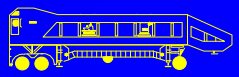
Development of a Long-term Accelerated Pavement Testing Programme and Structural Design Models

Paper I-1

S V Kekwick, H L Theyse and E G Kleyn

(presented by Dr M de Beer)



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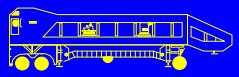
Introduction

- HVS development since late 1960s;
- Three production machines operational from late 1970s to 1990s, plus prototype;
- Latest SA HVS commissioned 1999, with ***dynamic load simulation*** capability;

- Underpins SA pavement engineering efforts and developments
  - a significant track record;



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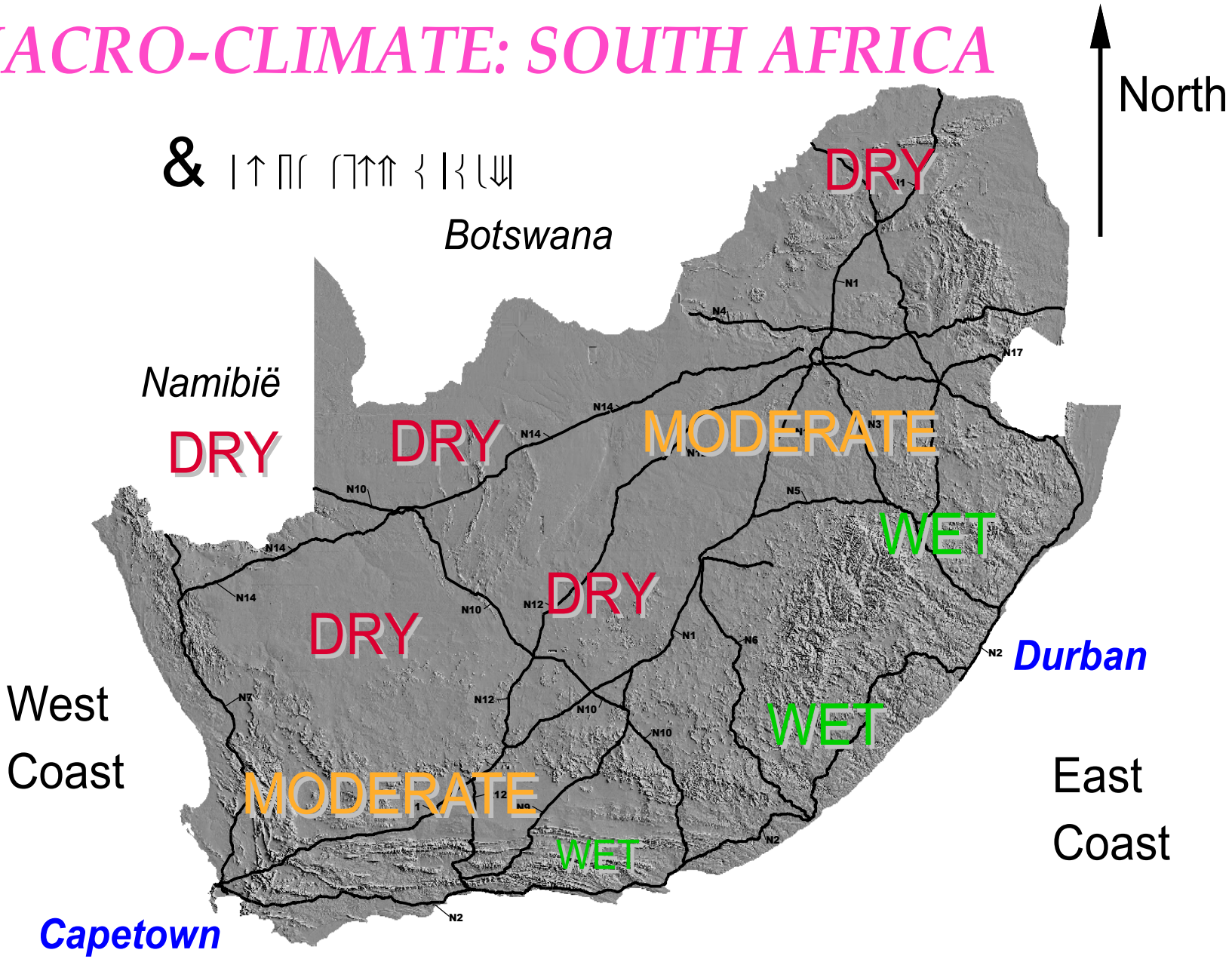
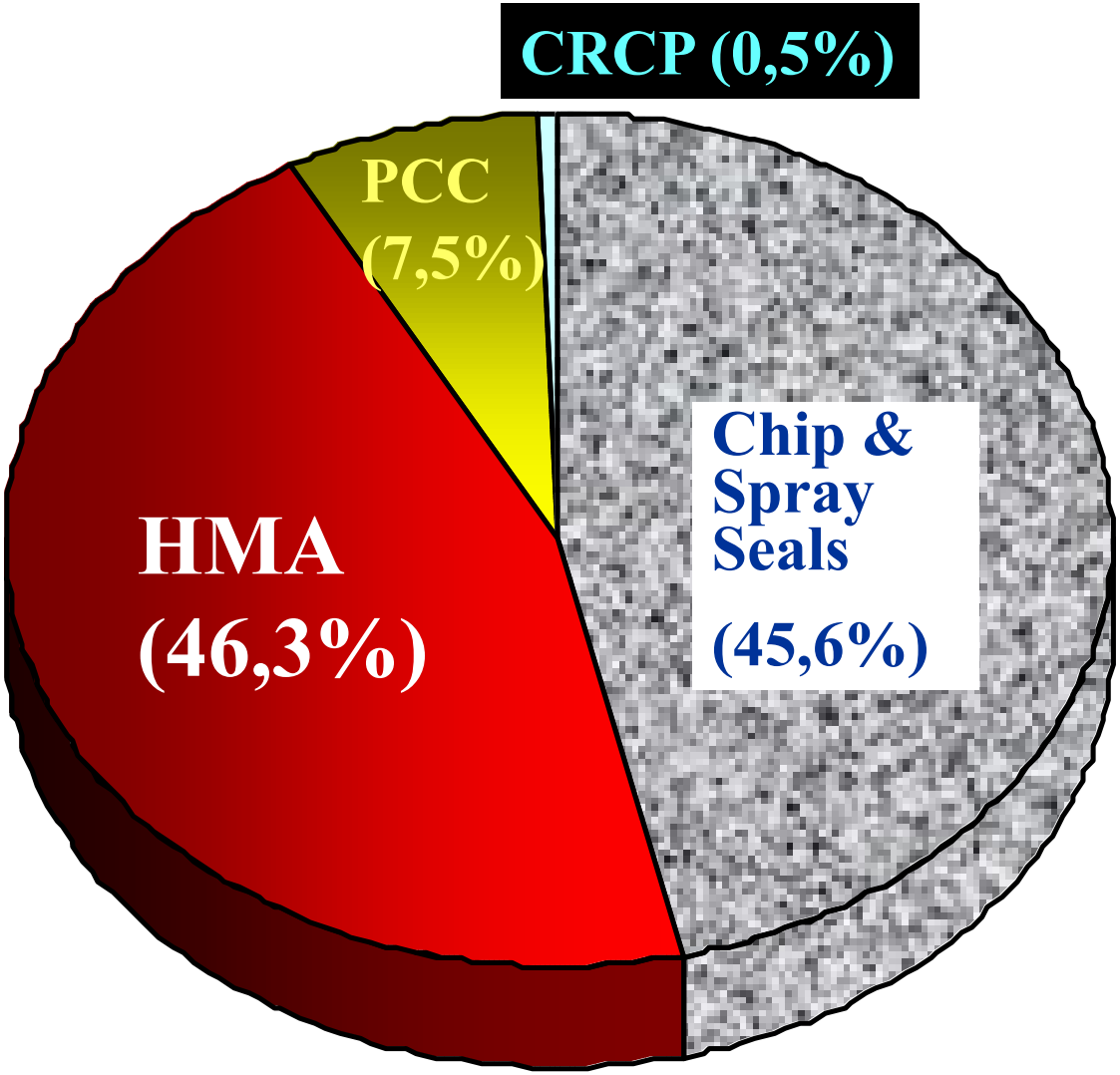
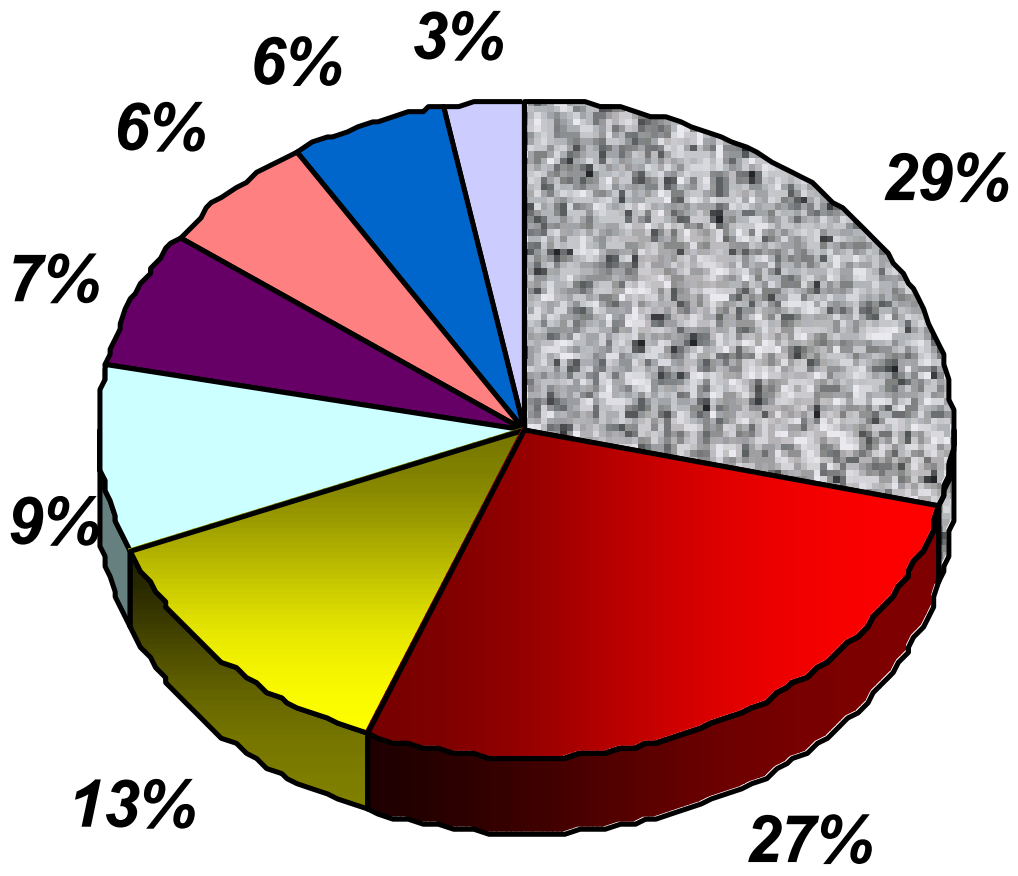
MACRO-CLIMATE: SOUTH AFRICA



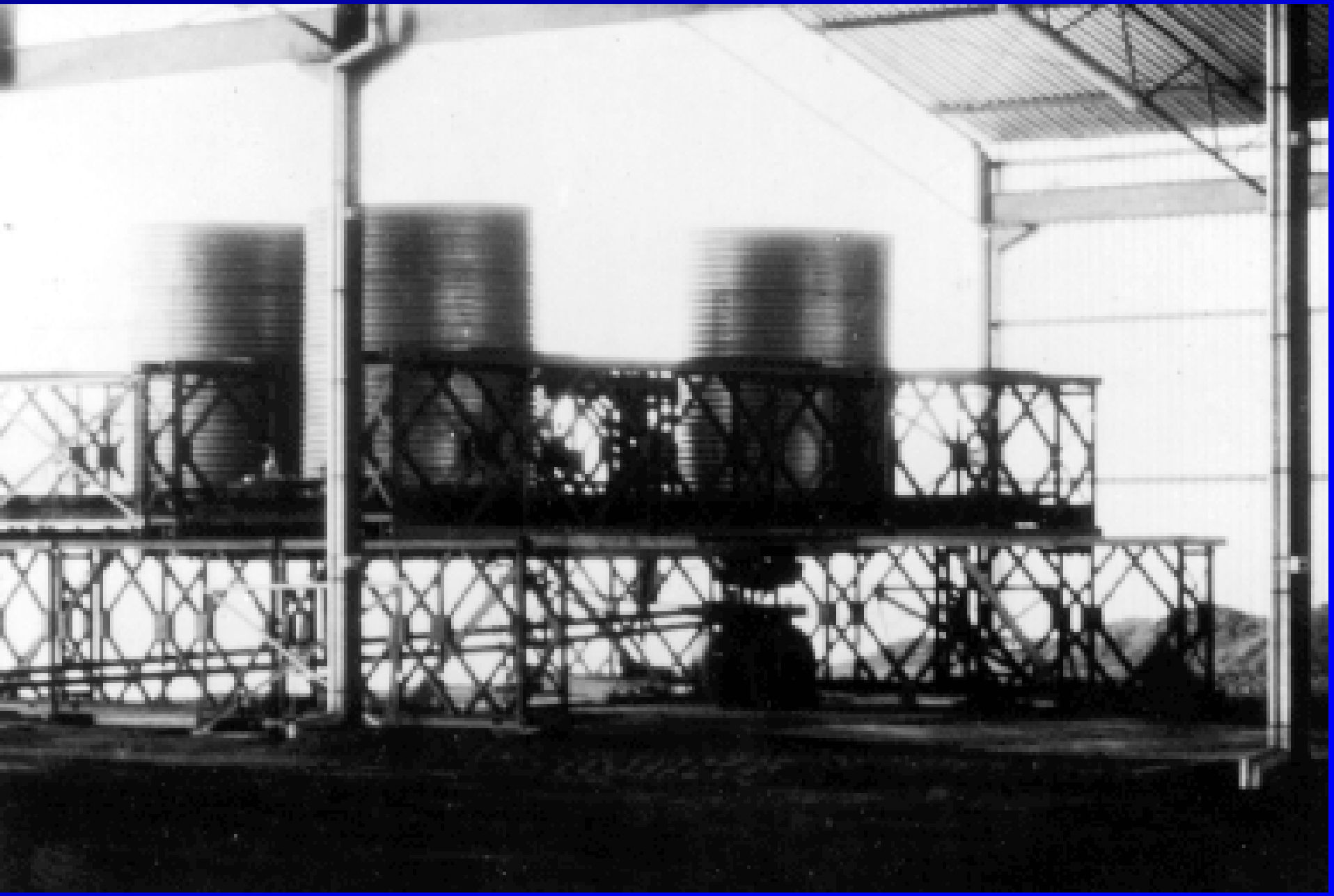
Surfacing Types of National Roads in South Africa (1997/8)

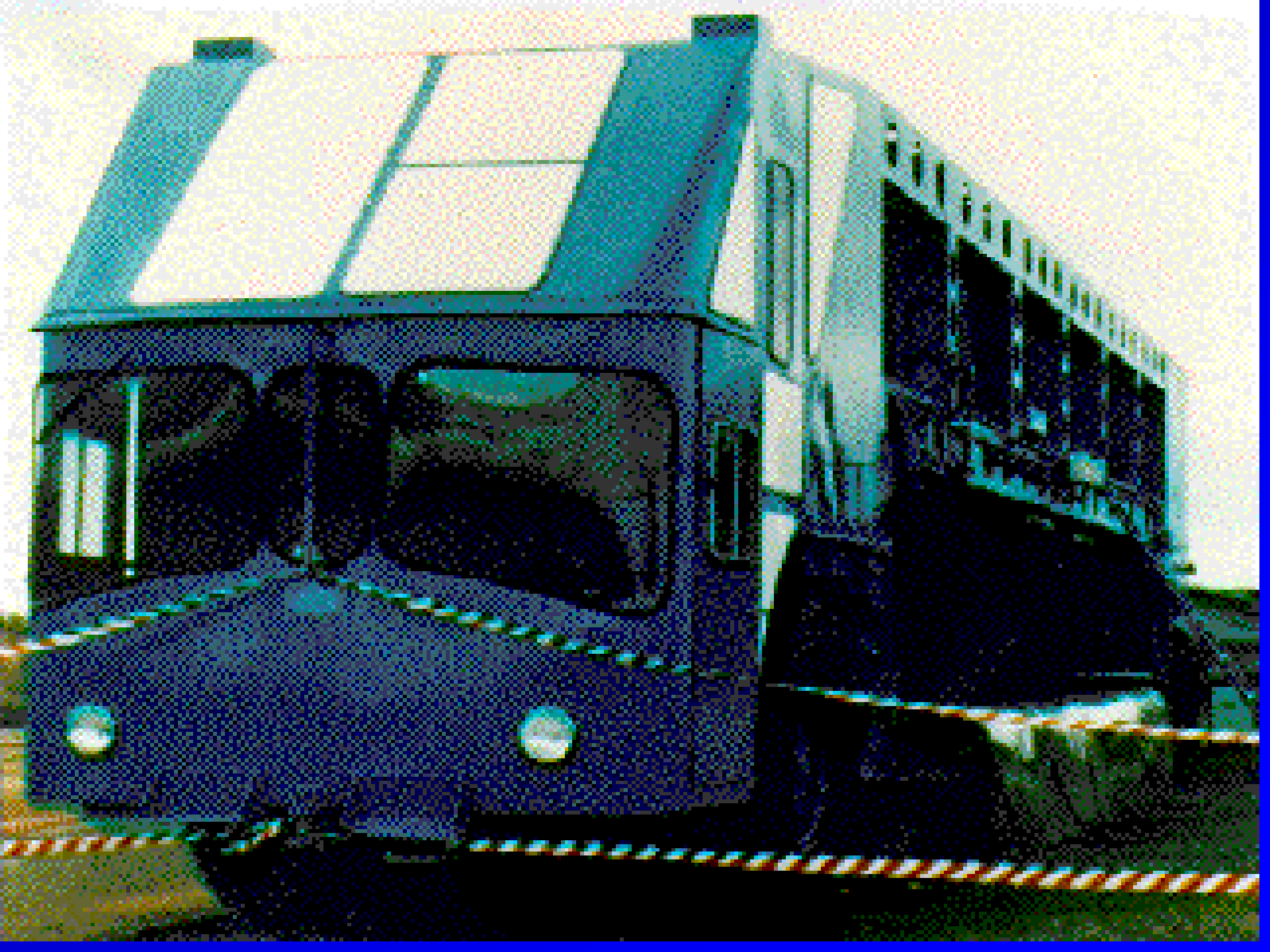


Base and Subbase Types of National Roads in South Africa (1997/8)



- G1/G2 Base on Stab Subbase (29%)
- G1/G2 Base on Nat gravel Subbase (27 %)
- HMA (13 %)
- PCC (9 %)
- C3/C4 Base on Nat gravel Subbase (7 %)
- C3/C4 Base on Stab gravel Subbase (6%)
- G3/G4/G5 Base on Nat Gravel Subbase (6%)
- G3/G4/G5 on Stab Subbase (3%)



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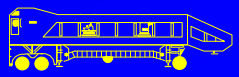
HVS - Mk IV
VTT
Heavy Vehicle Simulator
Dynatest / CSIR
HVS - Mk IV
VTT
Heavy Vehicle Simulator

This paper.....

- reviews factors that contributed to long-term success of SA HVS programme
- describes strategic and operational components of the programme
- discusses some specific examples of development of design transfer functions



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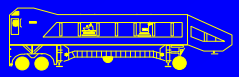
Objectives of the SA HVS programme

- ***Long-term:*** development of structural design models and transfer functions appropriate for local applications;
- ***Short-term:*** address specific pavement needs and problems as identified;
- **Ultimate goal**
  - to achieve optimal pavement design and most cost-effective structures



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Before.....

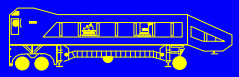
.....after

HVS 1979

1994

Components of the SA HVS programme

- Steering Committee/Project Champions will define:
  - Goals
  - Specific tasks/purposes
  - Policies
  - Strategic plans
  - Work programme/activities
  - Operational statistics
  - Deliverables/end products



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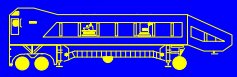
Components of the SA HVS programme

- Technology Transfer/Implementation
  - Test level: interaction of champions and Steering Committee
  - Test level: broader dissemination through presentations, workshops, site demonstrations
  - Longer-term: development of generic design parameters, higher degree work
  - Longer-term: inclusion in National guidelines



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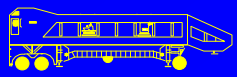
Some significant SA APT-related developments

- Mechanistic - Empirical analysis
- Damaging effect exponent quantification
- Dynamic Cone Penetrometer (DCP) design and analysis
- National guidelines/specifications
- Stress-In-Motion (SIM) technology
- Technology management
- Design transfer functions



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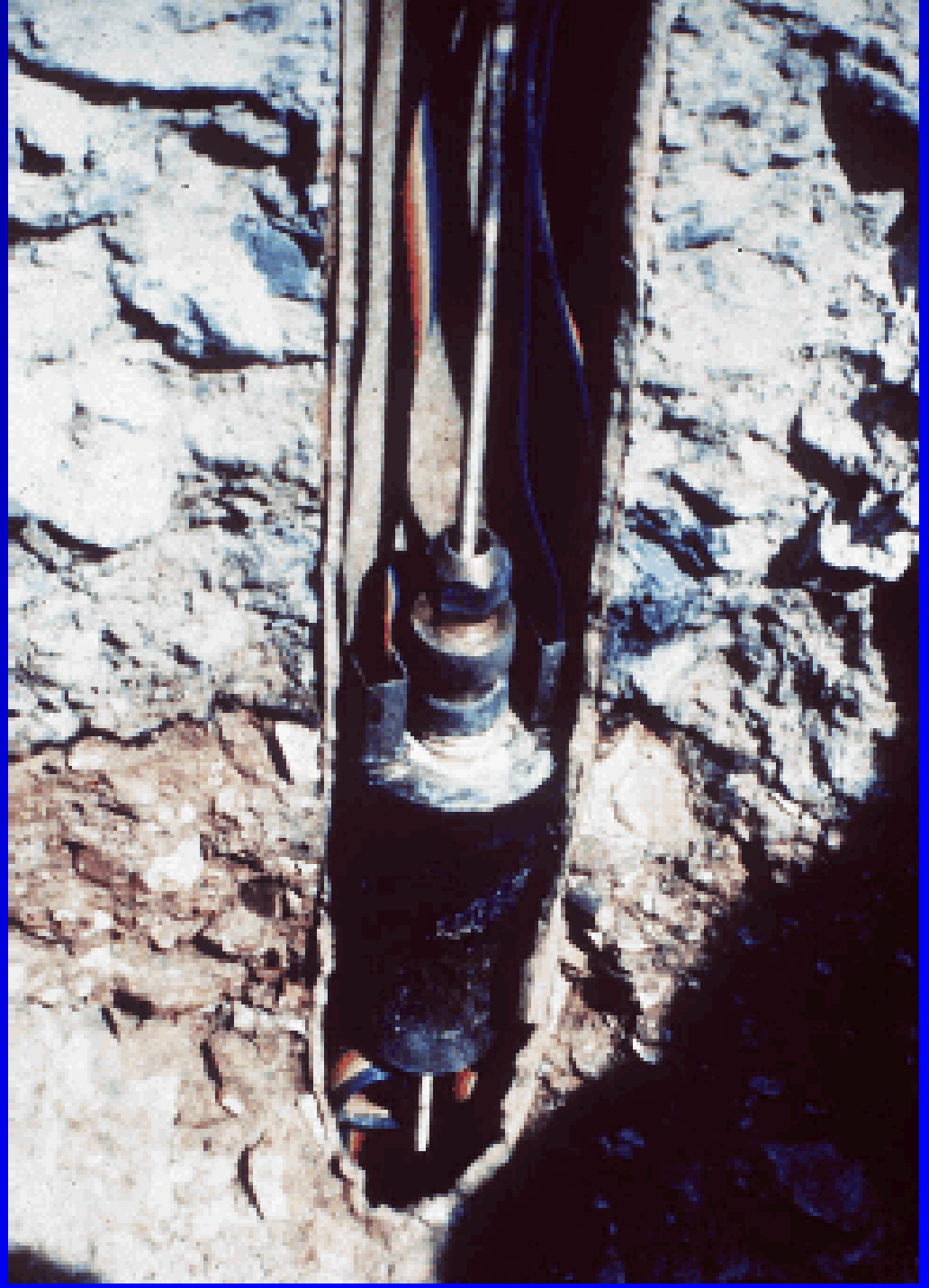
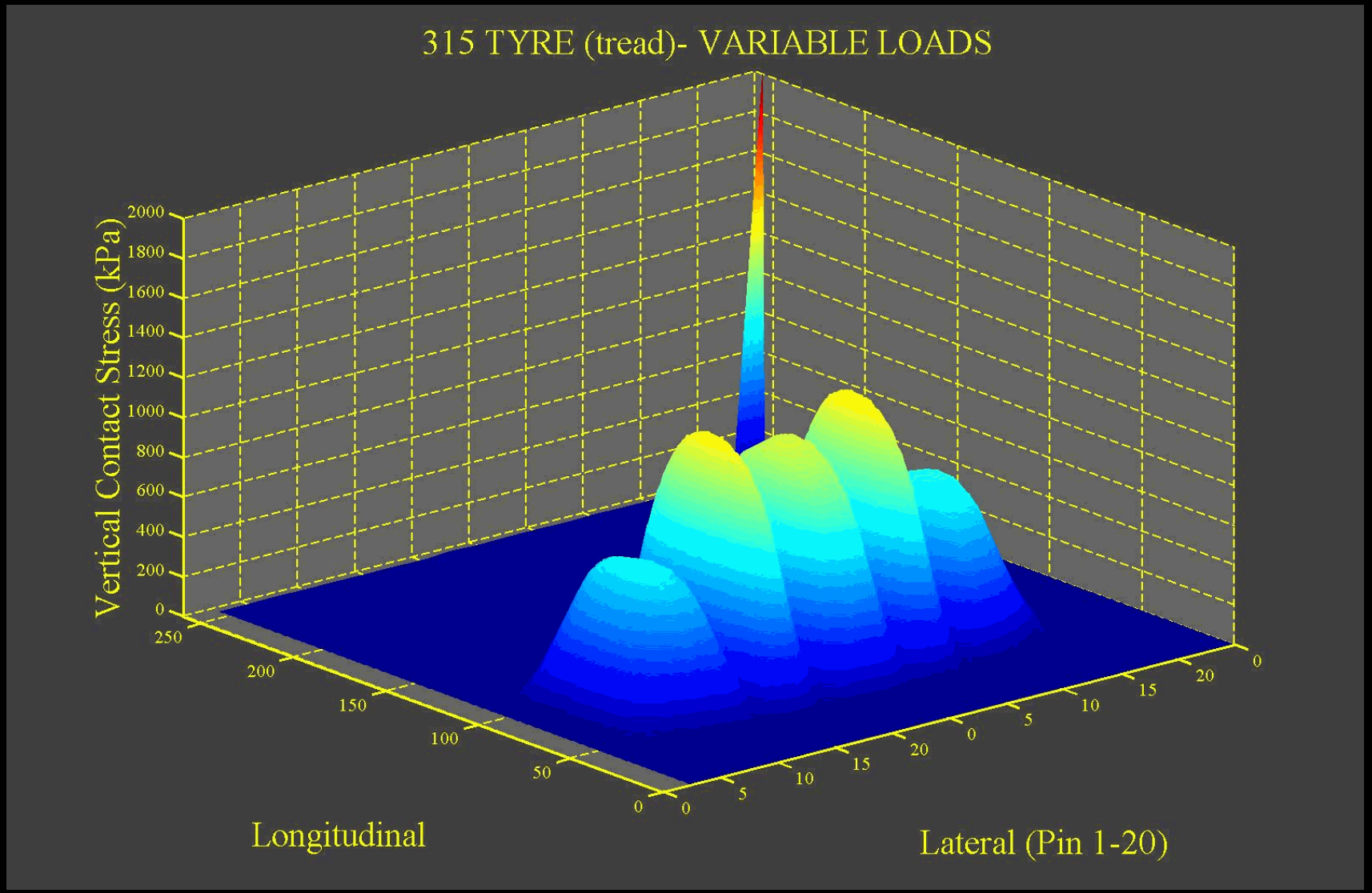


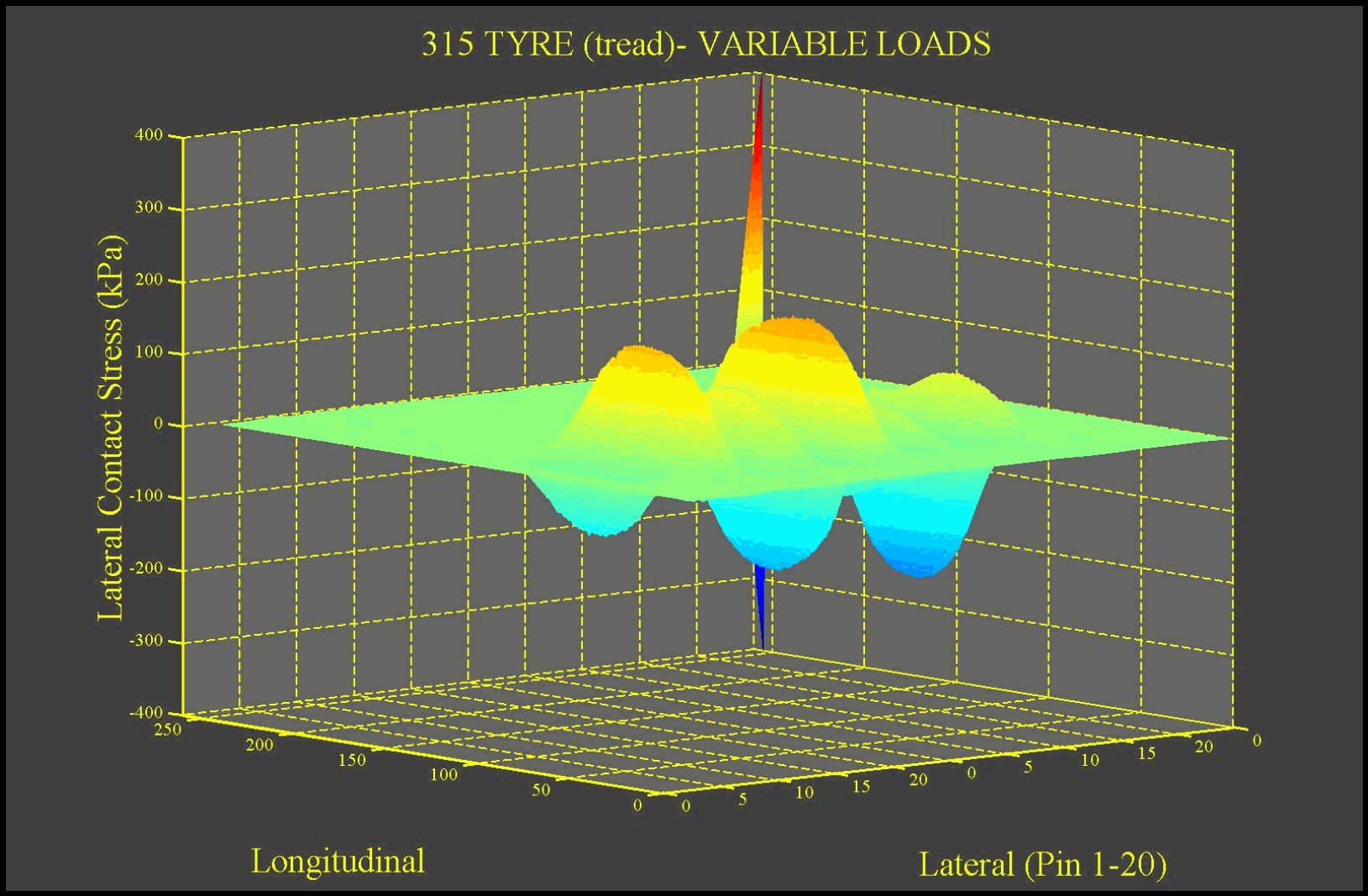

N/S

315/80 R22.5 HVS TIRE ON VRSPTA

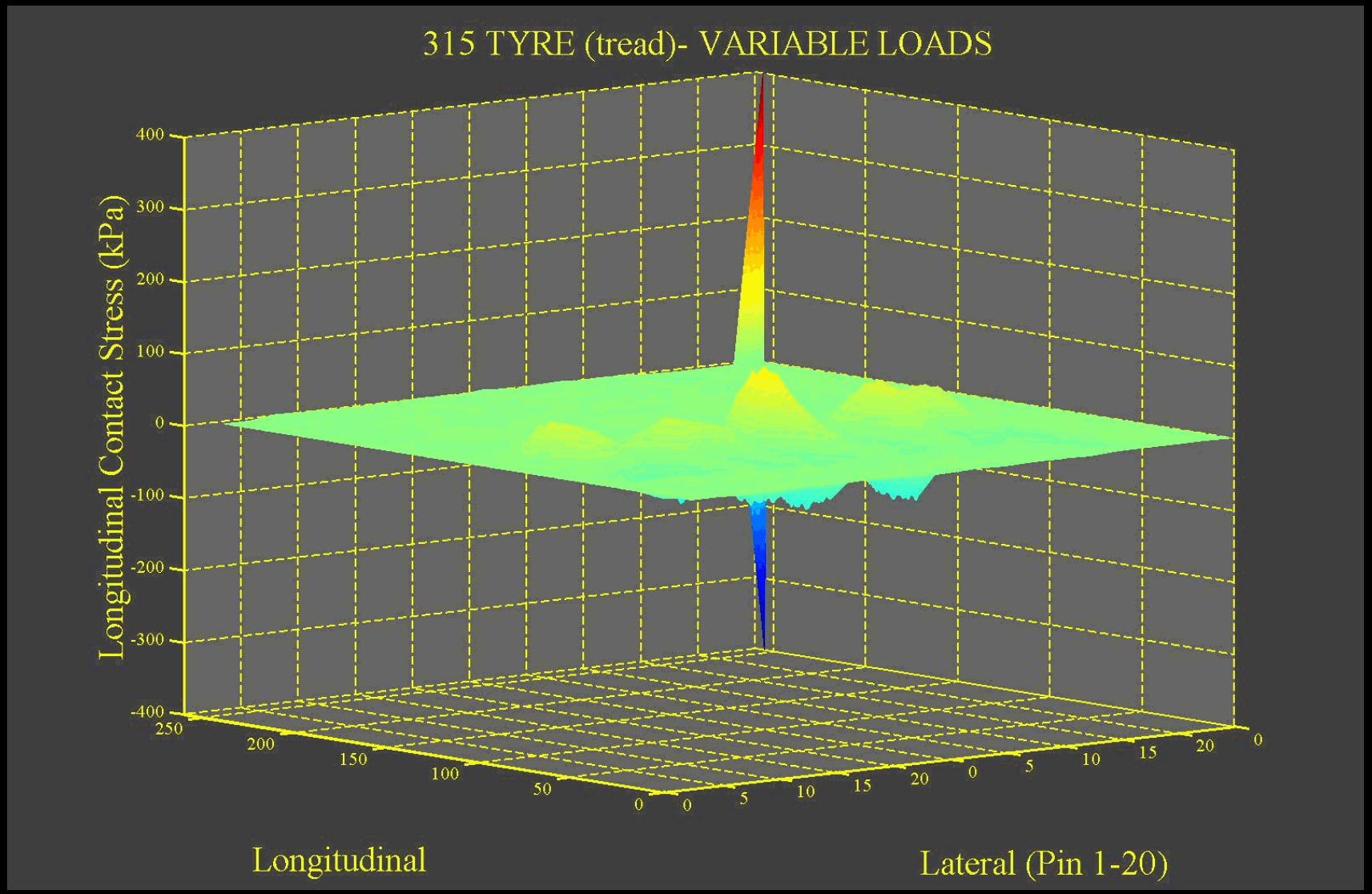
Vertical Contact Stress: Variable loads: 315/80 R22.5 Tire



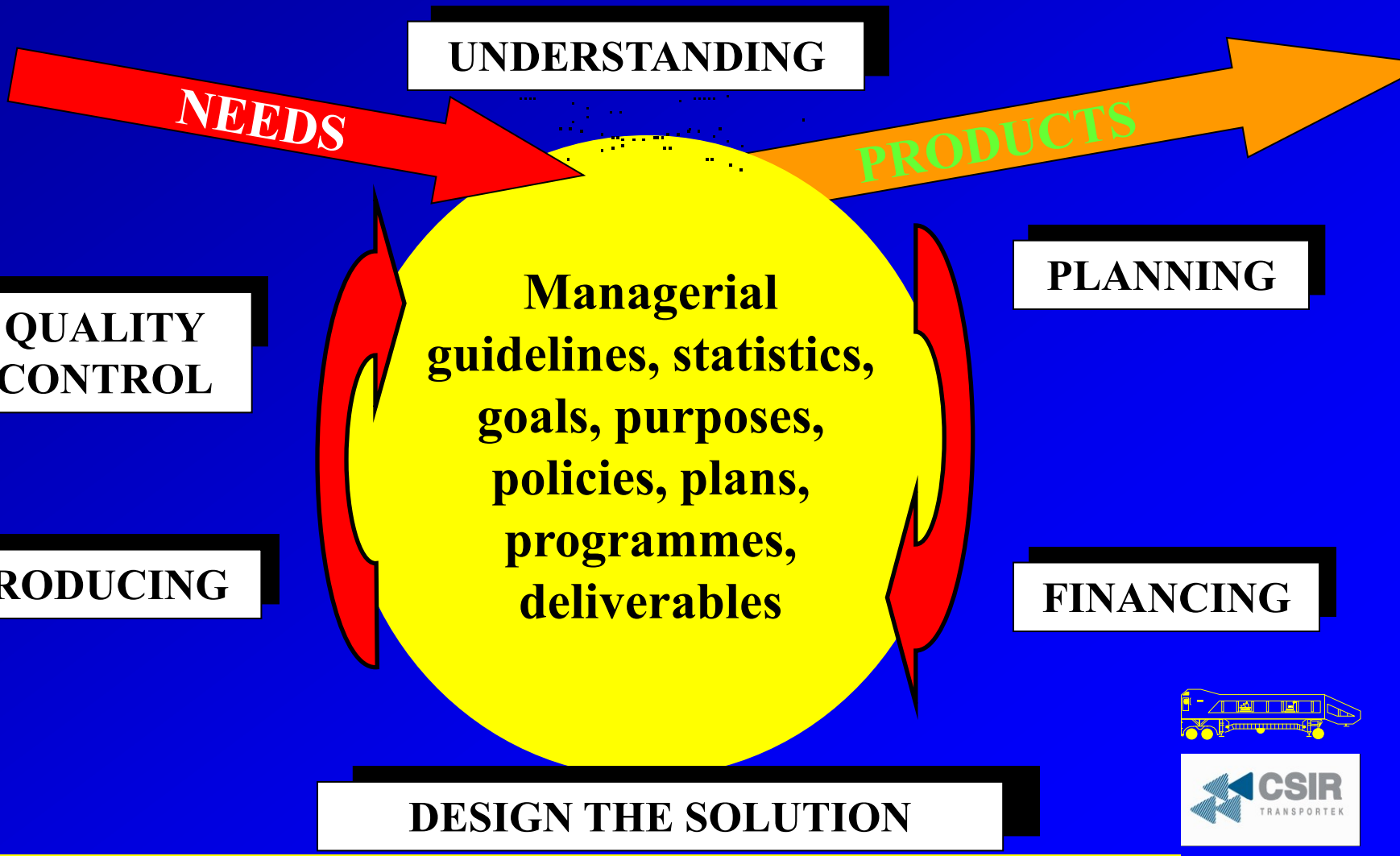
Lateral Contact Stress: Variable loads: 315/80 R22.5 Tire



Longitudinal Contact Stress: Variable Loads: 315/80 R22.5 Tire



Basic organizational process of converting needs to a products



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Process for ***partnered*** research and practice

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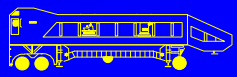
Examples of structural pavement design models

- Transfer functions for:
  - effective fatigue and crushing of lightly cemented layers
  - permanent deformation of natural gravel base and subbase layers
  - permanent deformation of imported (selected) and in situ subgrade layers



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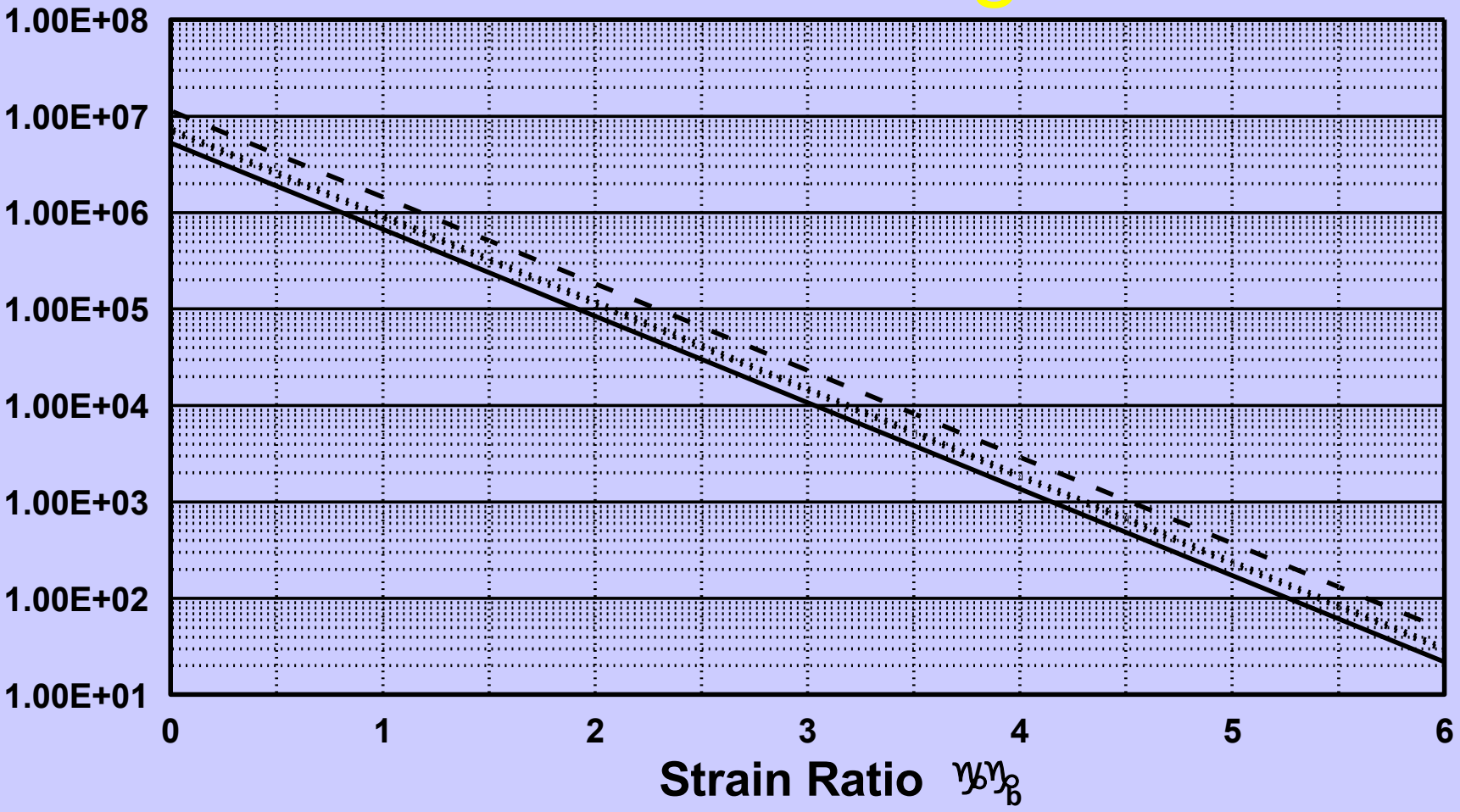
Fatigue Cracking and aging

Fatigue



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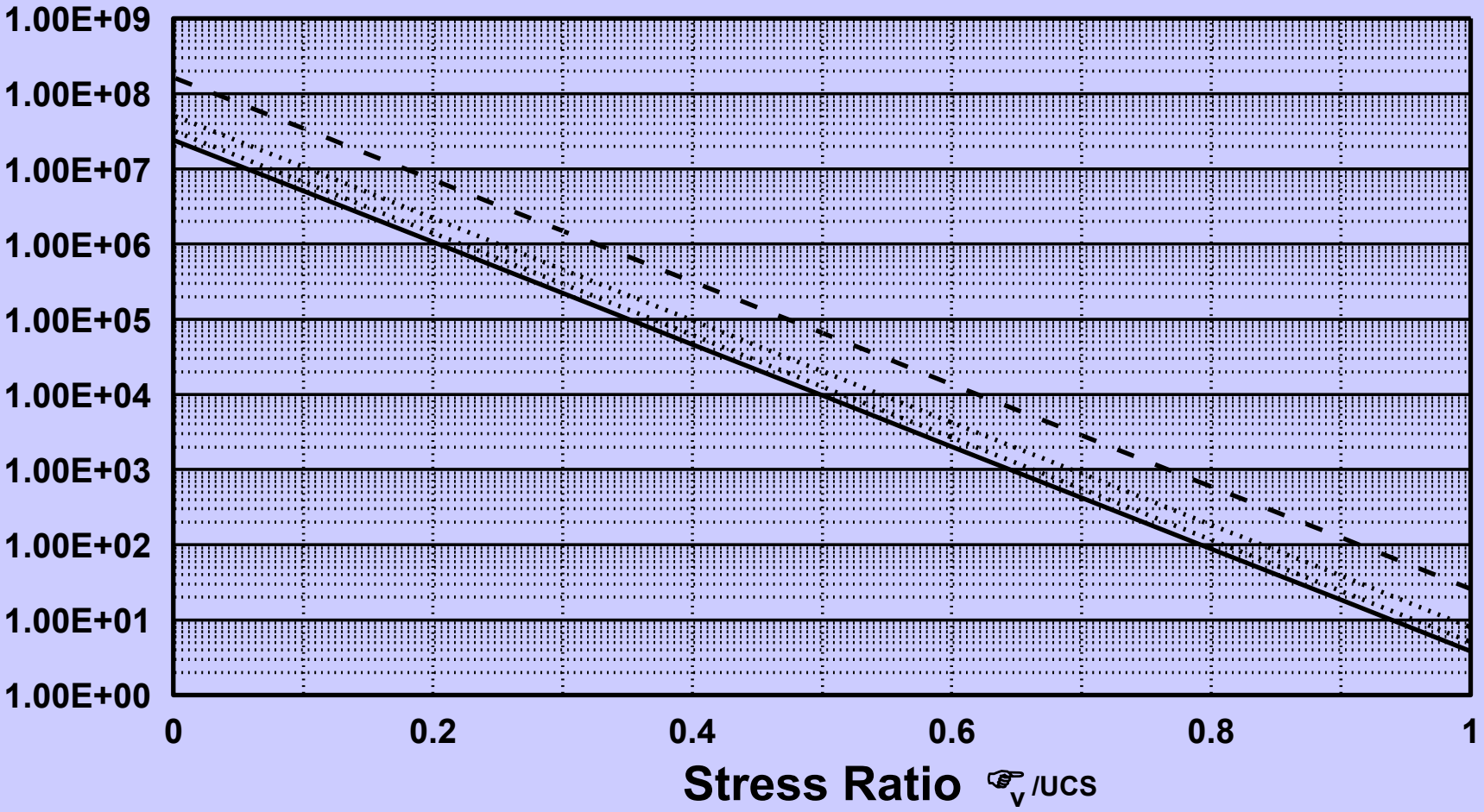
SURFACE DISINTEGRATION

Crushing



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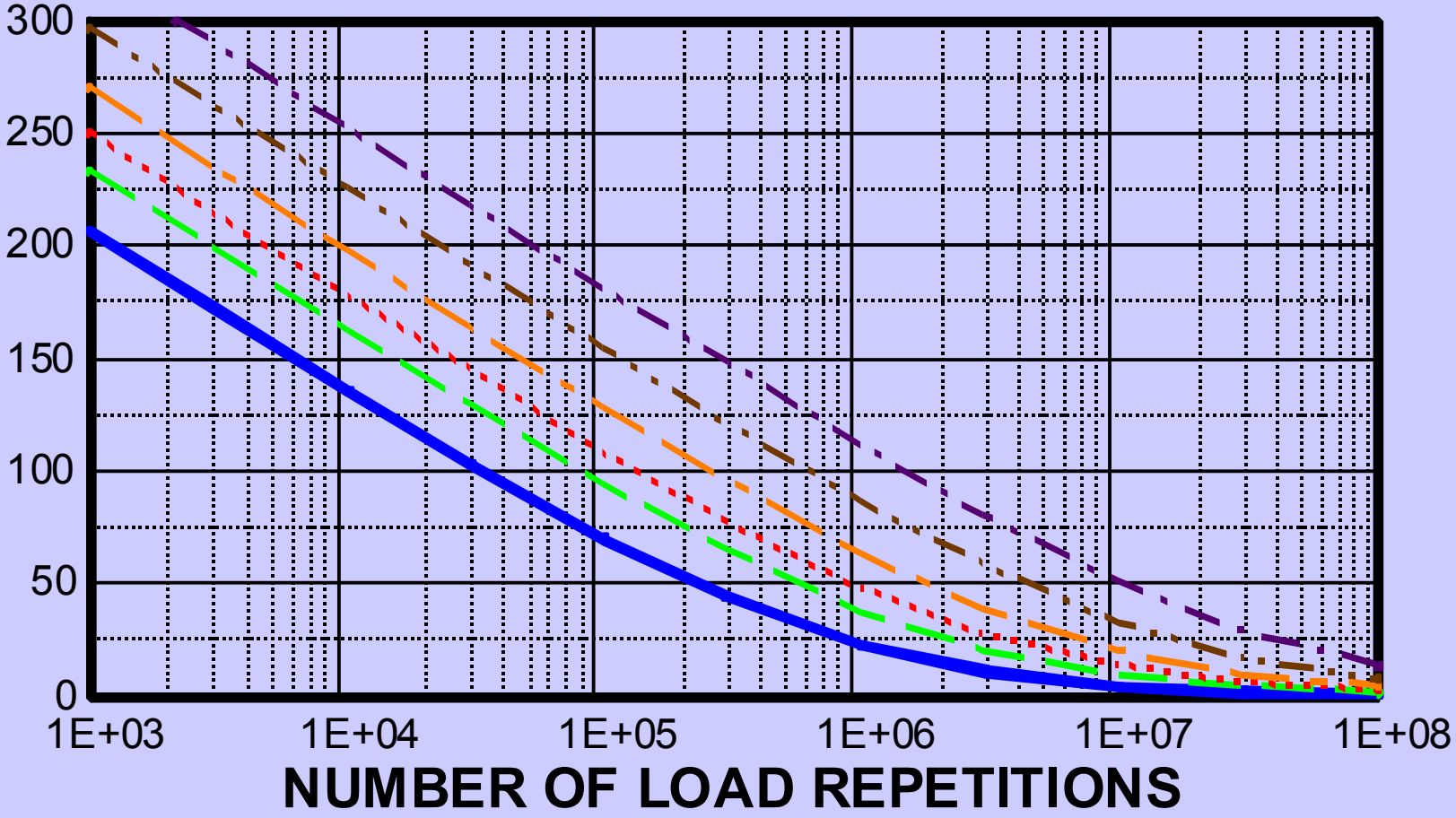
Permanent deformation



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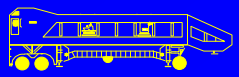
Conclusions

- SA HVS programme has been the dominant force in SA pavement engineering development for more than 20 years
- significant advances in SA pavement engineering have arisen directly from the programme



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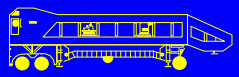
Conclusions

- Factors influencing the success of the SA HVS programme include:
  - identification of longer-term goals from the outset
  - interactive relationship between funders and research team
  - mechanisms for technology transfer and information dissemination



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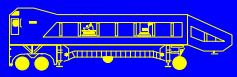
Conclusions (continued)

- Factors (continued):
  - developed understanding of the role of APT in pavement engineering
  - formalisation of processes such as strategy development, progress monitoring, definition of deliverables
  - appreciation of the need for higher-level analysis to attain long-term benefits
- up to four HVSs operating at the same time gave added impetus...



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