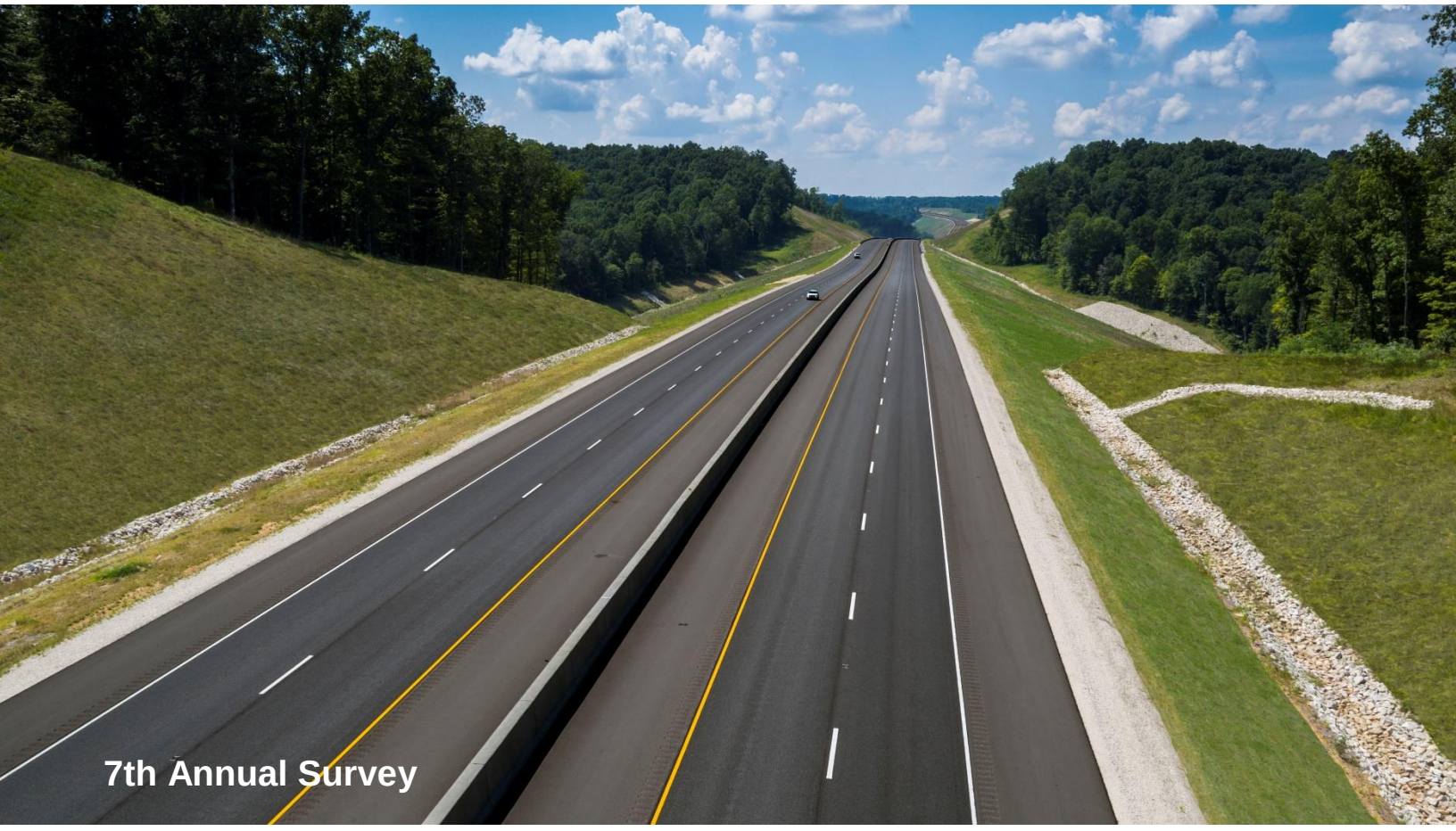
NATIONAL ASPHALT PAVEMENT ASSOCIATION

Asphalt Pavement Industry Survey on

Recycled Materials and Warm-Mix Asphalt Usage 2016

Appendix A:
Methodology & Survey Forms



Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage: 2016 Appendix A

Appendix A to the seventh edition of the *Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage* (Hansen et al., 2017) provides details on the methodology used to collect and analyze the 2016 construction season survey data, as well as reproduces the primary survey instruments used to collect data from asphalt mixture producers and from the State Asphalt Pavement Associations (SAPA).

Survey Methodology

To collect and analyze the data summarized in the main *Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage* report for the 2016 construction season survey, the following tasks were conducted:

1. Develop an online survey that enables an analysis of the quantities of recycled materials being used in asphalt mixtures, as well as the total amount of WMA produced nationally.
2. Conduct a voluntary survey of asphalt mix producers throughout the United States and follow up with verbal requests for information in locations where responses were low.
3. Estimate the total asphalt mixture market in each state or territory by using data provided by SAPAs and the U.S. Department of Transportation federal-aid highway apportionment to determine a weighting factor for each state and reconciling the total U.S. asphalt mix tonnage with national estimates.
4. Analyze and summarize the information nationally and by state and prepare a final report.

The survey was conducted using an online survey platform, SurveyMonkey®. Table A1 summarizes the questions asked in each section of the survey. Sections 1 through 4 have remained consistent from the 2009 to 2014 construction seasons. Additional questions were added to Sections 2 through 4 for the 2015 and 2016 construction seasons to gather additional information about RAP stockpiling, fractionation, the use of softer binders and recycling agents, the acceptance of processed RAS, and the use of WMA technologies at HMA temperatures. Section 5 was added in the 2012 construction season survey to collect information on the use of other recycled material in asphalt mixtures. For 2015, the Section 5 question asking about specific recycled materials was modified to replace one user-provided response with cellulose fiber. A copy of the survey form used to gather information for the 2016 construction season is provided as Appendix A.

Producers were notified of the survey through several forums and electronic media. Notice were placed in NAPA's e-newsletter, *ActionNews*, informing members of the survey and asking for their participation. SAPAs solicited participation by placing notices on their websites and in their newsletters. Announcements were made at NAPA meetings, as well as at several state asphalt conferences. A press release was sent to construction industry trade media, and was published in print and online. Notices of the survey and links were also shared through social media channels, including Twitter, Facebook, and LinkedIn.

Asphalt mixture producers then went to the SurveyMonkey website to complete the survey form. Some producers submitted PDF forms and the data were entered into SurveyMonkey by NAPA. Some multistate producers submitted data using a spreadsheet developed by NAPA. After the initial data was gathered and analyzed, anomalies in individual producer records were identified and reconciled.

Table A1: Survey Questions Summary (Questions Added in 2016 Highlighted in Yellow)

Section 1: General Information	Section 2: RAP	Section 3: RAS	Section 4: WMA	Section 5: Other Recycled Materials
Number of Production Plants	Tons Accepted	Tons Unprocessed Shingles Accepted	Average % Produced for DOT Tons	Were Other Recycled Materials Used (Y/N)
DOT Tons	Tons Used in HMA/WMA	Tons Processed Shingles Accepted	Average % Produced for Other Agency Tons	Other Recycled Materials Used (GTR, Steel Slag, Blast Furnace Slag, Cellulose Fiber, Up to Two User-Provided Responses)
Other Agency Tons	Tons Used in Aggregate	Tons Used in HMA/WMA	Average % Produced for Commercial & Residential Tons	Tons of HMA/WMA Produced Using Each Recycled Material
Commercial & Residential Tons	Tons Used in Cold-Mix Asphalt	Tons Used in Aggregate	Chemical Additive %	Tons of Each Other Recycled Product Used
	Tons Used in Other	Tons Used in Cold-Mix Asphalt	Additive Foaming %	
	Tons Landfilled	Tons Used in Other	Production Plant Foaming %	
	Average % for DOT Mixtures	Tons Landfilled	Organic Additive %	
	Average % for Other Agency Mixtures	Average % for DOT Mixtures	Were WMA Additives Used to Produce Mixtures at HMA Temperatures (Y/N)	
	Average % for Commercial & Residential Mixtures	Average % for Other Agency Mixtures		
	Excess RAP (Y/N)	Average % for Commercial & Residential Mixtures		
	Percentage of RAP Fractionated	Excess RAS (Y/N)		
	Percentage of RAP Mixtures Using Softer Asphalt Binder	What Sectors Allow RAS		
	Percentage of RAP Mixtures Using Recycling Agents	Estimated percent of RAS Binder Blending with New Asphalt Binder		
	Tons of RAP Stockpiled	Percentage of RAP Mixtures Using Softer Asphalt Binder		
		Percentage of RAP Mixtures Using Recycling Agents		

To determine the estimated total amount of RAP and RAS used and WMA produced nationwide and in each state, the total amount of asphalt mix produced in each state needed to be determined. Total tonnage of asphalt mix produced represents both commercial (i.e., private sector) and governmental (i.e., DOT and Other Agency) tonnages. Estimated tonnages for each sector were provided by SAPAs for 34 states/territories, totaling more than 302 million tons. This includes one SAPA that supplied an estimate of DOT-only tonnage. For this one state, total tonnage was estimated by dividing the DOT tonnage provided by the SAPA by the percent of DOT tons reported through the survey by asphalt mixture producers in that state.

To estimate the total tons in states where a SAPA estimate of total tonnage was not available, a power curve relationship based on an examination of the relationship between SAPA-estimated tons and federal-aid highway apportionment for those states was determined, resulting in Equation A1. This is the same methodology used to estimate tonnage in previous versions of this survey, as detailed in Hansen & Newcomb (2011), with the formula updated annually as SAPA-reported estimates and state federal apportionments change.

$$\text{Total Estimated Tons} = 0.0021 \times (\text{State Federal Apportionment})^{1.0869} \quad [A1]$$

Since 2012, 31 states have moved to raise additional local funds for transportation (T4America, n.d.). These additional funds are not accounted for in Equation A1, which can lead to underestimation of total tonnage in some states. This does have an impact on Appendix B and some other the state-level data included in this report; however, it has little impact on national values.

Appendix B and certain tables in this report detail survey responses and estimated values on a state-by-state basis. To keep specific producer data confidential, no state-specific information is provided in the tables or appendix if fewer than three producers from the state responded to the survey. Information from states with fewer than three responding companies is included in the estimated national values, however. Estimates were not calculated for American Samoa, Guam, the Northern Mariana Islands, or the U.S. Virgin Islands due to a lack of producer input and other data sources.

Survey Instrument

As outlined above, the following pages of this appendix provide a copy of the survey instrument used to collect responses from participants. The majority of asphalt mixture producers participating in the survey used the online survey platform SurveyMonkey® to provide their responses. Some producers submitted PDF forms and the data were entered into SurveyMonkey by NAPA staff. Some multistate producers submitted data using a spreadsheet developed by NAPA to collect the same information. The producers version of the survey begins on page 5; the SAPA version begins on page 21.

References

Hansen, K.R., & A. Copeland (2017). *Annual Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage: 2016, 7th Annual Survey* (IS 138). National Asphalt Pavement Association, Lanham, Maryland.

Hansen, K.R., & D.E. Newcomb (2011). *Asphalt Pavement Mix Production Survey: Reclaimed Asphalt Pavement, Reclaimed Asphalt Shingles, Warm-Mix Asphalt Usage: 2009–2010* (IS 138). National Asphalt Pavement Association, Lanham, Maryland.

T4America (n.d.) State Transportation Funding [web page]. Transportation for America, Washington, D.C. http://t4america.org/maps-tools/state-transportation-funding/ [Accessed 22 September 2017]

2016 Construction Season Survey: Producers Version

Recycled Materials and WMA Survey 2016

Purpose

The National Asphalt Pavement Association is working with the Federal Highway Administration to determine the amount of hot-mix asphalt (HMA), warm-mix asphalt (WMA), and recycled materials being produced and used in each state. This survey will be used to collect this data.

It is important for the industry that you complete this survey so that we have accurate information regarding the use of recycled materials and Warm-Mix Asphalt and to identify areas needing assistance in implementation.

DATA FROM THIS SURVEY WILL BE CONFIDENTIAL AND WILL BE USED ONLY FOR THE PURPOSES OF DETERMINING THESE QUANTITIES. IT WILL NOT BE USED FOR ANY OTHER PURPOSE. DATA WILL BE REPORTED BY STATE ONLY,AND NO STATE SPECIFIC DATA WILL BE REPORTED WHEN FEWER THAN THREE COMPANIES/BRANCHES RESPOND FOR A STATE. NO COMPANY-SPECIFIC INFORMATION WILL BE DISCLOSED OR USED IN ANY WAY.

It is recommended that you print a copy of the full survey — downloadable as a PDF from http://goaspha.lt/2016NAPA-FHWASurvey — to make sure you have the necessary data at hand before beginning the online survey.

Companies with multi-state operation may also wish to download a spreadsheet to report their data. Please return the completed spreadsheet to Kent Hansen, NAPA Director of Engineering at khansen@asphaltpavement.org.

Survey results will be shared with industry and government agencies and officials to help in the implementation of recycling and warm-mix technologies.

By completing this survey you will be eligible to receive a complimentary copy of the full report.

Your participation is greatly appreciated.

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Recycled Materials and WMA Survey 2016

Contact Information

The following information will be used only to confirm that we do not get duplicate information from a company and to contact you if we have any questions regarding your answers. Contact Kent Hansen, khansen@asphaltpavement.org, or Audrey Copeland, audrey@asphaltpavement.org, or by phone at 888-468-6499 at NAPA if you have any questions.

* 1. Company/Branch Name:

* 2. Contact Person's Name & Address

* 3. Contact Person's Email

* 4. Contact Person's Phone Number

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Recycled Materials and WMA Survey 2016

State

Please select the state for which you are providing the information.

If your branch operates in more than one state, please complete a separate questionnaire for each state. If a plant provides mix for more than one state, please divide the tonnage accordingly, using your best estimate if specific data is not available.

* 5. Which state is the information provided for?

- Alabama
- Alaska
- American Samoa
- Arizona
- Arkansas
- California
- Colorado
- Connecticut
- Delaware
- District of Columbia
- Florida
- Georgia
- Guam
- Hawaii
- Idaho
- Illinois
- Indiana
- Iowa
- Kansas
- Kentucky
- Louisiana
- Maine
- Maryland
- Massachusetts
- Michigan
- Minnesota
- Mississippi
- Missouri
- Montana
- Nebraska
- Nevada
- New Hampshire
- New Jersey
- New Mexico
- New York
- North Carolina
- North Dakota
- Northern Mariana Islands
- Ohio
- Oklahoma
- Oregon
- Pennsylvania
- Puerto Rico
- Rhode Island
- South Carolina
- South Dakota
- Tennessee
- Texas
- US Virgin Islands
- Utah
- Vermont
- Virginia
- Washington
- West Virginia
- Wisconsin
- Wyoming

* 6. How many plants does this survey response cover?

Number of plants

Recycled Materials and WMA Survey 2016

Total Asphalt Tonnage for 2016

Please complete the following information for the total tonnage of all asphalt production in 2016.

* 7. What was your total tonnage of asphalt mixes in 2016 for the following sectors? (Use best estimate if data is not available.)

State DOT	
Other Agency (City, County, FAA, Military)	
Commercial & Residential	

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Recycled Materials and WMA Survey 2016

RAP Supply and Use 2016

Please complete the following information on the amount of RAP received and used for 2016.

* 8. Did you accept, process, or use RAP in the state during 2016?

- ○ Yes
- ○ No

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Recycled Materials and WMA Survey 2016

RAP Supply and Use 2016

Please complete the following information regarding the amount of RAP received and used for 2016.

* 9. How many tons of removed asphalt pavement and asphalt millings were accepted/delivered to your facilities in the state in 2016?

Tons:

* 10. How many tons of RAP were used in 2016 for the following purposes? (Use best estimate if data not available.)

Recycled Back into HMA/WMA Mixes:

Aggregate Base:

Cold Mix:

Other:

Landfilled:

* 11. What was the average RAP percentage used in asphalt mixes during 2016 for the following sectors? (Use best estimate if data not available.)

State DOT

Other Agency (City, County, FAA, Military)

Commercial & Residential

* 12. At the end of the year 2016 did you have excess RAP (processed or unprocessed) in inventory?

- Yes
- No

13. What percentage of the RAP processed is fractionated into two or more sizes? (Use best estimate if data not available.)

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14. What percent of mixes using RAP were produced using a softer grade of asphalt binder? (Use best estimate if data not available.)

15. What percent of mixes using RAP were produced using rejuvenators? (Use best estimate if data not available.)

16. Please estimate how many tons of RAP you had stockpiled at the end of 2016. (Use best estimate if data not available.)

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Recycled Materials and WMA Survey 2016

Reclaimed Asphalt Shingles (RAS) Supply and Use for 2016

Please complete the following information on the amount of waste shingles received (processed and unprocessed) and used for 2016.

* 17. Did you accept waste shingles and/or process or use reclaimed asphalt shingles (RAS) in 2016?

- ◯ Yes
- ◯ No

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Recycled Materials and WMA Survey 2016

Reclaimed Asphalt Shingles (RAS) Supply and Use for 2016

Please complete the following information regarding the amount of waste shingles received (processed and unprocessed) and used during 2016.

* 18. How many tons of unprocessed shingles (manufacturers waste and tear-offs) were accepted/delivered to your facilities in the state in 2016?

Tons Unprocessed Shingles: _____

* 19. How many tons of processed shingles were accepted/delivered to your facilities in the state in 2016?

Tons processed shingles purchased: _____

* 20. How many tons of reclaimed asphalt shingles (RAS) were used for the following purposes in 2016? (Use best estimate if data not available.)

Recycled into HMA/WMA Mixes: _____

Aggregate Base: _____

Cold Mix: _____

Other: _____

Landfilled: _____

* 21. What was average RAS percentage used in asphalt mixes in 2016 for the following sectors? (Use best estimate if data not available.)

State DOT: _____

Other Agency (City, County, FAA, Military): _____

Commercial & Residential: _____

* 22. At the end of the year 2016 did you have any excess RAS? (Include processed and unprocessed shingles.)

- ◯ Yes
- ◯ No

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23. Is RAS allowed in (check all that apply)

- ☐ All DOT mixes
- ☐ Some DOT mixes
- ☐ Other Agency mixes (some or all)
- ☐ Commercial and Residential mixes (some or all)

24. What percent of the RAS binder do you estimate is blending with the new asphalt binder (enter a number between 0 - 100) *Typical values that have been reported in research are between 60 and 100 percent.*

25. What percent of mixes using RAS were produced using a softer grade of asphalt binder? (Use best estimate if data not available.)

26. What percent of mixes using RAS were produced using rejuvenators? (Use best estimate if data not available.)

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Recycled Materials and WMA Survey 2016

Warm-Mix Asphalt Production for 2016

Warm-mix asphalt is the generic term for a variety of technologies that allow the producers of asphalt pavement material to lower the temperatures at which the material is mixed and placed on the road by 10 to 100 degrees F.

* 27. Did any of your plants in this state use Warm-Mix Asphalt technologies in 2016?

- ◯ Yes
- ◯ No

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Recycled Materials and WMA Survey 2016

Warm-Mix Asphalt Production for 2016

Warm-mix asphalt is the generic term for a variety of technologies that allow the producers of asphalt pavement material to lower the temperatures at which the material is mixed and placed on the road by 10 to 100 degrees F.

* 28. What was average percent of mixes produced using warm-mix asphalt technologies in 2016 for the different sectors? (Use best estimate if data not available.)

State DOT	
Other Agency (City, County, FAA, Military)	
Commercial & Residential	

* 29. What percentage of the total warm-mix asphalt (WMA) for 2016 was produced using the following technologies? (Use best estimate if data not available.)

Chemical Admixture	
Additive (Zeolite) Foaming	
Plant Foaming	
Organic (Wax) Additive	

30. Were warm-mix additive also used in mixes produced at hot-mix temperatures (i.e., without lowering temperatures by at least 10 degrees F.)

- ◯ Yes
- ◯ No

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Recycled Materials and WMA Survey 2016

Other Recycled Material for 2016

Please let us know if you used any other recycled materials in HMA/WMA mixes in 2016.

* 31. Did you use other recycled materials (excluding RAP and RAS) in your mixes in 2016?
(This includes materials added to the mix such as: ground tire rubber, blast furnace slag, steel slag, glass, fly ash, bottom ash, foundry sand, cellulose fibers, etc.)

- ◯ Yes
- ◯ No

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Recycled Materials and WMA Survey 2016

* 32. What other recycled material (excluding RAP and RAS) did you use in your mixes in 2016?

	Yes	No
Ground Tire Rubber	○	○
Steel Slag	○	○
Blast Furnace Slag	○	○
Recycled Cellulose Fibers	○	○
Other 1*	○	○
Other 2*	○	○

* Please describe the other recycled materials used.

* 33. How many tons of HMA/WMA was produced using this product. (Use best estimate if data not available.)

Ground Tire Rubber	
Steel Slag	
Blast Furnace Slag	
Recycled Cellulose Fibers	
Other 1	
Other 2	

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34. How many tons of the recycled product was used in 2016? (Enter 0 if you do not have a reasonable estimate of this quantity)

Ground Tire Rubber	
Steel Slag	
Blast Furnace Slag	
Recycled Cellulose Fibers	
Other 1	
Other 2	

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Recycled Materials and WMA Survey 2016

Thank You

35. Would you like a complimentary copy of the final report?

- ○ Yes
- ○ No

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2016 Construction Season Survey: SAPA Version

NATIONAL ASPHALT PAVEMENT ASSOCIATION

2016 Recycled Materials and WMA Survey SAPA data

Please answer the following questions by April 30, 2017, to help NAPA in preparing the 2016 Recycled Materials and WMA Survey. The additional information you provide us on RAP and RAS will enhance the information we already provide in the survey report. If you have any questions please contact Kent Hansen at khansen@asphaltpavement.org.

Thanks

* 1. Name:

* 2. email:

* 3. State:

* 4. What is your best estimate of the total tons of asphalt mixture placed in your state in 2016. (This includes mixes produced for DOT, Other Agencies, and Commercial & Residential sectors.) [Below are the estimated tons from the 2015 Recycled Materials and WMA Survey for your reference.]

2015 Estimated Tons by State

2015 Estimated Tons by State

State	Estimated 2015 Tons, Million	State	Estimated 2015 Tons, Million
Alabama	7.50	Montana	4.08
Alaska	4.71	Nebraska	3.03
Arizona	6.76	Nevada	3.53
Arkansas	3.20	New Hampshire	1.77
California	25.51	New Jersey	8.66
Colorado	7.20	New Mexico	3.50
Connecticut	3.10	New York	16.80
Delaware	1.71	North Carolina	11.00
District of Columbia	1.72	North Dakota	3.04
Florida	14.39	Ohio	17.4
Georgia	5.00	Oklahoma	6.28
Hawaii	1.72	Oregon	4.85
Idaho	3.98	Pennsylvania	19.42
Illinois	15.80	Puerto Rico	1.00
Indiana	10.50	Rhode Island	2.28
Iowa	3.60	South Carolina	5.45
Kansas	4.00	South Dakota	2.05
Kentucky	6.50	Tennessee	7.76
Louisiana	4.00	Texas	20.00
Maine	2.27	Utah	3.49
Maryland	7.50	Vermont	2.10
Massachusetts	6.20	Virginia	12.50
Michigan	12.60	Washington	5.34
Minnesota	13.50	West Virginia	3.50
Mississippi	4.50	Wisconsin	11.00
Missouri	6.00	Wyoming	2.59
	SAPA Estimated Tons		

5. Comments:

6. Do producers in your state fractionate RAP?

- ◯ Yes
- ◯ No

7. Is RAS allowed in DOT Mixes?

- ◯ All
- ◯ Some
- ◯ None

Comments:

8. Is RAS allowed in Other Agency Mixes?

- ◯ All
- ◯ Some
- ◯ None

Comment:

9. Is RAS Allowed in Commercial and Residential Mixes?

- ◯ All
- ◯ Some
- ◯ None

Comment:

10. Does your state allow, prohibit, or require the use of rejuvenators or softer binders in high ABR mixes? (RAP, RAS, or RAP+RAS)?

	Require	Allow	Prohibit
Rejuvenator:	◯	◯	◯
Softer Binders:	◯	◯	◯

Comments:

11. What limits are put on RAS or combinations of RAP and RAS?

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