

HVSIA 2009

# HVSIA DESIGN CATALOGUE FEEDBACK

3 to 5 November 2009



100  
1908 - 2008



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
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# HVSIA design catalogue feedback

- Background
- Current status
- Recommendations



# Background

- Joe Mahoney idea in 2007
- Can we create a design catalogue based on all available data?
- What will it look like?
- etc
  
- 2008 feedback
  - Preliminary evaluation
  - Too early to do this
  - Not sure
  
- 2009
  - Final year undergraduate student
  - First preliminary/proposed/initial/(whatever else) version



## Current status

- Objectives of student project
- Data used
- Approach followed
- Outputs



## Objectives & scope

- Final year undergraduate dissertation project (limited scope)
- Develop a pavement selection catalogue based on historic HVS data
- Enable wider use of available HVS data to potential users without enough funding or experience for own development
- Analyse available data from HVSIA matrix regarding historic HVS test reports
- Develop generic pavement selection catalogue that can be used as a first-level indication of suitable pavement structures for various conditions
- Only evaluations on test reports

# Data

- Base-layers considered
  - Granular, Emulsion stabilised granular and Asphalt base-layers
- Type of surfacing used as secondary category
- Temperatures determined according to the temperature at which the tests were conducted
- Moisture conditions reflect the presence of water during a HVS test
- Only rutting failure mechanism
- Data as shown in current HVS reports available through the HVSIA matrix



# Approach

- Focussed on rut performance of base and surfacing combination - measured on surface of the pavement
- Rut performance to 10 mm and 20 mm surface rut
- Extrapolated based on slope where required



# Approach

- **Step 1** - Data acquisition
- **Step 2** – Group tests together - base-layer type
- **Step 3** - Identify tests not done at 40 kN - transform repetitions to E80s
- **Step 4** – Evaluate data sets. Calculate rut rate. Extrapolate where required. Determine repetitions before reaching 10 and 20 mm rut
- **Step 5** – Use repetitions and temperature and place test in correct position in 3-D matrix. ID whether test section is resistant to water
- **Step 6** – Evaluate 3-D matrix for duplication of tests. Evaluate duplicates and select most appropriate structure
- **Step 7** - Compare data with SAPDM pavements
- **Step 8** – ID gaps and use SAPDM to fill gaps



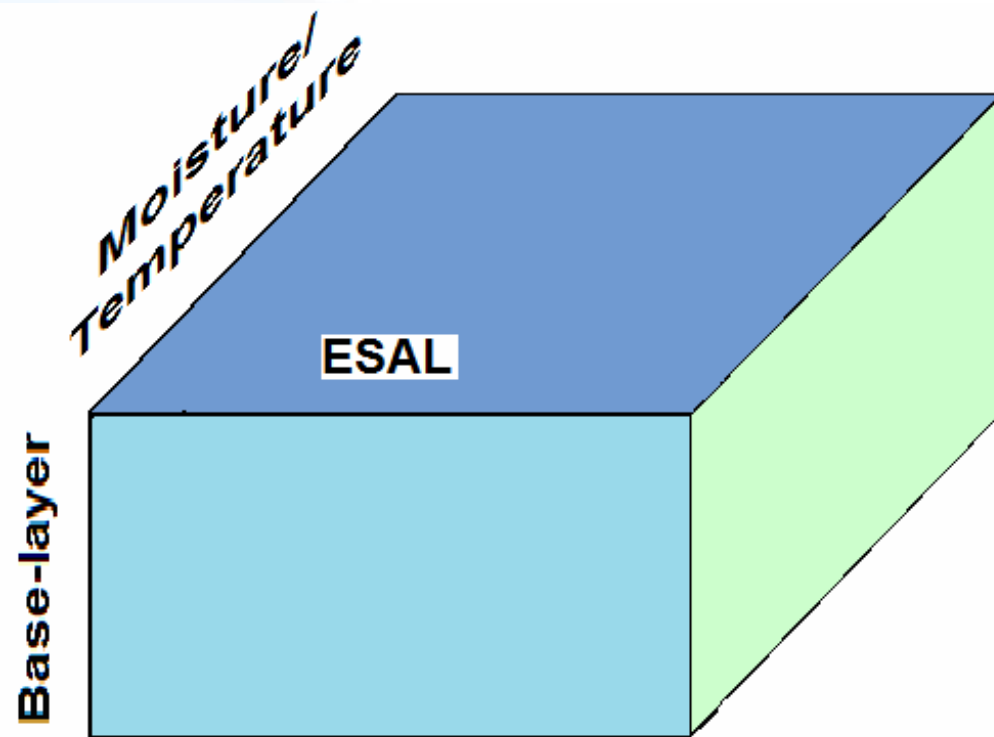


## Approach

- $RUT = (RUT\ RATE) * (\text{number of repetitions required}) + (\text{Rut at the start of secondary creep})$
- Wherever data on rut performance were stopped prematurely and data did not at least reach 5 mm of rut, data only used as secondary data point
  - only placed in matrix if no other data-point desires the same orientation. Where another data-point that is not secondary requires the same orientation, the secondary data-point will be removed



# Approach



# Outputs

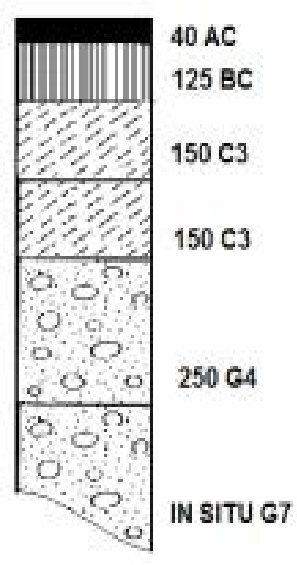
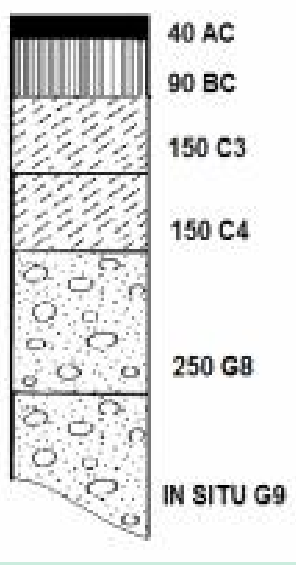
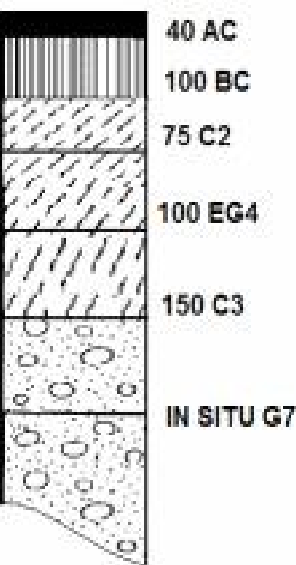
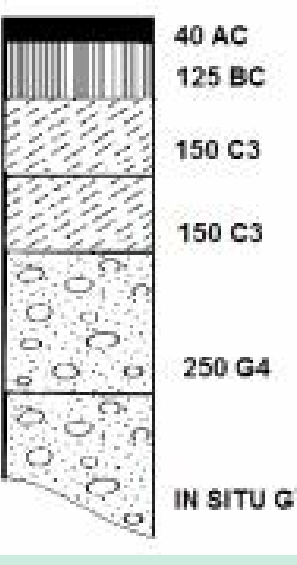
- Quick indication of the various pavements in the catalogues
- Not necessarily the same material classifications currently
- Maybe some questions regarding some of the structures – specific objectives in the test
- Granular base layer inputs

Road agency	Test station	Number of tests	Test numbers				
FDOT	FDOT, APT test facility	15	1A to 1C	2A to 2C	3A to 3C	4A to 4C	5A to 5C
Gautrans	P159/1, West of Pta	6	STD(CS)	STD(TS)	RR(CS)	RR(TS)	RRP(CS)
Finland and Sweden	Otaniemi	2	01	02			
Gautrans	S702, Near Bultfontein	4	387A4	389A4	390A4	392A4	
Caltrans	Richmond Field Station (RFS)	1	590RF				

80kN AXLES/LANE (10<sup>6</sup>)

	ES0.003	ES0.01	ES0.03	ES0.1	ES0.3	ES1	ES3	ES10	ES30	ES100
<b>Base-layer</b>	Surfacing type 03	(0.003-0.01)	(0.01-0.03)	(0.03-0.1)	(0.1-0.3)	(0.3-1)	(1-3)	(3-10)	(10-30)	(30-100)
<b>Asphalt</b>										
<b>Asphalt</b>										
<b>Granular</b>										
<b>Modified asphalt</b>										
<b>Emulsion stabilised Asphalt</b>										
<b>Granular</b>										

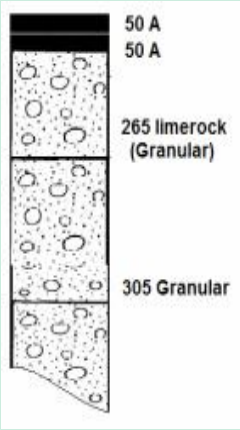
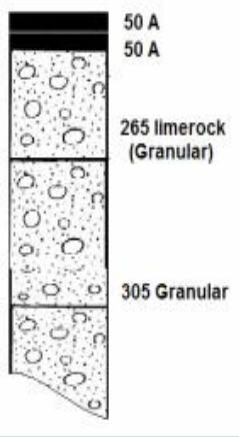
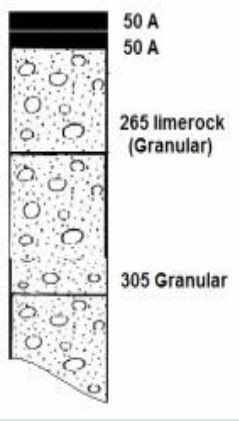
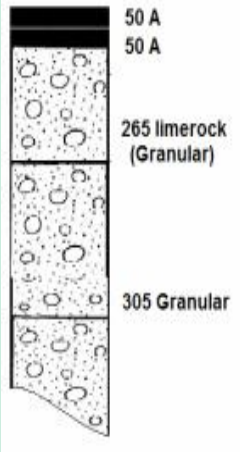


Traffic [E80s]	0.03 to 0.1 Wet ✓ SA	1 to 3 ✓ SA	3 to 10 ✓ SA	10 to 30 Dry ✓ SA
AC surfacing AC base	 <p>40 AC 125 BC 150 C3 150 C3 250 G4 IN SITU G7</p>	 <p>40 AC 90 BC 150 C3 150 C4 250 GB IN SITU G9</p>	 <p>40 AC 100 BC 75 C2 100 EG4 150 C3 IN SITU G7</p>	 <p>40 AC 125 BC 150 C3 150 C3 250 G4 IN SITU G7</p>



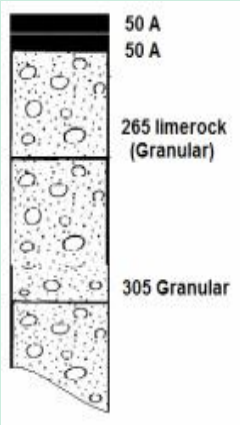
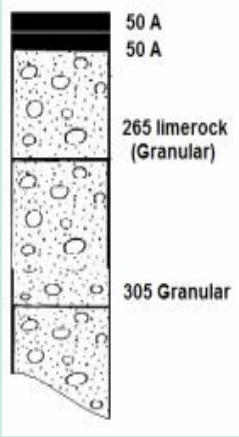
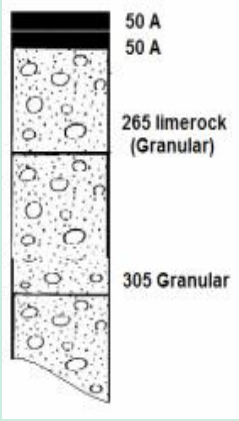
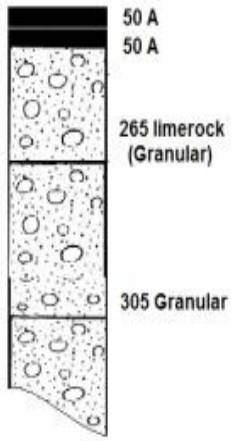
Traffic [E80s]	0.003 to 0.01 <i>FDOT</i>	0.01 to 0.03 <i>Gauteng</i>	0.03 to 0.1 <i>Gauteng</i>	0.1 to 0.3 <i>FDOT</i>	0.3 to 1 <i>Gauteng</i>	1 to 3 <i>VTI</i>	3 to 10 <i>Caltrans</i>
AC surfacing Granular base							
Layers	100 AC 265 limerock 305 granular <b>WET</b>	30 S 150 weathered granite 620 weathered granite <b>WET</b>	40 AC 150 G4 100 G8 150 G9 200 G9 <b>DRY</b>	100 265 limerock 305 granular AC <b>DRY</b>	30 S 150 weathered granite 620 weathered granite <b>DRY</b>	50 AC 250 G2 Fine sand <b>DRY</b>	90 AG 78 DGAC 349 G2 In situ clay <b>DRY</b>



Traffic [E80s]	0.01 to 0.03 <i>FDOT</i> 4A, 4B, 5B	0.03 to 0.1 <i>FDOT</i> 2A, 3A, 3B	0.1 to 0.3 <i>FDOT</i> 1B, 2B, 4C, 5C	1 to 3 <i>FDOT</i> 1C, 2C, 3C
Modified AC surfacing Granular base				
Layers	100 AC 265 limerock 305 granular	100 AC 265 limerock 305 granular	100 AC 265 limerock 305 granular	100 AC 265 limerock 305 granular

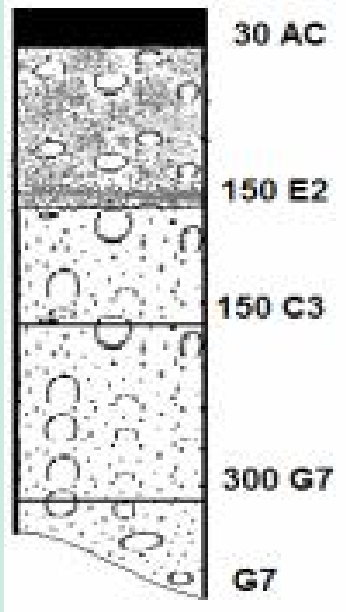
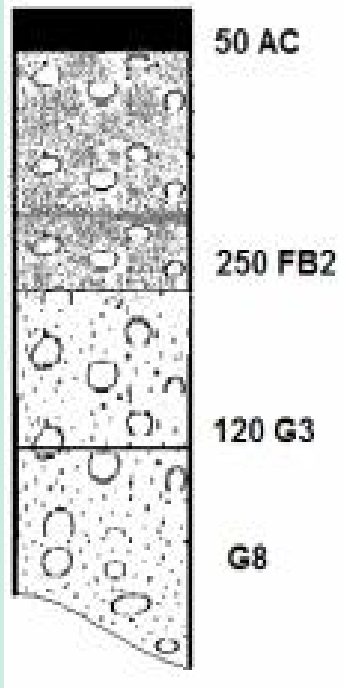
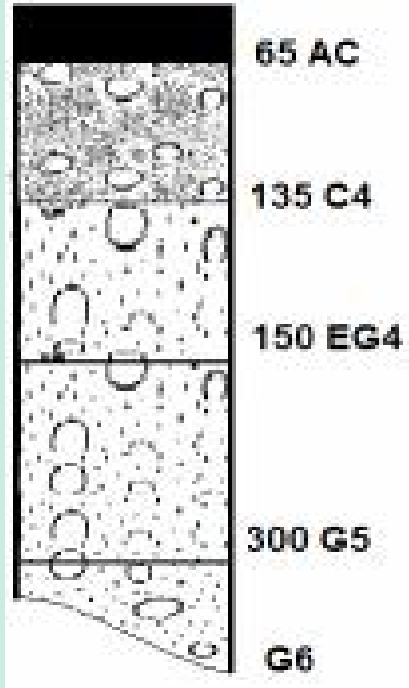
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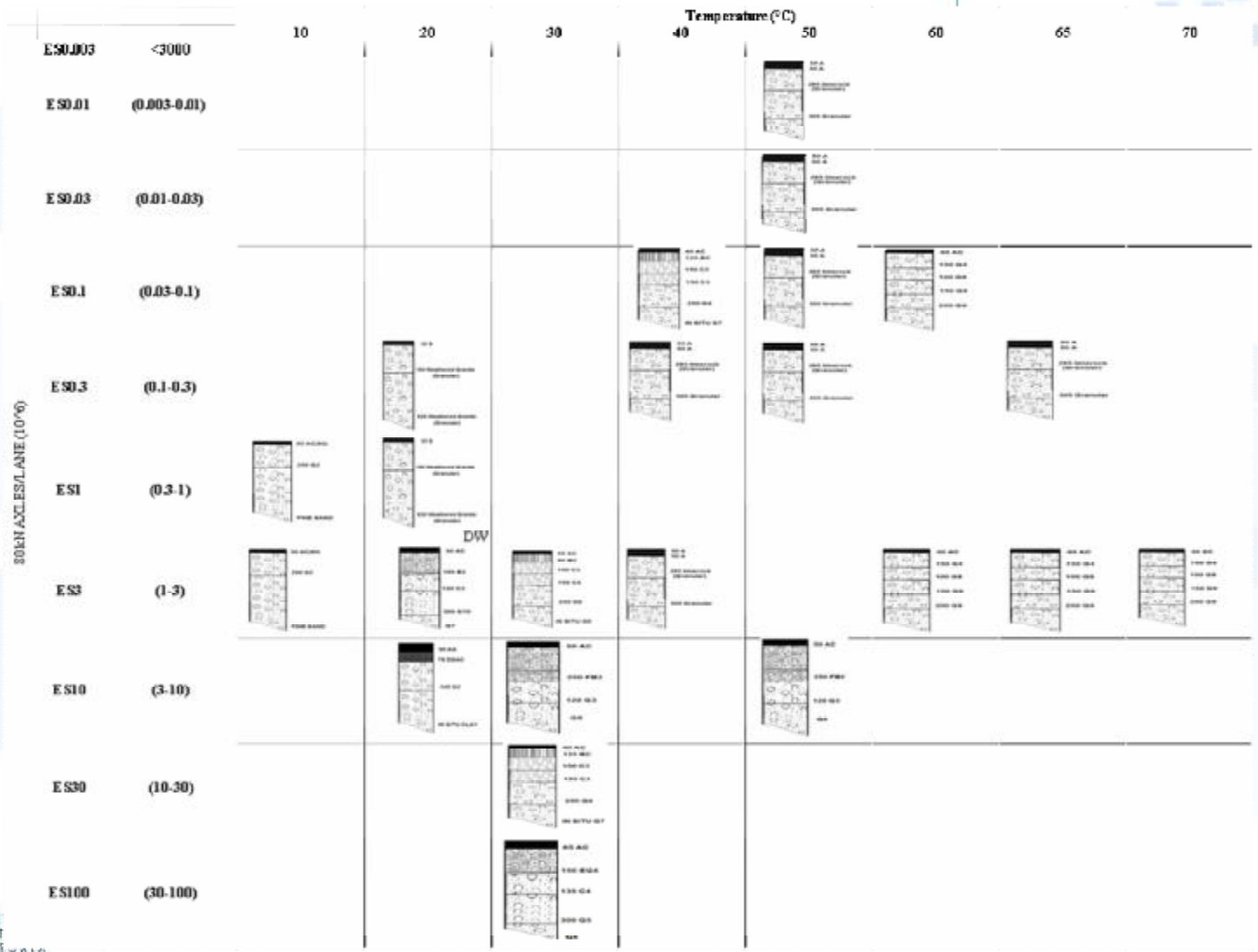
Traffic [E80s]	0.01 to 0.03 <i>FDOT</i> 4A, 4B, 5B	0.03 to 0.1 <i>FDOT</i> 2A, 3A, 3B	0.1 to 0.3 <i>FDOT</i> 1B, 2B, 4C, 5C	1 to 3 <i>FDOT</i> 1C, 2C, 3C
Modified AC surfacing Granular base				
Test conditions	50°C	50°C	65°C Ambient	Ambient
AC detail	1 – PG 67-22 2 – PG 67-22	1 – PG 76-22 2 – PG 76-22  1 – PG 76-22 2 – PG 67-22	1 – PG 76-22 2 – PG 76-22  1 – PG 67-22 2 – PG 67-22	1 – PG 76-22 2 – PG 76-22  1 – PG 76-22 2 – PG 67-22

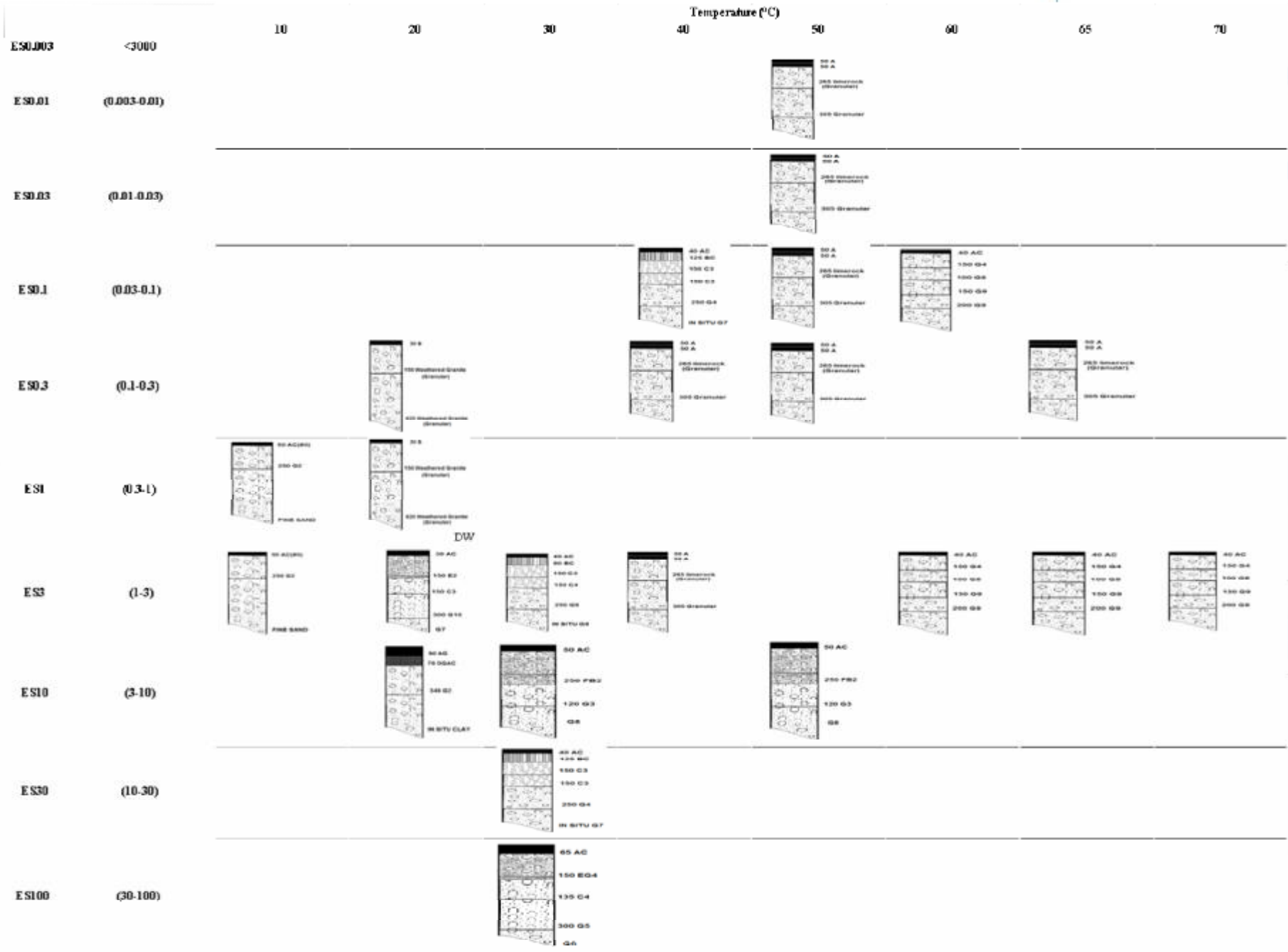




Traffic [E80s]	1 to 3 ✓ <i>Gauteng</i>	3 to 10 ✓ <i>Gauteng</i>	30 to 100 ✓ <i>Gauteng</i>
AC surfacing Emulsion stabilized Granular base	 <p>30 AC 150 E2 150 C3 300 G7 G7</p>	 <p>50 AC 250 FB2 120 G3 G8</p>	 <p>65 AC 135 C4 150 EG4 300 G5 G6</p>

# Temperature based matrix





# Conclusions

- Problem with HVS test reports data
  - each test different focus
- Data obtained from historic HVS test reports could be further evaluated and were comparable to data from pre-existing pavement design catalogues and pavement design software
- Pavement structures that were used to fill the 3-D matrix can thus be used as a pavement selection catalogue
- Pavement selection catalogue will aid potential users without enough funding or experience to draw relevant conclusions as a first level indicator for which pavement structure to use



# Recommendations

- Further development of asphalt base-layers for mePADS is needed for accurate life predictions
- The inclusion of a grading parameter into mePADS as well as an option for design reliability
- When HVS tests are evaluated with the same objectives as this report it is recommended that all failure modes be considered
- All of the pavement structures that have been tested over the last 10 to 15 years that had better results than that obtained from the TRH4 pavement design catalogue should be included in an updated version of the TRH4 pavement design catalogue

# Recommendations

- Feedback at TRB 2010
  - Committee meeting and DAWG
- Further work for APT 2012?

