



**HVSIA  
ANNUAL MEETING  
PRETORIA, SOUTH AFRICA  
OCTOBER 16 – 17, 2003**



US Army Corps  
of Engineers

Engineer Research and Development Center



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# US Army Engineer Research and Development Center

**Construction Engineering  
Research Laboratory**  
Champaign, Illinois

**Cold Regions Research and  
Engineering Laboratory**  
Hanover, New Hampshire

**Topographic Engineering Center**  
Fort Belvoir, Virginia

**Environmental Laboratory**  
**Coastal and Hydraulics Laboratory**  
**Information Technology Laboratory**  
**Geotechnical & Structures Laboratory**  
Vicksburg, Mississippi



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# Pavement/Geotechnical Testing Facility



# Heavy Vehicle Simulator

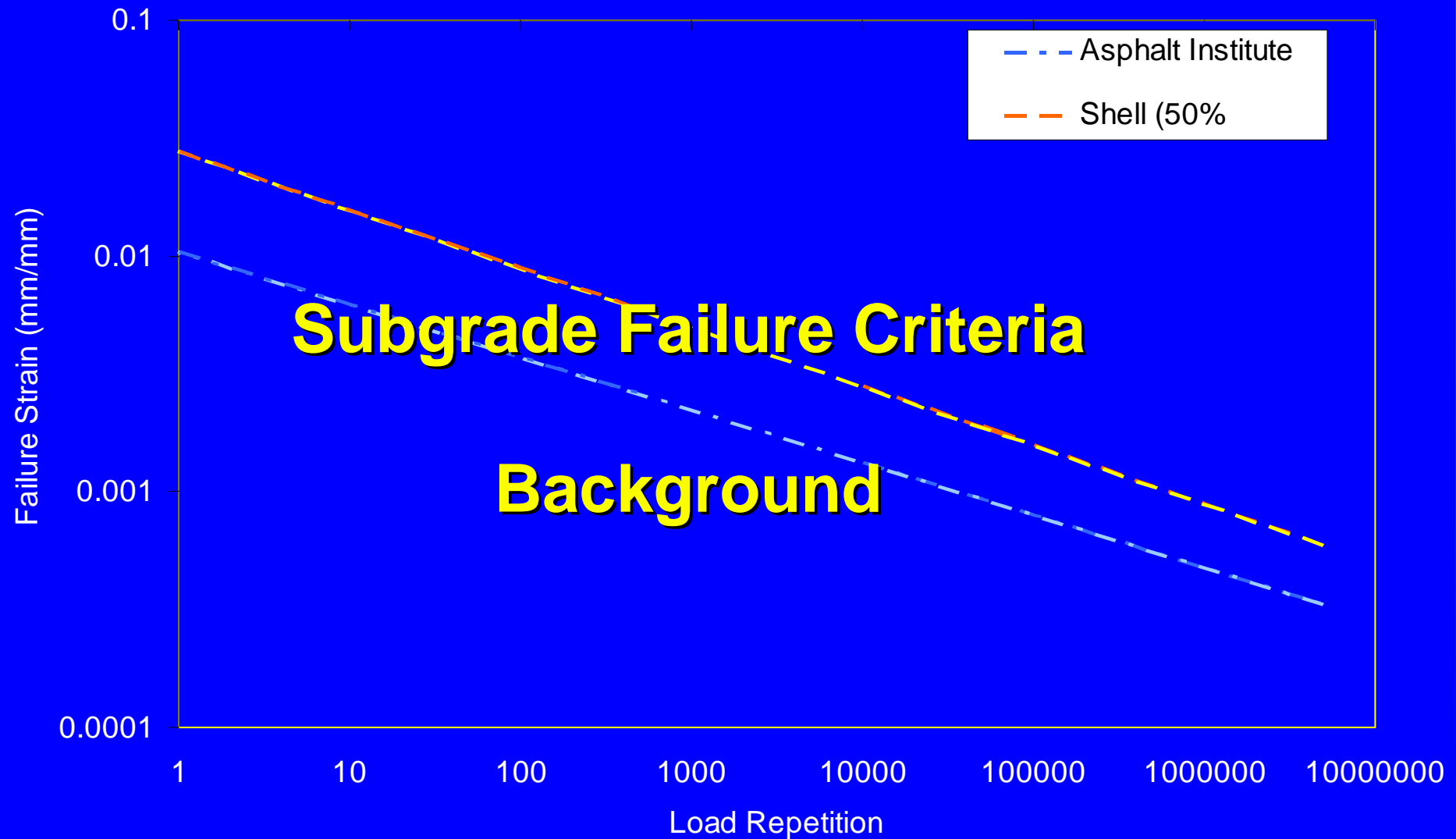
Wheel Load .....	20 – 100 kN roadway Up to 200 kN airfield
Test Wheel .....	Single, Dual or Aircraft
Tire Pressure .....	550 – 757 kPa on roads; up to 1450 kPa on airfields
Repetitions, Per Hour .....	600 (uni-directional)
Trafficked Length .....	Approximately 7 m
Trafficked Width .....	Variable up to 1.5 m
Trafficked Pattern .....	Variable
Power .....	Electric



# Current Work with the HVS

- Subgrade failure criteria (Janoo/Cortez).
- Reinstatement of utility cuts (Cortez/Janoo).
- Stress and strain response in thawing soils (Janoo)

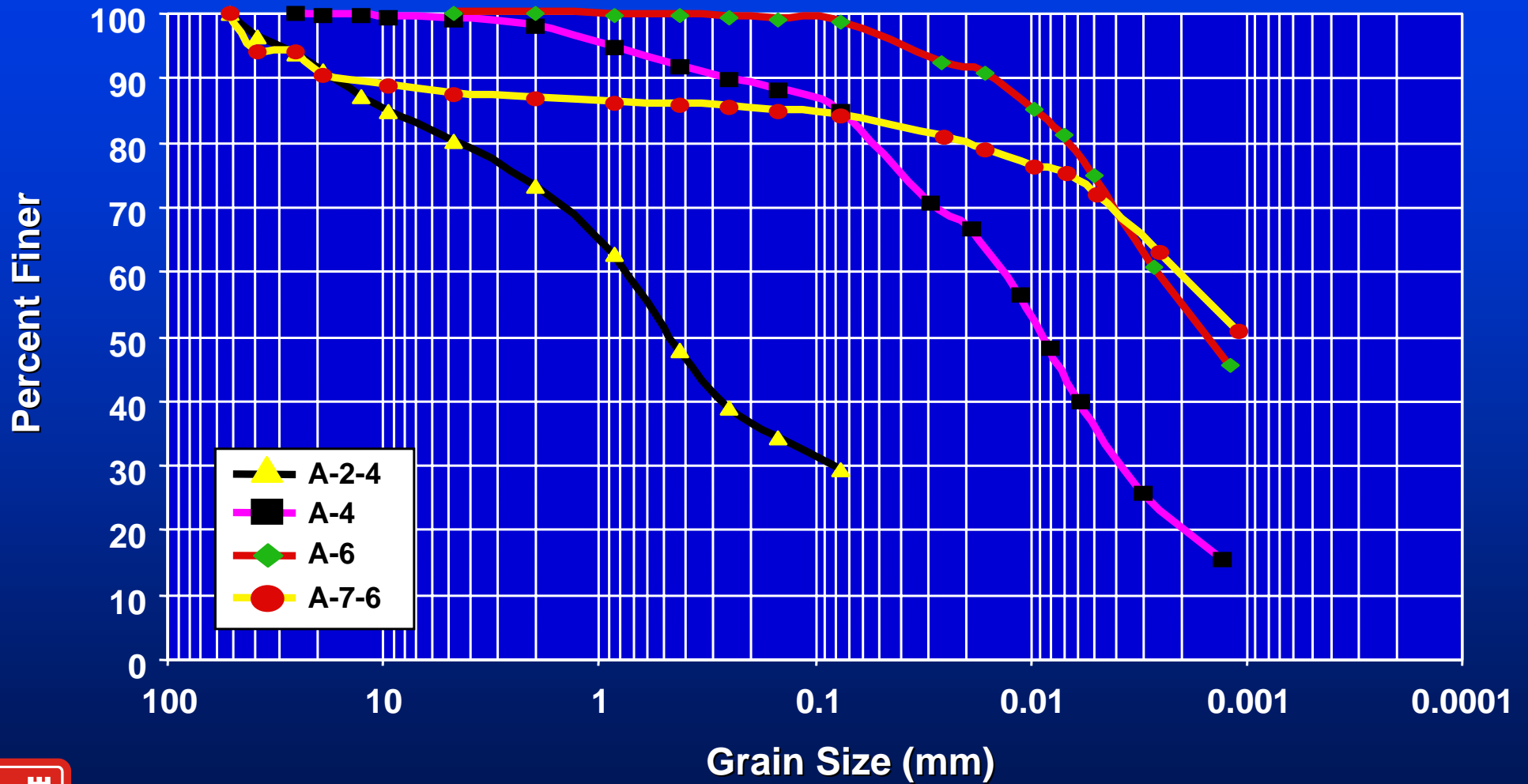


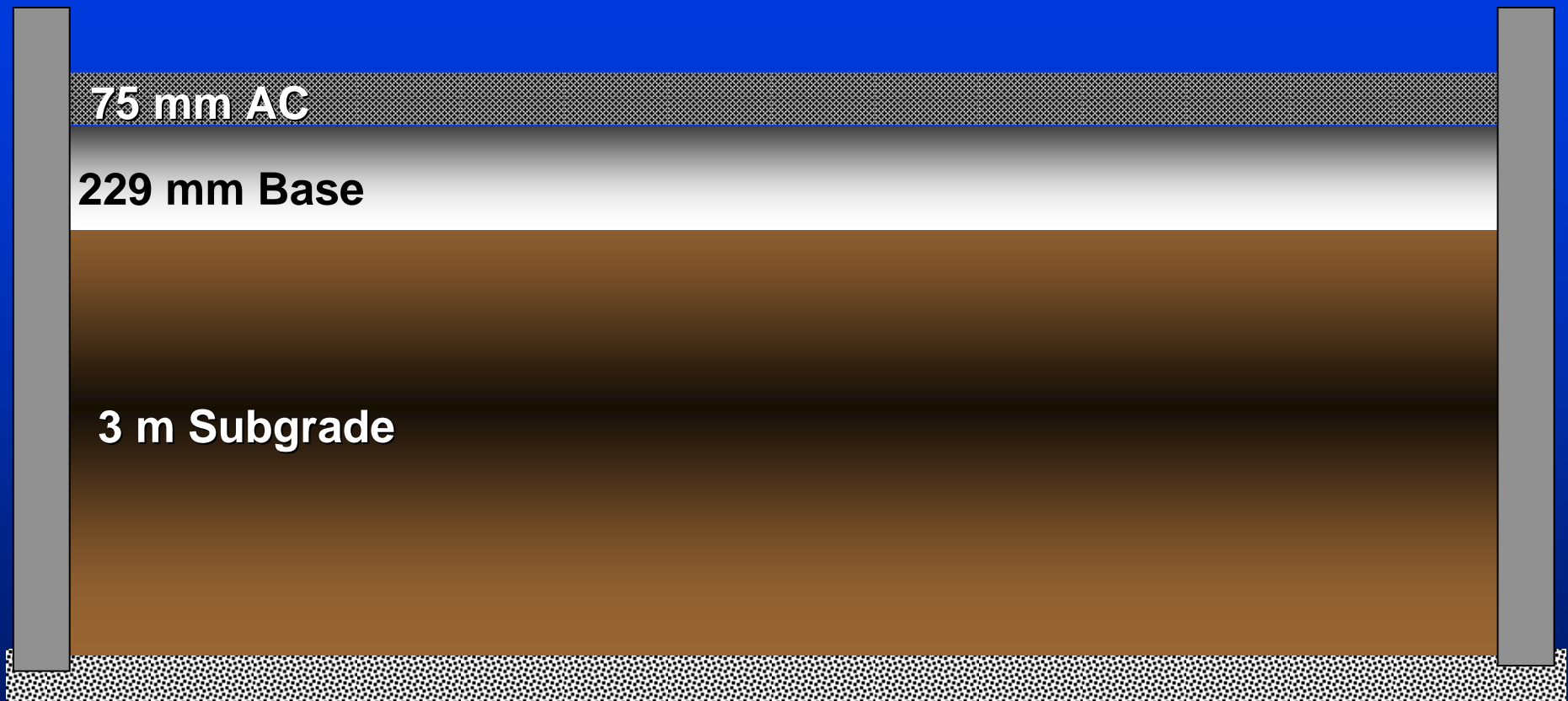


- **Hypothesis**
  - *The subgrade failure criteria is a function of soil type and moisture content*
- **Study involved the Danish Road Institute, Finnish VTT, FHWA, COE, Cornell University & Minnesota DOT**









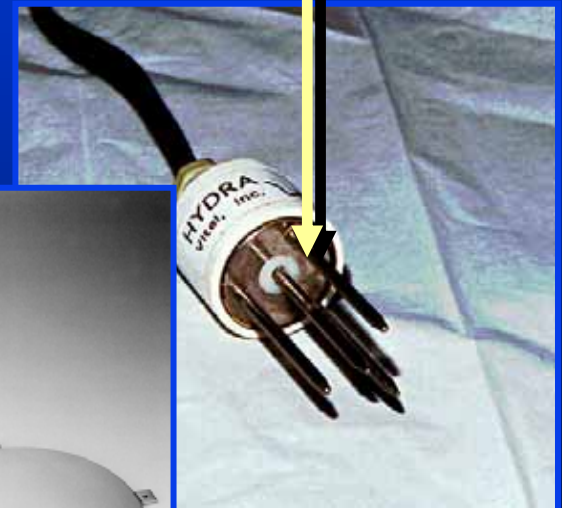
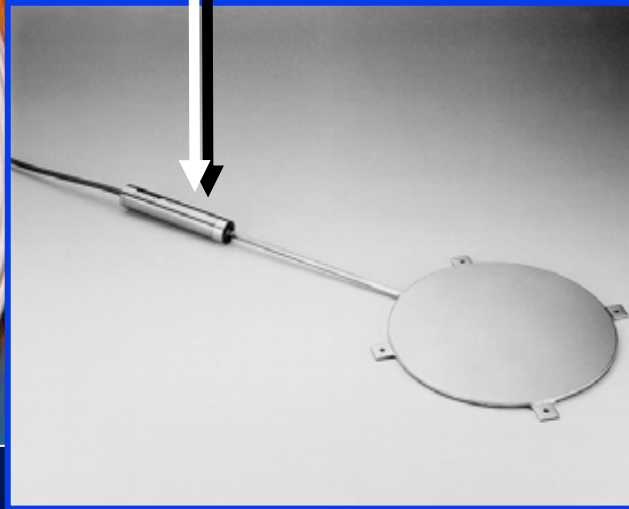
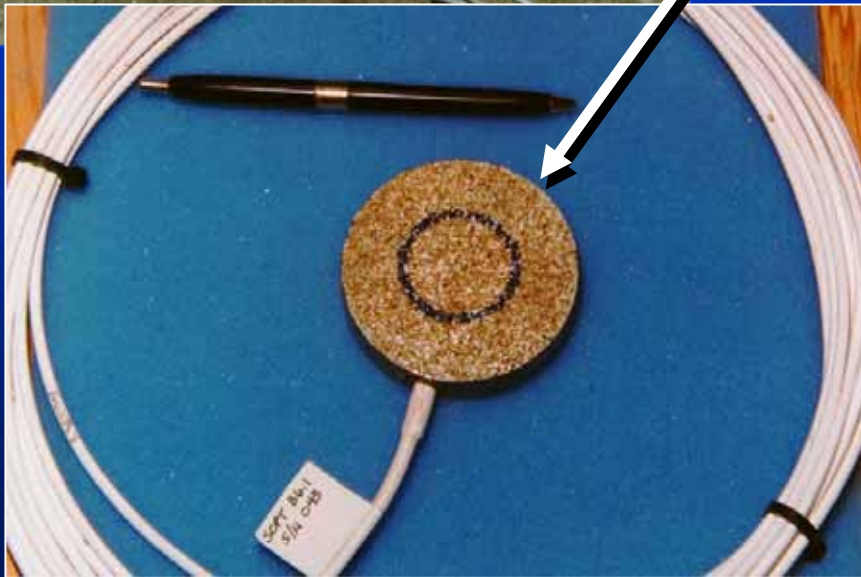
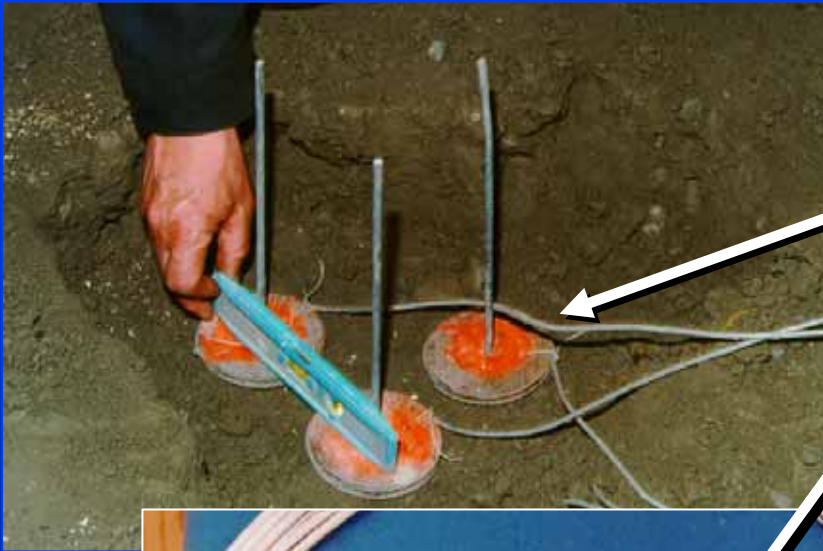
# Instrumentation

Stress Cells

Coil Gages (Strain)

Temperature

Moisture Sensors

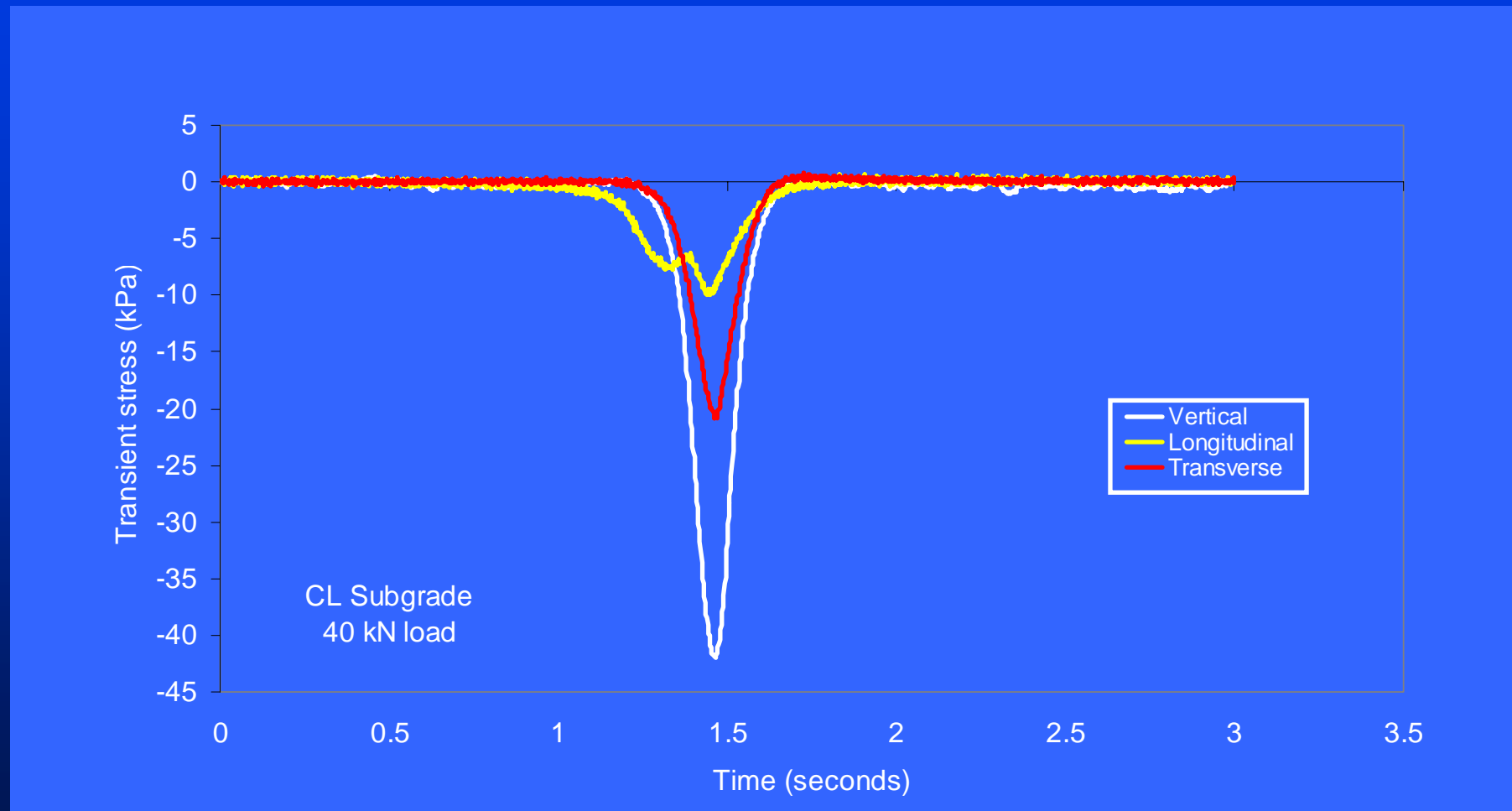


# Summary of Measurements

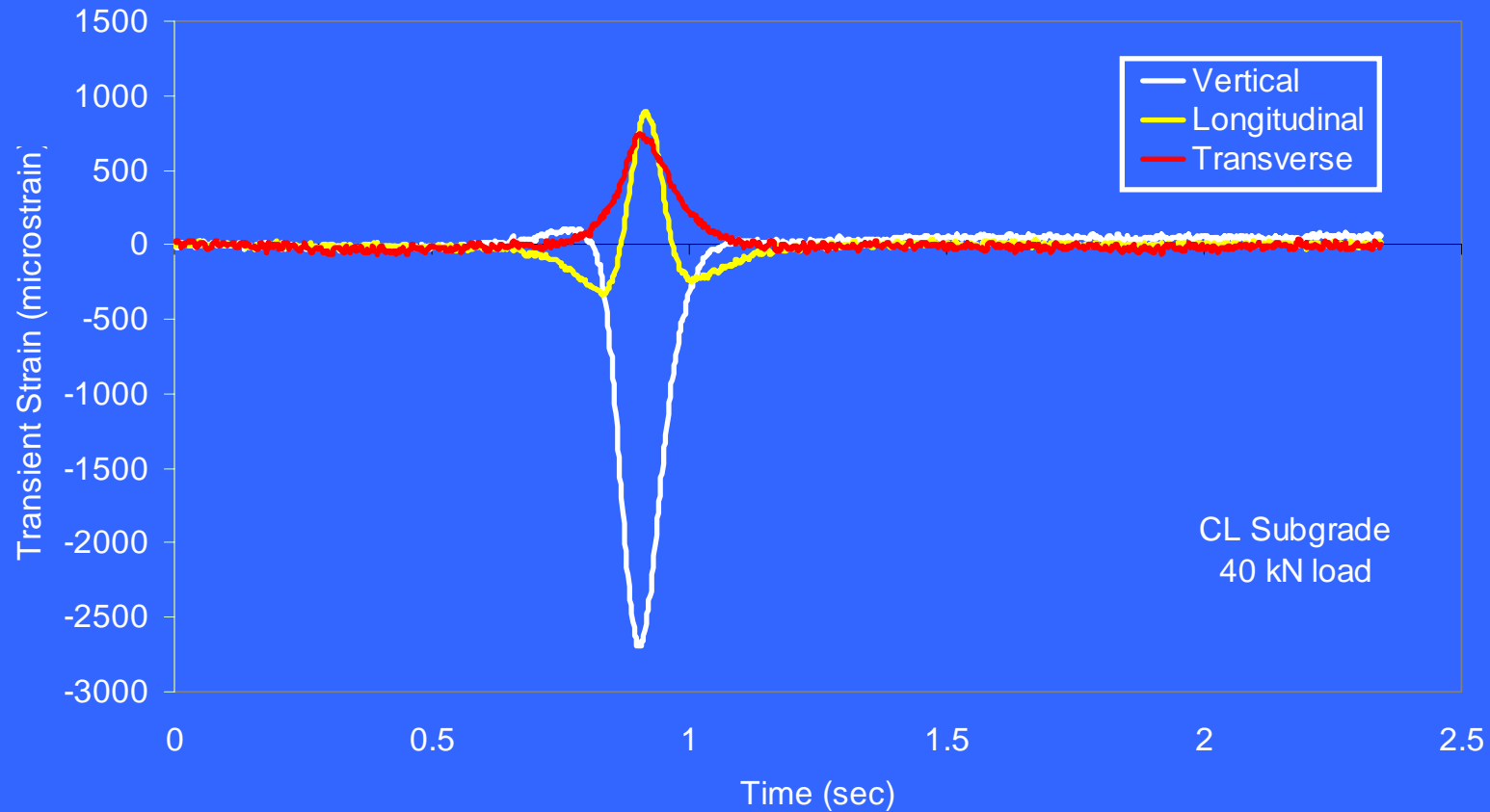
- HVS Load
- Number of load repetitions
- In-situ moistures
- In-situ temperatures
- Transient Vertical, Longitudinal & Transverse subgrade stresses
- Transient Vertical, Longitudinal & Transverse strains
- Permanent deformation (strains)
- Surface Rut Depths

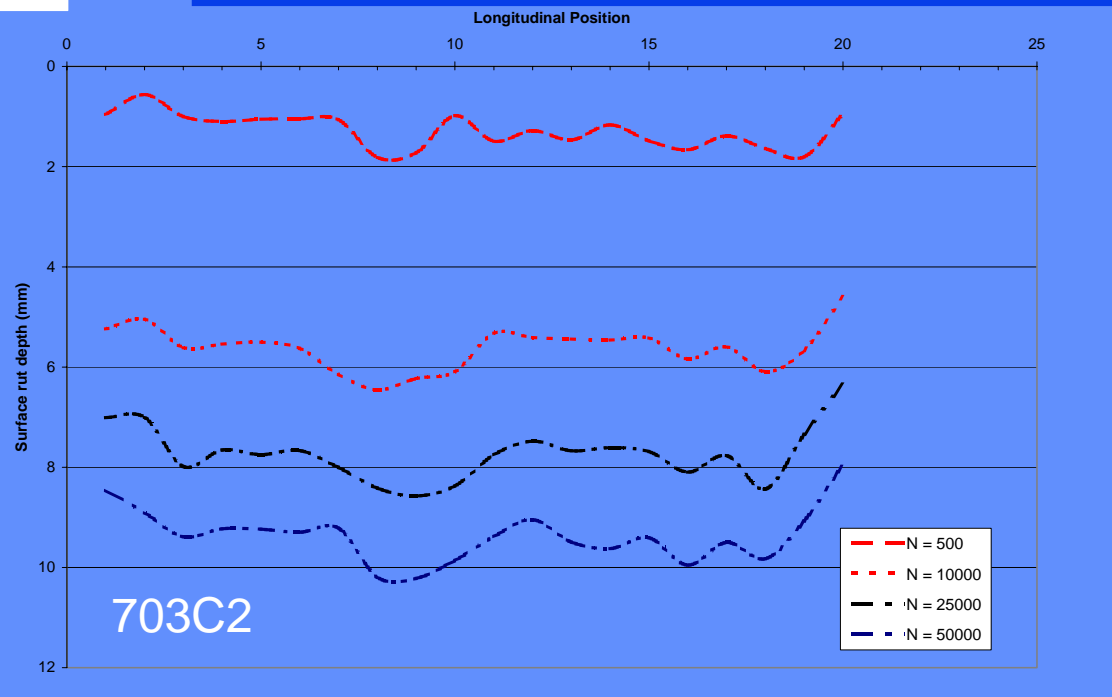
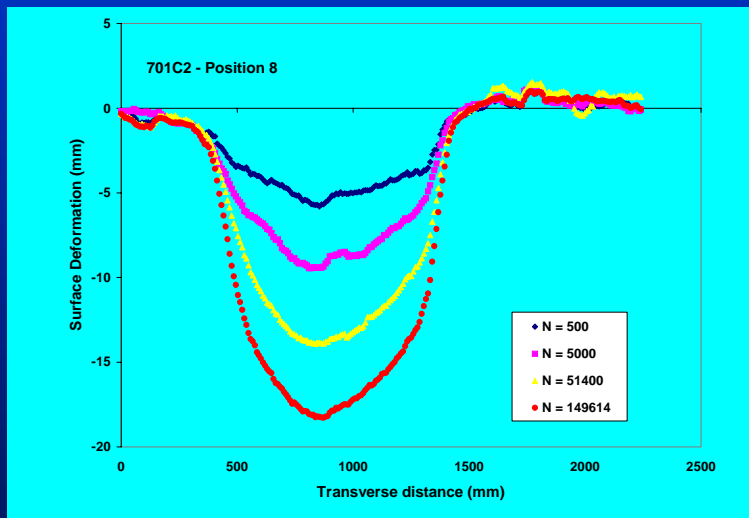
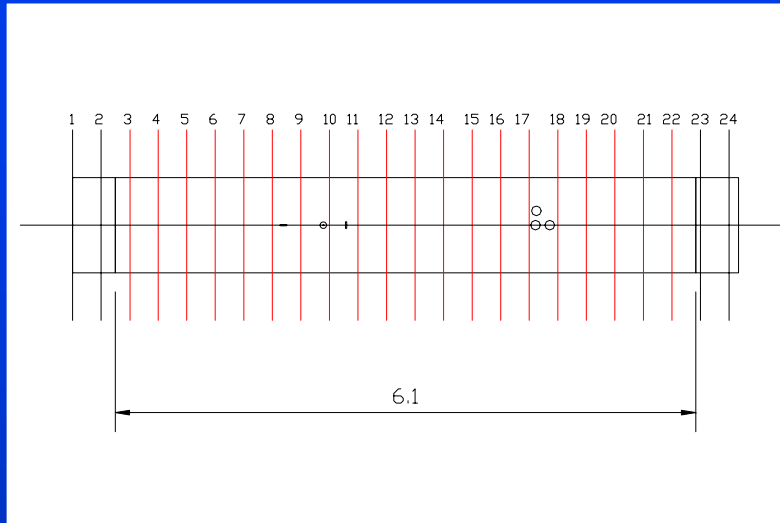


# Typical Stress Measurements

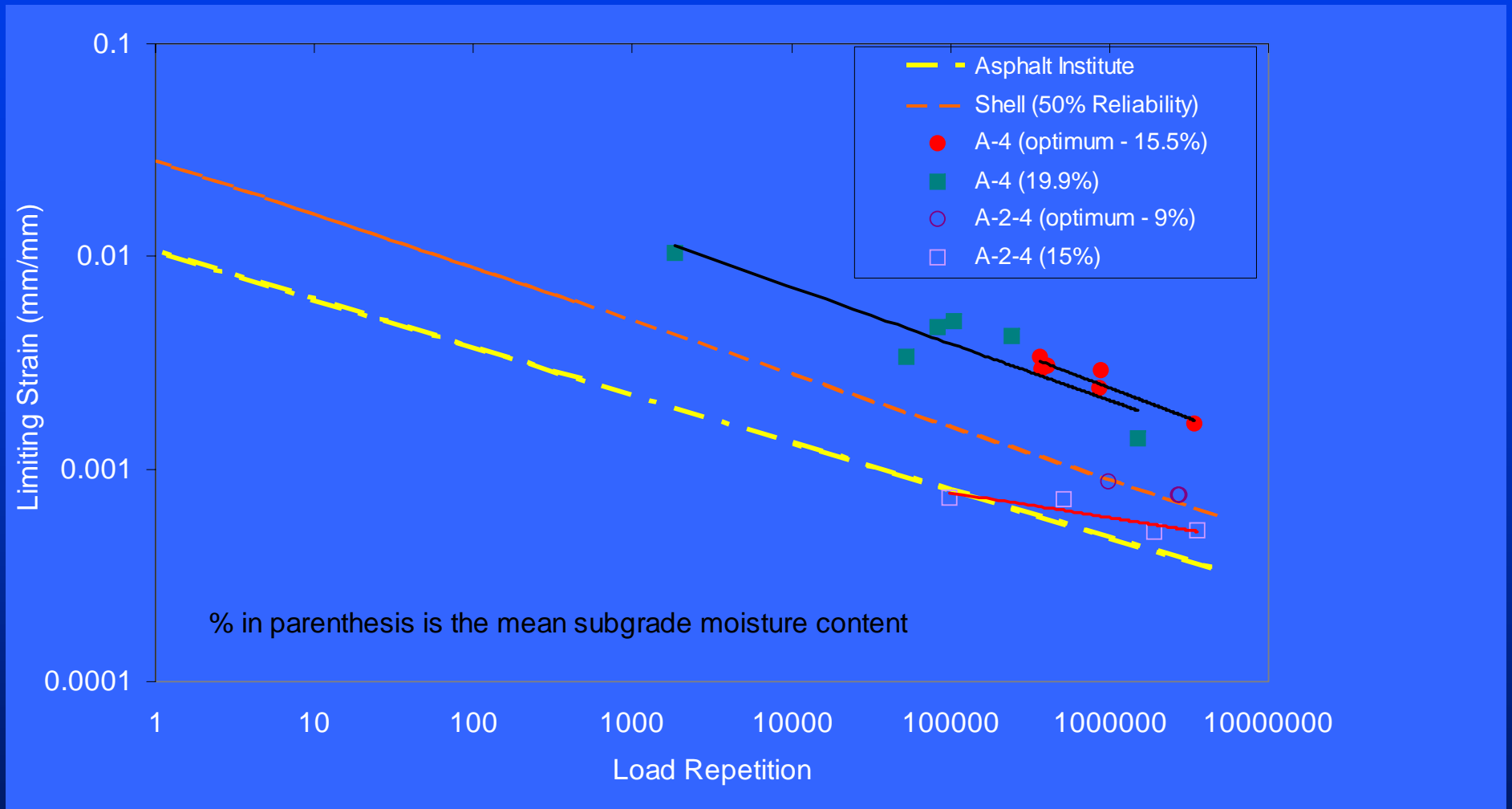


# Typical Strain Measurements





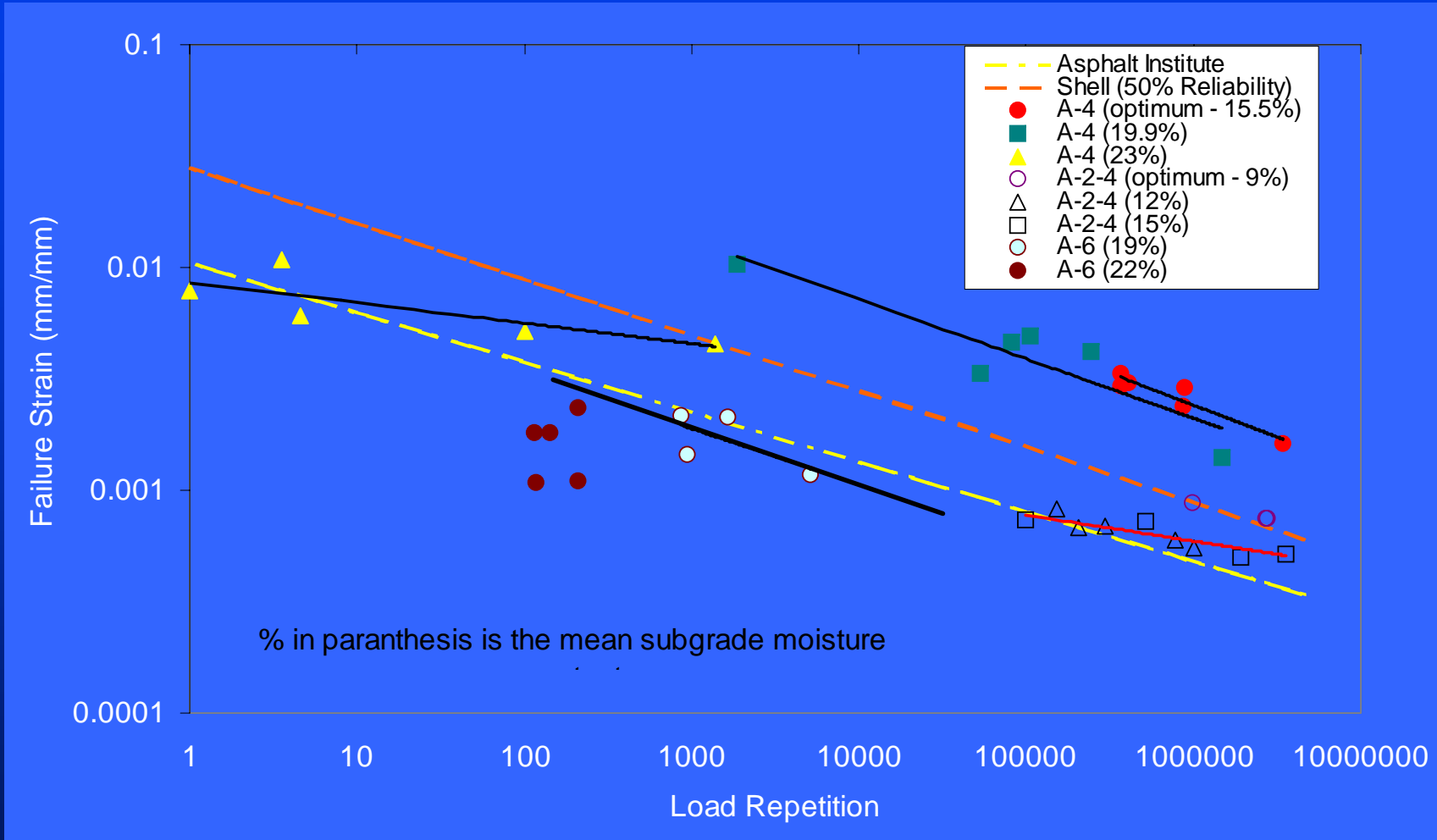
## Longitudinal rut measurements



LAST YEAR







# THE DO LIST

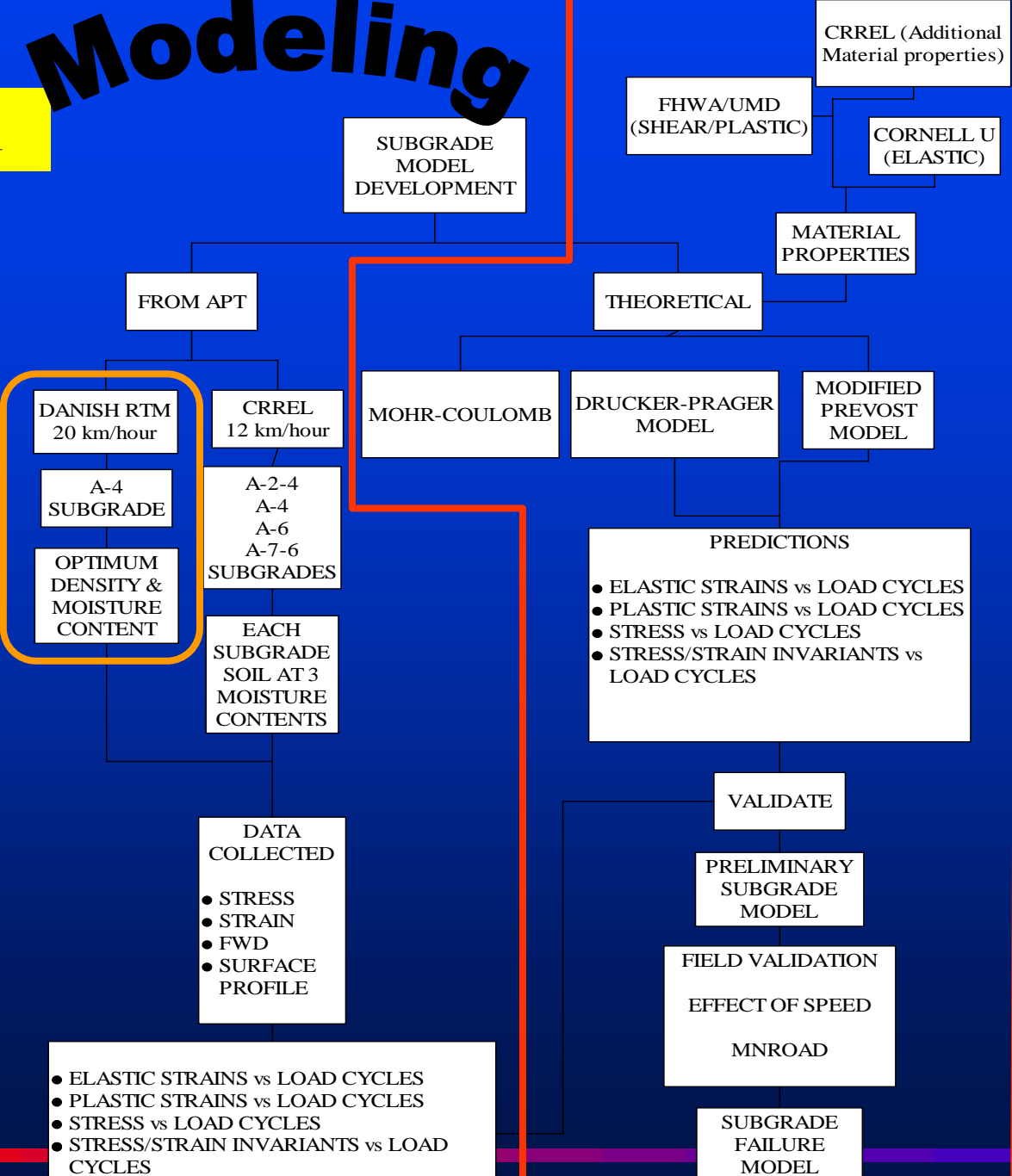
- **Finish database of test results**
- **Begin modeling effort**
- **Finish CH test sections.**
  - **(complete testing next summer)**



# Modeling

Track 1

Track 2



✓ Completed

(Fundamental Approach)

- ✓ TTI results (Shear, Resilient)
- ✓ UMD data (Shear)
- ✓ Cornell data (Resilient)
- ✓ Other ?
  - Permanent deformation for all cycles f(moisture content, soil type)



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# REINSTATEMENT OF UTILITY CUTS

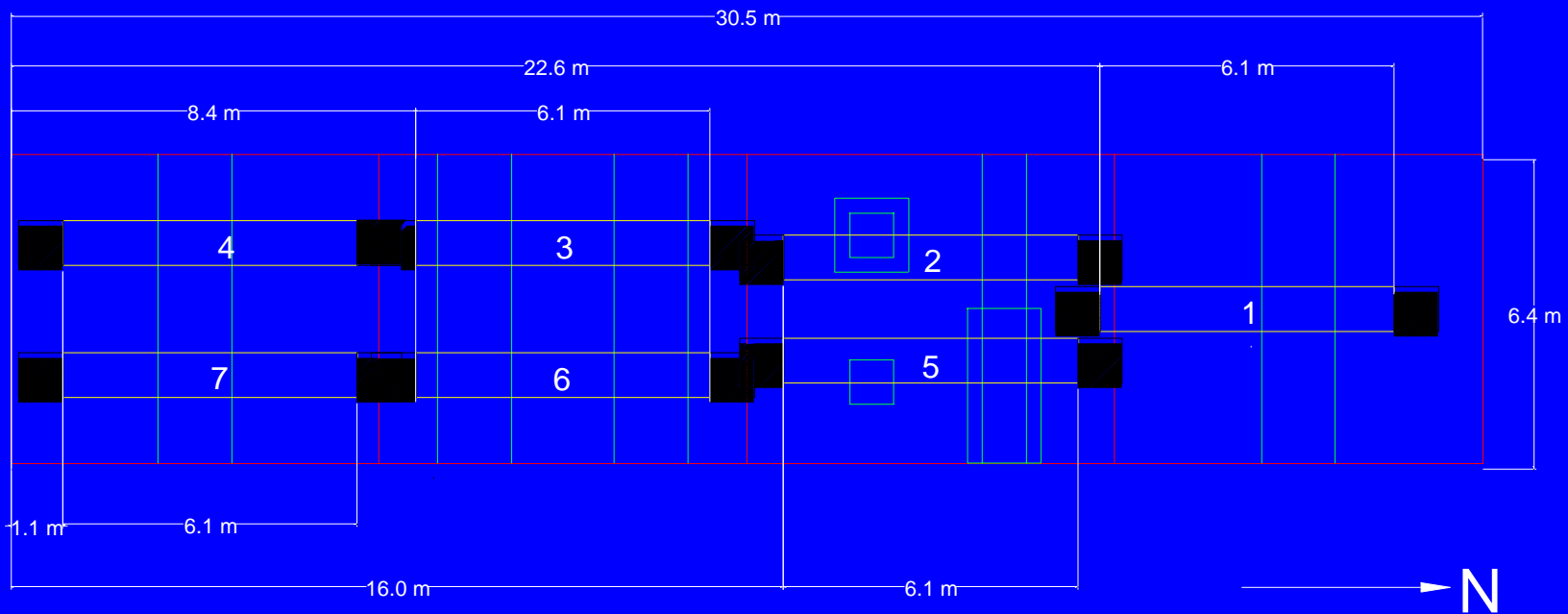


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- **Funded through a consortium of utilities and municipalities.**
- **OBJECTIVE**
  - **Best practice for reinstatement of cuts to minimize performance of existing pavements.**
- **Joint project between CRREL and NRC of Canada**



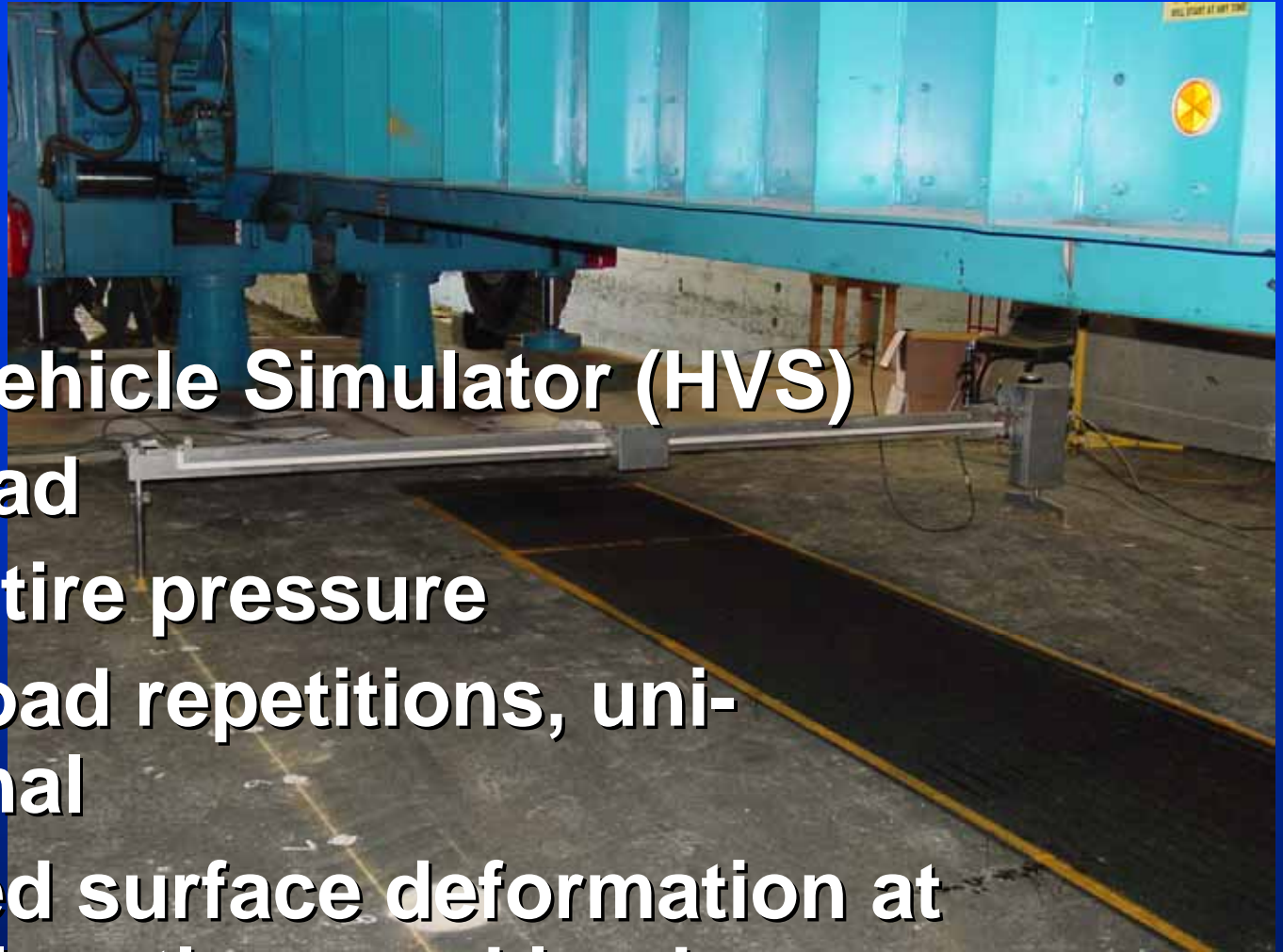


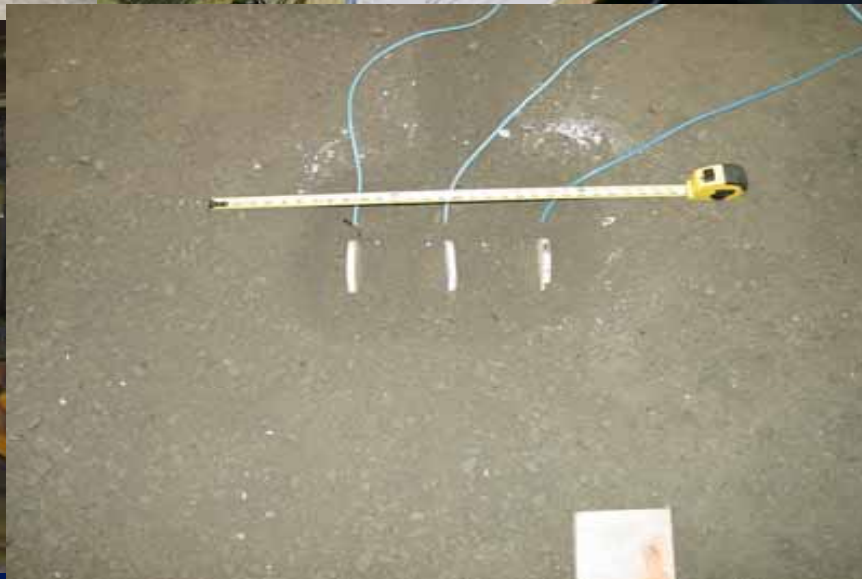
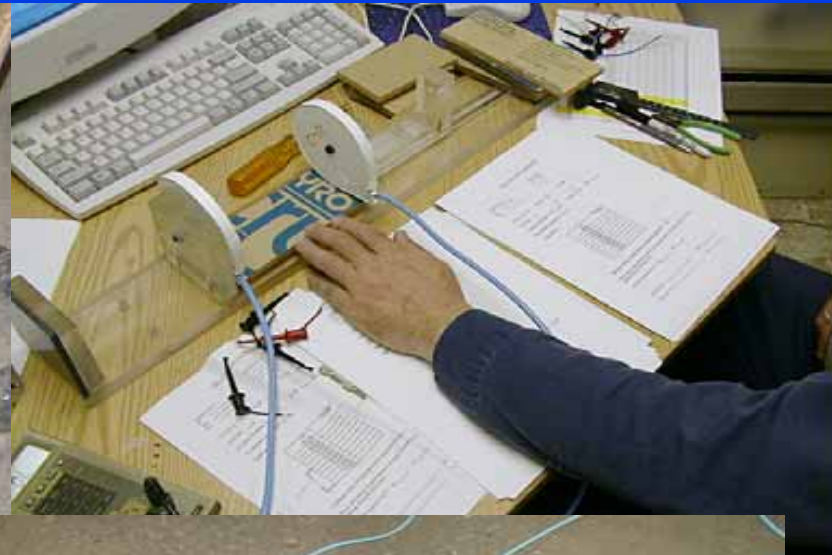
■ ACCELERATION/DECELERATION ZONES (1m x 1m)

NUMBER IN TEST WINDOW INDICATE SEQUENCE OF LOADING



- **Heavy Vehicle Simulator (HVS)**
- **40 kN load**
- **690 kPa tire pressure**
- **10,000 load repetitions, uni-directional**
- **Measured surface deformation at various locations and load reps**







## Future (?)

- Working on developing a follow up pool fund study for base course failure criteria.
- Working with University of Illinois and TENSAR to conduct APT on geogrid reinforced bases.



# Future (?)

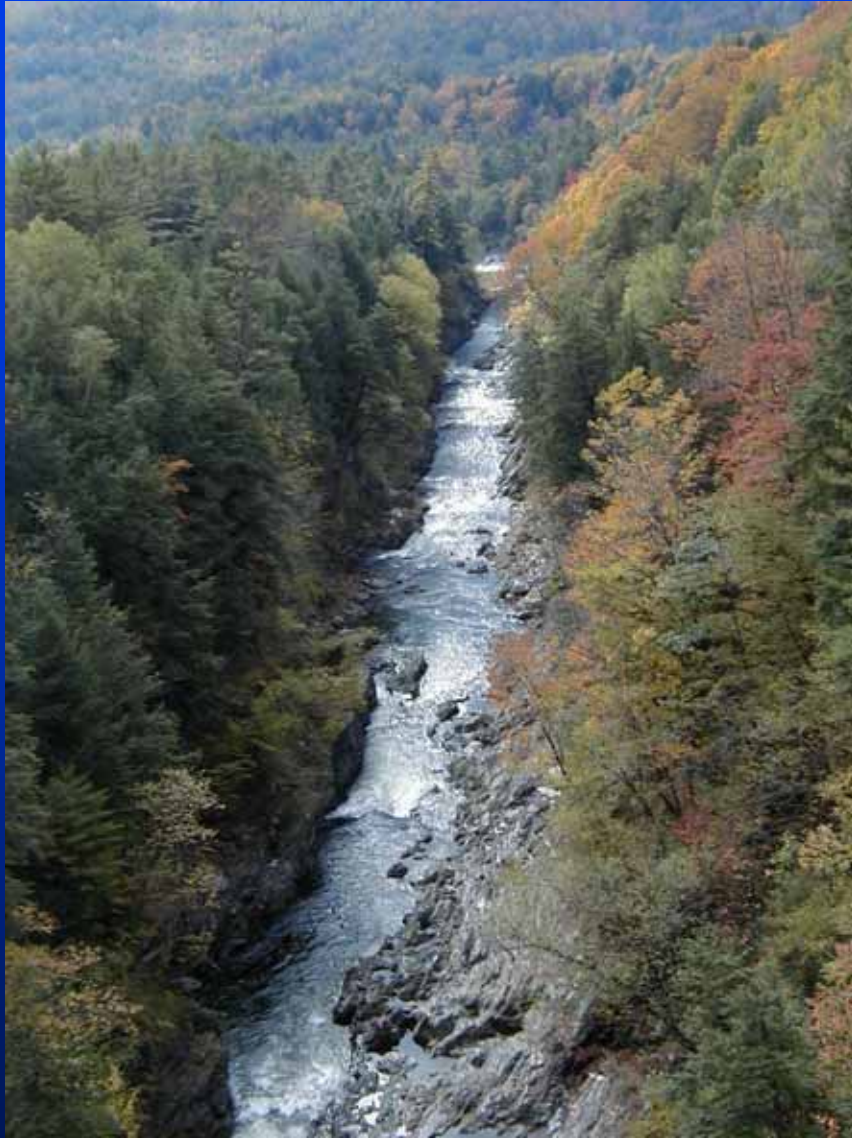
- **Working with Gas Technology Institute on additional experiments on utility cuts.**
- **Others**



# Publications

- One published report
- 8 draft reports on test section results
- Several papers
  - BCRA, ISAP, APT (Reno), ICHP (Ohio)





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