IDOT
HMA Update
2013

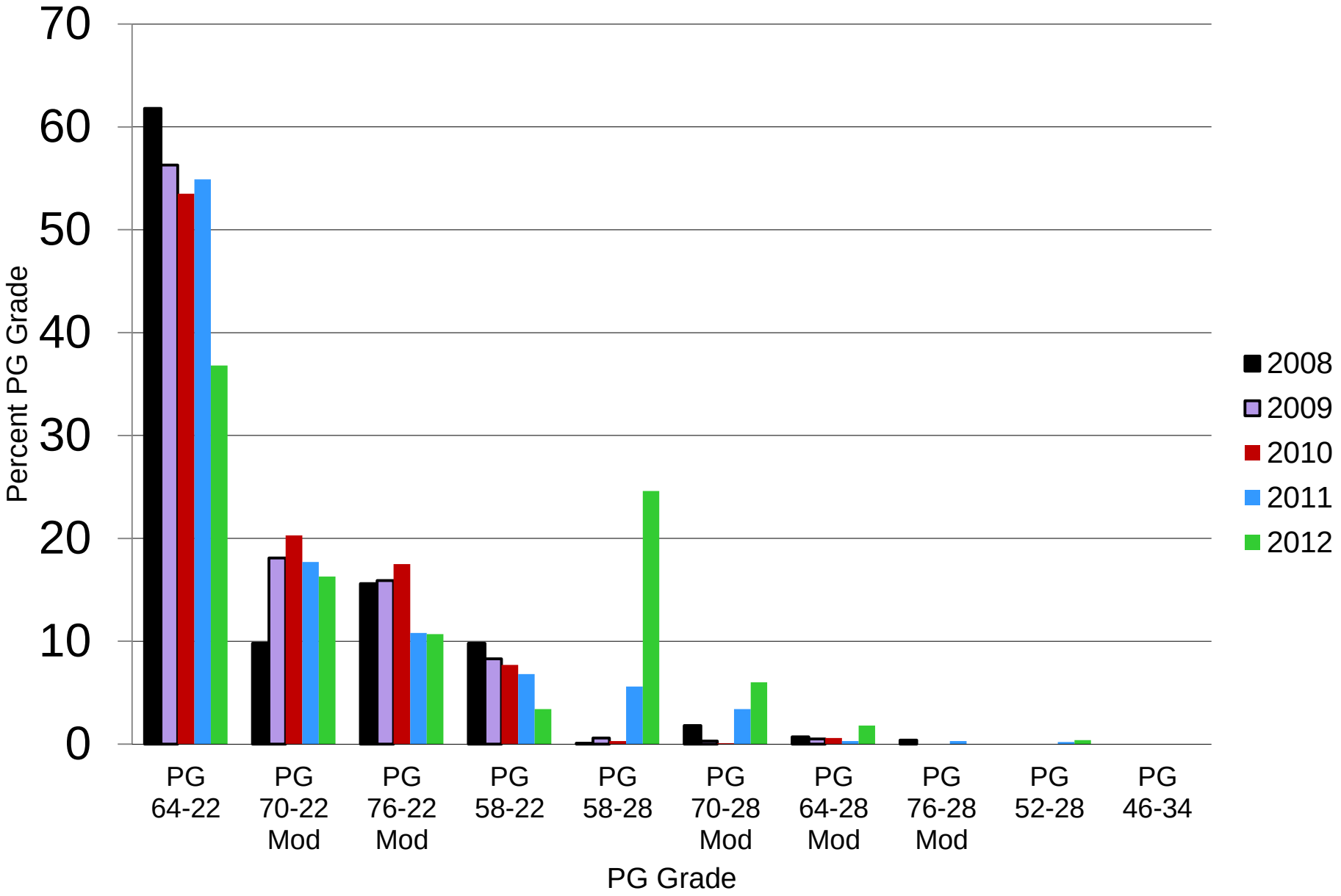
David L. Lippert, P.E.
Engineer of Materials and Physical Research

Illinois Department of Transportation

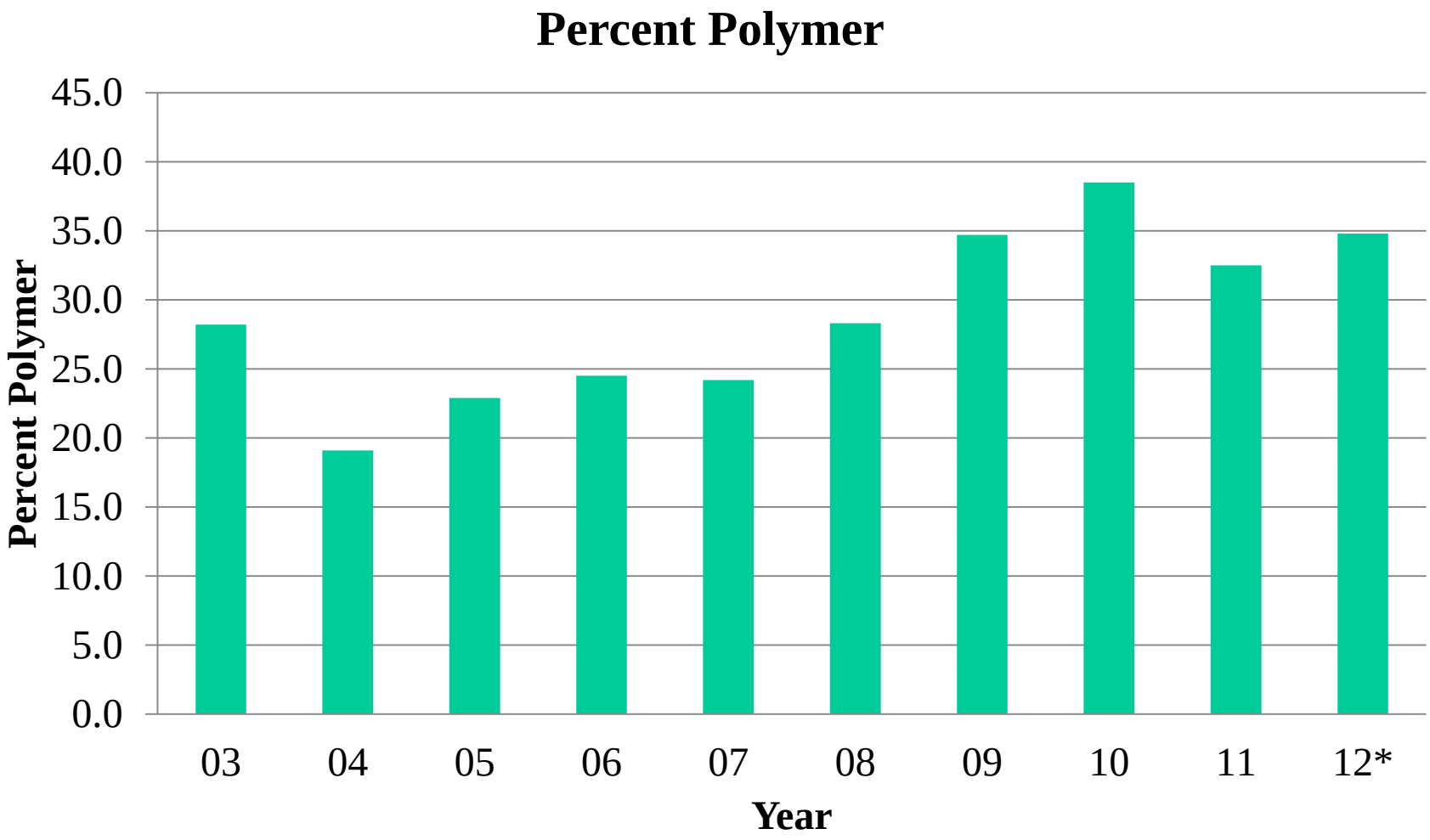
Illinois Asphalt Paving Association

PG Liquid Binder Usage

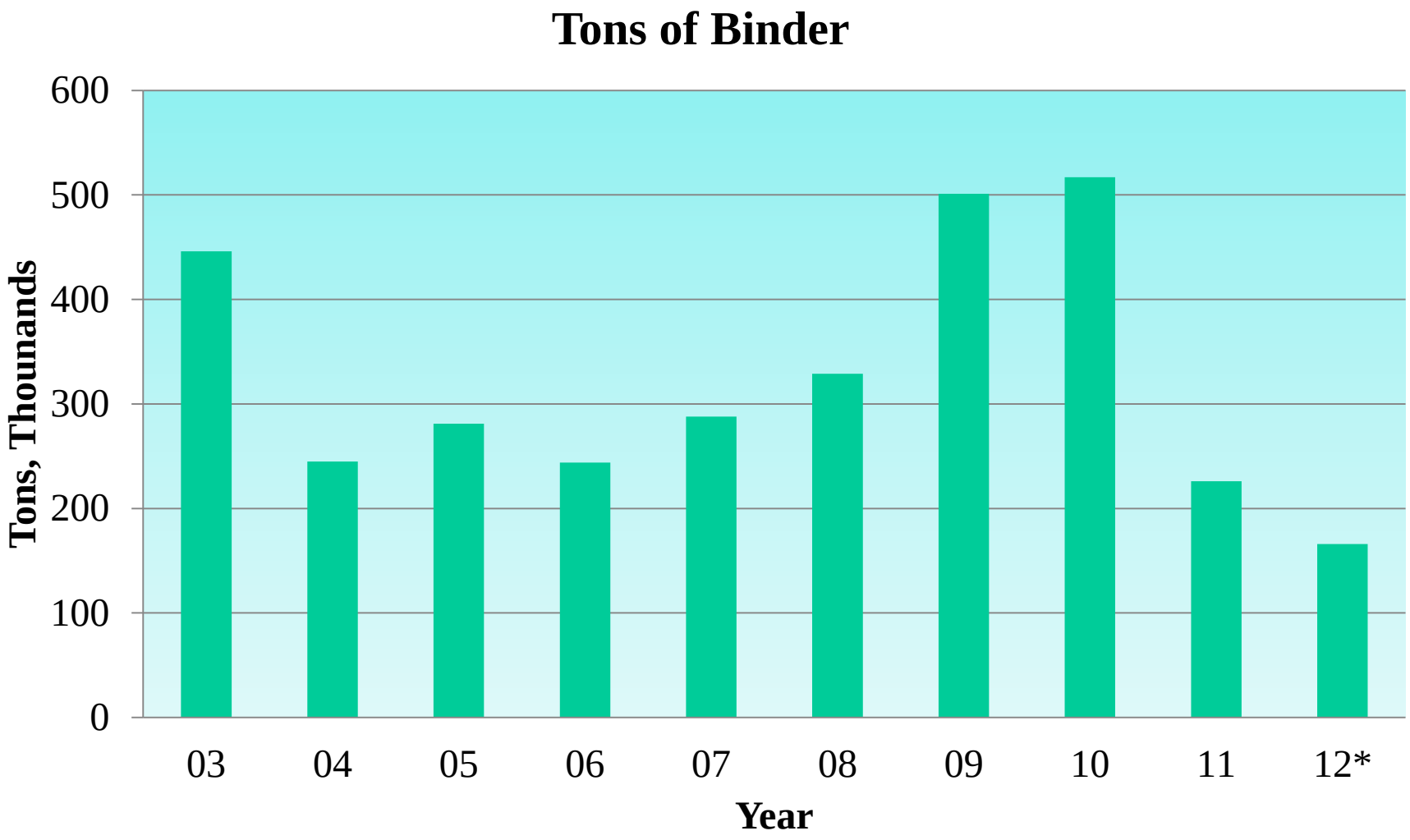
% Grades Used


70
60
50
40
30
20
10
0
Percent PG Grade
PG 64-22
PG 70-22 Mod
PG 76-22 Mod
PG 58-22
PG 58-28
PG 70-28 Mod
PG 64-28 Mod
PG 76-28 Mod
PG 52-28
PG 46-34
PG Grade
2008
2009
2010
2011
2012

% Polymer Usage

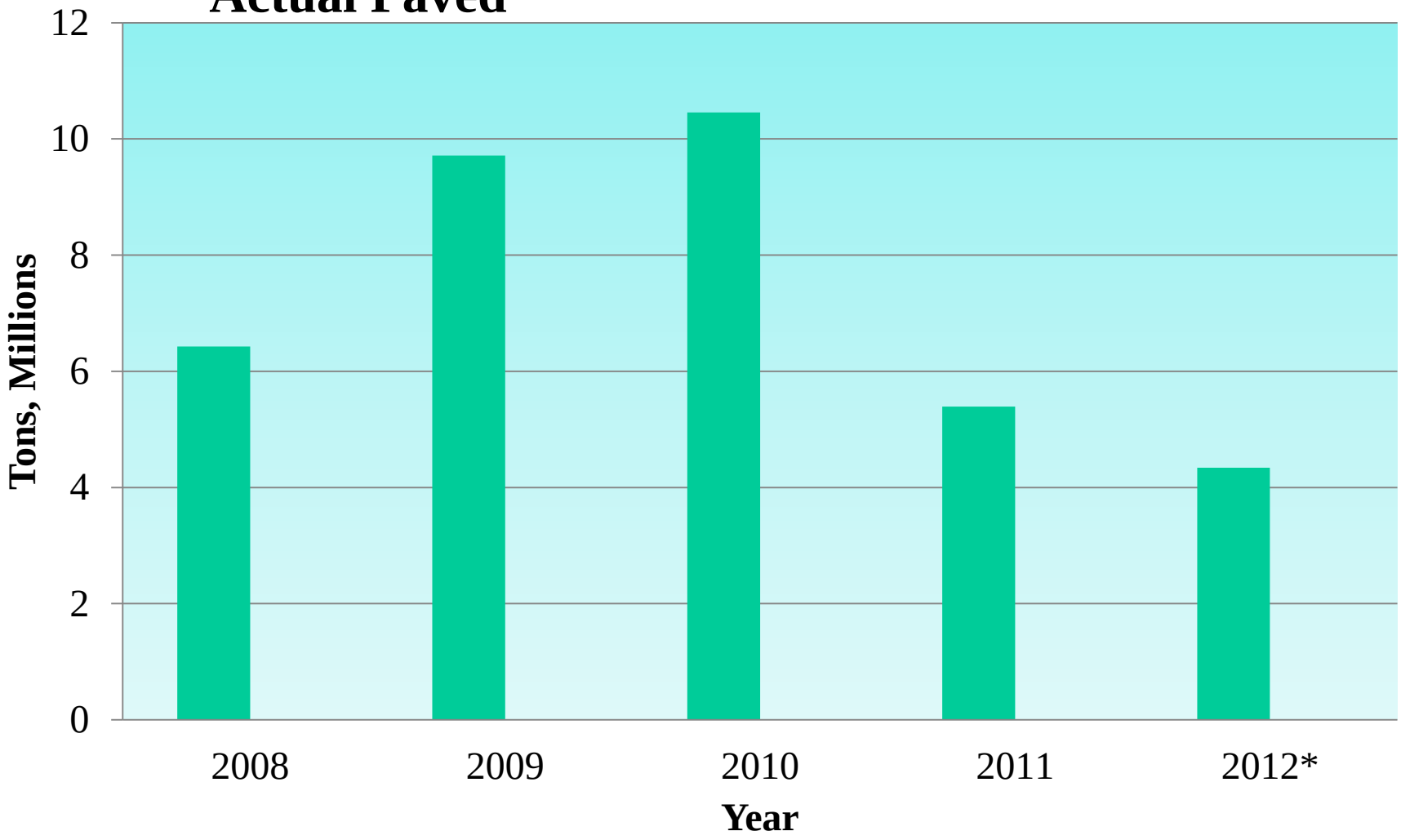


PG Binder Used (in thousand tons)



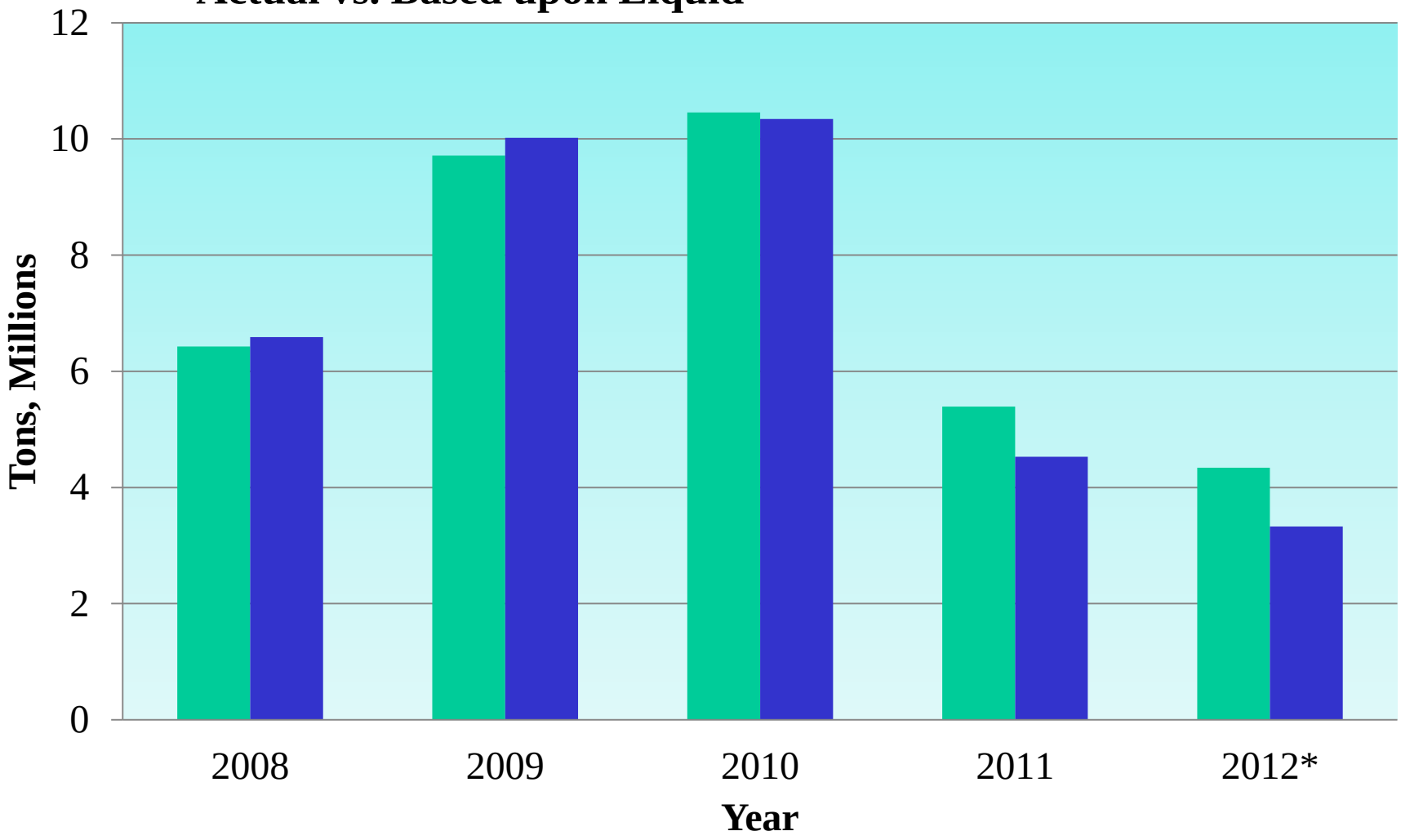
HMA (in million tons)

Actual Paved



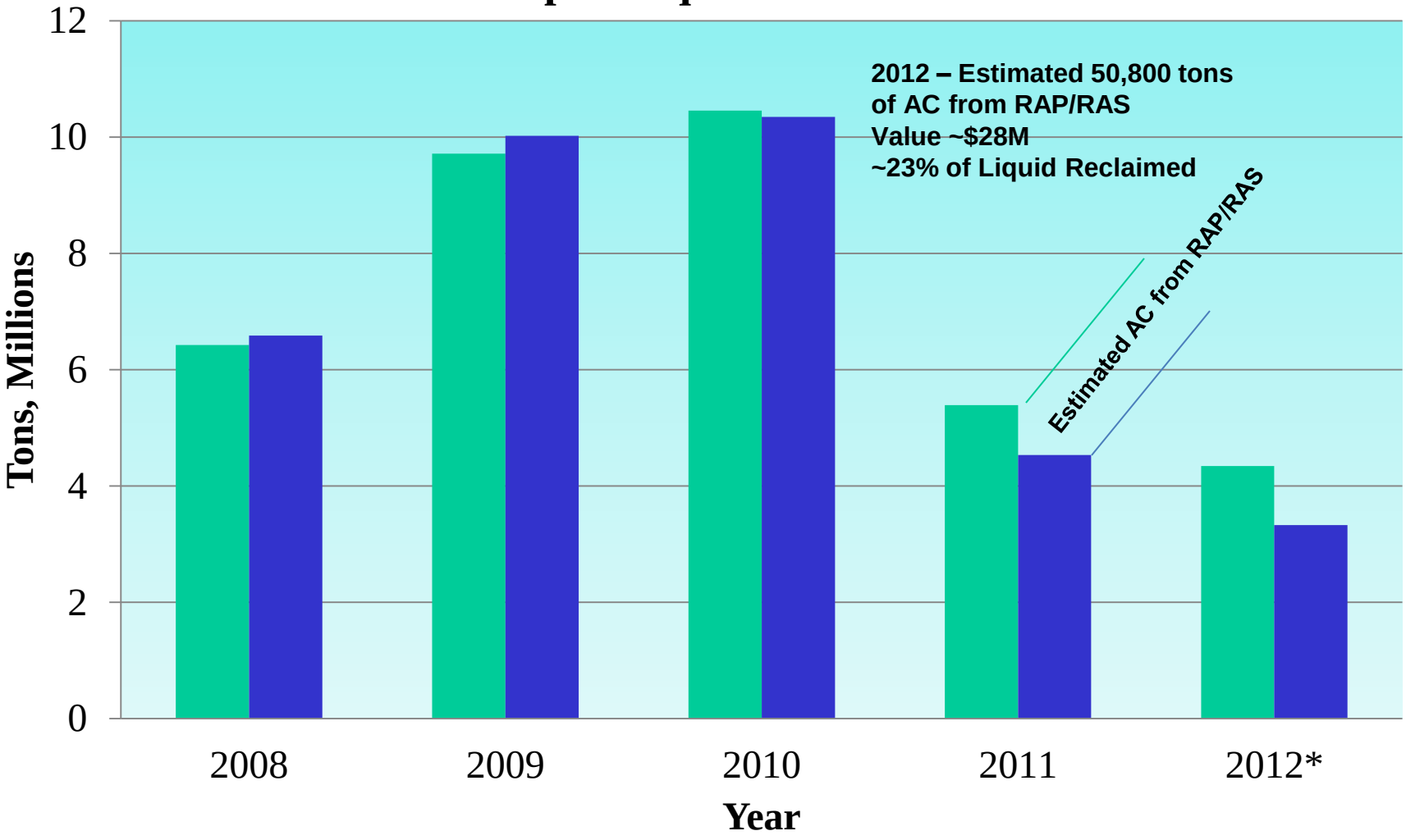
HMA (in million tons)

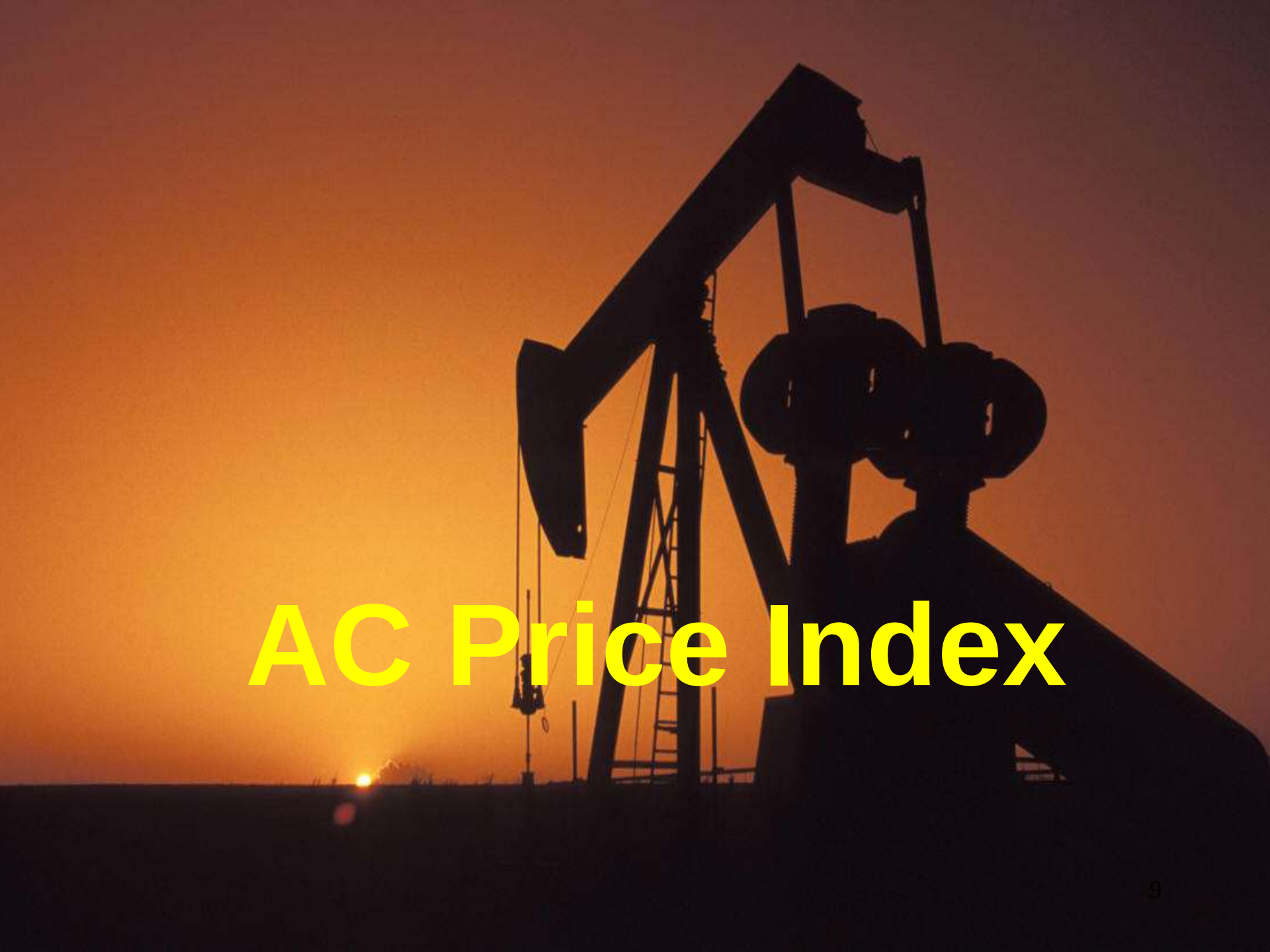
Actual vs. Based upon Liquid



HMA (in million tons)

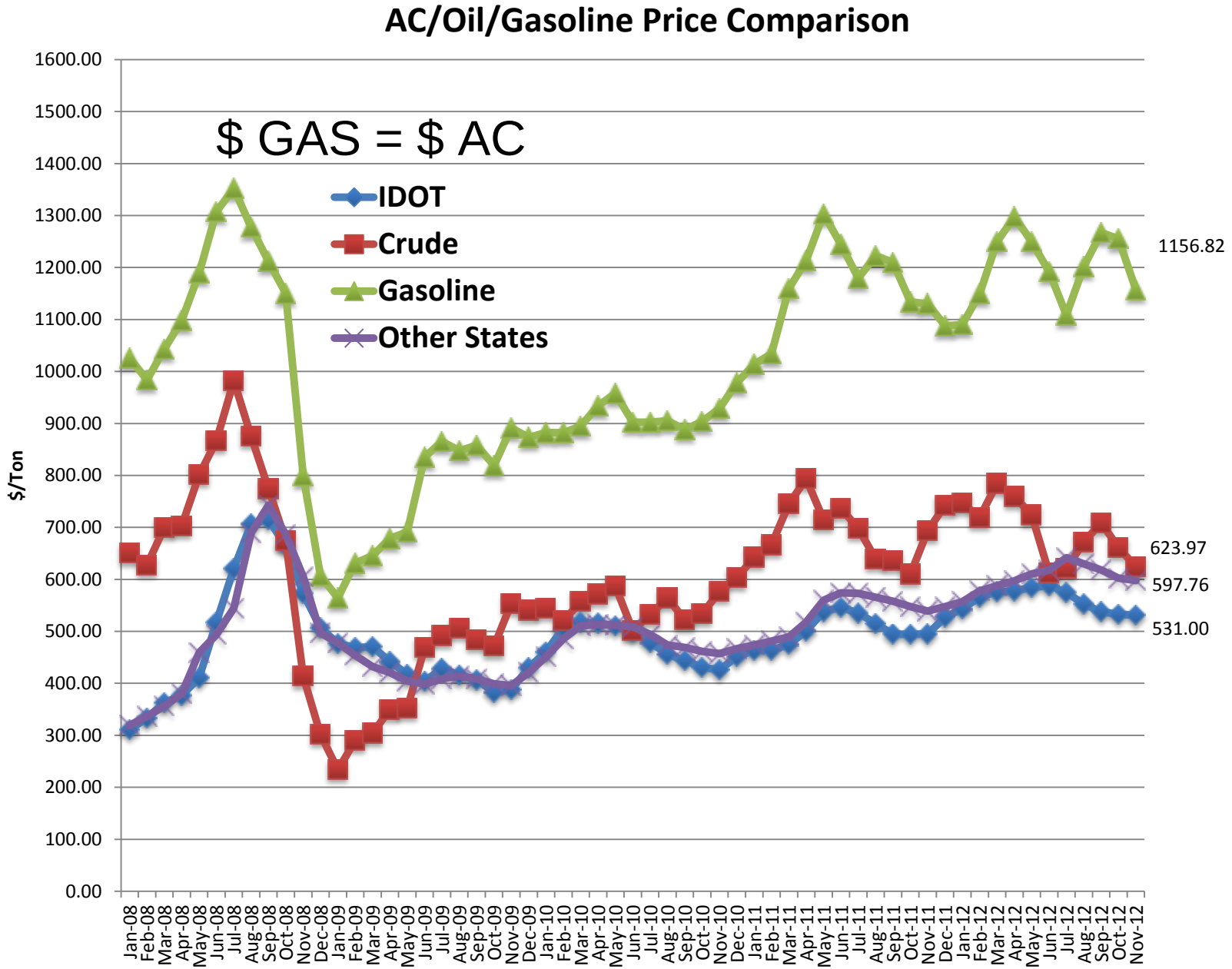
Actual vs. Based upon Liquid




AC Price Index

IDOT AC Price Index

- Based upon largest suppliers of previous year
- Prices submitted as of first of each month
- Average = Index
- BMPR Policy Memo 1-08.0
    - PERFORMANCE GRADED ASPHALT BINDER ACCEPTANCE PROCEDURE


AC/Oil/Gasoline Price Comparison
$ GAS = $ AC
IDOT
Crude
Gasoline
Other States
$/Ton
1600.00
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
1156.82
623.97
597.76
531.00
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Apr-08
May-08
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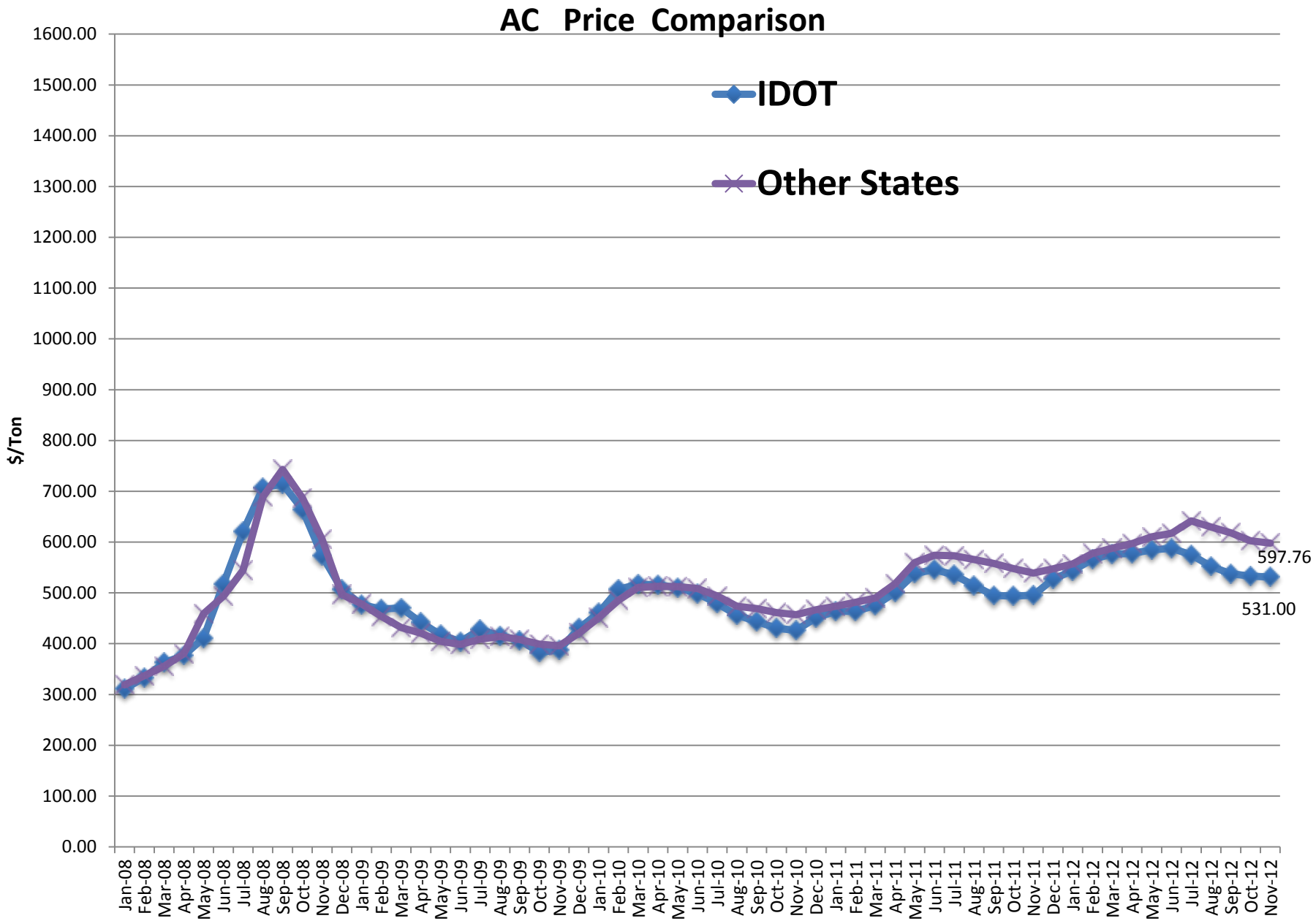
Oct-12
Nov-12


AC Price Comparison
IDOT
Other States
$/Ton
1600.00
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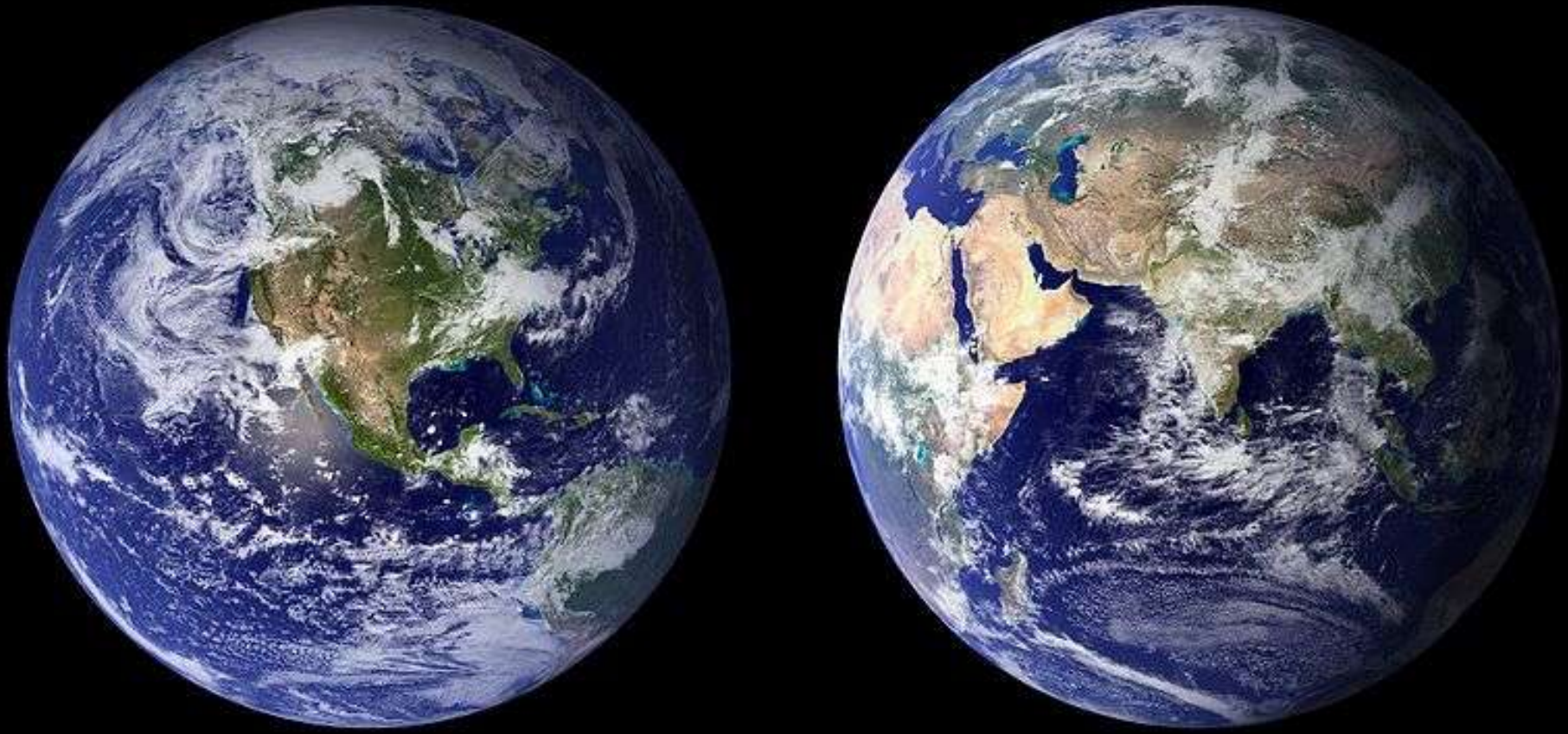
Nov-12



Sustainability:

Is the capacity to endure. For humans, sustainability is the long-term maintenance of responsibility, which has environmental, economic, and social dimensions, and encompasses the concept of stewardship, the responsible management of resource use. (Wikipedia)

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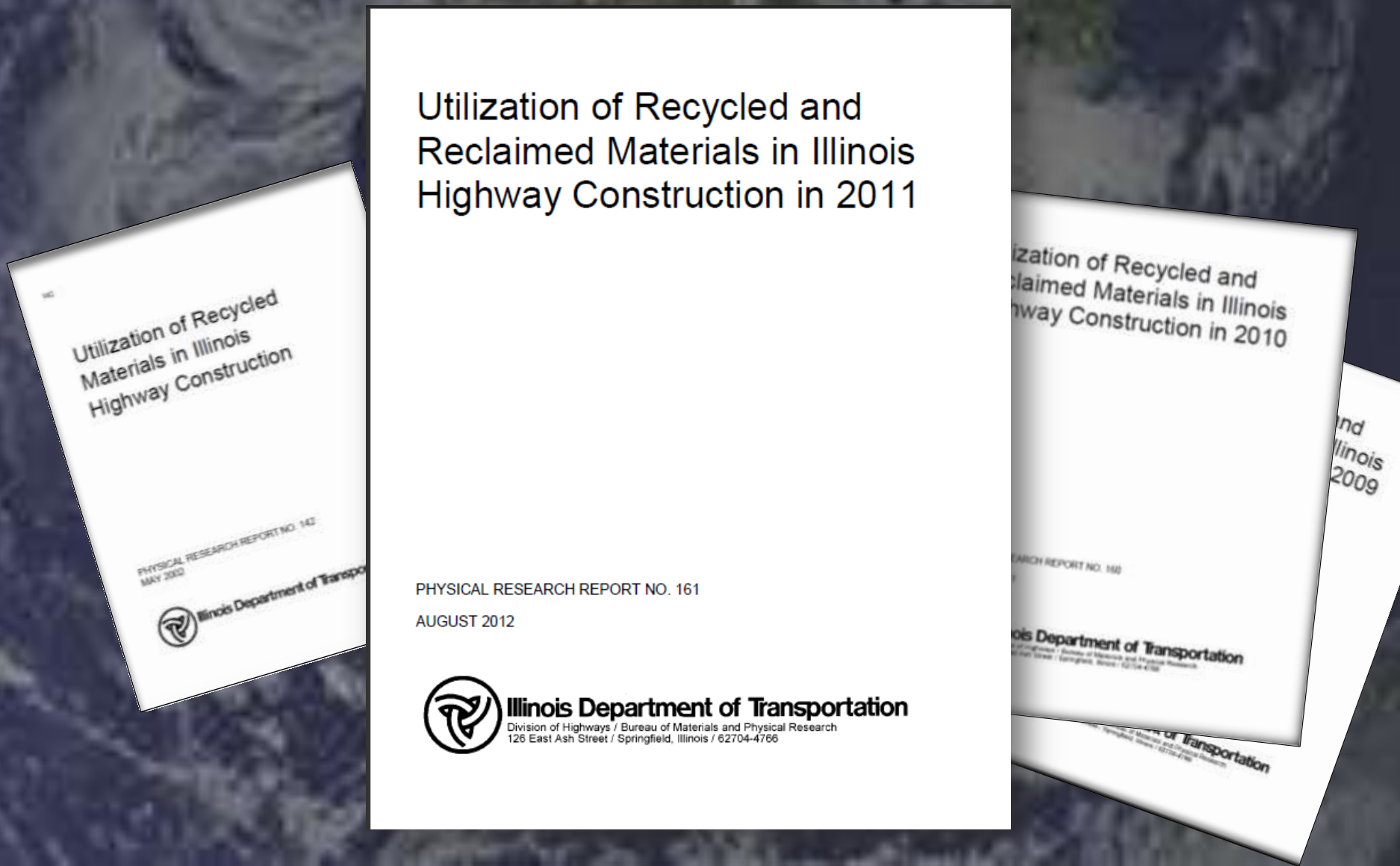
IDOT – A Major Recycler



Recycled and Reclaimed Materials Utilized in Highway Construction 2011

- Air-Cooled Blast Furnace Slag
- By-Product Lime
- Crumb Rubber
- Fly Ash
- Glass Beads
- Glass Cullet
- Ground Granulated Blast Furnace Slag
- Microsilica
- Reclaimed Asphalt Pavement (RAP)
- Reclaimed Asphalt Shingles (RAS)
- Recycled Concrete Material
- Steel Reinforcement
- Steel Slag
- Wet-Bottom Boiler Slag

2011 Recycling

- **1.2M Tons**
  - **48,000 semi truck loads**
  - **Line of Trucks 500 miles long**
  - **St. Louis to Joliet Both Directions**
- **Value $44M**

Don't Get Rapped by RAP Aggregate

RAP as Aggregate

Know your spec – What is max top size??

3” - 1 ½” - Other???


Fraud?

New BMPR Policy Memo

Reclaimed Asphalt Pavement (RAP) for Aggregate Applications

New BMPR Policy Memo

- All RAP material used for Aggregate Applications will follow this new PM.
- For RAP used from a contract back into the same contract, another contract, RAP taken to a central recycling facility or mix plant

Production Testing

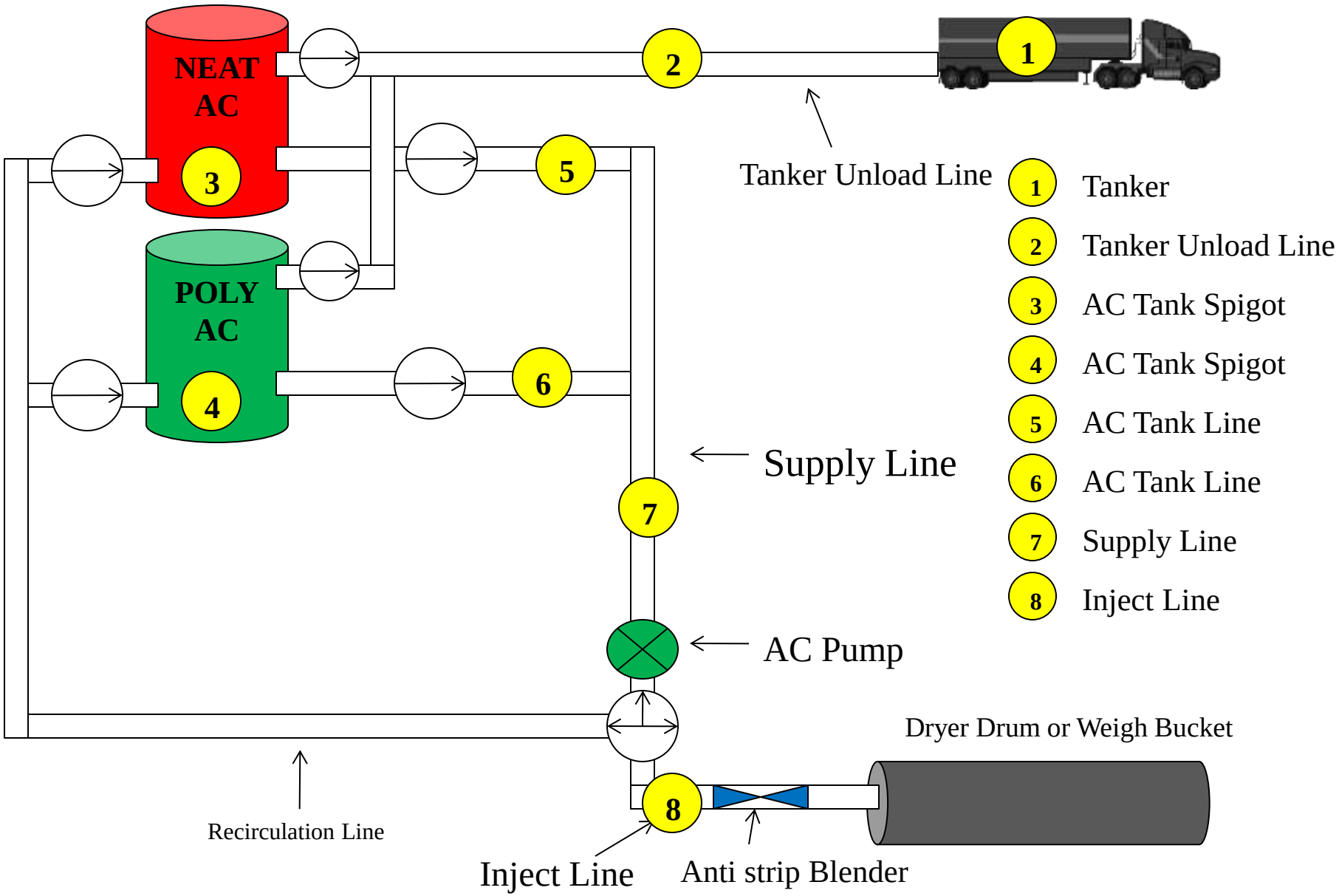
- Basic 100% passing gradation testing on top sieve size of material specified
- 1 test every 1,000 tons for first 5,000 tons, then 1 every 5,000 tons (contractor testing)
- Visual for uniformity
- Failing gradation response if sample is oversized

Loadout Testing

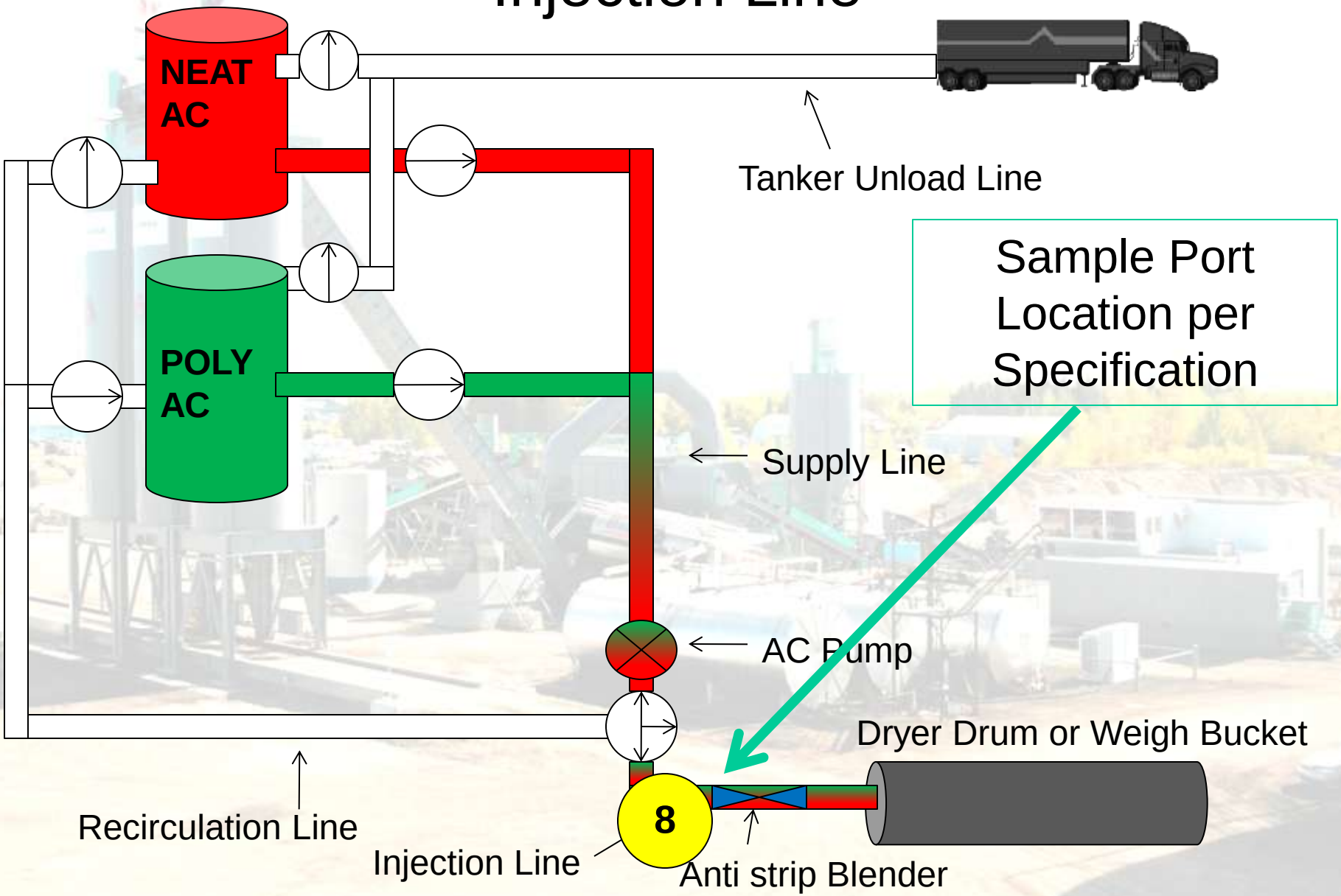
- 1 test every 5,000 tons
- More thorough visual inspection
  - Looking for over-sized agglomerations
  - segregation
- Loadout testing is waived for material being used back into same contract, if visual is acceptable

Liquid AC Sampling at HMA Plants

Sampling Points – Let's Count the Ways



Sample at closest point to the mix - at Injection Line



2012 District PG INV Field Samples

As of 11/21/12

District	Sample Total	Off Test	% Off Test
1	345	8	2.3
2	81	3	3.7
3	89	3	3.4
4	88	1	1.1
5	123	0	0
6	136	0	0
7	166	1	0.6
8	250	2	0.8
9	96	0	0
TOTAL	**1374**	**18**	**1.3 %**

District PG Investigative Field Samples

As of 11/21/12
2012 (2011) (2010)

District	Sample Total	Off Test	% Off Test
1	345 (357) (654)	8 (11) (12)	2.3 (3.1) (1.8)
2	81 (122) (215)	3 (3) (4)	3.7 (2.5) (1.9)
3	89 (57) (121)	3 (0) (1)	3.4 (0) (0.8)
4	88 (112) (223)	1 (0) (0)	1.1 (0) (0)
5	123 (95) (176)	0 (0) (0)	0 (0) (0)
6	136 (189) (227)	0 (2) (2)	0 (1.1) (0.9)
7	166 (179) (209)	1 (0) (1)	0.6 (0) (0.5)
8	242 (260) (249)	2 (0) (7)	0.8 (0) (2.9)
9	81 (99) (122)	0 (1) (2)	0 (1.0) (1.6)


Warm Mix Asphalt
Hot
Warm

WARM MIX ASPHALT (WMA)

- Jan 1, 2012 – BDE permissive use Spec issued
  - Allows WMA to be used by contractor
  - Limited to N70 and below mixes
  - Additives and Mechanical processes (foaming) allowed
  - Developing approved list of additives and processes

Warm Mix Technology Use Procedure

- Contractor makes request for use to District
- District Coordinates with BMPR
- WMA Technology “Provisional” until TWO contracts completed within state.
- Evaluate on minimum of 2,000 tons of MAINLINE SURFACE MIX.
  - 1,000 tons of HMA control section
  - 1,000 tons of WMA Technology test section
- Mix testing
  - Four (4) gyros (HMA and WMA Technology).

Warm Mix Technology Use Procedure

- Notify BMPR before production.
- Samples taken.
- Must meet Hamburg Wheel Tracking Device test requirements.
- Once two projects completed with success WMA technology has “approved” status.

Illinois Department of Transportation
Bureau of Materials and Physical Research
APPROVED / PROVISIONAL LIST OF
TECHNOLOGIES FOR PRODUCTION OF WARM MIX ASPHALT (WMA)
December 16, 2011
BDE Permissive Use Specification for Warm Mix Asphalt (effective 1/1/2012)

APPROVED TECHNOLOGIES LIST FOR WMA TECHNOLOGIES
December 16, 2011

Company	WMA Technology		Date Approved
	Mechanical	Additive	

PROVISIONAL TECHNOLOGIES LIST FOR WMA TECHNOLOGIES
December 16, 2011

Company	WMA Technology		Date Provisionally Accepted
	Mechanical	Additive	
Astec Industries, Inc. 1725 Shepherd Road Chattanooga, TN 37421	Generation One (G1) of the Astec® Double Barrel Green System		12/2011
GENCOR INDUSTRIES, INC. 5201 North Orange Blossom Trail Orlando, Florida 32810	Gencor Ultrafoam GX™		12/2011
MAXAM Equipment, Inc. 1575 Universal Avenue Kansas City, MO 64120	MAXAM ® AQUABlack		12/2011
Stansteel 12711 Townepark Way Louisville, KY, 40243	Stansteel Accu•Shear™		12/2011
Stansteel 12711 Townepark Way Louisville, KY, 40243	Stansteel Eco•Blend™		12/2011
Terex Corporation 200 Nyala Farm Road Westport, CT 06880 USA	Terex® Warm Mix Asphalt System		12/2011
MeadWestvaco 501 South 5th Street Richmond, VA 23219-0501		EVOTHERM™	12/2011
Sasol Wax North America Corporation 21325B Cabot Blvd Hayward, California 94545		SASOBIT®	12/2011
Akzo Nobel Surfactants 525 West Van Buren Street, Chicago, Illinois 60607-3823		REDISET™	12/2011

Warm Mix Asphalt

- Nationally around 20% of asphalt is warm mix
- Illinois – 4.3 M tons of HMA
  - Should be ~850K tons of WMA
  - 2012 ~ 35K tons of WMA
- Why
  - No approved WMA technologies
  - Approval takes a great deal of effort by contractor
  - Benefits are actually quite low ~ $0.25/ton or an added cost (additives).
  - PFP/QCP – contracting community has enough risk on plate.

Warm Mix Asphalt

- So what??
  - IDOT perceived as holding back progress
  - Ripe for mandate by Legislature to use in all mixes
- Benefits
  - Worker comfort/health
  - Saving of BTU's
  - Fewer emissions
- Actions to expect
  - Revisit approved technologies policy
  - Available this Summer


Reclaimed
Asphalt Shingles
(RAS)

RAS – Type I vs. Type II

Type I – New material (Pre-Consumer)

Type II – Roof Tear-Off's (Post-Consumer)

Type I – Manufacture Waste

Type II – Post-Consumer Waste

Sort and Grind

- Final sort
- Grind
- Screen
- Ready for HMA

RAP/RAS Specs and Policy

- Combined into single spec for 2013 adopting Asphalt Binder Replacement (ABR)
  - Link: http://www.dot.il.gov/desenv/specrev/80306.pdf
- RAS Policy revised issued August 2011
  - Link: http://www.dot.il.gov/materials/pdf/28-10.2reclaimedasphaltshinglesources.pdf

RAS Sources

Owner	Location	Type
C&D Recycling of Wisconsin 1000 Apache Court Fort Atkinson, WI 53538	1450 S. Virginia Road Crystal Lake, IL 60014	Type 2
Falcon Green Resources, Inc P.O. Box 638 Harvard, IL 60033	1200 N Rose Farm Rd Woodstock, IL 60098	Type 1
Southwind RAS, LLC 2250 Southwind Boulevard Bartlett, IL 60103	1950 Vulcan Blvd Bartlett, IL 60103	Type 2
Southwind RAS, LLC 2250 Southwind Boulevard Bartlett, IL 60103	6616 Darst Street Peoria, IL 60103	Type 2
Southwind RAS, LLC 2250 Southwind Boulevard Bartlett, IL 60103	4401 S. First Avenue Lyons, IL 60534	Type 2

Link: http://www.dot.il.gov/materials/reclaimedasphaltshingles.pdf

RAS Sources

Owner	Location	Type
Beverly Materials/Falcon Green Resources, Inc. 1200 N. Rose Farm Rd. Woodstock, IL 60098	34 W 007 Rt. 72 West Dundee, IL 60118	Type 2
Southwind RAS, LLC 2250 Southwind Boulevard Bartlett, IL 60103	4525 Prairie Hill Rd. South Beloit, IL 61080	Type 2
Southwind RAS, LLC 2250 Southwind Boulevard Bartlett, IL 60103	600 W. Eldorado Rd. Decatur, IL 62522	Type 2
Waste Commission of Scott Co. 11555 110th Avenue Davenport, IA 52804	Scott Area Landfill 11555 110th Ave (CR Y-48) Davenport, IA 52804	Type 2

Link: http://www.dot.il.gov/materials/reclaimedasphaltshingles.pdf

Goal: Engineer Asphalt Binder Replacement (ABR)

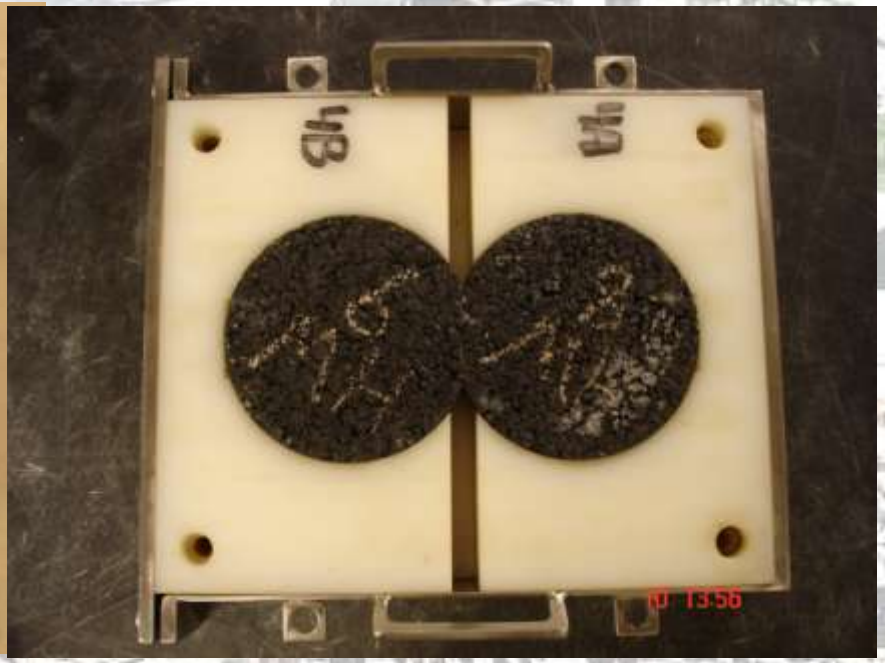

IDOT
Dist 8
Chicago
Tollway
IDOT
BMPR
IDOT
Dist 1


Goldilocks HMA Mix
Not too hard
Not too soft
“Just right”


Too Soft

Hamburg Wheel

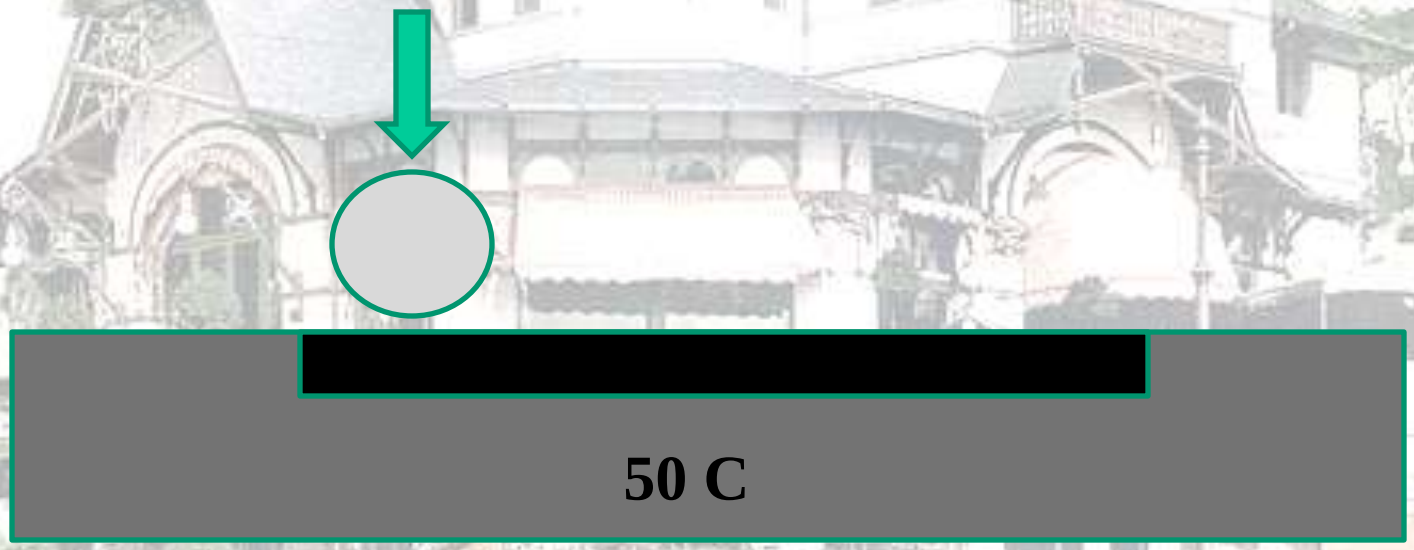
Specimen Prep

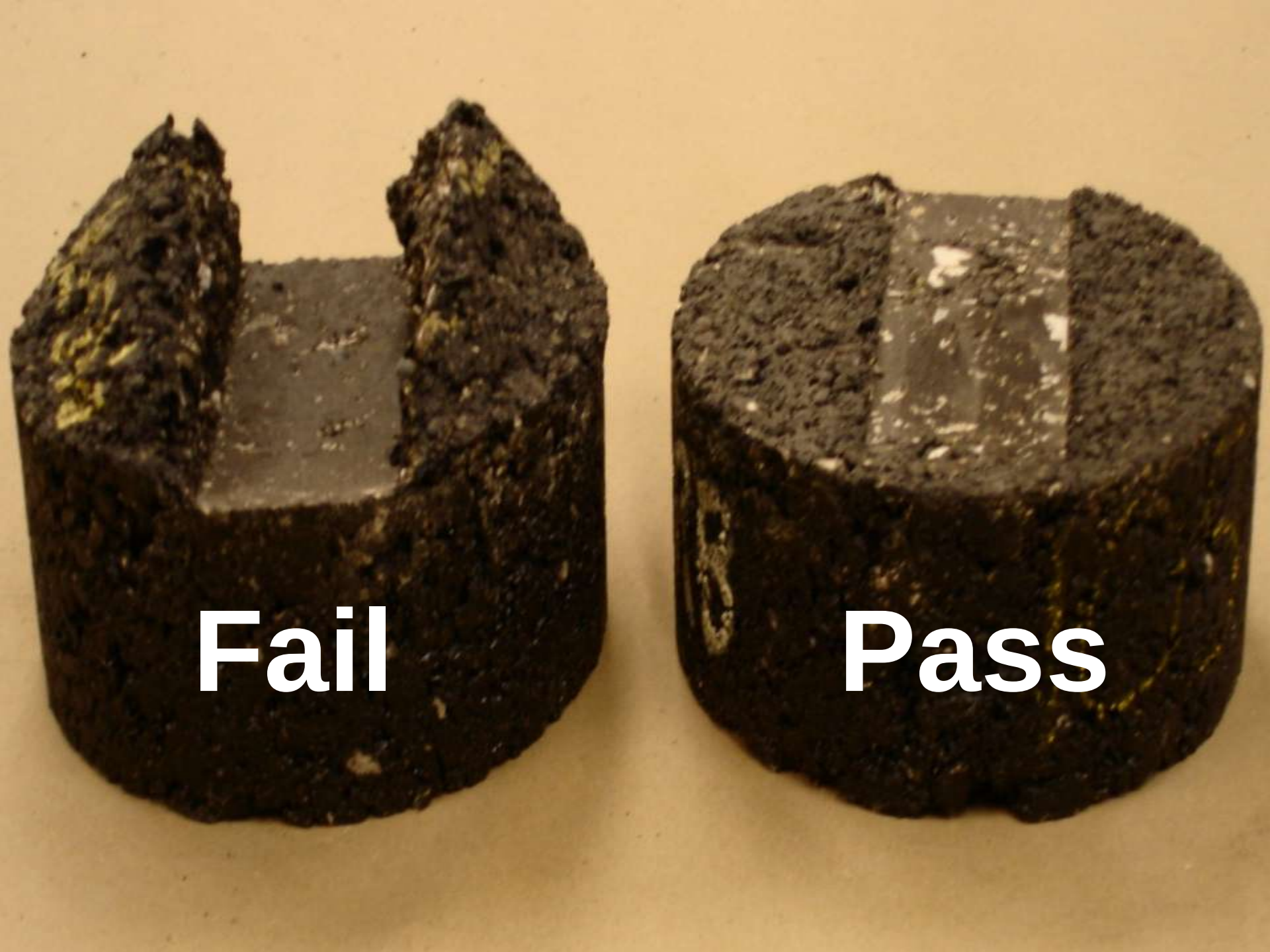


Hamburg Wheel

50 Passes/Minute

158 Lbs




Fail
Pass

Implementation Schedule

- 2011
  - High Replacement RAP and RAS
  - Permissive use Warm Mix
- 2012 - 2013
  - Other New mixes (fine graded) and Renewals
- 2014 on
  - Full Implementation


Too Hard

Laboratory Evaluation of High Binder Replacement with Recycled Asphalt Shingles (RAS) for a Low N-Design Asphalt Mixture

Hasan Ozer
Research Assistant Professor
University of Illinois at Urbana-Champaign

Illinois Bituminous Paving Conference, 2012

ILLINOIS CENTER FOR TRANSPORTATION

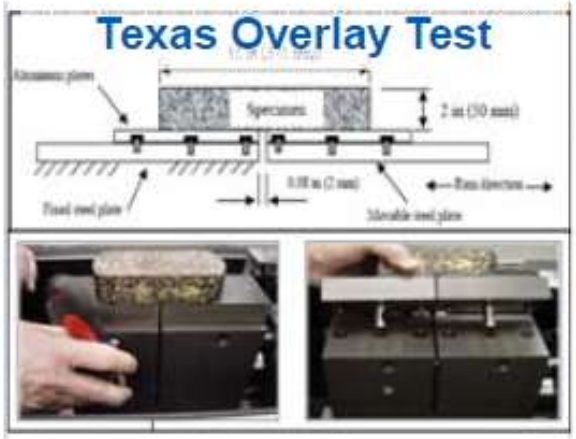
Experimental Program

Complex Modulus Test

Hamburg Wheel Track

Semi Circular Bending Beam

Texas Overlay Test



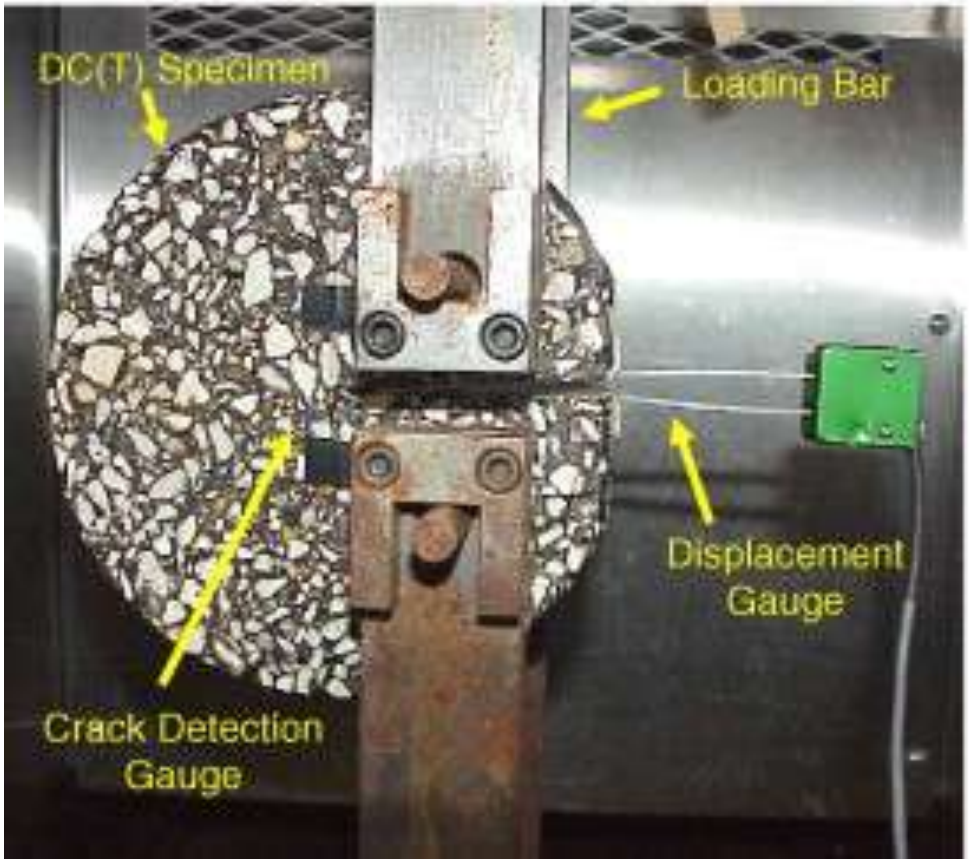
Disc Compact Tension

Push-pull Test

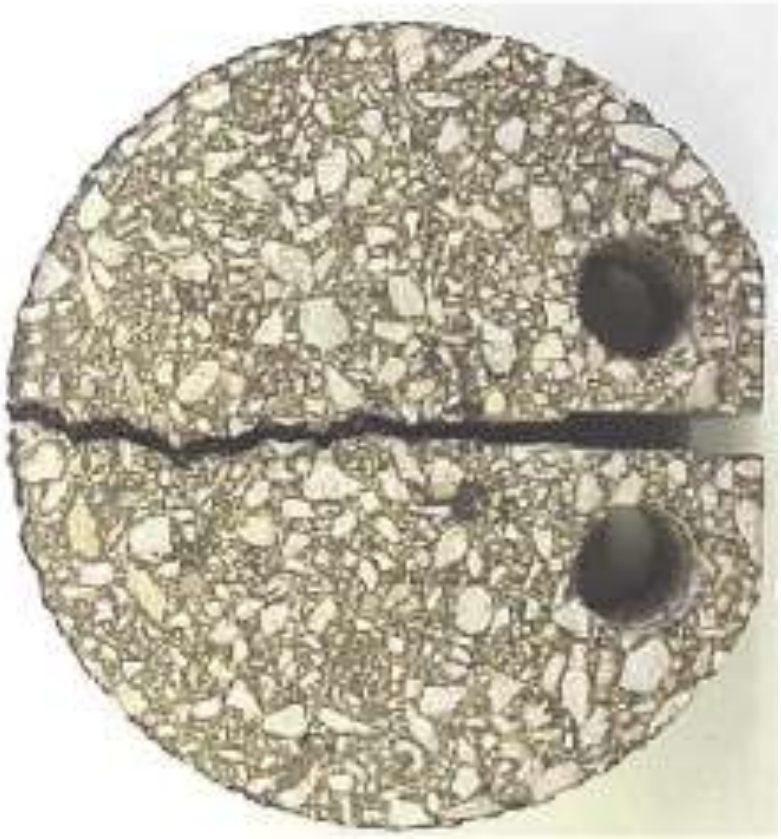
TRANSPORTATION

DCT – Test

a


DC(T) Specimen
Loading Bar
Displacement Gauge
Crack Detection Gauge

b

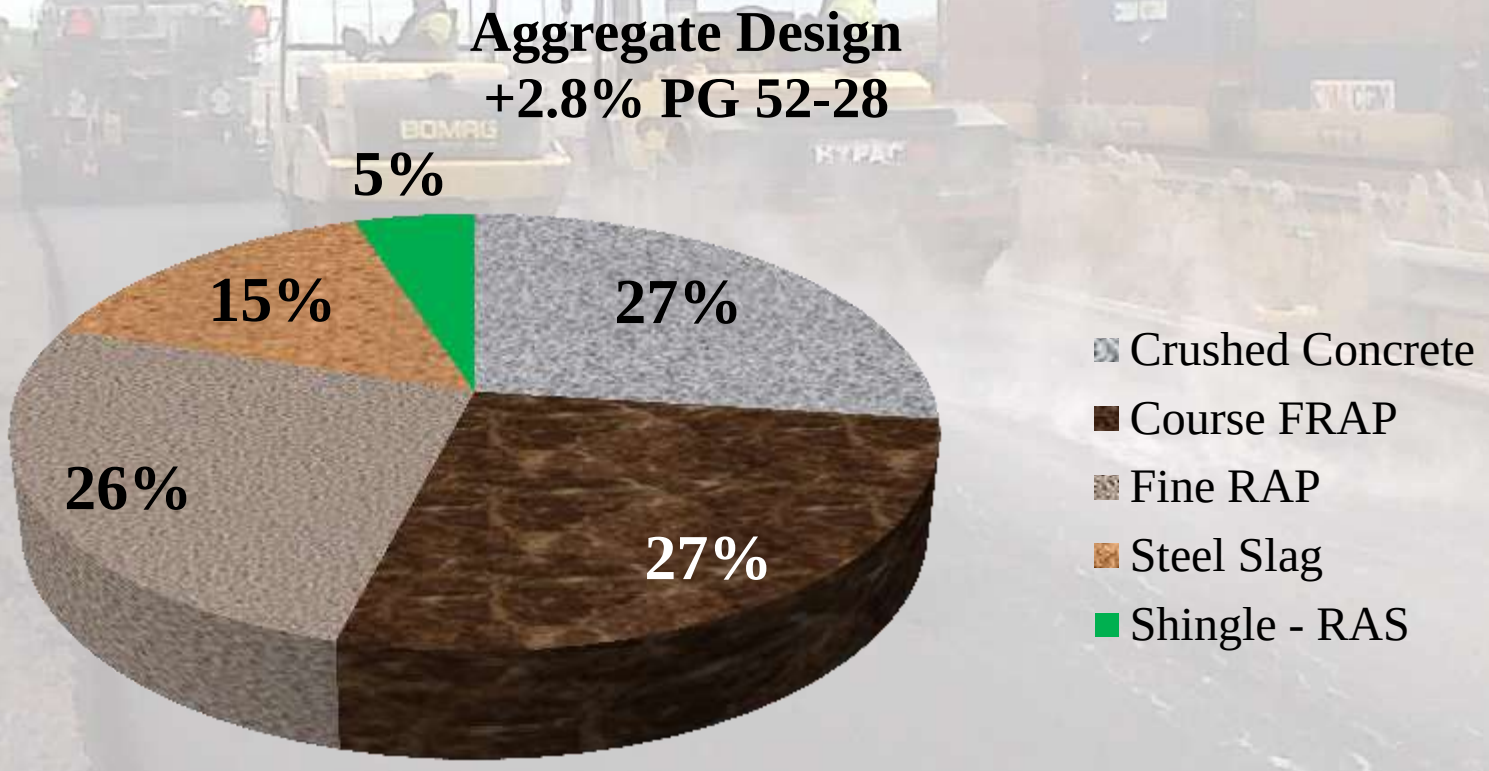



BOMAG
TOTAL RECYCLE
ASPHALT

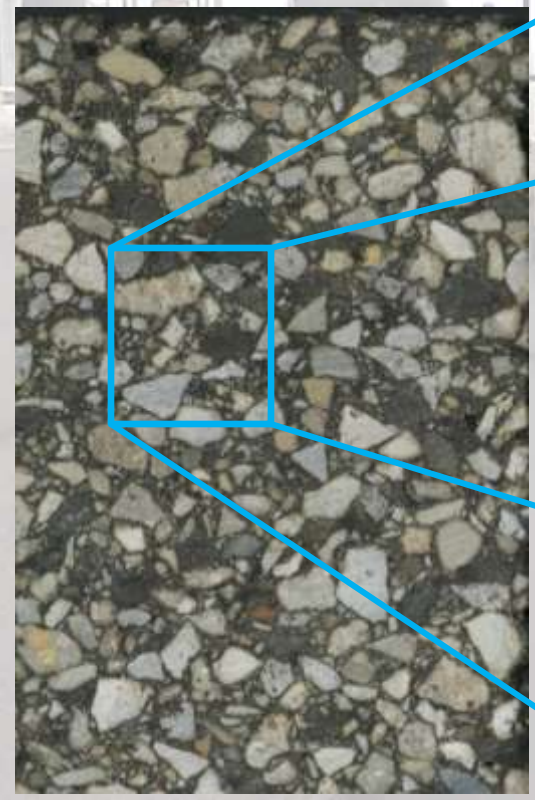
Total Recycle Asphalt (TRA)

- Sustainability Features
  - Over 97% recycled material – no mined material
    - Concrete Aggregate
    - RAP
    - RAS
    - Slag
  - 57% Asphalt Binder Replacement (ABR)
- Engineering Features
  - N50 Mix “D” Surface
  - PG52-28
  - TSR = 109.5/120.4 = 0.91
  - Hamburg - 5.3mm Ave @ 20,000 Passes
  - 20% reduced cost of mix

Mix Details


Aggregate Design
+2.8% PG 52-28
5%
15%
27%
26%
27%
Crushed Concrete
Course FRAP
Fine RAP
Steel Slag
Shingle - RAS

Total Recycle Asphalt



TRA Future

- Testing of plant produced material
  - District
  - BMPR
  - ICT @ UIUC
- Demo projects 2013 construction
- Special Provision for use as soon as 2014

PAY FOR PERFORMANCE

PFP/QCP Implementation Schedule

Revised

- 2013 & 2014 & Beyond
  - ~~PFP will be expanded to include:~~
    - ~~Interstate & Non-Interstate projects ≥ 4,000 tons~~
      - ~~50% in 2013~~
      - ~~100% in 2014~~
  - PFP full implementation (above 8,000 tons)
  - QCP for projects < 8,000 tons
    - 2 Projects/District in 2012
    - 50% in 2013
    - 100% in 2014 – start rollout for LR&S jobs

2012 PFP Projects

District	Projects	Tons	% Jobsite
1	6	87398	0
2	1	8,516	100
3	3	99,227	100
4	2	57,807	100
5	6	97,522	50
6	2*	76,000**	100
7	6(7*)	141,757	100
8	1 (3*)	8,000 (44,000)	100
9			
Total	25 (30*)	476,851 (612,227)	

* With carryover

**Approximate

2012 PFP Projects

District	Projects	Surface	Binder
1	6	6	0
2	1	1	0
3	3	1	2
4	2	1	1
5	6	3	3
6	2*	1	1
7	6(7*)	5	2
8	1 (3*)	1	2
9			
Total	25 (30*)	19	11

* With carryover

Average Pay

- Binder = 99.7
- Surface = 100.0
- Overall = 99.9

PFP Spec Revisions for 2013

- Increase timeframe for submittal of QC results to 48 hrs (allows aging to match IDOT)
- Exclude outer one foot of unconfined edge from random core calculations
  - Institute random 1test/half mile/unconfined edge core density with pay adjustment table similar to Dust/AC

QUALITY

CONTROL FOR

PERFORMANCE

2012 QCP Projects

District	Contract #	Mix Application	Tons	Pay	# of Mix Sublots tested by District
2	64529	N70 F Surf	5400	100%	2/6 = 33%
3	66A75	Surface	9,840	93.8%	10/10 = 100%
3	66A75	4.75 mm L.B.	4,920	99.5%	5/5 = 100%
3	66644	Surface	5,124	100.0%	5/5 = 100%
3	66644	4.75mm L.B.	2,509	100.0%	1/3 = 33%
8	76E52	Binder	1967	100.0%	2/2 = 100%
8	76E52	Surface	4103	100.0%	4/4 = 100%
9	78271	4.75 leveling Binder	6251.2	99.4%	2/7 = 29%
9	78271	C Surface	12929.6	97.9%	4/13 = 31%
			53,044	99.0%	70%

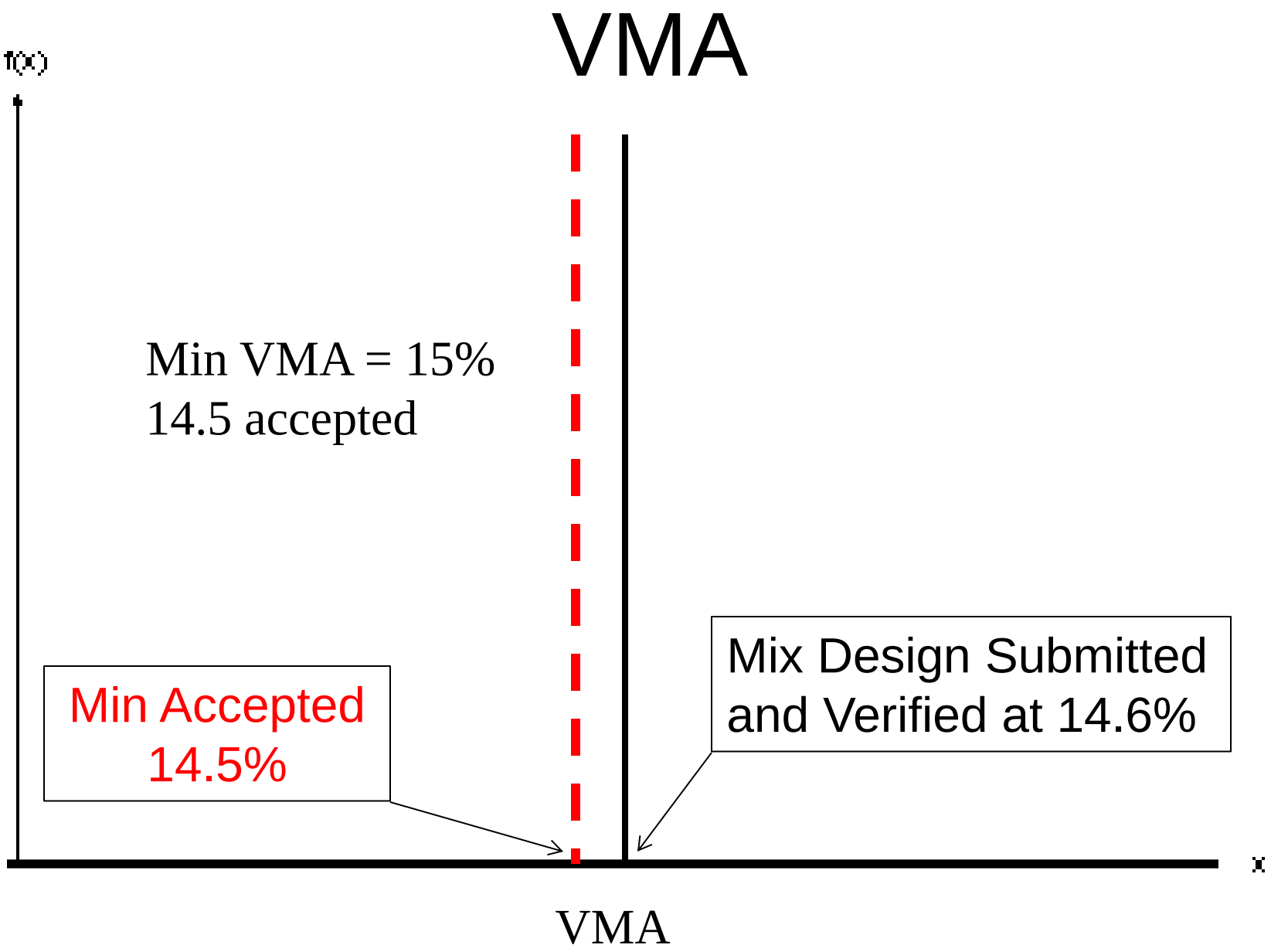
QCP Spec Revisions for 2013

1. Cap each Pay Parameter Prior to Calculating the Combined Pay Factor
2. Adjust Ranges for 103% Pay
3. Adjust Density for 95% Pay
4. Clarify Additional Dept. Testing/Results May be Included in Pay Calcs
5. Change Acceptable Limits density range for IL-4.75 from 92.0-98.0% to 90.0-98.0%
6. Increase timeframe for submittal of QC results to 48 hrs (allows aging to match IDOT)

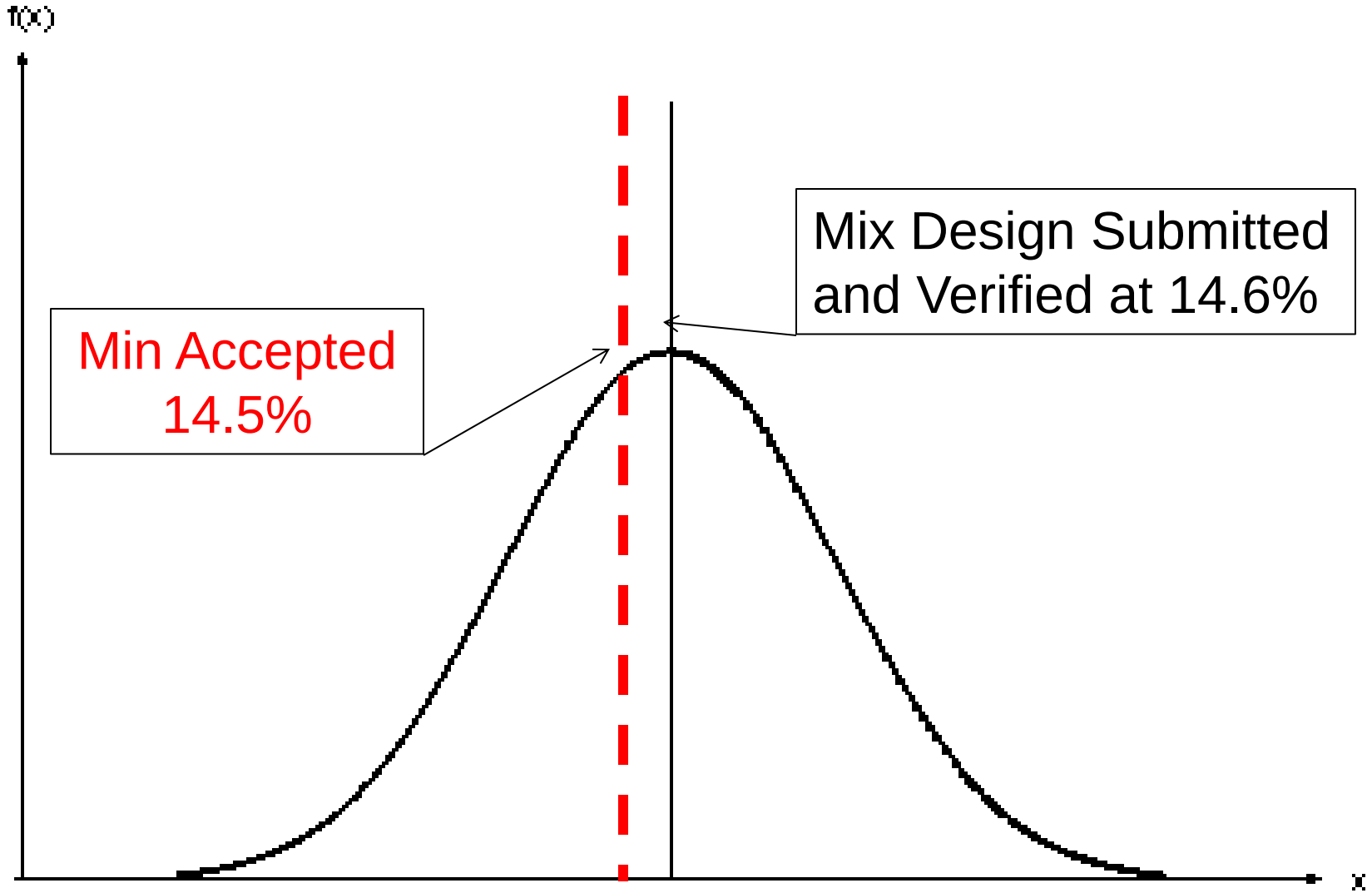

Mixture Cliff

Walking on the Edge Issues

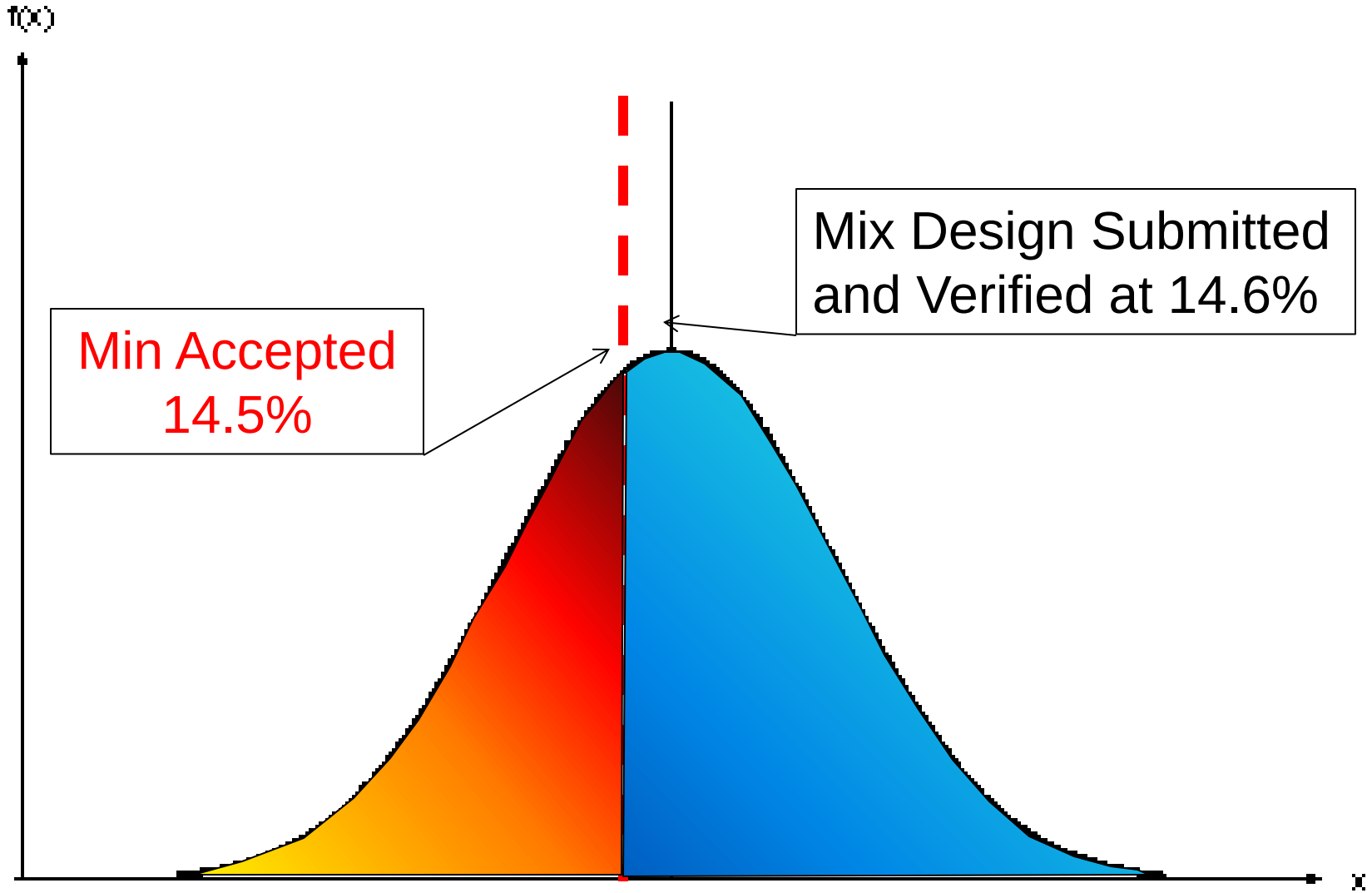
- Mix designs that barely meet criteria – send for verification on a wing and prayer
  - Just barely passed – a good thing right?
  - Cheap source but highly variable gradation may be costly in the end
- Bad Sampling methods


VMA
f(x)
Min VMA = 15%
14.5 accepted
Min Accepted
14.5%
Mix Design Submitted
and Verified at 14.6%
x
VMA

Normal Distribution

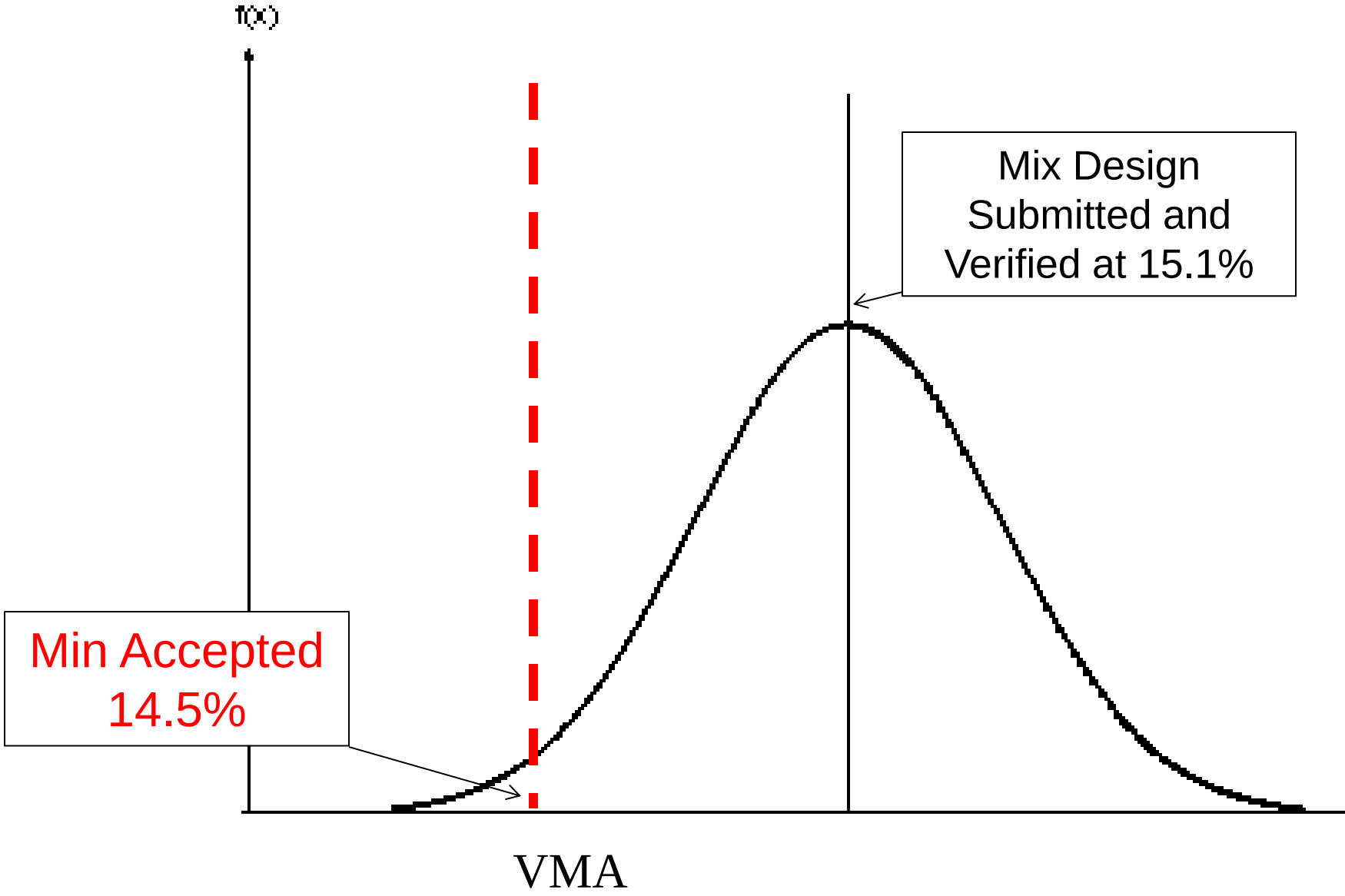


Normal Distribution

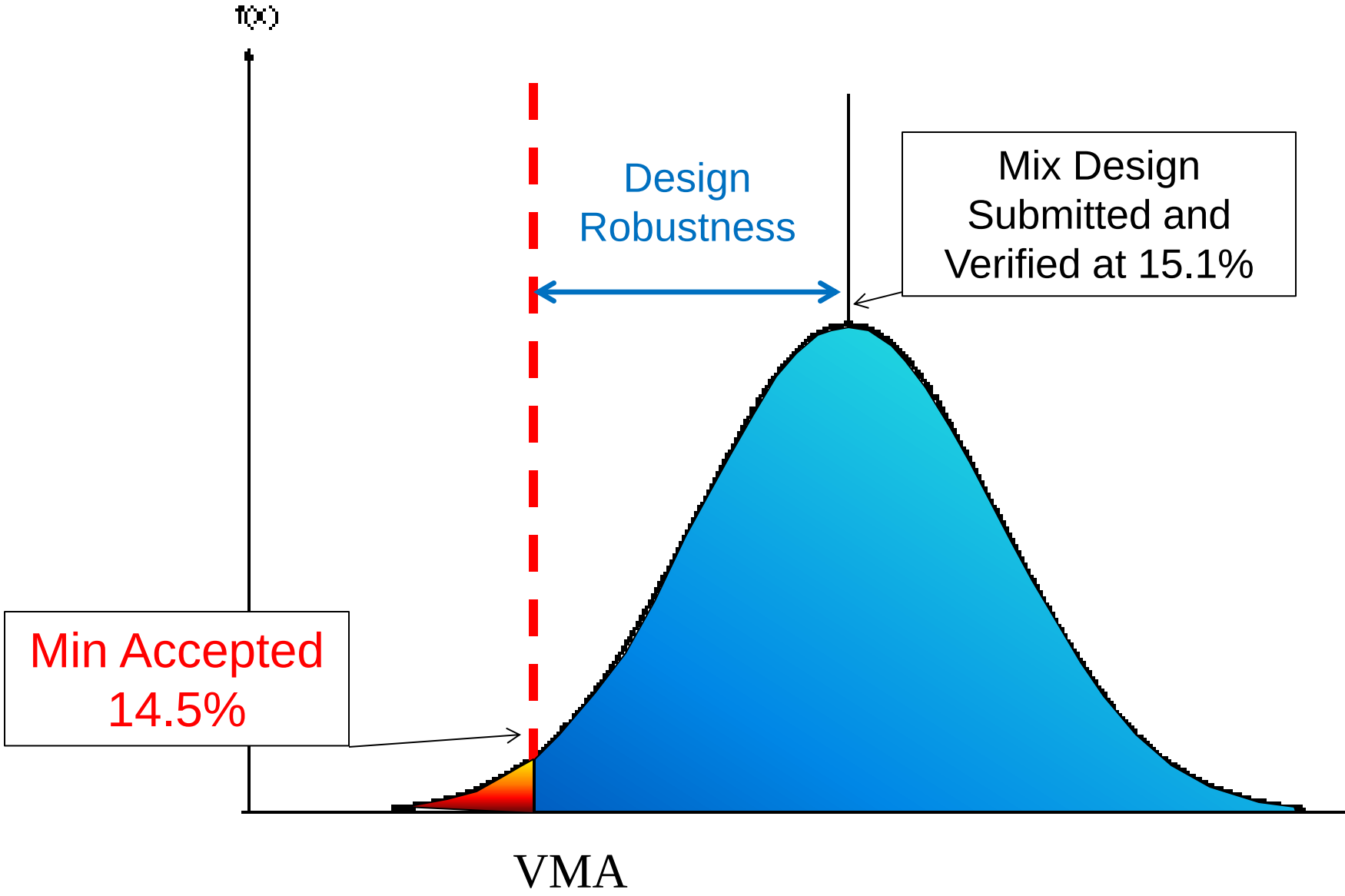


VMA

Normal Distribution



Normal Distribution



Sampling
Another Source of Variability

Avoid the Cliff!

- Don’t carry bad QC/QA habits to PFP or QCP
  - Seek “robust” designs that allow a margin of variability
  - Recognize lab to plant issues i.e. VMA collapse
- Make sure sampling is representative
  - If sample is questionable – combine all material, re-blend and re-split while being witnessed
- Poor sampling, marginal mix design, ignoring lab to plant issues (dust/VMA collapse) and variable aggregate supply
  - Bad combinations!
  - Adds up to Remove and Replace $$$

Tack Coat Special Provision

Spec Features

- **ICT Research Based**
- **Clarification on “Tack Coat” & “Prime”**
  - **“Prime” ~Aggregate bases.**
  - **“Tack Coat” ~ bonding pavement layers.**

Residual Application Rates

Type of Surface to be Tacked	Residual Asphalt Rate lb/sq ft (L/sq m)
Milled HMA	0.05 ± 0.01 (0.23 ± 0.05)
Aged Non-Milled HMA	0.04 ± 0.01 (0.18 ± 0.05)
Fog Coat between HMA Lifts	0.02 ± 0.01 (0.09 ± 0.05)
Milled Concrete	0.05 ± 0.01 (0.23 ± 0.05)
Non-Milled Concrete	0.05 ± 0.01 (0.23 ± 0.05)
Tined Concrete	0.05 ± 0.01 (0.23 ± 0.05)
Brick	0.02 ± 0.01 (0.09 ± 0.05)

New – Dilution is optional

New – Dilution by asphalt source only

SS-1h
(57% asphalt)

source's
quality water

Tack Coat = Emulsion + added water

Tack coat = 8300 lbs SS-1h + 2208 lbs added water

= 8,300 lbs SS-1h (57% asphalt) / 10,508 lbs tack coat

= **45.0 % asphalt**

Source's
Bill of Lading

SS-1h	**8,300 lbs.**
H_2O	**2,208 lbs.**
Tack coat	**10,508 lbs.**

Application Rate Verification

Geotextile Pad for Tack Coat Application Rate Measurement

Residual Asphalt Content

Material	Minimum % Asphalt by Weight
RC-70	60
HFE-90	65
SS-1, CSS-1 SS-1h, CSS-1h SS-1hP, CSS-1hP	57
SS-1vh	50

Method of Measurement & Basis of Payment

- Paid by weight
- Before and after weights
- Yield check performed at least once a day