Predictive Model for Nonlinear Resilient Modulus of Emulsified Asphalt Treated Base

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May 28, 2014

GeoShanghai 2014

Outline

- Background
- Experimental Design
- Test Results and Analysis
- Predictive Equation
- Conclusion

Background

- ATBs is the most commonly used stabilized layers because of available local asphalt resource
- Problem - lack of engineering characteristics for typical Alaskan ATBs
- Need - properly characterize these materials to better understand the effects of asphalt content on ATB behavior and provide accurate M_R values for flexible pavement design

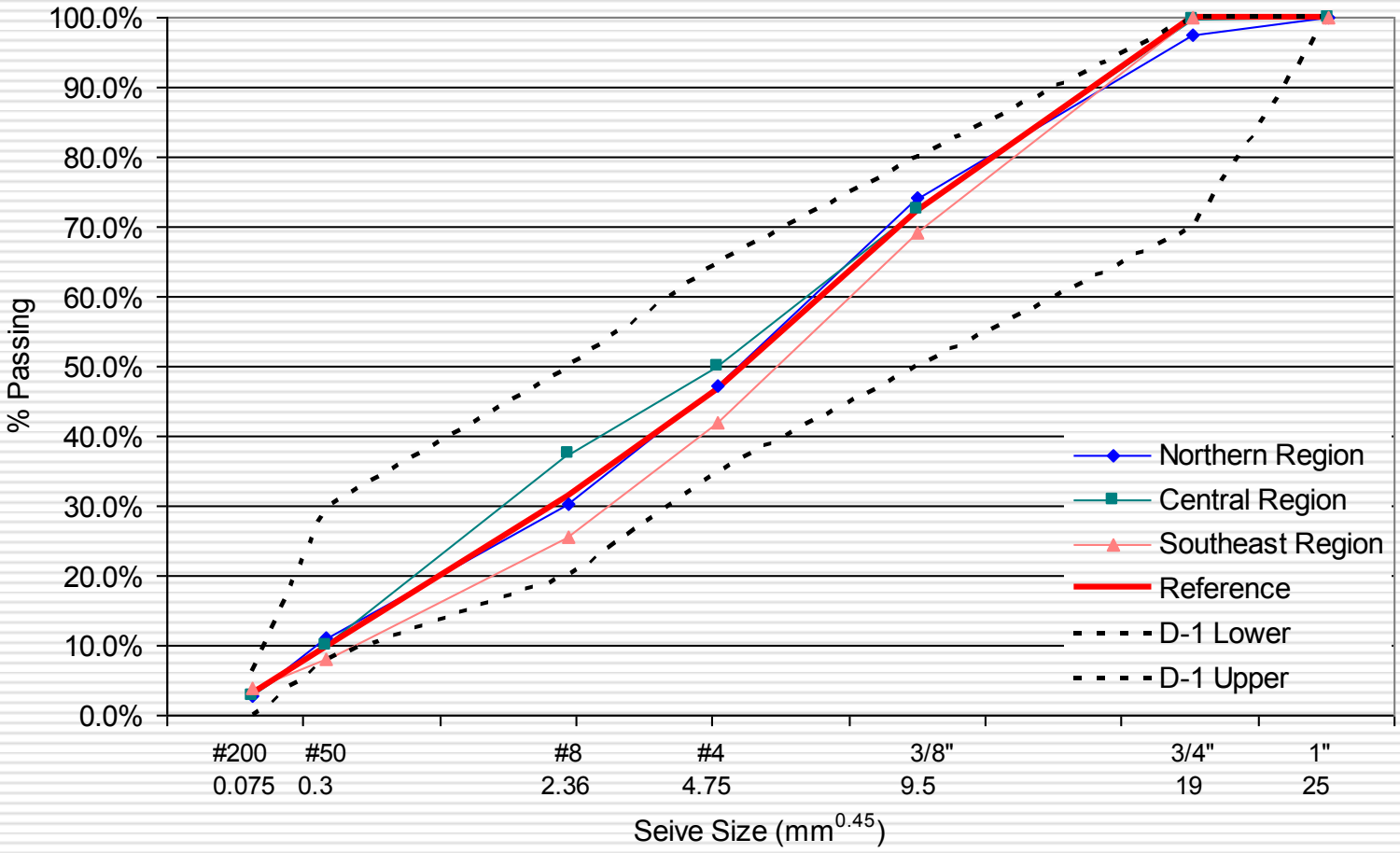

ARCTIC OCEAN
NORTHERN REGION
UAF
CENTRAL REGION
SOUTHEAST REGION
GULF OF ALASKA
BRISTOL BAY
ALEUTIAN ISLANDS
PACIFIC OCEAN
NORTON SOUND
ST LAWRENCE ISLAND
ST MATHEWS ISLAND
NUNIVAK ISLAND
KUSKOKWIM BAY
PRIBILOF ISLANDS

Experimental Design

Source	Abrasion Resistance (% Loss)	Percent Fractured Face (one fractured face)		Flat or Elongated Pieces (5:1)	
		Test Results	Requirement	Test Results	Requirement
Southeast Region	9.7%	100%	≥80%	3%	≤8%
Central Region	5.8%	91.7%		0	
Northern Region	2.7%	84.5%		0	

Northern Central Southeast

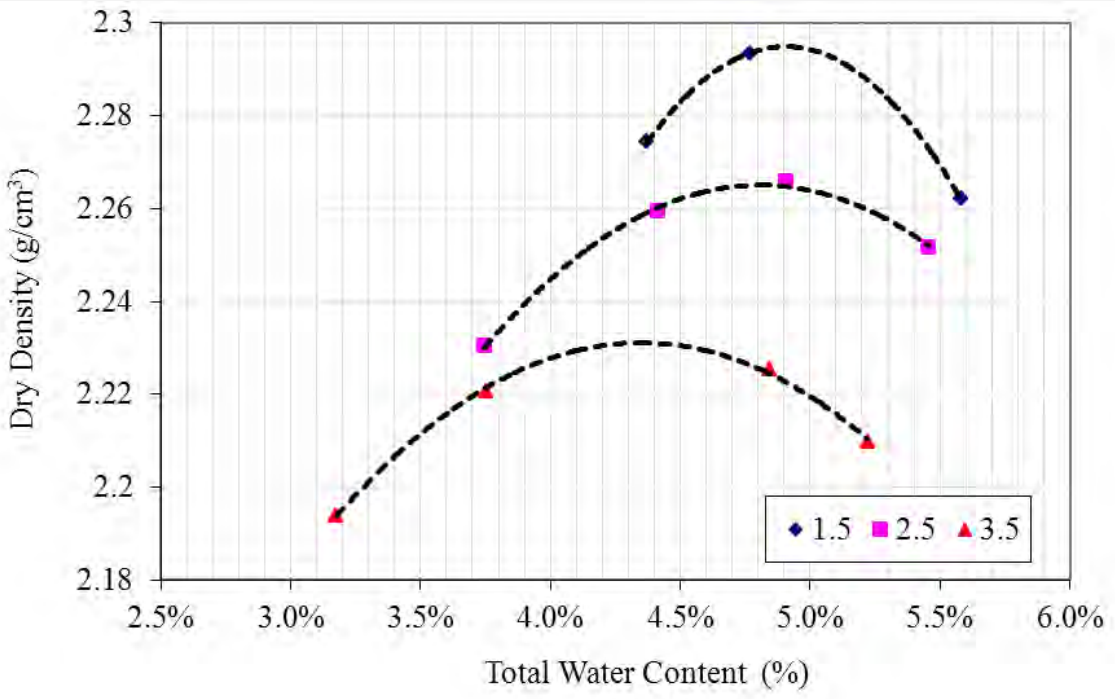
Experimental Design (Continued)



Experimental Design (Continued)

Compaction:

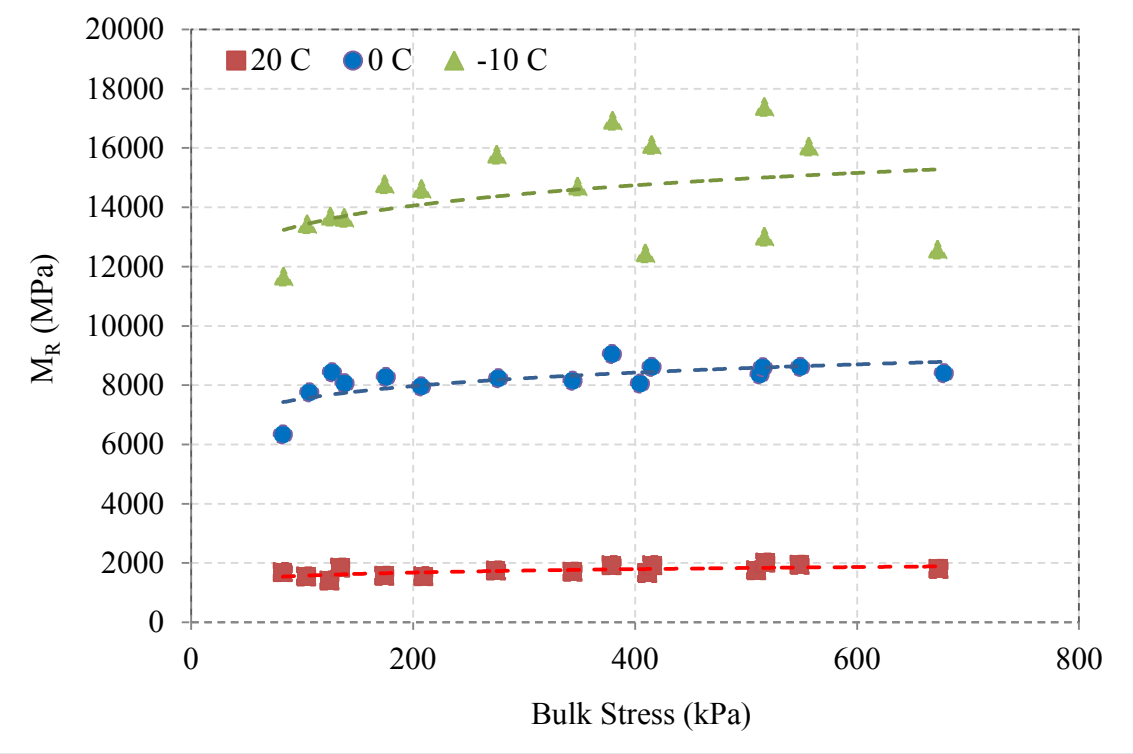
- ASTM D1557
- At "pseudo OMC"
- Diameter:100mm
- Height: 150mm



Experimental Design (Continued)

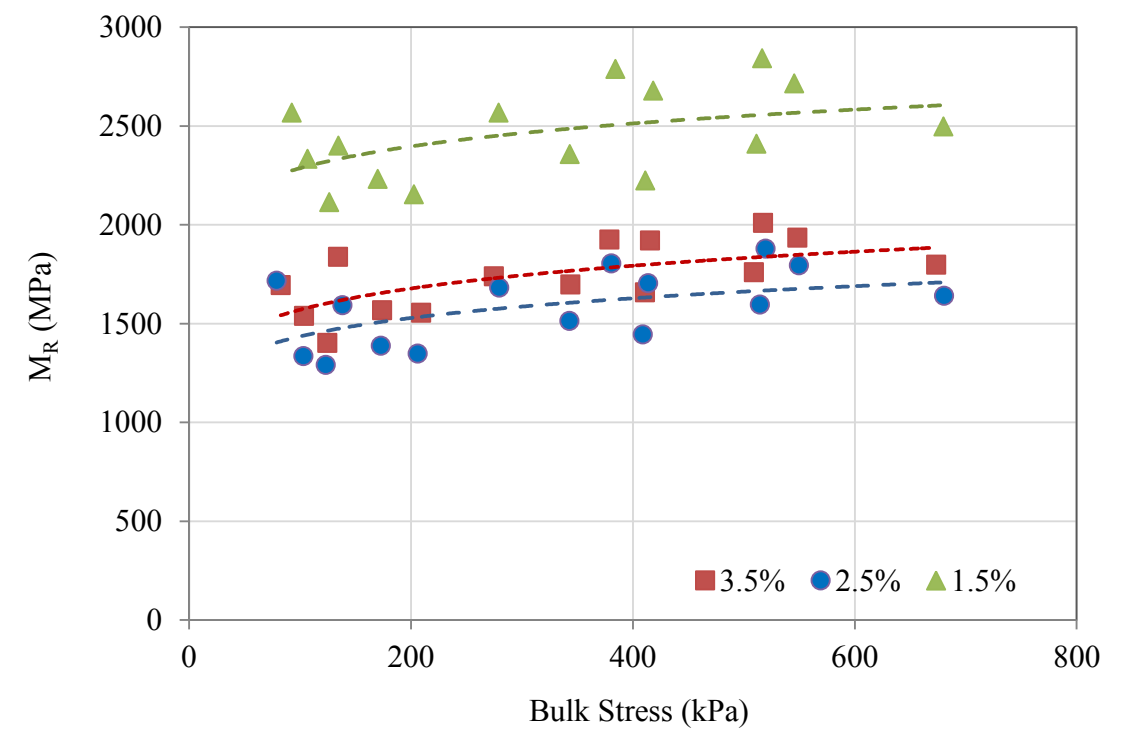
Testing Equipment Setup

Test Results and Analysis



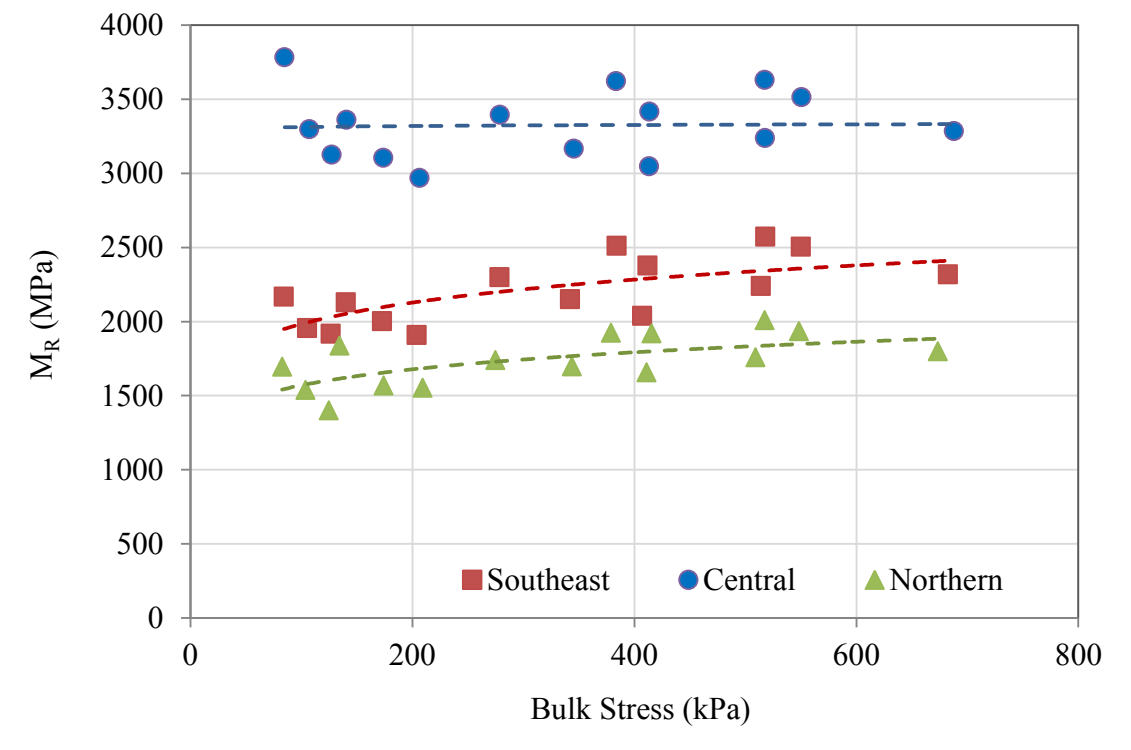
Effects of Temperature on MR of EATB
(Northern Region, 3.5% Residual Binder)

Test Results and Analysis (Continued)



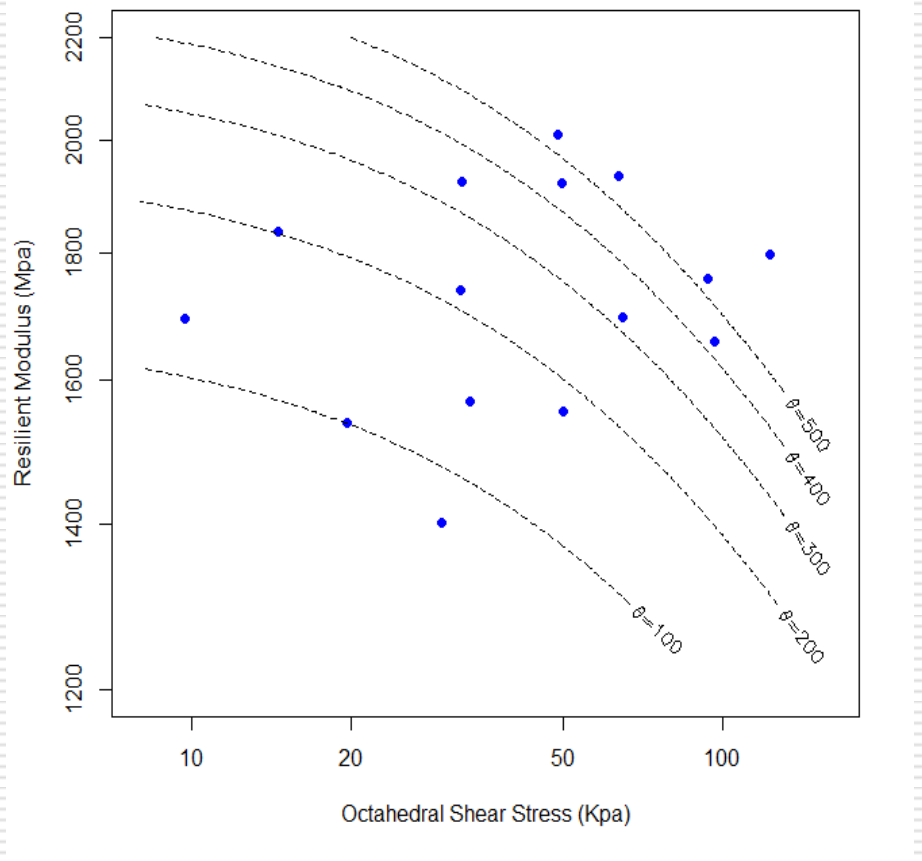
Effects of Binder Content on MR of EATB (Northern Region, 20°C)

Test Results and Analysis (Continued)

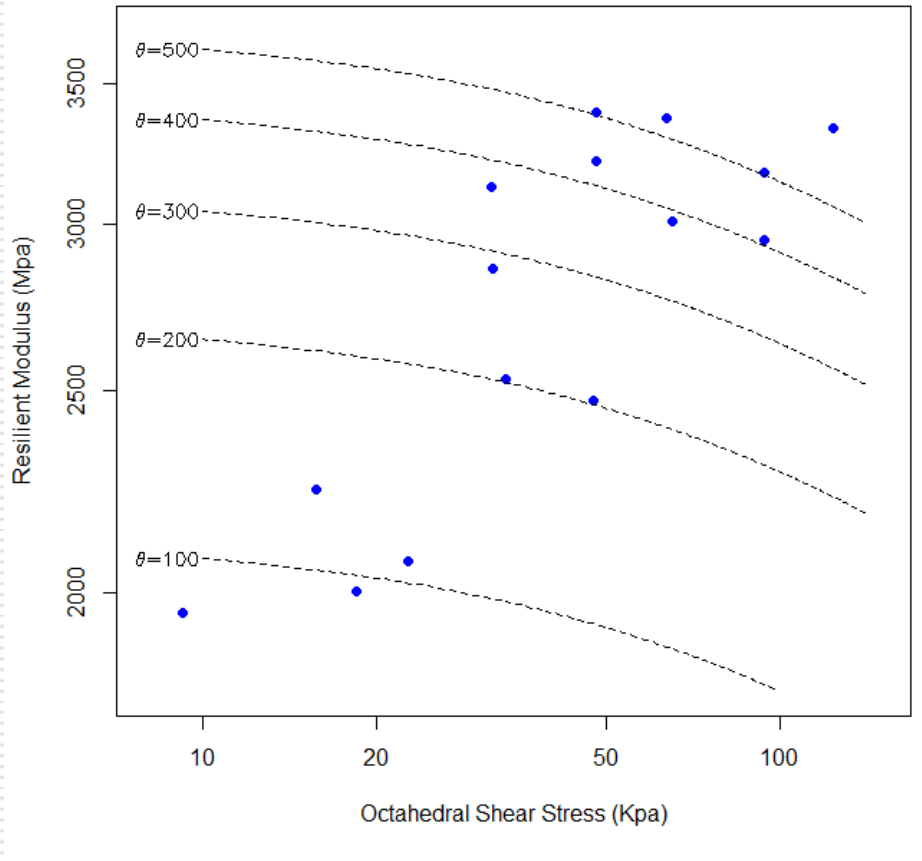


Effects of Aggregate Source on M_R of EATB (20°C, 3.5% Residual Binder)

Stress Dependent Property
(20ºC, 3.5% Binder, Northern Region)

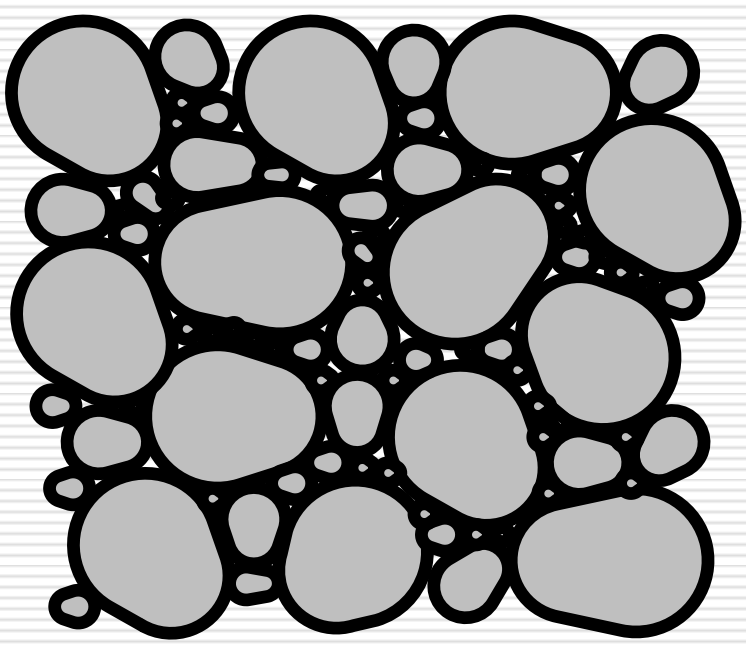


EATB

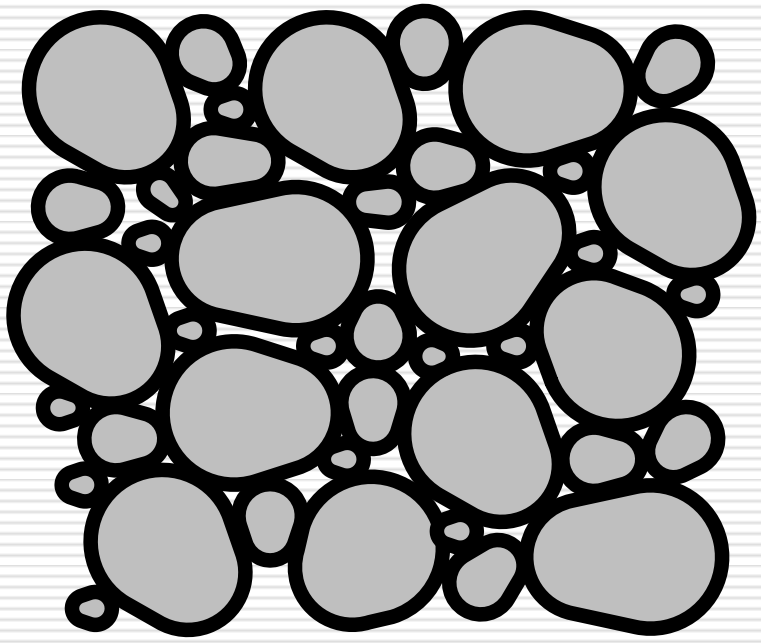


HATB

Internal Structure Sketches of HATB and EATB

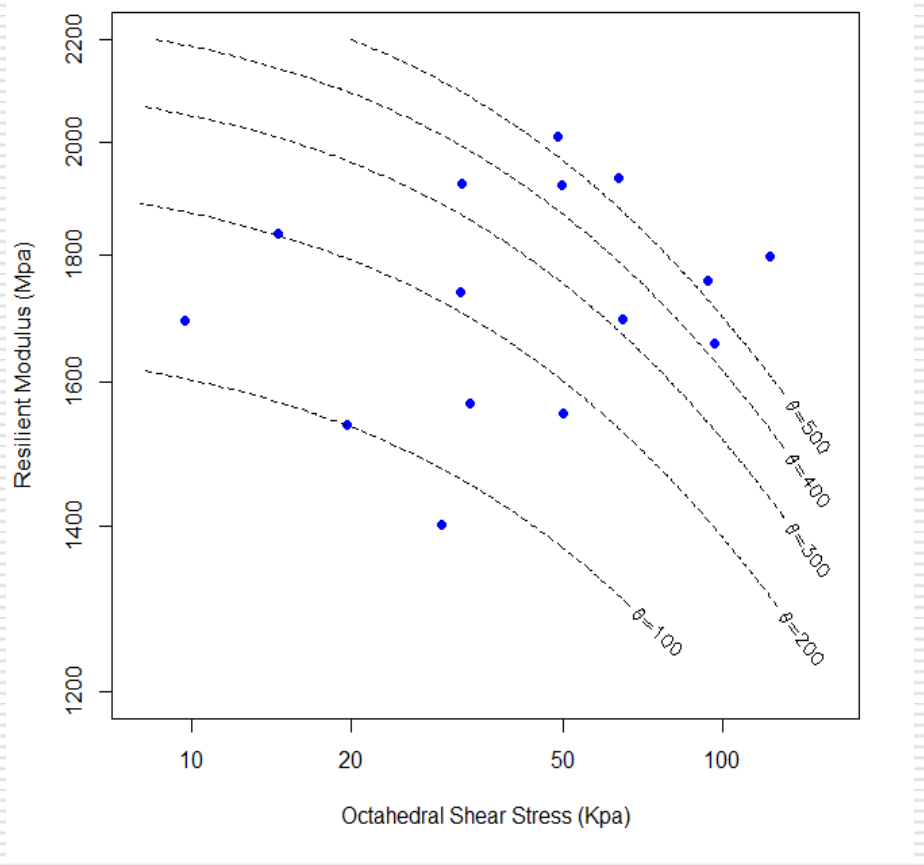


HATB

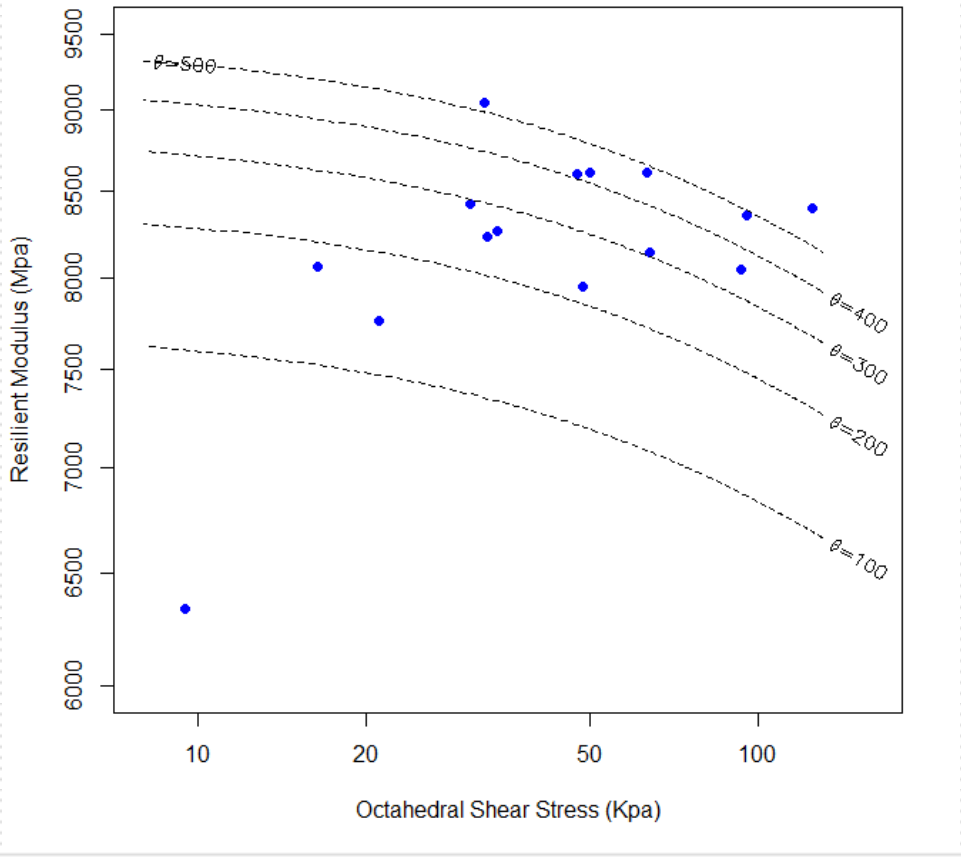


EATB

Stress Dependent Property
(3.5% Binder, Northern Region)



EATB, 20ºC,



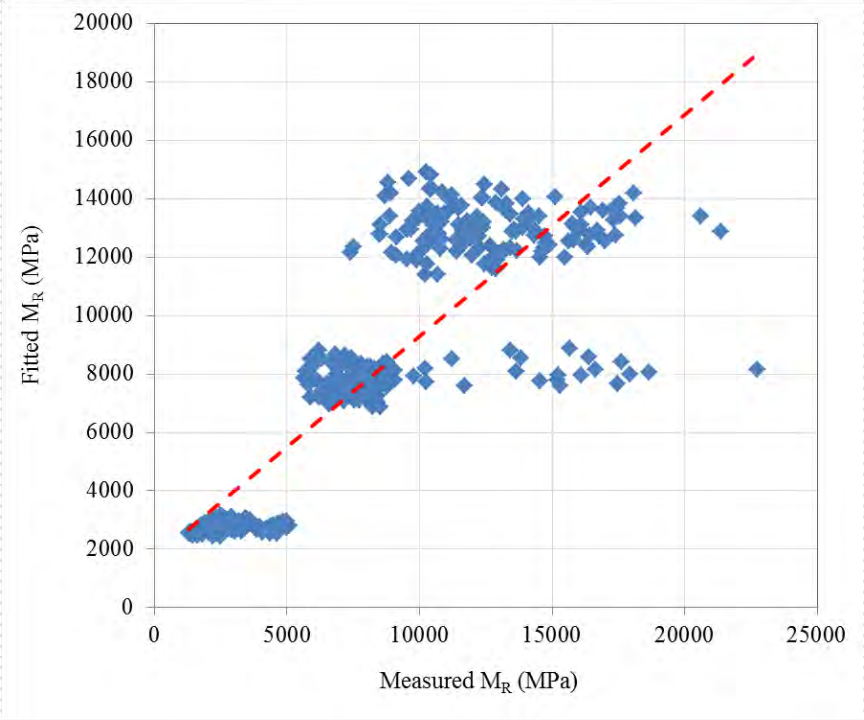
EATB, 0ºC

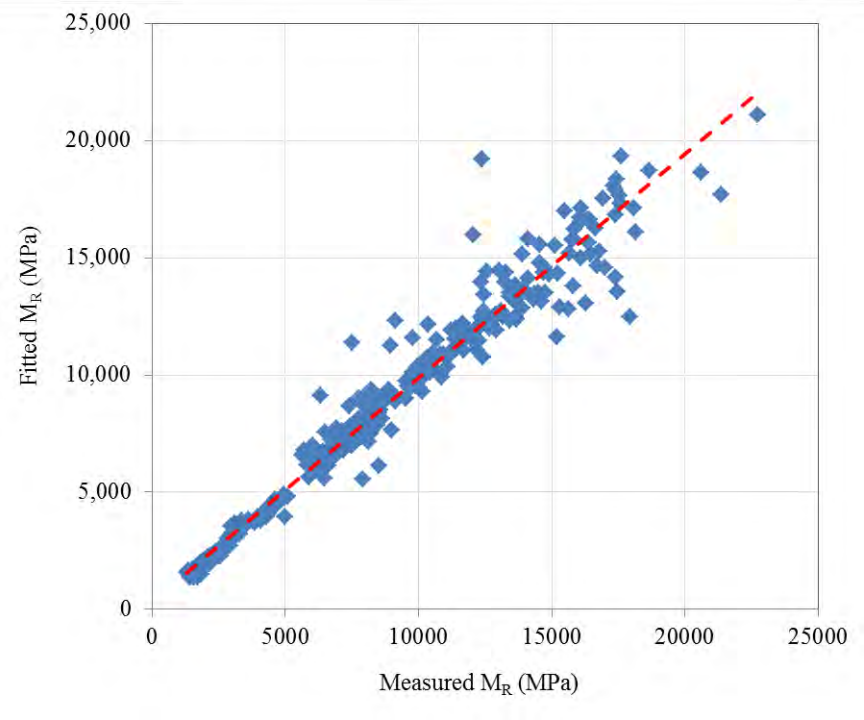
Predictive Equation

$$M_R = k_1 P_a \left(\frac{\theta}{P_a}\right)^{k_2} \left(\frac{\tau_{oct}}{P_a} + 1\right)^{k_3}$$

MEPDG

$$Ln(M_R) = a_0 + a_1 F + a_2 T + a_3 P_b + (b_0 + b_1 F + b_2 T + b_3 P_b) Ln\left(\frac{\theta}{P_a}\right) + (c_0 + c_1 F + c_2 T + c_3 P_b) Ln\left(\frac{\tau_{oct}}{P_a} + 1\right)$$





Conclusions

- M_R increases as:

  Bulk Stress ↑ Shear Stress ↓

  Temperature ↑ Aggregate Angularity ↑

- Predictive Model was proposed.