR BASES (MODERATE OR DRY REGIONS)											DATE 1996
PAVEMENT CLASS AND DESIGN BEARING CAPACITY (80 kN AXLES/LANE)											
ROAD CAT.	ES0.003 < 3000	ES0.01 0,3-1,0x10 ⁴	ES0.03 1,0-3,0x10 ⁴	ES0.1 3,0-10x10 ⁴	ES0.3 0,1-0,3x10 ⁶	ES1 0,3-1,0x10 ⁶	ES3 1,0-3,0x10 ⁶	ES10 3,0-10x10 ⁶	ES30 10-30x10 ⁶	ES100 30-100x10 ⁶	Foundation
A							40A 125 G2 150 C3 40A 150 G2 150 G5	40A 150 G2 250 C3	50A 150 G1 250 C3	50A 150 G1 300 C3	
B						S 125 G4 150 C4	S*/30A 150 G3 150 C4	40A 150 G2 200 C4			150 G7
C				S 100 G5 125 C4	S 125 G5 125 C4	S 125 G4 125 C4	S 150 G3 150 C4				
				S 125 G4 125 G6	S 125 G4 150 G6	S 125 G4 150 G5	S 150 G3 150 G5				
D	S1 100 G5 100 G7	S1 100 G5 125 G7	S1 100 G4 125 G7	S1 100 G4 125 G6	S 125 G4 125 G6	S 125 G4 150 G6					150 G9 G10
				S1 100 G5 100 C4	S 100 G5 125 C4	S 125 G4 150 C4					

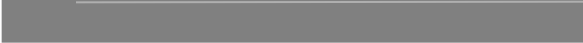
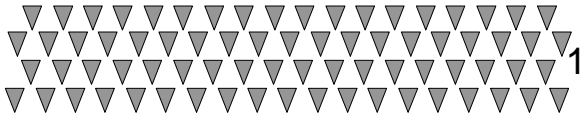

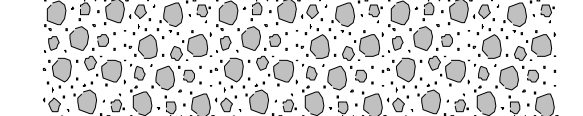
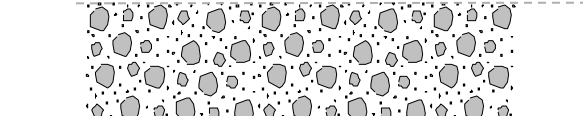
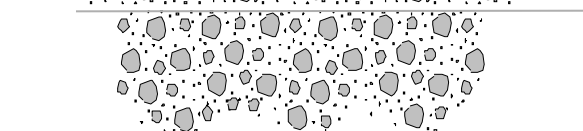
Catalogue Encourages The Use of "Virgin" material and limits innovation

Symbol A denotes AG, AC, OR AS. A0, AP may be recommended as a surfacing measure for improved skid resistance when wet or to reduce water spray.
 S denotes Double Surface Treatment (seal or combinations of seal and slurry)
 S1 denotes Single Surface Treatment
 * If seal is used, increase C4 and G5 subbase thickness to 200mm.

Typical South African Pavement and SAMDM

South African Pavement Structure

Current ME Damage Model

	10-40 mm Wearing course	Asphalt Fatigue – Freeme 1970s
	150 mm Crushed stone base	Permanent Deformation FOS Maree 1970s to 1980s
	150 - 300 mm Cemented subbase	Effective Fatigue and Crushing Failure De Beer 1980s
	150 mm Granular upper selected subgrade	Vertical Strain Criteria Dorman and Metcalf 1965
	150 mm Granular lower selected subgrade	Vertical Strain Criteria Dorman and Metcalf 1965
	In situ subgrade	Vertical Strain Criteria Dorman and Metcalf 1965

In addition to age of models current SAMDM has number of limitations, i.e. no damage models for plastic deformation in Asphalt layers, number of models outdated, no models for “Foam”, “ETB”, Surface Seals, etc, etc

SAMDM – Lipstick on a PIG ?



Outdated models with new Software Interface

SAPDM Revision - Progress To Date

Research

- Basic research completed by most teams, Surface Seals still in progress - work only started April 2011
- **May 2015 = 116 Reports**

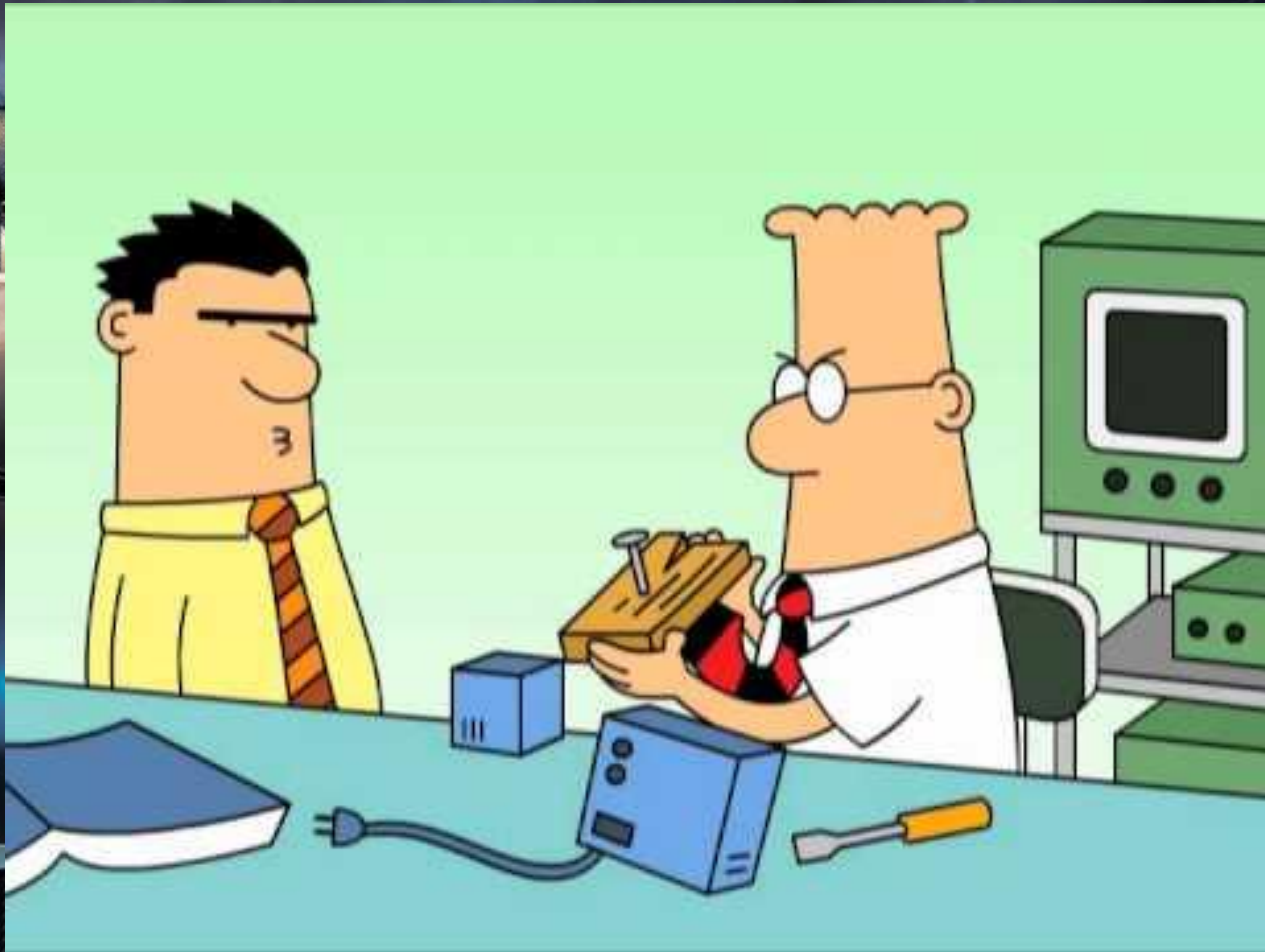
Field Trials

- Environmental = 41 Sites - **Completed**
- Experimental Sections
 - R35 Stabilisation = Oct 2012 - **Monitoring Ongoing**
 - R104 Instrumented Typical Pavements = Aug 2013 – **Traffic Speed Deflectometer Measurements**

Software Development

- **Software coding in progress ...**

NEED FOR SPEED WORLD™





South African Road Design System (SARDS)

Portal

Why Name Change?

To differentiate the software portal from the pavement design revision, as software is not only doing pavement design, but capacity, safety, etc as well !

Asset Management Cycle and SARDS

Closing the Loop



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

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

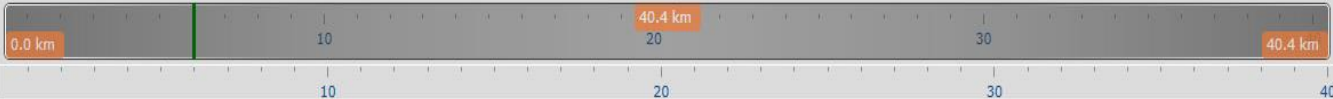
15.590 km (15590)
42.423 km (58013)

Linear Viewer

5.75km

Workspace Print Export Reset Workspace

Road Overview



Video Player

Video playback controls including play/pause, stop, and navigation buttons.



01-06-2010 Lane: 2

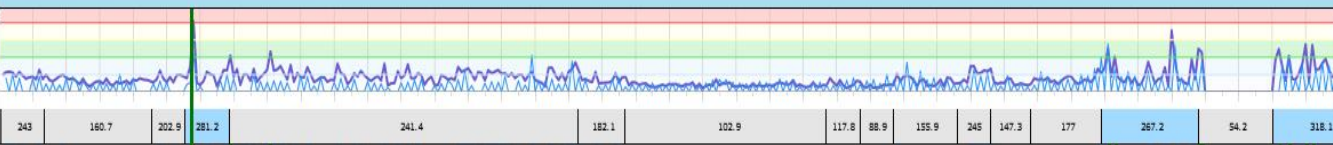
Video Road Viewer Asbuilt Visual Data Charts Heat Map Additional Data

Road Detail

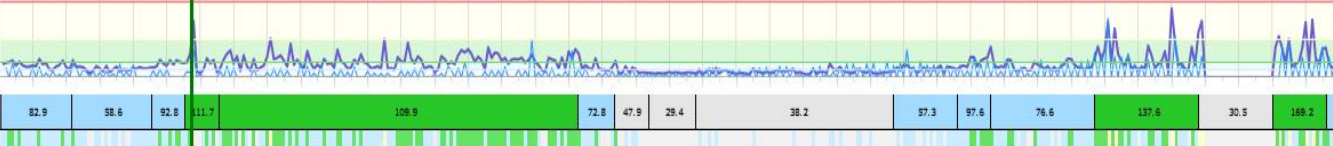
- Lane P3
- Lane P2
- Lane P1

Design Sections

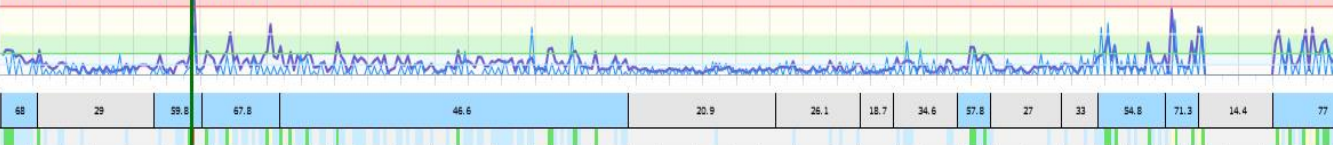
- ▼ FWD D0
 - Data for 2009/03
 - Data for 2009/02



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



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



Hide Menu

Projects

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

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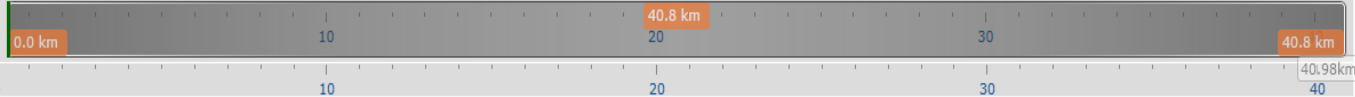
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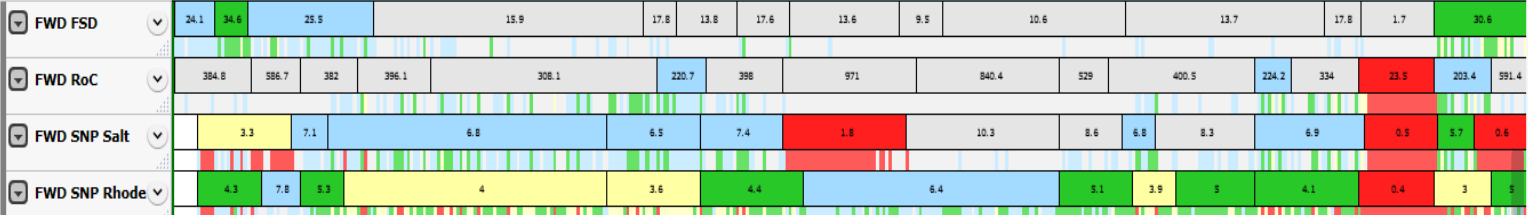


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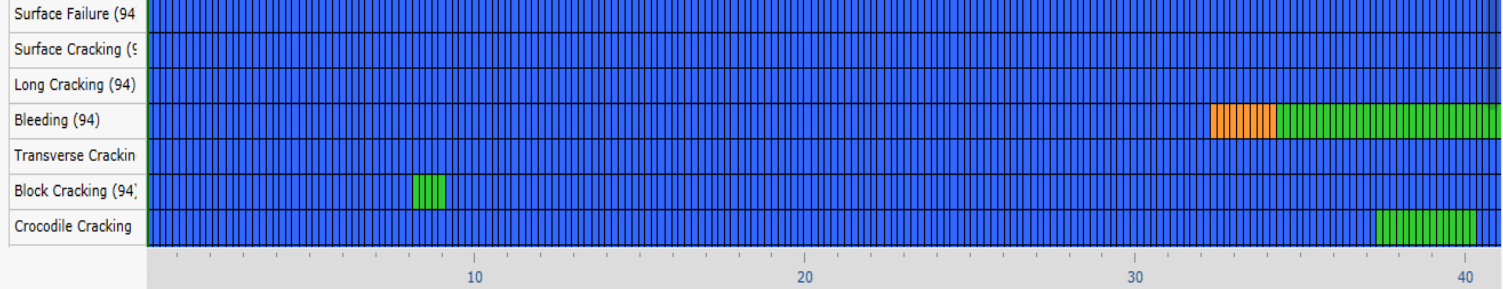
Design Sections



Asbuilt Viewer

Layer	Material	Start (km)	End (km)
Surface	60mm Surface (2002)	0.000	4.000
Surface	25mm Surface (1975)	4.000	33.000
Surface	40mm Surface (2002)	33.000	40.838
Base	200mm Base (2002)	0.000	4.000
Base	125mm Base (1975)	4.000	33.000
Base	300mm Base (2002)	33.000	40.838
Subbase	125mm Subbase (1975)	0.000	4.000
Subbase	225mm Subbase (2002)	4.000	33.000
Subbase	150mm Subbase (1975)	33.000	40.838
Selected	150mm Selected (1975)	0.000	4.000
Selected	150mm Selected (1975)	4.000	33.000
Selected	100mm Selected (1975)	33.000	40.838

Real Data



SARDS Detail Feedback

Title	Presenter
R35 Status Feedback	H Theyse
Surface Seals	G van Zyl



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

Thank you!

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