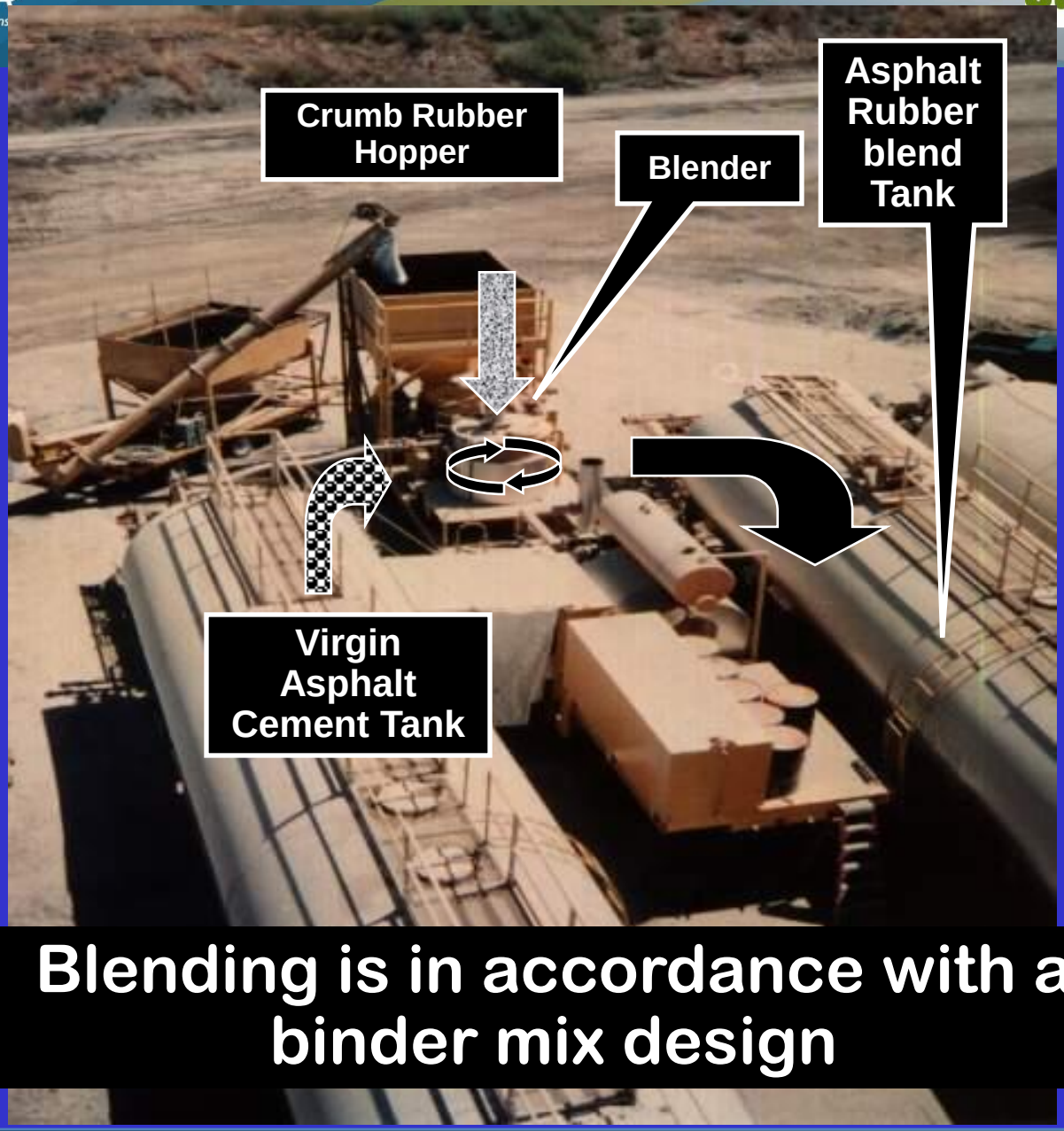
Best Practices For Manufacture and Placement of Asphalt-Rubber Pavements

Note: Terminal blends, rubberized emulsions, and other rubberized asphalt products are produced using different processes and requirements.

Crumb rubber

Minus No. 10 mesh is used, free of wire and other contaminants, up to 0.5% fiber.

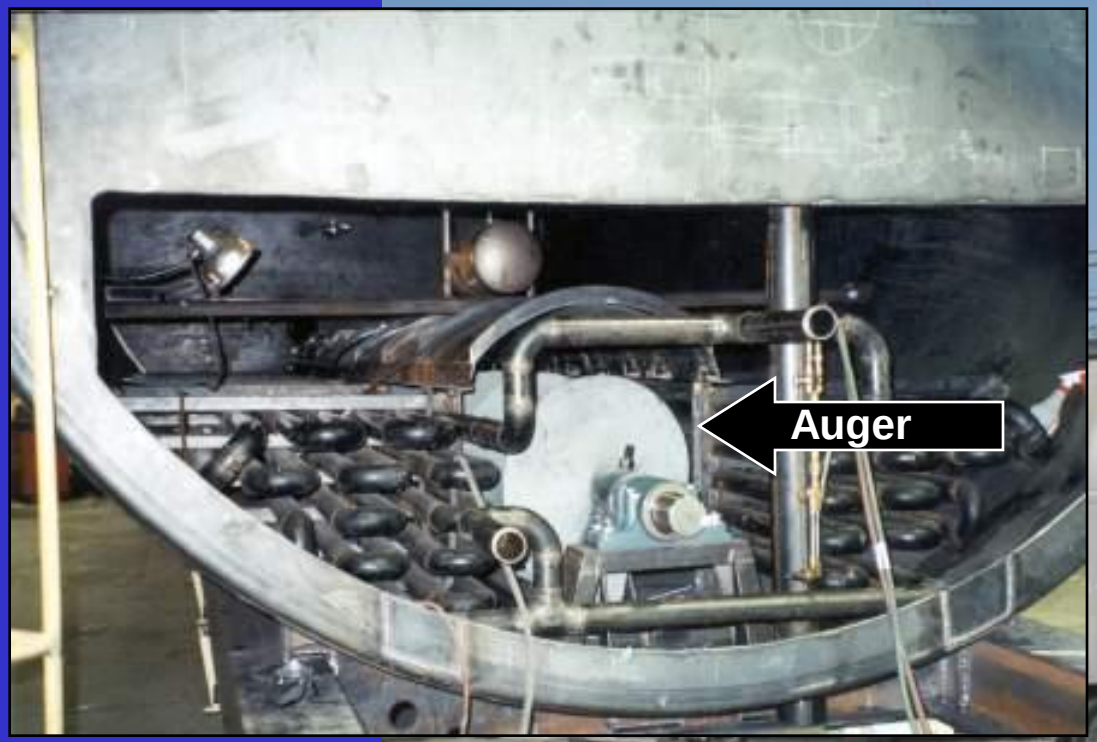


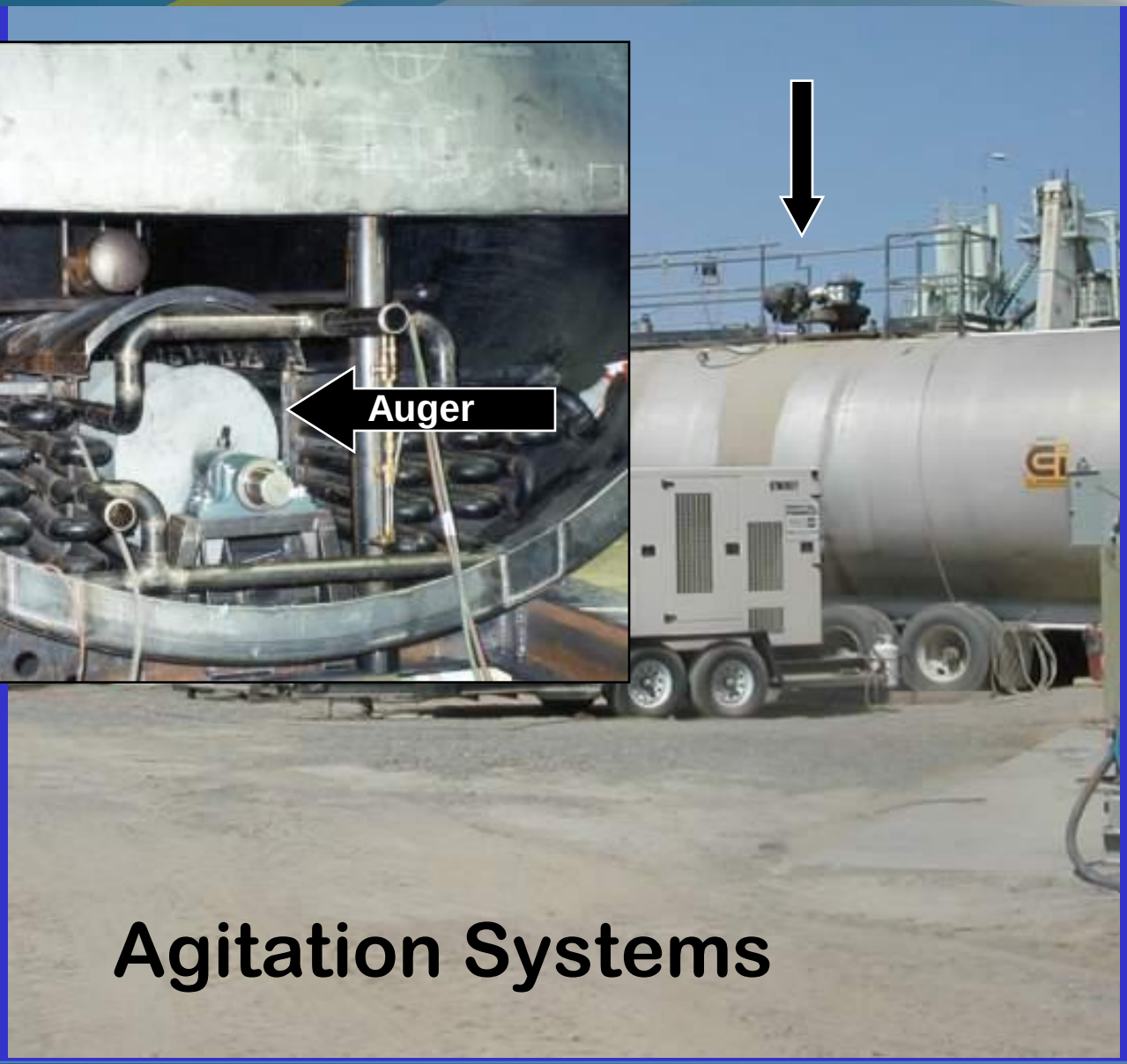
Blending is in accordance with a binder mix design

Ground tire rubber is typically received in 2,000 pound "Supersacks".

The Rubber is weighed by the hopper's load cells.

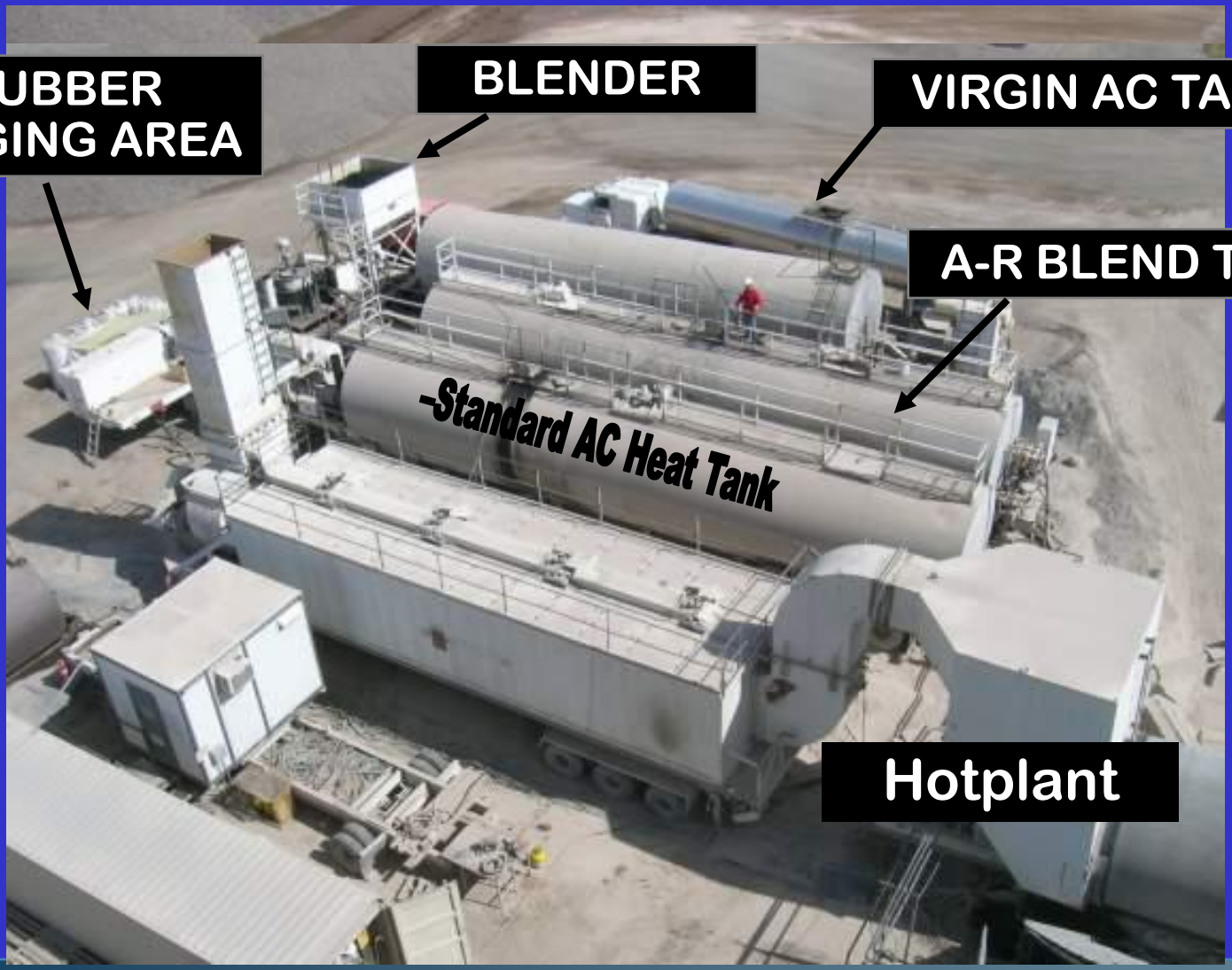
Maintaining Heat and Agitation is Key



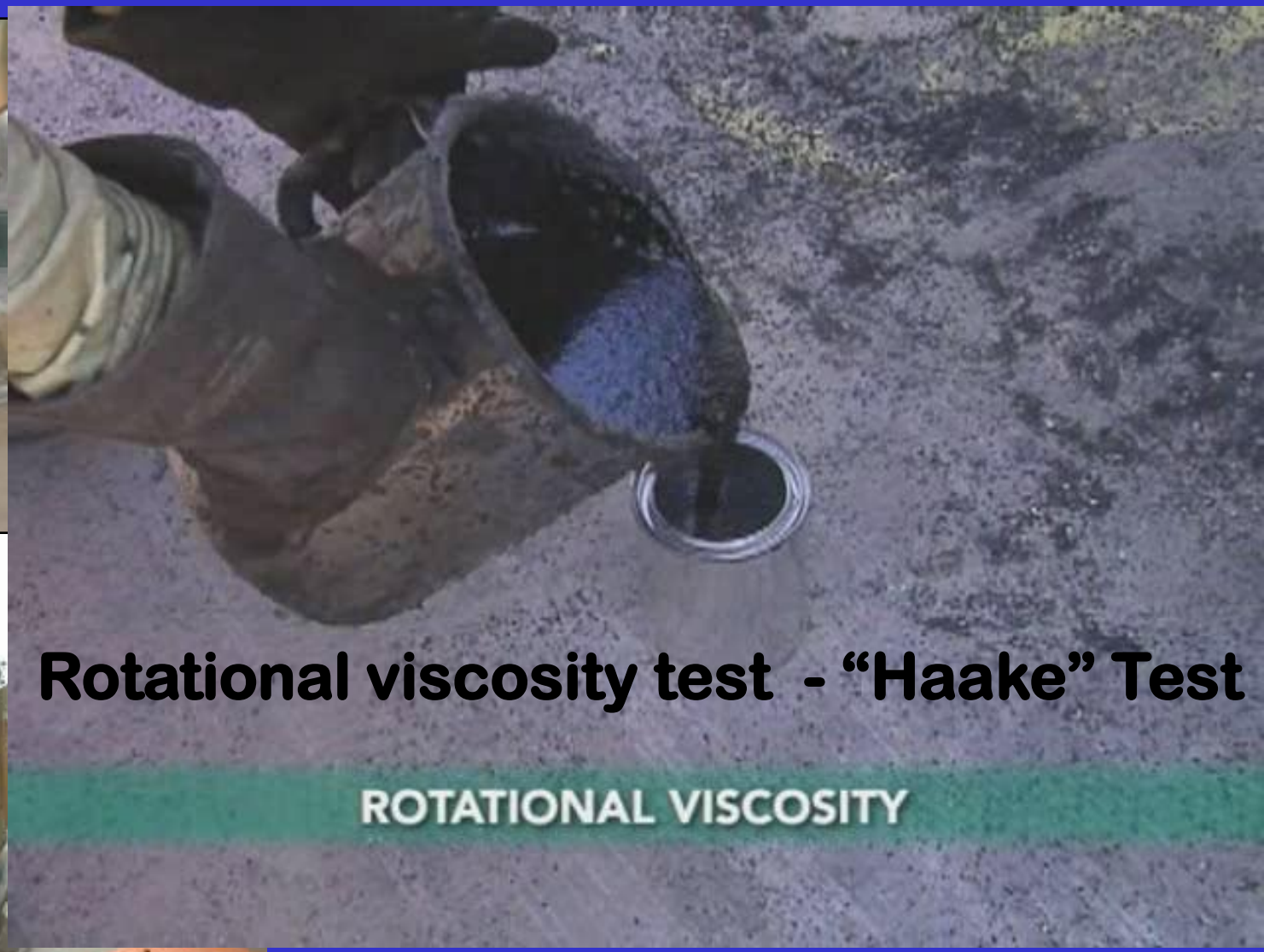


Agitation Systems

Portable Asphalt-RubberPlant setup at a Hotplant.



Meter / Pump is interlocked with Hotplant



Rotational viscosity test - “Haake” Test

SOME CONCERNS WITH FIELD BLENDING PROCESSES

- Limited Production Rate for hotplant
- Elevated heat at plant - safety
- End of project cleanout

A-R Paving is done with conventional paving techniques.

Successful AR Production is about Heat Management

- Virgin Asphalt Temp: >375° F
- Binder Temperature: 375 ° - 425° F
- Aggregate Temperature: <325° F
- Breakdown Roller: 290 ° F
- Ambient/Surface Temp: >55°F RHMA-G

PLACING AC WITH A-R BINDERS

- Don't pave in the cold but AR performs well in the cold
- No use of pneumatic rollers
  - "Rubber picks up Rubber"
- Elevated mix temperature is not solution
- Use of limewater in some areas

Things Can Go Wrong

- Plant Breakdowns
- Limited Shelf Life
- Last Day Cutoff

Important!

Don’t confuse constructability with performance.

Performance in Indio, CA

MILE
0

Elements of a successful AR Project

- Experienced Binder Designer
- Experienced Mix Designer
- Blender / Hot Plant Compatibility (Electronics)
- On-site contractor quality control
- Knowledgeable Agency inspection
- Common Sense

Common Sense Best Practices

- Tarp loads
- Shorten windrows when paving with bellys
- Keep rollers close
- Weather forecast
  - Wind
  - Long range outlook
- Nighttime temperatures

CONCLUSIONS

- A-R mixes resist reflective cracking
- Gap graded and open graded mixes perform well and are durable
- Constructability and unique field issues must be dealt with
- Upfront costs hamper widespread usage
- Noise mitigation may be part of future

Summary

- Asphalt-Rubber is construction friendly
- A-R is quiet, smooth, long lasting and an environmental winner

Sample Specifications

JACOBS

CalRecycle

KLEINFELDER

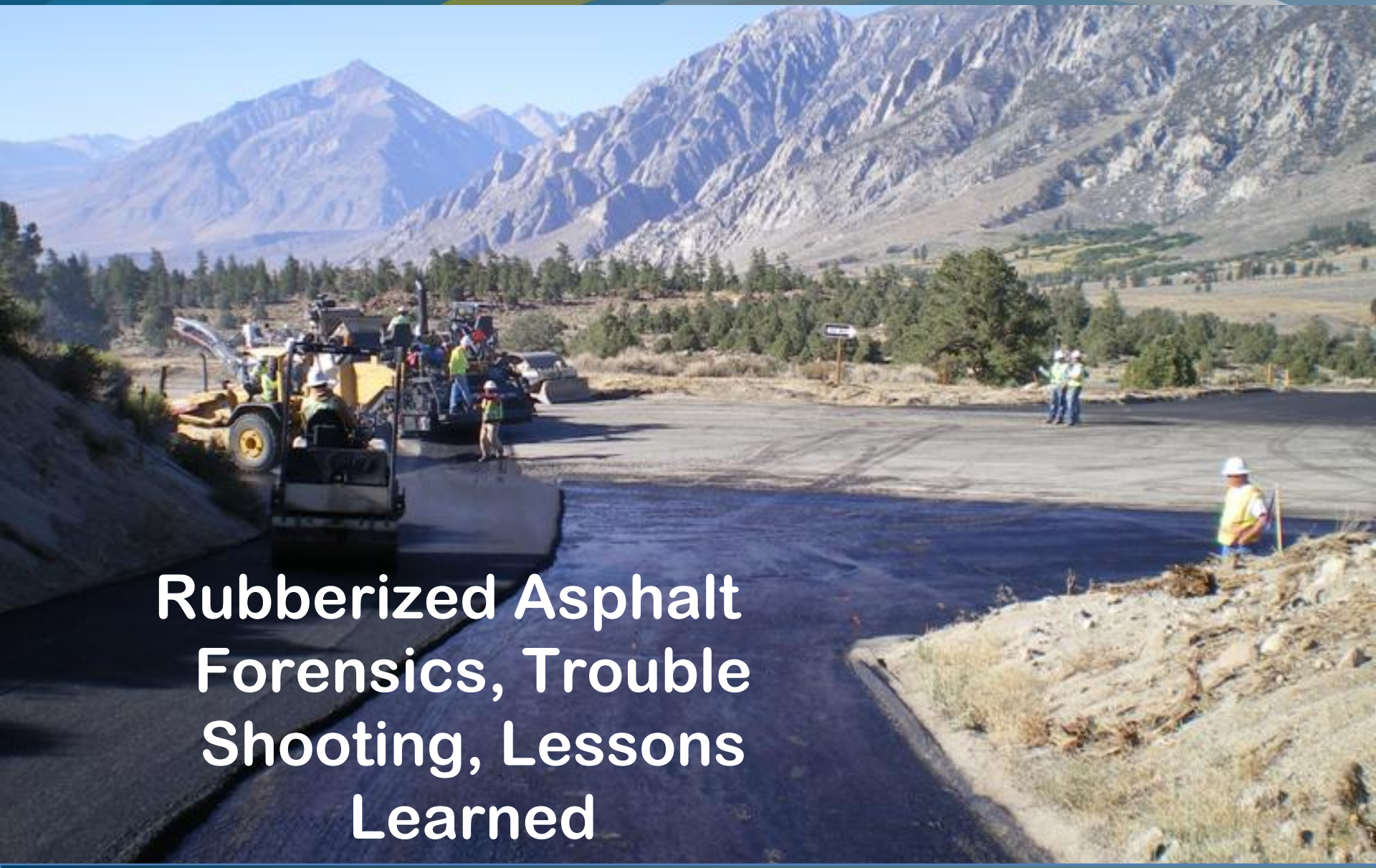
Sample Specifications for Various Rubberized Asphalt Products

These specifications are provided for reference only. Users should employ them with care, and only after fully understanding them and modifying them as appropriate to meet the intended purpose.

Product	Source	Suggested Uses: Gap Grade	Wear Cours	Open Grad	Dens e	Chip Seal	SA MI	Slurry Seal	Cap e	Sample Specification	Supporting Specification	Supporting Specification
AGENCY SPECIFICATIONS												
Asphalt Rubber Gap Grade	Caltrans[1]	X	X							RHMA-GG SSP.doc	SECTION 39 HMA.pdf	2006_StdSpecs.doc
Asphalt Rubber Gap Grade	Greenbook	X								Greenbook_ARHM.pdf	**Greenbook**	
Asphalt Rubber Gap Grade	County of Sacramento	X								Sac County ARHM GG.doc	2006_StdSpecs.doc	
Rubberized Bonded Wearing Course - Gap Graded	Caltrans[1]	X	X							Rubberized Bonded Wearing Course - GG SSP.doc	SECTION 39 HMA.pdf	2006_StdSpecs.doc
Asphalt Rubber Open Grade	Caltrans[1]		X	X						RHMA-OG and OGHB SSP.doc	SECTION 39 HMA.pdf	2006_StdSpecs.doc
Rubberized Bonded Wearing Course - Open Graded	Caltrans[1]		X	X						Rubberized Bonded Wearing Course - OG SSP.doc	SECTION 39 HMA.pdf	2006_StdSpecs.doc
Stone Matrix Asphalt - rubberized	Texas DOT		X							Texas SMA.doc		
Terminal Blends			X	X	X	X				specification used depends on desired properties of binder		
Asphalt Rubber Chip Seal	Caltrans					X				A-R Seal Coat SSP.doc	2006_StdSpecs.doc	
Asphalt Rubber and Aggregate Membrane	Greenbook					X	X		X	GRBK_Sec_203 -ARAM.doc	**Greenbook**	
Rubberized Chip Seal	County of Sacramento					X				Sac County Rubber Chip Seal.doc	2006_StdSpecs.doc	
A-R Stress Absorbing Membrane Interlayer	Caltrans						X			A-R Seal Coat SSP.doc	2006_StdSpecs.doc	
Rubberized Emulsion Slurry Seal	proposed Caltrans specification							X		reas_proposed_caltrans_specification.doc		
Rubberized Cape Seal	City of Stockton								X	Stockton Rubberized Cape Seal.DOC	2006_StdSpecs.doc	
INDUSTRY SPECIFICATIONS												
Terminal Blends	from Paramount Petroleum					X				PGTRchipseal.pdf	2006_StdSpecs.doc	
Tire Rubber Modified Slurry Seal	from Pacific Emulsions							X	X	2006_StdSpecs.doc	Caltrans Section 37-2[2]	
Asphalt Rubber Slurry Surfacing	from Valley Slurry Seal							X		Asphalt Rubber Slurry Surfacing.mht		
Polymer Modified Asphalt Rubber Slurry Seal	from Valley Slurry Seal							X	X	Polymer Modified Asphalt Rubber Modified Slurry Seal.mht		
Asphalt Rubber Cape Seal	from Valley Slurry Seal								X	Asphalt Rubber Cape Seal.mht		
SUPPORTING SPECIFICATIONS												
HMA Compaction Acceptance Testing	City of Sacramento	X	X		X					Compaction Acceptance Testing.doc	2006_StdSpecs.doc	
Asphalt Compensation Adjustment	Caltrans	X	X	X	X	X	X		X	Asphalt Compensation Adj.doc		

Notes: [1] - When using the revised version of Section 39, a placement/acceptance method must be specified - Method, Standard, or QC/QA

[2] - Caltrans Section 37-2, specify that base asphalt used in the emulsion contain 10% tire rubber



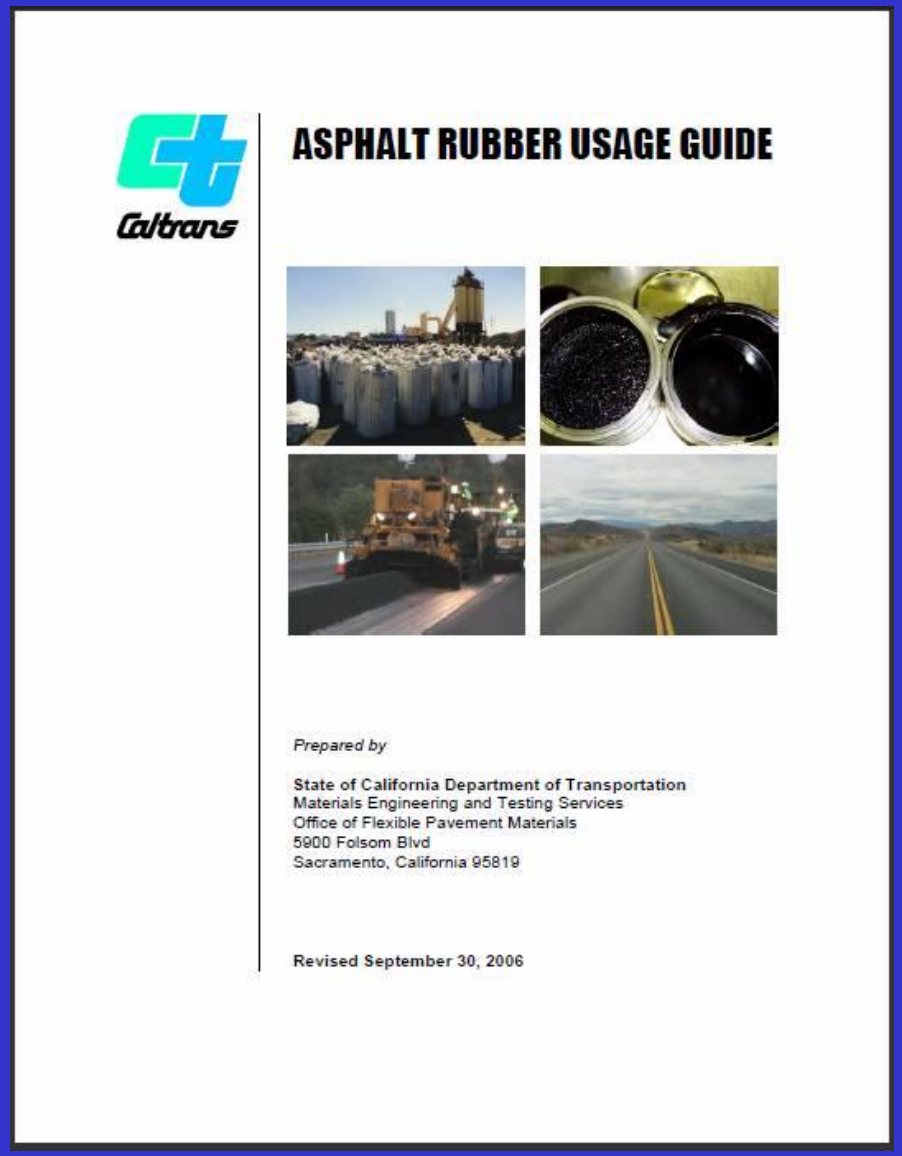
Rubberized Asphalt Forensics, Trouble Shooting, Lessons Learned

RAC is a great material

- But it has its limitations:
  - It needs to be HOT
  - Handwork should be minimized
- So - be careful in areas that are difficult to pave:
  - Roundabouts
  - Turn pockets
  - Approaches
  - Parking areas – power steering tears

Guidance

- Caltrans Guide
- CalRecycle Technical Assistance



Caltrans

ASPHALT RUBBER USAGE GUIDE

Prepared by

State of California Department of Transportation
Materials Engineering and Testing Services
Office of Flexible Pavement Materials
5900 Folsom Blvd
Sacramento, California 95819

Revised September 30, 2006

Longitudinal Joints

Transverse Joints, Turn Pockets

Tracking

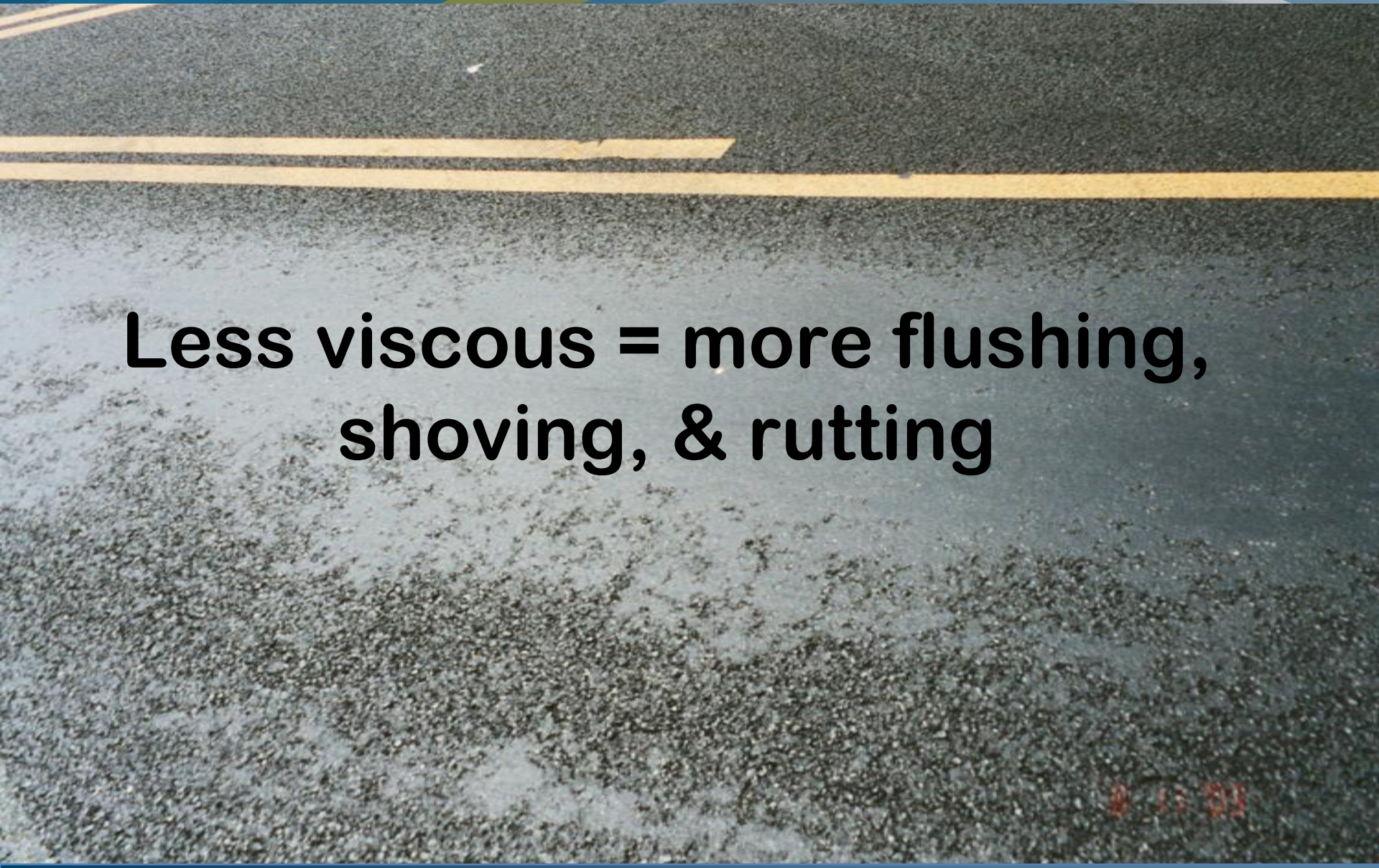
Materials

- Rubberized asphalt
- Terminal blends
- Asphalt-Rubber

Viscosity is what defines Asphalt-Rubber Binder

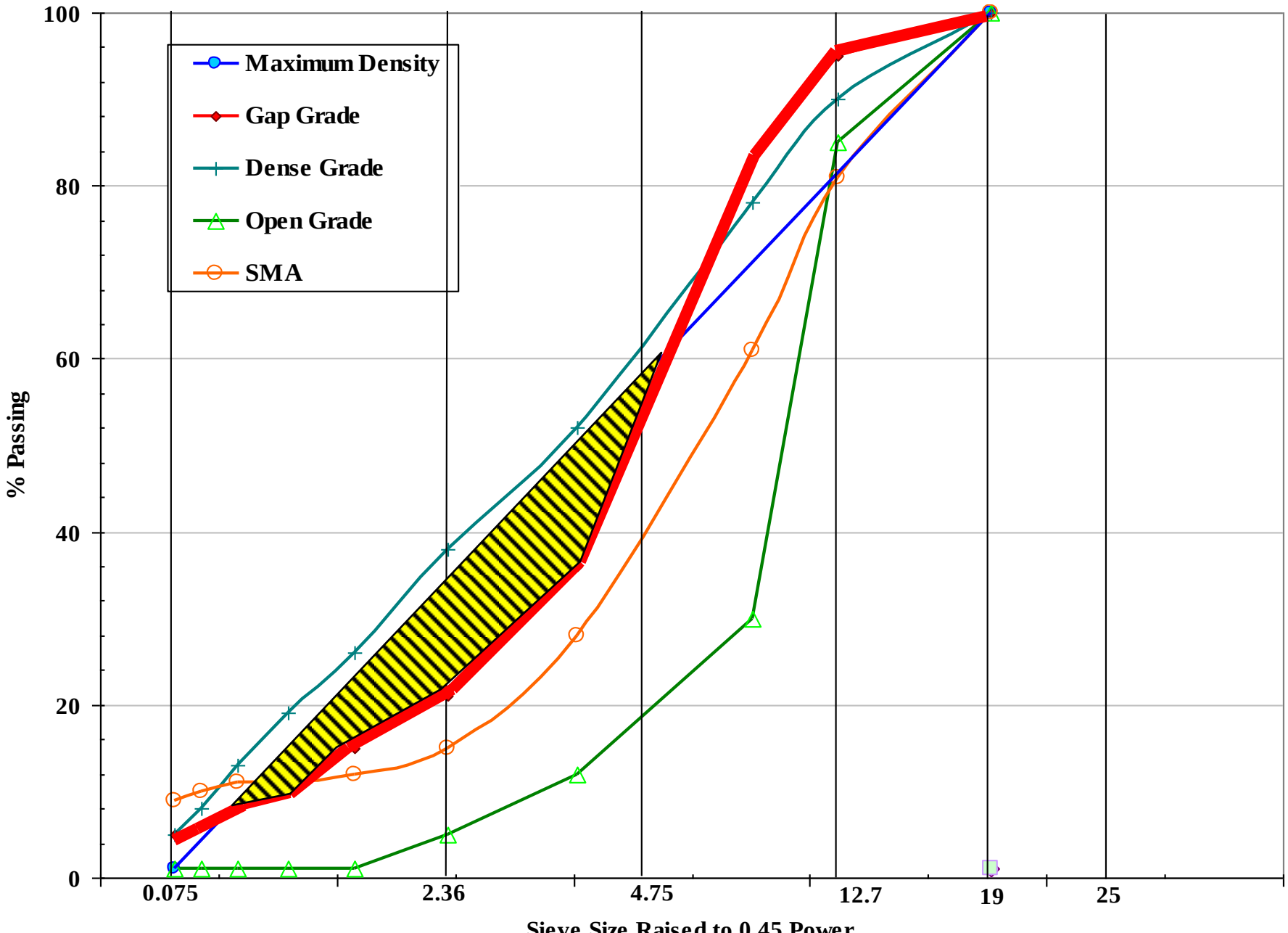
Asphalt-Rubber
1,500 to 2,500 Centipoises At 375°
Extremely Viscous

Rubberized Asphalt Terminal Blend
300 to 600 Centipoises At 325°
Significantly Less Viscous Than AR



Less viscous = more flushing, shoving, & rutting

Composite Power 45 Chart



The Box Test

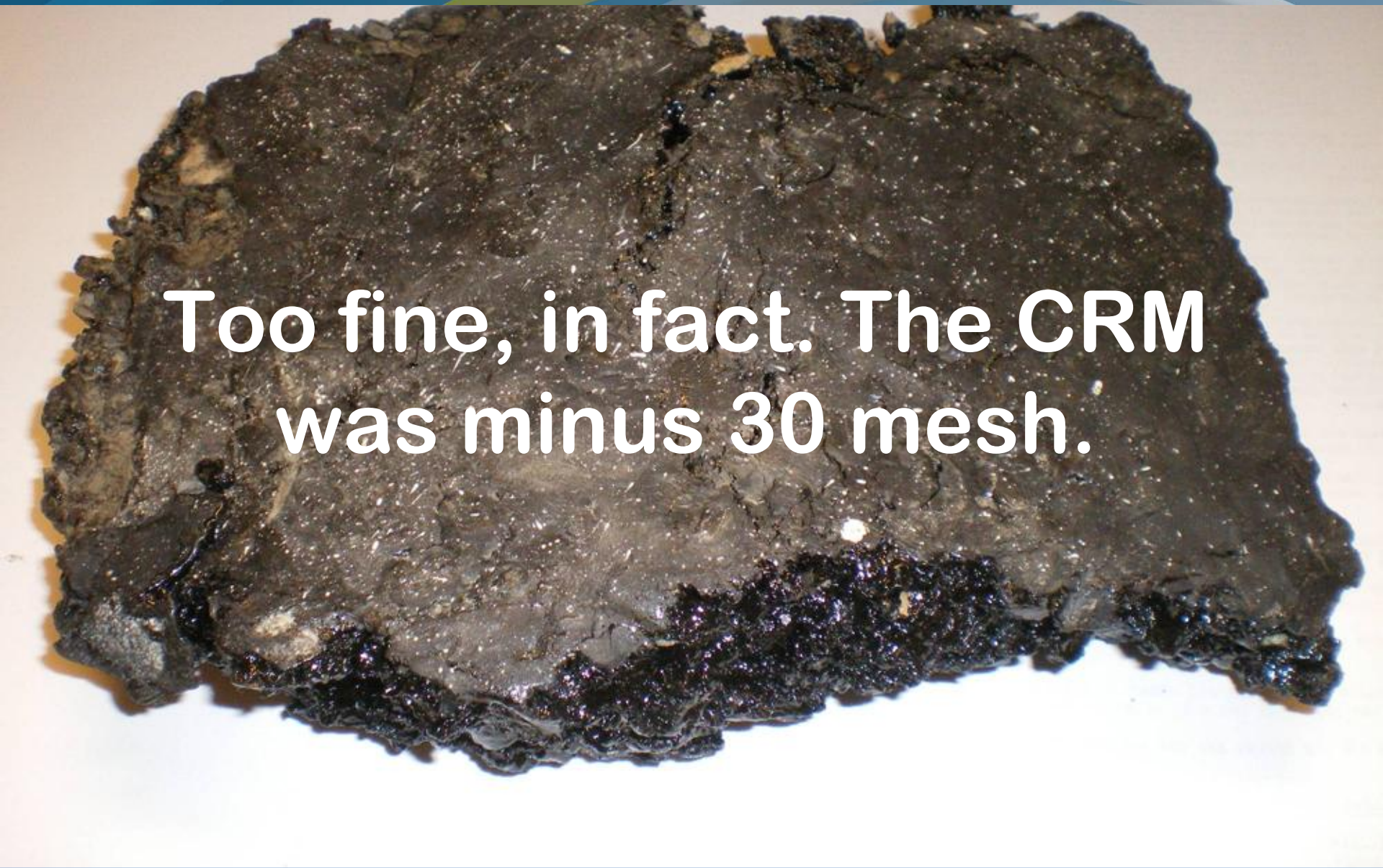
Or the Comb Test

Better Yet…

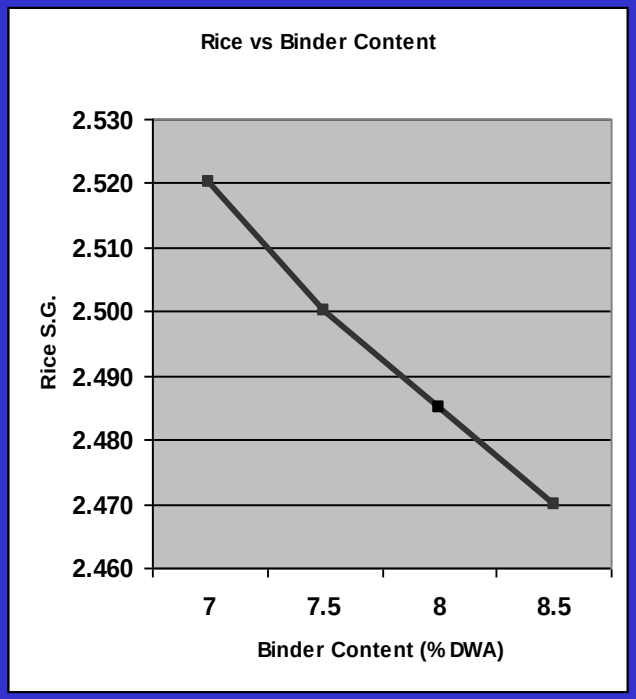
- Read the specs
- Understand the material
- Review the submittals
- Pay attention to details

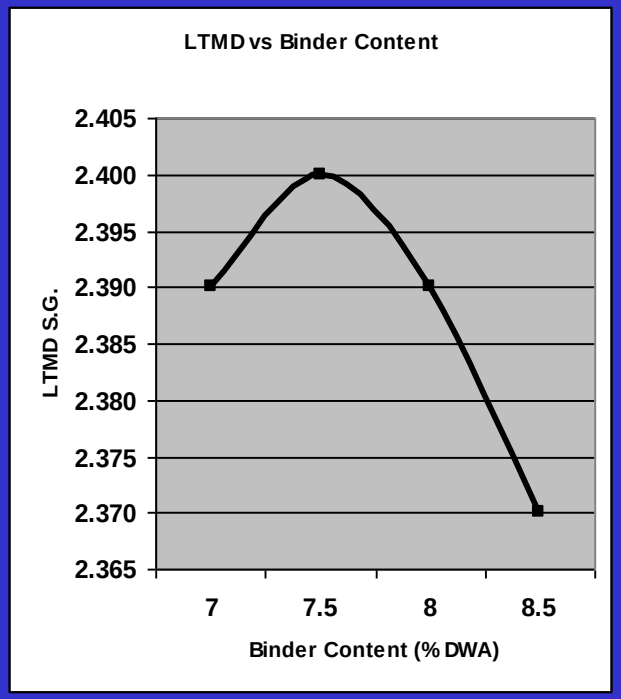
And I do mean details.

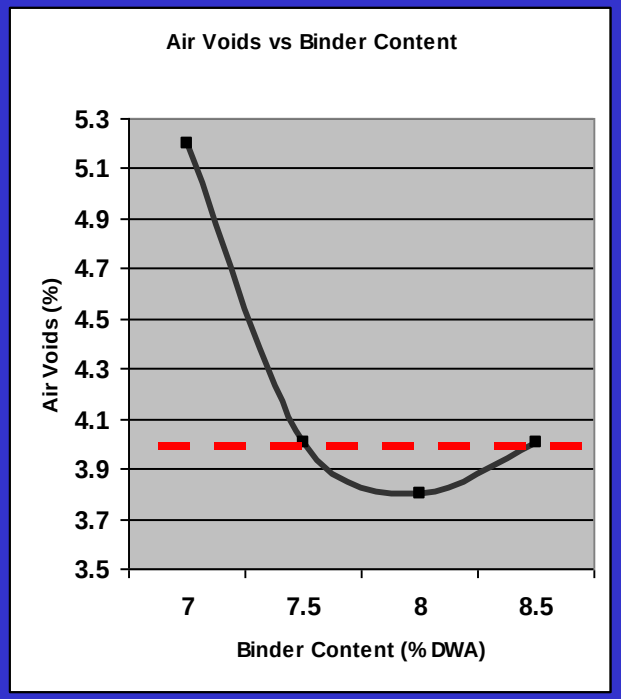
On this project, everything was fine.


Too fine, in fact. The CRM was minus 30 mesh.

Mix Design



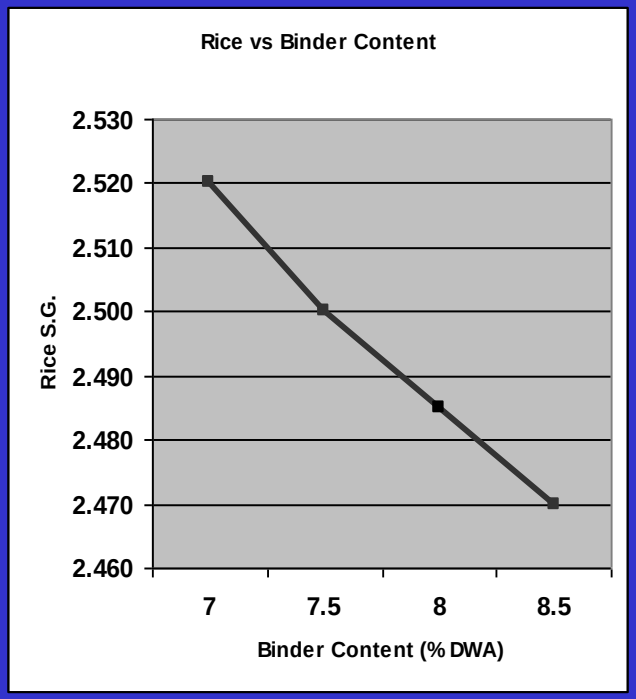


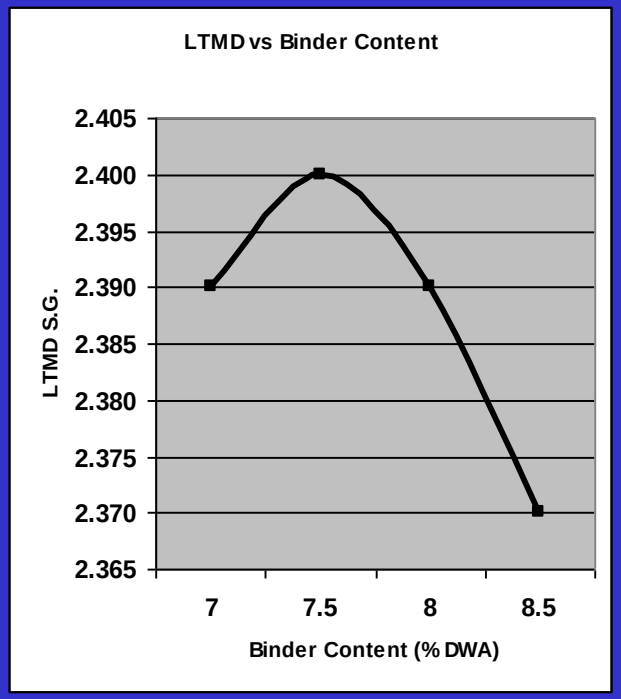


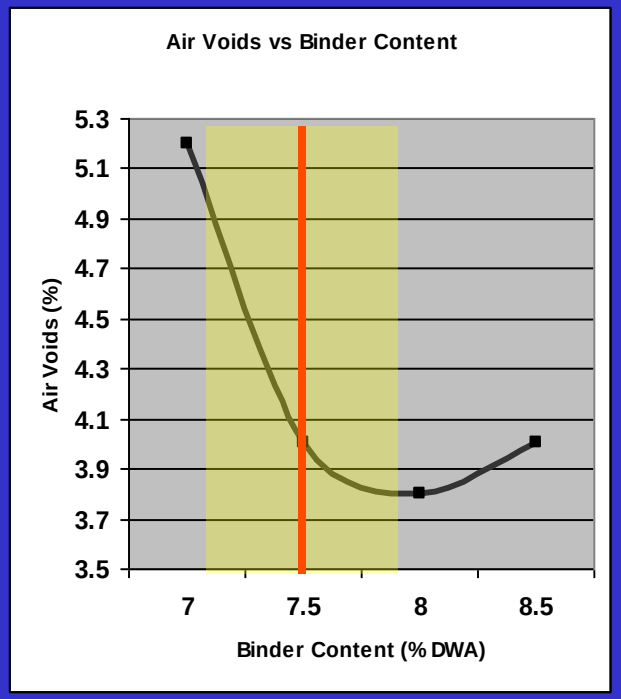
Rice **LTMD** **Voids**

4% at 7.5, 8, and 8.5 % binder

Mix Design



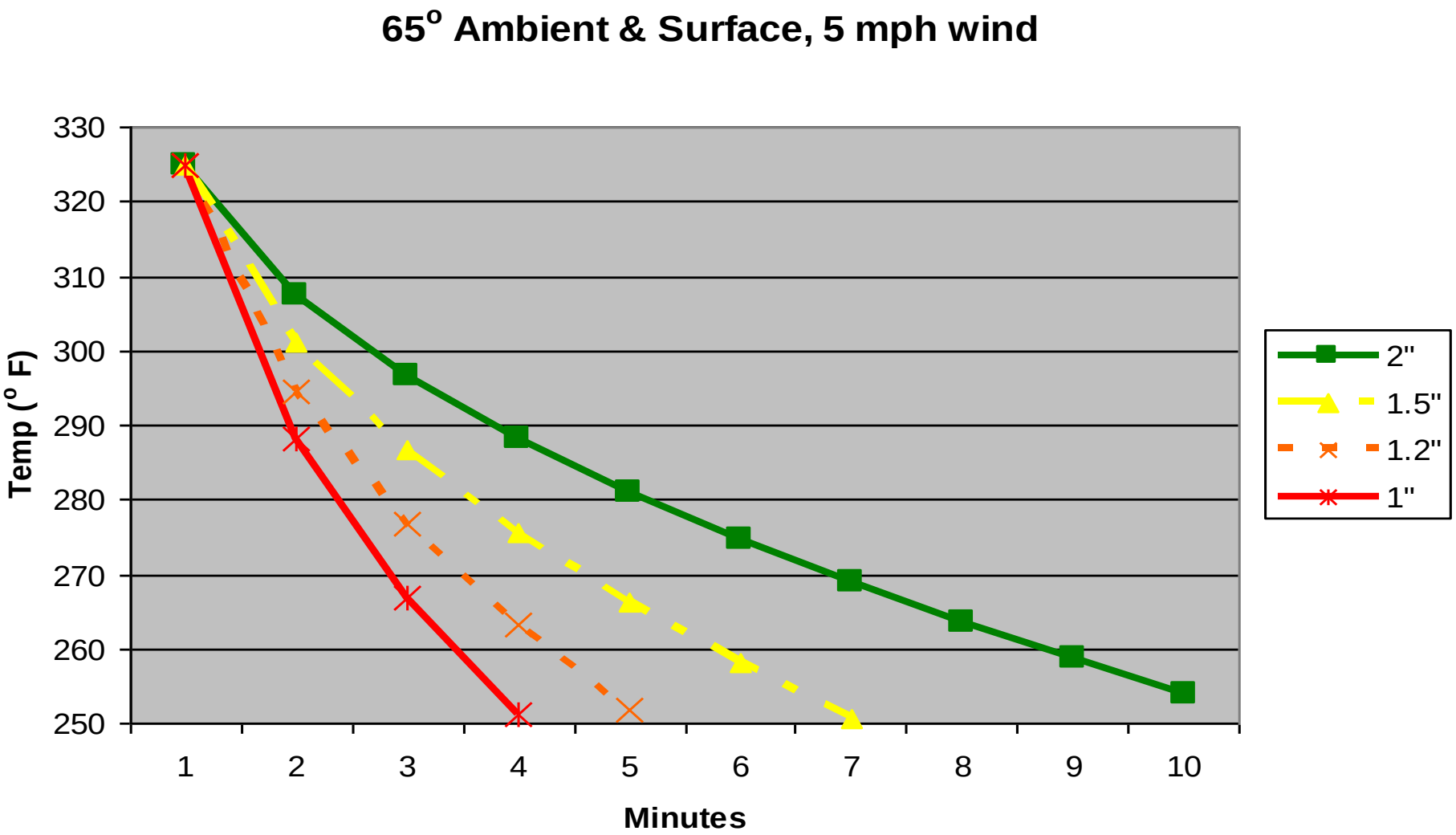




Rice **LTMD** **Voids**

Consider operational tolerance in OBC – what happens to the properties?

Time Available to Compact (TAC)


65° Ambient & Surface, 5 mph wind
Temp (° F)
330
320
310
300
290
280
270
260
250
1
2
3
4
5
6
7
8
9
10
Minutes
2"
1.5"
1.2"
1"

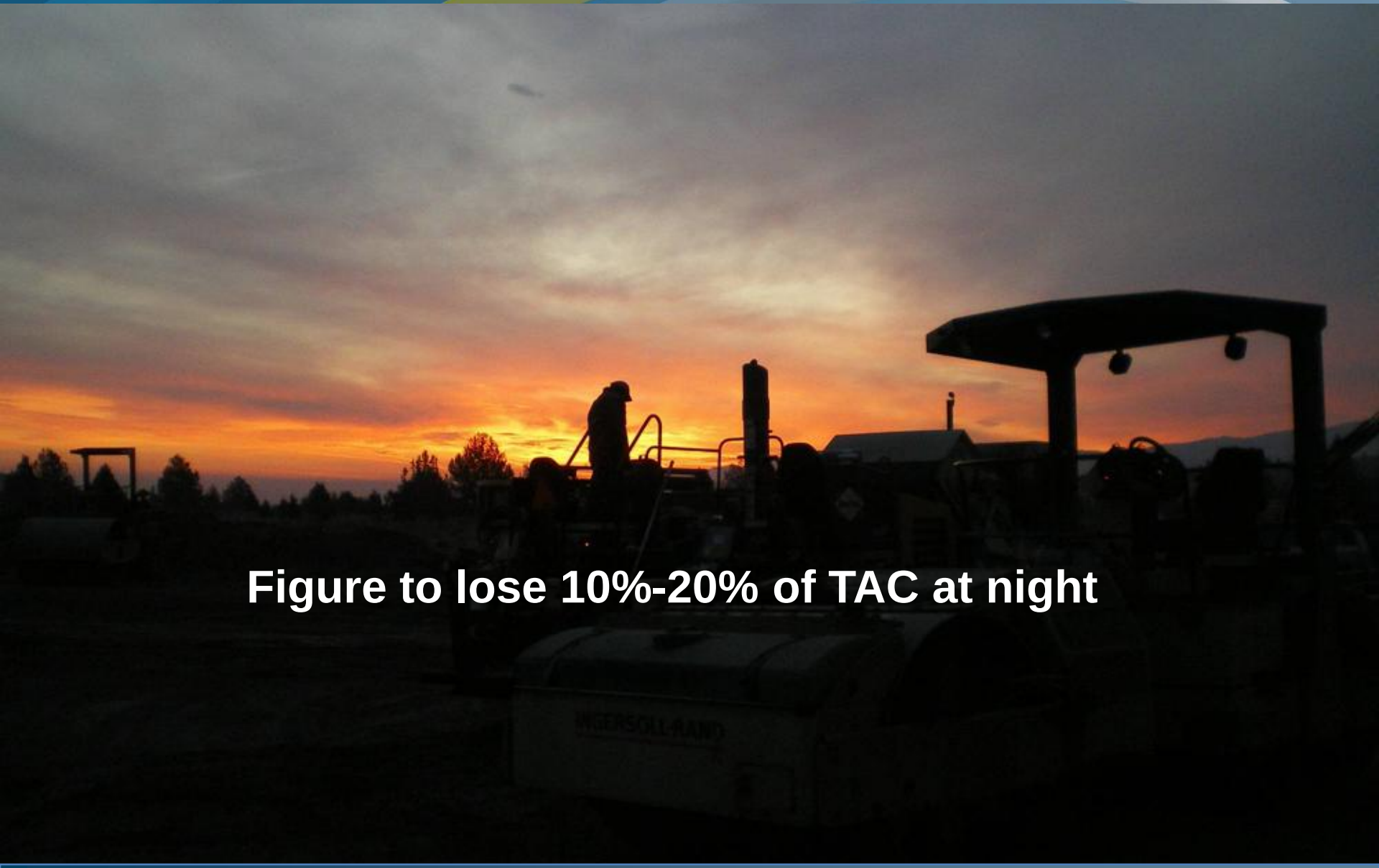
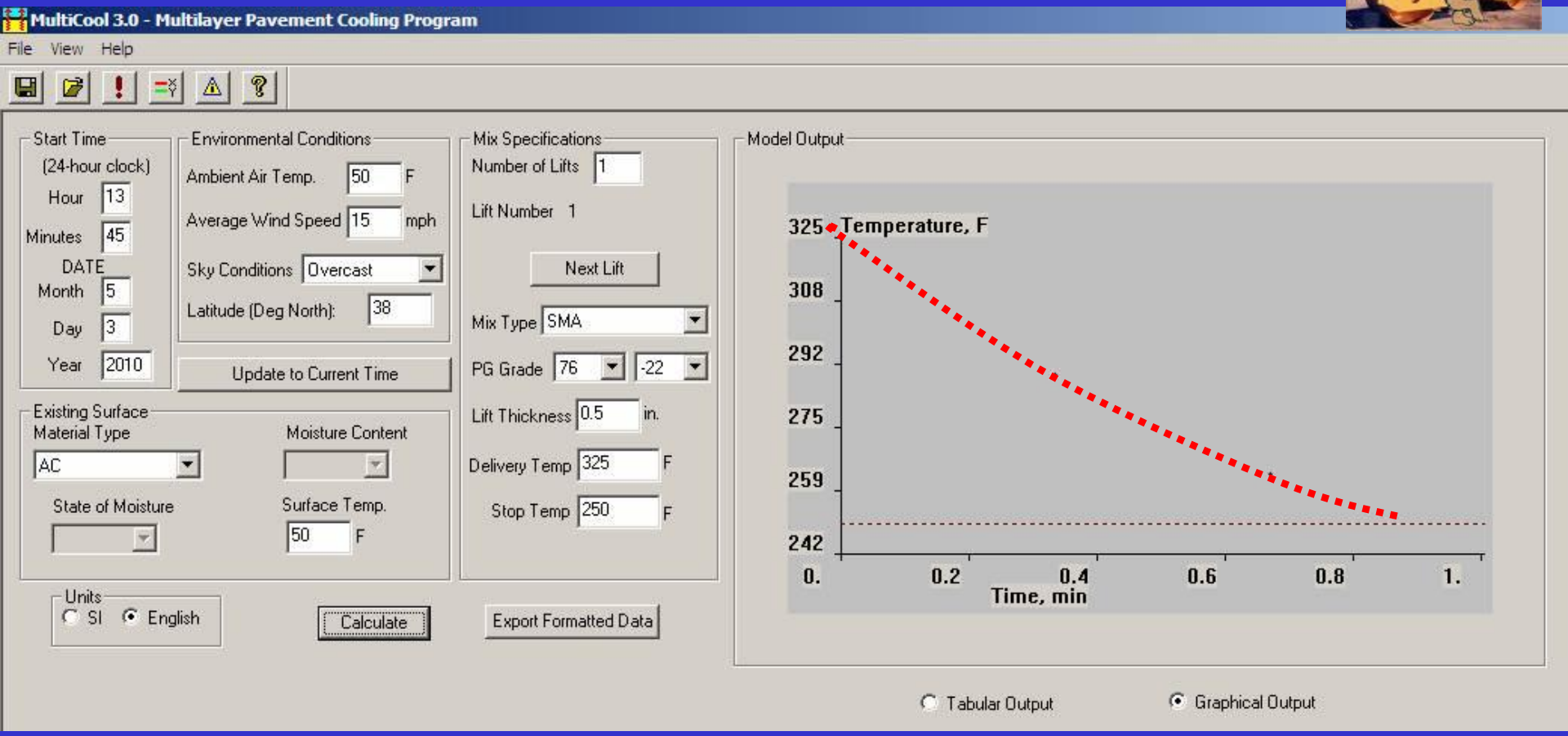


Figure to lose 10%-20% of TAC at night

Multicool

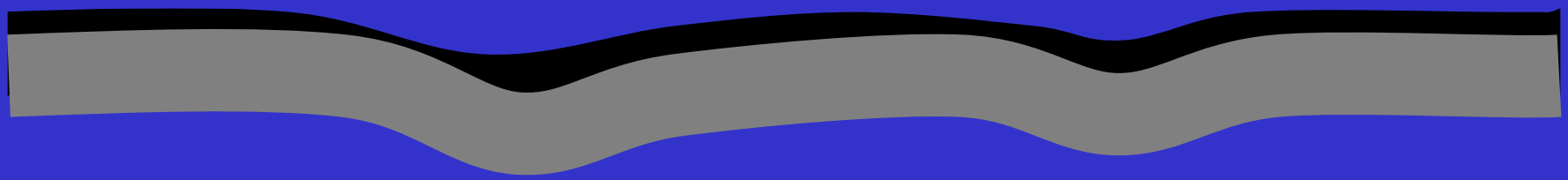


50º, 15 mph wind, ½" – less than a minute

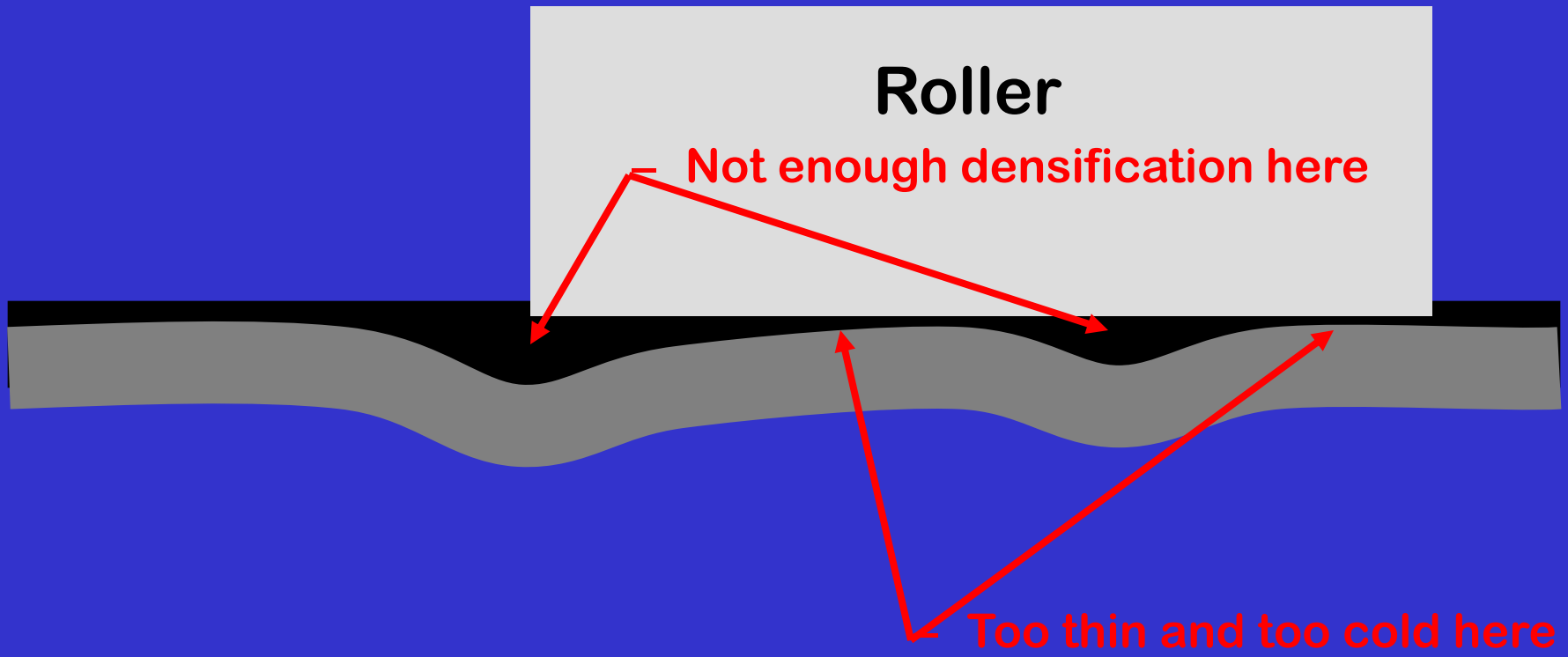
½” Thick? No Way!

- 1.5” AVERAGE thickness
- No pre-leveling
- No advance profile grinding
- Ride quality requirements

But it’s not just cooling



But it's not just cooling



Leveling Course or Profile Coldmilling

Uniform Adequate Lift Thickness

Crack Seal

Crack Seal

Measure what you can

- Binder content
- Gradation
- LTMD
- Rice
- Stability
- Density

Testing Gets Attention

and Quantifies Results

Avoid method specs as much as possible

Think "Optimum Binder Content" – not minimum

Performance / Durability

- Use RAC in proper applications
- Think about minimum thickness, not average
  - Pre-level
  - Profile coldmilling

Performance / Durability

- Pay attention to details
  - Materials
  - Mixture properties
  - Workmanship
- Design mixes to perform, not just to meet minimum requirements
- Avoid method specifications – test for acceptance

Do not assume the material understands your desire to finish the project or how you would like it to perform. It will perform based on how it is designed, produced, and placed.