Utilization of RAP

NORTH DAKOTA ASPHALT CONFERENCE
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History

- Many recycled products have been utilized in HMA
  - Glass
  - Used Tires
  - Roofing Shingles
  - Industrial Byproducts

What is RAP ?

Reclaimed **A**sphalt **P**avement

Old asphalt pavement that has been removed from the roadway by either full-depth removal or milling.

RAP Stockpile


PR-1200
cmi
44

RAP Stockpile

RAP History

Our transportation system is costly…But it also represents an investment turned into a savings account…

Where does it go?

- Landfill
- Embankments
- Roadbeds
  - Base and Subbase
  - Shoulder Widening
- New pavement
  - Highest and Best Use

Roadbeds

Value is roughly equal to granular base


2006 6 6

Roadbeds

Value is roughly equal to granular base Replacement Value Plus...

$ Reduced Haul if processed in place

$ Conservation of aggregate resources

$ Overall economics (Fuel Consumption & Equip. Savings)

This historically accounted for the largest recycling tonnage

Shoulders

Value is greater than granular material + increased structural number

- $ Reduced Haul when processed and left in place
- $ Conservation of aggregate resources
- $ Overall economic benefit and less shoulder maintenance
- $ Energy savings vs. paved shoulders
- $ Safety of wider shoulder

Milling pavement

Millings added to Shoulder

Finished RAP Shoulder

RAP Shoulders

RAP Shoulders

RAP Shoulders

RAP in Recycled New Pavement

Value = Virgin Aggregate + Asphalt cost

20% RAP on a 50,000 ton DOT Project

10,000 tons of RAP @ 6.0% Asphalt

- 9400 ton Aggregate @ $20 = $188,000
- 600 tons of Binder @ $550 = <u>$330,000</u>
- *TOTAL* *$518,000*
- *or* *$10.36/project ton*

RAP in New Pavement: Case Study

Illinois Tollway Authority (Since 2005)

- RAP Usage: 1.8 million tons (enough to fill Soldier Field Stadium from top to bottom)
- Asphalt Cement: Saved nearly 4 million barrels of liquid asphalt
- Scrap Tires: Utilized more than 228 thousand for better durability, lower noise levels, and better friction values
- Saved $10 million, about $1/ton per 1% RAP usage…15% RAP = $15 ton savings

RAP in New Pavement: Case Study

SDDOT

- Since expanded use in 2006, RAP: 600k tons
- Asphalt Cement: Saved nearly 36,000 tons of binder
- Saves roughly $3.5 million/year in Program Cost
- Expecting additional value with WMA

Issues to Address

- **Project Planning**
  - **Looking at less dollars available!**
  - **Larger backlog!**
  - **RAP is quality aggregate**
  - **Quantities/Binder selection?**
  - **Sequence of Work…Mill to Mix**
  - **Plan Information (Original Mix Attributes, Original Aggregate Attributes, Original Pavement Thickness)**

Contractor's

- **Knowledge = Quality = Profitability**
  - **Experience utilizing RAP**
  - **RAP creates new volumetric issues (VMA and Va areas)**
  - **Virgin aggregate gradation for RAP**
  - **QC/QA properties**

Mix Issues to Address

- **Long Term Durability**
  - **Binder properties in Superpave testing system using RAP aggregate**
  - **Use of polymer modified asphalts with RAP**
  - **Use of softer virgin binder grades with RAP**
- **ARE the correct Specifications in place?**

National Research

- Numerous Tests at NCAT Test Track & Other Accelerated Testing Sites
- NCHRP 9-12: Incorporation of Reclaimed Asphalt Pavement in the Superpave System
    - Black rock argument
    - Binder grade selection
    - Mixture and pavement performance

NCHRP 9-12 Conclusions

- RAP is not just a Black Rock.
- Significant binder blending occurs.
- Significant binder savings will occur.
- Mixtures will perform if sufficient preliminary engineering is conducted.

RAP + Virgin HMA

- Equivalent Aggregate Characteristics
- Proper Binder Grade
- Quality Control
- Construction Specifications

RAP Management

Knowledge of the RAP Quality is essential!

- Binder Quantity
- Binder Grade
- Gradation
- CAA
- FAA
- F&E
- SE

The Big Question

How Much RAP Can Be Utilized?

- Specifications
- Existing RAP Properties
- %’s up to 50% are common
- %’s over 50% are being experimented with

High levels of #200 material

- Milling RAP generates #200 material
- Fractionating / Crushing generates #200
- #200 may often limit the amount of RAP that may be added to Specification HMA
- Consider mixes or virgin aggregate combinations that can accommodate the high #200

Steps to minimize excess # 200

- If possible, screen RAP before crushing
  - Less material to crush
  - Creates less dust
- Adjust milling operations
  - Travel speed
  - Milling head speed
  - Depth

So how much RAP can I add?

- Depends on the Specifications
- Higher %'s require increased QC
- Preliminary testing and design considerations are necessary
- Pick and choose where to use your RAP

Knowledge = Quality = Profitability

Field Issues

- Field control of volumetrics
- Consistent RAP
  - Quantity
  - Quality
- Air voids (RAP binder content)
- Field VMA specification
- Inplace density

The Bottom Line

Reclaimed Asphalt Pavement:

- Saves dwindling aggregate resources
- Recovers non-renewable petrochemical resources
- Diverts large volumes of materials from overloaded landfills
- Reduces road building costs
- Available close to the market
  - reduces trucking