



International Consortium of HVS Users 2nd Meeting – October 2003

Gautrans HVS program

October 2002 – October 2003



Overview of presentation

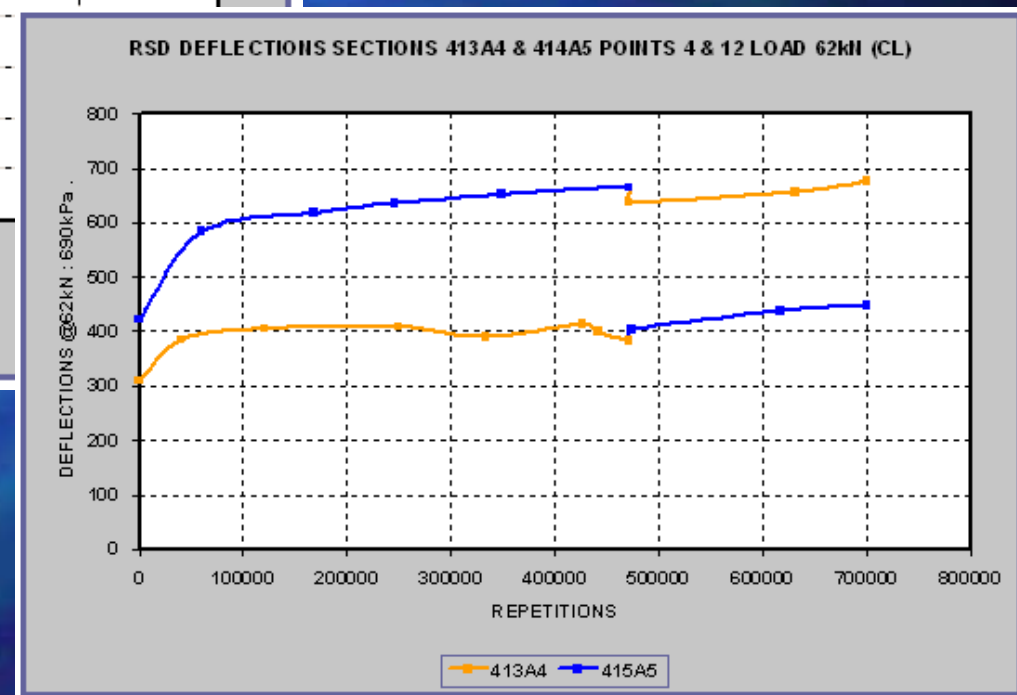
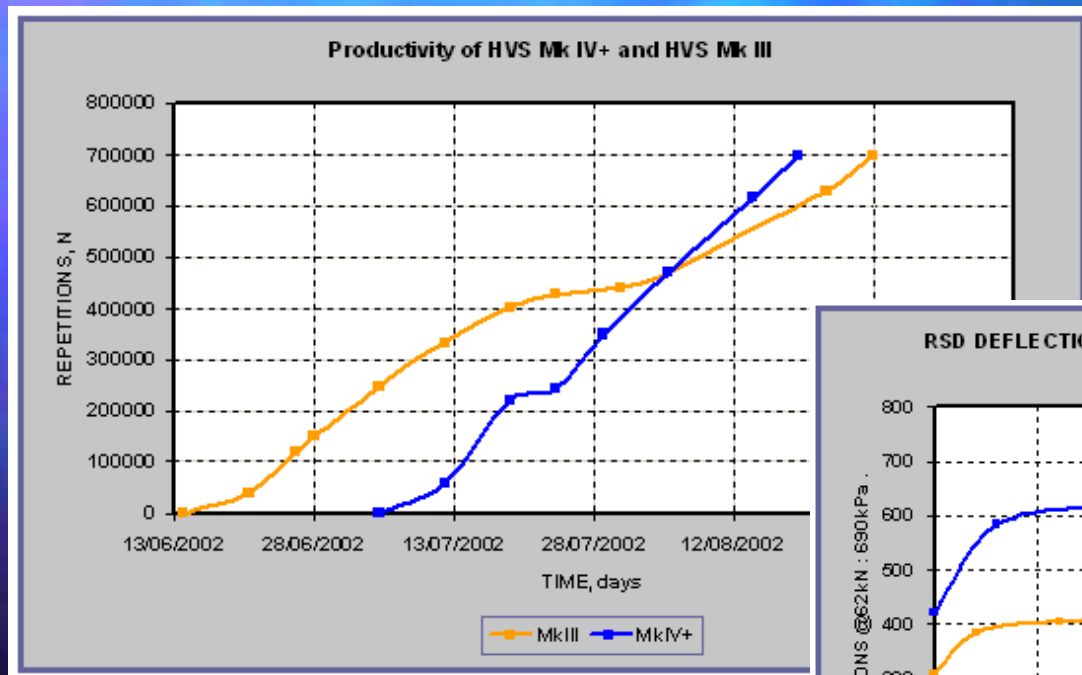
- Work done before October 2002
 - HVS Mk III vs HVS Mk IV+
- October 2002 – October 2003
 - N7 tests in the Western Cape
 - LVR tests in the Western Cape
- Work planned for after October 2003
 - Concrete road tests in KwaZulu-Natal
 - Deflection study (FWD vs RSD vs MDD)
 - Compaction study
 - Comprehensive laboratory testing of emulsified bitumen treated crushed stone

Pre-October 2002: HVS III vs. HVS Mk IV+

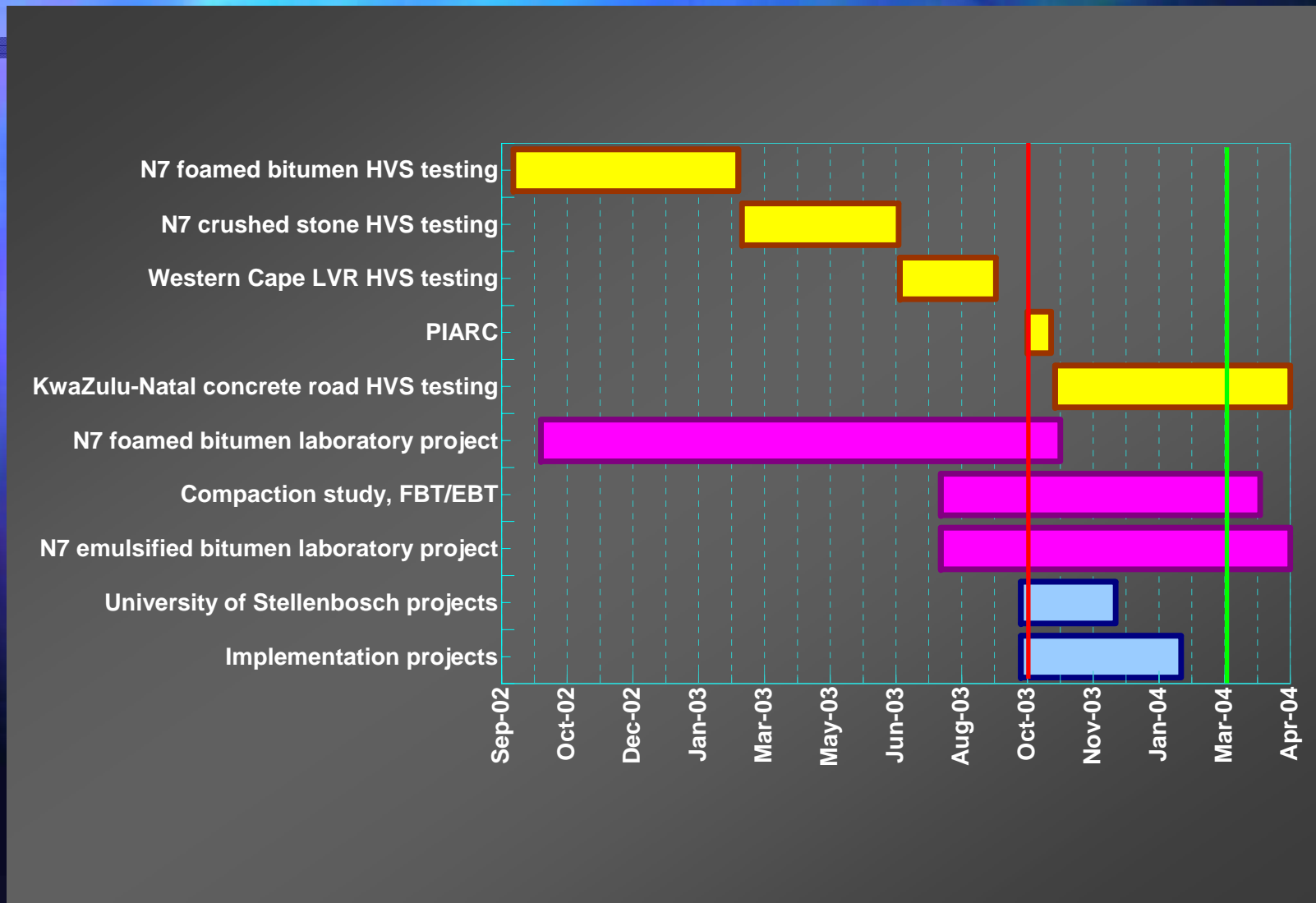
- Machines tested head-to-tail
- Swapped after 475 000 repetitions
- www.gautrans-HVS.co.za



Pre-October 2002: Comparative testing



October 2002 – October 2003: HVS and associated projects



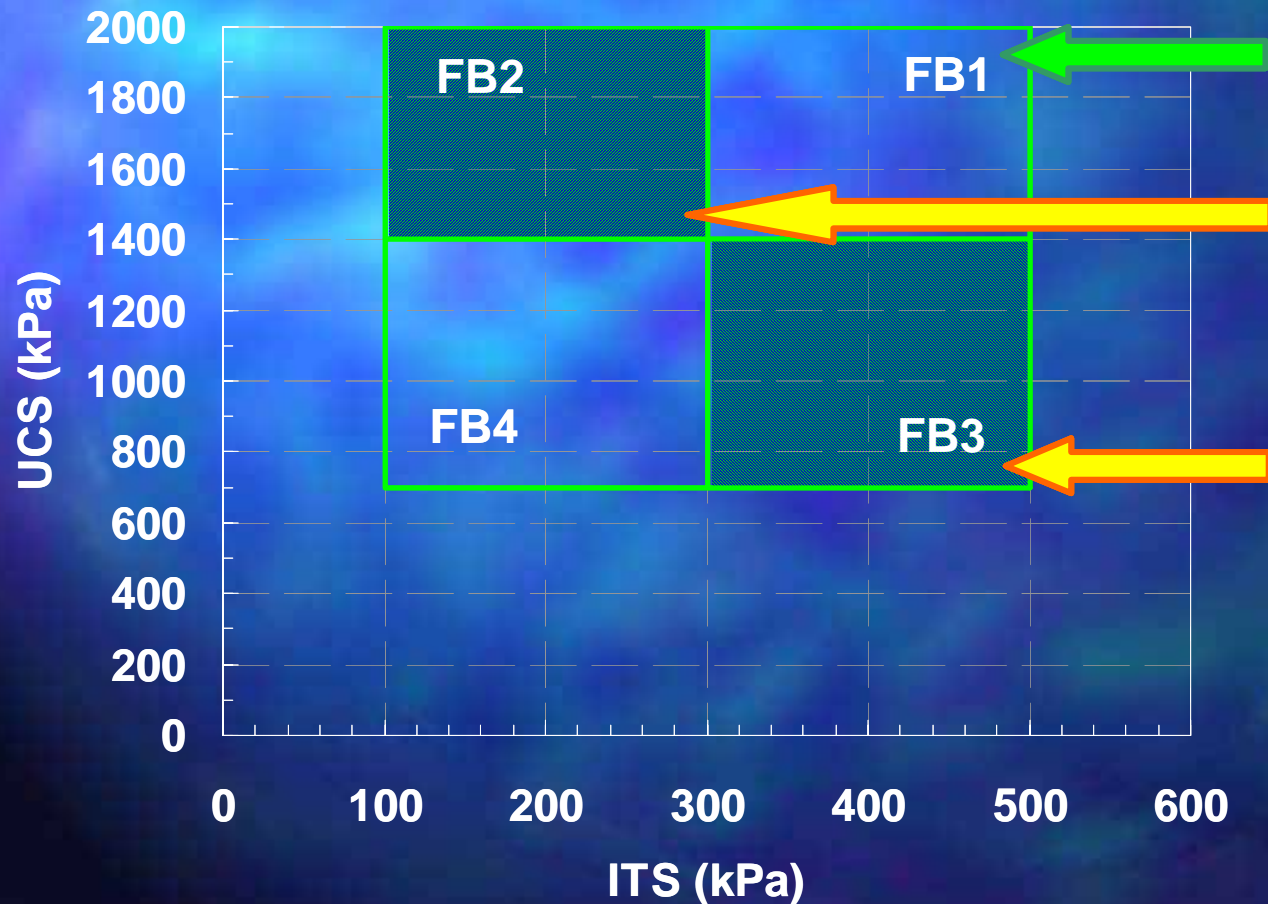
October 2002 – October 2003: HVS program funding

HVS tests and associated projects	Cost (R million)	
	Gautrans	Others
N7 foamed bitumen HVS testing	1,18	1,17
N7 crushed stone HVS testing	1,81	
Western Cape LVR HVS testing		1, 51
PIARC		
KwaZulu-Natal concrete road HVS testing		3,07
N7 foamed bitumen laboratory project	0,86	0,34
Compaction study, FBT/EBT	0,46	
N7 emulsified bitumen laboratory project	1, 31	0,10
University of Stellenbosch projects	0,16	
Implementation projects	0,36	0,09
Total	6,14	6,28

October 2002 – October 2003: N7 foamed bitumen project

- Guideline on foamed bitumen treatment released in September 2002
 - Material classification and structural design based on results from one HVS site – moderate quality material
- Project components
 - HVS tests on foamed bitumen treated, recycled crushed stone base
 - HVS tests on crushed stone base
 - Laboratory tests on foamed bitumen treated, recycled crushed stone
 - HVS and laboratory tests on emulsified bitumen treated crushed stone?

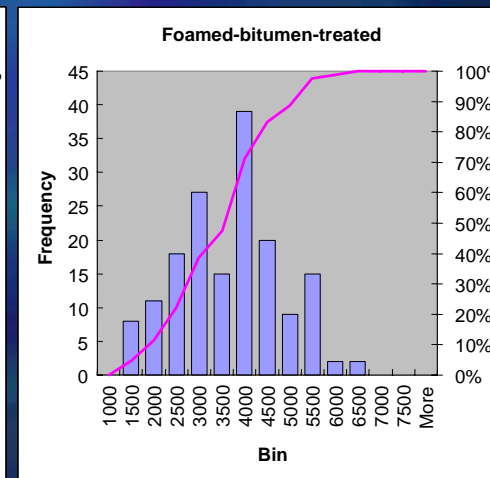
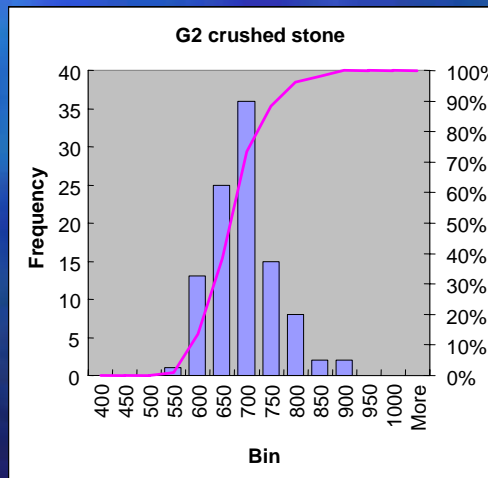
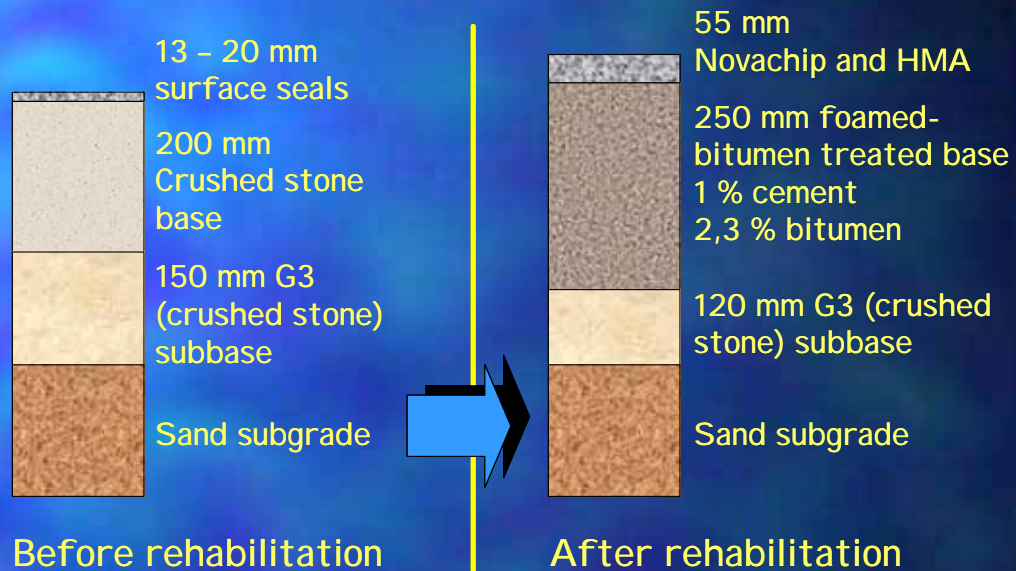
October 2002 – October 2003: N7 foamed bitumen project



**Supplement
material
classification and
design method**

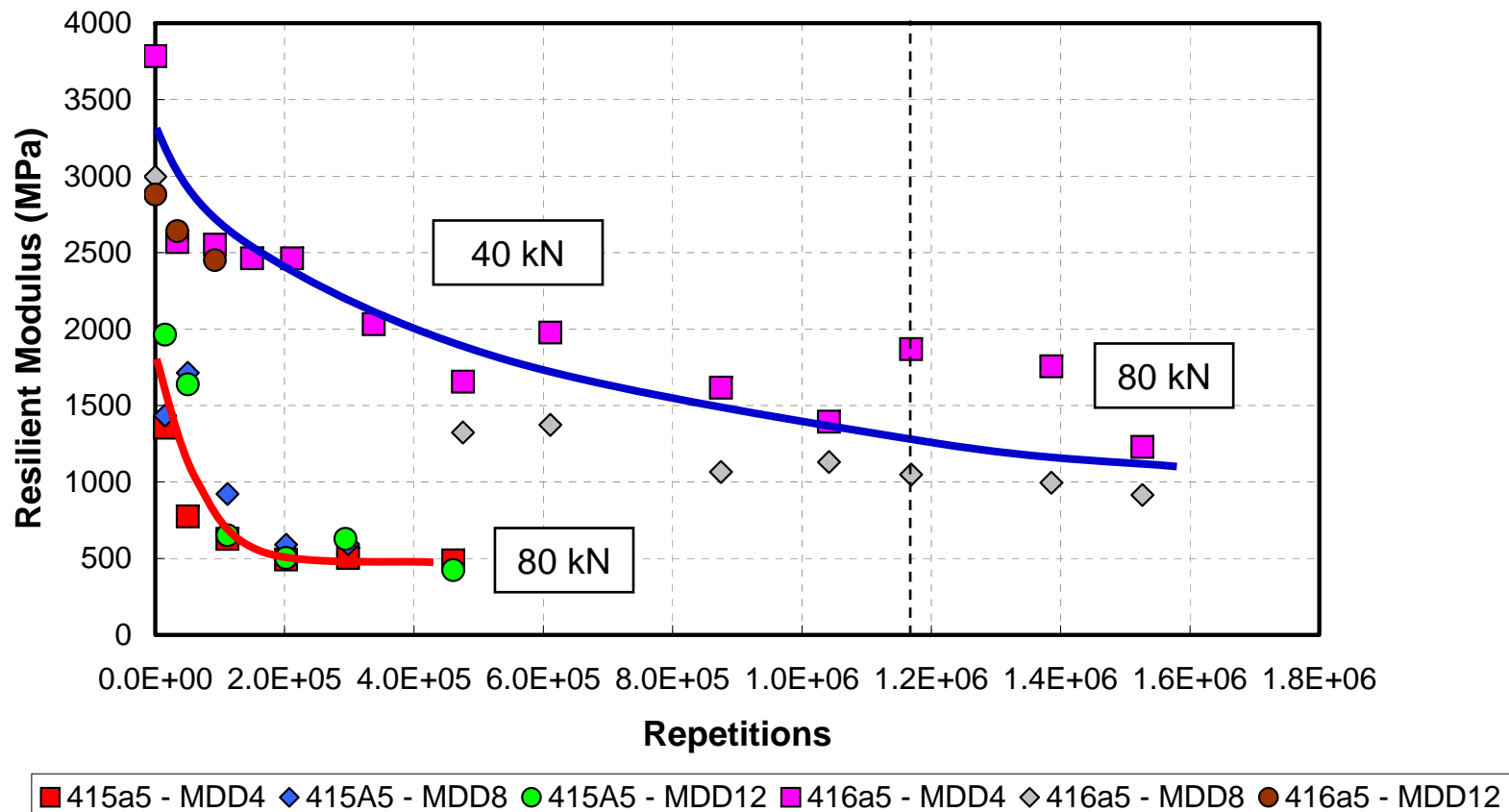
**Tested on road
P243/1 M,
TG2 material
classification and
design method**

October 2002 – October 2003: N7 foamed bitumen HVS project

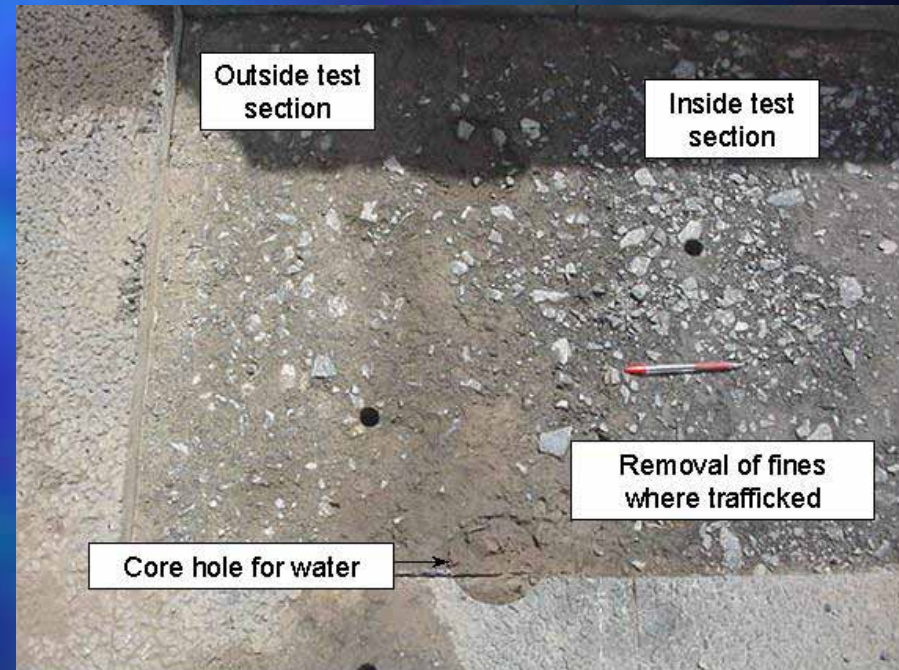


October 2002 – October 2003: N7 foamed bitumen HVS project

G2 Foamed bitumen treated base resilient modulus at 40 kN



October 2002 – October 2003: N7 foamed bitumen HVS project



October 2002 – October 2003: N7 foamed bitumen lab project

- Objectives

- Measure

- Engineering properties
 - Mechanical properties
 - Durability

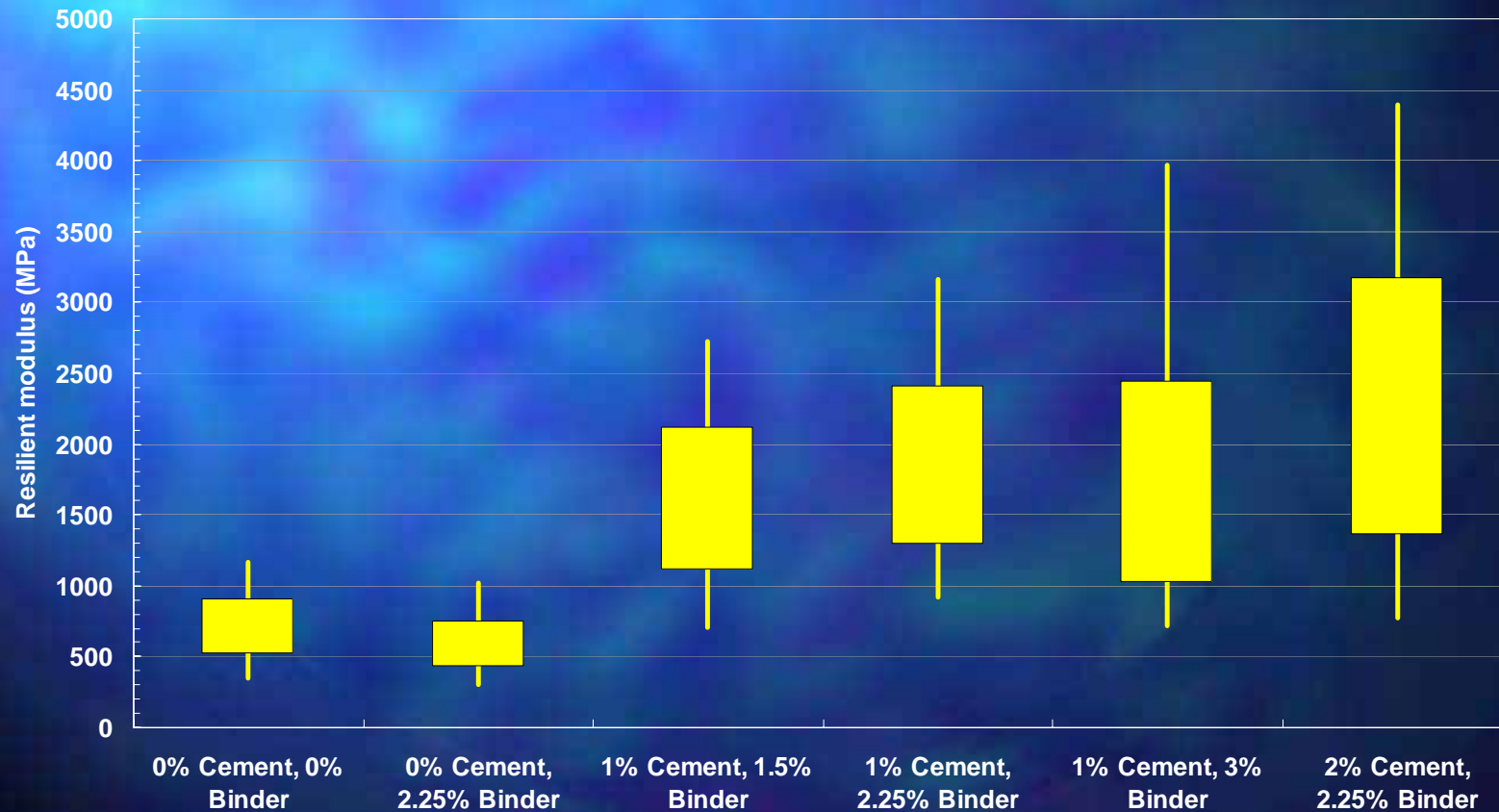
- Provide recommendations on material classification

- Calibrate structural design models

- "Effective fatigue"
 - Plastic deformation

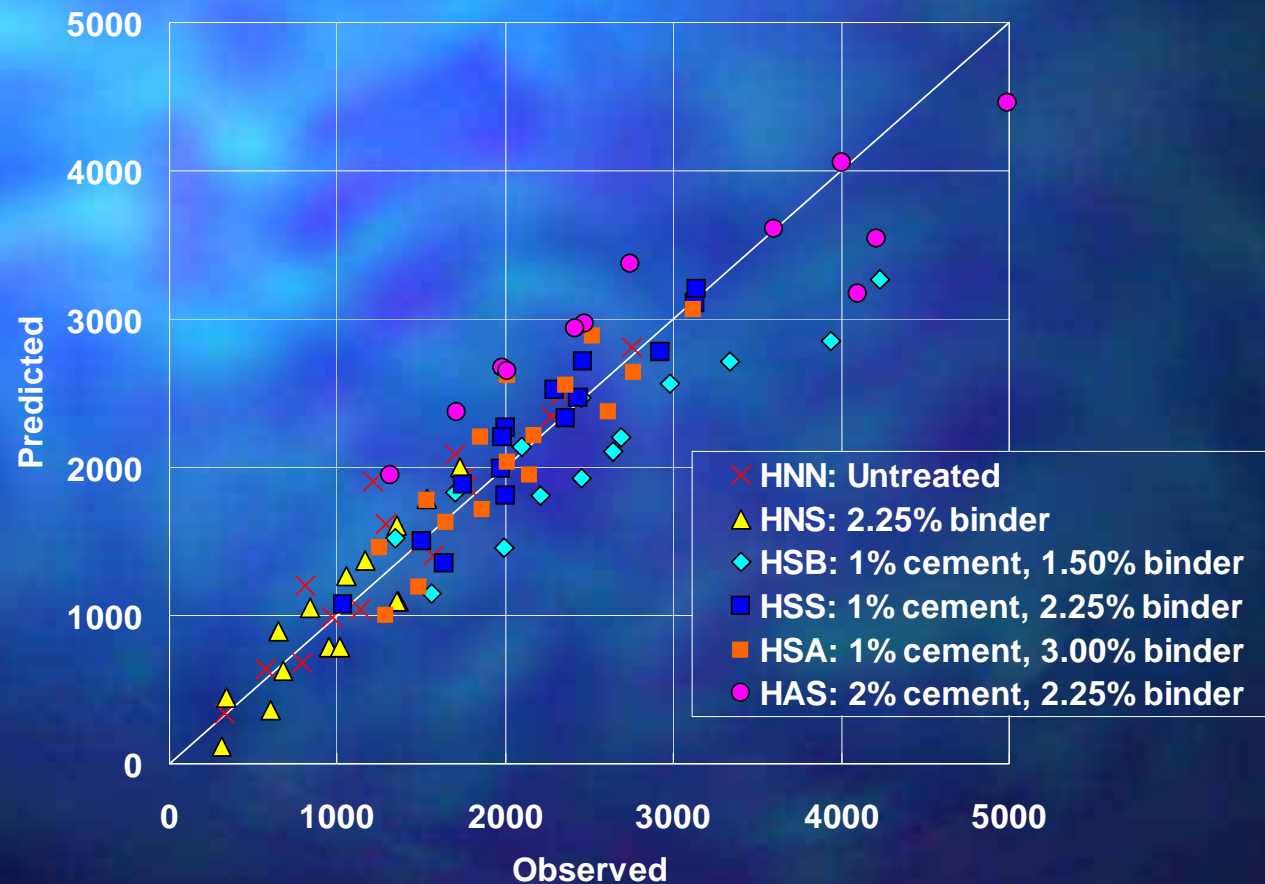
October 2002 – October 2003: N7 foamed bitumen lab project

■ Resilient modulus



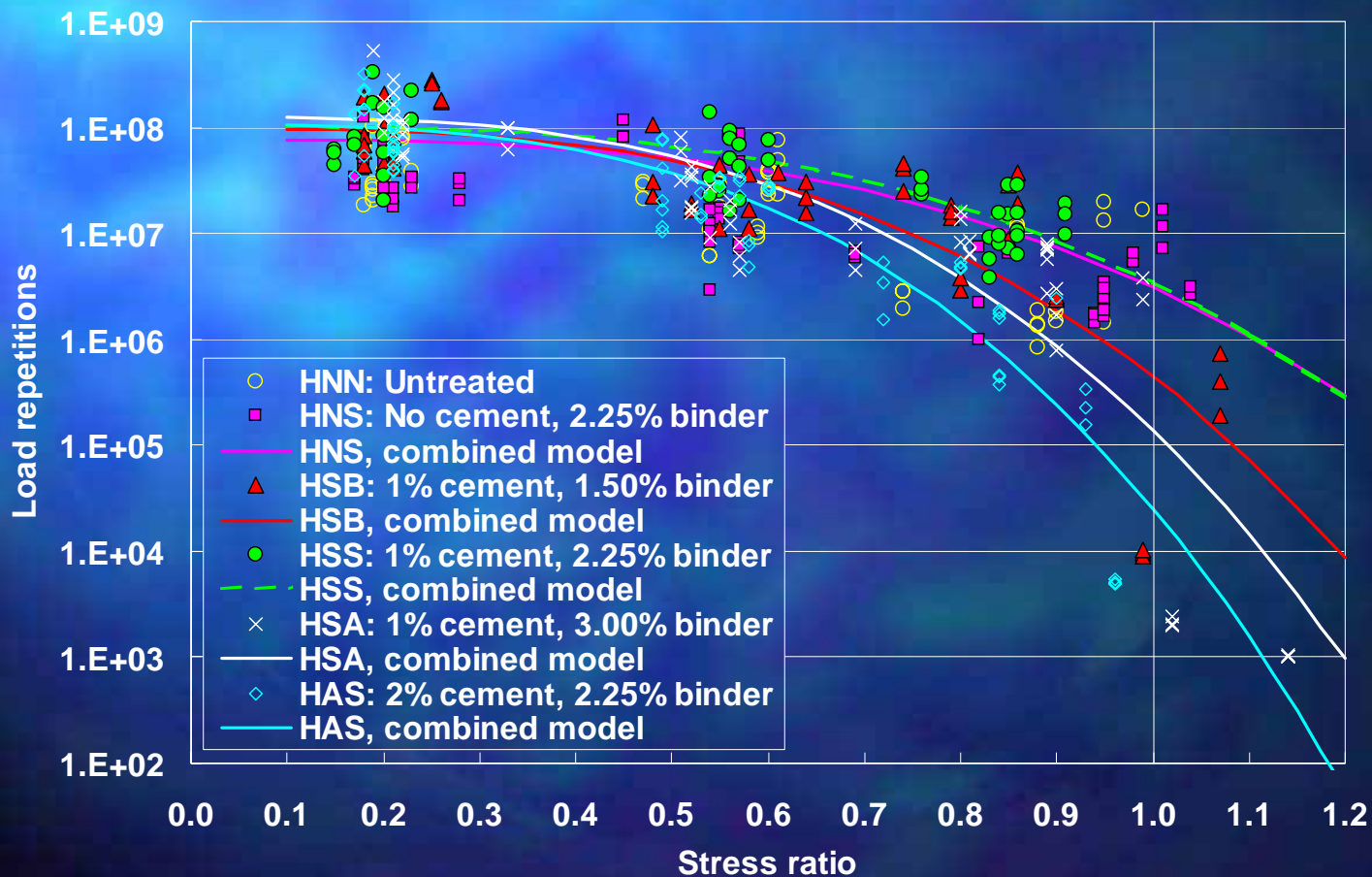
October 2002 – October 2003: N7 foamed bitumen lab project

■ Shear strength



October 2002 – October 2003: N7 foamed bitumen lab project

■ Plastic deformation



October 2002 – October 2003: Western Cape LVR project

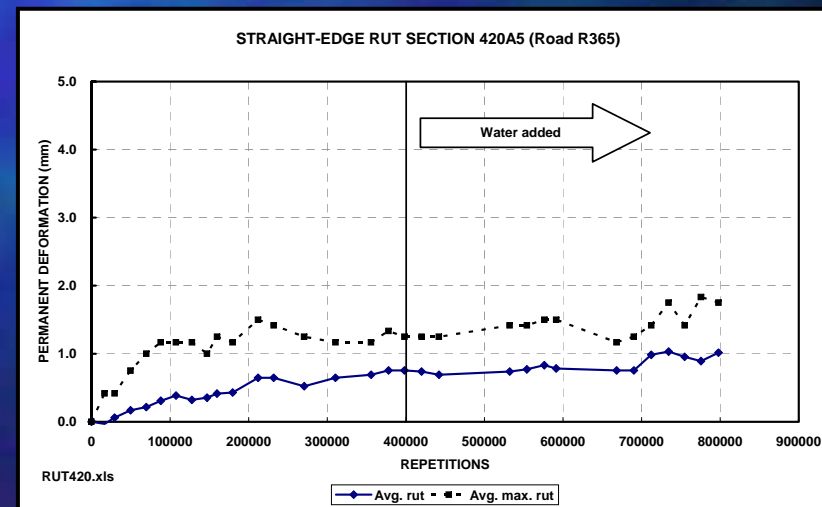
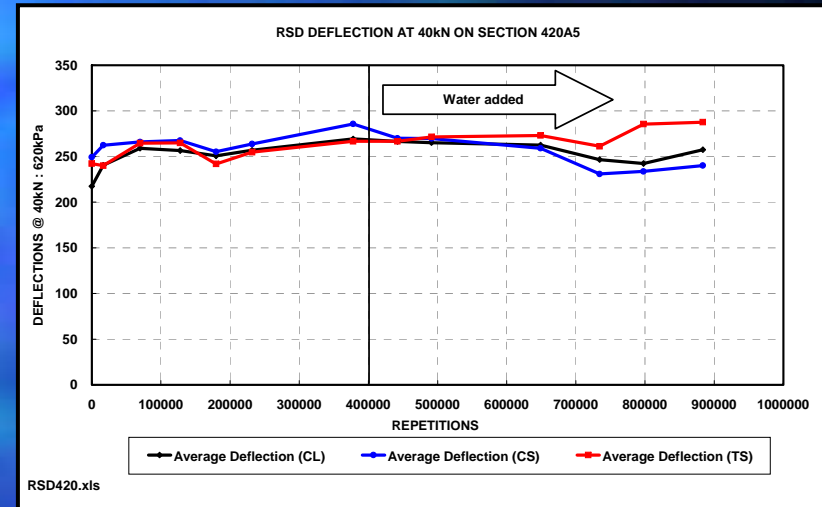
■ Motivation

- 150 000 km SA provincial unsealed road network
- Average annual gravel loss of 10 mm \mathbb{M} , replace 10.5 million m³ each year
- Recommendations from previous work
 - Test more base material types
 - Test more surfacing types
 - Test effect of environment on structural performance

October 2002 – October 2003: Western Cape LVR project

- 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)

October 2002 – October 2003: Western Cape LVR project



Post-October 2003: Compaction study

- FBT Laboratory project
 - Higher binder content – lower absolute density
- HVS on N7
 - Dry density lower on recycled slow lane compared to
 - Slow lane before recycling
 - Undisturbed fast lane
- Compare density in lab using constant compaction energy
 - Gyratory
 - Vibration table
 - mod AASHTO

Post-October 2003: Compaction study

- Expected outcome
 - Does emulsified-bitumen promote compaction?
 - Fines suspended in fluid available for filling voids
 - Breaking of emulsion \mathcal{M} , volumetric changes?
 - Does foamed-bitumen inhibit compaction?
 - Fines caught up in stiff "mortar"
 - Realistic density specifications for construction

Post-October 2003: N7 EBT crushed stone laboratory project

- Comprehensive laboratory testing of emulsified-bitumen-treated crushed hornfels
 - Engineering properties
 - UCS, ITS, permeability, shrinkage
 - Mechanical properties
 - Resilient modulus, Shear strength, Plastic deformation, Strain-at-break
 - Durability
 - Erosion, retained ITS, retained UCS, mechanical brush

Post-October 2003: N7 EBT crushed stone laboratory project

- Outcome
 - Recommendation on M_r input values
 - Calibrated laboratory plastic deformation models (on par with model developed for FBTCS)
 - Different binder to cement content ratios
 - Shear stress
 - Density
 - Degree of saturation
 - Contribute data towards future proper
 - Material classification
 - Durability specifications