

Information Series 138

**2<sup>nd</sup> Annual Asphalt Pavement  
Industry Survey on  
Reclaimed Asphalt Pavement,  
Reclaimed Asphalt Shingles,  
and Warm-Mix Asphalt Usage:  
2009–2011**



This document is disseminated under the sponsorship of the U.S. Department of Transportation, Federal Highway Administration in the interest of information exchange. The United States Government assumes no liability for its contents or use of the information contained in this document.

The contents of this report reflect the views of the contractor, who is responsible for the accuracy of the data presented herein. The contents do not necessarily reflect the official policy of the Department of Transportation.

This report does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade or manufacturer's names may appear only because they are considered essential to the object of this document.



NAPA Building • 5100 Forbes Blvd. • Lanham, MD 20706-4407  
Tel: 301-731-4748 • Fax: 301-731-4621  
Toll free: 1-888-468-6499 • [www.AsphaltPavement.org](http://www.AsphaltPavement.org)  
Publication Sales: [napa-orders@abdintl.com](mailto:napa-orders@abdintl.com) • Toll free: 888-600-4474  
Tel: 412-741-6314 • Fax: 412-741-0609

**2<sup>nd</sup> Annual Asphalt Pavement Industry Survey**

IS-138

Produced April 2013

4. Title and Subtitle 2 <sup>nd</sup> Annual Asphalt Pavement Industry Survey on Reclaimed Asphalt Pavement, Reclaimed Asphalt Shingles, and Warm-Mix Asphalt Usage: 2009–2011		5. Report Date April 2013	
		6. Performing Organization Code	
7. Author(s) Kent R. Hansen, P.E. and Audrey Copeland, Ph.D., P.E.		8. Performing Organization Report No.	
9. Performing Organization Name and Address National Asphalt Pavement Association 5100 Forbes Blvd. Lanham, MD 20706		10. Work Unit No.	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address Federal Highway Administration Office of Pavement Technology (HIPT-10) 1200 New Jersey Ave. SE Washington, DC 20590		13. Type of Report and Period Covered Final  Final Report 2009–2011	
		14. Sponsoring Agency Code	
15. Supplementary Notes FHWA Contracting Officer's Representative: Victor Lee Gallivan			
16. Abstract <p>One of the shared goals of the Federal Highway Administration (FHWA) and the National Asphalt Pavement Association (NAPA) is to support and promote sustainable practices such as pavement recycling and warm-mix asphalt (WMA). The use of recycled materials, such reclaimed asphalt pavement (RAP) and reclaimed asphalt shingles (RAS), in asphalt pavements reduces the amount of new materials required to produce asphalt mixes and materials going to landfills. This is vital to the mission of environmental stewardship and extending the service life of the nation's infrastructure while lowering overall costs.</p> <p>WMA technologies have been introduced to reduce the mixing and compacting temperatures for asphalt mixtures as a means of reducing emissions. Additional benefits include improved compaction of asphalt mixtures leading to improved pavement performance. As part of FHWA's Every Day Counts initiative, WMA was chosen for accelerated deployment in federal-aid highway, state department of transportation (DOT), and local road projects.</p> <p>It is important that the industry track the deployment of these technologies that reduce costs, energy, waste, emissions, and the amount of new materials required for road construction. FHWA has established two survey mechanisms for tracking the use of recycled materials and WMA in asphalt pavements. The first survey tracks state DOT usage and the other tracks industry usage. These have established a baseline of RAP, RAS, and WMA usage and tracked the growth of the use of these sustainable practices in the highway industry.</p> <p>The objective of this survey was to quantify the use of RAP, RAS, and WMA produced by the asphalt pavement industry. Survey results show significant growth in the use of RAP, RAS, and WMA technologies from 2009 through 2011. The asphalt industry remains the country's number one recycler by recycling asphalt pavements at a rate of over 99 percent and almost all (98 percent) contractors/ branches reported using RAP in 2011. The amount of RAP used in asphalt mixtures has increased by 19 percent, from 56 million tons in 2009 to 66.7 million tons in 2011. Assuming 5 percent liquid asphalt in RAP, this represents over 3.3 million tons (19 million barrels) of asphalt binder conserved. The estimated savings at \$600 per ton for asphalt binder is \$1.98 billion.</p> <p>Use of RAS (both manufacturers' scrap and post-consumer shingles) increased 70 percent from 2009 to 1.2 million tons 2011. Assuming a conservative asphalt content of 20 percent for the RAS, this represents 380,000 tons (2.2 million barrels) of asphalt binder conserved. The estimated savings at \$600 per ton for asphalt binder is \$228 million.</p> <p>In 2011, WMA was about 19 percent of the total asphalt mixture market. WMA use increased by 67 percent from 2010 to 2011, and over 300 percent since 2009. Plant foaming is used most often in producing WMA, with about 95 percent of the market. WMA additives accounted for 5 percent of the market.</p>			
17. Key Words Reclaimed asphalt pavement, reclaimed asphalt shingles, warm-mix asphalt, RAP, RAS, WMA		18. Distribution Statement No Restrictions	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 24	22. Price

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

# 2<sup>nd</sup> Annual Asphalt Pavement Industry Survey on Reclaimed Asphalt Pavement, Reclaimed Asphalt Shingles, and Warm-Mix Asphalt Usage: 2009–2011

---

## Executive Summary

The 2011 survey results show that the asphalt pavement industry continues to improve its outstanding record of sustainable practices by further increasing the use of recycled materials and warm-mix asphalt (WMA). The use of recycled materials such as reclaimed asphalt pavement (RAP) and reclaimed asphalt shingles (RAS) conserve raw materials and reduce overall asphalt mixture costs while WMA technologies improve conditions for achieving performance and long life, conserve energy, reduce emissions from production and paving operations, and improve conditions for workers.

The objective of this survey was to quantify the use of RAP, RAS, and WMA produced by the asphalt pavement industry. The National Asphalt Pavement Association (NAPA) conducted a voluntary survey of asphalt mixture producers in the United States and State Asphalt Pavement Association (SAPAs). The survey was broken into four sections: general information, RAP, RAS, and WMA. Asphalt mix producers from 49 states and Puerto Rico completed the 2011 survey. No survey information was available for the District of Columbia or Delaware. A total of 203 companies/branches with 1,091 plants are represented in the 2011 survey. The following are highlights of the 2011 survey:

- The asphalt industry remains the country's number one recycler by recycling asphalt pavements at a rate of over 99 percent. About 98 percent of the contractors/branches reported using RAP in 2011, up slightly from 96 percent in 2010. The amount of RAP used in asphalt mixtures was 66.7 million tons in 2011, a 19 percent increase over the tons used in 2009 (56 million tons) and about a 7 percent increase over the tons used in 2010 (62.1 million tons). Assuming 5 percent liquid asphalt in RAP, this represents over 3.3 million tons (19 million barrels) of asphalt binder conserved. Similar to 2010, less than 1 percent of RAP was sent to landfills.
- Use of RAS (both manufacturers' scrap and post-consumer shingles) increased from 1.1 million tons in 2010 to 1.2 million tons in 2011, an 8 percent increase. Assuming a conservative asphalt content of 20 percent for the RAS, this represents 380,000 tons (2.2 million barrels) of asphalt binder conserved.
- Total tonnage of WMA is estimated at 68.7 million tons in 2011. This was a 67 percent increase over 2010 WMA tonnage (41.1 million tons). In 2011, WMA was about 19 percent of the total asphalt mixture market. Plant foaming is used most often in producing WMA, with about 95 percent of the market; additives accounted for 5 percent of the market.

## Background

One of the shared goals of the Federal Highway Administration (FHWA) and the National Asphalt Pavement Association (NAPA) is to support and promote sustainable practices such as incorporating recycled materials in pavements and warm-mix asphalt (WMA). Reclaimed asphalt pavement (RAP) ranks as the single most recycled material in the United States and is vital to the mission of extending the service life of the nation's infrastructure while lowering overall costs. Another recycled material increasingly used in asphalt mixtures is reclaimed asphalt shingles (RAS) from both manufacturers' waste and post-consumer shingles. The use of RAP and RAS in asphalt pavements reduces the amount of materials going to landfills and can reduce the amount of new asphalt binder required in mixes, which helps to stabilize the price of asphalt mixtures.

WMA technologies reduce the mixing and compacting temperatures for asphalt mixtures. Environmental benefits include reductions in both fuel consumption and air emissions. Construction benefits include the ability to extend the paving season into the cooler months, haul the material longer distances, improve compaction, and use higher percentages of RAP (Prowell, et al., 2012). As part of FHWA's Every Day Counts initiative, WMA was chosen for accelerated deployment in federal-aid highway, state department of transportation (DOT), and local road projects.

FHWA works closely with the pavement industry through associations and other stakeholders to promote pavement recycling technologies and WMA. As part of this effort, FHWA has established two survey mechanisms for tracking the use of recycled materials and WMA in asphalt pavements. The first survey tracks state DOT usage and the other tracks industry usage. Since 2007, FHWA has partnered with the American Association of State Highway and Transportation Officials (AASHTO) to conduct a biennial survey of state DOTs' use of recycled materials (Copeland, 2011; Copeland, et al., 2010; Pappas, 2011) (Copeland, 2011) (Copeland, et al., 2010) (Pappas, 2011). The results of the FHWA/AASHTO survey are typically presented at FHWA Expert Task Group meetings. FHWA partners with NAPA to conduct the survey of asphalt producers to determine industry use of RAP, RAS, and WMA technologies. Both surveys have established a baseline of RAP, RAS, and WMA usage and tracked the growth of the use of these sustainable practices in the highway industry.

The FHWA/NAPA industry survey first began in 2010. The survey results showed significant growth in the use of RAP, RAS, and WMA technologies from 2009 to 2010 (Hansen & Newcomb, 2011). In order to continue to track the use of these technologies, FHWA again partnered with NAPA to conduct a similar survey of RAP, RAS, and WMA use for 2011. This report documents the 2011 industry survey results including the survey methodology, results, trends, and changes from 2009 through 2011. The survey questions and data by state are included in the appendices.

## Objective and Scope

The objective of this effort is to quantify the use of RAP, RAS, and WMA produced by the asphalt pavement industry. NAPA conducted a voluntary survey of asphalt mixture producers in the United States and of state asphalt pavement associations (SAPAs). While keeping specific producer data confidential, NAPA staff compiled the amount of asphalt mixtures being produced, the amount of RAP and RAS used, and the amount of WMA being produced in the United States. The data are broken out on a state-by-state basis in Appendix B. The data are analyzed and summarized in this report.

In order to accomplish this work, the following tasks were conducted:

1. Develop a survey similar to the 2009–2010 survey that enables an analysis of the quantities of RAP and RAS 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 from responding SAPAs and the U.S. Department of Transportation Federal 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.

## Survey Methodology

The survey was conducted using a web survey service, SurveyMonkey®. The survey for 2011 was identical to the survey used for 2009 and 2010 (Hansen & Newcomb, 2011). A copy of the 2011 survey is included in Appendix A. Producers were notified of the survey through several forums and electronic media. A notice was posted in NAPA’s e-newsletter, *ActionNews*, informing members of the survey and asking for their participation. SAPAs participated by placing notices on their Web sites 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 republished to their Web sites. Notices of the survey and links were published through social media channels, including Twitter, Facebook, and LinkedIn. Asphalt mixture producers then went to the Web site and completed the survey form. After the initial data was gathered and analyzed, anomalies in individual producer records were identified and reconciled.

The survey was broken into four sections. These sections were general information, RAP, RAS, and WMA. Table 1 summarizes the questions asked in each section.

**Table 1: Survey Questions Summary**

<b>Section 1: General Information</b>	<b>Sections 2 and 3: RAP &amp; RAS</b>	<b>Section 4: WMA</b>
Number of Plants	Tons Accepted	Average % Produced for DOT Tons
DOT Tons	Tons Used in HMA/WMA	Average % Produced for Other Agency Tons
Other Agency Tons	Tons Used in Aggregate	Average % Produced for Commercial & Residential Tons
Commercial & Residential Tons	Tons Used in Cold Mix	Chemical Additive %
	Tons Used in Other	Additive Foaming %
	Tons Landfilled	Plant Foaming %
	Average % for DOT Mixes	Organic Additive %
	Average % for Other Agency Mixes	
	Average % for Commercial & Residential Mixes	

Most surveys were completed online with one multistate contractor collecting data from its different operations and submitting them in spreadsheet form. Data from the online survey was imported into a spreadsheet and checked for accuracy and missing data. When anomalies in the data were noted, the person submitting the data was contacted to resolve the anomaly.

To determine the total amount of RAP, and RAS used and WMA produced in each state and in the nation, the total amount of asphalt mix produced in each state needed to be determined. Total tonnage of asphalt mix produced represents commercial (i.e., private) and government (i.e., DOTs and local agencies) tonnages. Estimated tonnages were provided by SAPAs in 33 states/territories which totaled about 285 million tons. This included three SAPAs that supplied DOT-estimated tonnages. For these three states, the total tonnage was estimated by dividing the DOT tonnage by the percent of DOT tons provided by asphalt mix producers in that state who completed the survey. To estimate the total tons in states where a SAPA estimate of total tonnage was not available, the total asphalt mixture tonnage was estimated through a relationship developed for those states where SAPA estimated tons were available and their federal highway apportionment. This is the same methodology used to estimate tonnage in the 2009–2010 survey; for more details see Hansen & Newcomb, 2011. This resulted in the following power curve relationship:

$$\text{Total Estimated Tons} = 0.1484 \times (\text{State Federal Apportionment})^{0.8769}$$

This formula was then used to estimate the tonnage for states with no SAPA estimate based on the state’s federal apportionment.

## Survey Results

Asphalt mix producers from 49 states and Puerto Rico completed the survey. There is no 2011 survey information available for the District of Columbia or Delaware. In 2009–2010, 48 jurisdictions completed the survey. A total of 203 companies/branches with 1,091 plants are represented in the 2011 survey. In the 2009–2010 survey, 1,027 plants were represented. Table 2 summarizes the number of companies/branches and the number of plants reporting for each state.

**Table 2: No. of Companies/Branches Completing Survey in State**

State	2009–2010		2011		State	2009–2010		2011	
	Companies	Plants	Companies	Plants		Companies	Plants	Companies	Plants
Alabama	3	17	5	38	Montana	2	4	4	8
Alaska	3	20	2	2	Nebraska	—	—	1	3
Arizona	2	4	4	6	Nevada	2	3	2	3
Arkansas	3	9	2	9	New Hampshire	1	11	1	11
California	6	49	4	48	New Jersey	2	21	3	21
Colorado	8	26	7	24	New Mexico	—	—	1	3
Connecticut	2	18	3	23	New York	13	68	11	64
Delaware	1	3	—	—	North Carolina	6	52	5	29
Dist. of Columbia	—	—	—	—	North Dakota	—	—	3	8
Florida	6	61	4	22	Ohio	5	50	5	87
Georgia	2	16	6	66	Oklahoma	4	20	3	18
Hawaii	1	4	1	7	Oregon	6	10	6	16
Idaho	5	17	3	8	Pennsylvania	17	63	7	34
Illinois	16	44	7	24	Puerto Rico	1	16	1	14
Indiana	3	19	4	29	Rhode Island	2	2	2	2
Iowa	7	16	6	14	South Carolina	4	16	3	6
Kansas	6	25	4	21	South Dakota	1	3	3	9
Kentucky	3	24	4	19	Tennessee	2	10	7	72
Louisiana	2	5	2	5	Texas	7	38	9	41
Maine	2	19	2	17	Utah	5	30	6	17
Maryland	4	10	4	10	Vermont	1	9	1	7
Massachusetts	2	8	2	6	Virginia	5	38	7	26
Michigan	4	40	6	39	Washington	6	39	4	30
Minnesota	2	4	6	26	West Virginia	1	14	3	15
Mississippi	1	12	4	26	Wisconsin	1	3	3	13
Missouri	6	35	7	38	Wyoming	2	2	3	7

The average tons produced per plant was 121,000, 117,000, and 121,000 for 2009, 2010, and 2011, respectively.

Table 3 includes the estimated tonnage for each state as given by the SAPA or estimated from the federal apportionment and includes the reported tonnage for each state from the survey results. Figures 1–3 illustrate the Table 3 data and provide another perspective on the survey responses that represent the ratio of the tons reported in each state to the total estimated tons for each year, 2009–2011. The closer a state’s number is to 100 indicates that the reported tonnage from the survey matches the estimated tonnage provided by the SAPA or estimated from the federal apportionment. The returned survey results represent about 36 percent of the estimated total U.S. tonnage for 2011.

**Table 3: Summary of Estimated and Reported Plant Mix Asphalt Tons by State**

State	Tons (Millions)					
	2009		2010		2011	
	Estimated	Reported	Estimated	Reported	Estimated	Reported
Alabama	7.50	1.75	8.00	1.09	8.00	4.24
Alaska	3.67	0.82	4.41	1.15	5.98	0.20
Arizona	7.50	0.42	7.14	0.71	8.00	0.91
Arkansas	3.05	0.71	4.15	0.78	5.56	0.53
California	19.97	8.44	13.79	7.68	23.00	9.38
Colorado	7.72	3.00	10.52	2.62	6.50	2.50
Connecticut	4.96	2.20	5.01	1.79	4.34	2.95
Delaware	0.79	0.35	0.65	0.25	2.08	—
District of Columbia	1.62	—	1.81	—	1.71	—
Florida	14.70	6.91	13.00	5.81	13.57	3.01
Georgia	13.00	1.39	11.70	1.34	9.50	7.29
Hawaii	1.73	0.40	1.91	0.33	1.81	0.54
Idaho	3.00	1.13	3.09	1.14	3.45	0.56
Illinois	19.25	7.81	17.60	7.17	13.94	2.12
Indiana	9.60	3.28	7.90	3.06	9.50	4.07
Iowa	4.74	3.54	3.45	1.99	3.30	1.31
Kansas	4.17	2.08	7.12	1.85	4.00	1.67
Kentucky	7.00	1.72	7.00	1.74	7.00	1.86
Louisiana	6.00	1.30	6.00	1.30	6.00	0.58
Maine	1.80	1.61	2.03	1.60	1.91	1.56
Maryland	7.20	1.07	6.50	1.06	6.50	1.73
Massachusetts	6.00	1.54	6.00	1.34	6.00	1.17
Michigan	11.50	7.49	10.80	7.03	10.00	6.54
Minnesota	12.50	0.42	13.10	0.29	13.00	4.94
Mississippi	4.62	1.45	4.79	1.41	6.00	2.67
Missouri	7.13	3.02	4.70	3.19	8.00	4.06
Montana	3.78	0.19	3.99	0.17	4.89	0.59
Nebraska	2.96	—	3.09	—	3.37	0.11
Nevada	3.11	0.43	3.57	0.43	4.24	0.43
New Hampshire	1.86	1.25	1.94	1.18	1.92	0.90
New Jersey	9.33	3.28	9.09	2.87	8.73	3.24
New Mexico	3.78	—	3.84	—	4.48	0.52
New York	16.00	5.65	16.00	5.54	16.50	5.88
North Carolina	9.37	4.95	12.11	5.66	11.00	2.90
North Dakota	2.55	—	2.70	—	3.89	1.05
Ohio	14.50	5.69	15.10	6.23	14.30	10.81
Oklahoma	5.74	2.47	5.99	2.16	5.20	1.91
Oregon	5.22	1.27	4.81	1.16	4.91	1.95
Pennsylvania	17.40	10.97	18.30	11.66	16.83	4.17
Puerto Rico	2.49	0.97	1.44	0.75	1.19	0.74
Rhode Island	2.07	0.22	2.34	0.19	1.73	0.21
South Carolina	6.23	1.77	6.14	1.98	6.00	0.85
South Dakota	2.73	0.16	2.96	0.22	2.17	0.93
Tennessee	7.95	1.07	7.87	0.73	9.04	7.05
Texas	14.77	4.23	16.54	5.73	13.67	6.36
Utah	3.14	3.71	3.35	3.23	4.00	2.77
Vermont	1.74	0.51	2.12	0.80	1.96	0.71
Virginia	9.10	4.64	10.90	4.51	13.10	4.06
Washington	5.70	4.65	5.70	4.46	4.20	3.26
West Virginia	2.90	1.40	3.00	1.79	3.75	2.10
Wisconsin	10.52	0.50	11.96	0.50	13.00	1.53
Wyoming	2.77	0.15	2.83	0.20	3.25	0.32
Total	358.43	123.98	359.85	119.87	365.97	130.54

Note: Shaded cells indicate states and years where the SAPA provided data used to compute total estimated value. Where no data was available on total tons, a relationship between tonnage and federal apportionment was used to estimate the total tons for states.



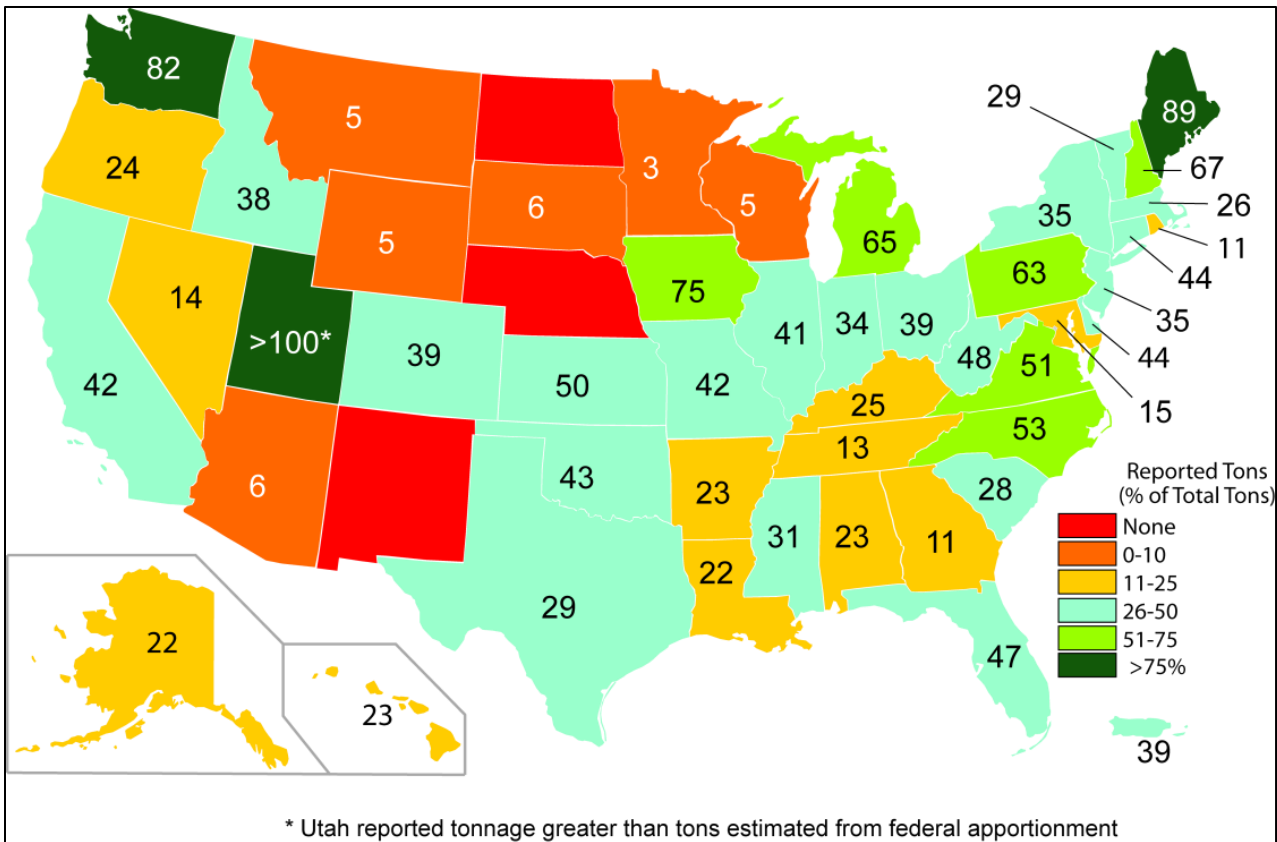


Figure 1: 2009 Reported Tons as a Percent of Estimated Total Tons

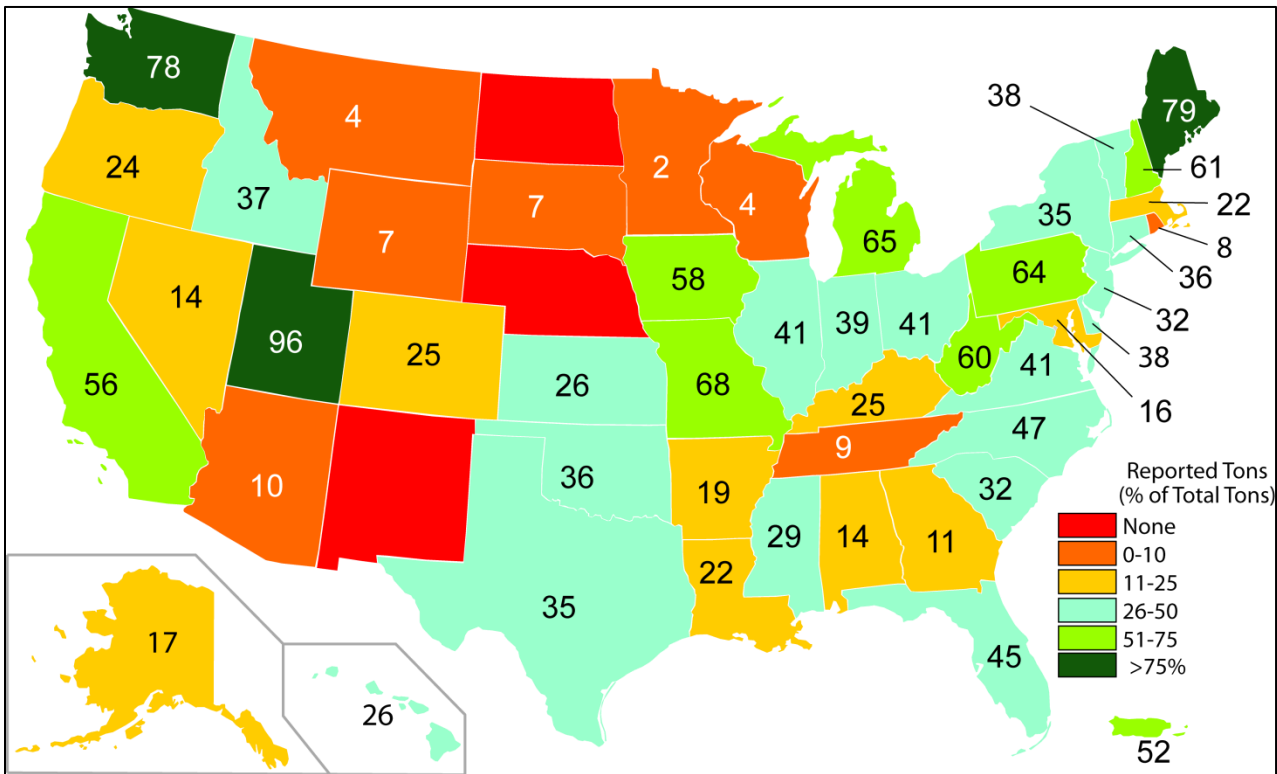


Figure 2: 2010 Reported Tons as a Percent of Estimated Total Tons

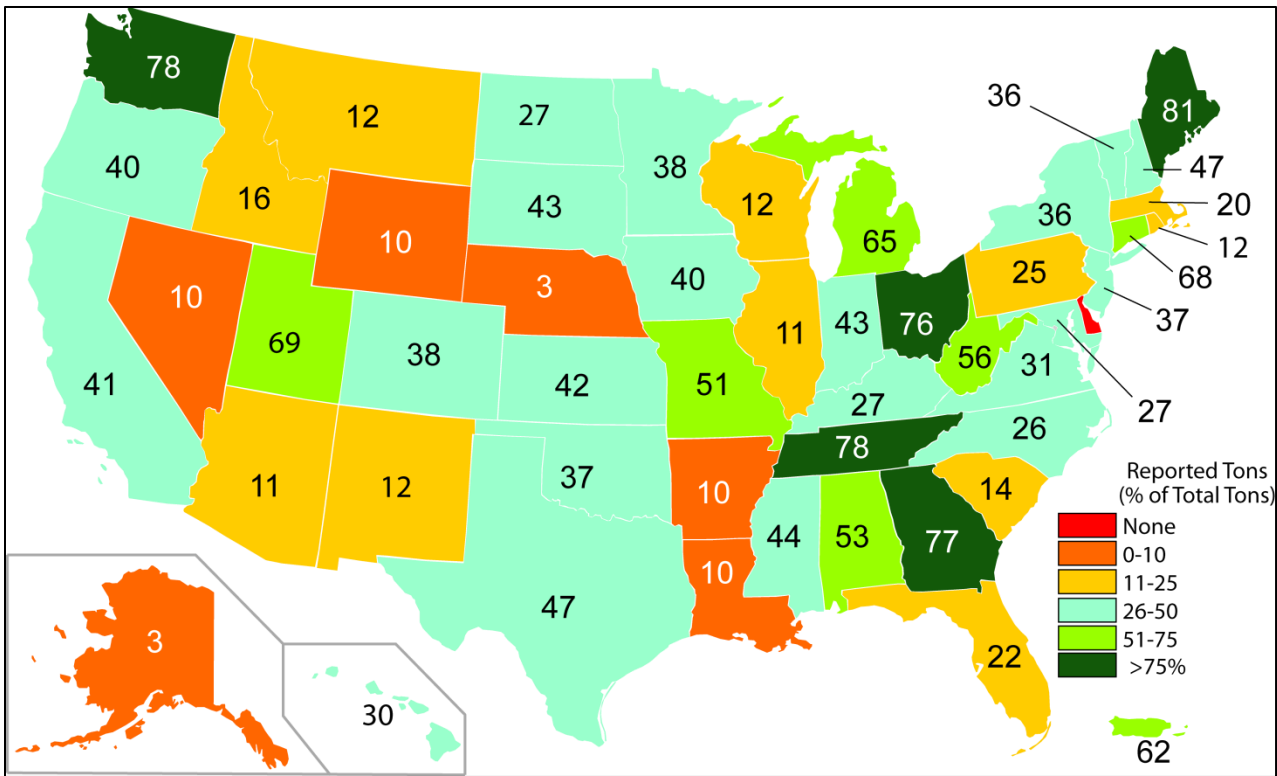


Figure 3: 2011 Reported Tons as a Percent of Estimated Total Tons

Figure 4 shows the number of plants as well as the average tons produced per plant separated by different user/producer group regions. Both the North East Asphalt User/Producer Group (NEAUPG) and the North Central Asphalt User/Producer Group (NCAUPG) have seen a decrease in tons per plant each year since 2009. The Rocky Mountain Asphalt User/Producer Group (RMAUPG), Pacific Coast Conference on Asphalt Specifications (PCCAS), and Southeastern Asphalt User/Producer Group (SEAUPG) have seen an increase in tons per plant from 2010 to 2011.

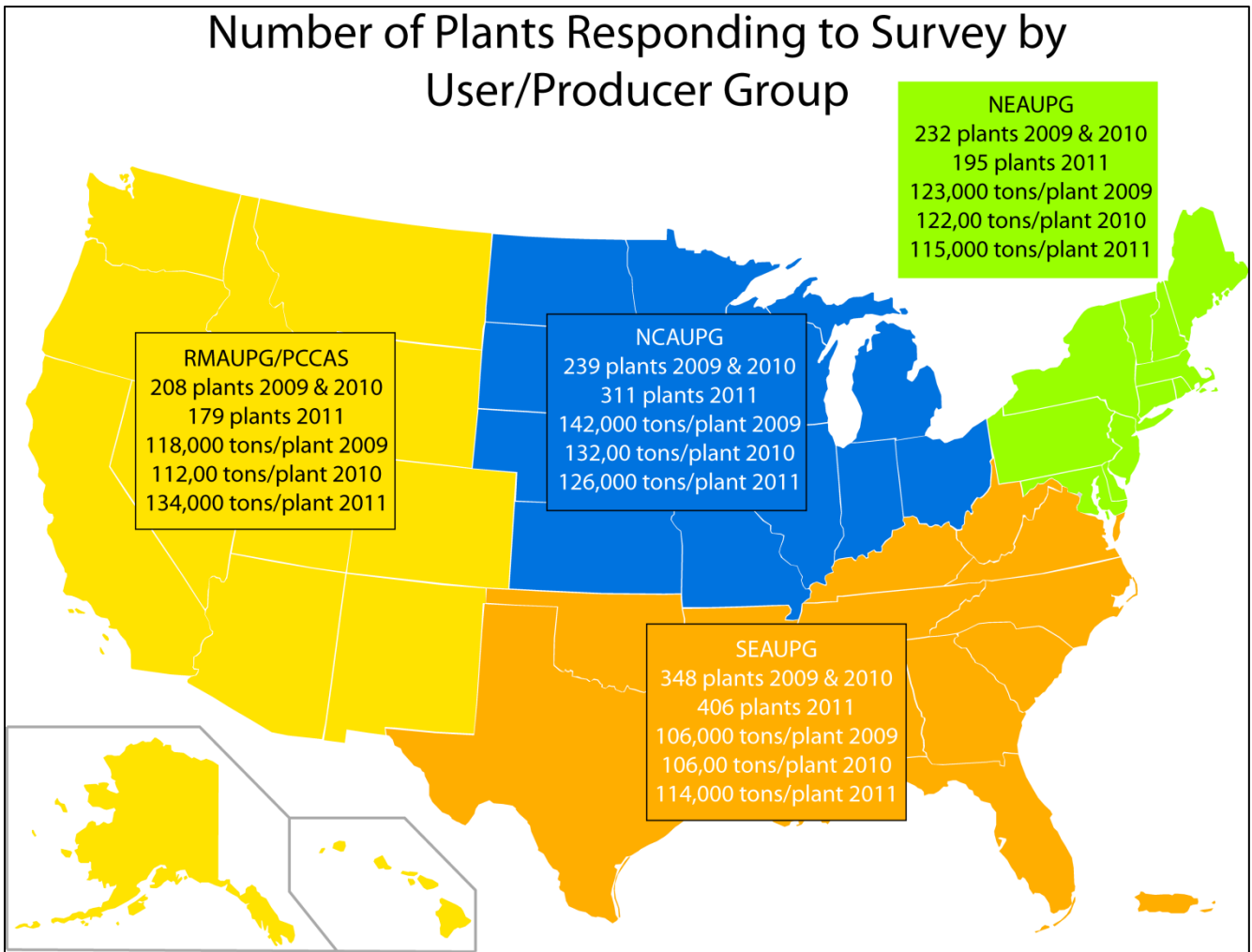


Figure 4: Number of Plants Responding to Survey by User/Producer Group Regions and Estimated Tonnage for Each Year

### Reclaimed Asphalt Pavement

Table 4 summarizes the RAP, RAS, and WMA data from the surveys. The information asked for in the survey is shown in Appendix A and summarized in Table 1. Producers were not asked about allowable RAP or binder replacement requirements. Based on the total estimated tons of RAP received for a given survey year and the amount used for all purposes, including landfilling, there was an estimated 2.3 million, 1.7 million, and 6.3 million tons of RAP stockpiled for future use in 2009, 2010, and 2011, respectively, out of a total of 67.2 million, 73.5 million, and 72.8 million tons received, respectively. Figure 5 is a visual representation of the estimated total tons of RAP used in asphalt mixes, aggregate, cold mix, other uses, and landfilled. The overwhelming majority of RAP is used in hot-mix asphalt (HMA) or warm-mix asphalt, which is the most optimal use of RAP. It is estimated that less than 0.1 percent was sent to landfills in 2009 and 2010 and less than 0.4 percent in 2011.

Table 4: Summary of RAP, RAS, WMA Data

	Reported Values			Total Estimated Value		
	2009	2010	2011	2009	2010	2011
<b>Tons of HMA/WMA Produced</b>	Tons (Millions)			Tons (Millions)		
Total	123.9	119.8	131.7	358.4	359.8	366.0
DOT	56.9	55.6	63.1	169.2	172.5	175.3
Other Agency	28.1	27.8	36.4	83.5	86.2	101.1
Commercial and Residential	35.6	32.6	32.2	105.8	101.2	89.5
<b>RAP</b>	Tons (Millions)			Tons (Millions)		
Accepted	23.2	24.0	29.8	67.2	73.5	79.1
Used in HMA/WMA	20.1	21.6	25.1	56.1	62.1	66.7
Used in Aggregate	1.5	1.6	1.2	6.2	7.3	4.9
Used in Cold Mix	0.4	0.4	0.1	1.5	1.6	0.2
Used in Other	0.1	0.07	0.2	0.7	0.8	0.7
Landfilled	0.06	0.001	0.1	0.1	0.004	0.3
	Average % Used in Mixes					
Average % for DOT Mixes <sup>1</sup>	12.5%	13.2%	15.8%			
Average % for Other Agency Mixes <sup>1</sup>	14.0%	15.2%	16.7%			
Average % for Commercial & Residential <sup>1</sup>	17.5%	18.0%	19.7%			
National Average All Mixes Based on % Reported for Different Sectors <sup>1</sup>	15.6%	17.2%	18.2%			
National Average All Mixes Based on RAP Tons Used in HMA/WMA <sup>2</sup>	16.2%	18.0%	19.1%			
Companies/Branches Reporting Using RAP	189	189	198			
<b>RAS</b>	Tons (Thousands)			Tons (Thousands)		
Accepted	332	558	769	957	1,851	2,499
Used in HMA/WMA	245	392	430	701	1,099	1,192
Used in Aggregate	5	2	14	6	3	74
Used in Cold Mix	—	—	—	—	—	—
Used in Other	39	34	—	123	124	—
Landfilled	—	0.5	0.1	—	6	0.2
	Average % Used in Mixes					
Average % for DOT Mixes <sup>1</sup>	0.33%	0.78%	0.66%			
Average % for Other Agency Mixes <sup>1</sup>	0.37%	0.47%	0.93%			
Average % for Commercial & Residential Mixes <sup>1</sup>	0.63%	0.81%	1.04%			
National Average All Mixes Based on RAS Tons Used in HMA/WMA <sup>2</sup>	0.27%	0.33%	0.33%			
Companies/Branches Reporting Using RAS	44	61	81			
<b>WMA</b>	% Total Production			Tons (Millions)		
DOT	6.3%	15.0%	23.5%	8.6	20.0	34.6
Other Agency	4.4%	11.7%	18.2%	3.6	9.8	16.3
Commercial & Residential	4.5%	11.6%	19.9%	4.6	11.3	17.8
Total				16.8	41.1	68.7
	% of Market					
Chemical Additive %	15%	6%	3.8%			
Additive Foaming %	2%	1%	0.2%			
Plant Foaming %	83%	92%	95.4%			
Organic Additive %	0.3%	1%	0.3%			
Companies/Branches Reporting Using WMA	85	121	150			

<sup>1</sup> Average percent based on contractors reported percentage for each sector.

<sup>2</sup> Average percent based on total reported tons of RAP used in HMA/WMA divided by reported total tons HMA/WMA produced.

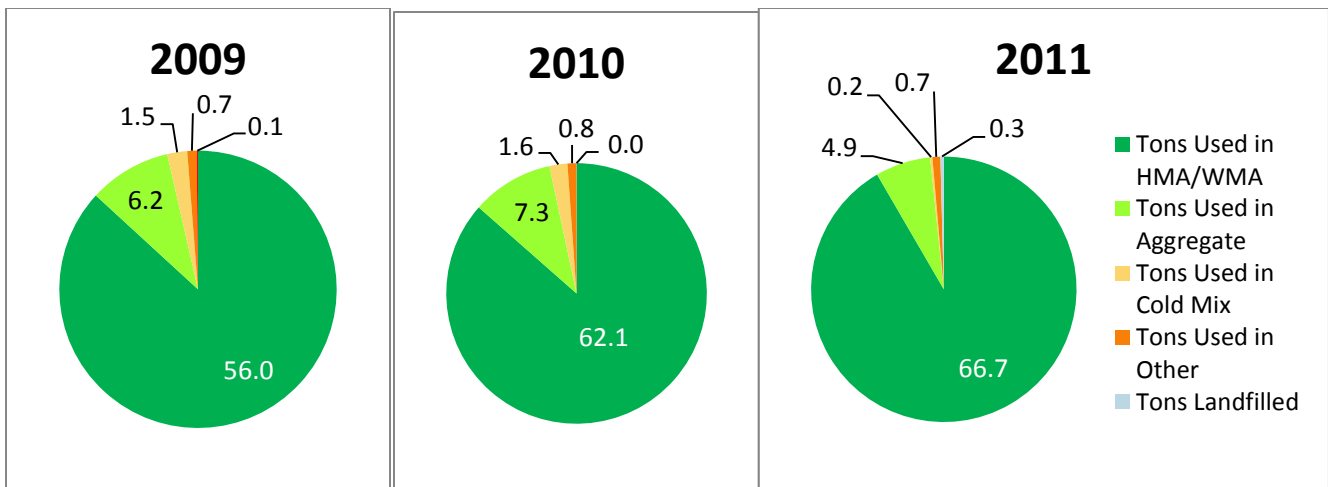


Figure 5: RAP Tons by Final Use (Million Tons)

Figure 6 shows the total estimated amount of RAP used in the different industry sectors. These values were calculated using the average percentages of RAP reported for the different sectors and adjusted to account for the difference between reported RAP tons and tons calculated from the percentage by sector.

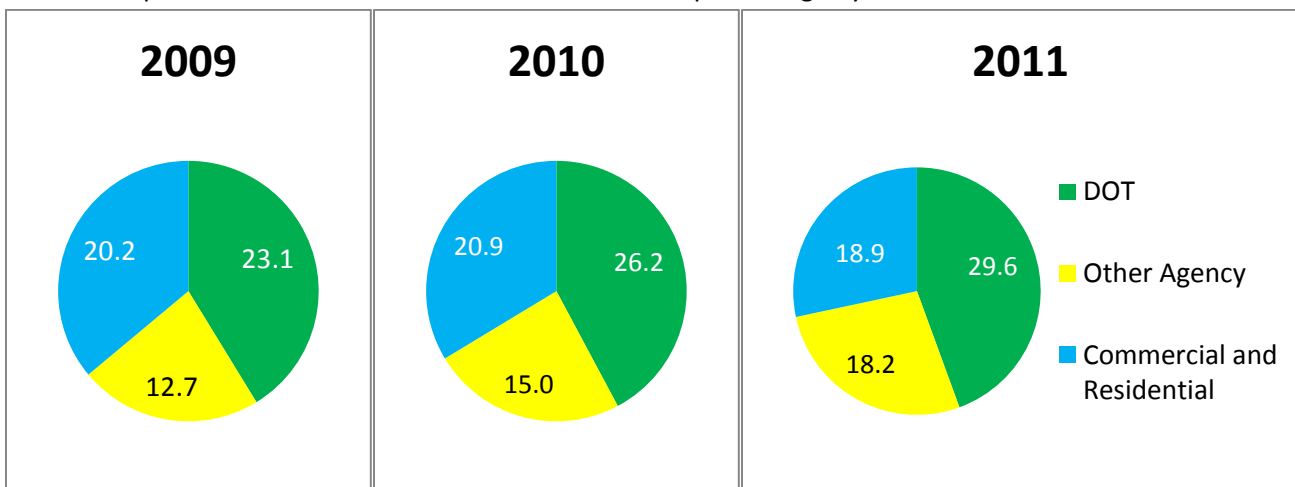


Figure 6: RAP Use by Sector (Million Tons)

Figures 7–9, and Table 5 show the average percent of RAP used in the different states based on reported RAP and total tons. It should be noted that the accuracy of data for individual states will vary depending on the number of responses received from each state and the total number of tons represented by the responses. Comparing Figures 9–11, the number of states averaging more than 15 percent RAP in HMA/WMA (colored green in the charts) increased from 2009 to 2011. The use of increased amounts of RAP has quickly spread in the Midwest and West. As of 2011, Nebraska estimated averaging 30 percent RAP in HMA/WMA.

For 2011, 98 percent of the contractors/branches reported using RAP, and more than 88 percent of these contractors reported excess RAP. From 2010 to 2011, the amount of RAP used in HMA/WMA increased from 62.1 million to 66.7 million tons, for a 7 percent increase. The average percent RAP used in mixes has increased from about 18 percent in 2010 to 19 percent in 2011.

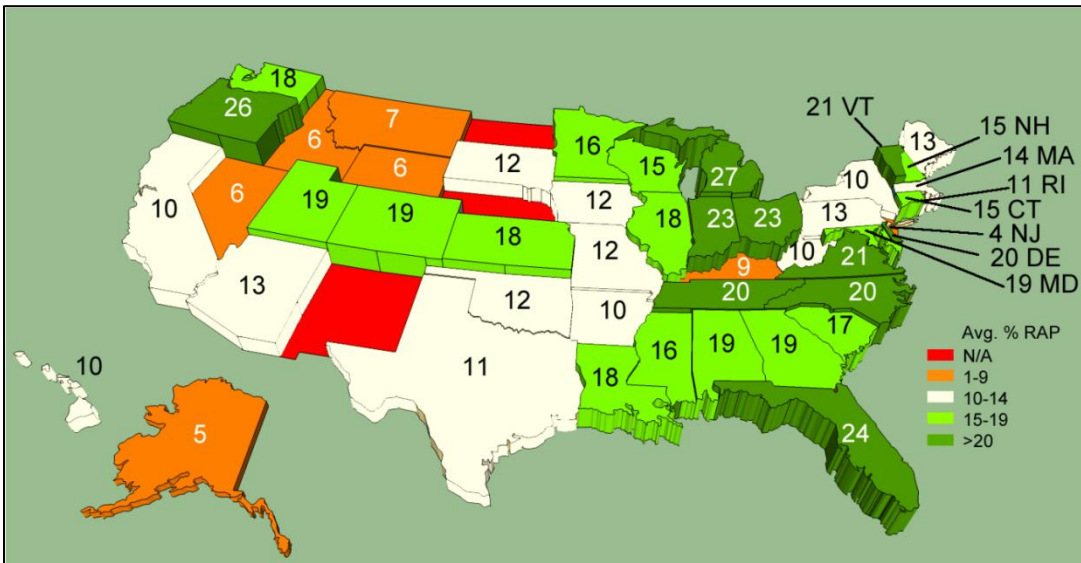


Figure 7: Estimated Average Percent of RAP by State for 2009

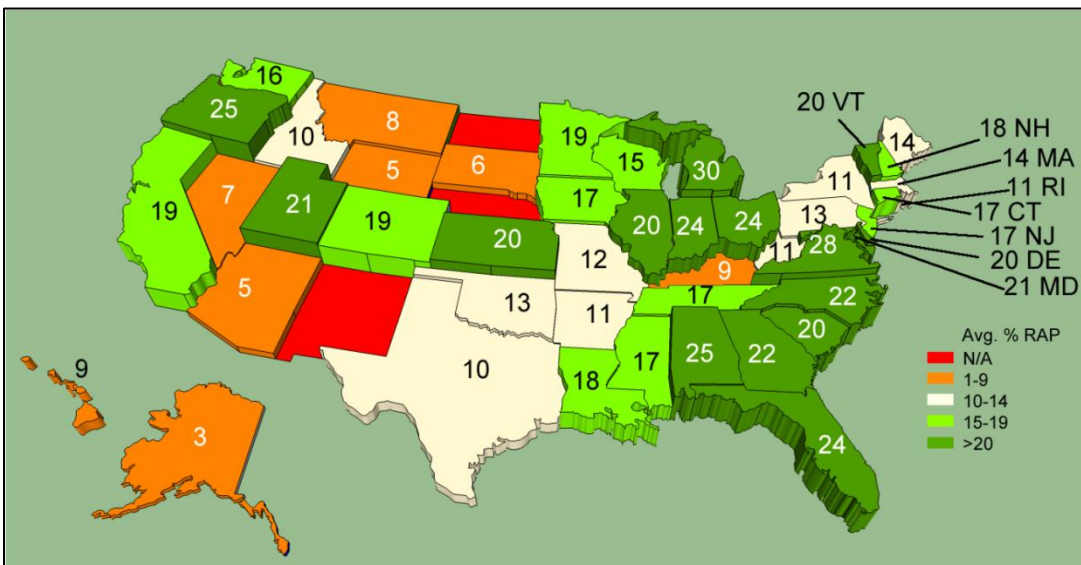


Figure 8: Estimated Average Percent of RAP by State for 2010

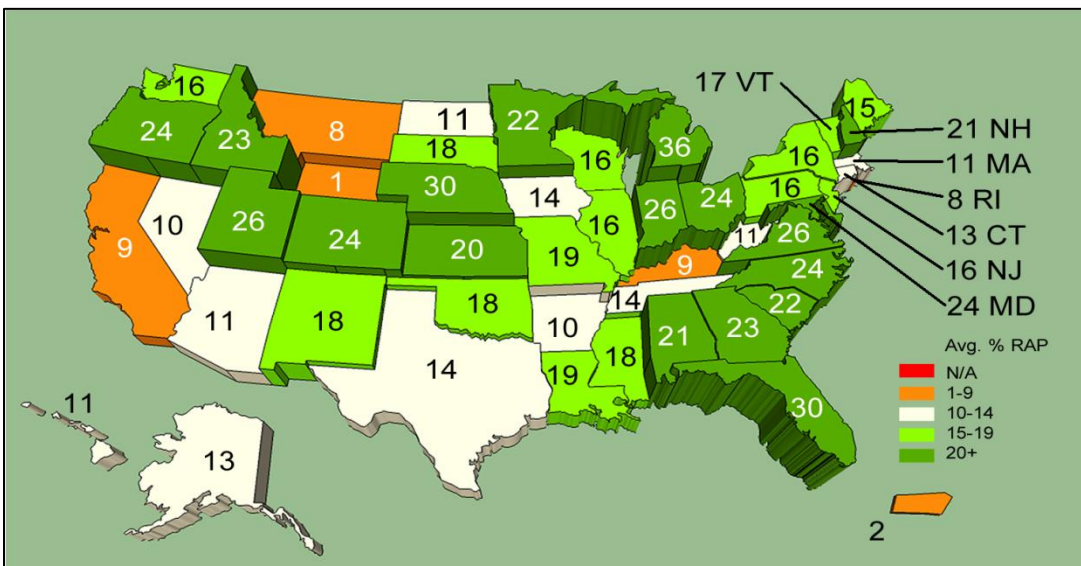


Figure 9: Estimated Average Percent of RAP by State for 2011

Table 5: Estimated Average Percent of RAP by State

State	Average RAP Percent			State	Average RAP Percent		
	2009	2010	2011		2009	2010	2011
Alabama	19	25	21	Montana	7	8	8
Alaska	5	3	13	Nebraska	NR	NR	30
Arizona	13	5	11	Nevada	6	7	10
Arkansas	10	11	10	New Hampshire	15	18	21
California	10	19	9	New Jersey	4	17	16
Colorado	19	19	24	New Mexico	NR	NR	18
Connecticut	15	17	13	New York	10	11	16
Delaware	20	20	NR	North Carolina	20	22	24
Dist. of Columbia	NR	NR	NR	North Dakota	NR	NR	11
Florida	24	24	30	Ohio	23	24	24
Georgia	19	22	23	Oklahoma	12	13	18
Hawaii	10	9	11	Oregon	26	25	24
Idaho	6	10	23	Pennsylvania	13	13	16
Illinois	18	20	16	Puerto Rico	0	0	2
Indiana	23	24	26	Rhode Island	11	11	8
Iowa	12	17	14	South Carolina	17	20	22
Kansas	18	20	20	South Dakota	12	6	18
Kentucky	9	9	9	Tennessee	20	17	14
Louisiana	18	18	19	Texas	11	10	14
Maine	13	14	15	Utah	19	21	26
Maryland	19	21	24	Vermont	21	20	17
Massachusetts	14	14	11	Virginia	21	28	26
Michigan	27	30	36	Washington	18	16	16
Minnesota	16	19	22	West Virginia	10	11	22
Mississippi	16	17	18	Wisconsin	15	15	16
Missouri	12	12	19	Wyoming	6	5	1

NR	= No contractors reporting
	= 1–9 %
	= 10–14%
	=15–19%
	= ≥20%

## Reclaimed Asphalt Shingles

Table 4 includes the summary of RAS data from the surveys. The information asked for in the survey is shown in Appendix A and summarized in Table 1. Producers were not asked about allowable RAS or binder replacement requirements. Based on the total estimated tons received and the amount used for all purposes, including landfilling, about 1.23 million tons of RAS was stockpiled for future use in 2011. The survey for 2009 and 2010 showed a total stockpile amount of 742,000 tons for both years. From 2010 to 2011, the amount of RAS accepted by producers increased by 35 percent. The amount of RAS landfilled decreased from 2010 to 2011 from about 0.3 percent to less than 0.1 percent. In 2011, no RAS was reported as being used for other purposes, while in 2009 and 2010 a small percentage of RAS tons was diverted to other purposes. This change may be accounted for in the increase in the number of RAS tons used in aggregate in 2011.

Figure 10 shows the total estimated amount of RAS used. There was a large increase, 48 percent, in the amount of RAS used between 2009 and 2010 and a more modest increase, 8 percent, from 2010 to 2011. Similar to RAP, RAS is

primarily used in HMA/WMA. Figure 11 summarizes how RAS was used in the different sectors of the paving market. These values were calculated using the average percentages of RAS reported for the different sectors and were adjusted to account for the difference in reported RAS tons and the tons calculated from the percentage by sector. There was a large increase in the use of RAS by public agencies other than DOTs, a decrease in the DOT sector, and a modest increase in the commercial/residential sector. The number of companies/branches using RAS increased from 61 to 81 from 2010 to 2011, a 33 percent increase.

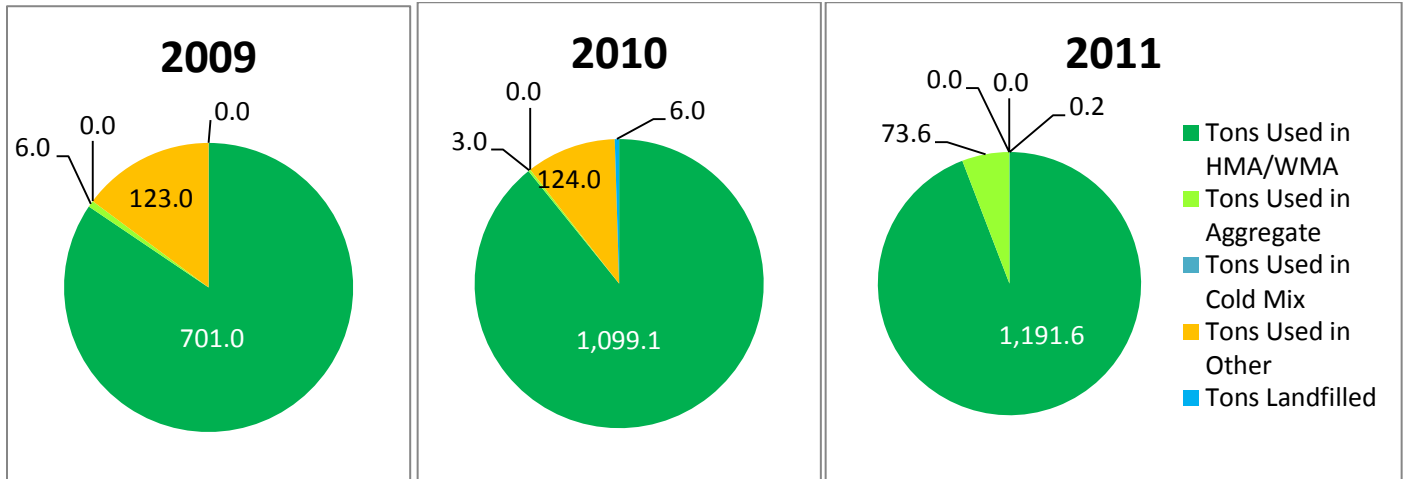


Figure 10: Summary of RAS Use (Thousand Tons)

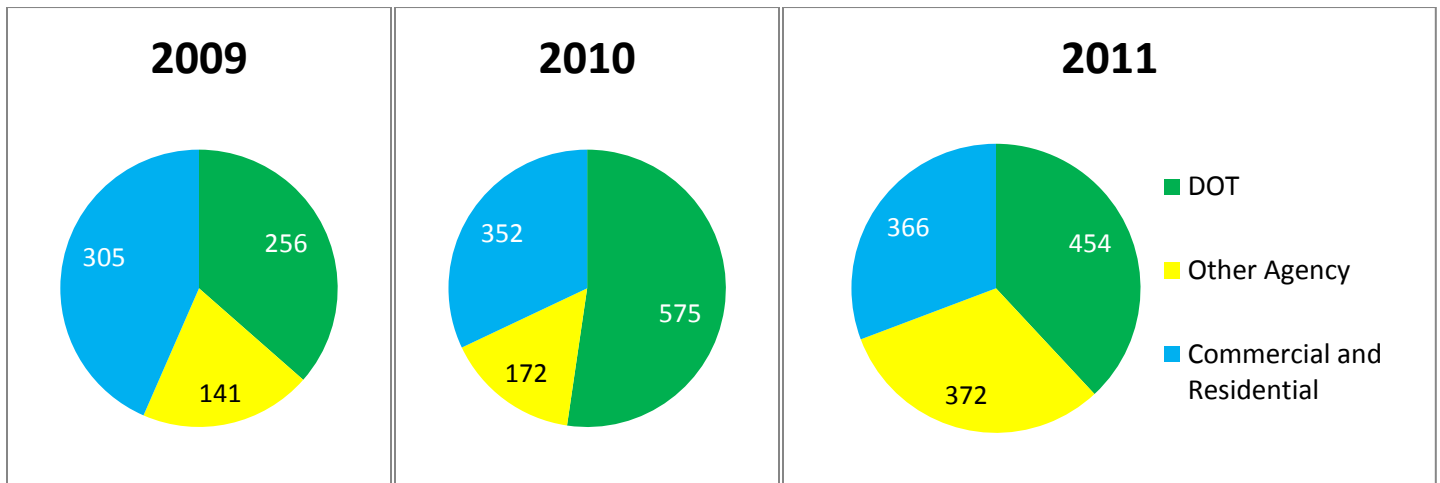


Figure 11: Summary of Estimated RAS Use by Sector (Thousand Tons)

Figure 12 shows states where plant-mix producers reported using RAS in 2009 through 2011. Red indicates states where RAS use was not reported for these years. The number of states where plant-mix producers reported using RAS increased from 26 to 32 from 2010 to 2011. Four states (Nevada, West Virginia, Delaware, and Rhode Island) reported using RAS in previous years, but did not report its use in 2011. (Note: No data was reported for Delaware for 2011.) Table 6 shows the states where producers reported using RAS for 2009–2011.



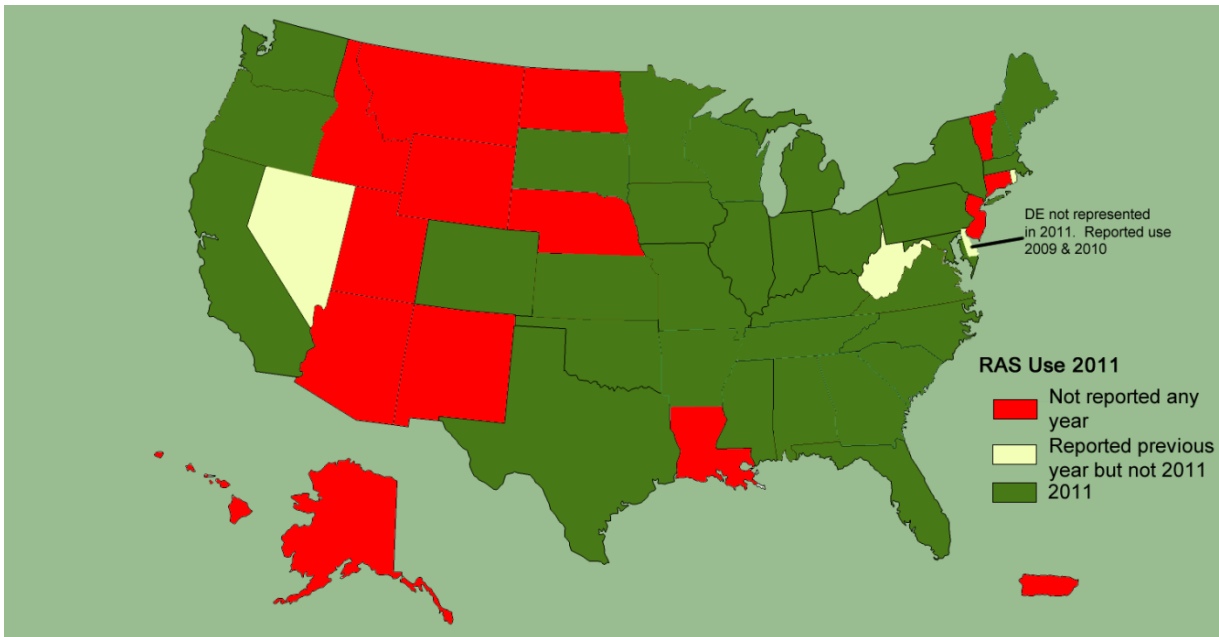


Figure 12: States with Companies/Branches Reporting Using RAS

Table 6: State Reporting RAS Use

State	RAS Used?			State	RAS Used?		
	2009	2010	2011		2009	2010	2011
Alabama	No	Yes	Yes	Montana	No	No	No
Alaska	No	No	No	Nebraska	NR	NR	No
Arizona	No	No	No	Nevada	No	Yes	No
Arkansas	No	No	Yes	New Hampshire	No	No	Yes
California	Yes	Yes	Yes	New Jersey	No	No	No
Colorado	Yes	Yes	Yes	New Mexico	NR	NR	No
Connecticut	No	No	No	New York	Yes	Yes	Yes
Delaware	Yes	Yes	NR	North Carolina	Yes	Yes	Yes
Dist. of Columbia	NR	NR	NR	North Dakota	NR	NR	No
Florida	Yes	Yes	Yes	Ohio	Yes	Yes	Yes
Georgia	No	No	Yes	Oklahoma	Yes	Yes	Yes
Hawaii	No	No	No	Oregon	No	Yes	Yes
Idaho	No	No	No	Pennsylvania	Yes	Yes	Yes
Illinois	Yes	Yes	Yes	Puerto Rico	No	No	No
Indiana	Yes	Yes	Yes	Rhode Island	No	Yes	No
Iowa	Yes	Yes	Yes	South Carolina	No	No	Yes
Kansas	No	Yes	Yes	South Dakota	No	No	Yes
Kentucky	Yes	Yes	Yes	Tennessee	No	No	Yes
Louisiana	No	No	No	Texas	Yes	Yes	Yes
Maine	No	No	Yes	Utah	No	No	No
Maryland	Yes	Yes	Yes	Vermont	No	No	No
Massachusetts	Yes	Yes	Yes	Virginia	Yes	No	Yes
Michigan	Yes	Yes	Yes	Washington	Yes	Yes	Yes
Minnesota	No	Yes	Yes	West Virginia	Yes	No	No
Mississippi	Yes	Yes	Yes	Wisconsin	No	No	Yes
Missouri	Yes	Yes	Yes	Wyoming	No	No	No

NR = No Contractors Reporting  
 Yes = RAS Use Reported  
 No = No RAS Use Reported

## Warm-Mix Asphalt

Table 4 includes the summary WMA data from the survey. The survey asked producers their estimated percentages of tons produced for the different sectors and the percent of which technologies were used.

WMA saw another strong increase from 2010 to 2011. Figure 13 shows a steady increase in the number of companies/branches using WMA from 2009 to 2011. Figure 14 shows a steady increase in the number of tons of WMA. This is probably due to increased acceptance of WMA by all industry sectors.

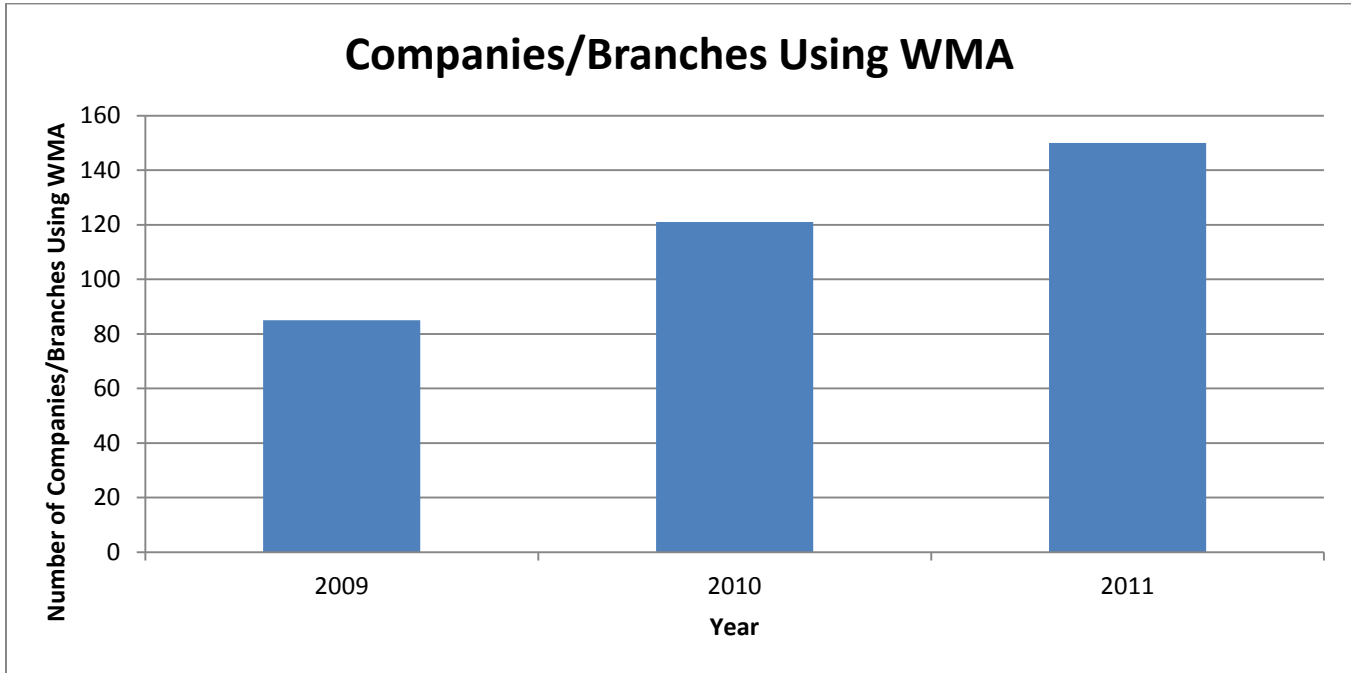


Figure 13: Number of Companies/Branches Using WMA

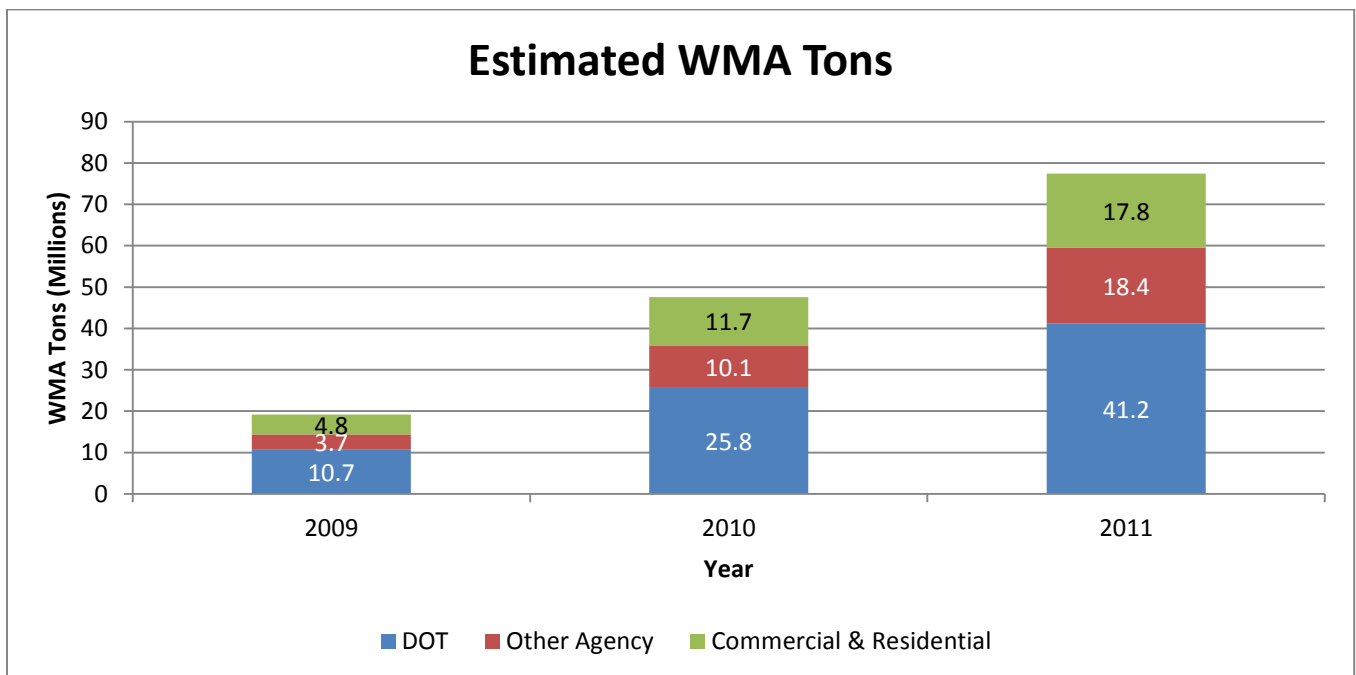


Figure 14: Estimated Tons (in millions) WMA by Industry Sector

Figures 15–18 show the estimated total tons of WMA produced in each state grouped by region. Figure 19 shows WMA production as a percentage of the total asphalt mix production for 2011. It should be noted that the accuracy of data for individual states will vary depending on the number of responses received from each state and the total number of tons represented by the responses.

While most states showed an increase in WMA production from 2010 to 2011, two states — Maryland and Texas — showed a decrease. The reasons for these decreases are uncertain. A contributing factor for the reduced WMA tonnage in Texas is a reported 17-percent decrease in total asphalt mix production from 2010 to 2011 in that state. Maryland, however, had the same estimated total tonnage from 2010 to 2011.

Nationally, the total tons of WMA increased from 41.1 million tons in 2010 to 68.7 million tons in 2011, a 67 percent increase. Plant foaming is used most often in producing WMA. Use of WMA additives is declining, accounting for about 17 percent of the total WMA production in 2009, 8 percent in 2010, and 5 percent in 2011.

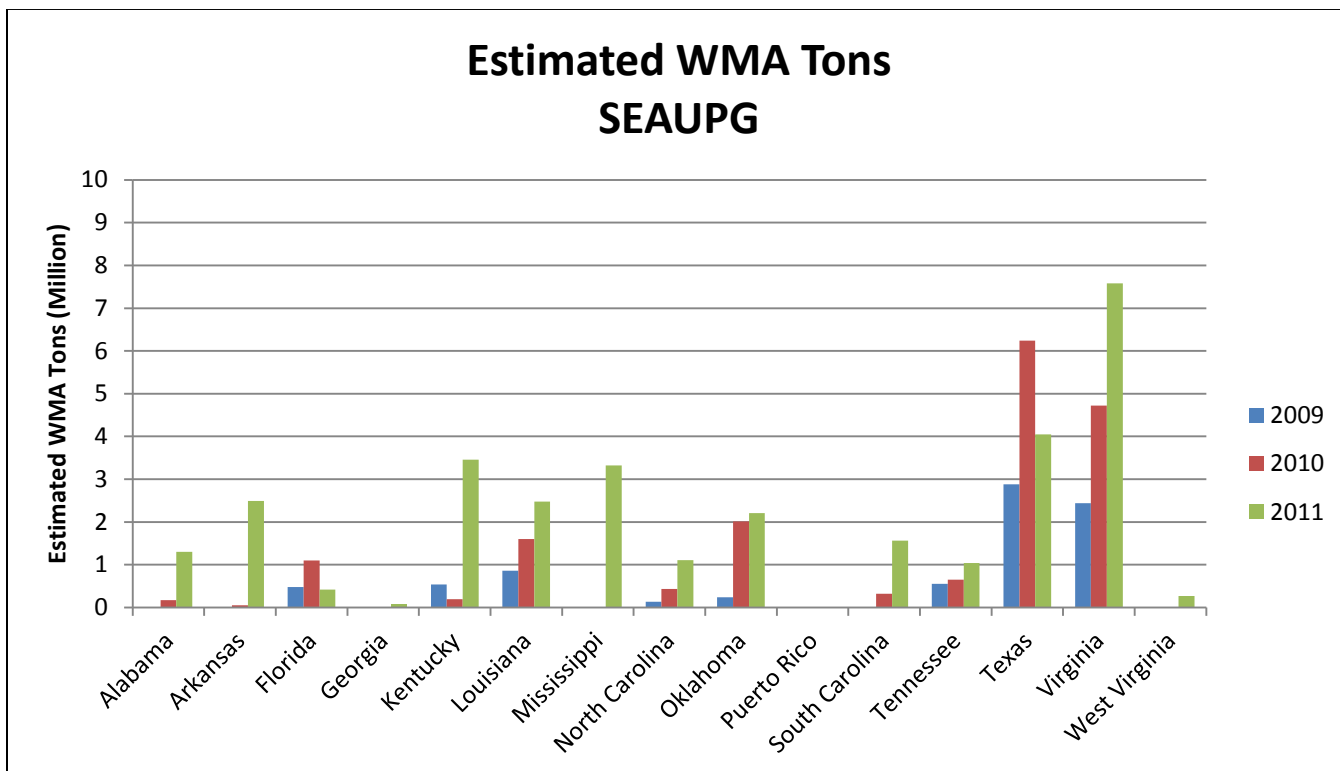


Figure 15: Estimated Total WMA Tons for Southeastern Asphalt User/Producer Group States

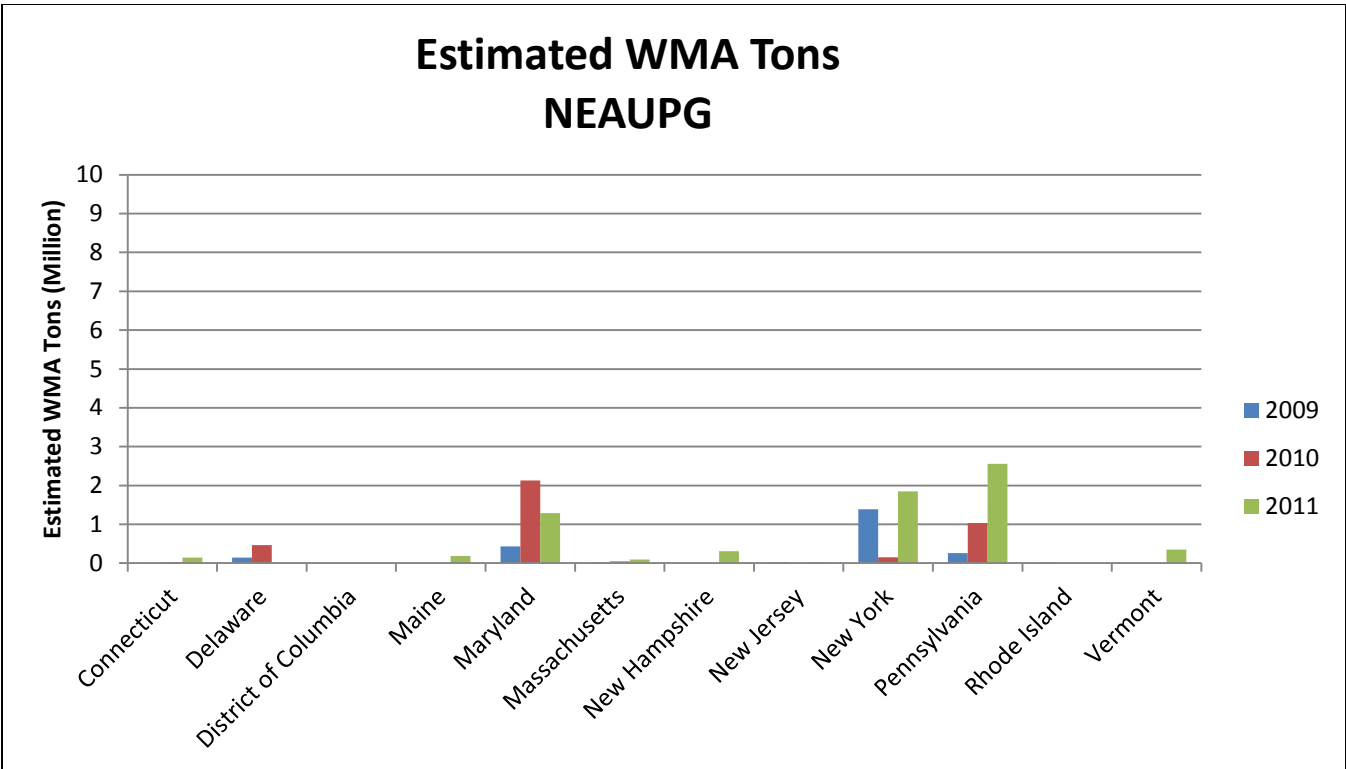


Figure 16: Estimated Total WMA Tons for North East Asphalt User/Producer Group States

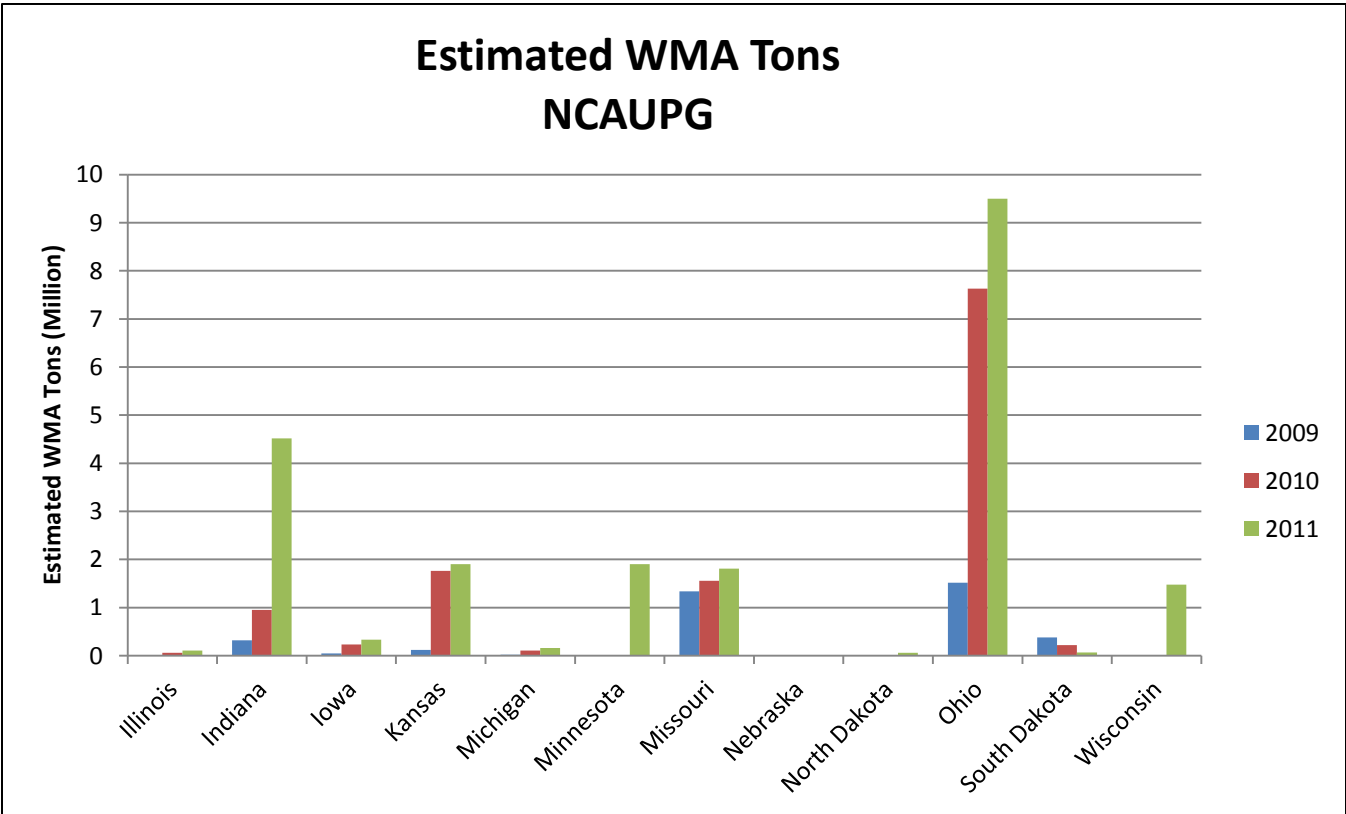


Figure 17: Estimated Total WMA Tons for North Central Asphalt User/Producer Group States

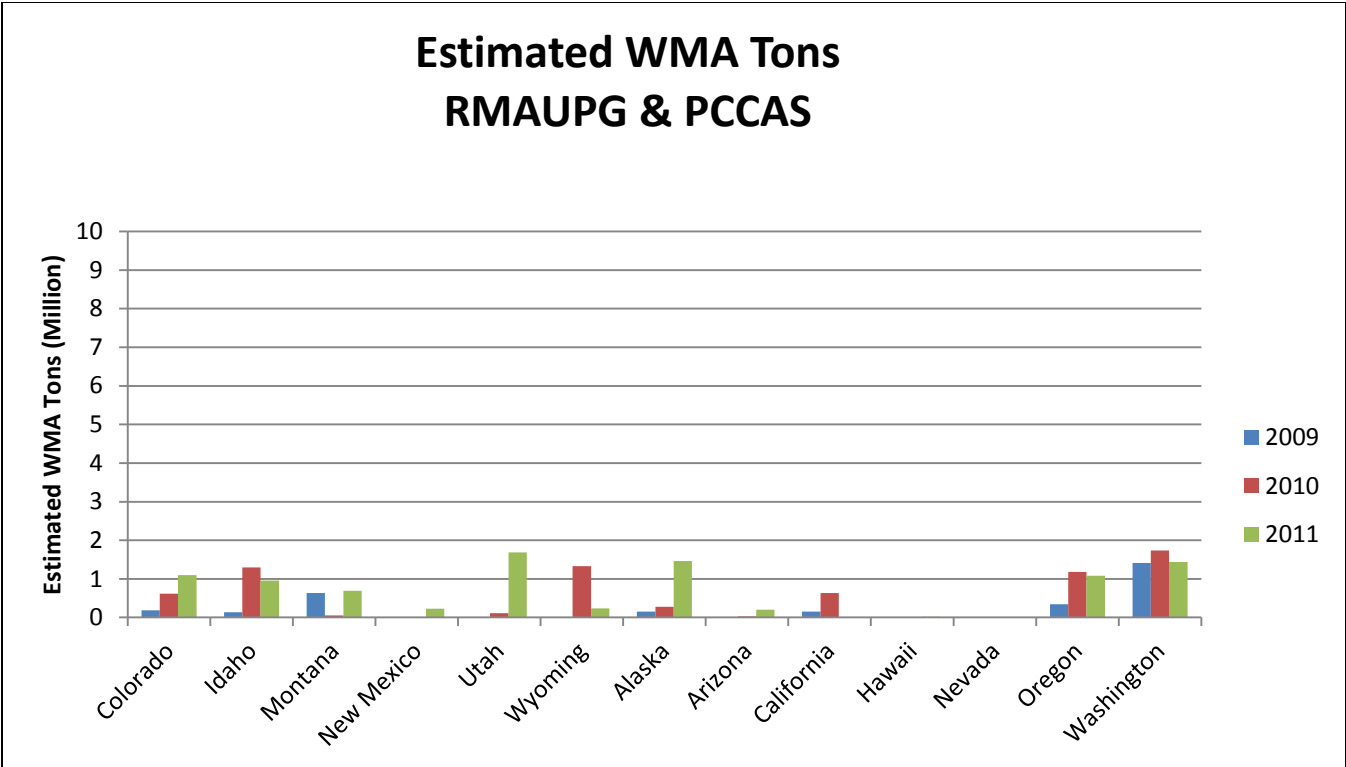


Figure 18: Estimated Total WMA Tons for Rocky Mountain Asphalt User/Producer Group and Pacific Coast Conference on Asphalt Specification States

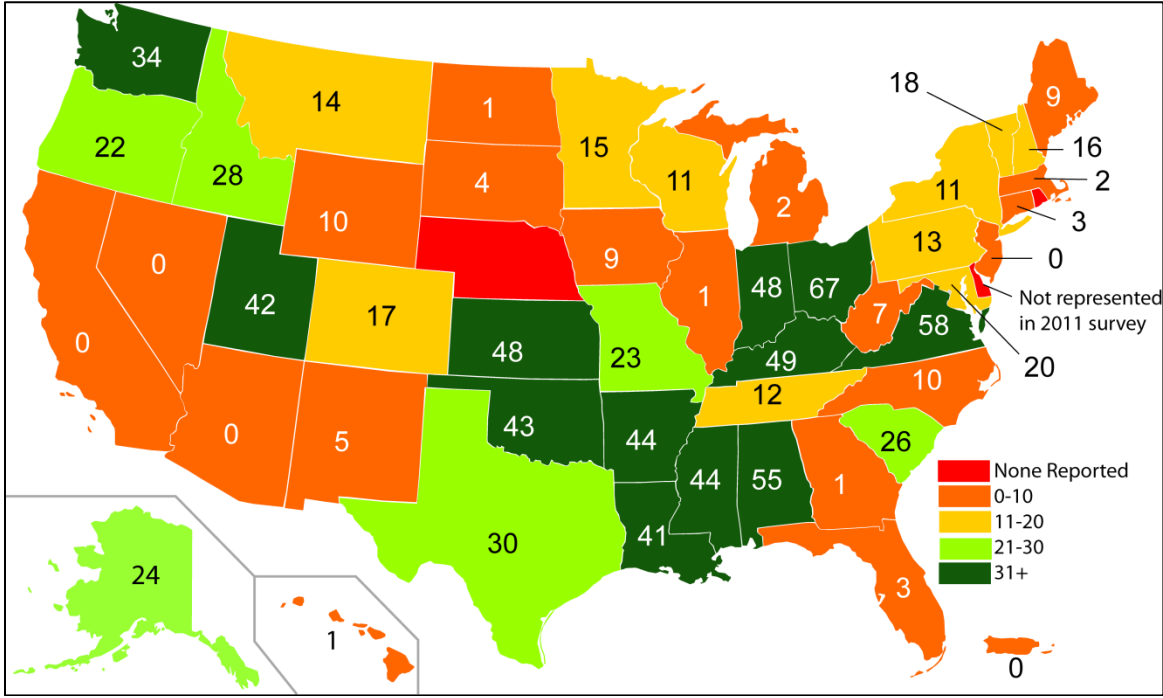


Figure 19: 2011 WMA Production as a Percentage of Total Asphalt Mix Production.

### Summary and Conclusions

The objective of this survey was to quantify the use of RAP, RAS, and WMA produced by the asphalt pavement industry. Asphalt mix producers from 49 states and Puerto Rico completed the 2011 survey. A total of 203 companies/branches with 1,091 plants were represented in the 2011 survey.

The estimated total asphalt mix production saw a slight increase from 360 million to 366 million tons from 2010 to 2011.

The use of recycled material continues to increase. The survey shows:

- The number of contractors using RAP increased from 189 in 2009 and 2010 to 198 in 2011.
- 98 percent of the contractors/branches reported using RAP in 2011, up slightly from 96 percent in 2009 and 2010.
- The estimated amount of RAP used in asphalt mixtures has increased steadily from 2009 to 2011. The estimated tons of RAP used in asphalt mixes for 2009, 2010, and 2011 are 56.1 million, 62.1 million, and 66.7 million tons, respectively. This represents about a nearly 19 percent increase in the amount of tons used between 2009 and 2011 and a more than 7 percent increase in the amount of tons used between 2010 and 2011.
- The estimated average percent of RAP used has increased from 16.2 percent to 18.0 percent to 19.1 percent for 2009, 2010, and 2011 respectively.
- 88 percent of the contractors/branches reported having excess RAP in 2011. The estimated excess tons of RAP accepted in 2011 was 6.3 million tons.
- Use of RAS (both manufacturers' scrap and post-consumer shingles) increased from 1.1 million tons used in 2010 to 1.2 million tons used in 2011, an 8 percent increase.
- The amount of RAS acceptance by asphalt mix producers increased by 35 percent from 2010 to 2011, and 74 percent of the contractors/branches reported having excess RAS for 2011. The estimated excess tons of RAS accepted in 2011 was 1.3 million tons.
- Of the RAS used in 2011, 94 percent was used in asphalt mixes. The remainder was primarily combined with aggregates. Less than 0.2 percent was landfilled.
- The number of states with reported RAS use increased from 26 to 32 in 2011.

The use of WMA continues to increase steadily. The survey shows:

- The estimated total production of WMA for 2011 was 68.7 million tons. This was a 67 percent increase over 2010 WMA (41.1 million tons) and over 300 percent increase over 2009.
- WMA was about 19 percent of the total asphalt mixture market in 2011.
- Plant foaming, representing more than 95 percent of the market, is the most commonly used technology; additives accounted for less than 5 percent of the market.

The 2011 survey results show that the asphalt pavement industry continues to improve its outstanding record of sustainable practices by further increasing the use of recycled materials and WMA. RAP use continues to increase steadily, but there still is an excess in the amount of RAP produced versus RAP used each year. This indicates that opportunities exist to increase the amount of RAP used in asphalt mixes through permissive specifications and through improved RAP processing, production equipment and procedures, and education.

RAS use saw a smaller increase in 2011 to about 1.2 million tons used in asphalt mixes. This represents nearly 11 percent of the estimated 11 million ton waste shingle market (manufacturer and post-consumer waste). This indicates that there are still opportunities for increasing the use of RAS in asphalt mixtures, especially in the 16 states and territories where no RAS use was reported for 2009–2011. As with RAP, permissive specifications, improved processing, production equipment and procedures, and education will help.

WMA again saw an increase of more than 67 percent from 2010 to 2011. All reporting states, with the exception of Nebraska and Rhode Island, reported using WMA in 2011. WMA production now represents about 19 percent of the total estimated asphalt mix production in the United States, and it is expected to grow as contractors and agencies gain experience and more states implement permissive specifications.

## Bibliography

Copeland, A. *Reclaimed Asphalt Pavement in Asphalt Mixtures: State-of-the-Practice*. Washington, DC: Federal Highway Administration, 2011.

Copeland, A., Jones, C., and Bukowski, J. Reclaiming Roads. *Public Roads*, Vol. 75, No. 5, March/April 2010. Retrieved September 20, 2011, from Federal Highway Administration:

<http://www.fhwa.dot.gov/publications/publicroads/10mar/06.cfm>

Hansen, K. and Newcomb, D. *Asphalt Pavement Mix Production Survey: Information Series 138*. Lanham, Md.: National Asphalt Pavement Association, 2011.

Hansen, K., Newcomb, D. and Cervarich, M. Asphalt Tops the Charts for Environmental Stewardship — Again. *HMAT - Hot Mix Asphalt Technology*, Vol. 16, No. 5, September/October 2011.

Pappas, J. *Recycling Materials Survey*. Presented at RAP ETG May 10 Meeting, Irvine, Calif., 2011.

Prowell, B., Hurley, G., and Frank, B. *Warm-Mix Asphalt: Best Practices, 3<sup>rd</sup> Edition: Quality Improvement Publication 125*. Lanham, Md.: National Asphalt Pavement Association, 2012.



NATIONAL ASPHALT  
PAVEMENT ASSOCIATION

*National Asphalt Pavement Association  
NAPA Building  
5100 Forbes Blvd.  
Lanham, Maryland 20706-4407  
www.AsphaltPavement.org  
napa@AsphaltPavement.org  
Tel: 301-731-4748  
Toll Free: 1-888-468-6499  
Fax: 301-731-4621*

*Publication Sales:  
<http://store.AsphaltPavement.org>  
napa-orders@abdintl.com  
Toll Free: 888-600-4474  
Tel: 412-741-6314  
Fax: 412-741-0609*

**2<sup>nd</sup> Annual Asphalt Pavement Industry Survey  
IS-138**

