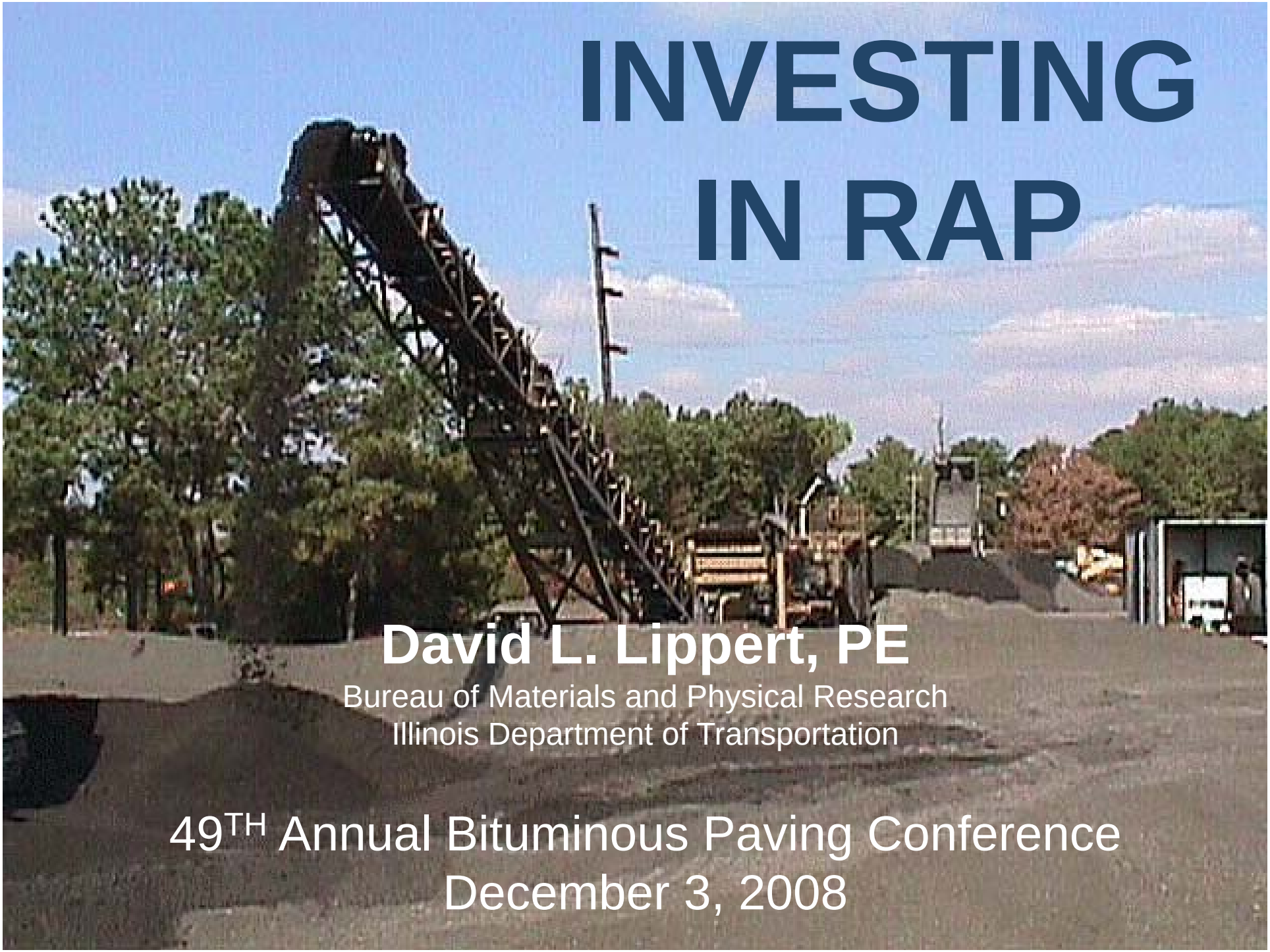

INVESTING IN RAP

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Illinois Department of Transportation

49TH Annual Bituminous Paving Conference
December 3, 2008

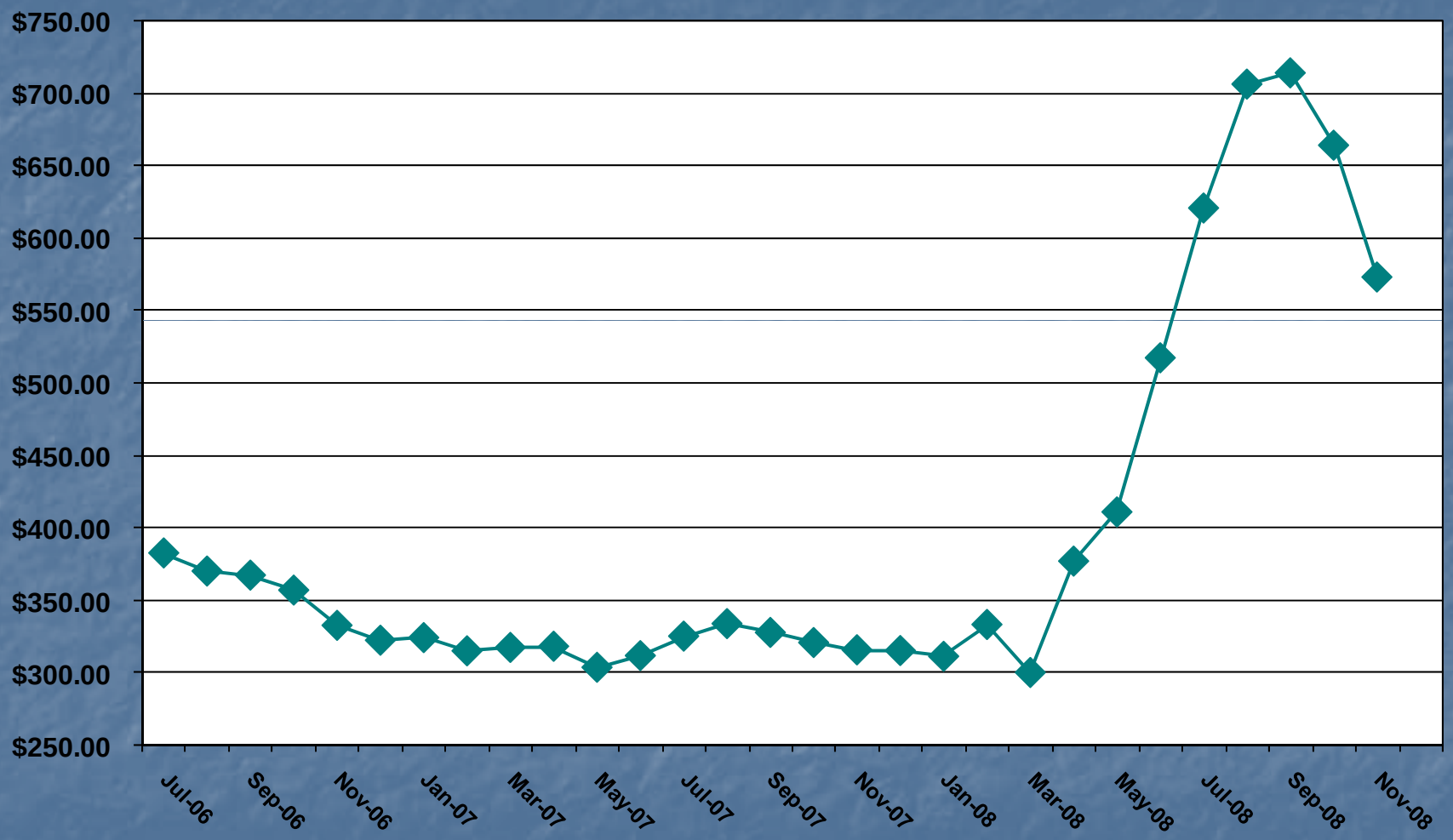
INVESTING IN RAP

- Background
- Barriers
- Research Efforts
  - National
  - Illinois
- Producer Opportunities

Background

- 1980's Roto-milling became popular
  - Urban Areas – saves curb
  - Millings become property of contractor – little control
- 1990's SuperPave and Polymer Mixes
  - Did not allow RAP - Piles of RAP grew
  - Contractors needed to improve pile quality
- 2000's
  - Piles sorted by quality
  - High oil prices – push for increased RAP use

Bituminous Price Index



2007 Max RAP % Changes

N-Design	Binder / Level Binder	Surface	With Polymer
30	30	30	NA
50	25	15	10
70	15/25*	10/15*	10
90	10	10	10
105	10	10	10

Shoulders up to 50%

***RAP Max Percentage if Crushed to -3/8”**

New in 2007

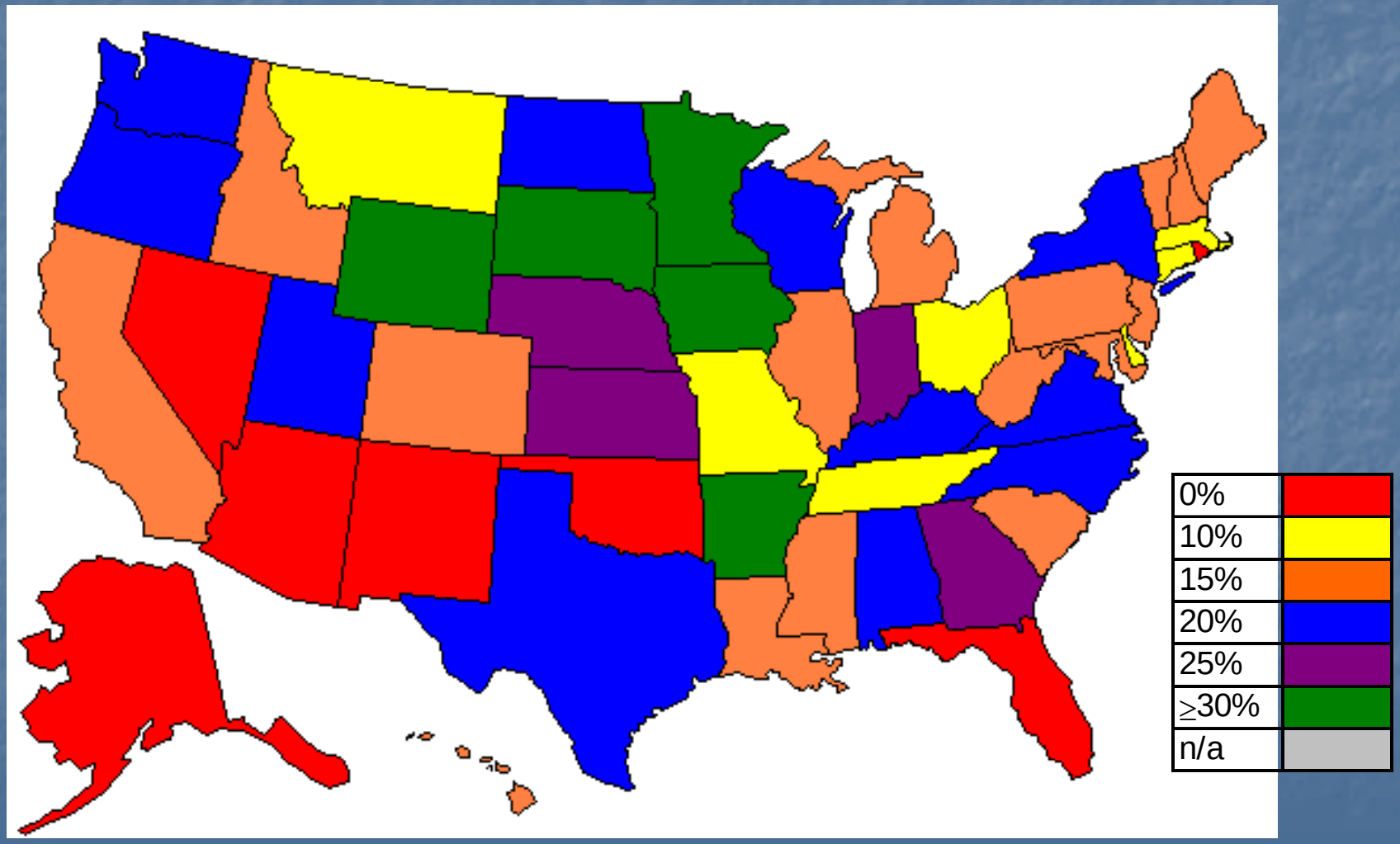
Barriers to Usage of RAP

Agency Survey

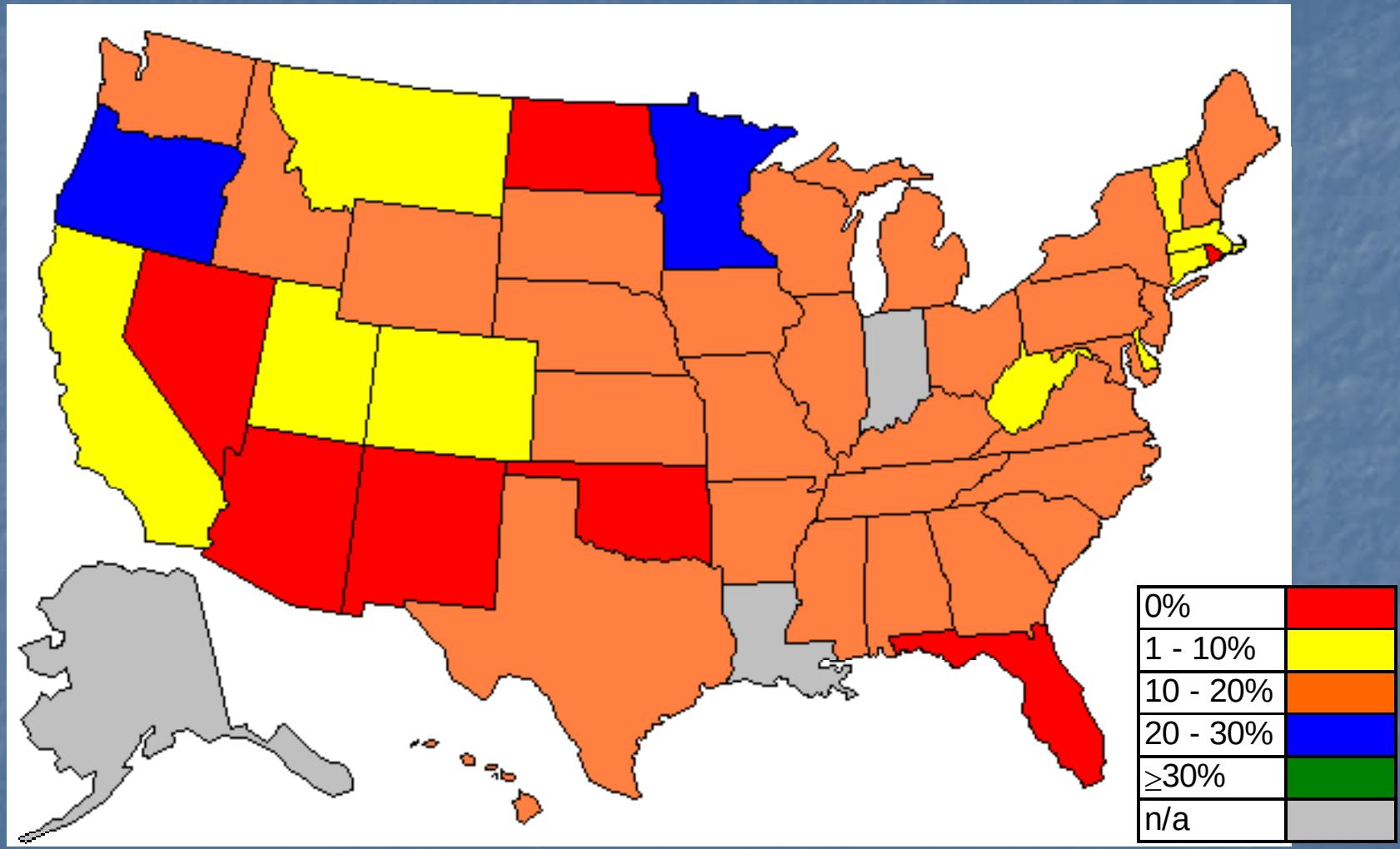
Contractor survey

Agency Survey

Surface Mixes – Allowed (2007 Survey)



Surface Mixes -- Average Use (2007 Survey)



Barriers – State Perspective

- Stockpile Management – Quality/Gradation
- Availability – Used as Aggregate
- AC Binder – Grade Bumping/Final Blend
- Mix – Durability, Testing and Variability
- Contractor – Unwilling to Use
- Specifications – Existing
- Designer – Not Allowing

Producer Survey

Number of RAP Cold Feed Bins

- One 61%
- Two 36%
- Three 3%


Supply of RAP
Stable 51%
Declining 24%
Increasing 25%

RAP Management Practices

- Combine all RAP into a single stockpile

50%

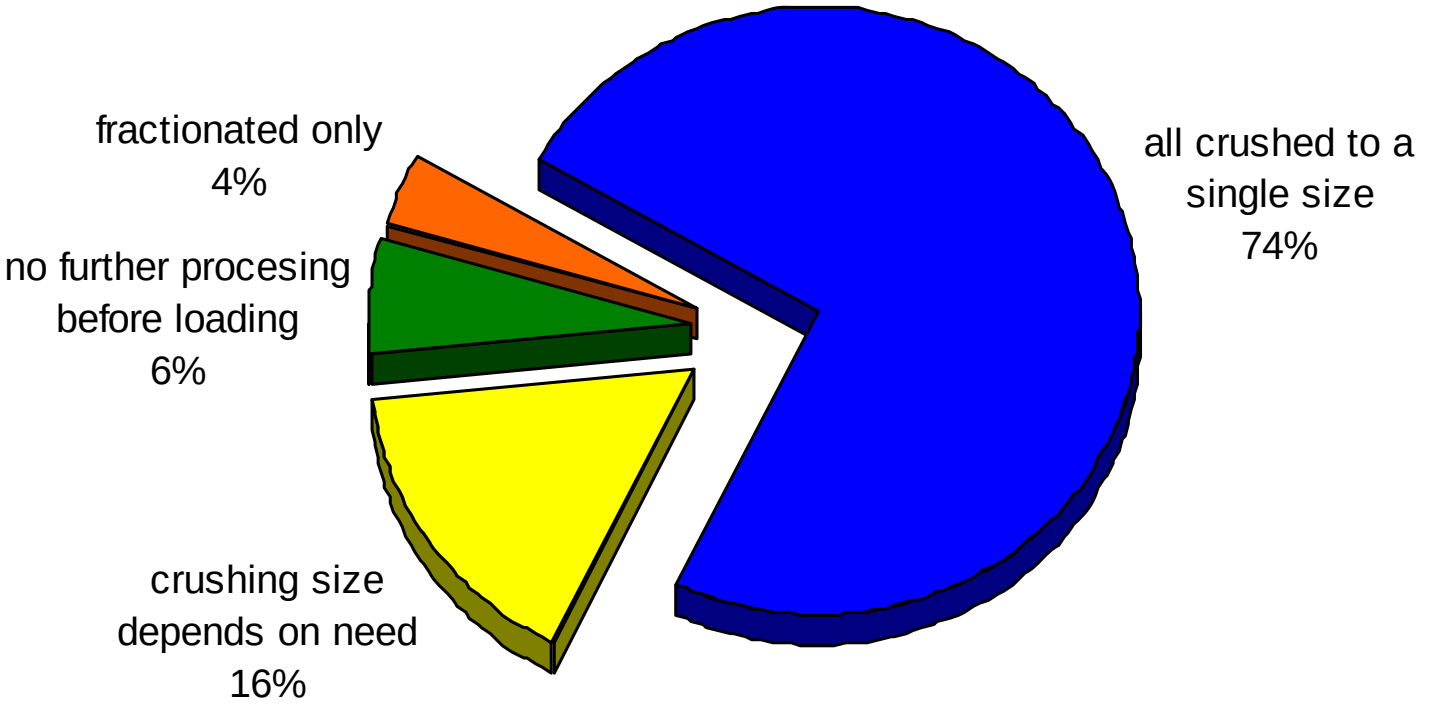
- Maintain separate stockpiles for different sources of RAP

50%

Producer Reasons Given for Separate RAP Stockpiles

- Required by state
- To keep millings separate from multiple source RAP
- To improve consistency with RAP stockpiles

RAP Crushing & Processing



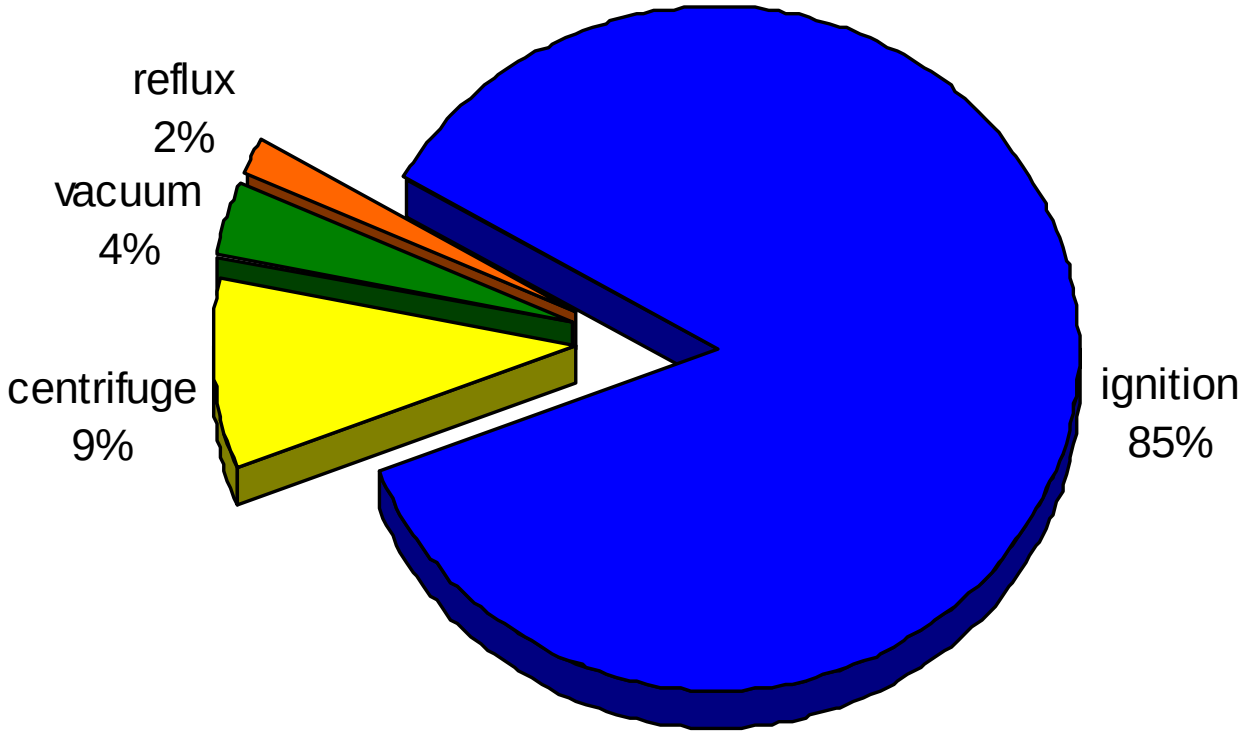
RAP Crushing: Max Size

Screen Size	% of Responses
< 1/2 inch	6%
1/2 inch	52%
5/8 inch	16%
3/4 inch	11%
1 inch	5%
> 1 inch	11%

Quality Control: Frequency of Testing RAP Stockpiles

Testing Frequency (one test per…)	% of Responses
500 tons or less	43%
Greater than 500 tons, less than or equal to 1000 tons	33%
Greater than 1000 tons, less than or equal to 2000 tons	20%
Greater than 2000 tons	4%

AC Content of RAP Stockpiles



Producer Key Findings

- Most HMA producers have a limited supply of RAP (only 27% of producers have enough RAP to run 25% in all mixes)
- Nearly half of producers use the same RAP% in surface and non-surface mixes
- Most HMA producers claim that the greatest factor limiting RAP usage is agency specifications

Producer Key Findings

- Most HMA producers do not use best practices for RAP management
  - Separate stockpiles for different sources
  - Screening/Crushing to minimize dust
  - Minimizing moisture in RAP stockpiles
  - Fractionating RAP
- Meeting volumetric properties during production is the second most cited limiting factor for increased RAP usage

Producer - Key Barriers

- RAP Pile Management for Aggregate Quality
- Grade bumping at higher RAP Percentages
- Agency Maximum RAP Percentage Limits
- Meeting volumetric properties during production

Research Efforts

National

- NCAT Test Track
- NAPA
- AASHTO/NCHRP
- North Central User Producer Group
- FHWA - RAP Expert Task Group

Illinois Research

- Illinois Center for Transportation (ICT)
  - Determination of Usable Residual Asphalt Binder In RAP
  - Impact of High RAP Content on Pavement Structural Performance
- Bureau of Materials and Physical Research
  - Determination of Aggregate Quality in RAP
  - Trials Using Warm Mix Asphalt W/RAP

Determination of Aggregate Quality in RAP

Goal:

Assign Aggregate Quality (A, B, C or D) to Processed RAP

Aggregate Quality in RAP Study

- Aggregate of Known Quality
- Coating With Asphalt
- Removing Coating.
  - Ignition
  - Extraction w/Trichloroethylene
  - Removal w/N-Propyl Bromide (Safer solvent)
- Re-run Traditional Quality Test on Recovered Material
- Correlate to MicroDeval

MicroDeval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COMPANY, INC.
START
STOP
GILSON
MD-2000
MICRO-DEVAL
JAR LIDS TO LEFT
CLOSE BOTH DOORS TO OPERATE MACHINE


GILSON
COMPANY, INC.
www.globalgilson.com


3/8” Steel Balls
5,000 Grams
Sample + Water

Aggregate “Before”

Aggregate “After”

- 9,500 to 12,500 Rotations
- Break on #12 Sieve
- Measure Percent Passing “Loss”

“Investment” Opportunities for Increasing RAP

- Specification of Max RAP%
  - Must be Able to Control Mix Without Fighting Variability of Segregated RAP
- Reduced Grade Bumping Requirements
  - Warm Mix Asphalt May Reduce Need for Grade Bumping

How to Reduce Variability
of
RAP Usage Above 20%?

Fractionation

Producer Equipment Investment

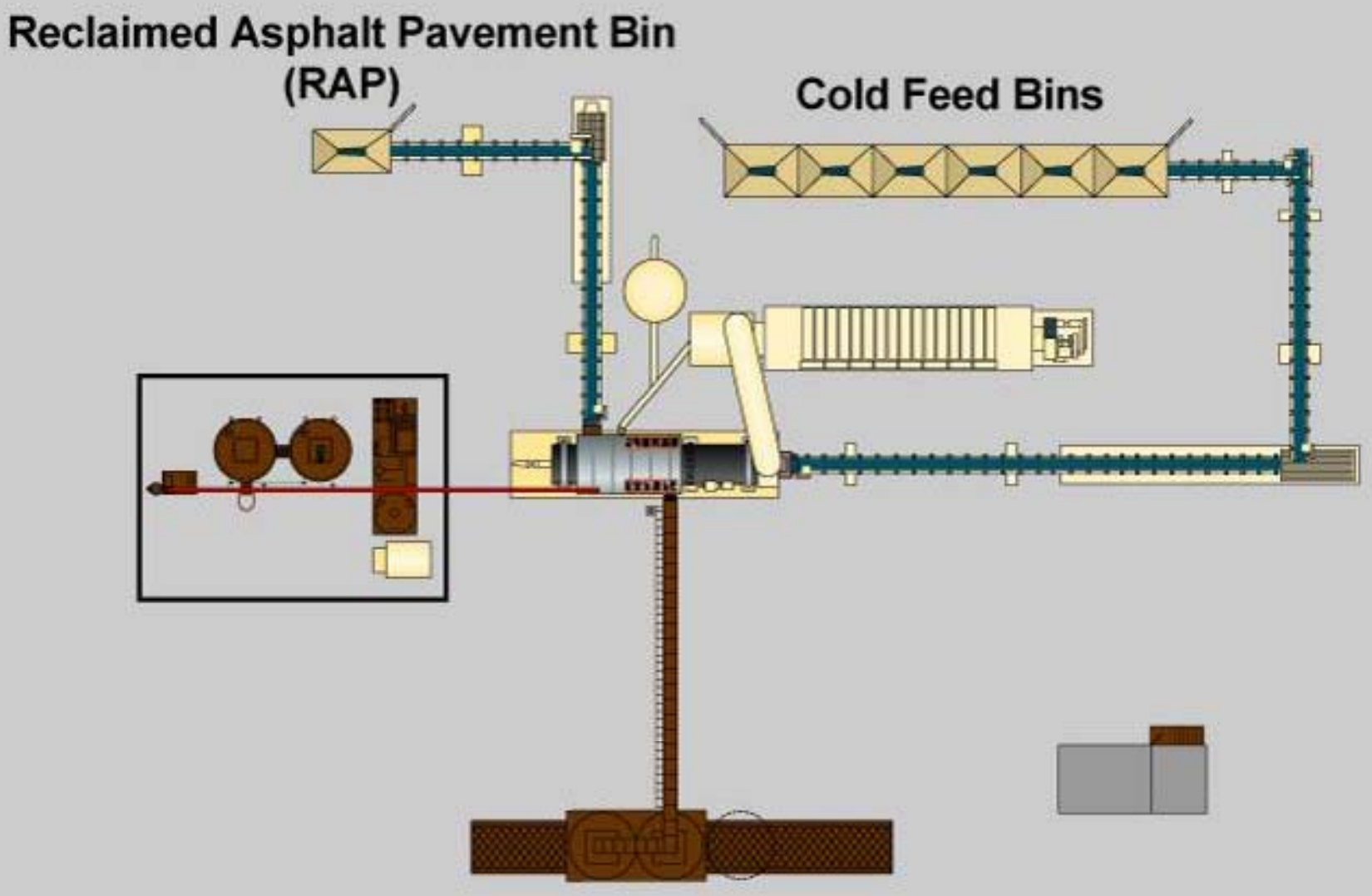
Single Gradation:

Prone to Segregation and High Variability

1/2 x 0

6% AC

Segregated and Variable ~ 20% Max



1980-1990's HMA Facility with Single RAP Bin

Fractionation: Reduces Segregation and Variability

1/2 x 4

4% AC

4 x 0

7% AC


2007 6 7

How to Reduce Grade Bumping when Using RAP?

Warm Mix Asphalt

Shows Promise – Possible Investment for Future

Why Warm Mix Asphalt?

- **Conventional HMA temperature requirement causes “burn off” lighter oils – why grade bump down is needed**
- **Lower temperature mix easier to produce with high RAP percents**
- **WMA – ability to compact mix**
- **Being looked at Nationally by FHWA Expert Task Group – Other states have demos started in 2007**

Trials Using Warm Mix Asphalt w/RAP

- Warm Mix Issues and Possibilities
  - Usage Needs Review Without RAP
  - Some WMA Systems Result in Low TSR's at Production – Long Term??
  - Lower Production Temperatures (Below 285) May Eliminate Need for Grade Bumping
  - Need Trial Sections That Can Be Followed for Performance

Proposed IDOT RAP Specification

- Being Sent Out for Review by BDE in Near Future
- Features Increased RAP of 5 to 10% if Fractionation Used
- Reduced grade bumping if WMA Used
  (Tentative feature –WMA with and without RAP needs more field trials and performance monitoring)
  - Working with Districts to Obtain WMA Trials

Draft Max FRAP % Changes

N-Design	Binder / Level Binder	Surface	With Polymer
30	30 35	30 35	NA
50	25 30	15 25	10
70	15/25* 25	10/15* 20	10
90	10 20	10 15	10
105	10	10	10

Shoulders up to 50%

***RAP Max Percentage if Crushed to -3/8”**

New in 2007

Producer Opportunities To increase Usage of RAP

- Control RAP Gradation (Fractionate)
  - Volumetric Control is Key to Higher RAP%
- Control incoming stockpiles by quality to retain highest usage
  - Surface: A or B Quality
  - Binder: A, B or C Quality
- Hopeful of Positive Outcome in RAP Quality Testing

Resource Links

- FHWA:

http://www.fhwa.dot.gov/PAVEMENT/recycling/rap/index.cfm

- NCAT RAP ETG:

http://www.ncat.us/RAP/RAP.html

ICT:

http://www.ict.uiuc.edu/


Thank You