

WARM MIX ASPHALT

ROB TREECE

SHAUNA TECLAMARIAM

U.S. OIL

State of Alaska – Warm Mix Project

- Location - Petersburg, Alaska which is located in the heart of Southeast Alaska's Inside Passage at the tip of Mitkof Island
- Scope – Pave 3" lift of South Mitkof Highway from Crystal Lake Hatchery Road to the South Mitkof Island ferry terminal access road
- 24 ft wide and 39,606 ft length
- Project AKSAS:68646 FED#MGS-0937(31)

State of Alaska

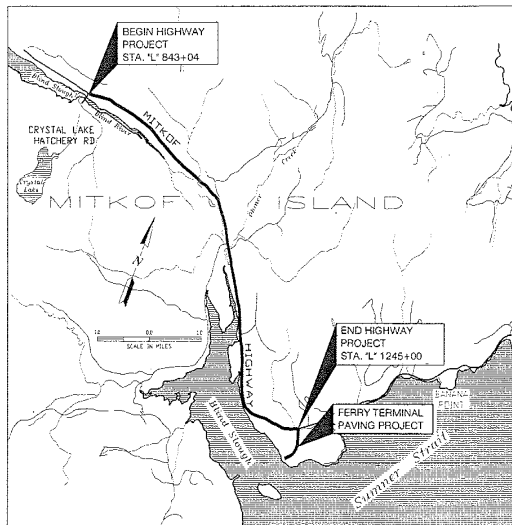
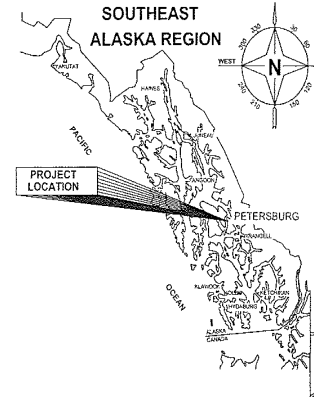
Department of Transportation and Public Facilities

Design and Engineering Services Division-Southeast Region

Petersburg, Alaska

Petersburg South Mitkof Highway Upgrade (Phase II) & South Mitkof Island Terminal Paving

PROJECT No. MGS-0937(31)~68646



VICINITY MAP

DESIGN DESIGNATIONS		
ITEM	2006	2026
A.D.T.	240	290
D.M.V. 12.7%	30	40
V. (MPH)	50	50
P.H.F.	0.9	0.9
Direction		
Distribute	55/45	55/45
%T.	3.0%	3.0%
E.A.L. (20yr.)		50.000

PROJECT SUMMARY	
B.O.P. 843+04 TO E.O.P. 1245+00	
CDS ROUTE NO. 294,000	
CDS MILEPOINT 16.24 TO 23.74	
LENGTH OF PROJECT - 39,606 FT.	
LENGTH OF PAVING - 39,606 FT.	
LENGTH OF GRADING - 39,606 FT.	
WIDTH OF PAVING 24 FT.	

THE FOLLOWING STANDARD DRAWINGS APPLY TO THESE PROJECTS:

A-1	E-00.00	G-09.04S	G-25.20	S-00.10	T-21.02
C-04.12	E-13.00	G-09.04W	G-30.00	S-05.01	
C-05.10	G-00.01	G-10.01	G-31.00	S-30.03	
D-04.21	G-04.06S	G-13.00	I-20.13	T-05.10	
D-06.10	G-04.07W	G-20.10	I-81.00	T-06.00	

PROJECT INDEX

SHEET NO.	DESCRIPTION
A1	TITLE SHEET
A2-A3	ESTIMATE OF QUANTITIES AND BASIS OF ESTIMATE
MIKTOF HIGHWAY UPGRADE (PHASE II)	
B1-B2	TYPICAL SECTIONS
D1-D2	CULVERTS AND DITCHES WORK SUMMARY
D3-D4	CULVERT SUMMARIES
D5	MISCELLANEOUS SUMMARIES
D6	HIGHWAY SIGN SUMMARY
E1-E3	CULVERT DETAILS
E4	CULVERT CONSTRUCTION WORK PLANS
E5-E6	FISH CULVERT PLAN AND DETAILS
E7	DITCH BLOCK DETAILS
E8	BEAVER DECEIVER PLAN AND DETAILS
E9	CURVE WIDENING DETAILS AND SUMMARY
E10	SUPERELEVATION RATES AND TRANSITION LENGTHS
E11	GUARDRAIL PLAN
E12	ET PLUS GUARDRAIL DETAILS
E13	PAVING PLAN AT OHMER CREEK BRIDGE
E14	APPROACH DETAILS
F1-F8	LAYOUT / ESCP PLAN VIEWS
H1-H2	TRAFFIC CONTROL PLANS
R1	USFS QUARRY DEVELOPMENT PLAN
SOUTH MITKOF FERRY TERMINAL PAVING	
AA1	FERRY TERMINAL SITE PLAN
AA2	CONTROL SURVEY DATA SHEET
AA3	TERMINAL STAGING AREA LAYOUT
BB1-BB2	TYPICAL SECTIONS
DD1	FERRY TERMINAL SIGN SUMMARY
EE1	TERMINAL STAGING AREA GRADING & PAVING PLAN
EE2-EE3	TERMINAL STAGING / PARKING AREA SIGNING, STRIPING PLAN AND DETAILS
EE4	MISCELLANEOUS SIGNING AND STRIPING DETAILS

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PLOT: PSPACE OR MSPAGE 1=1/1(F)

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
DESIGN & ENGINEERING SERVICES DIVISION-SOUTHEAST REGION



RECOMMENDED FOR APPROVAL:
JACK D. BEEDLE, P.E. 3-3-08 3/6/08
REGIONAL PRE-CONSTRUCTION ENGINEER
DATE
APPROVED: 3-3-08 3/6/08
MALCOLM A. MENDES, P.E., L.S.
SOUTHEAST REGION DIRECTOR
DATE

CERTIFIED TRUE & CORRECT AS-BUILT OF ACTUAL FIELD CONDITION:

CONSTRUCTION PROJECT MANAGER DATE

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	MGS-0003(31) ~ 68646	2008	A1	46

CONTRACTOR

- **Secon** – Based out of Juneau, AK
- Division of **Colaska** which includes:
 - Quality Asphalt Paving – Anchorage
 - Exclusive Landscaping – Fairbanks
 - Aggpro – Ready Mix Divisions
- **Colis** is the parent company based out of France

JOB INFO

- 22,747 total tons placed - September 2 – 15th
- Final oil content 5.09%
- Mix production - 270 tph @ 260 F
- Placement Of Mix – 250 to 230 F
- 3" mat thickness
- Bomag BW 205 roller – 1 pass vib, ½ pass static
- Plant 1 Mile From Job
- This plant uses 2 – 2.5 gallons burner fuel per ton during normal hot mix production
- Dry rock coming right from crusher helped keep fuel consumption down

EQUIPMENT

- AESCO 7' PARRALEL FLOW DRUM RATED AT 300 TONS PER HOUR
- BLAW-KNOX PF5510 PAVER
- BARBER GREEN 650 PICK UP MACHINE
- BOMAG BW 205 ROLLER







CLSU321047-5

WOODPECKER QUARRY







MARSHALL MIX DESIGN

	<u>CSE</u>	<u>INT</u>	<u>FINE</u>	<u>TARGET</u>	<u>SPECS</u>
■ AGG BLEND %	31	56	13		
■ 19.0 MM (3/4)	100			100	100
■ 12.5 MM (1/2)	55	100		87	81 – 93
■ 9.5 MM (3/8)	18	99	100	75	69 – 81
■ 4.75 MM (#4)	3	71	86	53	47 – 59
■ 2.38 MM (#8)	3	51	68	39	33 – 45
■ 2.00 MM (#10)					
■ 1.18 MM (#16)	2	37	52	29	24 – 34
■ .550 MM (#20)					
■ .500 MM (#30)	2	29	34	22	18 – 26
■ .425 MM (#40)					
■ .300 MM (#50)	2	22	16	16	12 – 20
■ .180 MM (#80)					
■ .150 MM (#100)	2	15	4	11	8 - 14
■ .075 MM (#200)	1.2	10.2	1.6	6.3	4.3 – 8.3

MARSHALL MIX DESIGN

	<u>MARSHALL</u>	<u>TARGET</u>	<u>SPECS</u>
■ FRACTURE %		100	80 MIN 1 FACE
■ UNIT MASS – PCF	159.2		
■ VOIDS FILLED - %VFA	82		65 – 78
■ VOIDS MIN AGG - %VTM	2.5		3 – 5
■ VOIDS MIN AGG - %VMA	13.9		12.0 MIN
■ STABILITY – LBS	2940		1200 MIN
■ FLOW – IN	12		8 – 16
■ MAX. SPG Gmm	*2.624 (2.622)		
■ MAX. UNIT MASS - PCF	*163.3 (163.2)		
■ DUST/ASPHALT RATIO	1.4		0.6 – 1.4
■ NUMBER OF BLOWS	50		
■ ASPHALT TYPE	PG58-28(plus)		
■ ASPHALT CONTENT	5.0		4.6 – 5.4
■ ASPHALT SPG Gb	1.012		
■ ANTI-STRIP	AD-HERE LOF 6500		0.3%







TURN OFF HEATERS
BEFORE DISCHARGE

WAYBE HOT

APPLY NO
FLAME TO VALVE



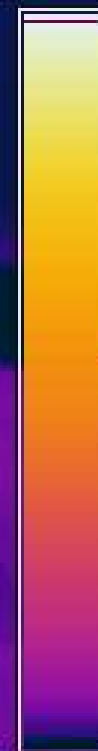
www.tecint.co.uk

ThermaCAM™

+1 248 °F

+2 39.1

248



-5



Tatm=278 Dst=54 FOV 24

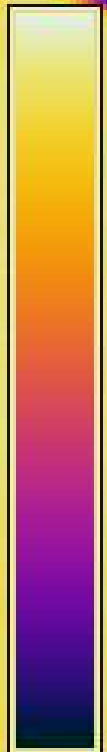
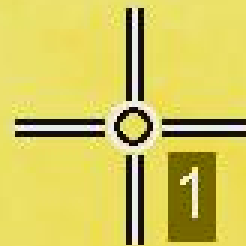
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ThermaCAM™

+1 233 °F

+2 241

249



4

Tatm=278 Dst=54 FOV 24

9/ 4/09 7.46.14 AM -40 - +250 Trefl=68.0

HMA - 315



WMA - 265



Hot Mix (155 °C)

WAM (110 °C)





HMA



A photograph of a road construction site on a mountain. A large asphalt paver machine is in the center, laying a fresh layer of dark asphalt. Several workers in orange safety vests and hard hats are standing around the machine. To the left, a metal guardrail runs along the edge of the road, with a steep, rocky hillside in the background. The scene is brightly lit, suggesting a sunny day.

WMA

WINDROW TEMP





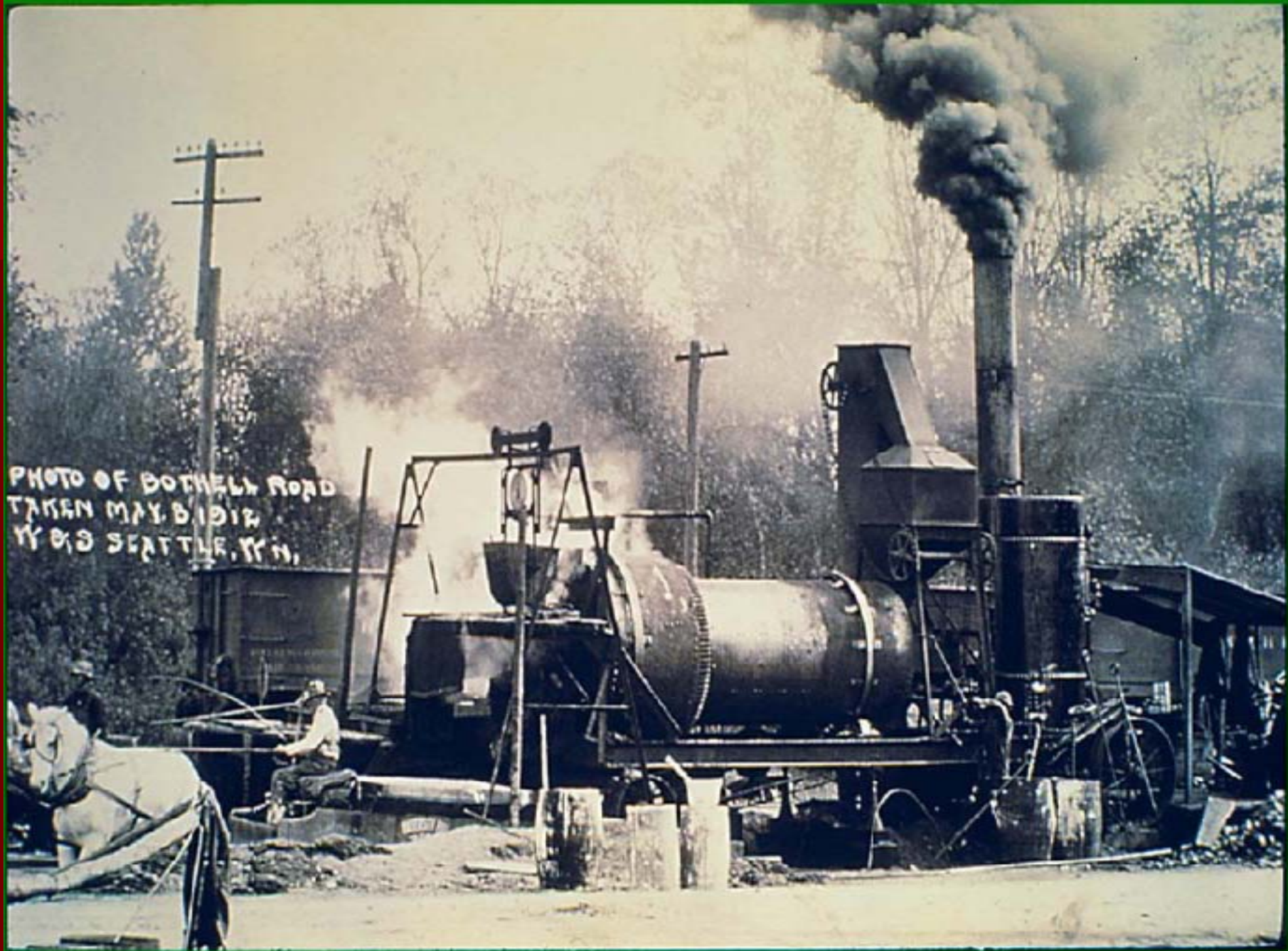


PAVER REBUILD KIT

WWW.BDQPP.COM

Bill Dempsey's Quality Paving Parts

PHOTO OF BOTHELL ROAD
TAKEN MAY 6, 1912
BY O. S. SEATTLE, W. N.

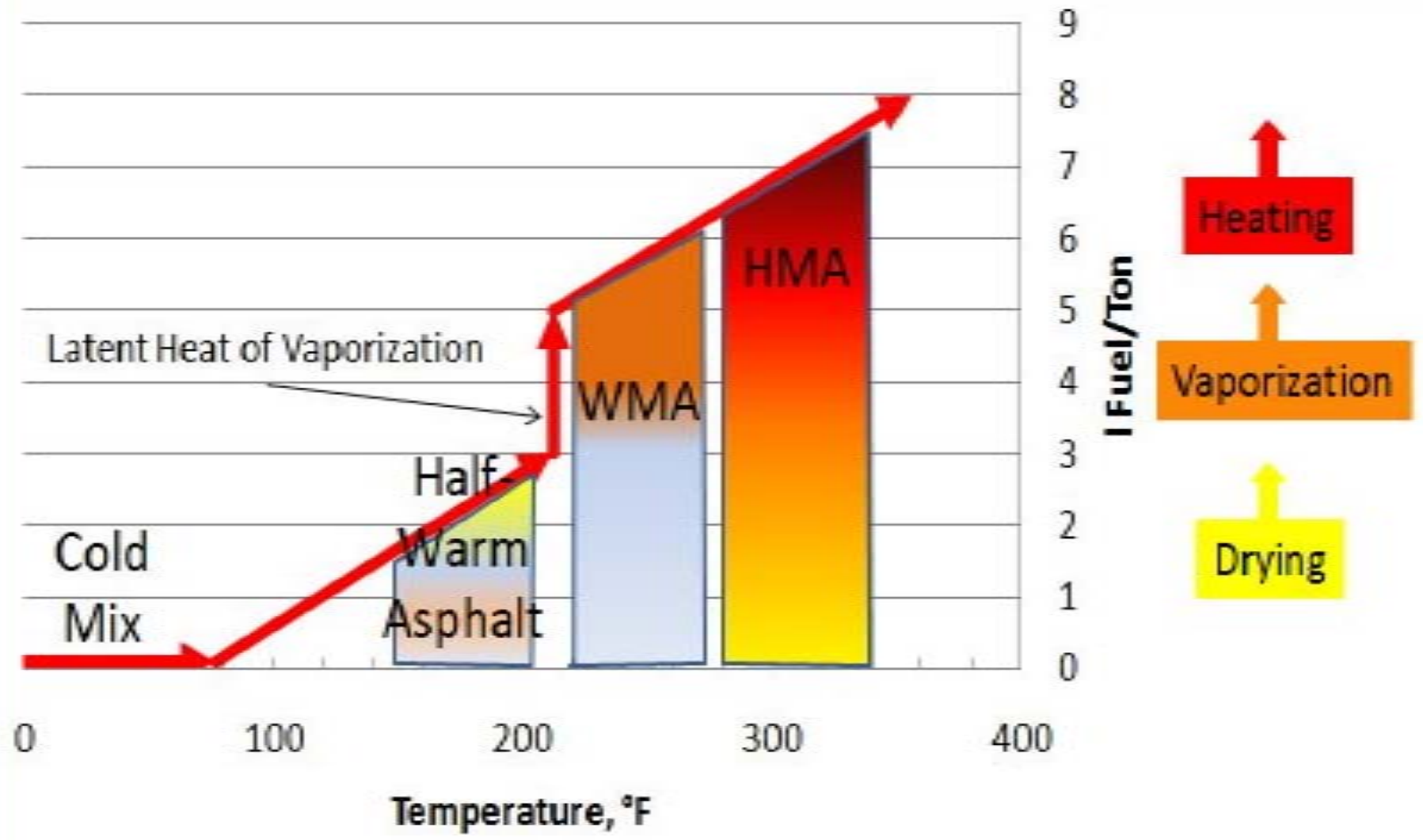


COST SAVINGS

- Saved $\frac{1}{2}$ gallon burner fuel per ton @ \$1.50 = .75 per ton
- Not needing finish roller saved .65 per ton
- Total savings per ton around \$1.40
- 1.5% Sasobit cost \$40 per liquid ton
- About \$2.00 per mix ton
- Total savings?

BENEFITS OF WMA

- Safer Environment For Employees (Emissions & Odors)
- Reduced Greenhouse Gasses
- Reduced Fuel Usage (Lowers Energy Costs 10-30%)
- Compaction Aid
- Pave In Cooler Weather And Still Obtain Density
- Longer Haul Distances While Still Maintaining Workability
- Extending Paving Season
- Higher Percentages of RAP
- Able To Pave Over Crack Sealant
- Less Hardening Of Binder (Appearance & Longer Life)
- Earlier Opening To Traffic



General techniques

- Organic additives
- Foaming techniques
- Emulsion based techniques
- Low-viscosity vegetable based binders
- Chemical additives

Technologies Marketed in U.S.

WMA Technology

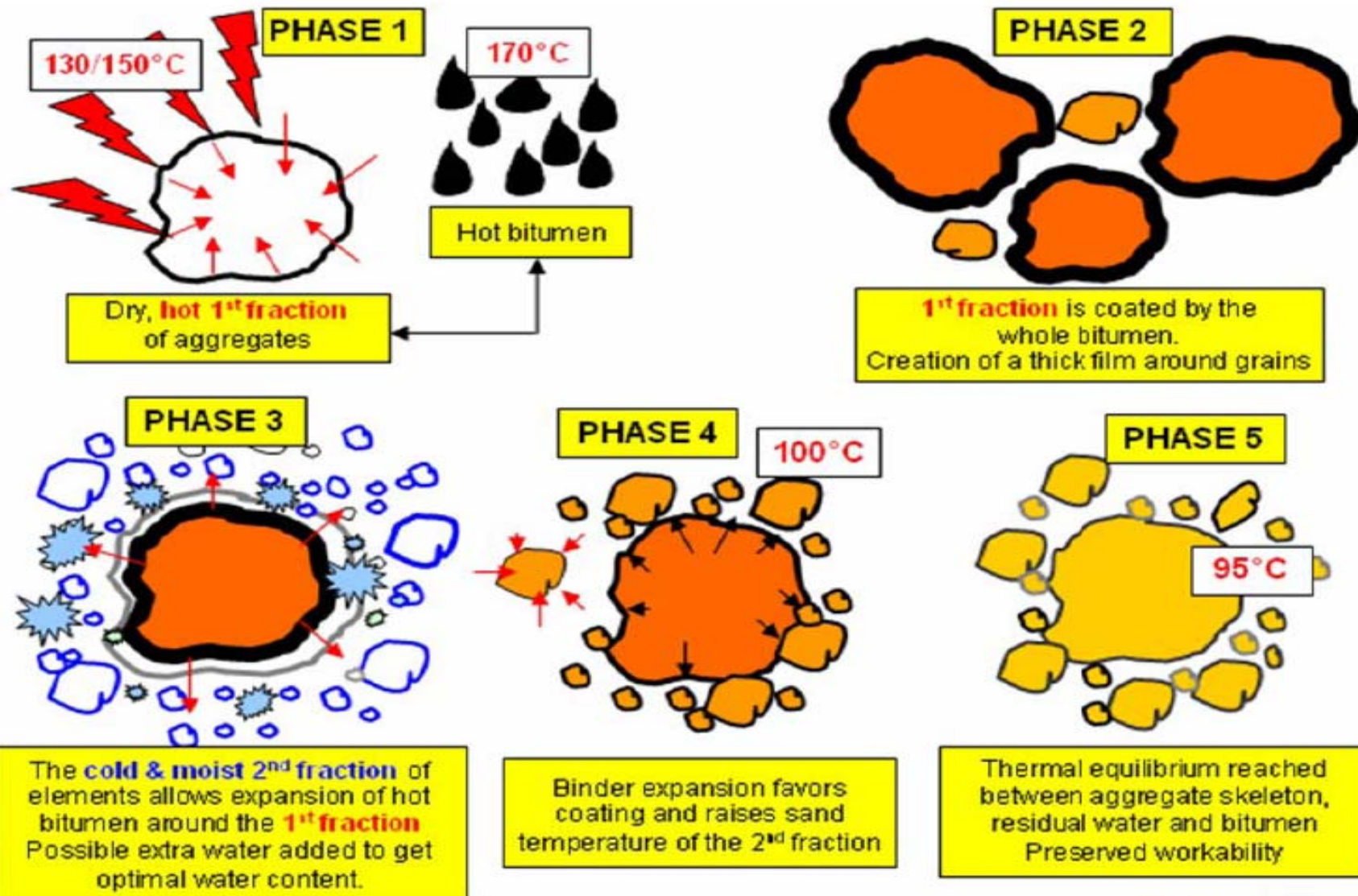
Process Type

■ Advera	Additive/Foaming
■ Aspha-min	Additive/Foaming
■ Cecabase RT1	Chemical Additive
■ Double Barrel® Green	Foaming
■ Evotherm™	Chemical Additive
■ Gencor1	Foaming
■ (LEA) Low Energy Asphalt	Foaming (moisture in fine aggregate)
■ Rediset™ WMX	Chemical Additive
■ REVIX™	Chemical Additive
■ Sasobit	Organic Additive
■ StanSteel1	Foaming
■ Synthetic Zeolite	Foaming
■ Terex1	Foaming
■ WAM-Foam	Foaming

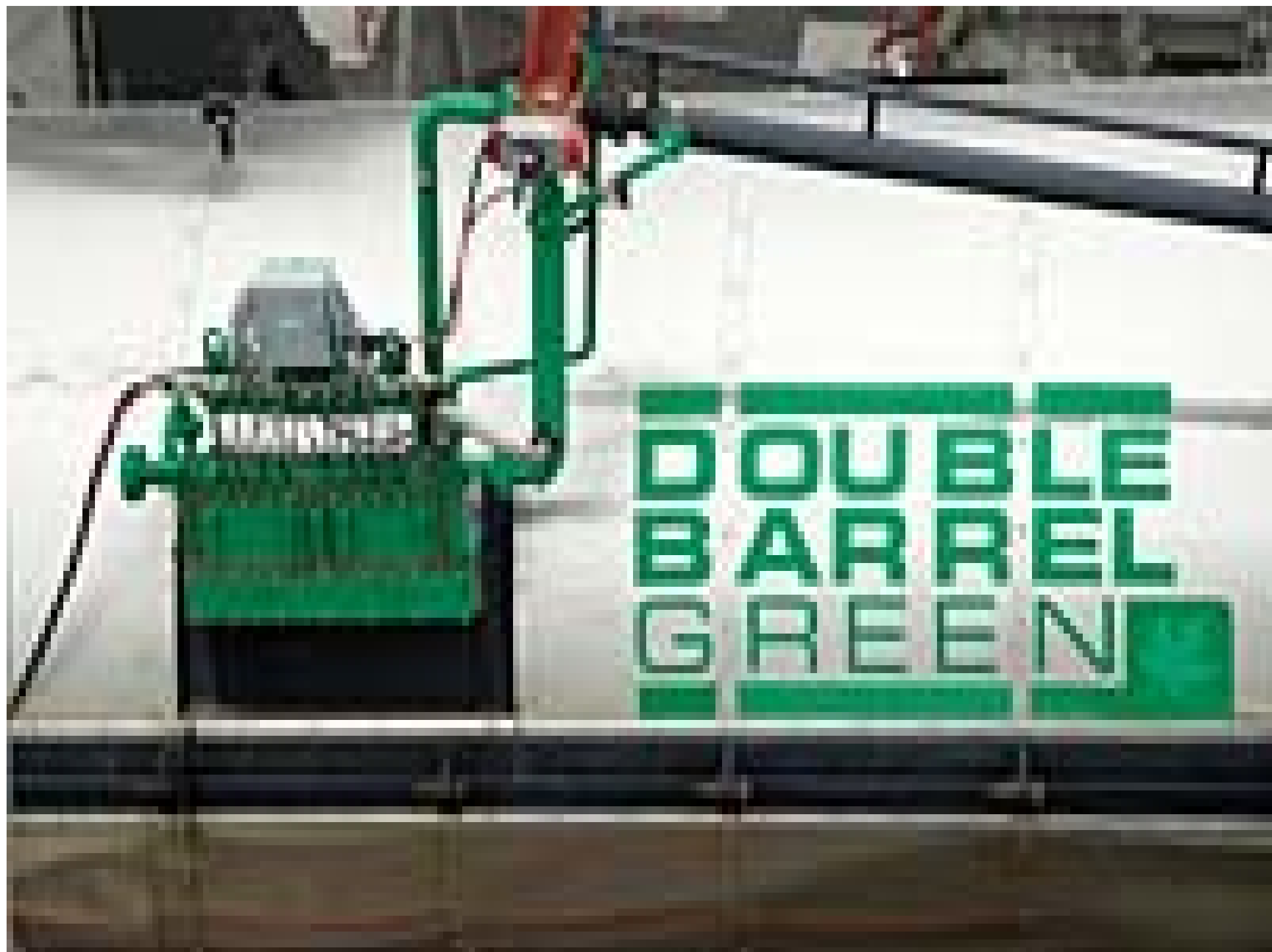
Foaming

- Foaming done in plant
- Another version is an additive such as Zeolite, (Advera) Sodium Aluminum Silicate, which has been hydro thermally crystallized (water) added to the foaming process
- Another version is WAM-Foam which has two different asphalts and water
- Another version is the LEA processes (3 types)

LEA1: 1st variant (with precoating)







Chemical

- Rediset WMX made by Akzo Nobel
- Revix- Mathy Technology & Engineering
Services Paragon Technology Services
- Evotherm made by MeadWestavco

Organic Chemical

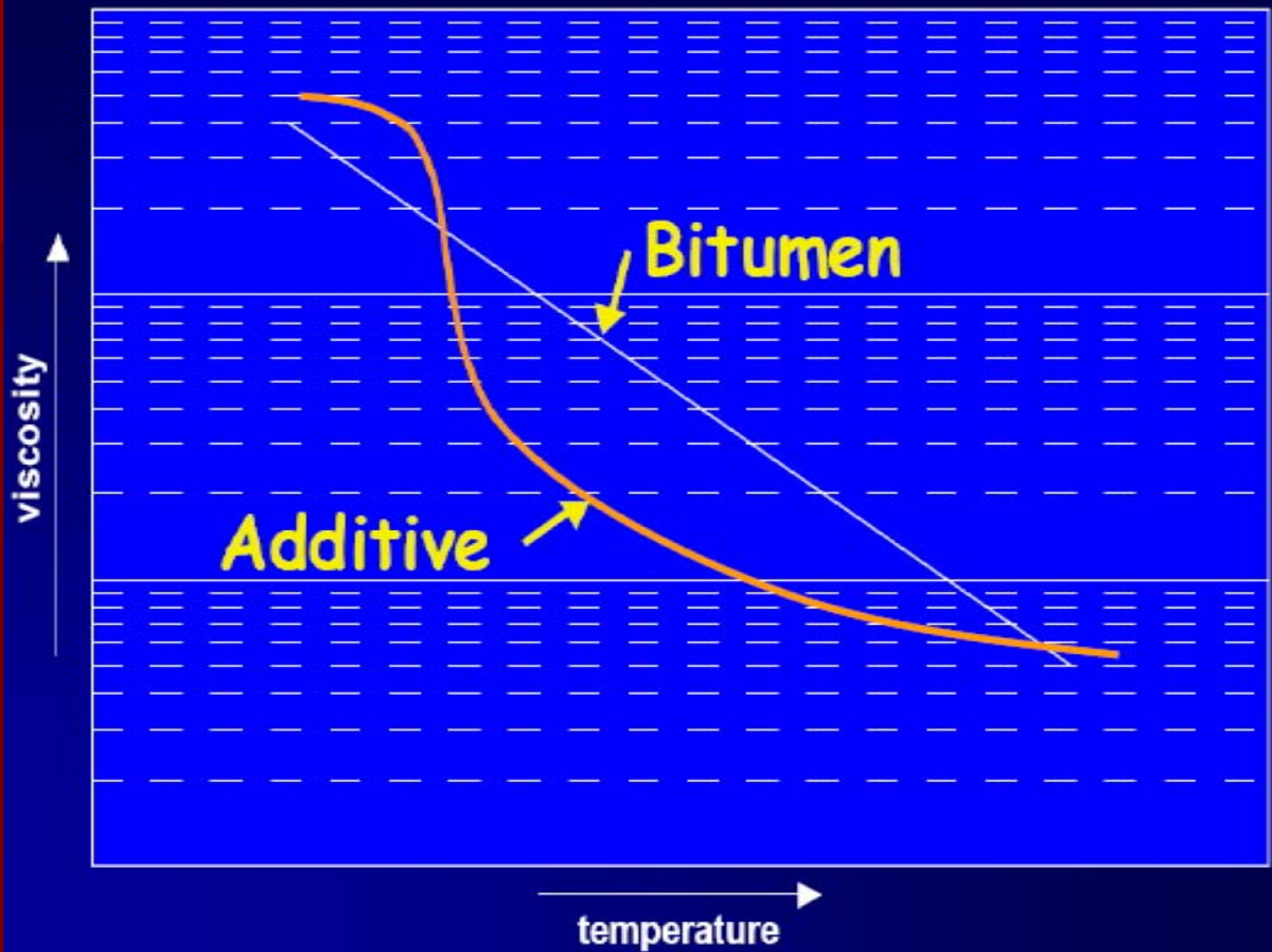
- Added to the mixture or the asphalt
- Additives are paraffins (waxes) or amids
- Sasol Wax
- Asphaltan B/Montan Wax
- Fatty Acid Amide (Germany)

Sasobit

- Made in South Africa. It is a long chain aliphatic hydrocarbon produced from coal gasification (some time known as FT paraffin wax)
- Completely soluble in asphalt binders above 240° F.
- General addition range is 1.5 to 3% by wt of mix.

SASOBIT





PG58-28 PLUS

PG58-28 PLUS WITH SASOBIT

TESTS

ORIGINAL

Vis@135C,Pa-s

Flash Point, C

Specific Gravity

Toughness, in-lbs

Tenacity, in-lbs

DSR@58C,G*/sinδ

DSR@70C,G8/sinδ

RTFO

Mass Loss %

Elastic Rec.@25C

DSR@58C,G*/Sinδ

DSR@70C,G8/sinδ

MSCR,%Rec

58C, 100Pa

58C,3200Pa

Diff % Rec

US OIL	MACTEC	ASPHALT INSTITUTE	ALASKA	US OIL	US OIL	MACTEC	ASPHALT INSTITUTE
0.512	0.538	0.518	0.513	0.526	0.526	0.528	0.522
344	316	334		332	332	330+	328
1.018				1.019			
	87					127	
	70					78	
2.12	2.3	2.39	2.04	4.86		4.45	5
					1.09		
0.28	0.21	0.17	0.228	0.18	0.18	0.221	0.18
70	75	73.8	64.6	75		78	75
4.65	4.75	4.74	4.41	10.58		9.73	9.65
					2.73		
	24.1	30.3				71.6	70.2
	15.6	18.4				49.9	42.2
	8.49	39				21.7	40

PG58-28 PLUS

PG58-28 PLUS WITH SASOBIT

PAV

DSR@19C, G*Sinδ

DSR@25C, G*Sinδ

BBR@-12C,S

BBR@-12C, m

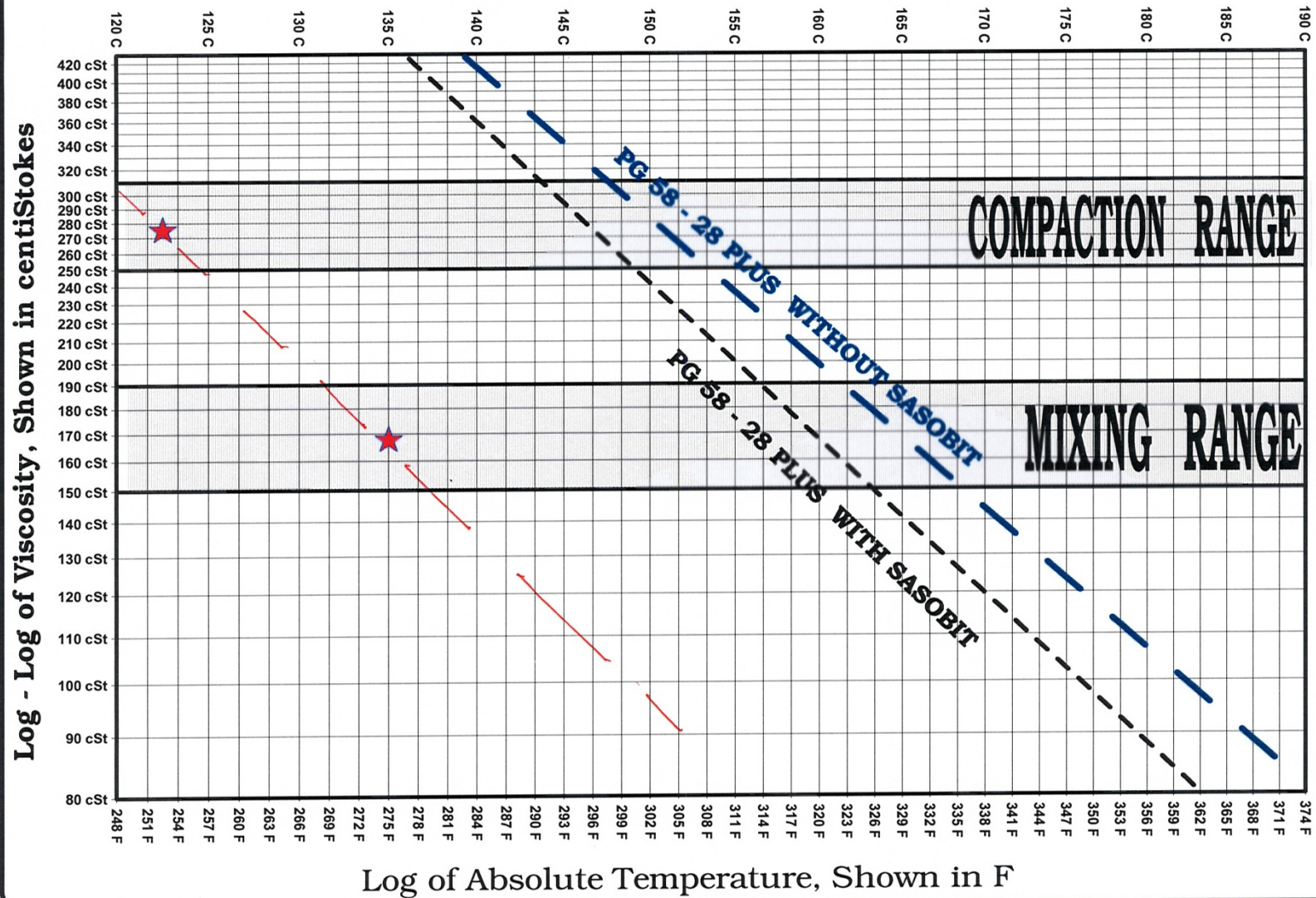
BBR@-18C,S

BBR@-18C, m

GRADE

U.S. OIL	MACTEC	ASPHALT INSTITUTE	ALASKA	US OIL	US OIL	MACTEC	ASPHALT INSTITUTE
4045	3053	3890	3803	4786		3950	5180
					2252		
					153		
					0.309		
220	201	212	211	265		262	270
0.314	0.317	0.307	0.311	0.269		0.280	0.274
PG58-28 PLUS	PG58-28 PLUS	PG58-28 PLUS	PG58-28 PLUS		PG70-22		

Temperature - Viscosity Chart



Specific Gravity = 1.018 @ 60 F; 1.011 @ 77 F Without SASOBIT











Handling the Liquid Asphalt at Lower Temperatures Requires

- Proper Insulation of tanks, pumps, & calibration system are all critical
- • Properly calibrated & controlled metering systems



Experimental Features in Highway Construction
Work Plan

For

Warm Mix Asphalt Demonstration Project
for Inclusion in the
Petersburg Mitkof Highway Upgrade
Phase II Project

Project Number AKSAS 68646
Federal Project MGS-0937(31)

Alaska Department of Transportation & Public Facilities
SE Design & Engineering Services

Bruce Brunette, P.E.

SE Regional Materials Engineer
&

Steve Saboundjian, P.E.

Statewide Pavement Engineer

Orig. May 2008, Rev. Aug.2008

Study

- Alaska DOT will study the road for 3 years.
- Some mix is being sent to TWG to be studied
- Special project with lab in Virginia to look at high temperature rutting, moisture damage, fatigue performance and low temperature performance. Looking at warm mix vs. standard PG for area.



Concerns

- Baghouse issues

- preheat for 15 to 20 minutes to remove condensation

- moisture pressure drop across bags

- return line inspect more frequently

- Burner issues

- difficult to adjust with low temperature combined with lower production rate

- Contamination of fuel in mix (brown colored mix, which would have higher emissions)

Research Needs

- Mix Design
- Long-term Performance
- Product Approval System
- Quantification of Benefits
- RAP and WMA
- Production Equipment
- Grades of Asphalt

FHWA WMA TWG

- NCHRP9-43 Mix Design Practices for WMA
- NCHRP 9-47 Engineering Properties, Emissions, and Performance of WMA
- Develop quality and environmental testing protocols
- Provide guidelines on mix design and construction
- Identify benefits of WMA

WMA Unknowns . . .

■ Design concerns

- ❖ Short term conditioning of the mix
- ❖ PG grade adjustment
- ❖ Stripping concerns
- ❖ Design compaction levels
- ❖ Compaction temperature
- ❖ Mix volumetrics
- ❖ Modifiers on Binder

WMA Unknowns . .

■ Quality concerns

- ❖ Mix conditioning to ensure repeatability
- ❖ Long term performance

□ Plant concerns

- ❖ Impact on baghouse
- ❖ RAP handling
- ❖ Document on energy saving
- ❖ Document on plant emissions

WMA Unknowns . .

■ Field concerns

- ❖ Impacts on compaction
- ❖ Workability limits (extended season, etc)
- ❖ Mix tenderness

□ Performance concerns

- ❖ Premature failures
- ❖ Rideability
- ❖ Performance advantages

High quality Warm Asphalt Mix requires

Controlling

Bauaufsicht

Überprüfung der entsprechend einer erteilten Genehmigung zugelassenen Ausführung des Bauwerks durch das Bauaufsichtsamt.

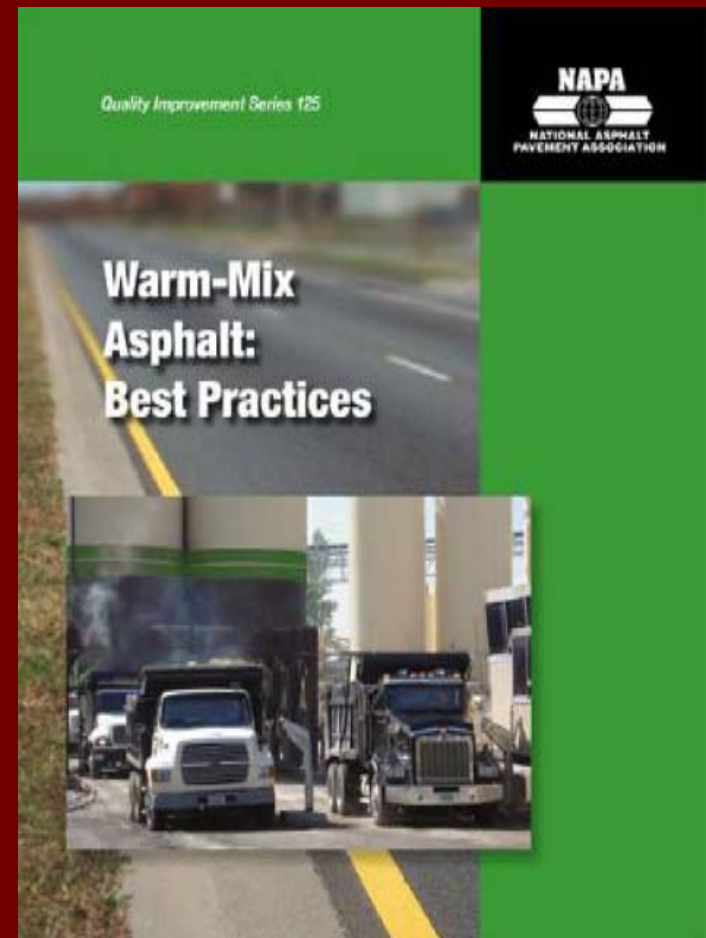


Bauaufsicht

Warm Mix Asphalt: Best Practices

Quality Improvement Series #125

- Stockpile Moisture Management
- Burner Adjustments and Efficiency
- Aggregate Drying and Baghouse Temperatures
- Drum Slope and Flighting
- Combustion Air
- RAP usage
- Placement Changes



WSDOT

- Allowing 1 to 2 day paving with warm mix
- Warm mix must be placed in the same lane
- Test section for each section
- They will be putting out a general form as to how to do change order and what they are looking for.
- Not wanting a failure or warm mix will be dead







Events

- Warm-Mix Asphalt & Recycling Symposium
June 8-10, 2009 at Hyatt Regency in
Sacramento, CA
- TWG Warm-Mix will be at U of Mass. on
May 14-15