




Alaska Department of
Transportation & Public Facilities

**Sasobit Warm Mix Asphalt Performance:
Mitkof Highway Update**

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Anchorage, 31-Oct-2011



Alaska WMA Usage (2008-2011)

Year	Region	WMA	Project	Tons
2008	SE	Sasobit	Mitkof Hwy	23,000
2009	NR	Astec DBG	Alaska Hwy	15,000
2009	CR	Evotherm 3G	Anchorage In't. A/P	7,700
2010	NR	Astec DBG	Dalton Hwy	112,000
2010	NR	Gencor GMU	Alaska Hwy	24,000
2011	NR	Astec DBG	Steese Hwy	10,000
				191,700
2012	SE	?	Prince of Wales Island	54,400


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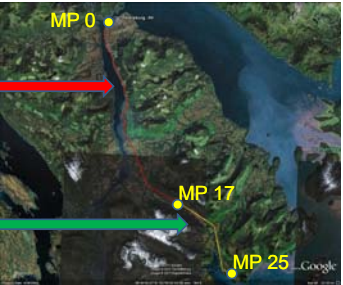
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Mitkof Hwy – Projects Location



HMA 2009

WMA 2008
(Experimental Features in Construction)

MP 0

MP 17

MP 25


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Mitkof Hwy Projects

- **HMA 2009:** MP 0-17
From Scow Bay to Crystal Lake Hatchery Road, # 68819
- **WMA 2008:** MP 17-25
From Crystal Lake Hatchery to Ferry Terminal, # 68646
- **Contractor:** *Seccon Inc.*

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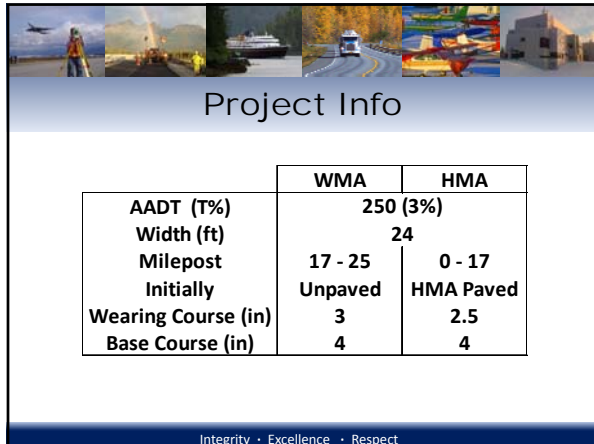
Petersburg, AK "Little Norway"



Longitude: 132 57W
Latitude: 54 49N

Average (35-year record)	August	September
Temperature, °F	54	50
High Temperature, °F	63	57
Low Temperature, °F	47	43
Precipitation, in	7.6	11

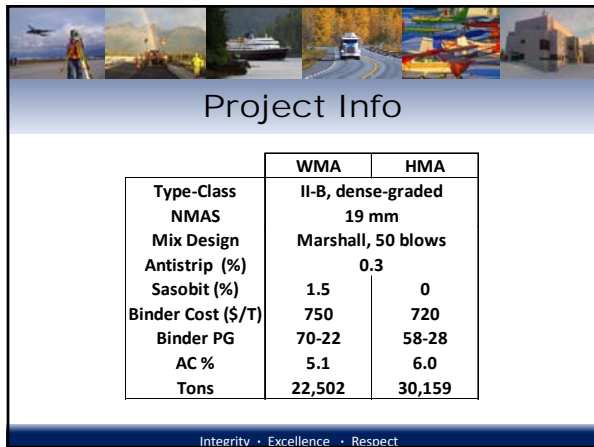
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Project Info

	WMA	HMA
AADT (T%)	250 (3%)	
Width (ft)	24	
Milepost	17 - 25	0 - 17
Initially	Unpaved	HMA Paved
Wearing Course (in)	3	2.5
Base Course (in)	4	4

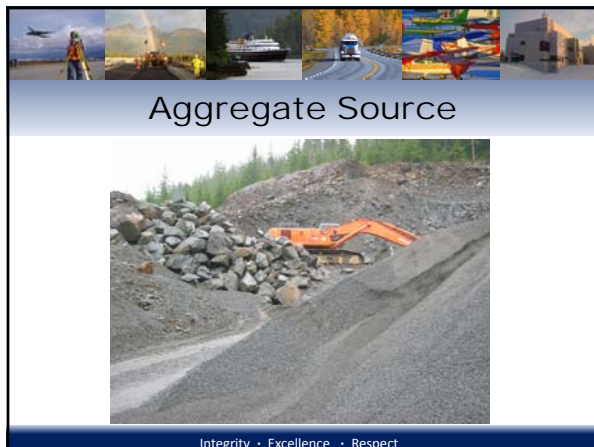
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Project Info

	WMA	HMA
Type-Class	II-B, dense-graded	
NMAS	19 mm	
Mix Design	Marshall, 50 blows	
Antistrip (%)	0.3	
Sasobit (%)	1.5	0
Binder Cost (\$/T)	750	720
Binder PG	70-22	58-28
AC %	5.1	6.0
Tons	22,502	30,159


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Aggregate Source




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Sasobit-modified Binder

- Original **PG 58-28+**
- Adding 1.5% Sasobit >>>> final **PG 70-22**
- Low-temperature cracking issue
- PG 58-28 has 100% & 98% reliabilities
- PG 70-22 has 100% & 92% reliabilities

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Sasobit

- Synthetic wax produced by Sasol Wax GmbH
- Fine, crystalline, long-chain aliphatic hydrocarbon
- High melting point: 240 F ~ 115 C
- Reduces viscosity: flow enhancer, compaction aid
- Added by blending + stirring at producer's plant, terminal

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Sasobit



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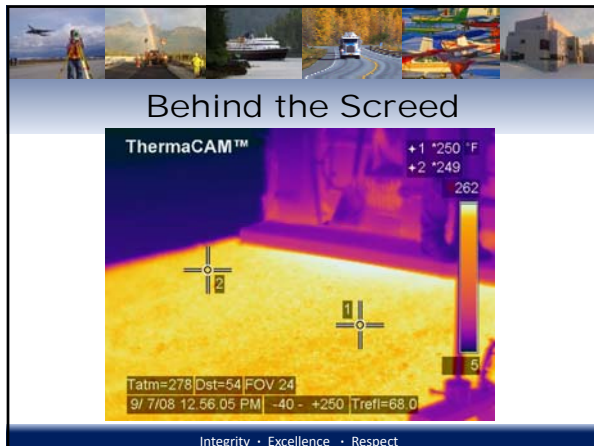


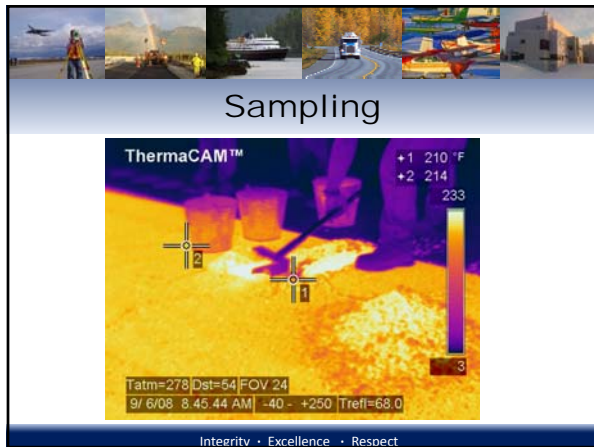


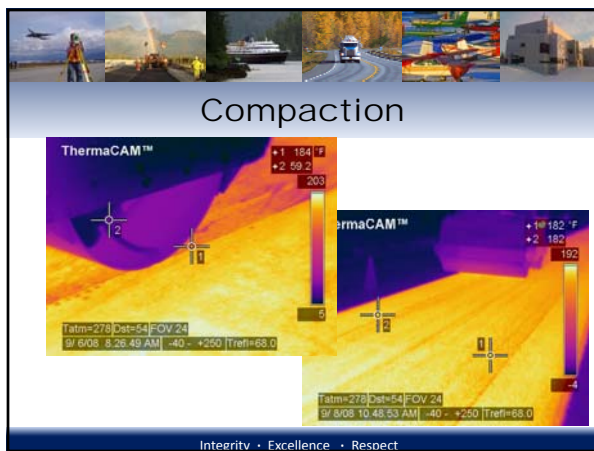












Compaction

ThermaCAM™

+1 168 °F
+2 161
188
-11

Tatm=278 Dst=54 FOV 24
9/ 9/08 4:48:36 PM -40 - +250 Trefl=68.0

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Mat Density

	Percent Compaction	
	WMA	HMA
Upper / Lower	98.0 / 92.0	
Average (%)	95.5	94.9
Std.Dev.	1.3	1.2
Tons	22,502	30,159

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Laboratory Mix Evaluation

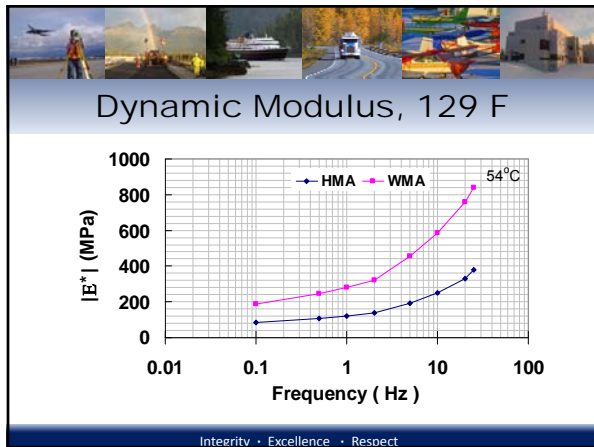
- Rutting and Moisture Susceptibility Concerns
- AUTC/UAF: WMA, HMA
- Mix reheated, compacted, cored & trimmed
- Dynamic Modulus ($|E^*|$):
 - 40 - 129°F ; 0.1 - 25 Hz
- Flow Number (F_N): 129°F
- Tensile Strength Ratio (TSR)

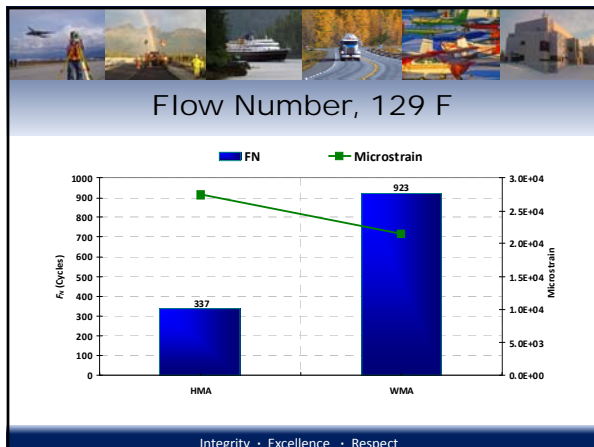
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Asphalt Mix Performance Tester
 $|E^*|, F_N$



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Moisture-Induced Damage AASHTO T-283



Project Mix	Conditioned Strength, psi				Dry Strength, psi				Tensile Strength Ratio, %
	#1	#2	#3	Average	#1	#2	#3	Average	
WMA	127	143	132	134	181	188	170	180	74.76
HMA	58	58	59	58	73	76	82	77	75.95

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Lab Evaluation

- Thermal Stress Restrained Specimen Test (TSRST)
- 2" x 2" x 10"

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TSRST results

Specimen ID Replicate	Mix Type	Fracture Temperature (°C)
300AK - Average		
300AKSTA	Hot-Mix	-31.25
300AKSFB	Hot-Mix	-31.10
300AKSFA	Asphalt	-31.50
300AKSFB	Asphalt	-32.05
275AK - Average		
275AKSFA	WMA - 275°F	-28.43
275AKSFB	WMA - 275°F	-27.70
275AKSFA	WMA - 275°F	-28.73
275AKSFB	WMA - 275°F	-3.15
250AK - Average		
250AKSFA	WMA - 250°F	-27.88
250AKSFB	WMA - 250°F	-28.47
250AKSFA	WMA - 250°F	-28.00
250AKSFB	WMA - 250°F	-28.77
250AKSFA	WMA - 250°F	-27.50
240AK - Average		
240AKSFA	WMA - 240°F	-28.72
240AKSFB	WMA - 240°F	-28.50
240AKSFA	WMA - 240°F	-28.00
240AKSFB	WMA - 240°F	-30.30
240AKSFA	WMA - 240°F	-27.85

- HMA Fracture Temp. -31.48 C = -25 F
- WMA Fracture Temp. -28.23 C = -19 F
- Temp. Difference = 3.25 C = 6 F

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Pavement Condition Survey



2011 Crack Survey: WMA

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Pavement Condition Survey




2011 Crack Survey: HMA

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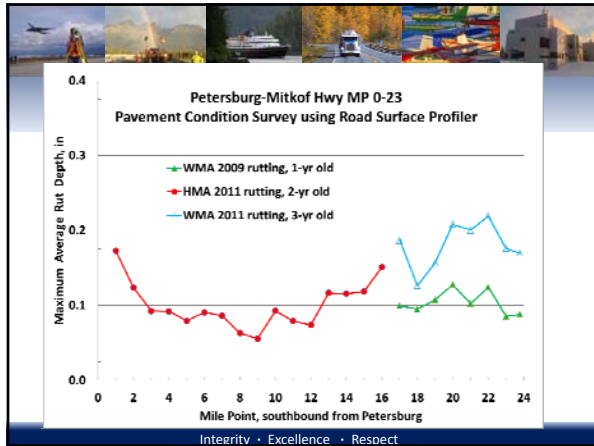


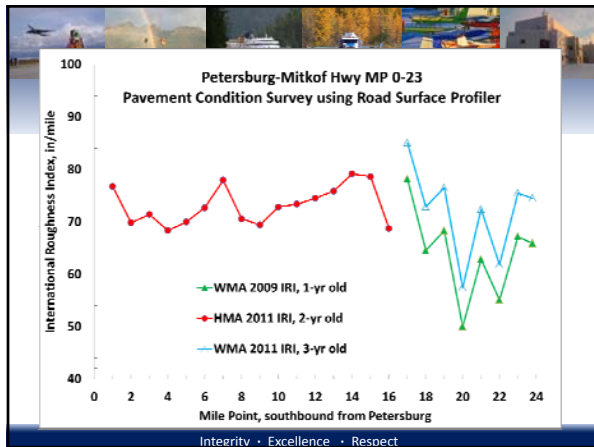
Pavement Condition Survey

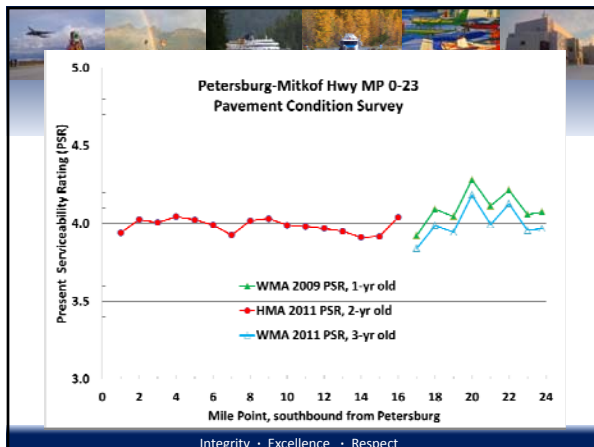
2009 & 2011 PMS surveys using
Road Surface Profiler




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Conclusions & Lessons Learned

- Sasobit-WMA produced, placed and compacted successfully
- Reduced mix production temperature
- Reduced plant fuel consumption: ≈ 20-30 % savings (1 gal/ton)
- Reduced emissions & fumes
- Reduced compaction temperature
- Ease of compaction; compaction aid


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Conclusions & Lessons Learned

- Binder Stiffening:
PG 58-28+1.5% Sasobit >>> PG 70-22
- Lab mixture evaluation: stiffening, rutting, moisture susceptibility
- Pavement condition surveys
- Sasobit-modified WMA quality & performance ≥ HMA quality & performance

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Draft WMA Spec

Pre-approved additives, technologies

WMA Technology	Process Type	WMA Supplier
Aspha-Min	Foaming (Synthetic Zeolite)	Aspha-Min
Double Barrel Green / Green Pac	Foaming	Astec Industries, Inc.
ECO Foam II	Foaming	AESCO/Madsen Inc.
Evotherm	Chemical Additive	MeadWestvaco Asphalt Innovations
Rediset WMX	Chemical Additive	Akzo Nobel Surfactants
Sasobit	Organic Additive	Sasol Wax Americas, Inc.
Ultrafoam	Foaming	Gencor Industries Inc.

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Useful Information


<http://www.warmmixasphalt.com/>

2nd Int'l Warm-Mix Conference,
St. Louis, MO, Oct. 2011:
<http://www2.asphaltpavement.org/meetings/presentations/11mwmx/index.php>

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Useful Information




NCHRP Report #691

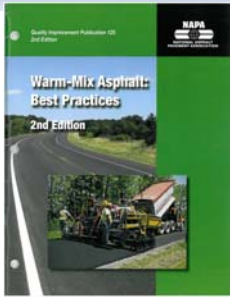
Mix Design Practices for Warm-Mix Asphalt

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_691.pdf

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Useful Information



Nat'l Asphalt Pavement Association, QIP 125

Warm-Mix Asphalt: Best Practices, 2nd Ed.

<http://store.asphaltpavement.org/index.php?productID=552>

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