Thursday Afternoon (May 4, 2007)

McDaniel

- FHWA website some issues with old versions of specs
- Discussed status of RAP use in states
- Several states allow more than 25% RAP
- Some states allow 40% or more, however not necessarily used
- Big difference in controlling RAP
- States concerned about frictional properties
- Issues with polishing in some areas
- Passed out survey from link
- Ewa compiling a summary of RAP use in each state, looked at current specs and went to state sites (by the end of May)
- Update Illionois spec
- Texas has a new spec that allows 35% if RAP is fractionated stop at 15-20% if not fractionated

Dave N.

In the past:

Did not control mix

RAP became way to cheapen mix…no maximizing recycling

Did not go beyond comfort level

Survey on use of RAP or contractors

75% people putting RAP back into HMA (1st largest use)

How much RAP allowed, used, potential in surface ? \

Greatest percent in 10-20% range

Average used is 12%

RAP mostly used in Base

Average 27% allowed

RAP in SMA

Average allowed 3%

Used 1%

Potential 11%

Work with states to allow more RAP

Issue with volumetric, milling uses many fines, thus limiting rap since fines are limited

Not a lot of consistency between states

Higher RAP designs require extra work

Look at regional RAP piles most likely will see trends

Mix design test in lieu of blending chart

NCHRP 452 Technicians manual is a good resource

NEED PERFORMANCE TESTING for RAP

Nchrp 455 quality control GUIDELINES

Processing rap report by kent hanson

Amount of RAP dependent on plant type

Obstacles

Binder characteristics

No. 200 sieve

Consistency is key
Need performance especially for cracking

Open conversation discussing RAP obstacles and research

- 50% RAP mixes are feasible
- French are looking at using 100% RAP
- Higher temperatures are harder on the metallurgy of plants
- Internal moisture will crack aggregate at high temperatures
- Part of the committee felt fractionation would be needed for 50% RAP
- Variability of RAP aggregates, binder characterization, and P 200 can be obstacles to higher content RAP mixes
- Variability of RAP is a bigger issue for surface mixes
- Sometimes more surface mix is placed than needed because of compactibility issues
- A method of using thinner surfaces should be developed to reduce the demand for higher quality materials
- Placement of two layers simultaneously does allow for thinner surface mixes to be placed without sacrificing frictional ride quality or compactibility
- Aggregate properties have a significant affect on RAP performance
    - Limestone tends to be very variable
- Some felt aggregates are not the biggest issue
- Some of the panel felt that variability comes from blends
- Screening RAP would help
- Some felt that the variability associated with screened RAP is lower than virgin material
- Fines removed from RAP can be used in SMA as filler
- NAPA survey encompasses both commercial and agency work
    - Commercial work tends to use more RAP
- RAP is worth what it replaces and should not be treated as a crusher run
- Three major areas for research
- long term performance with higher %
- how to design
- construction practices
- 90% RAP was originally surface mix and had a high grade aggregate
- Surface mixes have a high percentage of aged material
- Florida—milled off various levels generally if not cracked most aging in top ¼ of an inch
    - Milling deeper will yield good materials still
- Performance information on RAP mixes is hard to come by
    - A database of RAP performance is needed
- Some felt that states in general do not do a good job in evaluating virgin nor RAP
- What is the worst that can happen to you with RAP
    - Early pavement failure that could set industry way back
    - Does anyone know of anyone who has had a high content rap failure…as far as we know no failures have been attributed to RAP

Developed list of obstacles:

1. Fear agency reluctance

2. Gsb of RAP agg
3. lower PG binders expensive and compactability
4. Degree of co-mingling of binders (RAP/Virgin) in plants (7 votes)
5. Effect of RAO and Virgin binders on co-mingling -> mix tests
6. Replicating RAP and virgin plant heating in labs (6 votes)
7. Compatibility of binders
8. polymer in RAP piles different types of polymer
9. extraction and recovery of RAP binder
10. defining RAP – procedure for determining components characteristics
11. Variability of RAP—(agg, ac/content, modification, binder characterization) (5 votes)
12. Space limitation for multiple RAP piles at plant sites
13. standards for quality management of materials
14. long term performance test
15. existing spec are method specs
16. quality recycle same as virgin mixes keep same requirements in specs
17. agency ownership of RAP (agency has no seen lower prices for RAP mixes
18. characterization of RAP (Gsb, Pb, binder props)
19. resistance to use of extraction solvents
20. In-situ, rapid test for characterizing RAP
21. answering/addressing fears with legitimate info
22. Long term performance of high rap mixes
23. mix design procedures when using RAP
24. Not controlling RAP – treating as a crusher run
25. mix test for mix out of plant (compare virgin to recycle –performance test
26. perception of RAP mixes as lower value "AASHTO" best practices needed
27. getting info out to users
28. getting states with no or low % RAP specs up to speed with current practices (6 votes)
29. availability of RAP (state ownership, trading RAP/Base)
30. limitation of existing plant infrastructure
31. binder replacement not equal to RAP % --e.g. shingles
32. low temp grade of blended binder to solve problem of cracking when pavem is already cracked
33. documenting field performance of high rap mixes (8 votes)
34. the requirement to change the PG grade of the virgin binder
35. aging of mixes – using models to estimate aging and use to select virgin ac
36. processing/fractionating RAP (5 votes)
37. promote positives (saves nat resources and money)
38. recommended practices based on % of RAP
39. move towards in place recycling (100%)
40. policies and specs aren't clear for local use
41. not using existing test to discriminate/weed out bad mixes
42. lack of aging in APTs to validate performance
43. number of variable between lab conditions and field
44. how do we ensure we will get adequate friction

45. want finished mix to have desired properties
46. missing best practice manual for mix design and construction
47. study on long term performance of Rap mixes (aging, durability, low temp cracking
48. Diversity of equipment for processing and plants

Combine:
#47, 22, 25, 14, 45 (27 votes)

- study on long term performance of Rap mixes (aging, durability, low temp cracking
- Long term performance of high rap mixes
- mix test for mix out of plant (compare virgin to recycle –performance test
- long term performance test
- want finished mix to have desired properties

#48, 30 (4 votes)

- Diversity of equipment for processing and plants
- limitation of existing plant infrastructure

#46 and 26 and 38 and 13 (20 votes)

- missing best practice manual for mix design and construction
- perception of RAP mixes as lower value "AASHTO" best practices needed
- recommended practices based on % of RAP
- standards for quality management of materials

#3 and 34 (7 votes)

- lower PG binders expensive and compactability
- the requirement to change the PG grade of the virgin binder

#17 and 29

- agency ownership of RAP (agency has not seen lower prices for RAP mixes)
- availability of RAP (state ownership, trading RAP for Base)

#9 and 19, 18, 2 (14 votes)

- extraction and recovery of RAP binder
- resistance to use of extraction solvents
- characterization of RAP (Gsb, Pb, binder props)
- Gsb of RAP agg

Friday morning (May 5, 2007)
Discussed next meeting
July 9/10
Plant tour in SC
Presented 10 obstacles to RAP (voted on topics based on Thursday's list)

Cecil offered to send out new survey to DOTs to find out their concerns with RAP

1. Study to evaluate and/or develop a performance test that can be used as a guideline for evaluating RAP
2. Development of a best practices manual for mix design and construction which will highlight the advantages of RAP and include guidelines for producing a quality mix with varying levels of RAP
3. Develop a method to characterize RAP which avoids hazardous solvents that will address how to quantify Gsb, Pb, and binder grade of blends
4. Evaluation of Whether or not binder grade changes are necessary
5. Evaluation of the degree of co-mingling of binders (RAP/virgin) in plants
6. Documenting field performance of high rap mixes
7. Replicating RAP and virgin plant heating in labs
8. Getting states with no or low % RAP specs up to speed with current practices
9. Variability of RAP—(agg, ac/content, modification, binder characterization) (5 votes)
10. Processing/fractionating RAP

(Following presentations on website)
Kvasnak gave a brief overview of current RAP research
McDaniel presented work at Purdue on RAP
West discussed high content RAP in NCAT Track (current test sections)
Bahia discussed RAP research from 1990's
Daniel discussed RAP research at UNH
Sebaaly discussed RAP research in Nevada