



Reflective White Roof Coatings with Asphaltic Bleed Resistant Technology

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Agenda

1. EPS as a company
2. Roof Coating and Cool Roofs
3. Asphalt Roofs and tobacco juicing
4. New acrylic polymer
5. Benchmark study
6. Basecoat study
7. Conclusion

EPS Global Operations



Europe HQ, Ambacht NL



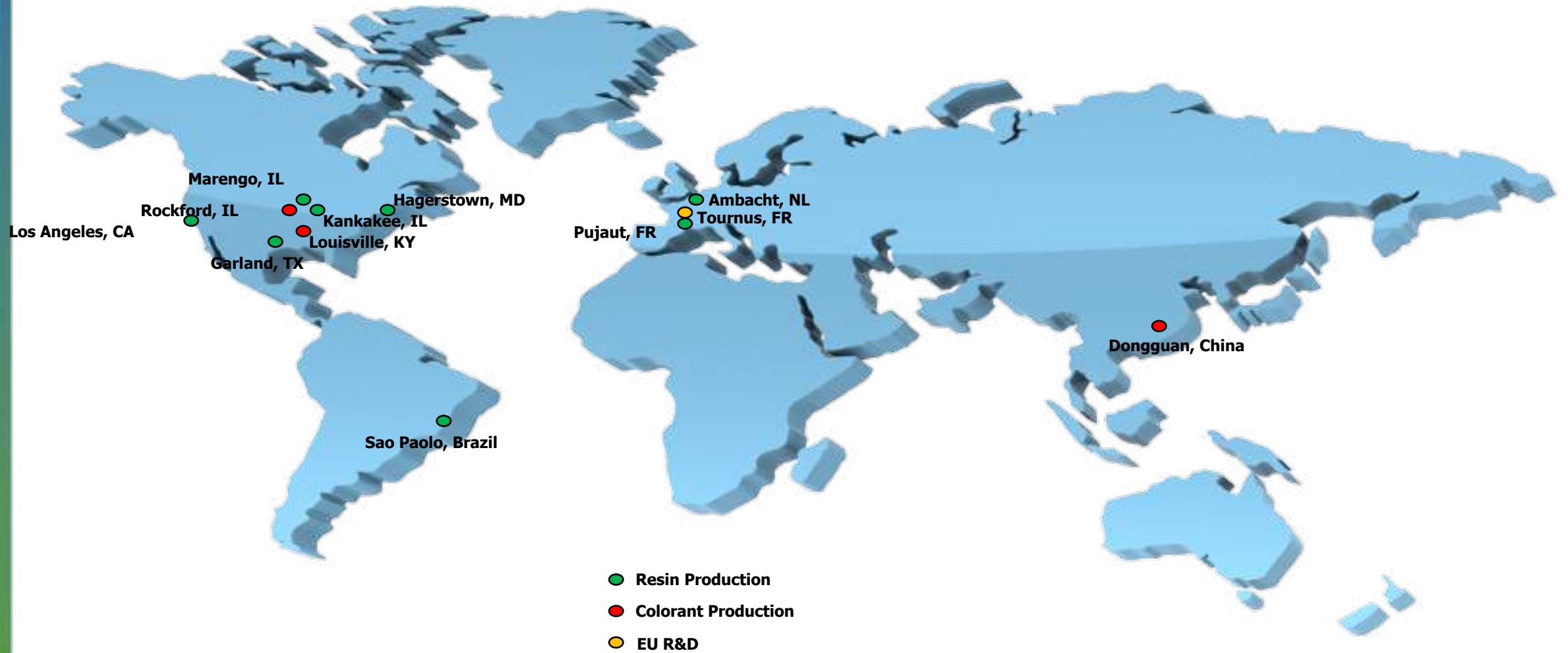
Supplier of premium polymer solutions & colorants to the architectural, industrial, construction and adhesives and sealants markets

Global footprint with 10 manufacturing and 3 R&D locations world wide

220,000 tonnes annual resin capacity

40,000 tonnes annual colorant capacity

EPS Global Operations



What is a Roof Coating

- RCMA (Roof Coatings Manufacturers Association)
 - Roof Coating: A fluid-applied adhered coating used for roof maintenance, roof repair, or as a component of a roof covering system or roof assembly
- NRCA (National Roofing Contractor Association)
 - A roof coating is a film applied to a roof surface to provide weather protection to an original roof surface
- Cool Roof Coatings
 - A roof coating that has been designed to reflect more sunlight and absorb less heat than a standard roof — www.energy.gov

Cool Roofs in Europe

- EU project from 2008 to 2011 – Cool Roofs

(<https://ec.europa.eu/energy/intelligent/projects/en/projects/cool-roofs#results>)

- ECRC (European Cool Roof Council)

A Cool Roof is a roofing system able to reject solar heat and keep roof surfaces cooler under the sun. This is due to the properties of the materials used, which reflect the solar radiation (solar reflectance) and release the heat they have absorbed (infrared emittance). Cool Roofing materials can be applied to most types of roofs including those of homes, apartment blocks, industrial structures, commercial buildings and offices.

(<http://coolroofcouncil.eu/> - Cool Roofs at a Glance.pdf)

Typical Benefits of Cool Roof Coatings

- Protect the roof surface by providing a low-cost, sacrificial layer that absorbs the punishment of the elements
- Extends the life of the roof indefinitely
- Reflective roof coatings reduce surface temperatures
- Greater occupant comfort – in occupied buildings without A/C
- Avoids building or occupant disruption and roof replacement
- Save money
 - Repair and /or coat vs tear off and replace
 - Federal and local tax deductions
 - Less A/C required for cooling
 - Peak Energy Use Reduction (see appendix A)

Types of Low Slope Roofing

- Metal and Concrete
- Sprayed Polyurethane Foam (SPF) – Provides insulation and protection. Requires a coating to protect the foam.
- Single Ply Membranes – Solid sheets that are self-adhered or heat weldable. Typical materials are PVC, CSPE, CPE, TPO and EPDM. Used on flat roof where water ponding is prevalent and in new construction
- Asphalt Roofs
 - Modified Bitumen (Mod Bit) – Bitumen modified with either APP or SBS, typically reinforced with a fiber mat. Granules for UV protection
 - Built Up Roof (BUR) – Oldest technology. Service life cycles of +50 years. Typically 4 layers of tar paper or fiberglass mat impregnated with asphalt.
 - Light oils in the asphalt will exude and bleed through coatings (“tobacco juicing”)

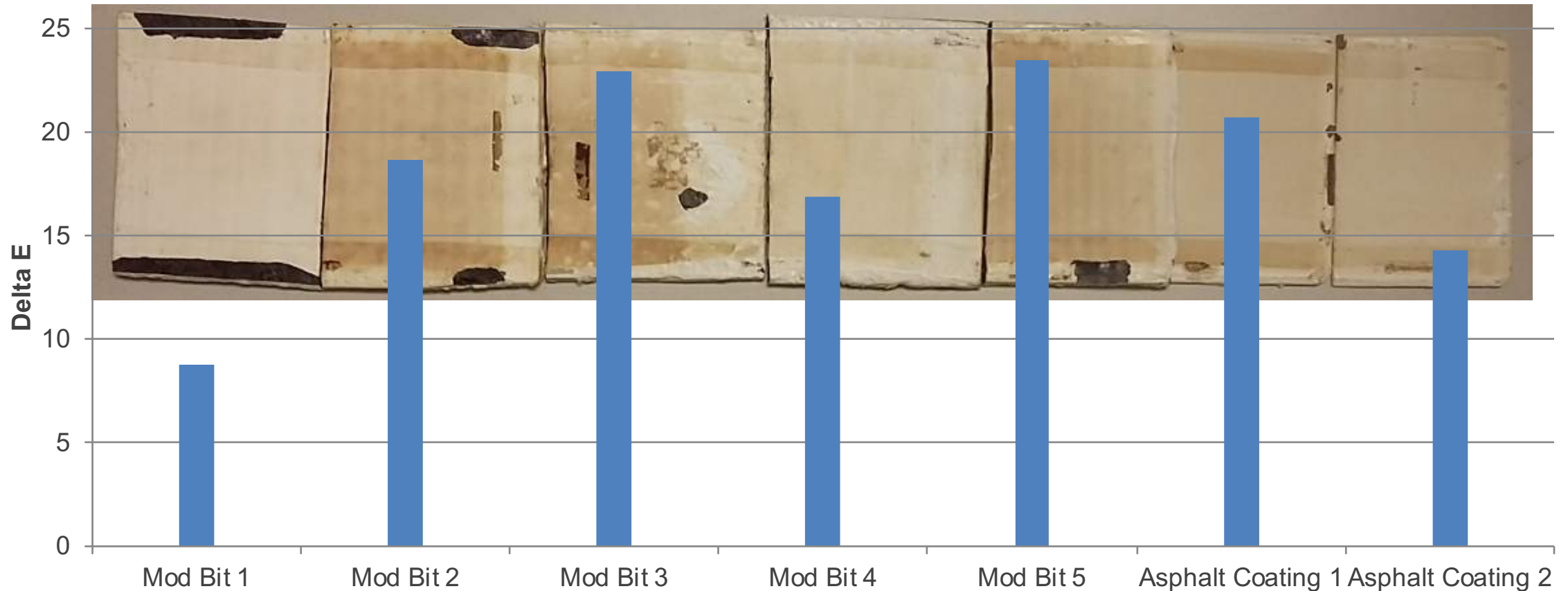
Asphalt Bleed Through on White Roof Coatings

- “Asphalt roofs, such as smooth-surfaced built-up or modified bitumen membranes, and granulated cap sheet contain light oils, called exudate that can leave a membrane soon after its application. This process, called “tobacco juicing” is normal and the exudate will generally wash off the roof after rainstorms. Any exudate on a roof prior to coating application should be thoroughly cleaned. **Special primers designed to resist the exudate from bleeding through to the fresh coating may be required prior to the application of light colored elastomeric coatings.**”
 - RCMA Tech Note 2: *Use of Primers Prior to Roof Coating*

Tobacco Juicing in Commercial Acrylic Roof Coatings

Purpose:	Understand the extent of tobacco juicing in commercial acrylic roof coatings applied over different asphalt based roofing materials
Materials:	• Modified bitumen roll roofing – 5 materials • Commercial asphaltic roof coatings – 2 materials • Commercial acrylic base coat specified for use over asphalt • Premium flexible acrylic top coat
Experiments:	500 hours QUV (ASTM G154) Measure color change (Lab Delta E) , Visual observations
Sample Preparation:	
Substrate:	Modified bitumen roofing or asphalt coatings applied onto aluminum panels
Base Coat:	Apply base coat over all substrates at 20 wet mils using draw down bar Cure 1 days @ 70°F, 50%RH
Top Coat:	Apply commercial top coat by brush at 20 wet mils Cure 1 day @ 70°F, 50%RH

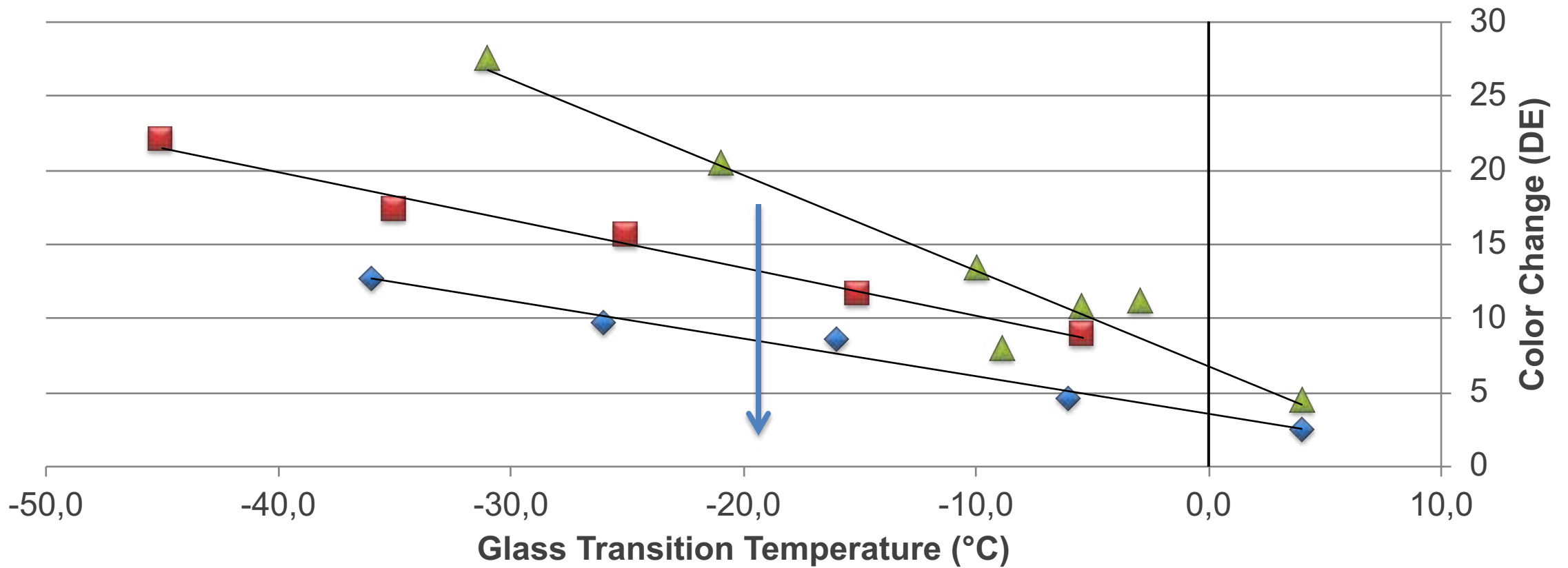
Tobacco Juicing in Commercial Acrylic Roof Coatings - Results



How to Design a Polymer That Resists Bleed Through?

- Bleed through occurs when light oils from asphalt diffuse through coating
- Diffusivity = Solubility x Permeability
 - Reduce the solubility – Not as much oil can dissolve into the the coating
 - Reduce the permeability – The oil that does dissolve can't travel through as fast

Product Development



2719 SR1 and ASTM D6083

	6083 spec	EPS 2719 SR1
Viscosity	85-141 KU or 12-85 Pa-s	Pass
Volume Solids	>50 %	Pass
Weight Solids	>60%	Pass
Initial Elongation (%)	>100%	Pass
Initial Tensile (psi)	>200 psi	Pass
Final Elongation (%)	>100%	Pass
Permeance (perms)	<50 perms	Pass
Water Swelling (%)	<20%	Pass
Accelerated Weathering	No cracking or checking	Pass
Wet Adhesion to SBS mod bit	2 pli	Pass
Fungi Resistance	Zero rating	Pass
Tear Resistance (Lb_f/in)	60 lbf/in	Pass
Low Temperature Flexibility single coat of 2719 w/ flexible top coat	-26°C Pass	Pass

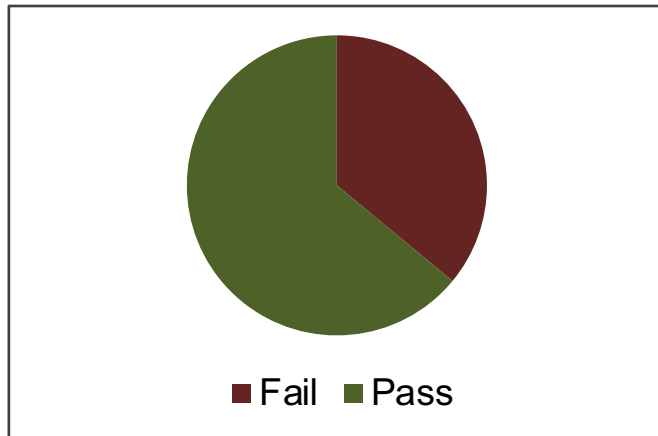
- Check appendix B



Benchmarking – Design

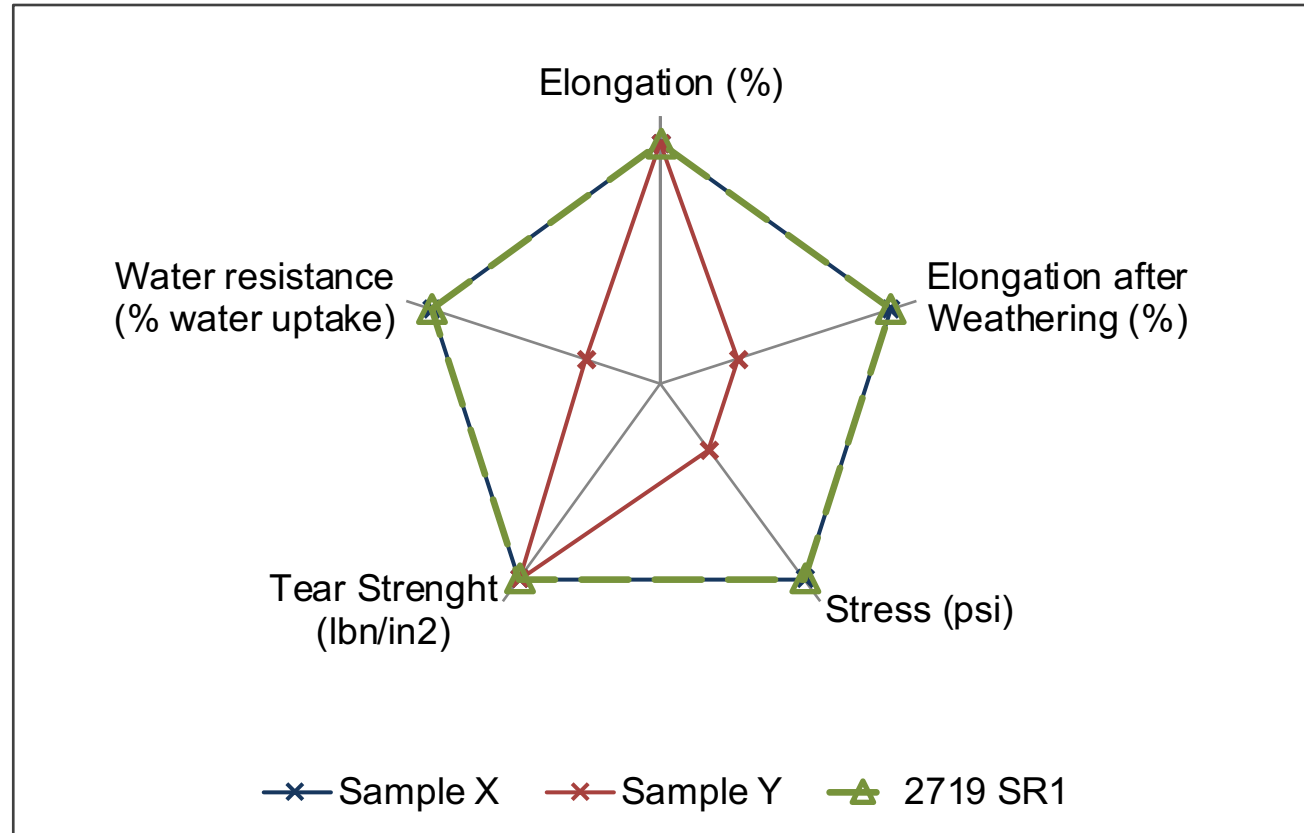
- 14 Commercial Products
- Test properties in ASTM D 6083
- Test dirt pick up resistance
- Test ability to block bleed through

Benchmarking – recap



Pass "X" - can be either 1, 3,
4, 6, 7, 10, 11, 13, 14

Fail "Y" – can be either 2, 5,
8, 9, 12



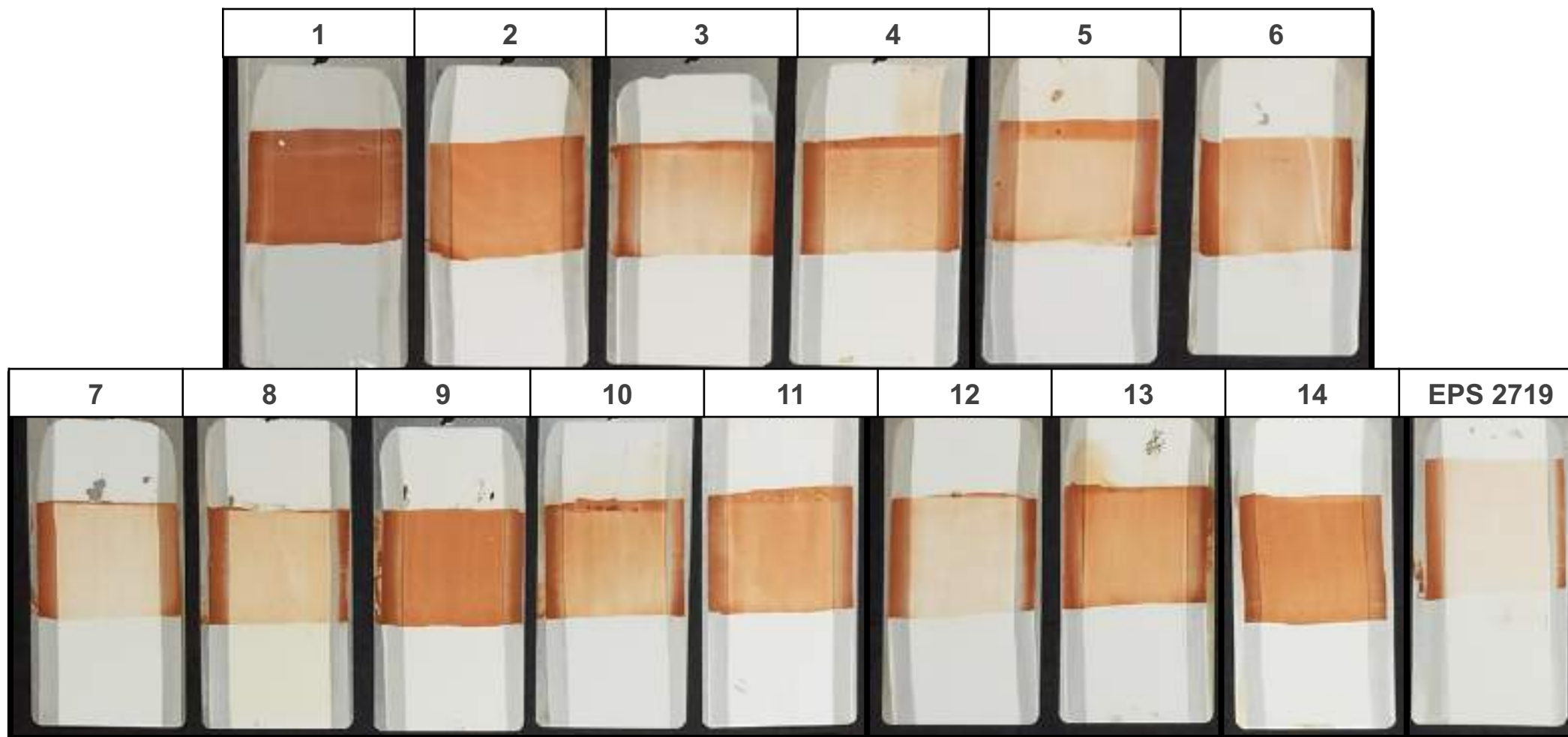
- Check appendix C

Dirt Pick-Up Resistance

- Draw down on Aluminum
- 24 hour ambient cure
- 7 days in QUV
- Red iron oxide slurry applied
- 4 hour wait
- Rinse
- Measure Delta E

- Check appendix D

Dirt Pick Up Resistance

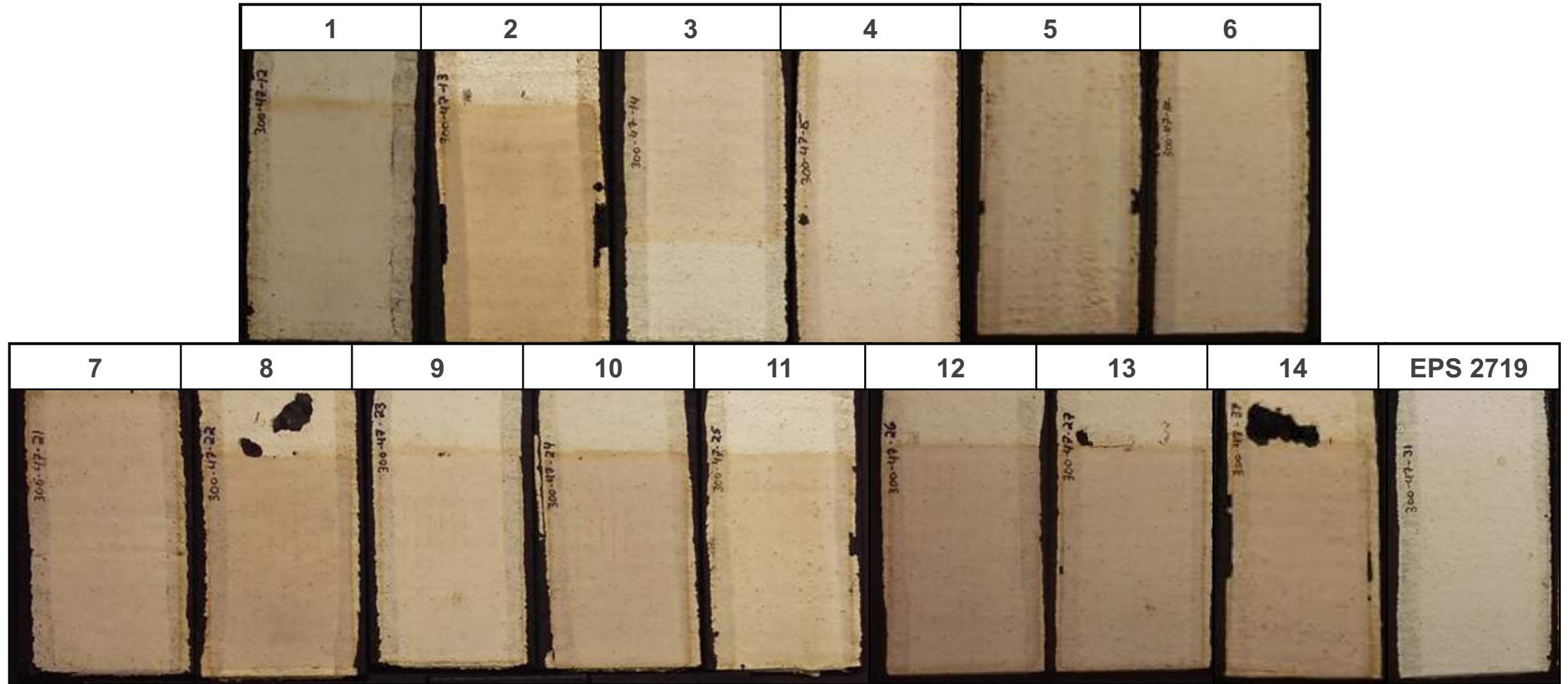


Bleed Through Resistance

- Draw down on APP Modified Bitumen
- 24 hour ambient cure
- 1000 hours QUV exposure
- Measure Delta E

- Check appendix E

Bleed Through Resistance



EPS 2719 as a Bleed Blocker Under Silicone

- Rapid Grown in silicone roof coating market
- Tobacco juicing a big problem over asphalt
- Repair = remove and do it right
- Current solution: 2K epoxies



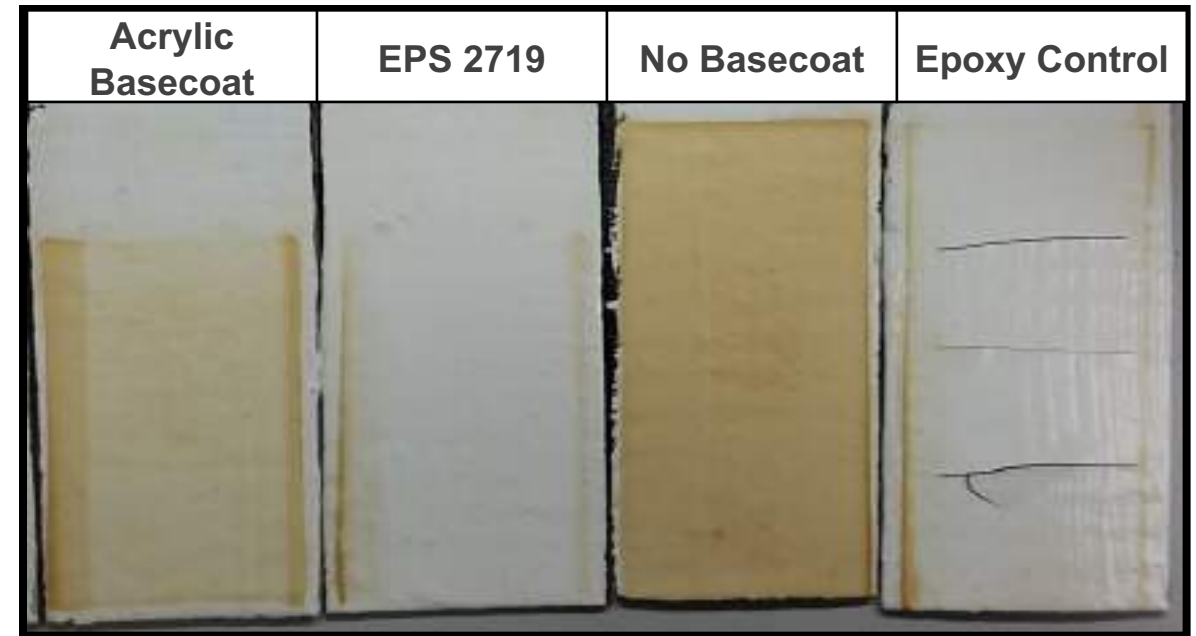
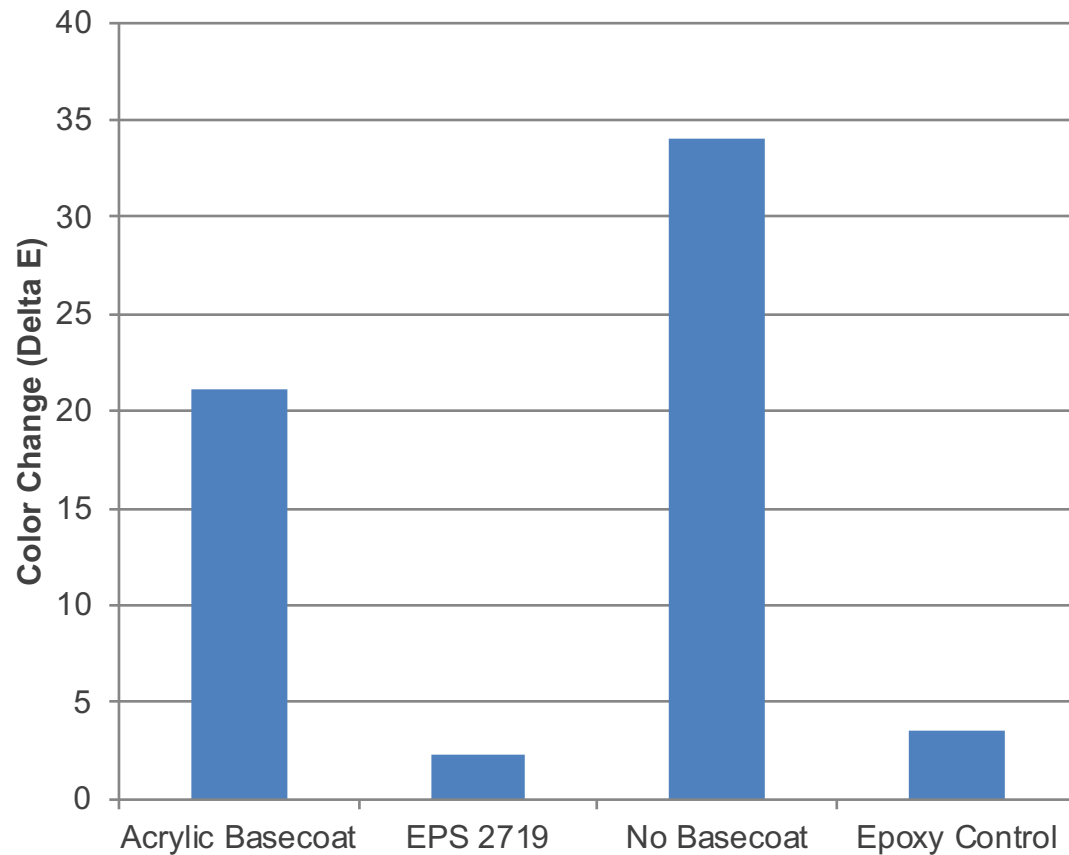
Experimental Details

Purpose:	Purpose: Evaluate the bleed block performance of EPS 2719 under Silicone
Materials:	Base coats: Commercial acrylic base coat, 2719 SR1, 2K Epoxy Top Coat: Silicone
Experiments:	500 hours QUV (ASTM G154)

Sample Preparation:

Substrate:	3"x6" panels of smooth APP mod bit cap sheet
Base Coats:	Apply base coats at 20 mil wet film thickness w/draw down bar Cure overnight @ 70°F, 50%RH
Top Coat:	Apply silicone by brush at 1.5 gal/sq (24 wet mils) Cure 3 days @ 70°F, 50%RH

EPS 2719 as a Bleed Blocking Basecoat Under Silicone



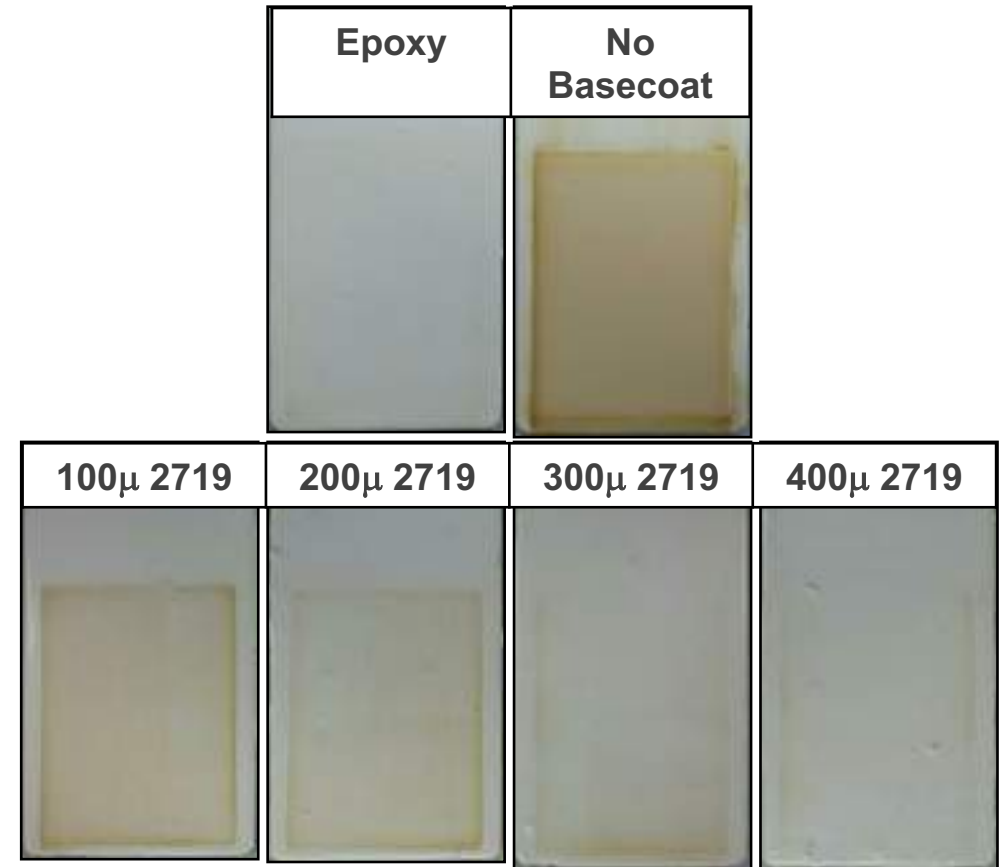
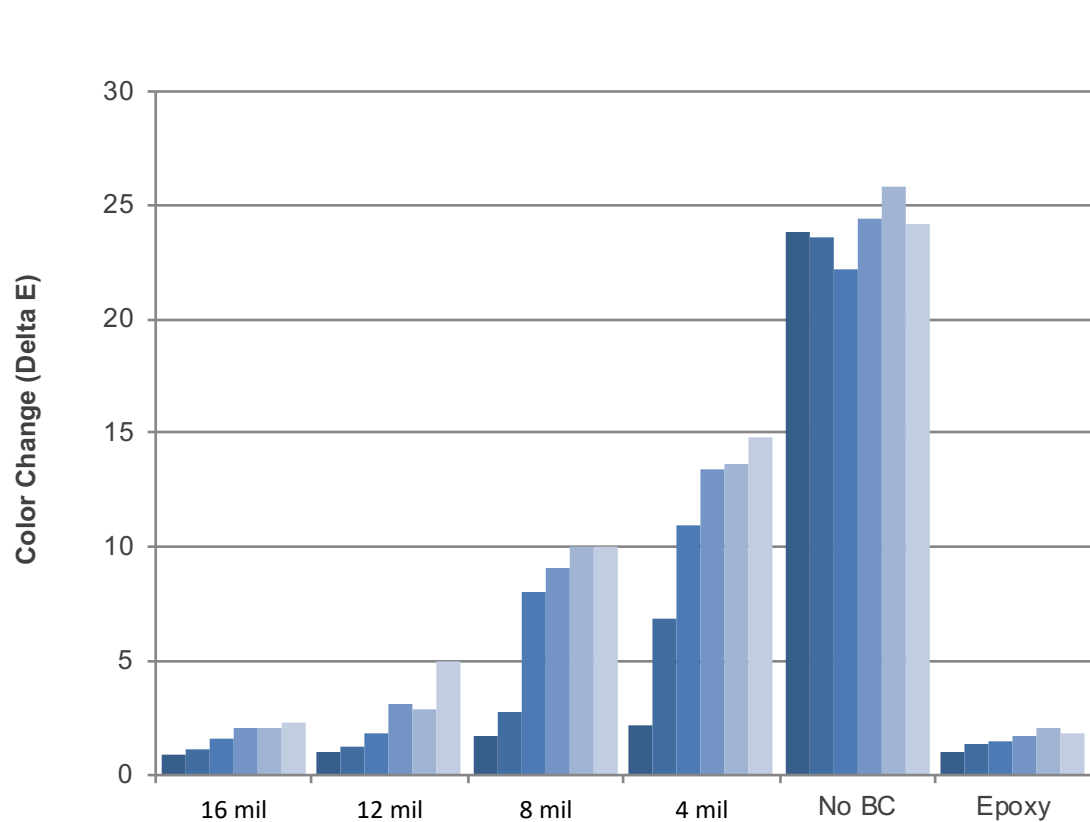
Experimental Details

Purpose:	Measure the effect of base coat thickness on asphalt bleed-through under silicone roof coatings
Materials:	Asphalt Emulsion, 2719 SR1 Base Coat, Epoxy, Silicone Top Coat
Experiments:	1000 hours QUV (ASTM G154) with weekly color measurements

Sample Preparation:

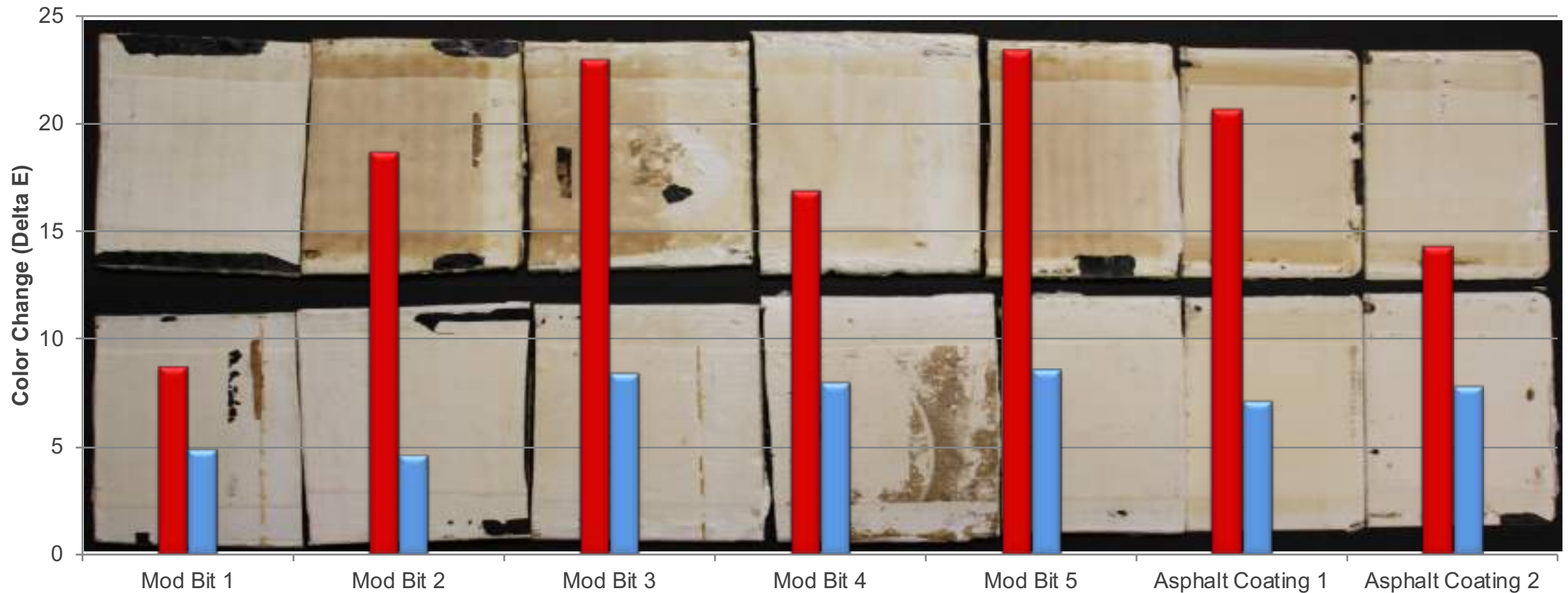
Substrate:	3"x6" Aluminum Q panel
Asphalt Base:	Apply 2 coats of asphalt at 2 gal/sq 4 hours apart. Cure 3 days @ 70°F, 50%RH
Base Coat:	Apply 2719 SR1 at 2, 1.5, 1, and 0.5 gal/sq = 32,24,16,8 wet mils Apply epoxy at 0.5 gal/sq = 8 wet mils Cure 3 days @ 70°F, 50%RH
Top Coat:	Apply silicone at 1.5 gal/sq = 24 wet mil Cure 3 days @ 70°F, 50%RH

EPS 2719 Basecoat under Silicone - Thickness



Tobacco Juicing in Acrylic Roof Coatings

Commercial Technology vs EPS 2719



EPS[®] 2719

- Resistance to bleed-through on asphalt
- Dirt pick up resistance
- Multiple substrate adhesion
 - Asphalt, metal, SPF, PVC, Concrete, other
- Balance of strength and elongation
- Base coat or top coat
- Free of APE surfactants, formaldehyde and Prop 65 components
- ASTM D6083 compatible

Acknowledgements

R&D formulation work

- ✓ Dr. Brent Crenshaw – EPS (Engineered Polymer Solutions)

Do you have questions? Contact me ...

- ✓ Massimo Longoni – EPS B.V. (Engineered Polymer Solutions)

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Appendix A - Savings from Peak Energy Use Reduction

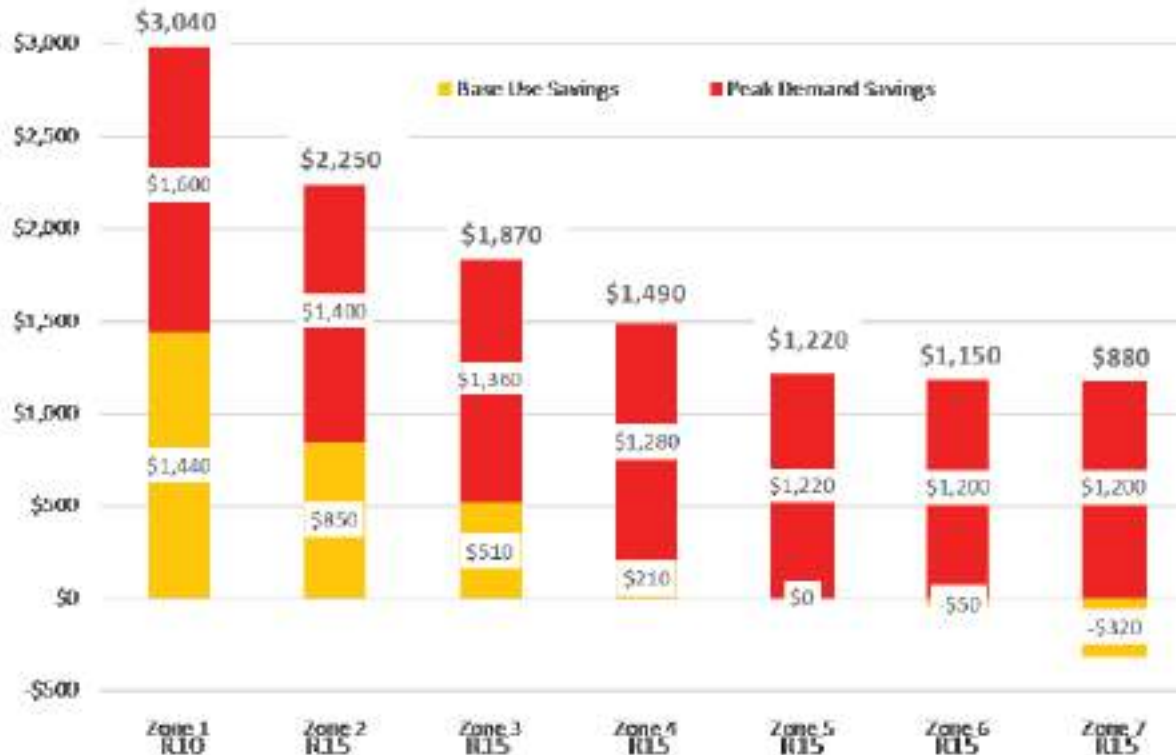


FIGURE 9: ESTIMATED NET ENERGY SAVINGS: REFLECTIVE ROOF INSTALLED OVER EXISTING (OLD) INSULATION*

(Annual Dollars / 20,000 Square Foot Roof Area)

*Old insulation values based on 2006 International Energy Conservation Code (IECC)

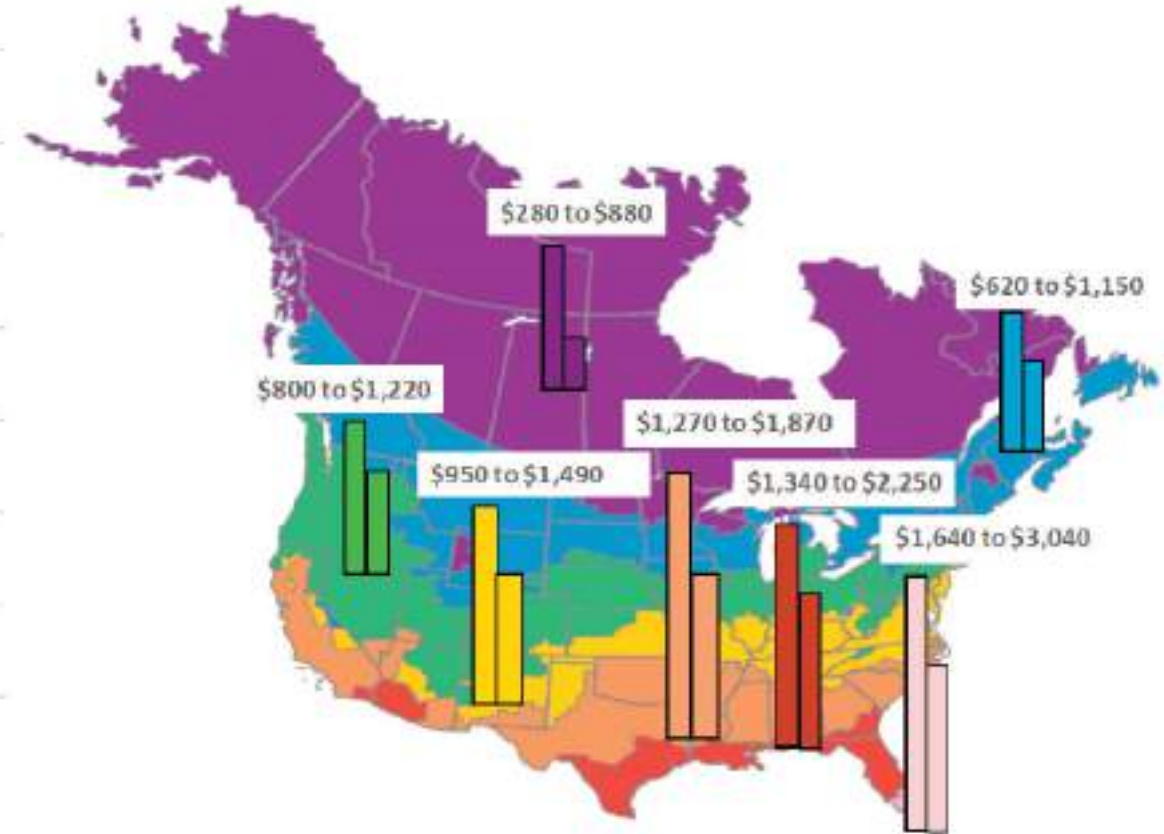


FIGURE 11: ESTIMATED RANGE OF NET ENERGY SAVINGS FOR A REFLECTIVE ROOF BY CLIMATE ZONE
(Annual Dollars / 20,000 Square Foot Roof Area)

Source: Roof Coatings Manufacturers Association, *Cutting Peak Electrical Demand with Reflective Roof Coatings*. Washington, DC, October 2017
<https://www.roofcoatings.org/wp-content/uploads/2017/10/RCMA-White-Paper-Peak-Energy-Demand.pdf>

Appendix B - Roof Coating Needs – ASTM D6083

Property	Test	ASTM	Spec
Toughness	Initial percent elongation	D 2370	100%
Toughness	Initial tensile strength	D 2370	200 psi
Toughness/ UV resistance	Final percent elongation after 1000 h accelerated weathering	D 2370	100%
Water resistance	Water vapor permeance	D 1653	< 50 perms
Water resistance	Water swelling	D 471	< 20%
UV resistance	Accelerate weathering (WOM)	D 4798	No cracking or checking
Adhesion / Water resistance	Wet adhesion	D 903	2 pli
Fungi resistance	Fungi resistance	G 21	Zero rating
Toughness	Tear resistance	D 624	60 lbf/in
Temperature resistance	Low temperature flexibility after 1000 h accelerated weathering	D 522	0.5" mandrel @ - 15°F

Additional Market Needs

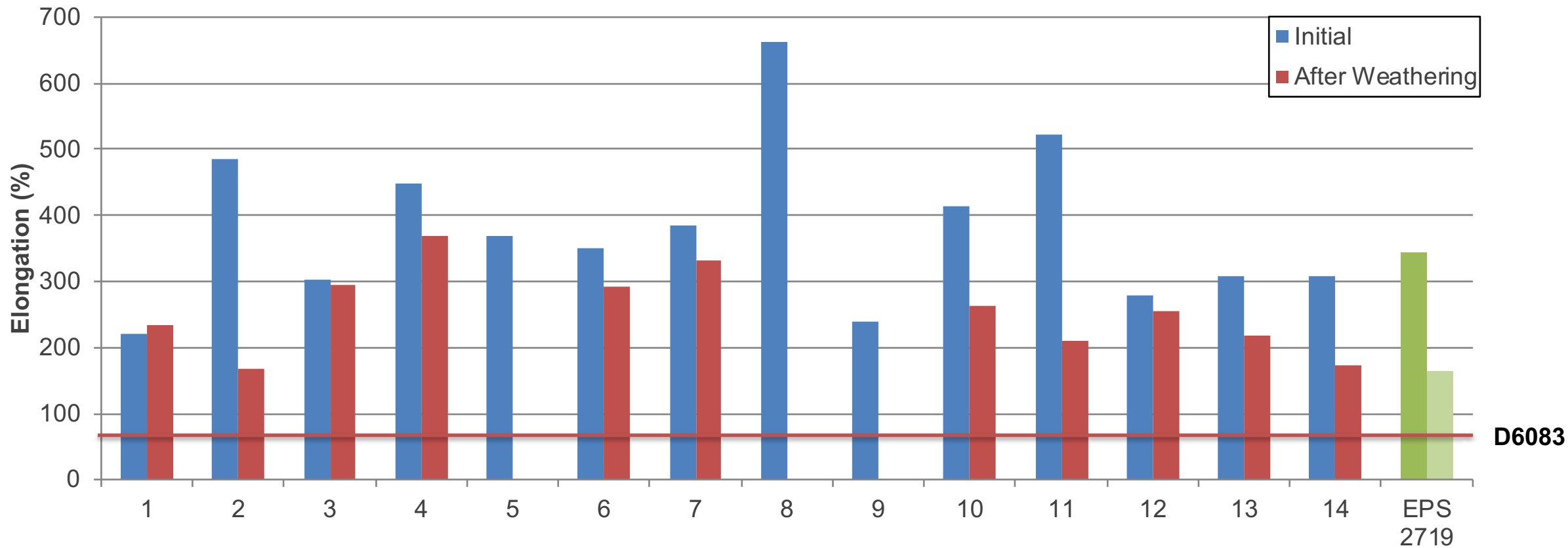
Color fastness	Dirt pick-up resistance	EPS	N/A
Color fastness	Bleed-through resistance	EPS	N/A



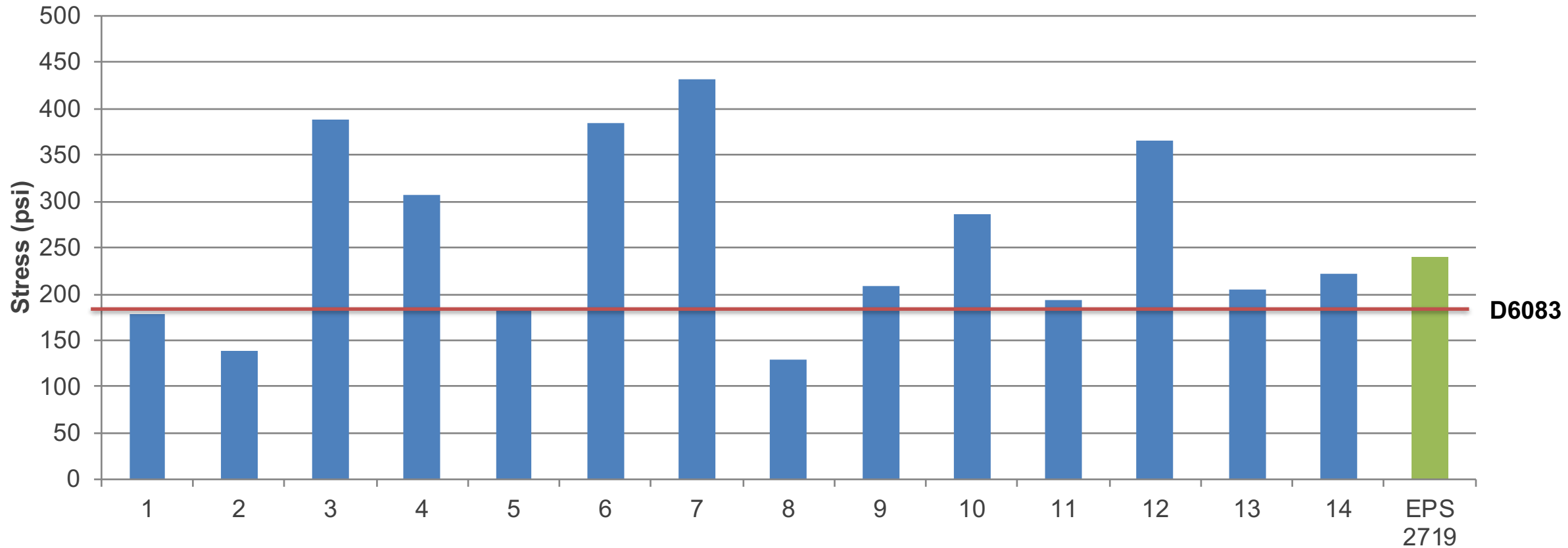
Appendix C - Liquid Properties of Coatings

Sample	Volume Solids %	Viscosity cP	Viscosity after 4 weeks @ 50°C cP
1	51	31,500	29,500
2	54	9,833	23,000
3	52	24,000	25,000
4	52	20,500	23,330
5	50	25,660	22,330
6	50	26,500	26,160
7	50	44,660	47,000
8	67	16,000	17,500
9	58	28,500	62,160
10	60	16,660	22,160
11	51	15,160	19,830
12	54	13,830	24,330
13	50	16,160	21,660
14	50	14,830	19,000
EPS 2719 SR1	51	22,330	21,330

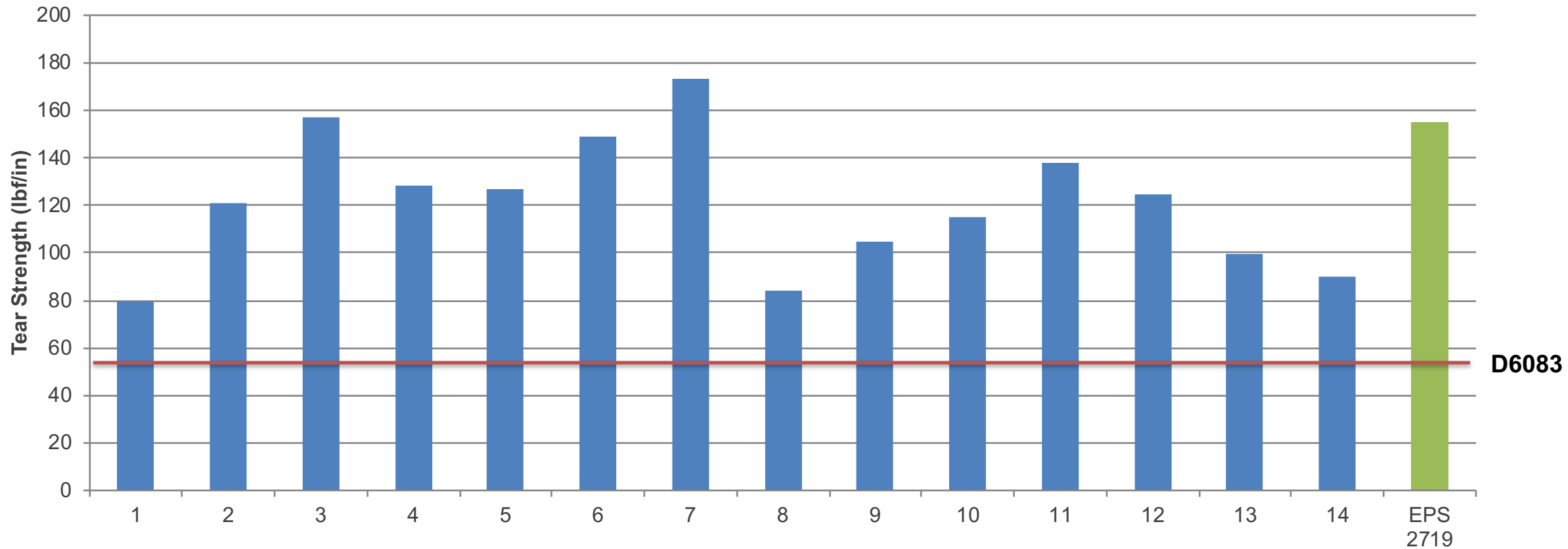
Appendix C - Benchmarking – Elongation Before and After Weathering



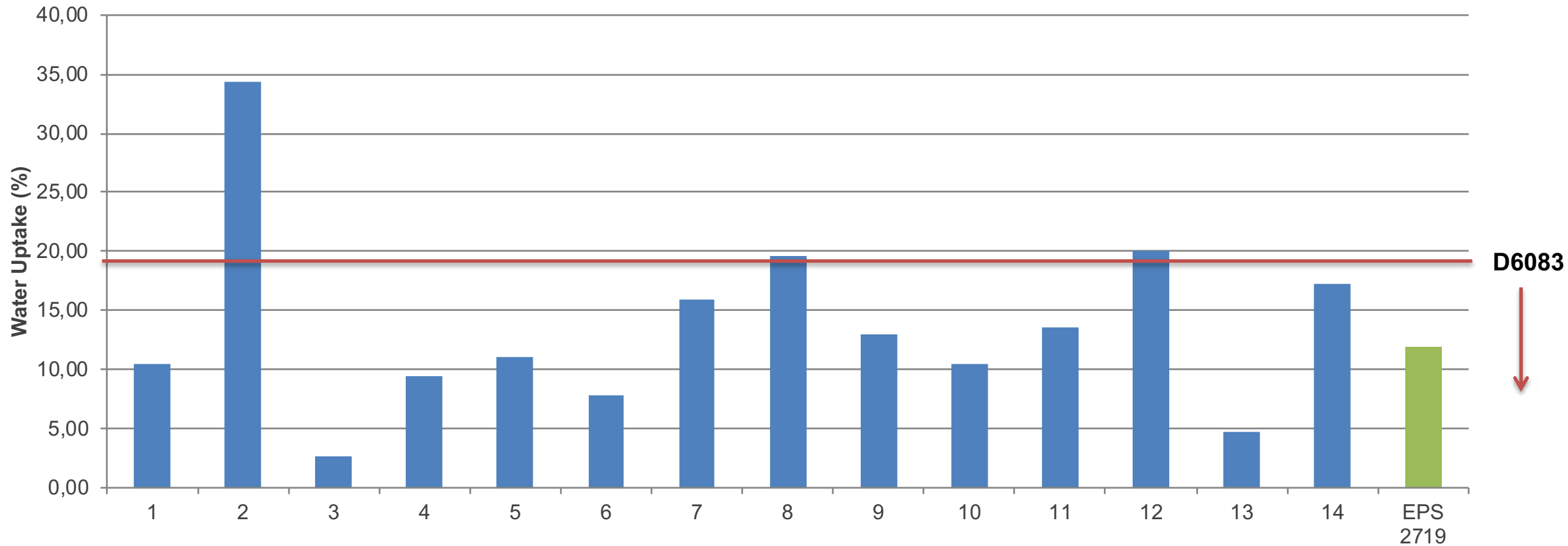
Appendix C - Benchmarking - Stress



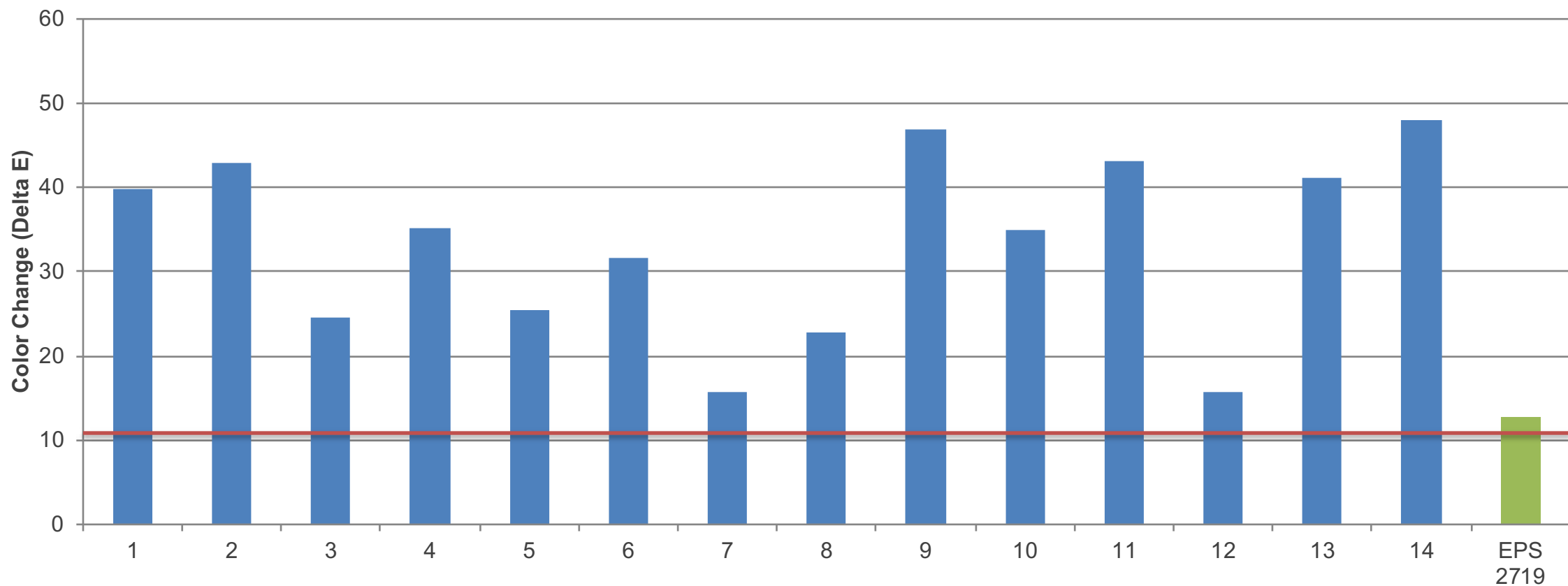
Appendix C - Benchmarking – Tear Strength



Appendix C - Water Resistance



Appendix D - Dirt Pick Up Resistance



Appendix E - Bleed Through Resistance

