



TRENDS IN RAP AND RAS USE: BUILDING ON SUCCESS AND EXPANDING THE BOUNDARIES

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Arizona Pavements/Materials Conference

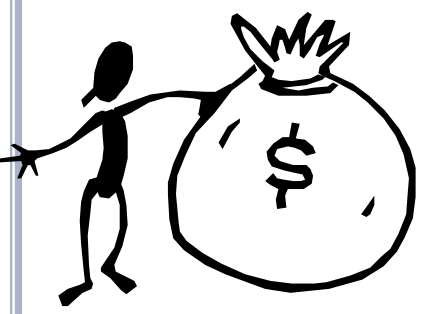
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BUILDING ON PAST SUCCESS



- Asphalt pavement is *the* most widely recycled material in the USA
- 100 million tons reclaimed annually
- 95% is reused or recycled
- \$1.8 billion in savings each year
- Reduces demand for new aggregates and binder and the energy to produce them
- Can perform as well as virgin mixes



TODAY IN THE USA



Strong incentives to recycle more

○ Economics

- Saves money
- Makes contractors more competitive
- Helps asphalt retain market share

○ Environmental

- Increasing awareness, legislation, regulations

INCREASING TRENDS IN ASPHALT PAVING

- Recycling
 - Reclaimed Asphalt Pavement
 - Recycled Asphalt Shingles
 - Ground Tire Rubber
 - Other waste or by-product materials
 - Total Recycle Mix in Illinois
- Warm Mix Asphalt
 - May offer ability to use higher recycled contents through reduced aging

RECLAIMED ASPHALT PAVEMENT (RAP)



Recycling began in USA over 40 years ago because of:

- Arab oil embargo – shortages and high prices
- Environmental concerns
- Development of milling machines

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And today???



WHAT TO DO WITH THE RAP?

CURRENT AASHTO GUIDELINES

- Adjust grade of binder added to account for the hard, oxidized binder in the RAP
 - 0 to 15% RAP, no binder grade change
 - 16–25% RAP, decrease virgin binder grade
 - Over 25% RAP, test RAP binder to determine appropriate virgin grade (or allowable RAP content)
- Percentage by weight of RAP in the mixture.
- Based on non-fractionated mixes with about 5% binder in RAP and new mix.

GUIDELINES MAY BE CONSERVATIVE

- Study for Indiana DOT showed they could use higher RAP contents before changing grade
 - Up to 25% RAP before changing grade
 - Up to 40% RAP by using one grade softer
- INDOT evaluated over 30 RAP stockpiles around the state
 - *They know what their RAP is like*

CHANGES OCCURRING IN US PRACTICE

- States are moving to higher RAP contents in more mixtures (with or without grade change)
- More contractors are splitting the RAP into different size fractions
- More interest in using asphalt shingles; increasing use of tear-off shingles
- More states are expressing RAP content in terms of percent of RAP binder

**FRACTIONATED
RAP =
crushed and
screened into
different sizes**



- Improves uniformity (remixes)
- Allows use of different sizes to meet mix design
- Better control of gradation (and binder content)

FRAP

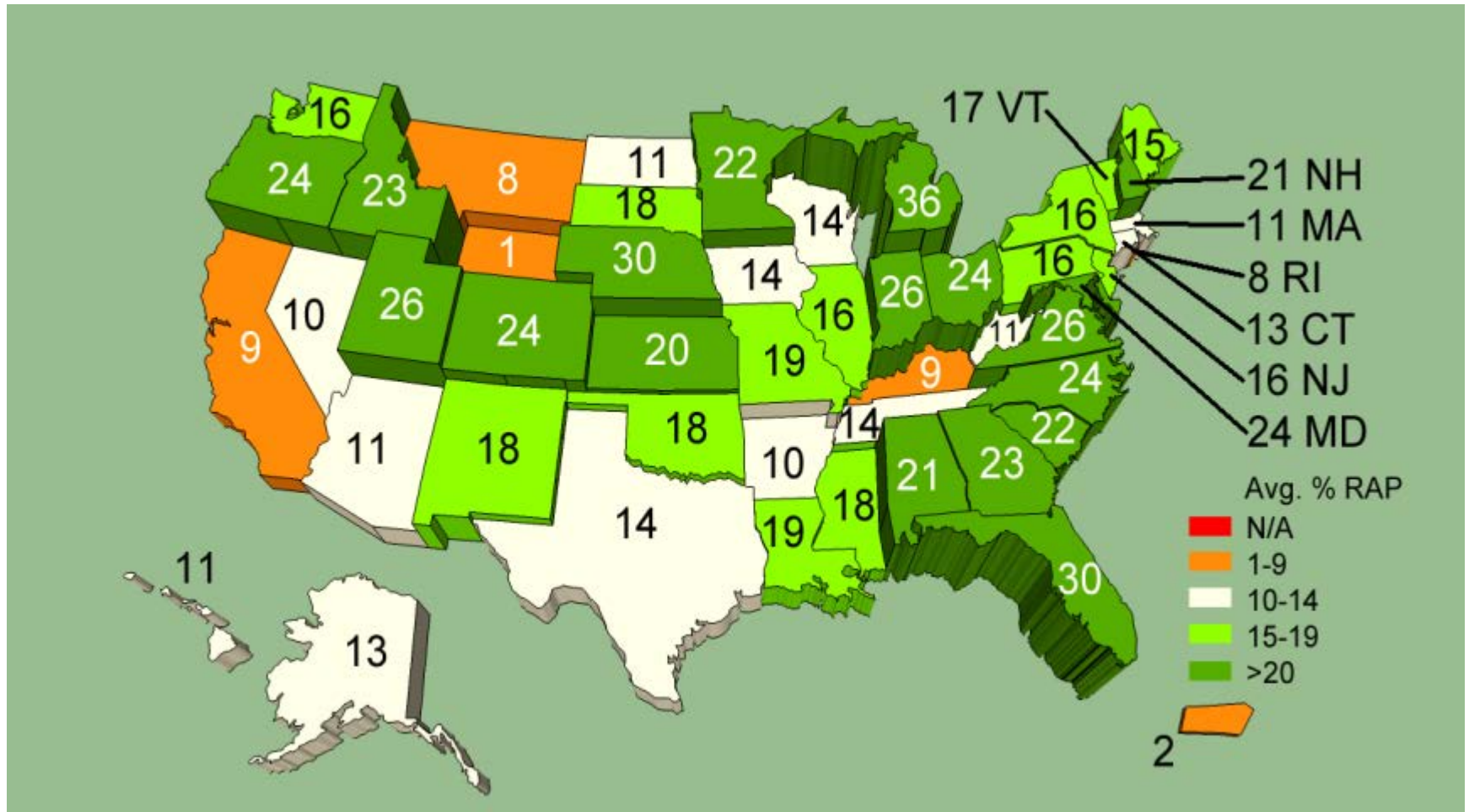


HOW MUCH RAP IS IN AN AVERAGE MIX?



2012 NAPA/FHWA Survey

2011 AVERAGE RAP CONTENT BY STATE



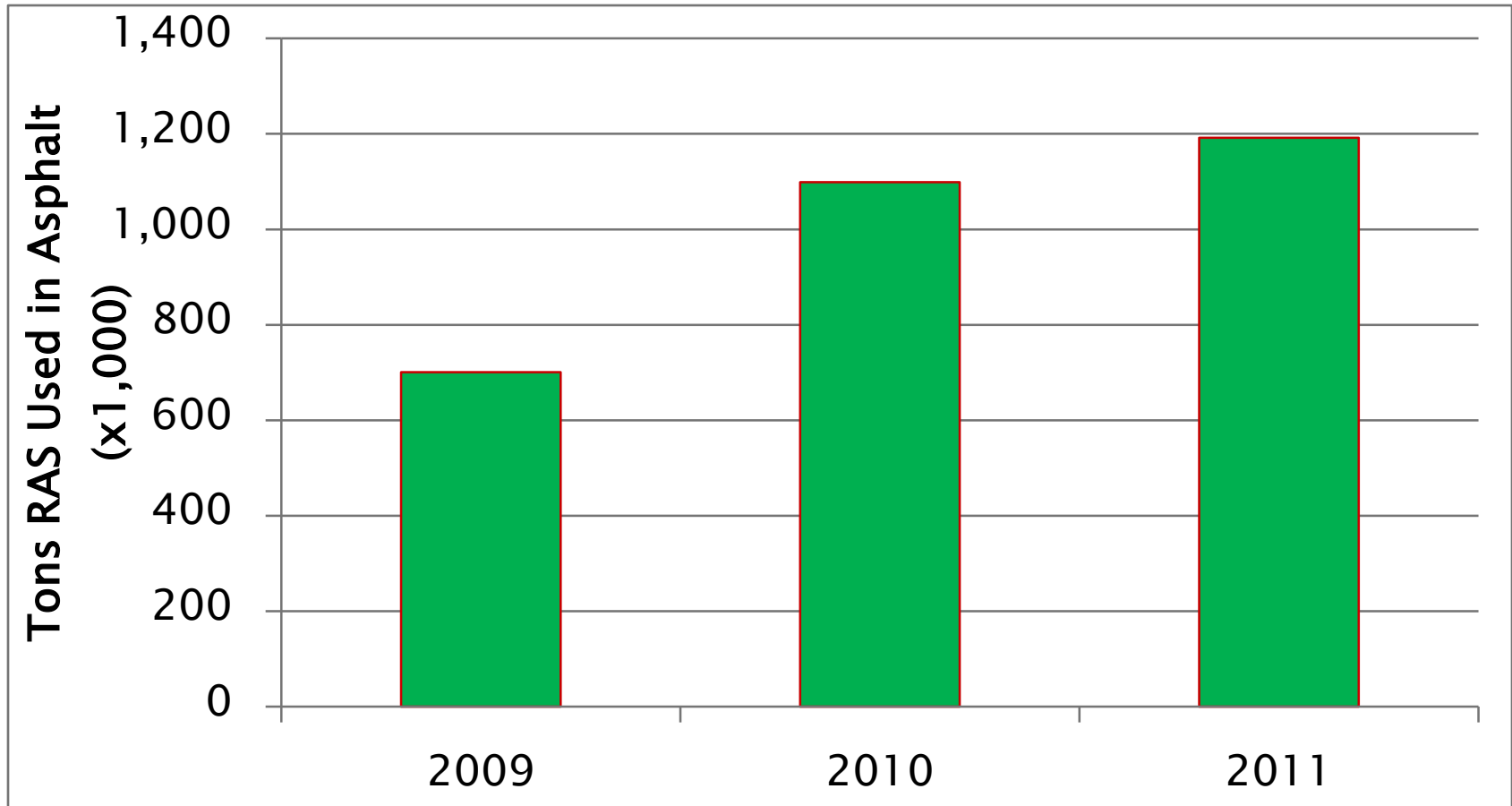
RECYCLED ASPHALT SHINGLES (RAS)



RAS = RECYCLED ASPHALT SHINGLES

- Recycling began in 1970's; increasing last 15 years
- Shingles can have high binder contents, $\geq 30\%$.
 - Contain hard, angular fine aggregate and fibers
 - Good for SMA
- But, shingle binder is very stiff (oxidized) so there is concern about cracking.
- So, allowable shingle content is about 20–25% of allowable RAP content.

TONS OF RAS USED IN ASPHALT MIXES



Asphalt mix producers in 32 States use RAS

BINDER REPLACEMENT

$$\frac{(A \times B) + (C \times D)}{E} \times 100\%$$

where A = binder content in RAP, %

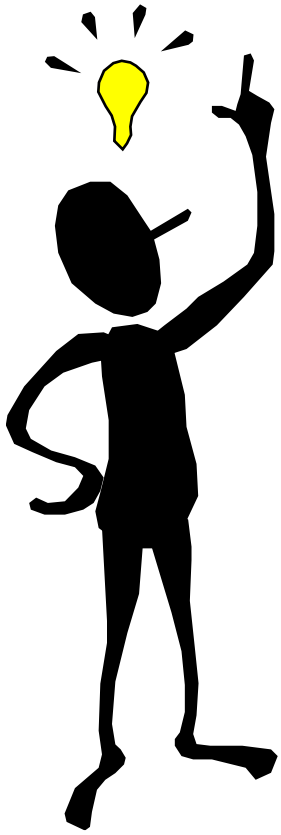
B = RAP content in mixture, %

C = binder content in shingles, %

D = shingle content in mixture, %

E = total binder content in mixture, %

*Alternates: Maximum Reclaimed Binder Content
or Minimum Virgin Binder Content*

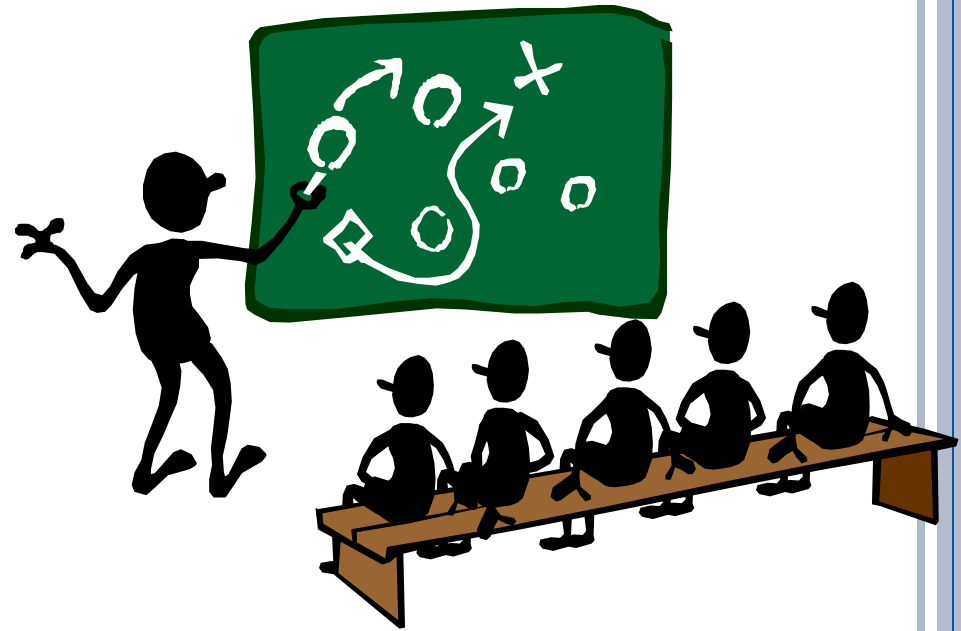


WHAT WE HAVE LEARNED

- High RAP contents can work – can *perform well* – if properly designed, produced and constructed.
- Start with good mix design that accounts for the RAP.
- But, need attention to detail during construction.

BUILDING ON PAST SUCCESS: GAME PLAN FOR INCREASED USE

- Sourcing
- Processing
- Stockpiling
- Reducing moisture
- Control during production



In Composite Pile



*After
Processing*

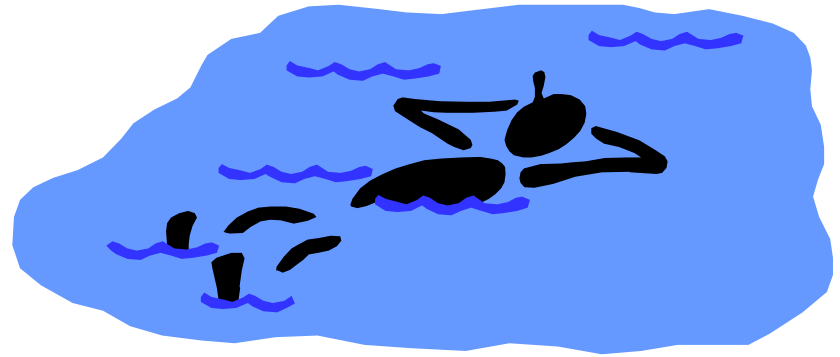


STOCKPILING PRACTICES

- Avoid segregation
- Avoid contamination
- Reduce stockpile moisture
- Test stockpiles regularly – *know what is in your stockpiles!*



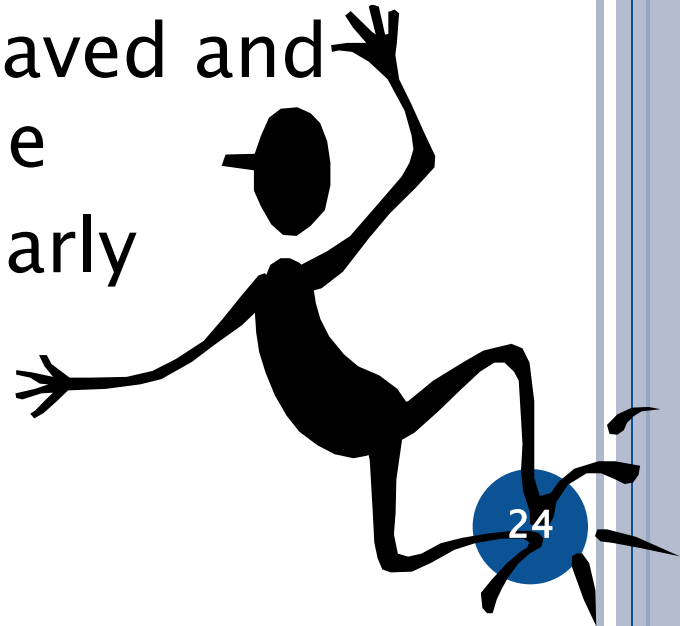
REDUCE STOCKPILE MOISTURE



- Expect to lose 12% production capacity for every percent stockpile moisture above 2%
- Reduce fuel consumption and drying costs by keeping your materials dry
- Lower moisture leads to increased production capacity
- Lower maintenance costs
- Lower paving costs

BEST PRACTICES

- Mill layers separately when you can
- Process RAP and stockpile properly
- Consider fractionating the RAP
- Avoid contamination
- Keep the RAP and RAS dry –paved and sloped area, covered stockpile
- Test the RAP stockpiles regularly
- Watch plant production



CONCLUSIONS



- History of successful RAP and RAS use
- Building on past successful use and expanding
- Asphalt recycling is sustainable
- Asphalt recycling is economical
- Asphalt recycling works!



THANK YOU!

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