

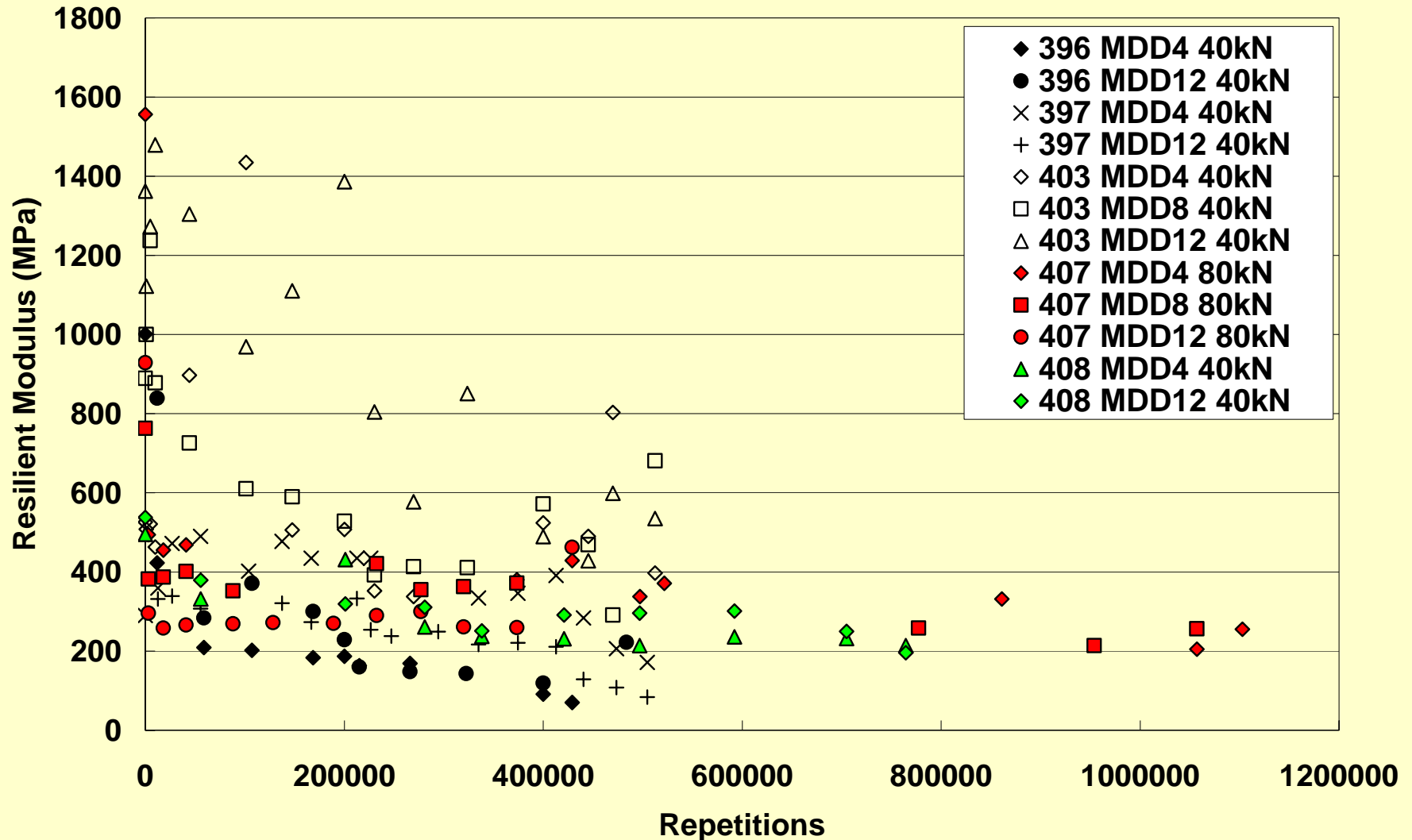
Observations on Measurement Effects in HVS Testing

Fritz Jooste

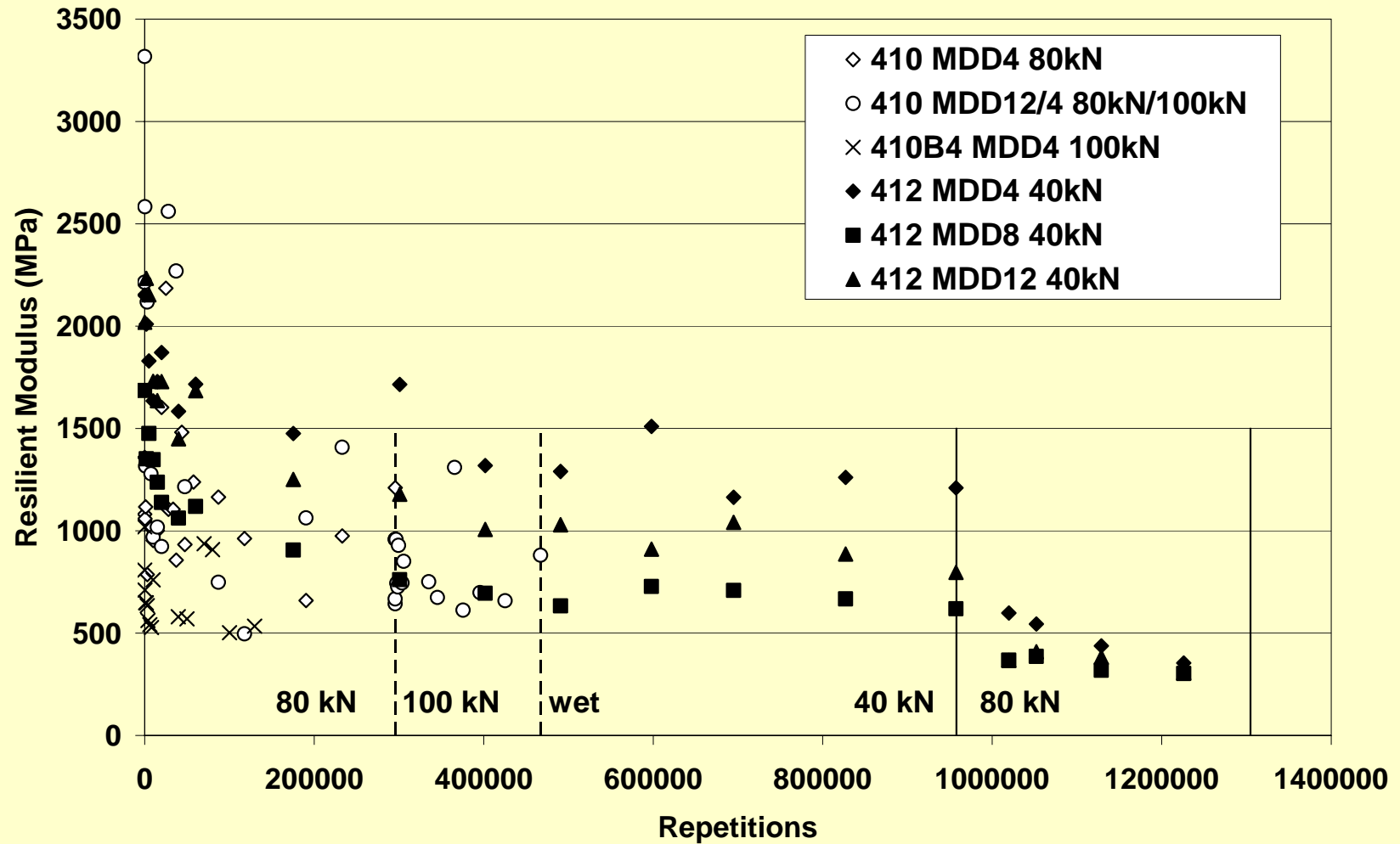
Key Issues:

- Consistent Pattern of Initial Increase in Deflections and resulting Decrease in Stiffness
- Impact on Design Method Developments
- Uncertainty Regarding Interpretation
- Suggestions to Resolve

Decrease in Stiffness

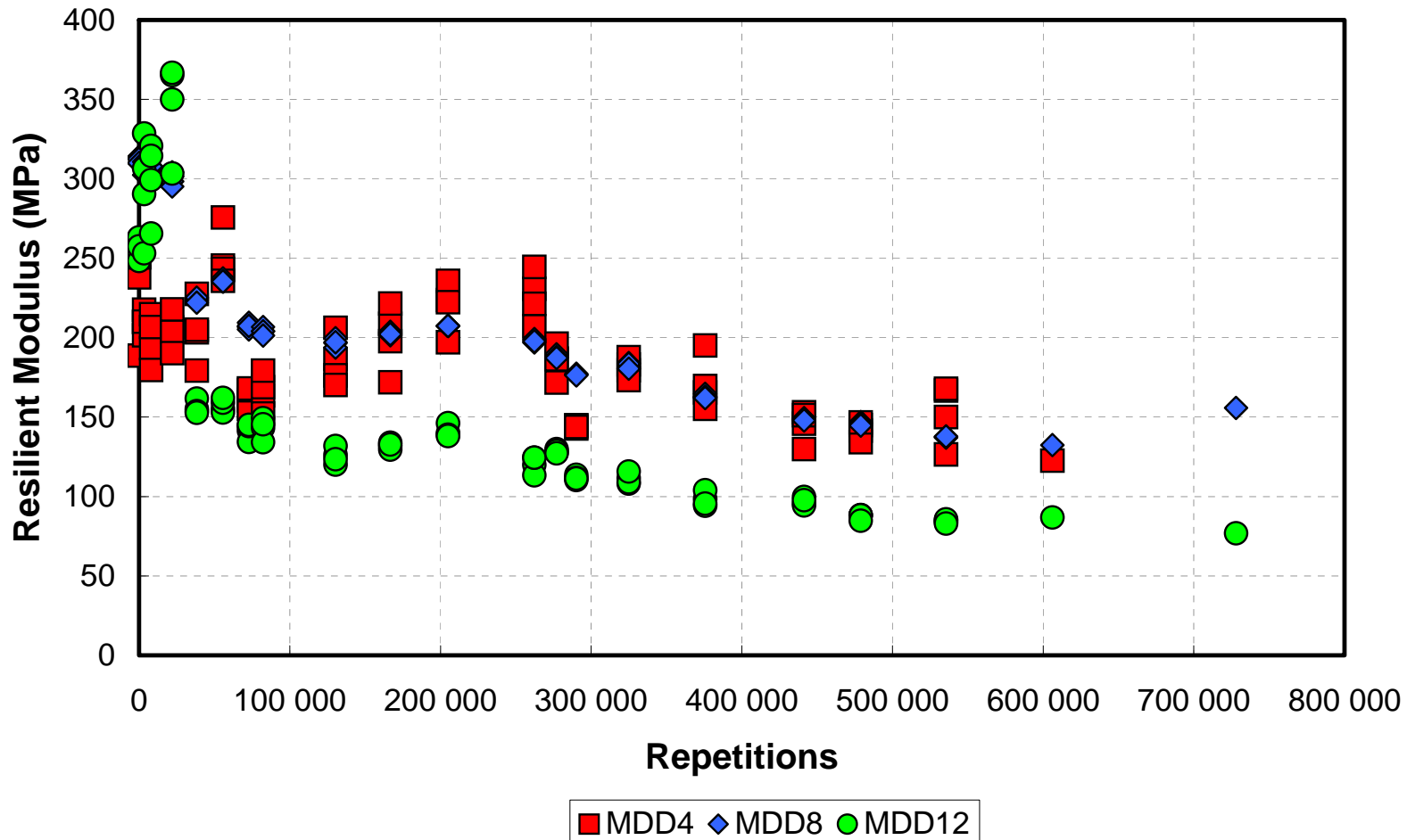


Decrease in Stiffness



Decrease in Stiffness

Phase I: HVS test 425A5
Upper subgrade resilient modulus at 40 kN



Consequences of the Phenomenon:

- Influences our thinking of the way in which materials deteriorate under loading
- Influences our assessment of typical layer stiffnesses
- Impacts on the development of mechanistic models

CSIR Investigation of the Issue:

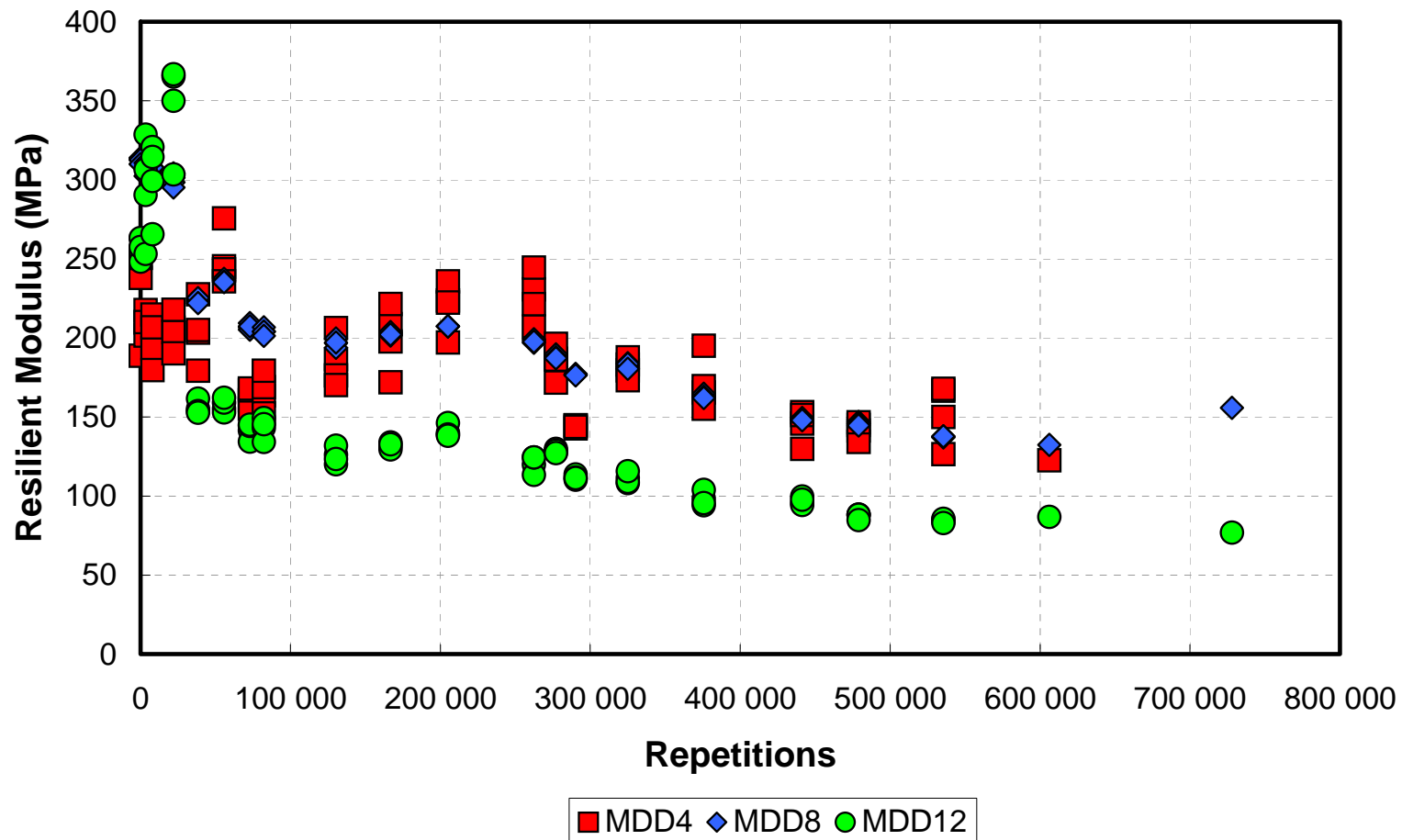
- Deflection increase / Stiffness decrease phenomenon reported in majority of APT tests
- Not limited to HVS testing

Key Questions:

1. Is the phenomenon related to:
 - Materials behaviour?
 - Pavement system behaviour?
 - Measurement setup or devices?
 - Processing and interpretation?
2. Are the trends reasonable?

Are The Trends Reasonable?

Phase I: HVS test 425A5
Upper subgrade resilient modulus at 40 kN



Consequences for ME Design

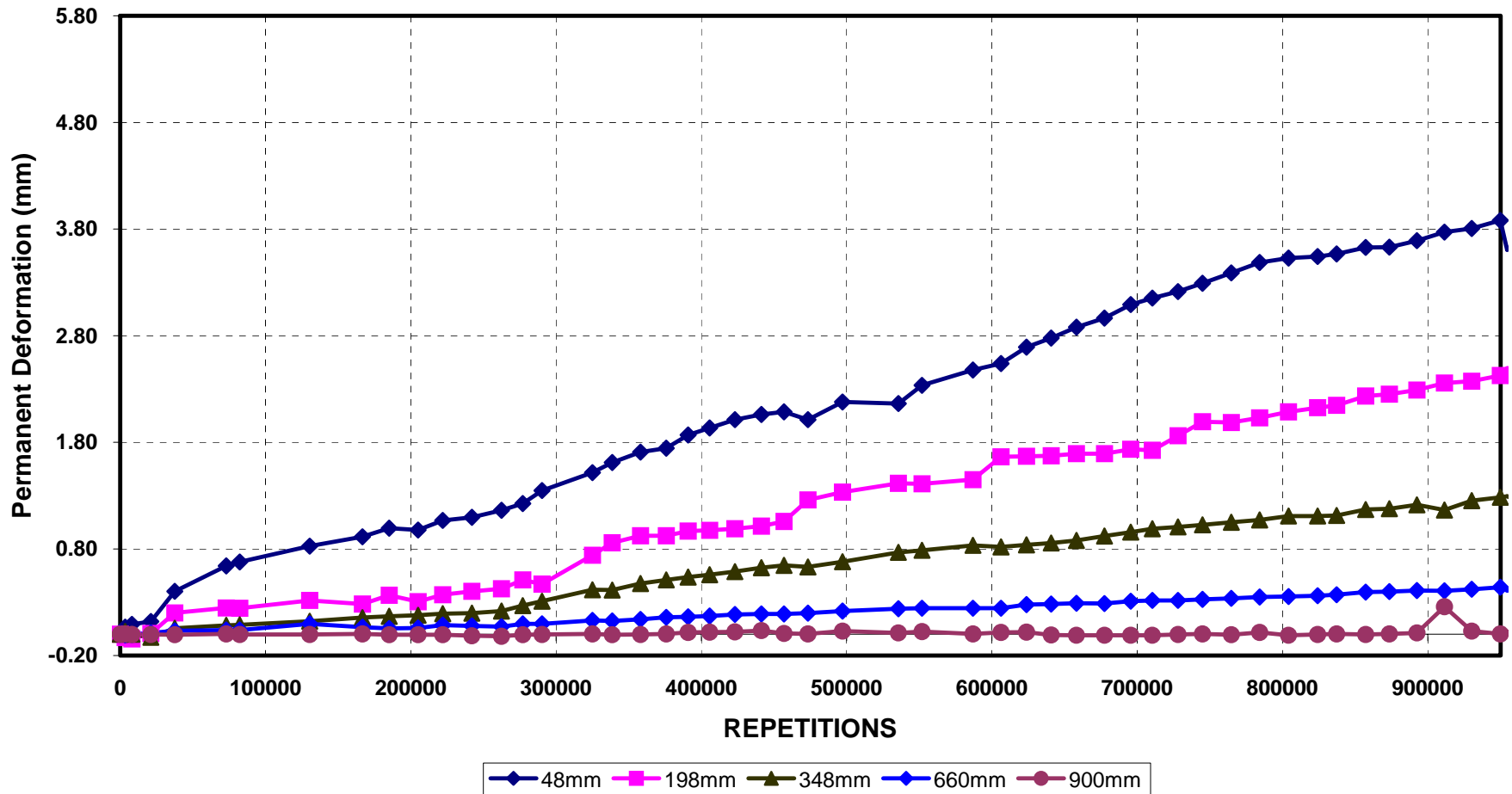
Estimated Structure At: ± 0 Reps $\pm 500,000$ Reps

Emulsion Treated Base	1500 MPa	750 MPa
Granular Subbase	150 MPa	75 MPa
Subgrade	250 MPa	140 MPa
Subgrade	600 MPa	200 MPa

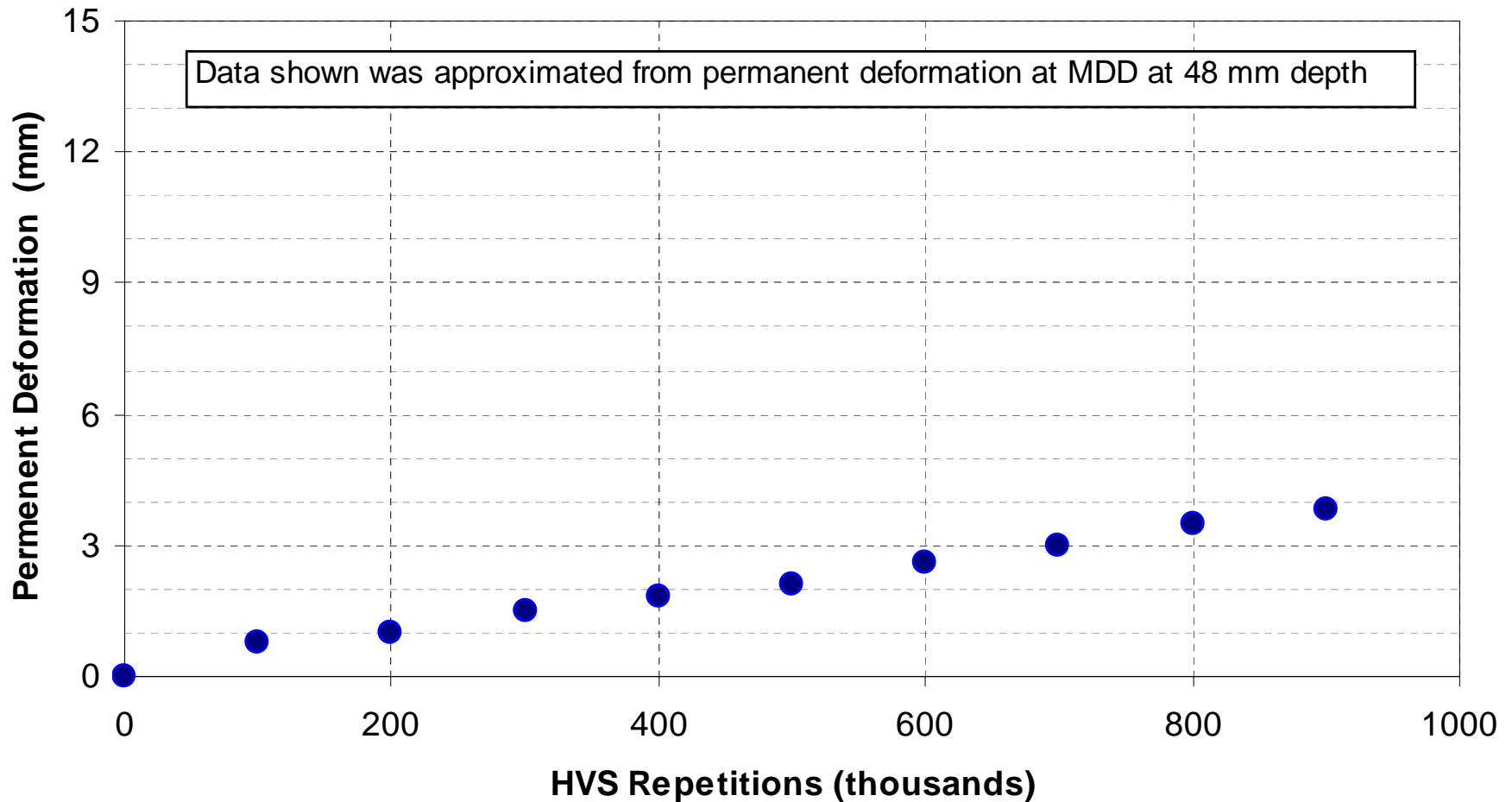
This is our assessment of the pavement behaviour

Measured Performance

MDD 4 Permanent Deformation SECTION 425A5



Measured Performance



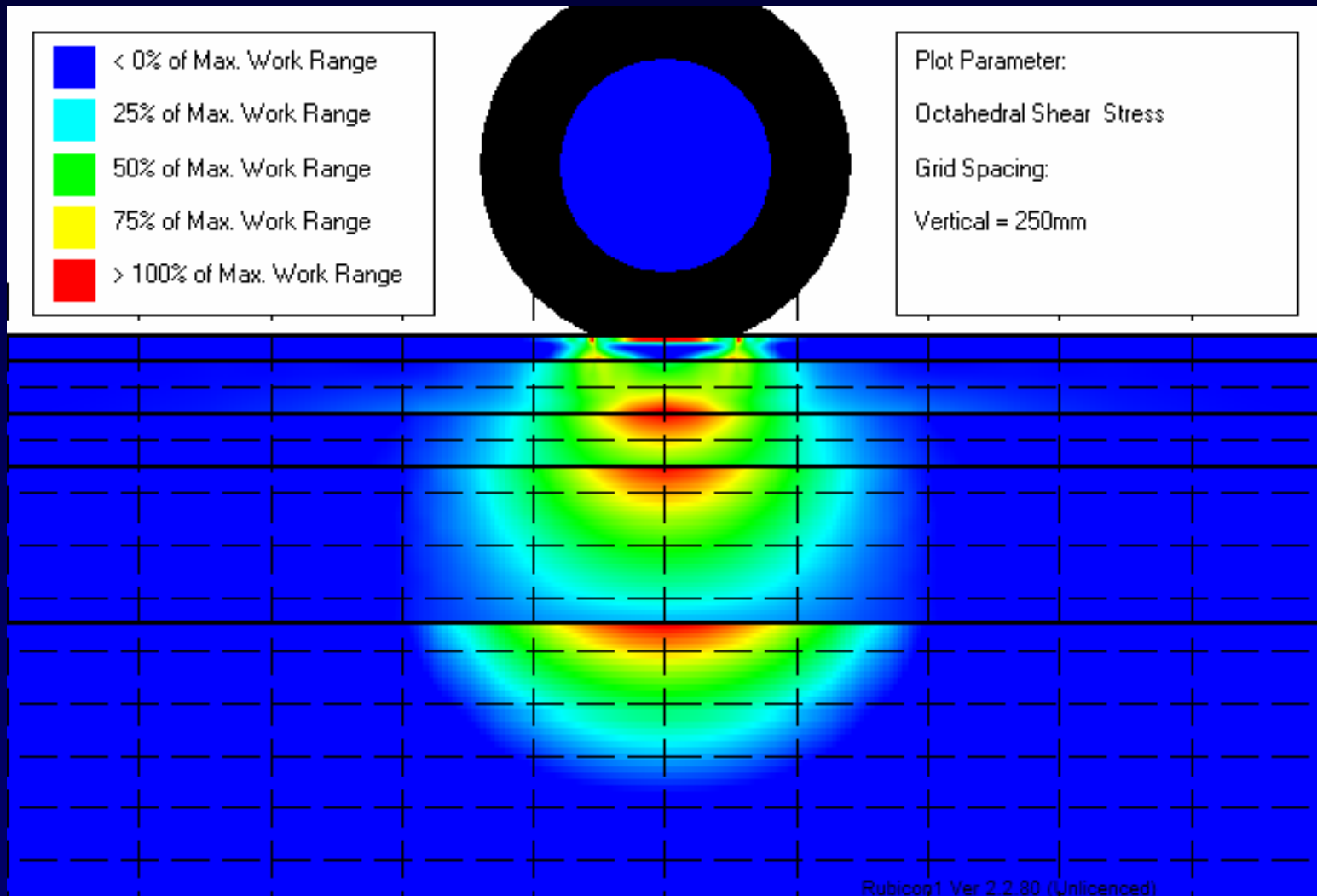
Consequences for ME Design

Estimated Structure At: ± 0 Reps $\pm 500,000$ Reps

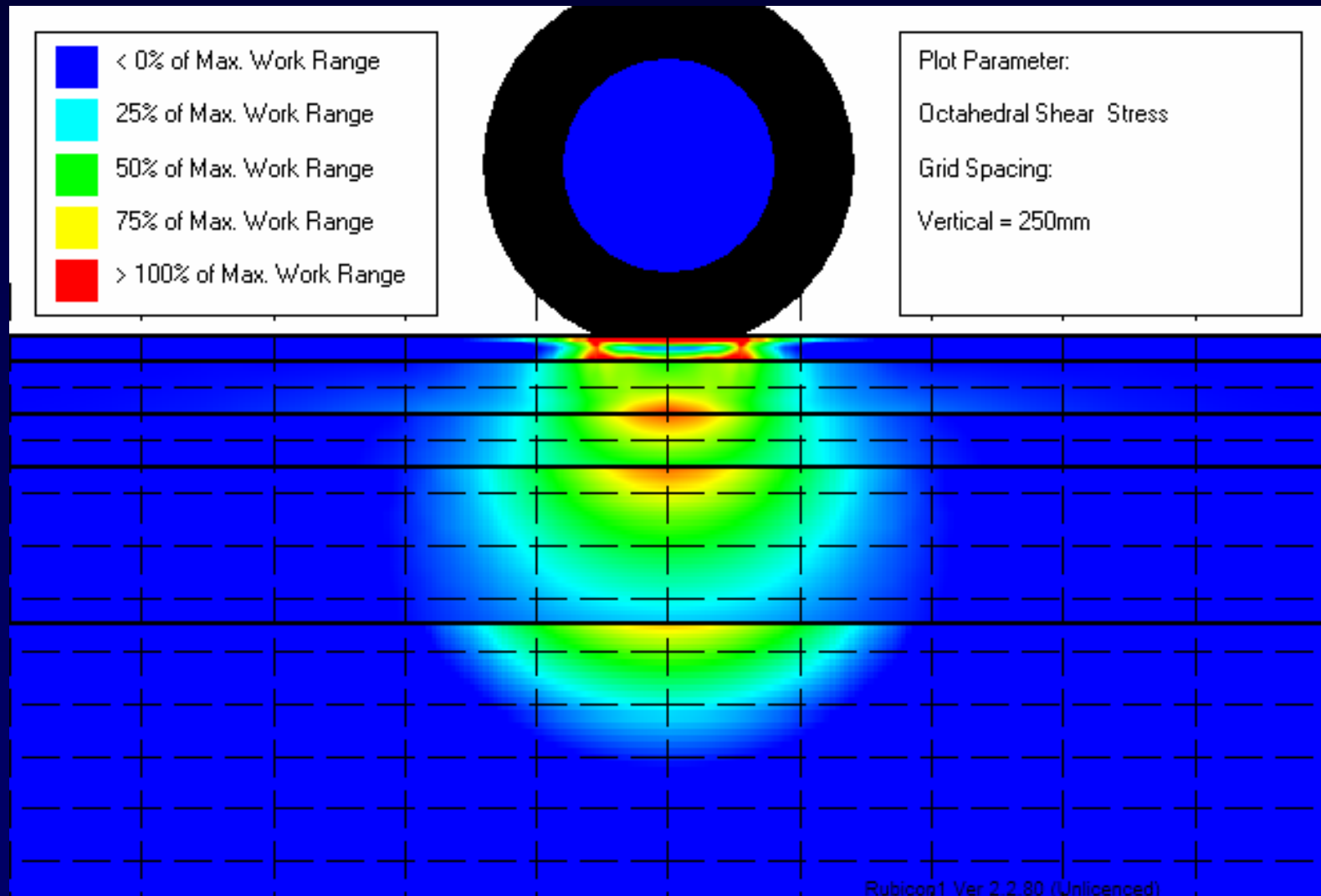
Emulsion Treated Base	1500 MPa	750 MPa
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Rut rate is similar. How do the stress states compare?

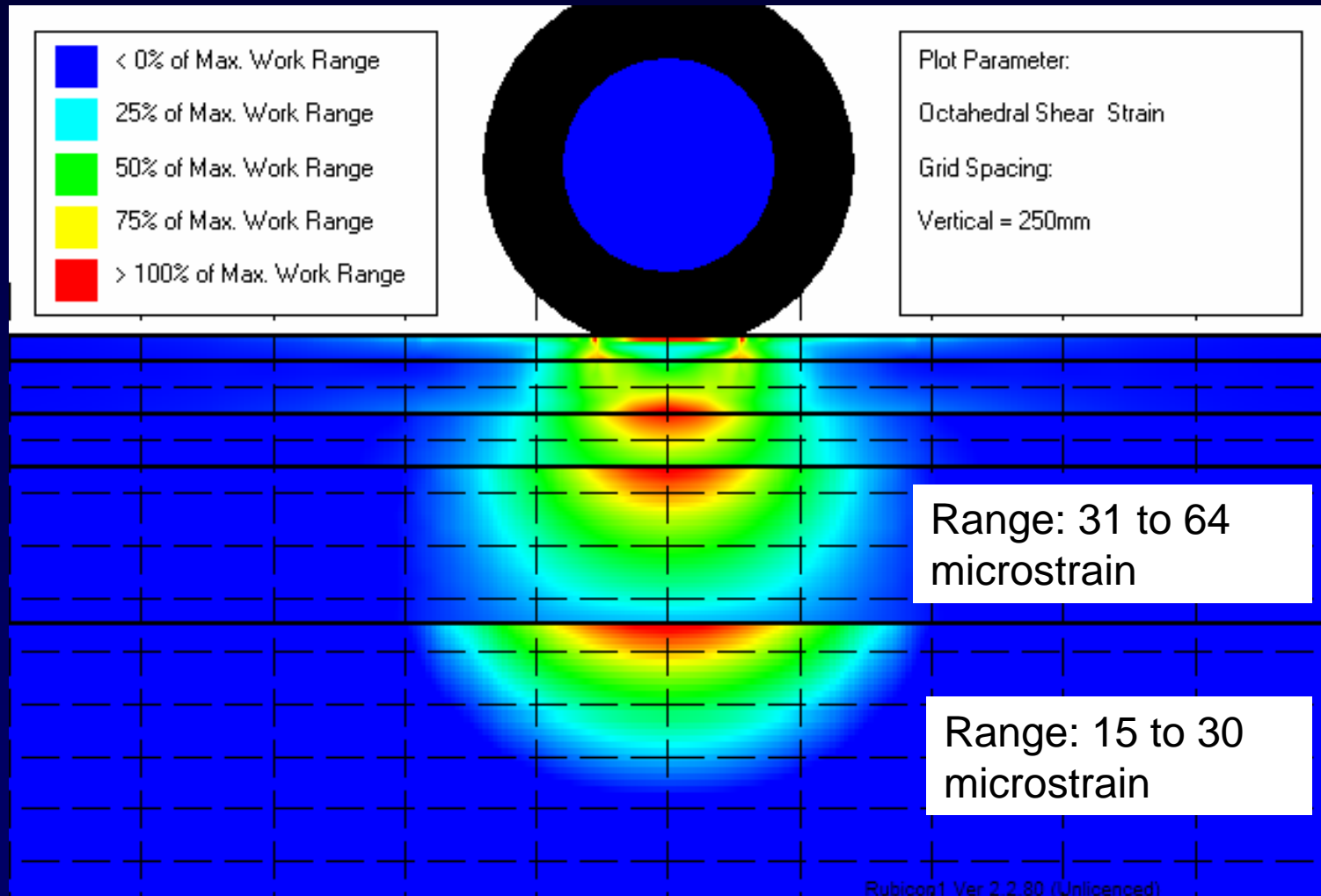
Octahedral Shear Stress State for Estimated Structure at Start of Test



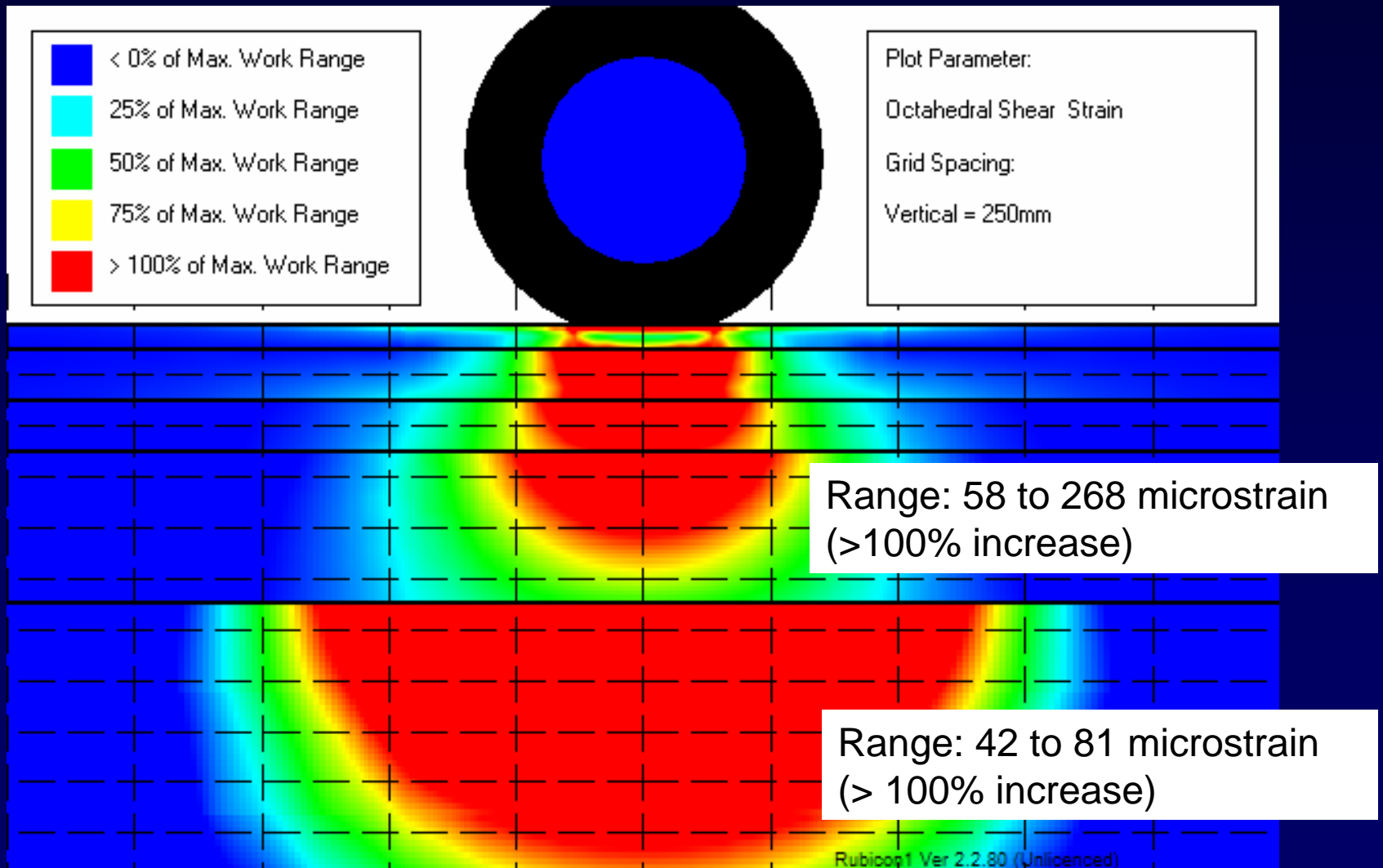
Octahedral Shear Stress State for Estimated Structure at Middle of Test



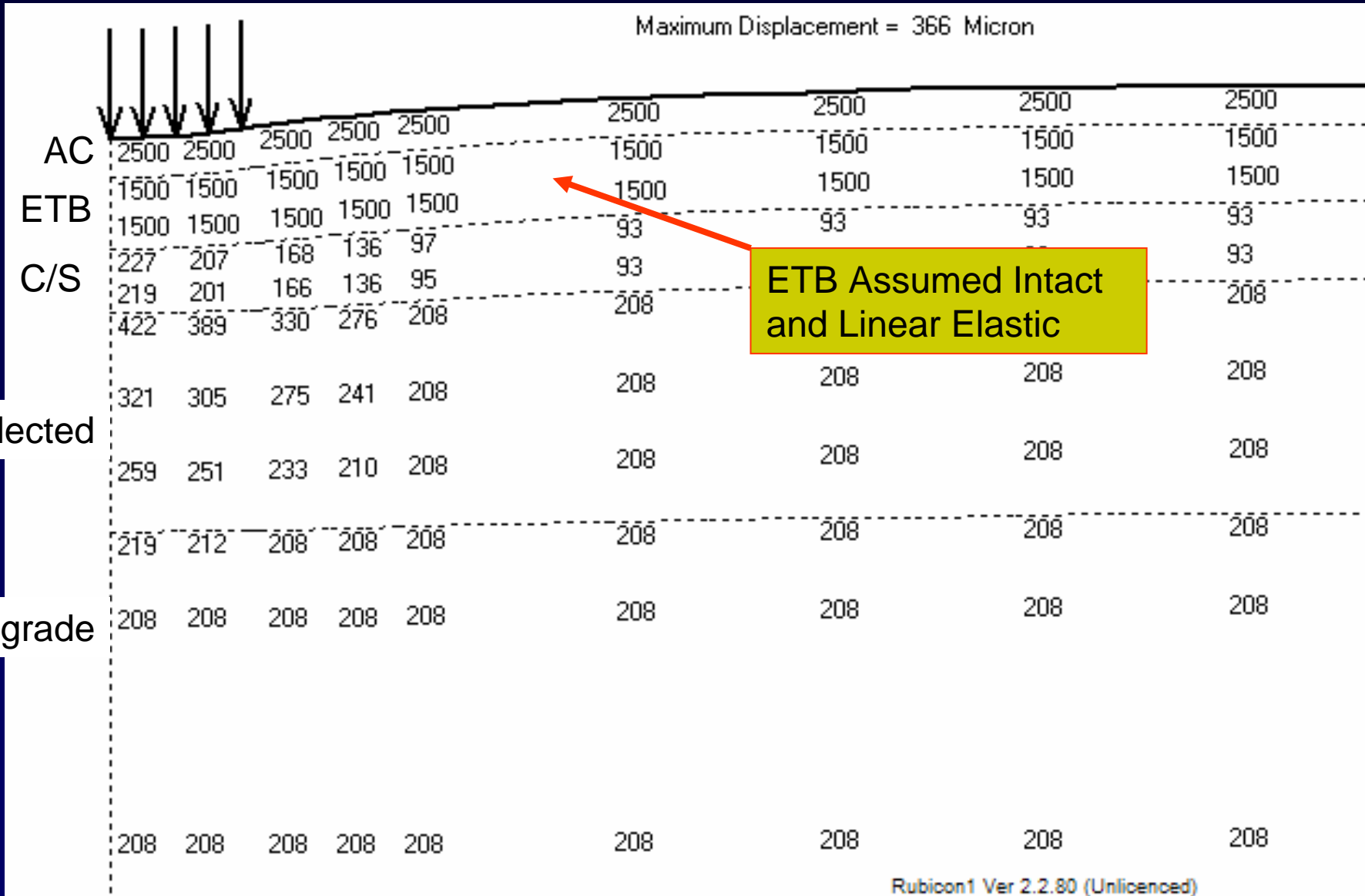
Octahedral Shear Strain State for Estimated Structure at Start of Test



Octahedral Shear Strain State for Estimated Structure at Middle of Test

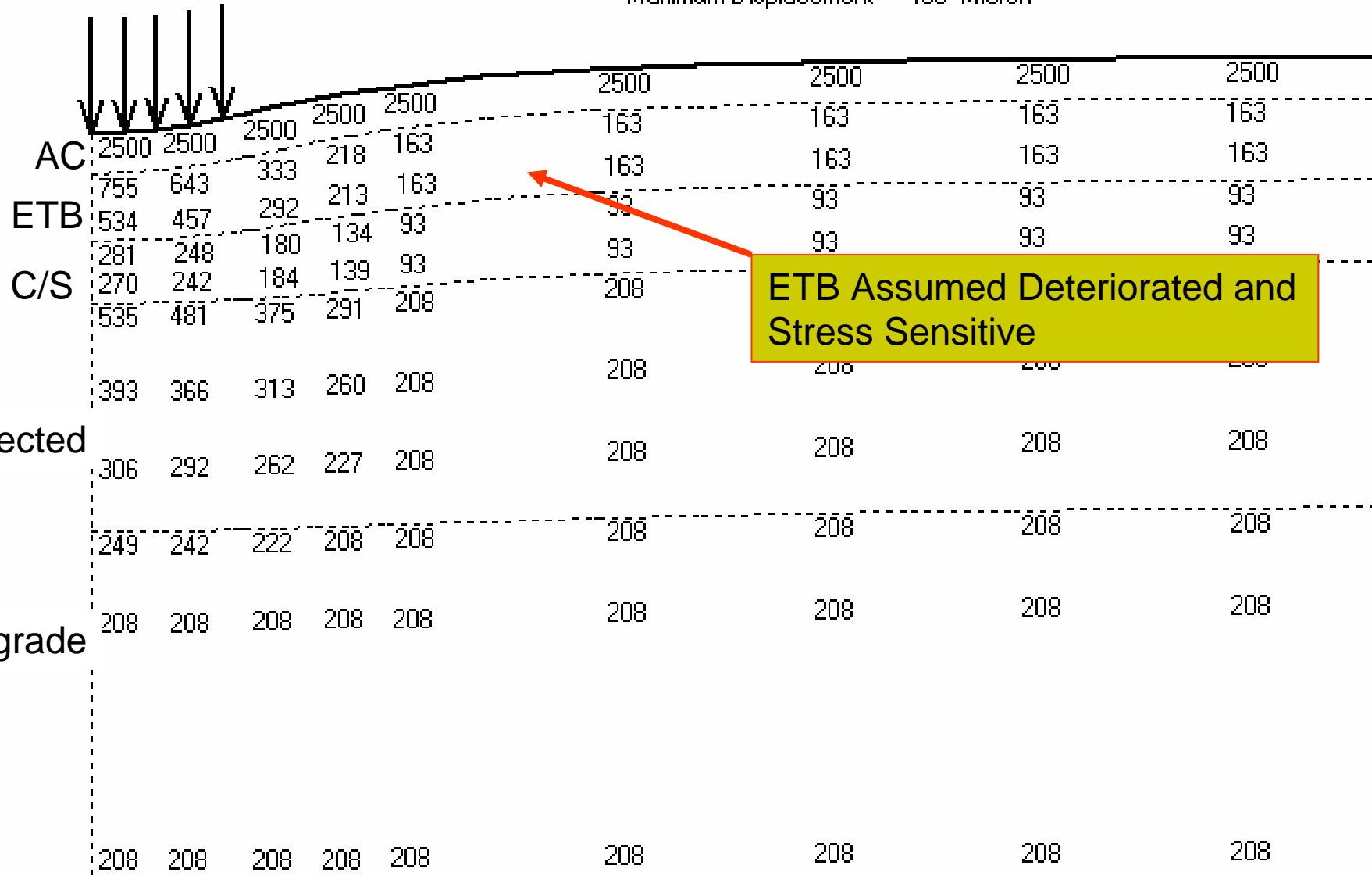


Are Stiffnesses Reasonable?



Are Stiffnesses Reasonable?

Maximum Displacement = 490 Micron



ETB Assumed Deteriorated and Stress Sensitive

Summary:

- Stiffness decrease phenomenon appears to occur in majority of APT tests
- Not always reasonable, can be counter-intuitive
- Can impact significantly on model development

Considerations/Suggestions:

- Need a fundamental understanding of resilient behaviour under loading
- Re-evaluate links between deflection and stiffness?
- Is APT changing the resilient response behaviour of the pavement (consider deflection decrease after rest period)?
- **Remain curious!**