Utah Experience

With

Elastomeric Binder Modification

Local Solutions for Local Challenges

Utah has a unique climate and geography requiring unique solutions

Where is Utah?


Mountain
Basin and Range
Low Desert
Colorado Plateau
Logan
Brigham City
Ogden
Great Salt Lake
Salt Lake City
West Valley City
Layton
Bountiful
Murray
Sandy
Wendover
Nephi
Delta
Fillmore
Richfield
Gunnison
Price
Green River
Moab
UTAH
Cedar City
Kanab
Monticello
Blanding
Duchesne

Climate

- Temperature Range
  - Low Desert: High 115^{o} F Low 26^{o} F
  - Colorado Plateau: High 110^{o} F Low -10^{o} F
  - Basin & Range: High 110^{o} F Low -15^{o} F
  - Mountain: High 100^{o} F Low -20^{o} F
- Common Daily Temperature Swing
  - Summer 40^{o} F
  - Winter 30^{o} F

Traffic

- Local Industrial and Mining
- Cross Country Trucking
  - East/West I-80, I-84, I-70
  - North/South I-15, (666, 191, 6)

Challenges to Pavement

- Typical distress mechanisms
  - Rutting (hot)
  - Stripping (wet)
  - Fatigue Cracking (intermediate)
  - Thermal Cracking (cold)
  - Raveling (cold)
- Construction Flaws
  - Segregation (raveling)
  - Density (fatigue or raveling)

Observations

- Utah pavement performance history leads to the conclusion that mixes produced with refinery run binders will either rut or suffer brittle failure.
- Something must be added to the HMA mix to stabilize it in our climate extremes.
- Mixes built with the same binder but different aggregates perform differently.

Postulate

- Although binder is an important part of the stability of the mix, it is not the only important factor.
- Desirable mix properties can be extended by adding toughness to the binder.
- Desirable antistripping properties can be obtained through priming aggregate surfaces

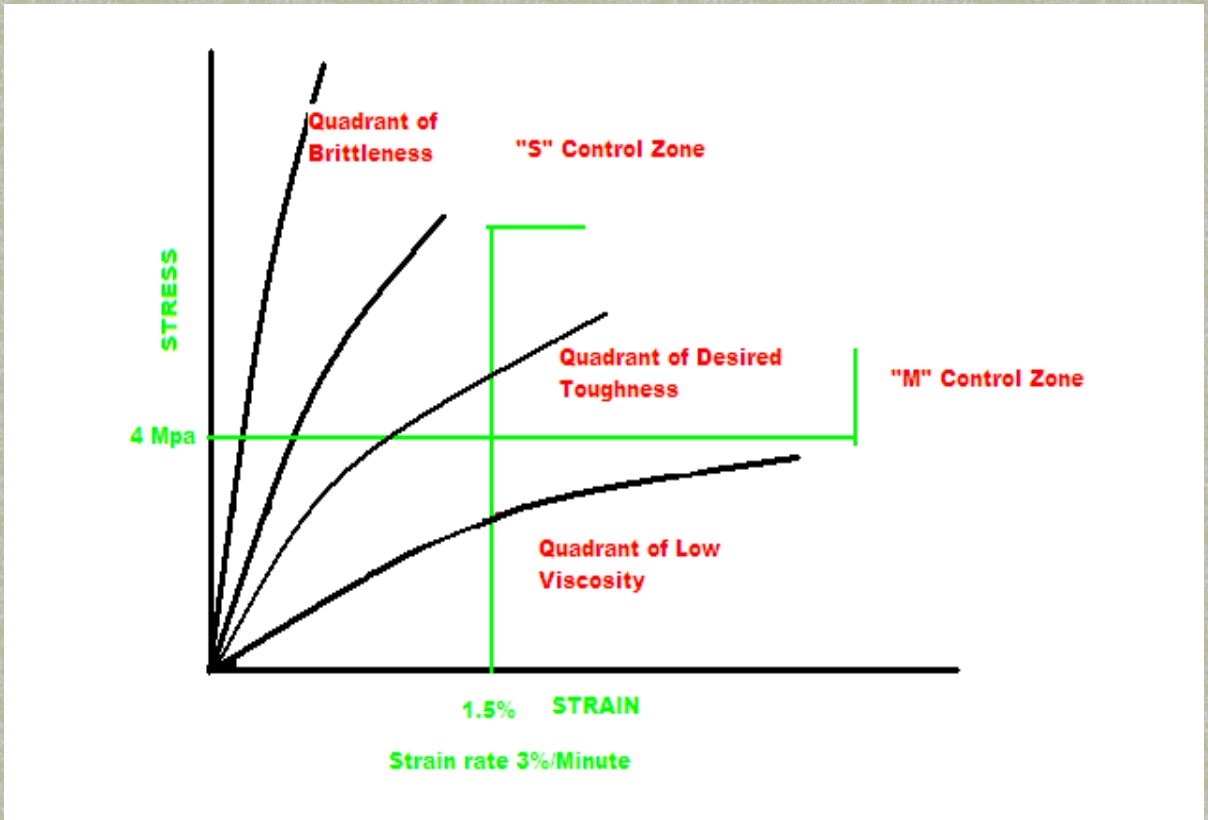
Specification Philosophy

- UDOT would rather support innovation through performance specification as opposed to recipe specification.
- Contractors and suppliers have great knowledge and must be included in development of specifications.
- Contractors and suppliers should control their own processes through quality control programs.
- Use Standard AASHTO tests with local interpretation.

Solutions

- Supporting cold temperature properties through toughness
- Supporting intermediate temperature properties through elasticity
- Supporting high temperature properties through high elastic stiffness
- Mix stability testing

Binder Toughness (Cold)

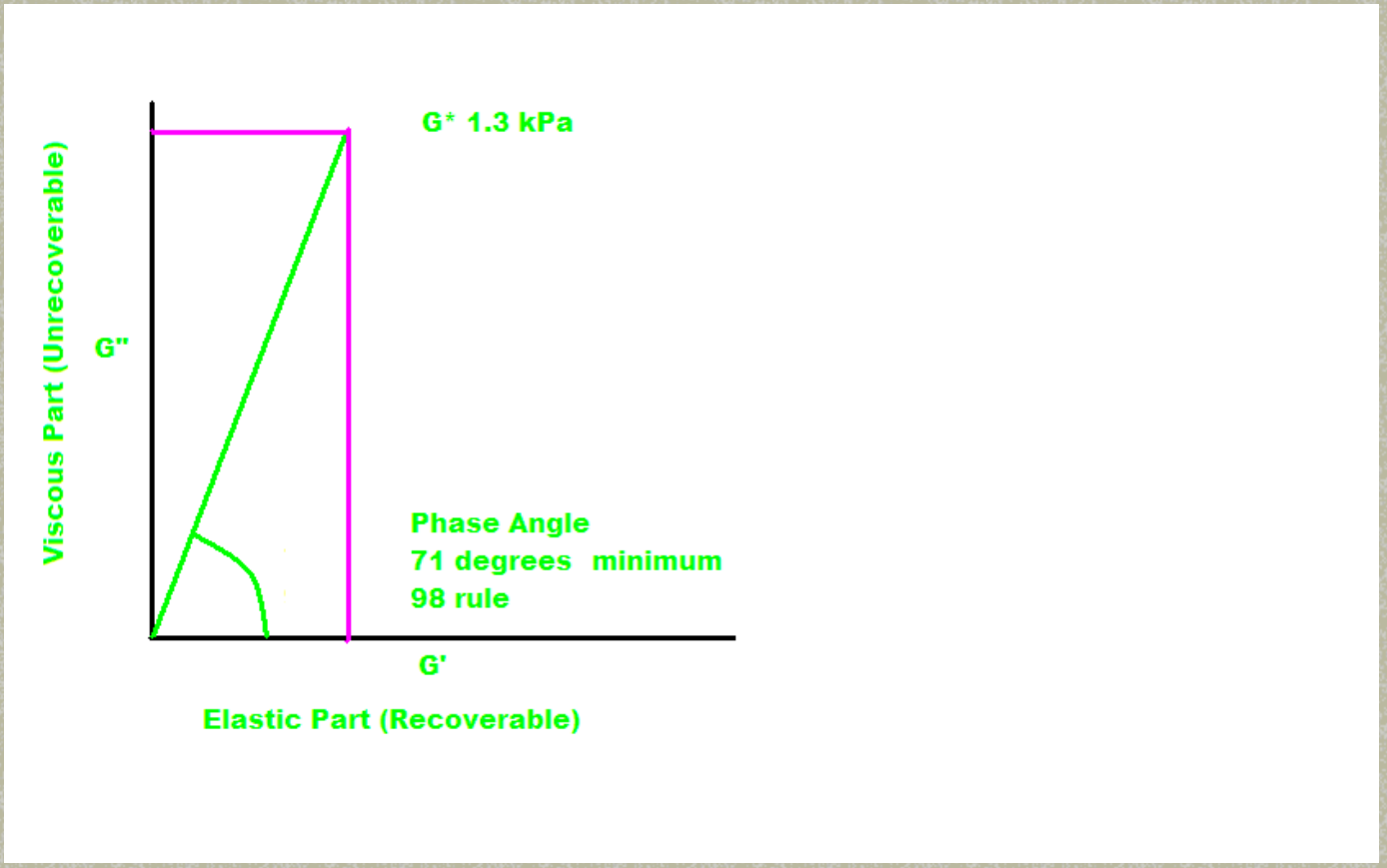


- Direct Tension at low grade temp.+10 deg. C, aged binder.

Elastic Recovery

- Test run at intermediate temperature, 77 deg F.
- Pull – Relax for 5 seconds – Cut
- Recovery must be 70% for Rule of 98
- Assures elastomeric properties in the standard fatigue temperature range.

Binder Elasticity (Hot)



- DSR at High Grade Temp. Unaged Binder

Mix Stability

- Hamburg Wheel Tracker
  - Drives High Temperature Stiffness
  - Drives Stripping Resistance
  - Drives post binder testing additives which may change the cold temperature toughness properties.
- Needed – Cold Temperature Mix Toughness Test.

Results

- I-70 Projects
  - Similar Climate
  - Similar Aggregate
  - Similar Traffic

Salina to Gooseberry MP 54-61

- Control Section
  - 3” HMA AC-10 1985
  - 3” HMA AC-20 1995
  - Mill 3” SMA PG 64-34 2004

Gooseberry to Spring Canyon MP 61-71

- 10” HMA 1967
- 5” HMA AC-10 1975 (Stripping Layer)
- 3.5” HMA PG 64-34 1994
- Mill 8.5” add 4” HMA, 2”SMA 64-34 2007

Spring Canyon. to Wide Hollow MP 71-78

- 9” HMA AC-15 1973
- 3” HMA AC-10 1984
- Mill 3” add 3.5” HMA 64-34 1993
- 0.75” OGSC 64-34 1993

Freemont to Muddy River MP 91-99

- 3” AC-10 1970
- 6” AC-10 1980
- 5” PG 64-34 1989

Alternative Theory

- High Modulus for the MEPDG
  - I-84 Morgan 2005
    - Mill 8”, Till 8” and Cement Treat Base - 500 psi
    - 7” 64-34, TLA 4%, RAP 30%

Conclusion

- Mix stability testing is necessary due to mix compatibility issues.
- Binder elasticity and toughness are desirable properties in solving Utah's pavement challenges.
- Superpave and SHRP M-320 do not address these issues resulting in local plus specifications.