AUTC Pavement/Asphalt Research Projects Update

Jenny Liu

June 20, 2012

Inclusion of LCCA in AKFPD Program

- Program Demo
- Discussion

Guidelines for Pavement Preservation

- Recent GoToMeeting on June 6
- Executive summary
- Update and review all volumes
  - Volume 1 – Roadmap
  - Volume 2 – Preservation guide
  - Volume 3 – Implementation plan

Verification of JMF for Alaskan HMA

- Field sites
  - Parks Hwy MP 287-305 Rehab. (9 sublots)
  - AIA runway 7R_25L Rehab. (4 sublots)
- Sample collection
  - Lab mix and Lab compacted
  - Field mix and field compacted
  - Field mix and lab compacted
  - Field cores

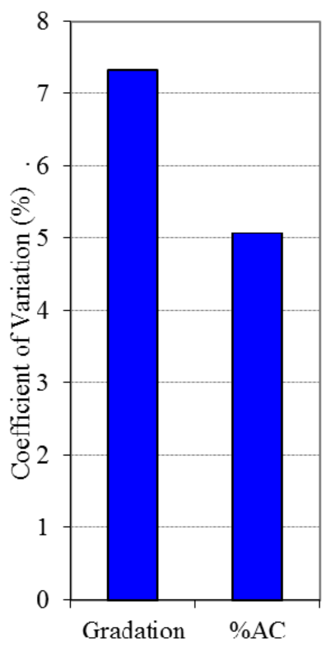
Verification of JMF for Alaskan HMA

- Composition properties
  - Gradation & binder content
  - Performed by DOT&PF, contractor & UAF
- Volumetric properties
  - VTM, VMA & VFA
  - L&L, F&F, F&L & core
- Mechanical properties
  - |E*| @ 4, 21, 37, 54ºC & 0.1, 0.5, 1, 2, 5, 10, 20, 25Hz (L&L, F&L)
  - IDT creep stiffness @ -10, -20, -30 ºC (L&L, F&L, F&F, core)
  - IDT strength @10, -20, -30 ºC (L&L, F&L, F&F, core)
- Influencing factors
  - Sublot, operator, scenario, temperature
- Correlation
  - Composition and mechanical properties
  - Volumetric and mechanical properties

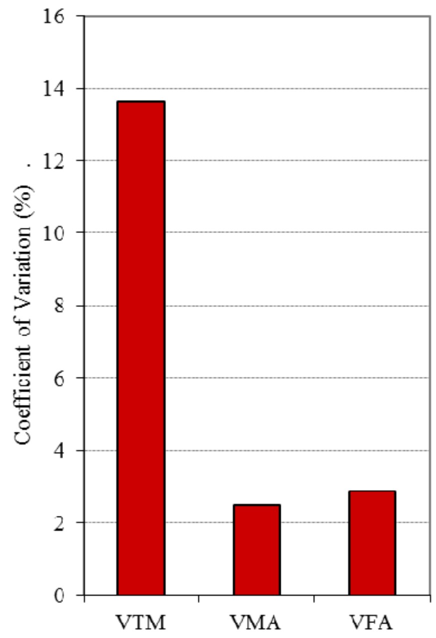
Findings

- Composition properties
  - Variance & error of gradation, affected by operator & sublot
  - Error of binder content, affected by operator
- Volumetric properties
  - Error of volumetric properties, affected by scenario and Sublot
  - Variance of volumetric properties, affected by scenario
- Mechanical properties
  - |E*|: Variance (sublot & temp), Error (sublot & freq & temp)
  - IDT Creep Stiffness: Error (sublot & scenario & temp & loading time)
  - IDT Strength: Error (sublot & scenario & temp)

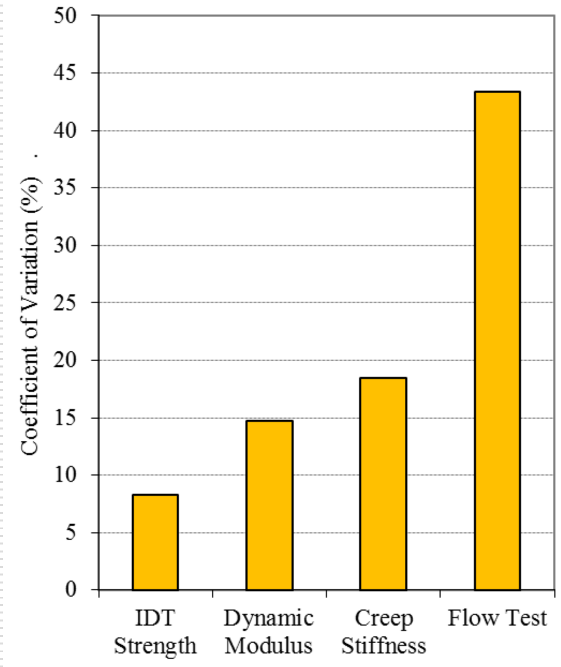
Summary of COV



Composition Properties

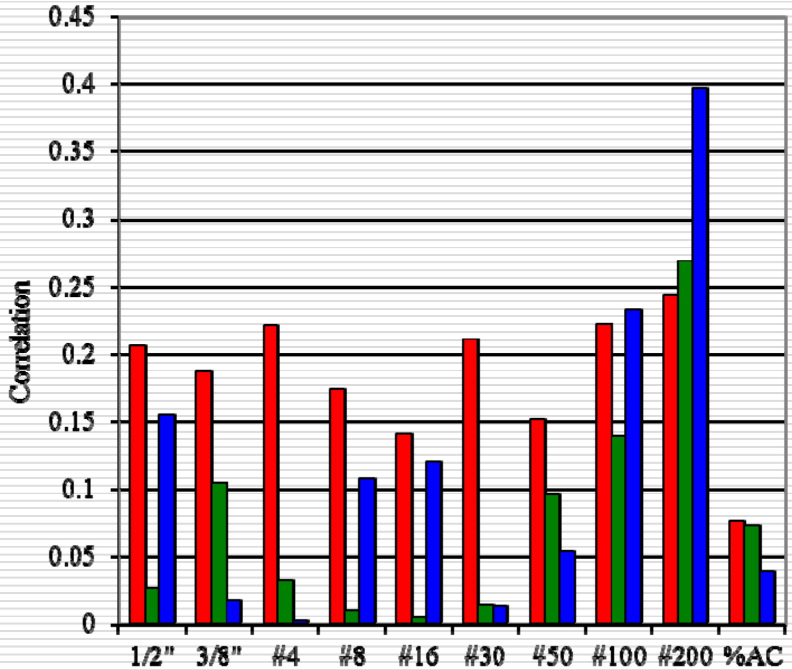


Volumetric Properties

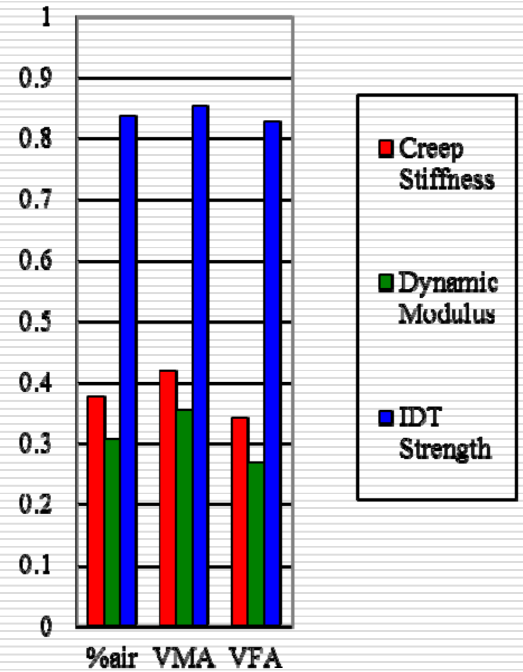


Mechanical Properties

Correlation



Correlation between composition and mechanical properties



Correlation between volumetric and mechanical properties

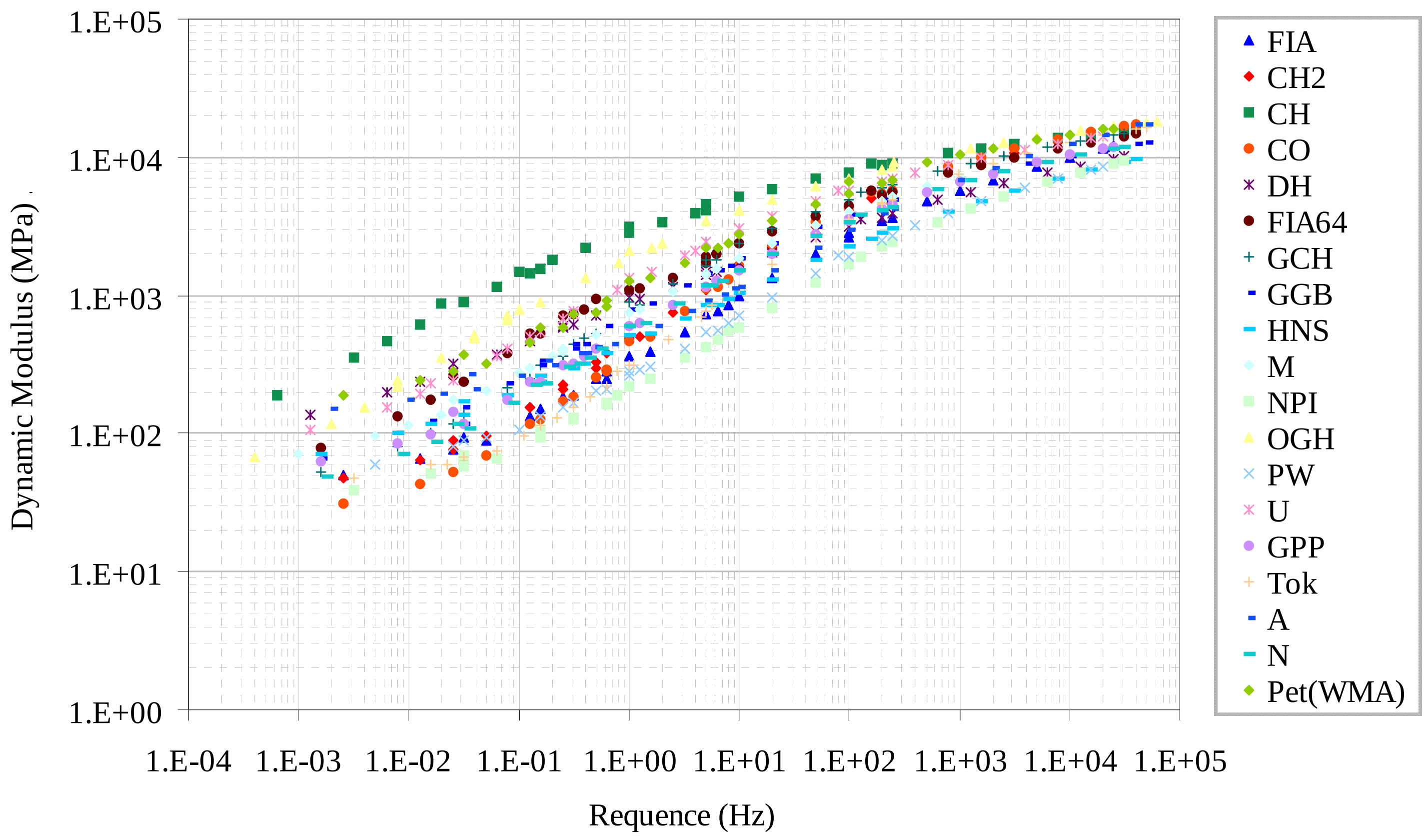
Characterization of Alaskan HMA Mixtures with the SPT

- 21 sources of HMA collected
- SPT (AMPT) Test
  - | E* |
  - Fn
  - Ft
- APA Test

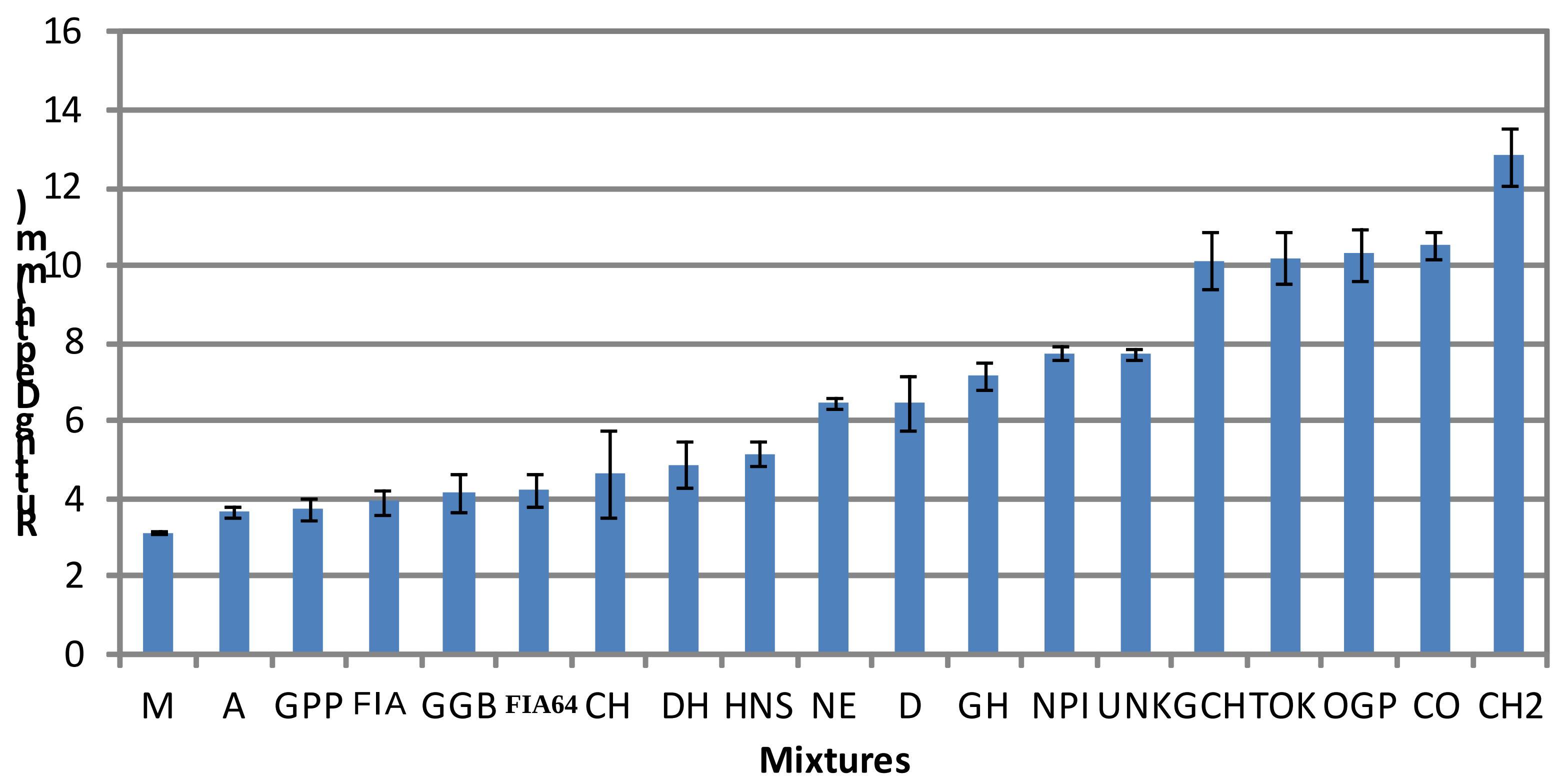
Characterization of Alaskan HMA Mixtures with the SPT

No.	Project	Project Number	Region	Label
1	FIA Runway 1L_19R stage 3 (64-34)	3-02-0096-034-2008/61016	Northern	FIA64
2	FIA Runway 1L_19R stage 3 (52-34)	3-02-0096-034-2008	Northern	FIA
3	Glenn Hwy: Hiland to Eklutna Resurefacing	52000/ARA-0A1-6(39)	Central	GH
4	Minnesota Dr Resurfacing: Int'l Airport Rd to 13th	51135/IM-042-1(93)	Central	M
5	Unalakleet Airport Paving	3-02-0309-02/61438	Central	UNK
6	East Dowling Road Extension and Recon.	58592	Central	D
7	Parks Hwy MP 287-305 Rehab	IM-QA4-4(17)/77137	Northern	N
8	HNS Ferry Terminal to Union Street	NH-095-6(18)	Southeast	HNS
9	Chena Hot Springs Rd MP 24-56	BH_NH-STP_0650(50)/61425	Northern	CH
10	Chena Hot Springs	BH_NH-STP_0650(50)/61425	Northern	CH2
11	Rich Hwy North Pole Interchange	ACIM_0A2_4(26)	Northern	NPI
12	Alaska Hwy MP 1267-1314	BR_NH_IM_0A1-1(10)	Northern	TOK
13	Dalton Hwy. MP 175-197 Rehabilitation	62860/ IM-065-4(10)	Central	DH
14	Glenn Highway MP 34-42, parks to Palmer Resurf.	52015/ARA-0A1-5(26)	Central	GPP
15	Old Glenn Hwy.: MP 11.5-18	57039	Central	OGP
16	Fairbanks cowles Sreet Upgrade	STP-0641(2)/60434	Northern	CO
17	AIA runway 7R_25L Rehab.	58540/ Aip 3-02-0016-129-2010	Central	A
18	PSG Mitkof Highway-Scor Bay to Crastal Lake Hatchery	68819	Southeast	Pet
19	Glenn Higway Gambell to airport MP 0-1.5	58800/IM-oA1-6(35)	Central	GGB
20	Glen Why MP 92-97 Cascade to Hicks Creek	NE-0A1-5(17)/52507	Central	GCH
21	Palmer-Wasilla Highway Phase II	50900	Central	PW

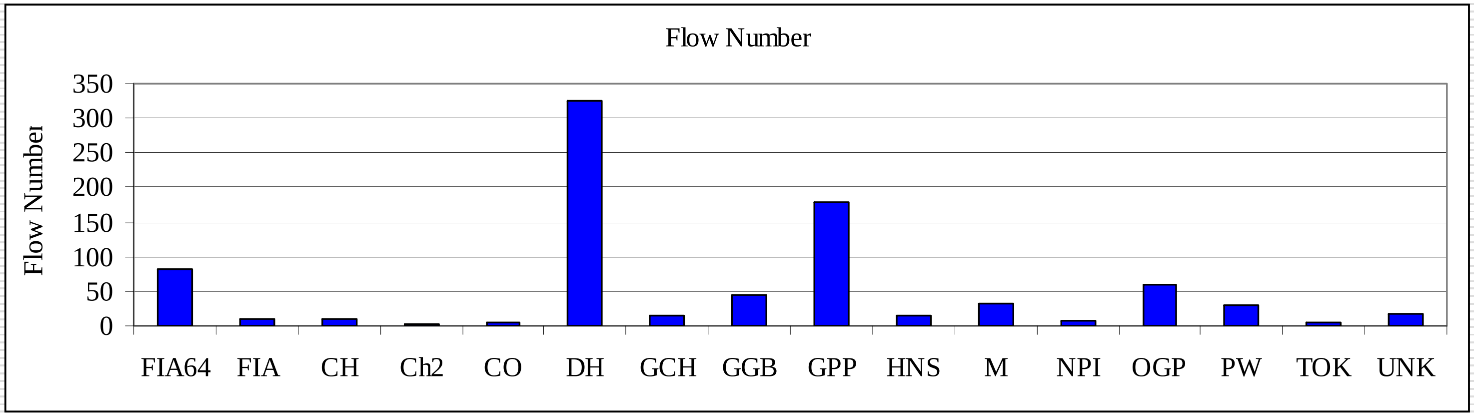
| E*| Master Curve Summary

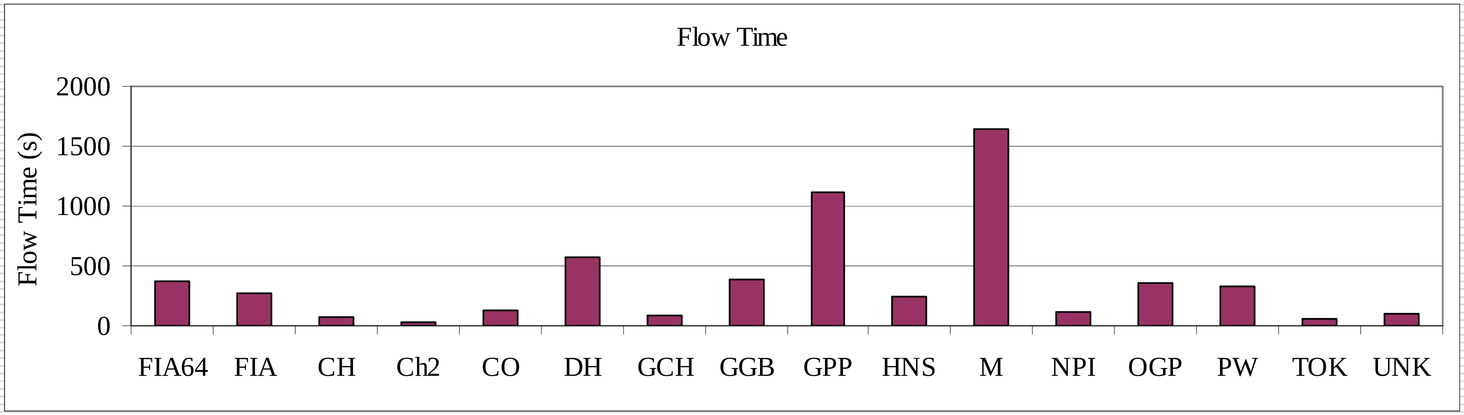


APA Data Summary

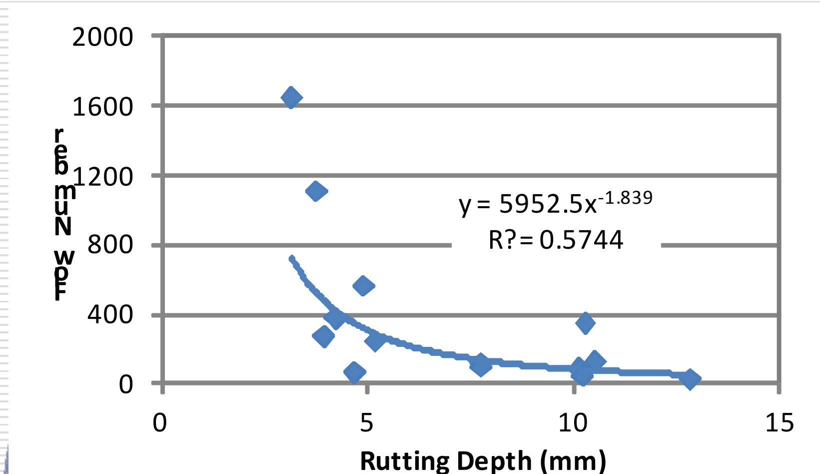


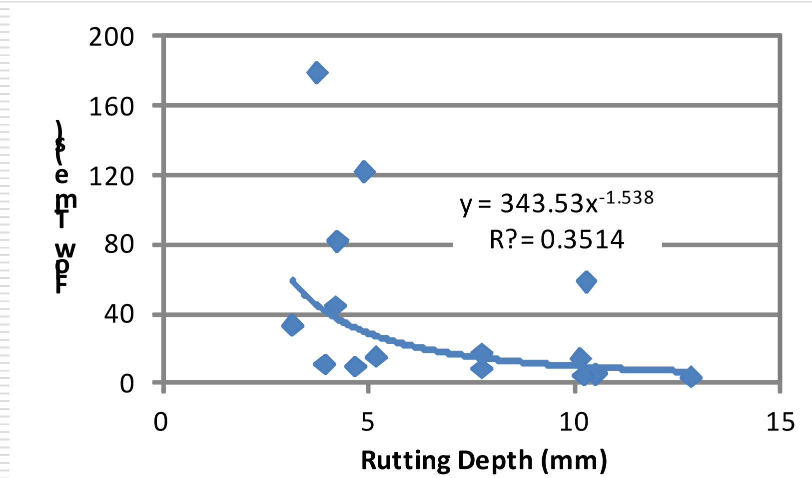
Flow Number and Flow Time





Correlation





Characterization of Alaskan HMA Mixtures with the SPT

- Verify | E*|
  - Witczack model (2002)
  - Modified Witczack model (2006)
  - Hirsch model (2003)
  - Al-Khateeb model (2006)
- Correlations
  - APA & Ft (Fn)
  - APA & | E*| (| E*| /sinϕ)
- Draft Report

Use of the Micro-Deval Test for Assessing Alaska Aggregates

- 16 sources of D-1 aggregates collected
- Aggregate tests included
  - Sieve analysis, hydrometer, and sand equivalence
  - Micro-deval
  - LA abrasion
  - Washington degradation
  - Sodium sulfate resistance

Use of the Micro-Deval Test for Assessing Alaska Aggregates

- Literature review
  - History of Washington degradation
    - Started in 1958
    - Marshal (1967) "The Washington Degradation Test A Status Report,"
    - Platts and Llyod (1966) "Degradation of Embankment and Foundation Materials,"
    - Designated as ATM313
  - Few references
  - Personal communications

Use of the Micro-Deval Test for Assessing Alaska Aggregates

- Literature summary
  - Micro-deval: correlation to pavement performance, low variability, same time as LA abrasion to run
  - LA abrasion: widely used, lack of correlation with actual pavement performances
  - Sodium and Magnesium Sulfate: takes several days to run, higher variability, correlates with the Micro-Deval test

Use of the Micro-Deval Test for Assessing Alaska Aggregates

- Test results
  - Micro-deval – a reliably repeatable procedure: average COV of 5.33% and average SD of 0.43%
  - Most aggregates within acceptable degradation range considering cutoff values: Micro-deval - 18% (max), LA abrasion - 50% (max), Washington Deg - 45% (min), and SSR - 9% (max)

Use of the Micro-Deval Test for Assessing Alaska Aggregates

- Micro-Deval procedure correlates highest between the other tests

Correlation (r) between Test Methods				
Test Method	Micro-Deval	LA Abrasion	Washington Degradation	Sulfate Soundness
Micro-Deval	1.00	0.35	-0.65	0.35
LA Abrasion	-	1.00	0.13	0.22
Washington Degradation	-	-	1.00	-0.23
Sulfate Soundness	-	-	-	1.00

- Comparison of normalized values
  - strongest relationship between the Washington Deg and Micro-deval

Field Evaluation of Crack Sealing of Asphalt Concrete Pavements in Alaska

- Literature Review
  - Cost effectiveness of sealing cracks
    - Rajagopal and Minkarah (2003) – Ohio DOT
    - Fang et al. (2000) – Purdue
    - Johnson et al (2000) - Montana
  - Methods of sealing cracks
    - CRRL along with many other references
  - Types of crack sealing materials
  - Mechanics of cracks
    - Cyne et al (2004) – Minnesota DOT
    - Osterkamp (1986) – Study of low temperature cracking on base material as well as asphalt

Field Evaluation of Crack Sealing of Asphalt Concrete Pavements in Alaska

- Field Evaluations
  - Group meeting on May 23, 2012
    - 120 sections to review
    - Highways include Richardson, Glenn, Parks, Elliot, Steese, and Sterling
  - Bob's category designations for thermal crack types (major and lessor thermal cracks)
  - Students – PASER and LTPP methods

Field Evaluation of Crack Sealing of Asphalt Concrete Pavements in Alaska

PASER FORM

Date			GPS		
Evaluating Person					
Road Name					
Section ID					
Region					
Town/City					
Beginning Mileage					
Ending Mileage					
Last Treatment					
Date of Last Treatment					
Original Construction Type					
Date of Original Construction					
ADT					
Last IRI averaged over section					
Last Rut averaged over section					
Last PSR averaged over section					
Speed Limit					
Road Category					

	Distress Type	none	low	medium	severe
1	Raveling				
2	Flushing				
3	Polishing				
4	Rutting				
5	Transverse Cracks				
6	Reflection Cracks				
7	Slippage Cracks				
8	Longitudinal Cracks				
9	Block Cracks				
10	Alligator Cracks				
11	Patches				
12	Potholes				
13	Frost Heaves				
14	Permafrost				
15	Deformation				
16	Drainage				
	Paser Number				

Comments:

LTPP Distress Survey for Pavements With Asphalt Concrete Surfaces

State Code:				
SHRP Section ID:				
Road Name:				
Road Number:				
Section:				
Section Center:				
Date:				
Surveyors:				
Air Temperature:				
Pavement Temp:				
Distress Type:				
Cracking		Low	Moderate	High
1	Fatigue (m^2)			
2	Block (m^2)			
3	Edge (m)			
4	Longitudinal			
4a	Wheel Path (m)			
	Sealed (m)			
4b	Non Wheel Path (m)			
	Sealed (m)			
5	Reflection	not recorded		
6	Transverse			
	No of Cracks			
	Length (m)			
	Length Sealed (m)			

Mile 44.4 Richardson Highway

Mile 152.5 Glenn

Financial Impact of Fines in the Unbound Pavement Layer

- Preliminary Phase (08/2011-12/2011)
  - Materials preparation
  - Soil properties tests
  - Training of testing procedures
  - Set testing parameters where necessary
  - Rehearsal test runs

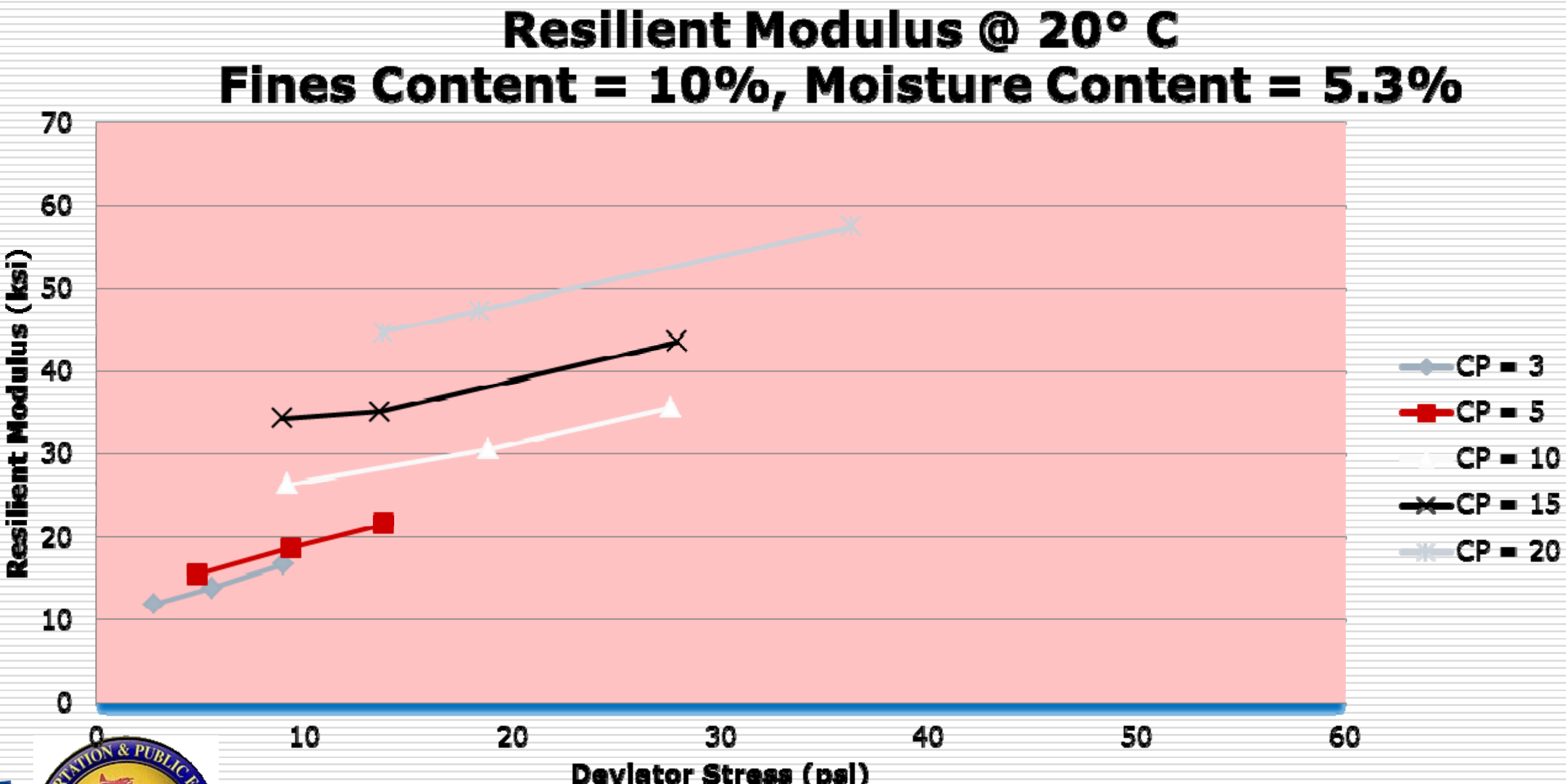
- Testing and Data Collection (12/2011 – 08/2012)

Resilient Modulus

Specimen 1	Temperature gradient		Low											
	Moisture content		3.30%				5.30%				6%			
	Temperature		-5	-3	-1	20	-5	-3	-1	20	-5	-3	-1	20
	Fines content	6%												
		8%												
		10%												
		12%												
	Temperature gradient		Medium											
	Moisture content		3.30%				5.30%				6%			
	Temperature		-5	-3	-1	20	-5	-3	-1	20	-5	-3	-1	20
	Fines content	6%												
		8%												
		10%												
		12%												
	Temperature gradient		High											
	Moisture content		3.30%				5.30%				6%			
	Temperature		-5	-3	-1	20	-5	-3	-1	20	-5	-3	-1	20
	Fines content	6%												
		8%												
		10%												
		12%												
Specimen 2	Temperature gradient		Low											
	Moisture content		3.30%				5.30%				6%			
	Temperature		-5	-3	-1	20	-5	-3	-1	20	-5	-3	-1	20
	Fines content	6%												
		8%												
		10%												
		12%												
	Temperature gradient		Medium											
	Moisture content		3.30%				5.30%				6%			
	Temperature		-5	-3	-1	20	-5	-3	-1	20	-5	-3	-1	20
	Fines content	6%												
		8%												
		10%												
		12%												
	Temperature gradient		High											
	Moisture content		3.30%				5.30%				6%			
	Temperature		-5	-3	-1	20	-5	-3	-1	20	-5	-3	-1	20
	Fines content	6%												
		8%												
		10%												
		12%												
Specimen 3	Temperature gradient		Low											
	Moisture content		3.30%				5.30%				6%			
	Temperature		-5	-3	-1	20	-5	-3	-1	20	-5	-3	-1	20
	Fines content	6%												
		8%												
		10%												
		12%												
	Temperature gradient		Medium											
	Moisture content		3.30%				5.30%				6%			
	Temperature		-5	-3	-1	20	-5	-3	-1	20	-5	-3	-1	20
	Fines content	6%												
		8%												
		10%												
		12%												
	Temperature gradient		High											
	Moisture content		3.30%				5.30%				6%			
	Temperature		-5	-3	-1	20	-5	-3	-1	20	-5	-3	-1	20
	Fines content	6%												
		8%												
		10%												
		12%												

Financial Impact of Fines in the Unbound Pavement Layer

- Data processing (06/2012 – 09/2012)



Thank you and questions?