

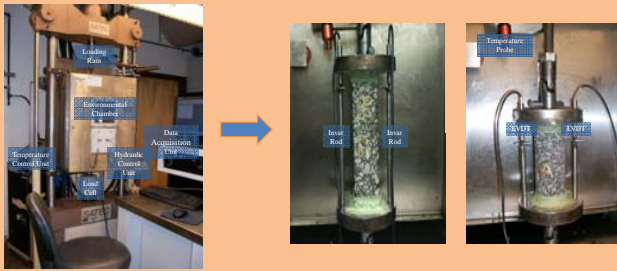
# Investigating Low – Temperature Properties of Cylindrical Superpave Gyrotatory-Compacted AC Specimens using the TSRST - TRB 11-2631

Edward M. Cortez - Elie Y. Hajji - Mohammad Zia Alavi - Peter E. Sebaaly

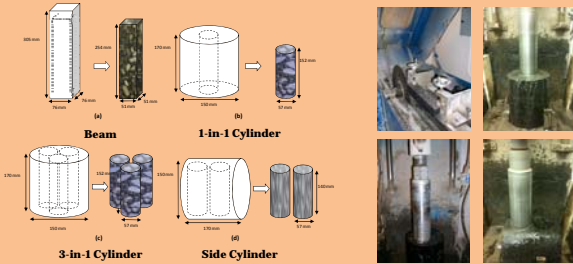
## Objectives

- Evaluate the effect of specimen shape and compaction method on TSRST results
- Check fracture temperatures from TSRST test against the true low temperature performance grade (PG) of the recovered binders from tested specimens

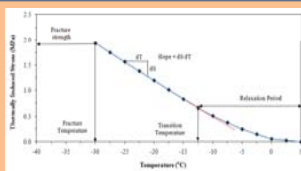
## TSRST Test Setup



## Specimen Geometry



## Terminology



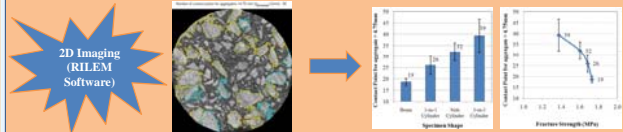
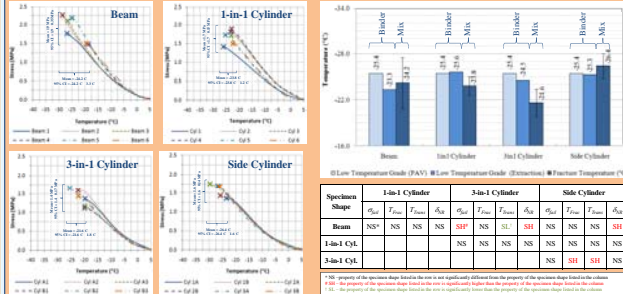
**Fracture Strength**,  $\sigma_{fail}$  = stress at which the specimen fractures  
**Fracture Temperature**,  $T_{frac}$  = temperature at which the specimen fractures  
**Transition Temperature**,  $T_{trans}$  = temperature corresponding to the end of the relaxation period / beginning of non-relaxation period  
**Slope**,  $\delta_{NR}$  = slope of the linear non-relaxation portion of the stress-temperature curve

## Experimental Plan

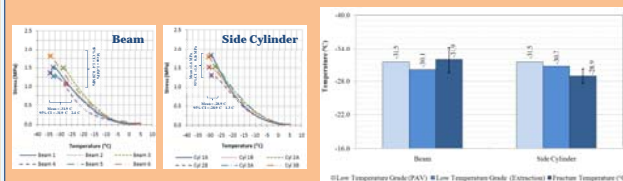
Phase	Mixture Properties	Specimen Geometry	Tests
1	PG 64-22 Mix; 12.5mm NMAS; intermediate gradation; 5.9% Opt. AC	1-in-1 Cylinder 3-in-1 Cylinder Side Cylinder	TSRST, Extraction/Recovery, PG Grading, 2D Planar Imaging
2	PG 64-28 Polymer Modified Mix; 19.0mm NMAS; intermediate gradation; 5.1% Opt. AC	Beam Side Cylinder	TSRST, Extraction/Recovery, PG Grading

## Results

### Phase I: PG64-22 Mix



### Phase II: PG64-28 Polymer-Modified Mix



## Conclusions and Discussions

- Cylindrical specimens prepared from SGC provide a better alternative to beam specimens.
- Side cylinders cored perpendicular to compaction direction gave promising results.
- Test results repeatability improved for side cylinders.
- TSRST results for beam specimens were not significantly different from side cylinders with the exception of  $\delta_{NR}$ .
- AASHTO R30 aging procedure simulates long-term aging reasonably for side cylinders.

### Benefits of Side Cylinders

- SGC readily available for most laboratories.
- Side cylinder specimens can easily be obtained from field cored samples:
  - ❖ Cylindrical specimens can be *cored at different lifts* of the AC layer parallel to traffic direction.
  - ❖ *Orientation* of the specimens will be preserved and can be tested to simulate actual thermal loading conditions in the lab by subjecting tensile stresses parallel to traffic direction.



## Acknowledgments

This study is a part of the overall effort in the Asphalt Research Consortium (ARC) work element E2d: *Thermal Crack Resistant Mixes for Intermountain States* sponsored by the FHWA, U.S. Department of Transportation. However, the contents of this report reflect the views of the authors and do not necessarily reflect the official views and policies of the FHWA. The authors gratefully acknowledge the FHWA support.