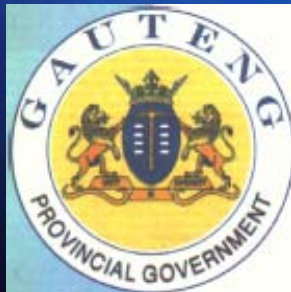


APT steering committee meeting: Low Volume Roads

H L Theyse
17 July 2003



Structure of presentation

- Details of HVS testing of a LVR in the Western Cape
 - Background
 - Proposal
 - Test program
 - Expected outcome
- Holistic discussion document
 - Framework against which research needs will be identified and proposals submitted

HVS testing of a LVR in the Western Cape: Background

■ N7/1

■ September 2002 to February 2003

- Foamed-bitumen-treated slow lane of the southbound carriageway

■ March to June 2003

- Crushed stone fast lane of the southbound carriageway

■ West coast

■ Opportunity to test gravel roads upgraded to a paved standard

- Sand and pebble subgrade
- Base layer imported (G4)
- Surface seal applied

HVS testing of a LVR in the Western Cape: Proposal

■ Motivation

- 150 000 km SA provincial unsealed road network
- Average annual gravel loss of 10 mm μ , replace 10.5 million m^3 each year
- Recommendations from previous work
 - Test more base material types
 - Test more surfacing types
 - Test effect of environment on structural performance

HVS testing of a LVR in the Western Cape: Proposal

- Test program
 - HVS
 - Short high wheel-load test
 - Longer, design wheel-load test including a wet test
 - Laboratory
 - Standard tests for unbound material on base layer
 - Static and dynamic Triaxial at different combinations of density (construction quality) and saturation (environment/maintenance)
 - 2nd level analysis
 - Calibration of a site and material specific structural design model by combining the HVS and laboratory data

HVS testing of a LVR in the Western Cape: Proposal

- Desired outcome
 - Confirm structural bearing capacity of a matching pavement structure in the TRH4 catalogue
 - Collect data for structural design (resilient modulus, shear strength and plastic deformation) of moderate quality unbound base layers
 - Development and HVS calibration of a site and material specific structural design model including the effects of
 - Density (construction quality)
 - Saturation (surfacing/maintenance/environment)

Holistic discussion document on Low Volume Roads

- Definition
- Deciding factors to upgrade to a paved standard
- Pavement design
- Construction
- Maintenance
- Appropriate research

Holistic discussion document on Low Volume Roads

■ Definition

■ Traffic

- Volume
- Composition (Heavy/light)

■ Pavement type?

- Previously gravel
- Base layer type
 - Moderate quality gravel
 - Stabilized
- Surfacing

■ Purpose/function?

- Rural access

Holistic discussion document on Low Volume Roads

■ Deciding factors

■ Safety

- Poor geometric standards
 - do we have the standard?
 - how big is the safety problem?

■ Economics

- Conventional TRH4 approach
 - Compare alternative designs
- LVR approach
 - To upgrade or not to upgrade
 - Construction and maintenance cost (road authority)
 - Vehicle operating cost (road user)
 - Environmental impact?

Holistic discussion document on Low Volume Roads

- Pavement design process
 - Given support
 - Decide on base layer material
 - Strength requirement?
 - What is available?
 - Treat/stabilize if not available?
 - Appropriate treatments? (snake-oils, foamed-bitumen, emulsified bitumen)
 - Mix design for treatment/stabilization
 - Decide on/design surfacing

Holistic discussion document on Low Volume Roads

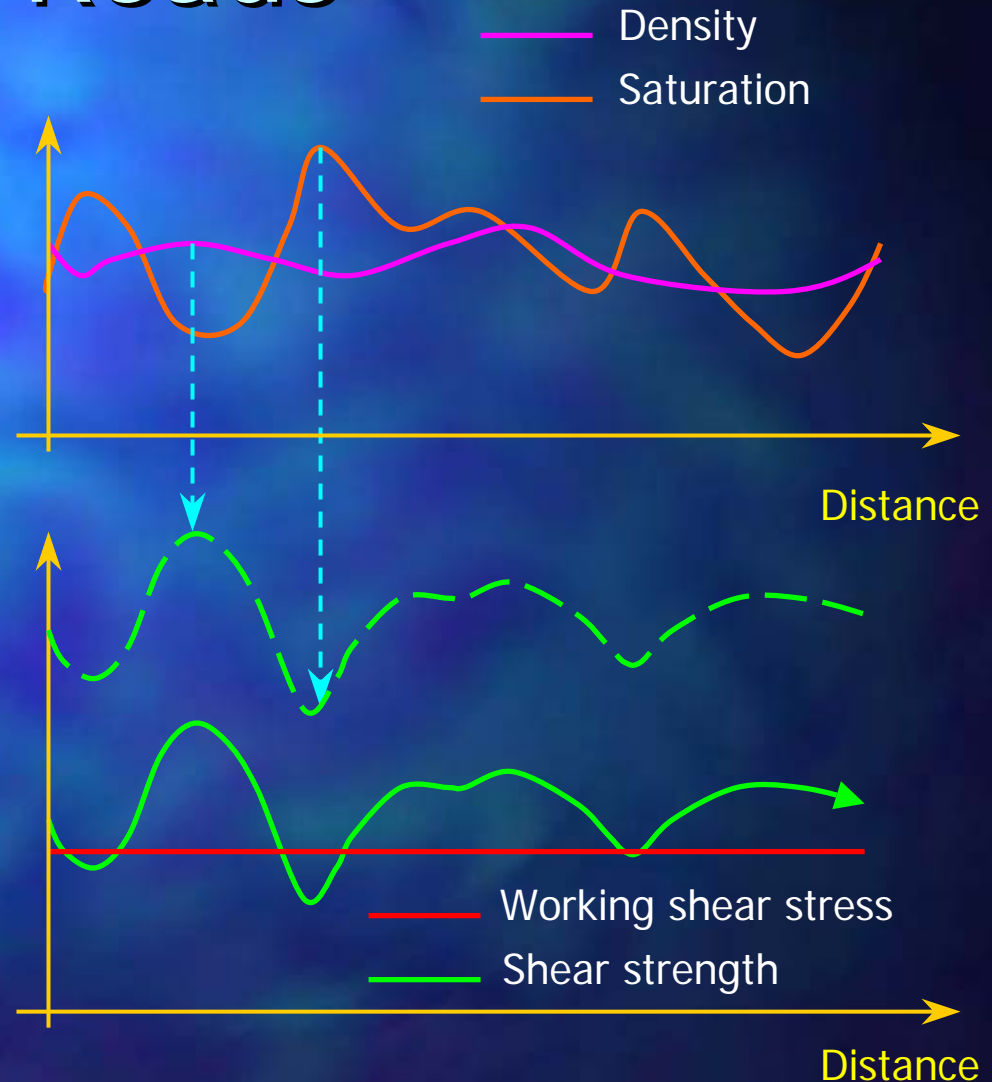
- Design considerations
 - Conventional TRH4 approach
 - Design for structural bearing capacity
 - Maintain functional service level
 - LVR approach
 - Structural and functional distress mechanisms to be considered
 - Low traffic volume/loads - structural bearing capacity probably sufficient but be careful of localized failure
 - Material quality (shear strength)
 - Variability
 - Moisture (environment and maintenance)
 - Density (construction quality)
 - Functional deterioration a major consideration

Holistic discussion document on Low Volume Roads

- Design “input”
 - Traffic characteristics
 - Functional – speed, turning, breaking
 - Structural – Standard design load or spectrum?
 - Material properties
 - Unbound - spatial variation
 - Treated/stabilized – modified/stabilized properties
 - Environment
 - Construction quality
 - Maintenance
 - Variability

Holistic discussion document on Low Volume Roads

- Design variability
 - Given subgrade
 - Variable quality
 - Differential settlement
 - Material strength
 - Moderate quality
 - Spatial variability = $f(\text{density, saturation})$
 - Construction
 - Spatial density variation
 - Maintenance/environment
 - Spatial saturation variation



Holistic discussion document on Low Volume Roads

■ Construction

- Appropriate quality control procedures and techniques
- Construction and quality control training
 - Conventional
 - Labour-intensive
 - In situ stabilization

■ Maintenance

- Strategies (maintenance “free” designs?)
- Typical expected maintenance interventions = f (functional deterioration)
 - Potholes
 - **Shear failure**
 - Surface distress (cracks, bleeding, raveling etc.)

Holistic discussion document on Low Volume Roads

■ Appropriate research

- Geometric standards
 - Are we creating a safety problem?
- Economic analysis
 - Functional deterioration models – adequate?
 - Environmental impact?
- Structural adequacy
 - Laboratory and HVS
 - Spatial variability in design

■ Appropriate research (continued)

- Functional deterioration
 - LTPP
 - Distress mechanisms
 - Deterioration models
- Training
 - Application of design
 - Construction and quality control
 - Maintenance