ARMA Fall Board of Directors Meeting

November 1, 2018

Omni Fort Worth Hotel
1300 Houston St.
Fort Worth, TX 76102

ARMA Fall Board of Directors Meeting
November 1, 2018
Ft. Worth, Texas

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ASPHALT ROOFING MANUFACTURERS ASSOCIATION

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ARMA Board of Directors Meeting Agenda

Thursday, November 1, 2018
The Omni Fort Worth Hotel
Fort Worth, Texas

Chair Presiding: Brian Chambers, Owens Corning

Time	Topic	Presiding Chair/ Speaker
7:30 a.m. – 8:30 a.m.	**Board of Directors Breakfast**	
8:30 a.m. – 8:45 a.m.	**Introduction, Opening Remarks, Roll Call** -Welcome and Introductions -Antitrust Policy Review (Deese) -Roll Call (Hitchcock) -Approval of Past Meeting Minutes (Chambers) -President's Report (Chambers)	Chambers
8:45 a.m. – 9:20 a.m.	**Presentation: Clayton Traylor, Leading Builders of America**	
9:20 a.m. – 9:25 a.m.	**Coffee Refresh**	
9:25 a.m. – 10:00 a.m.	**Presentation: Ralph Shirts, ExxonMobil**	
10:00 a.m. – 10:15 a.m.	**Break**	
10:15 a.m. – 10:45 a.m.	**Regulatory Counsel Report** -EPA Risk & Technology Reviews -Asphalt Fumes -Other Key Regulatory Developments	Sampson
10:45 a.m. – 11:15 a.m.	**Health, Safety, and Environment Committee** -Washington State Roofing Materials Assessment -ARMA/NRCA Silica Study -Emissions Factors Database -IH Database Program Restart/Update	Whiteside / Klein
11:15 a.m. – 12:00 p.m.	**ARMA Codes Steering Group** - Building Codes and Standards - Advocacy Issues - Stakeholder Activity - Technical Resource Group Update	Phillips / Fischer Keeler / McQuillen

12:00 p.m. – 1:00 p.m.	**Board and Associates Lunch**	
1:00 p.m. – 1:30 p.m.	**Communications, Marketing, and Education Committee** -2018 Communications and Marketing Plan Report -2019 Proposed Program	Jonas
1:30 p.m. – 2:00 p.m.	**Technical Affairs Committee** -Technical Review Task Force -Sustainability Task Force -Ventilation Task Force -Asphalt Recycling Task Force	Dinwiddie / Cote
2:00 p.m. – 2:15 p.m.	**Break**	
2:15 p.m. – 2:30 p.m.	**Treasurer's Update** -2018 Year-to-Date Financial Statements -2019 Draft Budget	Kersey
2:30 p.m. – 3:00 p.m.	**Other Business** -ARMA Nominating Committee Report -Associate Member Application Review -Reduced Truck Availability -Future Board Meeting Considerations / Survey -ARMA General Counsel Report -Next Meeting of ARMA Board of Directors	Chambers / Deese
3:00 p.m.	**Adjournment**	

ASPHALT ROOFING™
MANUFACTURERS ASSOCIATION

To: ARMA Members and Staff

From: Reed Hitchcock, Executive Vice President

Re: Antitrust Compliance - Quick Reference

The Asphalt Roofing Manufacturers Association ("**ARMA**" or "**Association**") has in effect an Antitrust Compliance Policy ("Policy"). The Policy is intended for the guidance of ARMA member company representatives, officers, directors and staff, when engaged in any activity conducted in the name of, or on behalf of, ARMA. All such persons are expected to be familiar with the Policy and to follow it both in letter and spirit.

The following cautionary statements are taken from the full Policy and are intended to be used as a quick reference tool. This document is not a substitute for the full Policy, which is available from the Association's office and with which all are expected to be conversant. At all Association meetings and events, including informal gatherings before, during or following such meetings and events, **ARMA** members, their representatives and guests will not discuss any of the following competitively sensitive topics:

1. Current or future prices, price levels, costs or profit margins.
2. What is a fair or rational profit level.
3. Actions which could lead to standardizing or stabilizing prices.
4. Pricing or bidding methodologies or procedures.
5. Pricing practices or strategies, including methods, timing or implementation of price changes.
6. Whether or how prices, warranties or other terms of sale are advertised.
7. Cash or any other discounts, rebates, service charges or other terms and conditions of sale.
8. Credit terms.
9. Product warranty terms.
10. Actual, planned or projected production, production capacity or capacity utilization.
11. Projected demand.
12. Confidential company plans for new products.
13. Dividing or allocating geographic or product markets or customers.
14. Whether or on what terms to do business with a supplier, competitor or customer.
15. Whether or on what terms to solicit other companies' employees for employment.
16. The business practices of individual firms.
17. The validity of any patent or the terms of any patent license.
18. Ongoing litigation, unless being reported upon by ARMA's General Counsel or discussed appropriately at ARMA's Counsel Forum.

We hope the above rules will be helpful as you participate in ARMA meetings and other activities. If you have any questions about antitrust compliance, do not hesitate to contact ARMA's General Counsel:

C. Michael Deese
ARMA General Counsel
Howe & Hutton, Ltd.
Tel: (202) 466-7252 x103
Email: cmd@howehutton.com

Asphalt Roofing Manufacturers Association
Board of Directors Meeting Minutes
May 17, 2018, Baltimore, MD

Attendees

Frank Klink	3M
Randy Morgan	3M
Ken Farrish	Atlas Roofing Corporation
Tom Lecorchick	Bitumar Inc.
Tom Lecorchick, JR	Bitumar Inc.
Yves Gosselin	Building Products of Canada
Biff Smith	Crafco Inc.
Jeff Stermer	Crafco Inc.
Lisa Zentner	Crafco Inc.
Bob Griffiths	Firestone Building Products
Helene Hardy Pierce	GAF
Matt Loncar	GAF
Andy Hilton	GAF
John Maitner	GAF
Frank Heard	Gibraltar Industries
Chuck Jerasa	Gibraltar industries
Laura Soder	Henry Company
James Fagan	Malarkey Roofing Products
Gregory Malarkey	Malarkey Roofing Products
Robert Almon	Mid-States Asphalt
Randy Hughes	Mid-States Asphalt
Brian Chambers	Owens Corning
Greg Keeler	Owens Corning
Bradley Link	Owens Corning
Devlin Whiteside	Owens Corning
John Corbett	PABCO Roofing Products
Sid Dinwiddie	PABCO Roofing Products
Curtis Maas	Reichel & Drews
JF Cote	SOPREMA, Inc.
Todd Jackson	SOPREMA, Inc.
Sara Jonas	SOPREMA, Inc.
Tim Kersey	SOPREMA, Inc.
Justin Dunlap	Specialty Granules LLC
Bob Toth	Specialty Granules LLC
Susan Frieze	TAMKO Building Products, Inc.
Bob Hockman	TAMKO Building Products, Inc.
David Humphreys	TAMKO Building Products, Inc.
Aaron Phillips	TAMKO Building Products, Inc.
Steve Ratcliff	Tarco Roofing
Jonathan Dietzel	Warrior Asphalt

Lionel van der Walt	RCI, Inc.

ARMA Staff

James Hilyard	ARMA Consultant
Craig Brightup	ARMA Federal Lobbyist
C. Michael Deese	ARMA General Counsel
Arthur Sampson	ARMA Regulatory Counsel
Reed Hitchcock	ARMA Executive Vice President
Daniel Quinonez	ARMA General Manager
Devin Sears	ARMA Government Affairs Manager
Ally Peck	ARMA Industry Affairs Coordinator
Mike Fischer	ARMA Vice President of Codes and Standards
Ralph Vasami	Kellen Executive Vice President

Introductions & Antitrust Reminder

ARMA President Brian Chambers, Owens Corning, called the meeting to order at 8:30 am EST and declared that a quorum was present. He welcomed meeting attendees, thanked members for their participation and support of the Association, and recognized sponsors of the meeting. Meeting attendees introduced themselves and Mike Deese, ARMA General Counsel, reviewed the ARMA Antitrust Compliance Policy, reminding all attendees that the policy governed the meeting. Reed Hitchcock, ARMA Executive Vice President, read the roll and declared that a quorum was present. Chambers introduced Reed Hitchcock as the returning ARMA Executive Vice President.

Approval of Meeting Minutes

MOTION: It was moved and seconded to approve the minutes of the November 1, 2017, ARMA Board of Directors meeting (Malarkey/Farrish). The motion passed unanimously.

ARMA Government Affairs Update

Craig Brightup, ARMA's federal lobbyist, provided an update on ARMA government affairs activities. He gave a report card for the year for Congress' performance on various legislative issues including spending bills, repealing/replacing Affordable Care Act, Tax Reform, reduced regulations, and workforce issues. He reviewed the failed attempt to repeal and replace the Affordable Care Act, as well as the Executive Order signed by President Trump on healthcare and the effect that the impending budget will have on it. He gave the Trump Administration credit for the tax reform bill that was passed.

Brightup highlighted major budgetary, spending, and tax legislation under consideration in Congress as well as developing regulatory issues in executive agencies. Brightup provided an overview of the effects that the transition of the Trump Administration has had on the government and the industry, as well as possible opportunities it may present for ARMA. Brightup reminded all of the OSHA Silica Rule that has an enforcement deadline of June 23, 2018.

Regulatory Report

Art Sampson, ARMA Regulatory Counsel, reported that Gradient, the consulting firm that developed the 2015 quantitative risk assessment (QRA) for occupational exposures to roofing asphalt, is developing an independent scientific justification for its dermal risk estimates in connection with a QRA currently being developed for the Asphalt Institute on worker paving

asphalt exposures. ARMA members active on the relevant AI groups overseeing this work are monitoring Gradient's expanded assessment of dermal cancer risks. With regard to non-cancer health effects, Sampson reported that there have been a series of studies suggesting that chronic lung damage is associated with asphalt work. Although there have been flaws in these studies – notably the inability to rule out other factors that might explain the lung findings – there is an increasing risk that future regulatory or scientific reviews may conclude that the recommended occupational exposure limit used by most ARMA members for controlling asphalt fume exposures in roofing plants is inadequate to protect worker health. The Asphalt Institute is currently sponsoring a critical review of the studies to identify limitations in the current data and make recommendations for new studies that may yield more definitive results. ARMA member scientists and HS&E specialists are monitoring this work at AI. Sampson reported that while additional regulatory or scientific reviews of roofing asphalt emissions are inevitable, no significant proceedings are underway or calendared. It is currently expected that the California Proposition 65 program will present the next challenge by reviewing the listing of roofing asphalt and its emissions as a carcinogen as soon as the 2019-2021 timeframe.

Sampson provided a brief update on the OSHA silica rule, noting that there are no indications that the standard's June 23, 2018, compliance date for manufacturing facilities (including ARMA member roofing plants) will be extended. He also summarized the NRCA study of worker silica exposures during the installation and removal of asphalt roofing products, a project that ARMA is co-sponsoring. To date, exposure assessments have been completed or scheduled for 20 of the 22 sites needed for the first phase of the study, which already has been funded. Thus far, reports are available for five sites, and all exposures are below the new OSHA "action level" for silica. Sampson emphasized that a convincing demonstration that this outcome can be expected on every asphalt roofing job will effectively establish that these operations are exempt from the standard. He also noted that the study is looking for two additional Modified Bitumen jobs.

Lastly, regarding the IH Database program, Sampson reported that the previous program Administrator, Dr. Gary Marchant of Arizona State University, has resigned and that ARMA was unable to reach an agreement with Johns Hopkins University to administer the program. Sampson will pursue engaging a legal assistant to serve as the administrator.

MOTION: It was moved and seconded to accept the Regulatory Report as presented (Corbett/Malarkey). The motion passed unanimously.

<u>Health, Safety, and Environment Committee Update</u>

Devlin Whiteside, Owens Corning, gave a summary report for the HSE Committee. She gave a brief overview of the Accident Prevention Contest Awards including what data is used to determine the awards. Chambers announced the winners of the 2017 ARMA Accident Prevention Awards and distributed the plaques for the President's Awards.

Whiteside gave an overview of the finalized Washington Roof Runoff Report to which ARMA contributed funding. Whiteside noted that the finalized data of the study was very positive for asphalt shingles, but that data was not published in the final report. The Board discussed the final report and the corresponding data. The Board agreed that since the data was positive for the industry, they would like to explore ways of publicizing it.

ACTION: ARMA HSE Committee to request the University of Washington provide the data from the Washington Roof Runoff Study for ARMA's use. (Malarkey/Corbett)

Whiteside provided an overview of the joint ARMA NRCA Silica Study. She explained that the work of the current consultant, Terracon, has not been satisfactory. In order to achieve the original objectives, the study will need additional data and more jobsites. The Board discussed this study and ARMA's strategy going forward.

ACTION: ARMA to reengage the IH Task Force to develop a strategy for phase 2 of the joint ARMA NRCA Silica Study.

Whiteside summarized the new silica rules that will go into effect for the industry in June 2018. She gave examples of how the industry is adapting to the new standard. She also noted that reduced federal regulatory activity has been followed by increasing state regulatory action.

MOTION: It was moved and seconded to accept the ARMA Health, Safety, and Environment Committee report as presented (Farrish/ Corbett). The motion passed unanimously.

Communications, Education, and Marketing Committee Update

Sara Jonas, SOPREMA, gave the report on the Communications, Marketing, and Education Committee. She highlighted the different programs that the committee has been engaged with during 2018, including rebranding the QARC awards. She noted that the current initiative is to build better brand awareness for both ARMA and the new awards.

MOTION: It was moved and seconded to approve the ARMA Communications, Marketing, and Education Committee update as presented (Malarkey/Farrish). The motion passed unanimously.

Treasurer's Report

Tim Kersey, Soprema, gave the Treasurer's update and presented the 2017 Audit Report, noting that expenses had tracked within budget. He highlighted ARMA's assets, revenues, and expenses compared to the previous year. Kersey then provided a breakdown of various major expenses that exceeded $10,000. Finally, he gave an overview of the first quarter of 2018 financial numbers, noting the association is tracking within budgetary expectations.

MOTION: It was moved and seconded to accept the ARMA Treasurer's Report as presented (Corbett/Farrish). The motion passed unanimously.

Lionel van der Walt, RCI, Inc.

Lionel van der Walt, RCI, Inc. introduced himself as the new Executive Vice President and Chief Executive Officer of RCI, Inc., representing building envelope consultants, and thanked ARMA for inviting him. He gave a summary of his background, including his work in the air freight industry and serving in the South African Air Force. Van der Walt explained his transition into his current role and new initiatives he has brought to RCI, most notably streamlining operational procedures and developing a certification program. He suggested that his organization and ARMA might each consider providing speakers for the other's meetings and that it would make sense to get the leaders of all building-related organizations together quarterly to discuss issues of common concern.

Codes Steering Group Update

Aaron Phillips, TAMKO Building Products, Inc., gave the ARMA Codes Steering Group update. Phillips gave an overview of the updated structure of the committee, then surveyed various stakeholder relationships. Over the past six months, the committee has been focused on a few major strategies, including an effort in Monroe County, FL to block an ordinance that would only allow standing metal seemed roofs. In this initiative, the committee obtained a Florida Lobbyist who was successful at both the county level and state level at blocking the effort. Going forward, the committee recommends ARMA to continue to engage its lobbyist to track the 2018-2019 Florida Congressional session. Across the country in California, the committee has recently been focused on reflectivity requirements in Los Angeles County and the City of Los Angeles. Phillips next gave a summary of ARMA's initiatives for the ICC Group A proposals. Finally, Phillips gave an explanation of the Denver Cool Roof Ordinance and the potential effects on the asphalt industry. ARMA has been approached by ERA to co-fund a lobbyist to advocate against the ordinance.

Greg Keeler, Owens Corning, reviewed the status of the Technical Resource Group's work on IBHS technical bulletins and related standards.

MOTION: It was moved and seconded to accept the ARMA Codes Steering Group report as presented (Malarkey/ Farrish). The motion passed unanimously.

ARMA Technical Affairs Committee Discussion

JF Cote, SOPREMA, provided an update on the activities of the Technical Affairs Committee. He surveyed the various publications that are currently being updated, identifying those topics are a priority. Currently the publications "Nail Application of Asphalt Strip Shingles for new and Recover Roofing" and "Color Shading of Asphalt Shingle Roofs" have been reviewed by the ARMA Counsel Forum and have been approved by the Executive Committee. He also announced that the committee is currently working with NRCA to update the "Quality Control Guidelines for the Application for Asphalt Roofing Systems" publication, so that it can be transferred into an eBook. Cote gave an update to the ARMA PCR/LCA/EPD project, noting that it is time to update the PCRs. The committee has recommended that UL Environment be contracted to update the ARMA PCRs at a cost of $10,000. Additionally, the committee has added two low slope asphalt roofing products to its LCA: Torch Applied and Self-Adhesive. Cote noted that the committee has also scheduled a tour of PRI testing facility at the ARMA Summer Committee Meetings.

MOTION: It was moved and seconded to accept the Technical Affairs Committee update as presented (Farrish/Malarkey). The motion passed unanimously.

New Business

Deese announced that the ARMA Counsel Forum and Executive Committee have approved a summary version of the ARMA Shipment Report that will be made available to the public. The Board discussed the reasons for making a publicly available version as well as what parameters will be included. The Board agreed to discuss the shipment report categories at the fall Board of Directors meeting. All changes to the shipment reporting program will go into effect Q2 2018.

ACTION: ARMA Staff to circulate the list of current shipment report contacts for companies to review and update if needed.

ACTION: ARMA Staff to include time in the agenda at the ARMA fall Board of Directors meeting for the Shipment Report categories to be discussed.

Mr. Farrish noted that recent enhanced enforcement of trucking regulations has resulted in reduced track availability for raw material and product shipments. He asked that this matter be placed on the agenda for discussion at the fall Board of Directors meeting.

Adjournment

There being no further business to come before the Board, the meeting was adjourned by general consensus at 2:35 pm EDT.

ARMA Communications, Marketing, and Education Committee

Communications, Marketing and Education Committee (CMEC)

2018 (YTD) Program Overview and Highlights

Committee Chairs: Sara Jonas | Carol Perkins
Marketing/Communications SVP: Bonnie Sonnenschein
Marketing/Communications Manager: Zach Harris

October 31, 2018

CMEC Mission & Goal

Mission

The CMEC supports the various ARMA roofing task groups and committees in developing marketing and communication materials to educate consumers and roofing professionals about the benefits of low and steep slope asphalt roofing systems.

Goal

To raise awareness for and promote the use of asphalt roofing technology in various building construction applications.

Overview of Program Achievements

This presentation will encompass all activity and accomplishments of the ARMA communications program from January 1 – present under the following three categories:

I. Discovery: Data and Research Findings

II. Media Development and Cultivation

III. Developing ARMA's Industry Authority

Discovery: Data and Research Findings

This year, the ARMA communications team has executed multiple data-gathering projects to better understand how ARMA is regarded in the industry, what types of information our audience members are seeking, how they obtain this information, and how ARMA can increase its message strength and diffusion.

The findings shared herein were used to a great extent to mold the 2019 CMEC proposal. The exact nature of the communications strategies / tactics developed are explained in exceptional depth in the 2019 proposal, therefore the following slides will provide an overview of the data-collection projects themselves but not the strategies developed from their insights.

Discovery: The IRE Contractors' Survey

In February, we secured an opportunity to poll contractors who attended the 2017 or 2018 IRE *for free*. This was used to gauge contractors' awareness of ARMA and QARC, and help guide the ARMA awards rebrand and future brand authority development. The survey concluded:

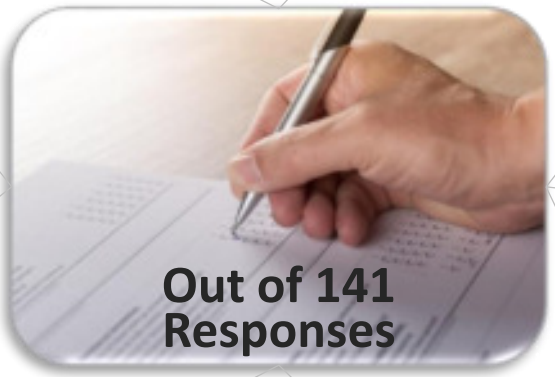
- QARC is not well-known, but contractors want to learn more
- ARMA is recognized in the industry, but there's room to improve
- ARMA is focusing on the correct media targets / platforms, but QARC doesn't always stick

Discovery: The IRE Contractors' Survey

47% have heard of ARMA

15% have contacted ARMA

72% want to learn more about ARMA's Awards Program



86.4% work with asphalt

77% work with shingles
66% work with modbit
29% work with BUR

92% have never heard of QARC

87% work with steep and low slope roofing

54% recognize asphalt as "innovative"

79% get their news from *Roofing Contractor*

Discovery: The Homepage Survey

In June, a survey was embedded on the website homepage to see which audiences are coming to ARMA, what information our visitors are seeking, if we are effective in providing that information, and what platforms are the most valued. The survey is still active, but results TYD show:

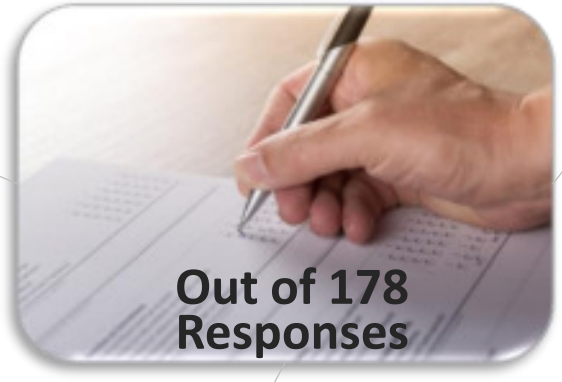
- Visitors are primarily homeowners
- Visitors are seeking information about shingles
- Videos, technical bulletins and news articles are effective platforms for reaching our audiences

Discovery: The Homepage Survey

84% were seeking info on shingles

7% on APP
9% on SBS

9% on BUR



80% said technical publications are important for obtaining asphalt roofing information

75% for news articles

72% for videos

56% were homeowners

12% were professionals seeking asphalt roofing information (analysts, material suppliers, consultants, home inspectors, etc.)

10% were contractors

8% were manufacturer employees

7% were engineers or architects

5% were building owners or managers

2% unspecified

**Percentages may exceed 100 in total as visitors could be seeking information on multiple topics*

Discovery: The ARMA Website

Since relaunching, the ARMA website has seen dramatic increases in engagement. Additionally, as the Google Indexing process approaches completion, website traffic began exceeding 2017 levels this August. When comparing August 2017 and 2018:

- The number of sessions has increased **five percent**
- Users (people): **four percent**
- Page views (total traffic): **10 percent**
- And pages per session: **five percent**

As we move deeper into 2018 and begin 2019, this trend is only expected to grow.

Discovery: The ARMA Website

When comparing total website engagement (January 1 – October 1), 2018's performance is far superior than this same time period last year. This is also expected to continuously improve as traffic numbers begin exceeding 2017 levels.

Pages / Session
17.05%
1.87 vs 1.59

Bounce Rate
-5.67%
69.29% vs 73.46%

Avg. Session Duration
23.15%
00:01:32 vs 00:01:15

Discovery: The ARMA Website

An ongoing 2018 research project has been the cultivation and analysis of our website's data. To date, this has revealed and in some cases confirmed several conclusions:

- Currently, our website is primarily servicing homeowners
- Information on shingles is viewed more often
- Most visitors come through organic traffic

Discovery: The ARMA Website – Most Popular Pages

YTD (1/1 – 10/1)	Page Sessions	Percentage of Web Traffic
Algae/Moss Prevention	15,470	11.82%
Homepage	12,267	9.37%
Shingle Brands	11,153	8.52%
Manufacturers	7,246	5.54%
Guide for Homeowners	6,107	4.67%
Technical Bulletins	3,920	2.99%
Resources	3,552	2.71%
Shingle Recycling	2,923	2.23%
FAQ	2,549	1.95%
Buckled Shingles	2,257	1.72%
Guide for Professionals	2,128	1.63%

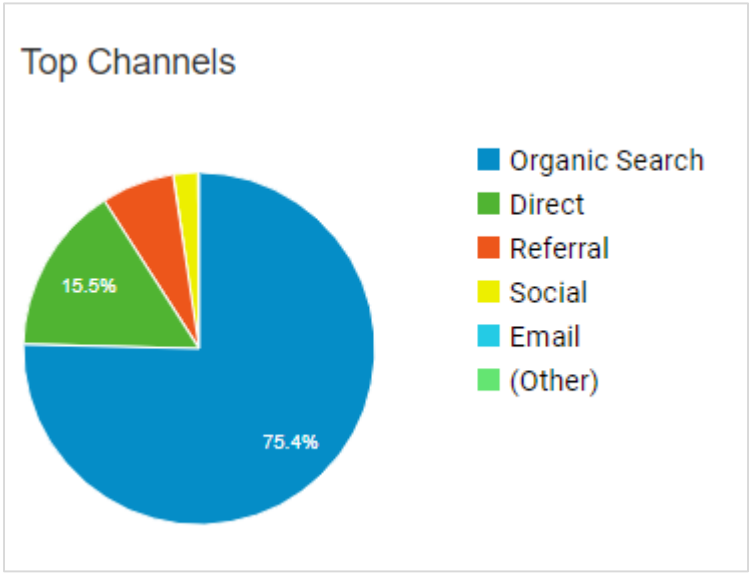
These 11 pages account for 53.15 percent of all traffic.

Discovery: The ARMA Website – Top Traffic Sources

YTD (1/1 – 10/1)	Page Sessions	Percentage of Sessions
Google / Organic	49,714	70.89%
Direct	10,881	15.52%
Bing / Organic	2,084	2.97%
Yahoo / Organic	940	1.34%
Facebook / Referral	721	1.03%
LinkedIn / Referral	356	0.51%
Shinglerecycling.org / Referral	328	0.47%
IKO / Referral	299	0.43%
Bergmanpressurewashing.com / Referral	240	0.34%
Duckduckgo.com / Referral	176	0.25%

Discovery: The ARMA Website – How They're Viewing

Data analysis shows the majority of visitors come through organic "search engine" traffic, meaning they are likely individuals seeking an answer to a question. While 15 percent are individuals familiar with ARMA and travel directly to our content. Additionally, the website has a healthy mix between mobile (including tablet) and desktop viewing.



1.	desktop	**39,922** (56.92%)
2.	mobile	**23,950** (34.15%)
3.	tablet	**6,259** (8.92%)

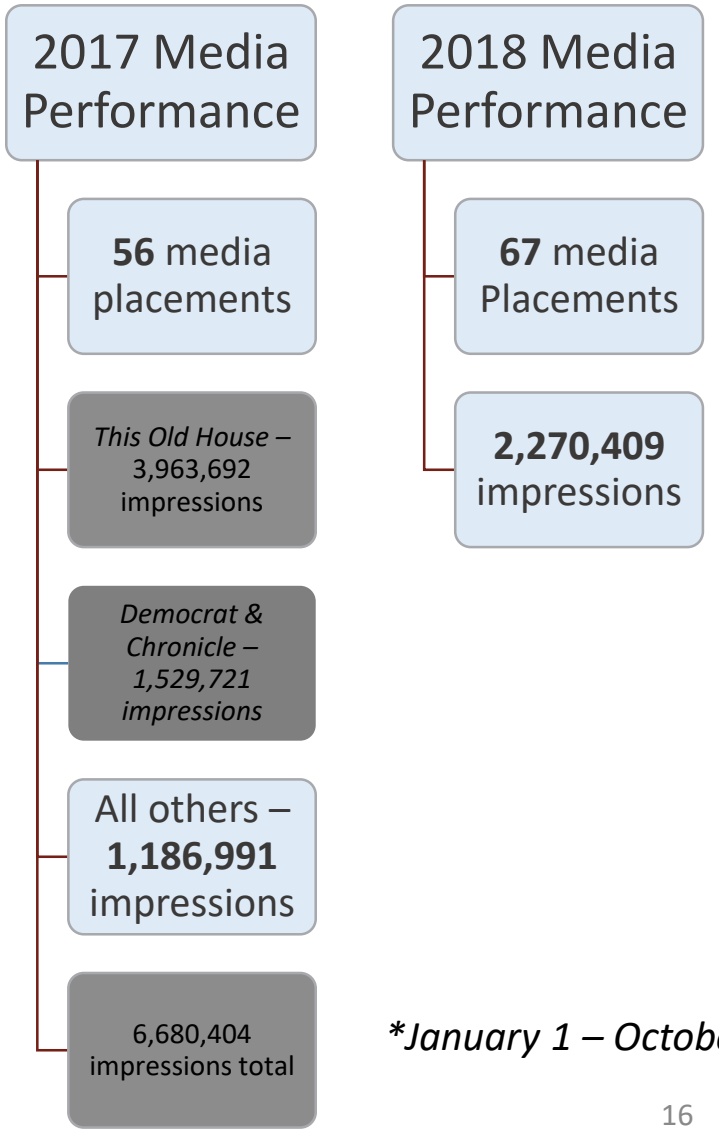
Media Cultivation and Development

This year, the communications team has amassed a large –and diverse– portfolio of media engagement, including press release coverage, article placements, Q&As, content contributions, industry reports and more. From the QARC Awards to the Q2 industry report, a plethora of ARMA news has reached our audiences so far this year.

To date, **67** media placements for **2,240,695** total impressions have been secured.

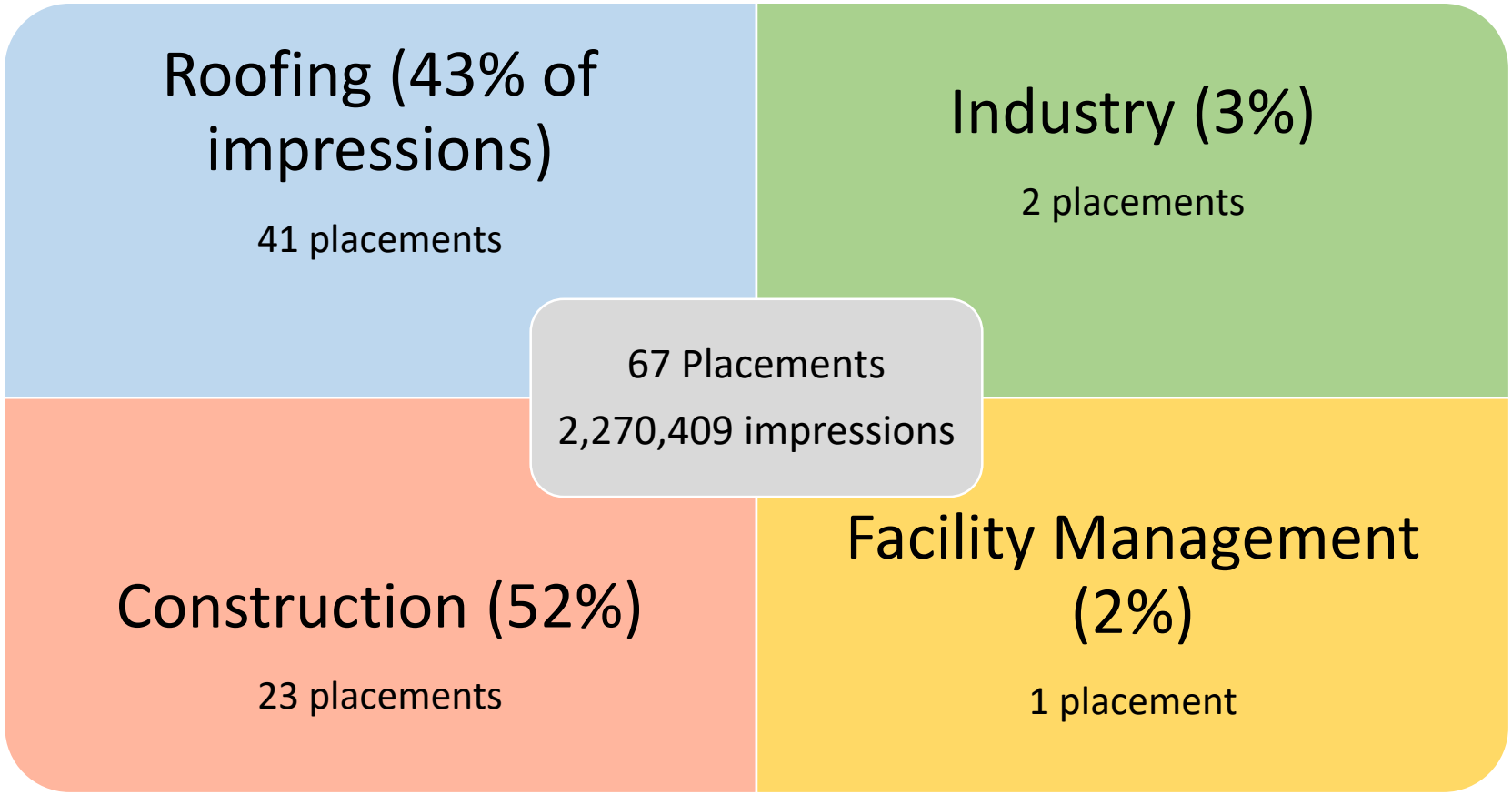
Media Cultivation and Development: Overview

While content contributions to *This Old House* and *Democrat & Chronicle* were valuable placements in 2017, such large-scale opportunities outside our target media will not manifest yearly. Therefore, the "core" of a trade media program prioritizes coverage in industry-specific media sectors, permitting stable growth in media engagement, reliability and authority. In this regard, the "core" of our program has grown by **91 percent** so far this year. (1,186,991 → 2,270,409).

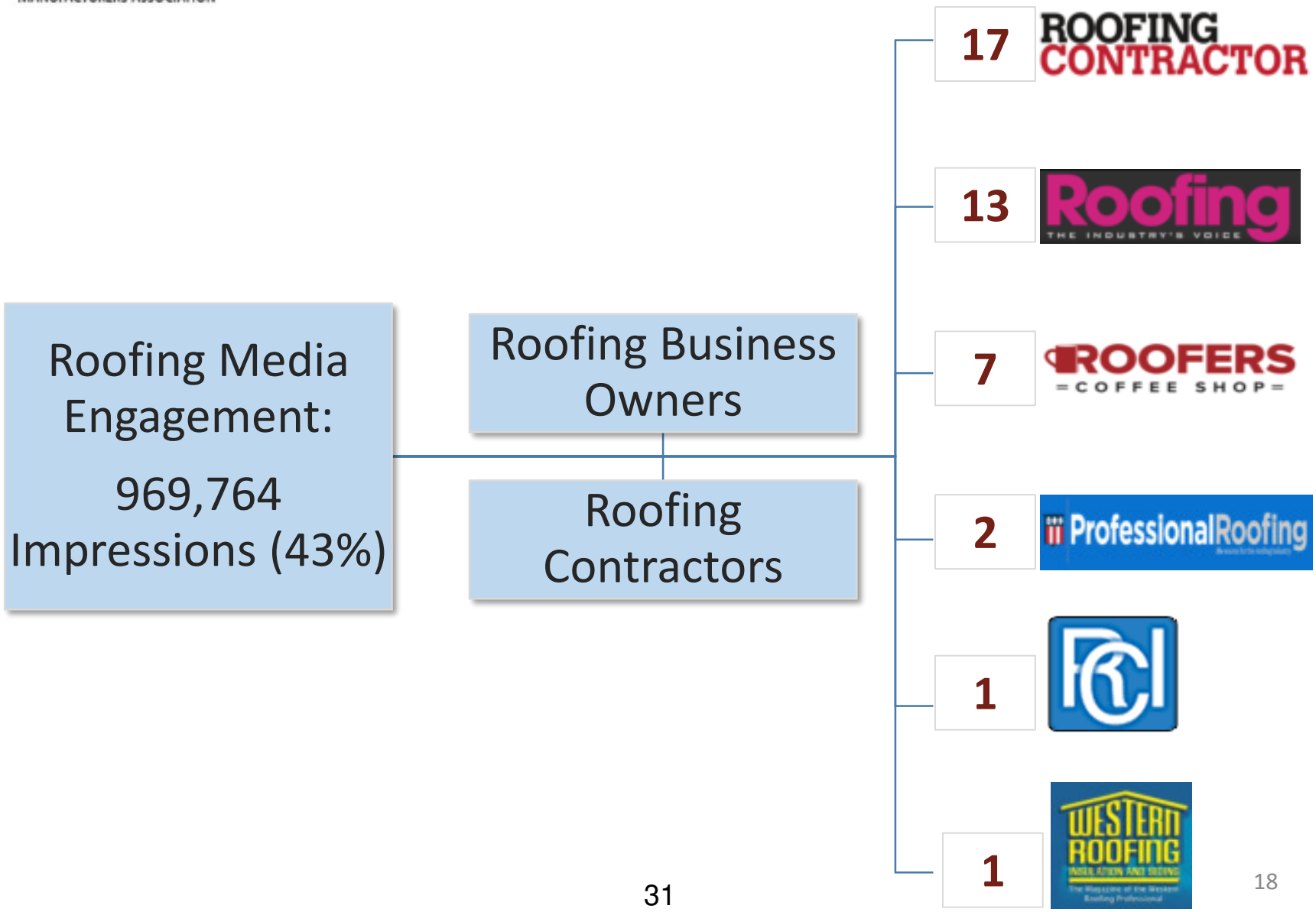


*January 1 – October 1

Media Cultivation and Development: News Sector Diversity



Media Cultivation and Development: Roofing Media



Media Cultivation and Development: Construction Media

Construction Media Engagement

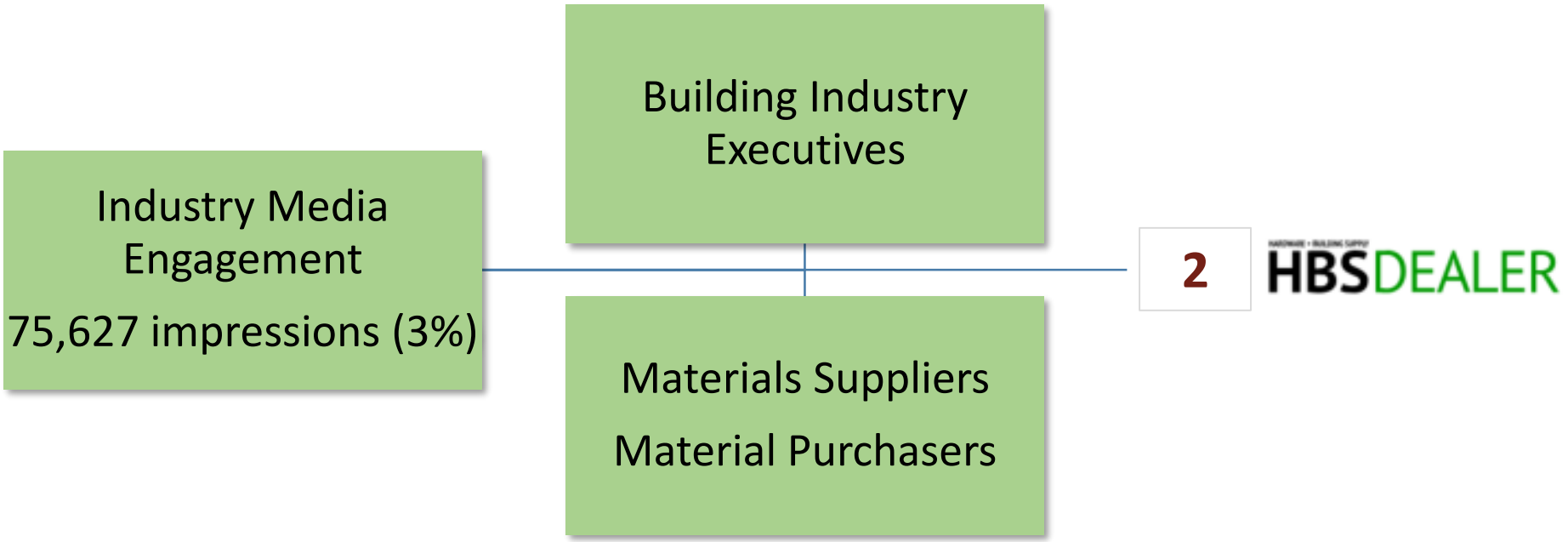
1,174,478 impressions (52%)

Architects
Builders
Contractors
Designers
Engineers

Project Managers
Remodelers
Renovators
Specifiers
Subcontractors

- 7 the construction specifier
  - 1 Extreme How-To
- 5 BE BUILDING ENCLOSURE
  - 1 CONTRACTOR
- 5 retrofit
  - 1 CONSTRUCTION CANADA
- 2 JLC
  - 1 Builder

Media Cultivation and Development: Industry Media



Media Cultivation and Development: Facility Management Media

Facility Management Media Engagement

50,540 impressions (2%)

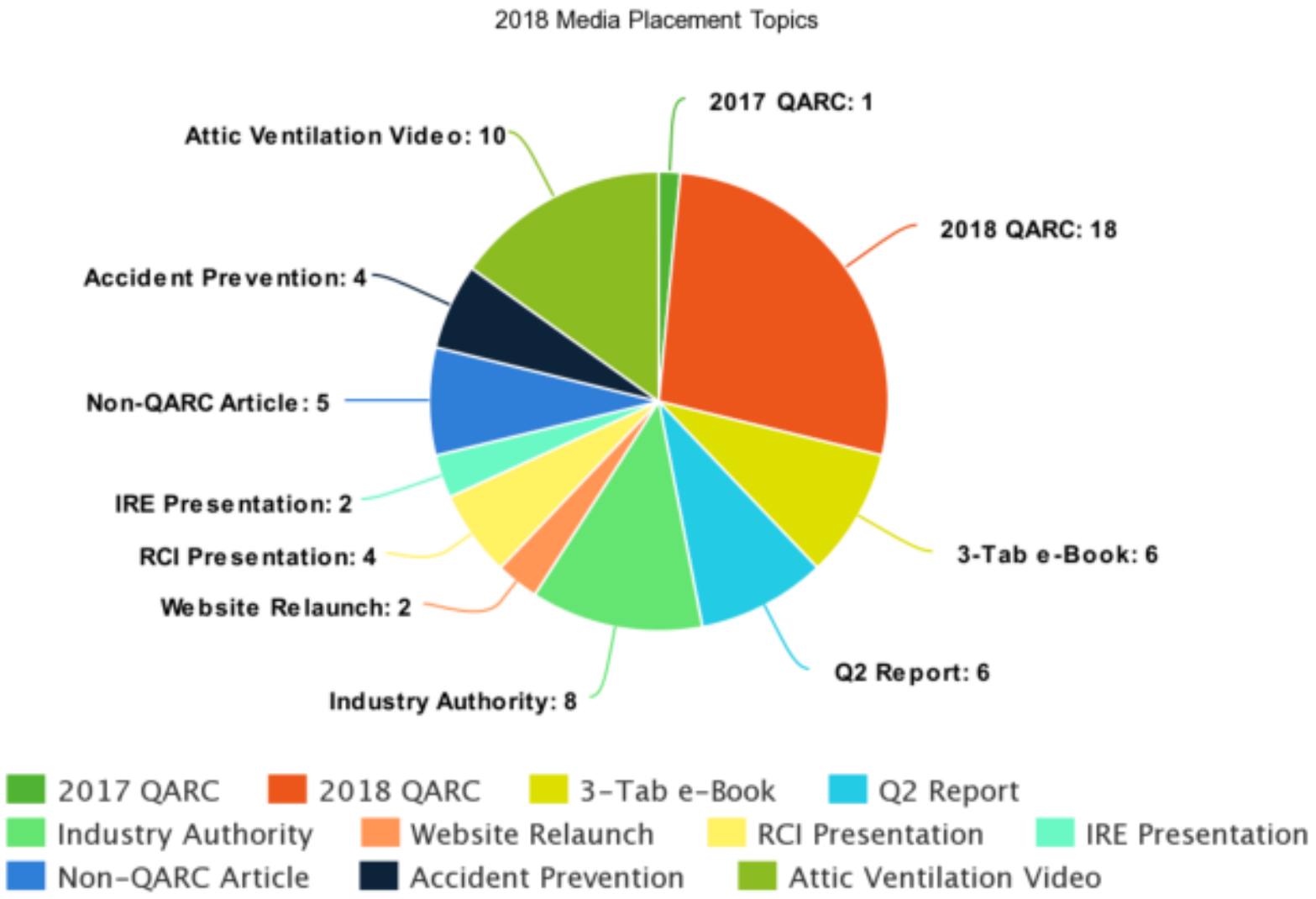
Building Managers

Building Owners

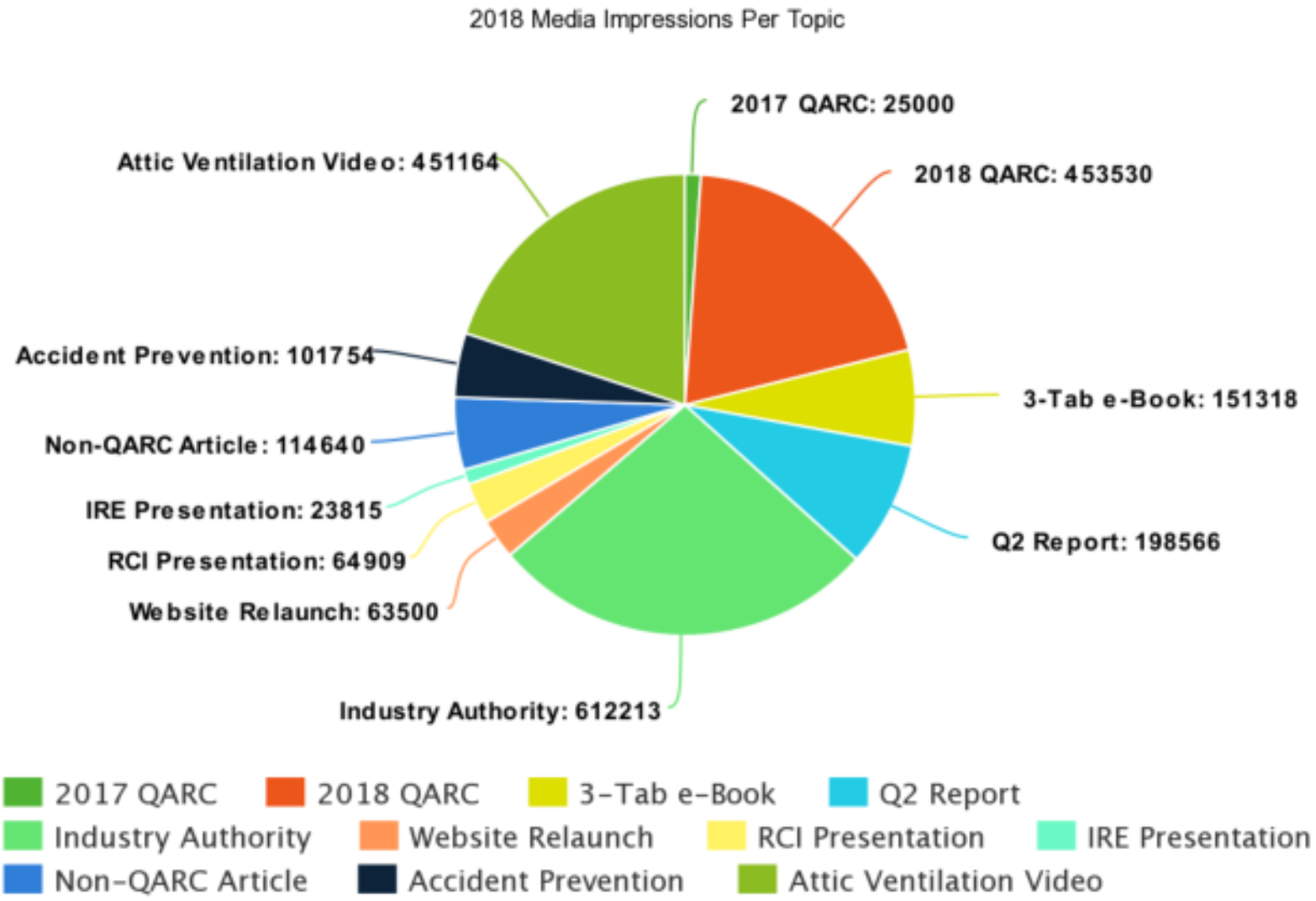
1

FACILITY EXECUTIVE

Media Cultivation and Development: ARMA News Coverage



Media Cultivation and Development: ARMA News Coverage



Media Cultivation and Development: ARMA Article Features

Built to Last

Multilayer asphalt roofing stands up to weather extremes

Construction Specifier – May 2018: Feature article on low slope asphalt roofing systems.

DETAILS

PONDING WATER BASICS

Proper Drainage Design Can Help Ensure the Reliability of Low-Slope Roofs

Roofing Magazine – May/June 2018: Feature article on ponding water basics.

Feature article: Highlighting the benefits of steep slope asphalt roofing. Slated for the December issue.

Media Cultivation and Development: QARC Feature Articles

The Topsail Residence – 2018 QARC Silver Winner

Status:
Placed

Roofing
THE INDUSTRY'S VOICE

West Loch Elderly Village – 2018 QARC Honorable Mention

Status:
Submitted

WESTERN ROOFING

The Museum of the American Revolution – 2018 QARC Bronze Winner

Status:
Submitted

ROOFING CONTRACTOR

The Cincinnati Music Hall – 2018 QARC Gold Winner

Status:
Researching Placement

Media Cultivation and Development: Article Breakdown

Low Slope

1. Low Slope Asphalt Roofing Feature **– Placed**
2. Ponding Water Basics **– Placed**
3. Museum of the American Revolution **– Submitted**

Steep Slope

1. Topsail Residence **– Placed**
2. West Loch Elderly Village **– Submitted**
3. Steep Slope Asphalt Roofing Feature **– Submitted**
4. Cincinnati Music Hall **– Researching Placement**

Media Cultivation and Development: QARC Success

2018 QARC media impressions **YTD***

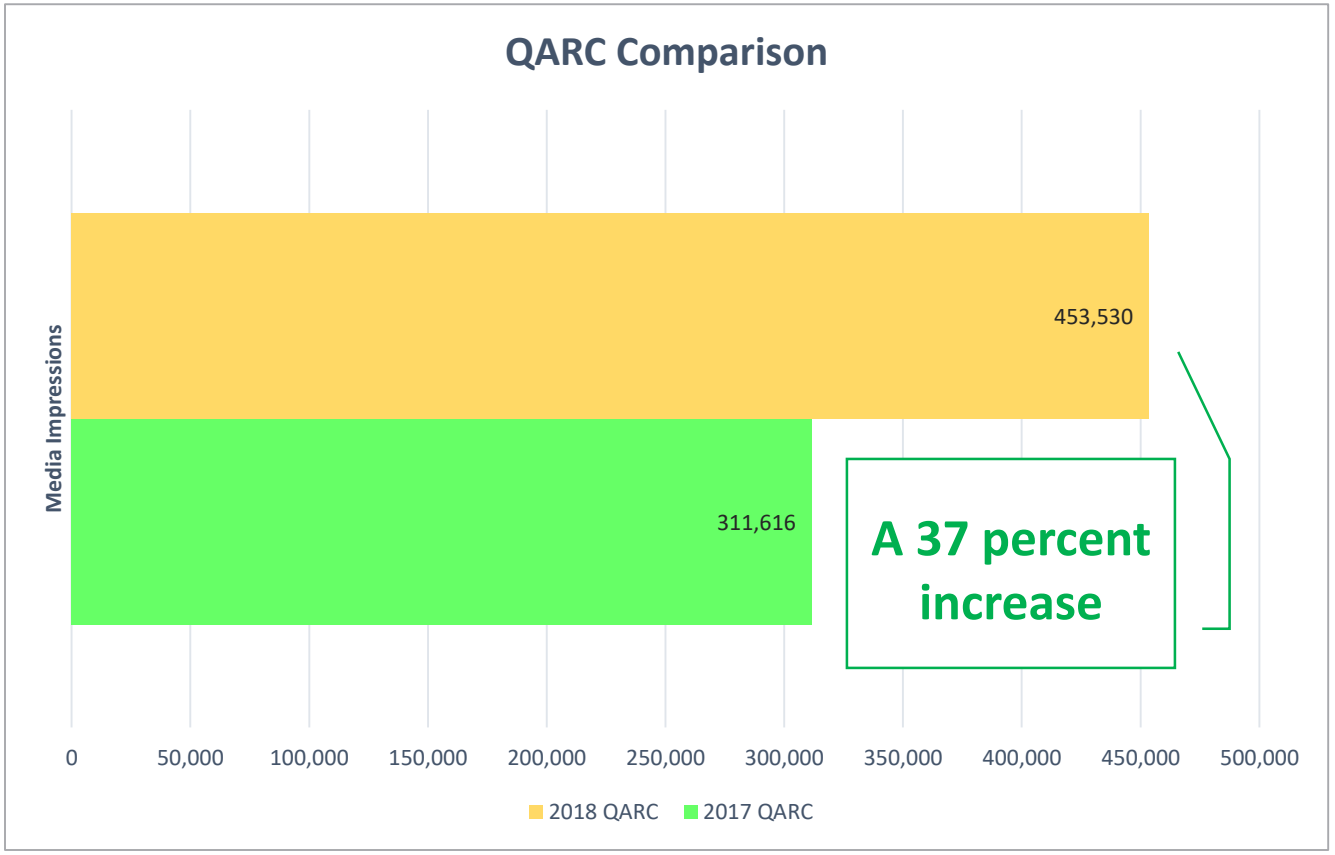
18 placements

453,530 impressions

Total 2017 QARC media impressions

10 placements

311,616 impressions



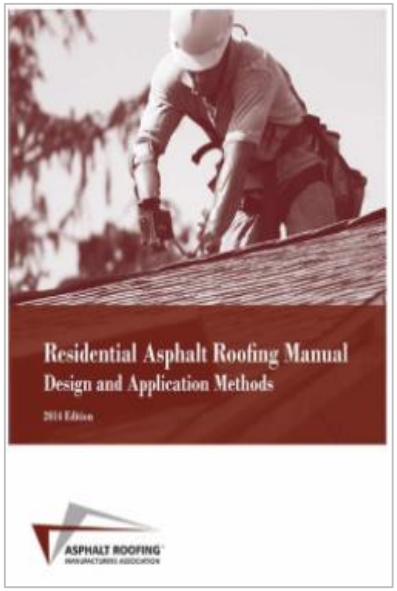
**Three 2018 placements not included: West Loch, Museum of the American Revolution, and the Cincinnati Music Hall*

Developing ARMA's Industry Authority

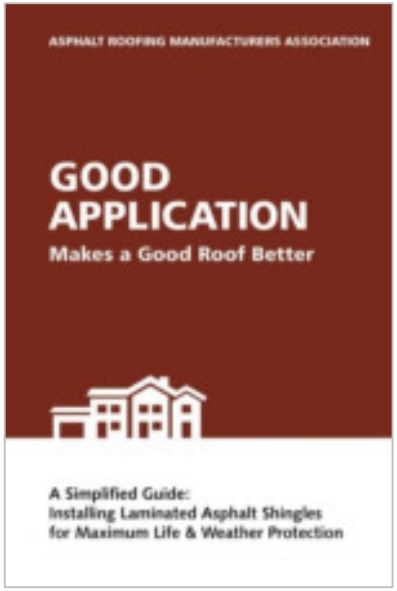
In addition to conducting research through data-collection projects and building productive and rewarding relationships with a diverse palate of media members, the communications team has actively promoted several marketing materials that raise ARMA's industry authority. These resources help boost our credibility, recognition and overall brand health.

Industry Authority: ARMA Bookstore

2 Print
2 eBook
Total: **$31.57**



29 Print
46 eBook
Total: **$730.30**



4 Print
4 eBook
Total: **$34.23**

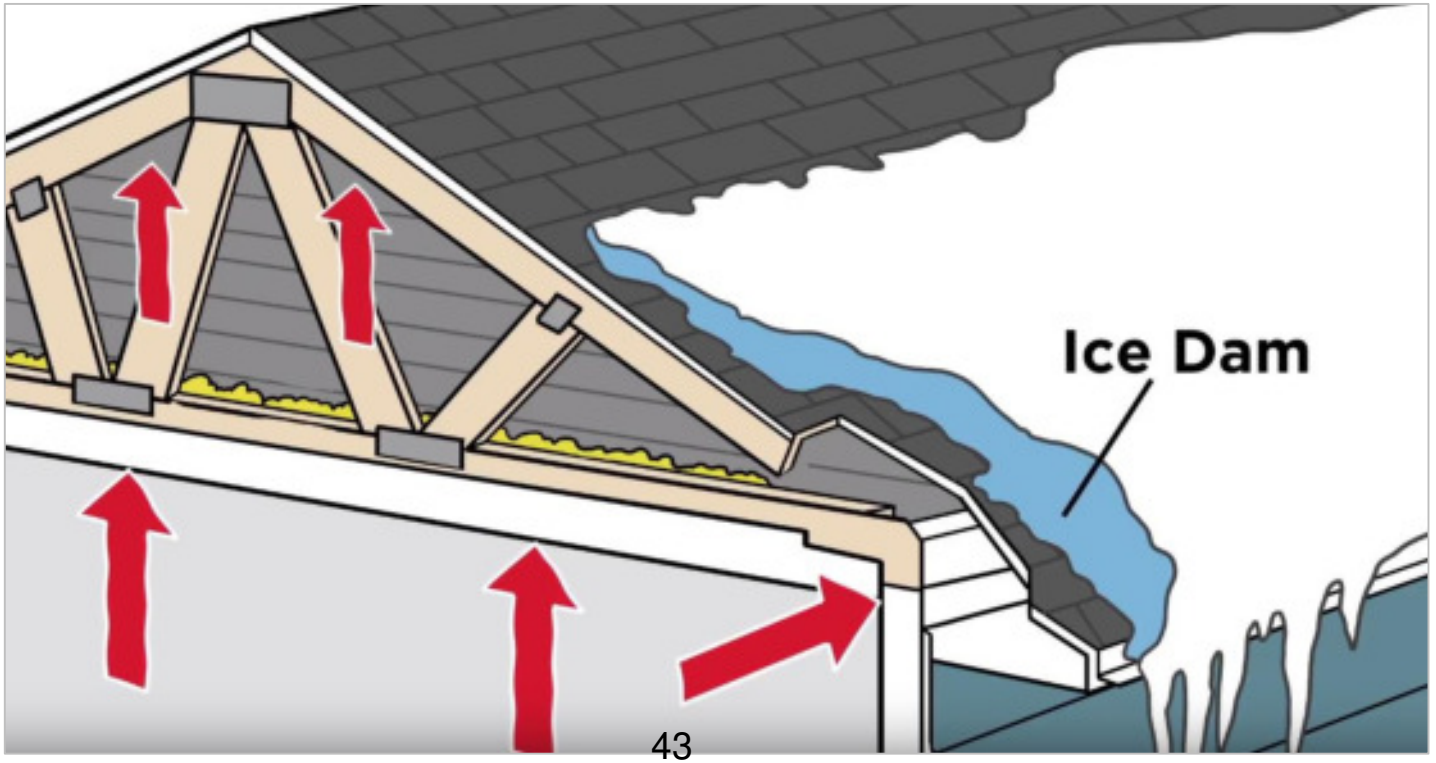
3 Print
9 eBook
Total: **$43.41**

99 Copies Sold Through October
Grand Total: **$839.51**

Available on all major retailers, including Amazon, Nook, Apple and the Google store.

Industry Authority: ARMA YouTube

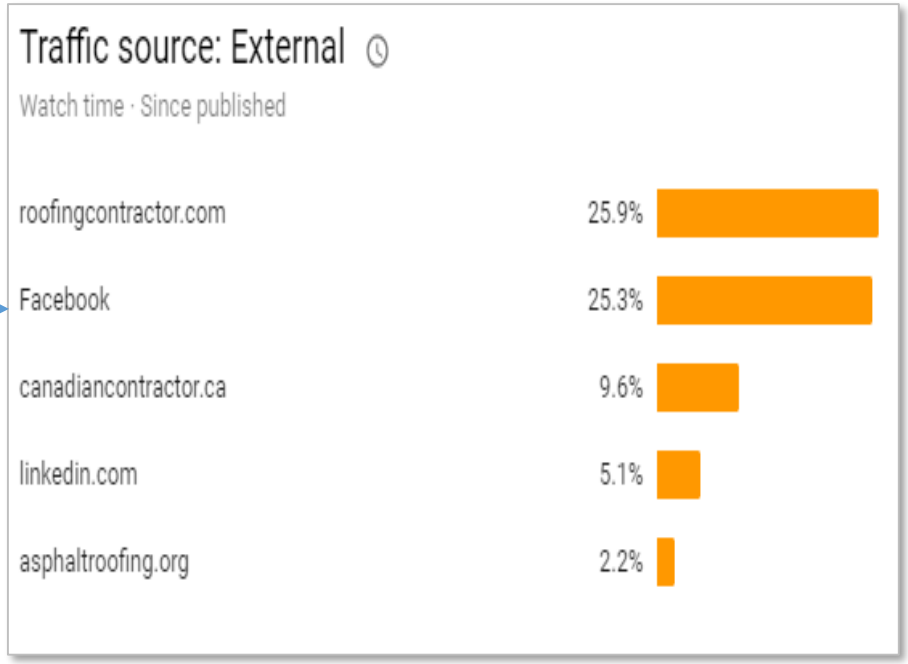
In April, the latest ARMA video on steep slope attic ventilation was launched. To date, the video has quickly amassed more than **7,000 views** and continues to grow. In total, the attic ventilation video has generated over **35,500 total impressions** (as recorded by YouTube analytics).



Industry Authority: ARMA YouTube

How do individuals arrive at our attic ventilation video?

- Suggested videos – 51.1%
- External – 23% (video promotion)
- YouTube search – 13.2%
- Browsing – 8.4%
- Unknown – 1.4%



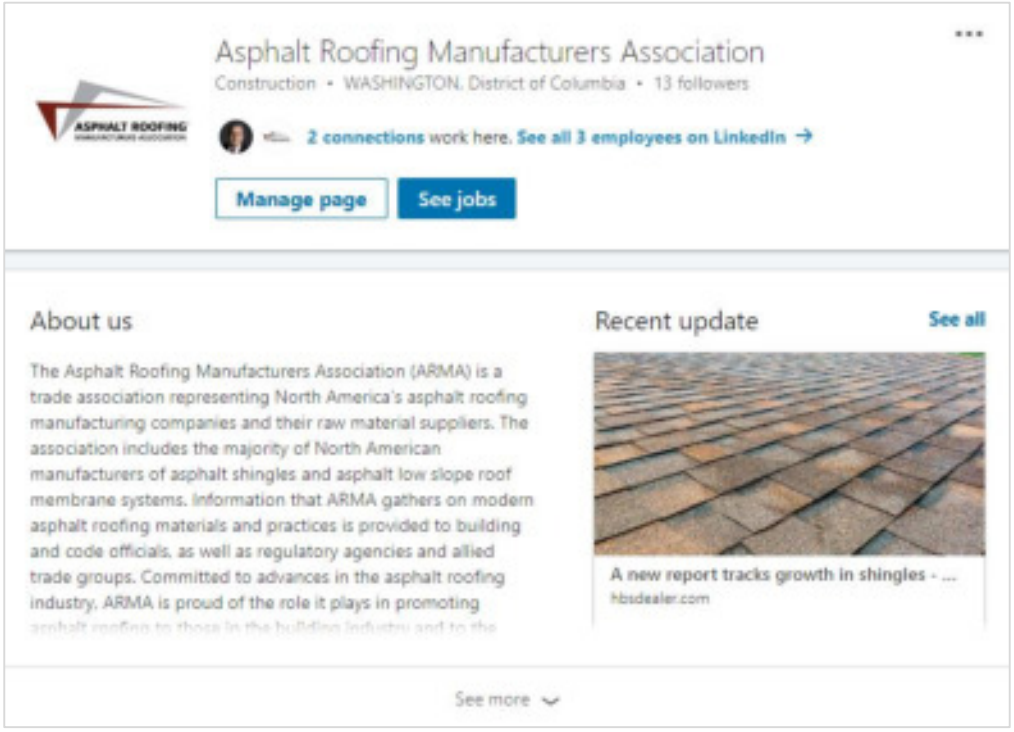
Industry Authority: Excellence in Asphalt Roofing

After an extensive promotional campaign of the 2018 QARC Award Winners, the communications team began the rebranding process for **ARMA Excellence in Asphalt Roofing** in conjunction with the CMEC. The rebranding process was officially completed and announced to the media in early October. Accomplishments so far include:

- Creation of the **Excellence in Asphalt Roofing** logo
- Completely rebranding QARC on the website, in marketing materials, in emails, templates and more.
- Updating the awards program rules and submission form with legal advisement
- Rewriting multiple website SEOs
- Writing and distributing a press release

Industry Authority: ARMA on LinkedIn

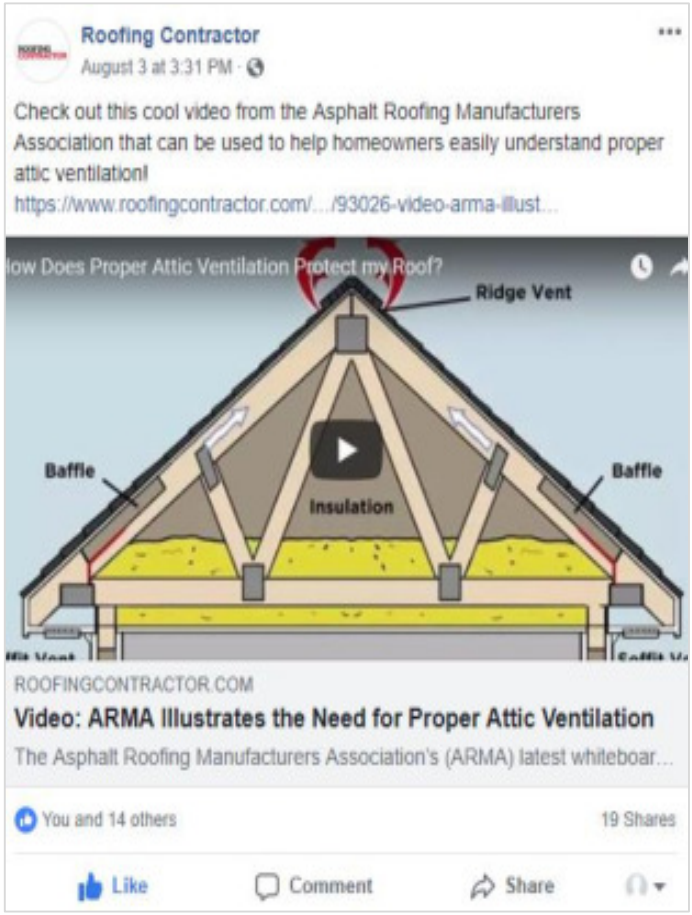
In late July, the ARMA LinkedIn page was transitioned to a corporate page registered under ARMA's Executive Vice President Reed Hitchcock. The ARMA communications team has actively shared content to build a new following base. To date, the page has amassed 89 followers and over 1,700 organic impressions.



Industry Authority: ARMA on Facebook

The ARMA Facebook page continues to steadily grow through organic interest. To date, the page has 133 likes, 145 followers, and engagement from member companies, contractors and construction professionals.

In August, the communications team developed and tested an ad criteria targeting roofing contractors. The 24 hour test yielded 3,775 impressions and 131 direct links to the attic ventilation video. The search criteria will be expanded as ads are implemented for upcoming campaigns, such as the Excellence in Asphalt Roofing Awards Program.



Looking Ahead to the Future

New eBook

Singly Ply

Metal Roofing

Press Releases & Articles

Rebuilding LinkedIn

Excellence in Asphalt Roofing

ARMA Technical Affairs Committee

ENVIRONMENTAL PRODUCT DECLARATION

APP-MODIFIED BITUMEN ROOFING MEMBRANE

INSTALLATION: TORCH APPLIED

Low-slope roofing membrane installed using a propane torch and consisting of an APP-modified bitumen cap sheet and base sheet.

The Asphalt Roofing Manufacturers Association (ARMA) is a trade association representing North America's asphalt roofing manufacturing companies and their raw material suppliers. The association includes the majority of North American manufacturers of asphalt shingles and asphalt low slope roof membrane systems. Information that ARMA gathers on modern asphalt roofing materials and practices is provided to building and code officials, as well as regulatory agencies and allied trade groups. Committed to advances in the asphalt roofing industry, ARMA is proud of the role it plays in promoting asphalt roofing to those in the building industry and to the public.

ARMA's vision and mission is to be an association committed to the long-term sustainability of the asphalt roofing industry and to advocate and advance the interests of the asphalt roofing industry by leveraging the collective expertise of its members.

APP-MODIFIED BITUMEN ROOFING MEMBRANE
INSTALLATION: TORCH APPLIED

According to ISO 14025

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Provided
DECLARATION HOLDER	UL Provided
DECLARATION NUMBER	UL Provided
DECLARED PRODUCT	APP-Modified Bitumen Roofing Membrane (Installation: Torch Applied)
REFERENCE PCR	UL Provided
DATE OF ISSUE	UL Provided
PERIOD OF VALIDITY	UL Provided
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications
The PCR review was conducted by:	UL Provided
	UL Provided
	UL Provided
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	UL Provided
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	UL Provided

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Participating Members

The following ARMA members provided data for the product covered within this document:

CertainTeed
www.certainteed.com

Firestone Building Products
www.firestonebpco.com

IKO
www.iko.com

GAF
www.gaf.com

Johns Manville
www.jm.com

Product Definition

Product Description

The low-slope roofing membrane included in this study consists of an atactic-polypropylene (APP)-modified bitumen cap sheet and a base sheet.

Component	Specification	Description
APP Cap Sheet	ASTM D6222, D6223, CSA A123.23	- Polyester and/or fiberglass mat coated with polymer-modified asphalt and colored mineral granule surfacing
APP Base Sheet	ASTM D6222, D6223, D6509, CSA A123.23	- Polyester and/or fiberglass mat coated with polymer-modified asphalt - A fine mineral matter may be applied as a surfacing or parting agent to both sides of the base sheets

Manufacturing Locations

The components of the low-slope APP-modified bitumen roofing membrane are manufactured in the United States and/or Canada.

Applications and Uses

Low-slope roofing systems are installed on roofs with slopes less than 2:12. Low-slope roofing systems are primarily used to protect buildings and structures from the weather.

In addition to providing beauty, affordability and reliability, modified bitumen roof systems are trusted to protect against weather conditions, temperature extremes, impacts and foot traffic. Multiple layers of roofing materials including engineered reinforcements provide strength and durability. It is a versatile solution, able to adapt to many roof designs.

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System Description

Material Content

Table 1 shows the input materials for APP-modified bitumen cap sheet and base sheet manufacturing, and the weight percentages of the components in the product system.

Table 1: Average material inputs for APP-modified bitumen cap and base sheet manufacturing

Material Inputs*	Weight Percentage in Individual Component
APP-Modified Cap Sheet (53% of representative roofing system)	
Asphalt	37%
Mineral granules	35%
Mineral stabilizers	18%
Atactic polypropylene (APP) polymers	5%
Polyester mat	4%
Sand	1%
Polyolefin film	<1%
Fire retardant (colemanite)	<1%
Selvage edge film (LDPE)	<1%
APP-Modified Base Sheet (45% of representative roofing system)	
Asphalt	512%
Mineral stabilizers	267%
Atactic polypropylene (APP) polymer	13%
Fiberglass / Polyester mat	4%
Sand	4%
Polyolefin film	<1%

*Total system also includes weight of ancillary materials used during installation

Manufacturing Process

APP Cap Sheets

Manufacture of APP polymer-modified bitumen cap sheets involves impregnating and coating a fiberglass or polyester mat with a polymer-modified asphalt. The polymer-modified asphalt is produced by mixing appropriate proportions of polymer, non-oxidized or lightly oxidized asphalt, and limestone or another suitable mineral stabilizer. An appropriate surfacing material is applied. APP cap sheets may use a colored mineral granule or fine mineral as surfacing. APP cap sheets may also utilize a polyolefin burn-off film on the back. The product is cooled, wound into rolls, and packaged for shipment.

APP Base Sheets

Manufacture of APP polymer-modified bitumen base sheets involves impregnating and coating a fiberglass and/or polyester mat with polymer-modified asphalt. The polymer-modified asphalt is produced by mixing appropriate

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proportions of polymer, non-oxidized or lightly oxidized asphalt, and limestone or another suitable mineral stabilizer. Fine mineral matter may be applied as a surfacing agent or as a parting agent to both sides of the base sheets. APP base sheets may alternatively utilize a polyolefin burn-off film on the back. The product is cooled, wound into rolls, and packaged for shipment.

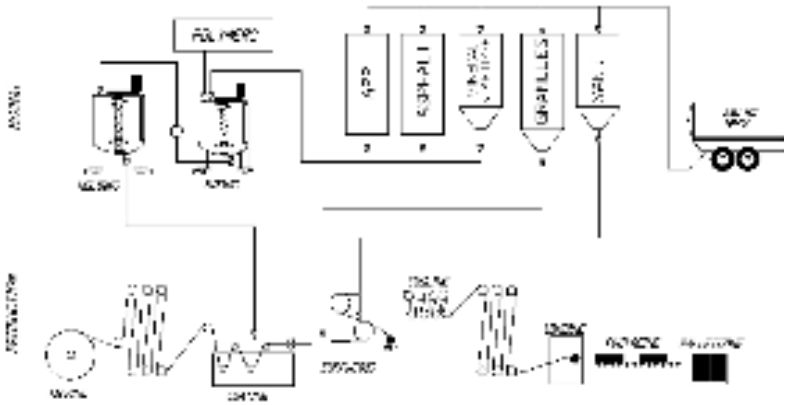

Figure 1: Modified bitumen sheet process diagram

Installation

For this EPD, an APP-modified bitumen roofing membrane consists of one base sheet and one cap sheet. APP systems are most commonly installed using a propane torch. The roll is positioned and heated with the torch, causing the asphalt compound on the roll to melt and the parting film to burn off. The sheet is then slowly unrolled into liquid bitumen as the installer continues to heat the roll. A weighted roller follows the sheet to secure the seam. This process is used to install the base sheet and the cap sheet. Mineral granules are applied to the adhesive that has migrated out of the cap sheet seams to protect it from UV and for aesthetic reasons.

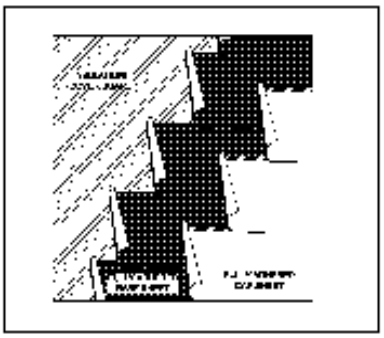

Figure 2: APP modified bitumen roof membrane system installation details

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The table below presents the installation details for the membrane. The effective coverage includes the required overlap of sheets while the scrap rate accounts for material wasted during installation. The VOC (non-methane) emissions associated with heating the asphalt for adhesion are calculated using the Area Source Category Method document on asphalt emissions (US EPA 2000). Information was not available on the direct emissions associated with burning the parting film, therefore this was not included in the study.

Table 2: Roofing system installation inputs and outputs, per 1 m²

	Weight of Material [kg / m²]	Effective Coverage [m² of Material / 1 m² of Roof]	Scrap Rate	Required Quantity of Material [kg / 1 m²]
Inputs				
Cap sheet	4.8	1.08	5%	5.43
Base sheet	4.1	1.08	5%	4.64
Flashing	0.10	N/A	10%	0.1
Mineral granules (at seams)	0.08	N/A	-	0.08
Propane	1.28 (MJ)	N/A	-	1.28 (MJ)
NMVOCs from torching	0.014	N/A	-	0.014
Outputs				
Installed System				9.77
Waste				0.549

End-of-Life

At the end-of-life, the low-slope membrane is removed by manual labor, often with roofing shovels. The debris is collected and transported off-site via truck. The waste is brought to a landfill.

Life Cycle Assessment – Product Systems and Modeling

Declared Unit

The declared unit of this study is 1 m² (10.8 ft²) of the installed roofing membrane. The associated reference flow (the quantity of material required to fulfill the declared unit) is 9.774 kg/m².

Life Cycle System Boundaries

The life cycle study encompasses the cradle-to-gate production, construction, and end-of-life (EoL) stages of a torch applied low-slope APP-modified bitumen roofing membrane, including raw material extraction and processing, product manufacturing, and installation, plus material disposal at EoL. Transportation between stages is accounted for, including raw material transport to the manufacturing facility, finished product transport to the construction site, and transport of the roof system at EoL to the landfill. Use, maintenance, repair, or replacement of the roof system over a building's service life is not included in this evaluation. In addition, production, manufacture and construction of manufacturing equipment and infrastructure; repair and maintenance of the production system; energy and water use related to company management and sales; delivery vehicles and laboratory equipment; as well as maintenance and operation of support equipment are all outside of the scope of the study.

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Product Stage			Construction Stage		Use Stage					End-of-Life Stage			
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4
Raw materials supply	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	De-construction	Transport	Waste processing	Disposal
X	X	X	X	X	MND	MND	MND	MND	MND	X	X	X	X

MND = module not declared

Assumptions

The analysis uses the following assumptions:

- Mineral granules can be made in a variety of colors, which affects the composition of the required mineral granule coating. White mineral granules were selected as a representative product for this study because the pigment used for white products, titanium dioxide, generally has a higher impact than other pigments; therefore, using white is a conservative assumption.
- Where a manufacturer was unable to calculate an average distance for the distribution of its final product from its facility, it provided a best estimate.
- Due to lack of data availability some proxy background data were used, specifically in the context of the geographical scope of the study.

Cut-off Criteria

No cut-off criteria were applied in this study. All reported data were incorporated and modeled using best available LCI data.

Transportation

Production-weighted averages for the transportation distances and modes of transport associated with each participating company are included for the transport of the raw materials to production facilities and the transport of the finished products to distribution centers. The transport of finished products from distribution center to the construction site and of waste from the construction site to landfill were each assumed to be 20 miles.

Temporal, Technological, and Geographical Coverage

Temporal: Primary data, collected from the participating ARMA member companies, is representative of the year 2012.

Technological: At least 75% of the production market is estimated to be represented within this study.

Geographical: The geographic coverage represented by this study is the United States and Canada, though some

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manufacturers source their raw materials from outside this region. Whenever US background data were not readily available, European data or global data were used as proxies, depending on appropriateness and availability. Results are presented as production weighted averages for the US and Canada.

Background Data

The LCA model was created using the GaBi ts Software system for life cycle engineering, developed by thinkstep AG (previously PE INTERNATIONAL). The GaBi 2013 database provides the LCI data for several of the raw and process materials obtained from the background system. Secondary data, information from relevant literature, are from a range of sources between 1977 (asphalt oxidation information) and 2013.

Data Quality

As the relevant foreground data is primary data or modeled based on primary information sources of the owner of the technology, no better precision is reachable within this product. Seasonal variations and variations across different manufacturers were balanced out by using yearly averages and weighted averages. All primary data were collected with the same level of detail, while all background data were sourced from the GaBi 2013 databases. Allocation and other methodological choices were made consistently throughout the model.

Allocation

As several products are often manufactured at the same plant, participating companies used mass allocation to report data since the environmental burden in the industrial process (energy consumption, emissions, etc.) is primarily governed by the mass throughput of each sub-process.

All packaging waste generated during installation, as well as 40% of the wooden pallets used for shipping of products, are assumed to be sent to landfill and the system credited with any avoided production of electricity generated from the combustion of landfill gas.

The impacts due to the use of any recycled materials during manufacturing come only from further processing required during the recycling process. Where in-house recycling is used to create other products, co-product allocation by mass is used and any additional processing steps required for use of the recovered materials are accounted for. It is conservatively assumed that all roofing materials disposed at EoL are sent to landfill. This will vary from job site to job site as some roofers may recycle metal components.

Life Cycle Assessment – Results and Analysis

Environmental Product Declarations (EPDs) created under a different Product Category Rule (PCR) are not comparable. Additionally, EPDs based on a declared unit shall not be used for comparisons between products, regardless of the EPDs using the same PCR.

Use of Material Resources

The material resource consumption associated with the installed roofing membrane is presented below for the production, construction, and EoL stages. Water consumption values are negative due to waste sent to landfill during installation and at EoL. A landfill introduces blue water to the watershed because it collects rainwater during its lifetime that is eventually released back into the ground water, therefore more blue water is coming out of the process than going in. Rainwater is not blue water and is therefore not included in the water consumption metric.

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Table 3: Resource use results for each life cycle stage, per 1 m²

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Renewable materials	kg	42.643.3	0.60.5	1.2	44.445.0
Nonrenewable materials	kg	15.615.7	1.1	2.3	19.019.1
Water consumption	L	69.363.2	-1.2	-21.3-21.4	46.840.6

Primary Energy by Life Cycle Stage

The primary energy demand associated with the installed roofing membrane is presented below for the production, construction, and EoL stages. Results are given as higher heating value (HHV), per the PCR. Renewable energy is negative for construction due to the credit given for reusing pallets.

Table 4: Primary energy demand results for each life cycle stage, per 1 m²

Primary Energy	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Nonrenewable fossil	MJ (HHV)	398	18.017.8	7.7	423424
Nonrenewable nuclear	MJ (HHV)	8.48.3	0.2	0.2	8.88.7
Renewable (solar, wind, hydro, geo)	MJ (HHV)	7.27.1	-1.2	0.3	6.36.2
Renewable (biomass)	MJ (HHV)	1 x 10^{-10}	1 x 10^{-5}	5 x 10^{-12}	**1 x 10^{-5}**

Life Cycle Impact Assessment

The environmental impacts associated with the installed roofing membrane are presented below for the production, construction, and EoL stages.

Table 5: Life cycle impact category results, per 1 m² (TRACI 2.1)

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Global warming potential	kg CO_2-eq	8.58.6	1.3	0.5	10.310.4
Smog creation potential	kg O_3-eq	0.4	0.2	0.04	**0.7**
Acidification potential	kg SO_2-eq	0.03	0.006	0.002	**0.04**
Eutrophication potential	kg N-eq	0.0070.008	4 x 10^{-4}	3 x 10^{-4}	0.0080.009
Ozone depletion potential	kg CFC-11 eq	6 x 10^{-10}	3 x 10^{-9}	1 x 10^{-11}	**4 x 10^{-9}**

Waste Generation

The waste generation associated with the installed roofing membrane is presented below for the production, construction, and EoL stages.

Table 6: Waste generation results, per 1 m²

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Non hazardous waste generated	kg	1.0	0.5	9.8	11.311.4
Hazardous waste generated	kg	0.004	-8E-06-9 x 10^{-6}	2 x 10^{-4}	**0.004**

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Additional Environmental Information

Reflective Roofs

Reflective roofs are defined as roofing products with high solar reflectance. Many in the construction industry define "cool roofs" as roofing products with high solar reflectance and high thermal emittance. Asphalt-based products have the inherent property of having high emittance, regardless of their reflective properties. Asphaltic roof systems typically have thermal emittance values greater than 0.80. Reflectance is a deliberate product characteristic, and varies based on the surfacing used.

There are reflective roof options available for virtually any roof and any building. Because of asphalt roofs' longevity, asphalt-based products provide excellent value for homeowners and building owners by delivering superior durability and sustainability at reasonable cost.

Modified bitumen membranes provide options for varying levels of reflectivity. The reflectivity is related to the color of the modified bitumen membrane surface, surfacing material, or field applied coating. While reflective roofs are an increasingly popular roof option, they represent one of many approaches to help building owners and consumers reduce building energy use and address contemporary environmental concerns.

Individual Component Results

The material resource consumption, primary energy demand, environmental impacts, and waste generation results associated with each individual component (excluding ancillary materials used during installation) of the roofing system are presented below for the production stage (A1-A3).

Table 7: Production stage (A1-A3) impact results for each system component, per 1 m^2 of individual component

Impact Category	Units	Base sheet	Cap sheet
Renewable materials	kg	20.51.0	17.3
Nonrenewable materials	kg	5.3	8.5
Water consumption	L	31.226.4	30.729.5
Nonrenewable fossil	MJ (HHV)	183203	16048
Nonrenewable nuclear	MJ (HHV)	3.98	3.65
Renewable (solar, wind, hydro, geo)	MJ (HHV)	3.21	3.2
Renewable (biomass)	MJ (HHV)	5 x 10^{-11}	6 x 10^{-11}
Global warming potential	kg CO^2-eq	4.13	3.95
Smog creation potential	kg O^3-eq	0.32	0.2
Acidification potential	kg SO^2-eq	0.01	0.01
Eutrophication potential	kg N-eq	0.005	0.002
Ozone depletion potential	kg CFC-11 eq	3 x 10^{-10}	32 x 10^{-10}
Non hazardous waste generated	kg	0.5	0.4
Hazardous waste generated	kg	0.002	0.002

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References

- ASTM (2014). "Product category rules for preparing an environmental product declaration for product group: Asphalt Shingles, Built-up Asphalt Membrane Roofing and Modified Bituminous Membrane Roofing." (http://www.astm.org/CERTIFICATION/DOCS/152.PCR_ASTM_Asphalt_Roofing_PCR_073114.pdf)
- LBP, University of Stuttgart and thinkstep GmbH, Leinfelden-Echterdingen (2013). GaBi 6 dataset documentation for the software-system and databases (http://documentation.gabi-software.com/)
- thinkstep (formerly PE INTERNATIONAL) (2015). "Life Cycle Assessment of Asphalt Roofing Systems: Cradle-to-grave LCAs of a steep-slope and four low-slope industry-average asphalt roofing systems."
- US EPA. "Area Source Category Method Abstract – Asphalt Roofing Kettles." (2000). (https://www.epa.gov/sites/production/files/2015-08/documents/asphalt.pdf)

LCA Development

The EPD and background LCA were prepared by thinkstep, Inc. (previously PE INTERNATIONAL).

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info@thinkstep.com
www.thinkstep.com

Contact Information

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529 14th Street, NW
Suite 750
Washington, DC 20045
Tel: (202) 591-2450

ENVIRONMENTAL PRODUCT DECLARATION

BUILT-UP ASPHALT ROOFING MEMBRANE

INSTALLATION: HOT ASPHALT

Low-slope roofing membrane installed using hot asphalt and consisting of a built-up roof (BUR) cap sheet and ply felt components.

The Asphalt Roofing Manufacturers Association (ARMA) is a trade association representing North America's asphalt roofing manufacturing companies and their raw material suppliers. The association includes the majority of North American manufacturers of asphalt shingles and asphalt low slope roof membrane systems. Information that ARMA gathers on modern asphalt roofing materials and practices is provided to building and code officials, as well as regulatory agencies and allied trade groups. Committed to advances in the asphalt roofing industry, ARMA is proud of the role it plays in promoting asphalt roofing to those in the building industry and to the public.

ARMA's vision and mission is to be an association committed to the long-term sustainability of the asphalt roofing industry and to advocate and advance the interests of the asphalt roofing industry by leveraging the collective expertise of its members.

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Provided	
DECLARATION HOLDER	UL Provided	
DECLARATION NUMBER	UL Provided	
DECLARED PRODUCT	Built-Up Asphalt Roofing Membrane (Installation: Hot Asphalt)	
REFERENCE PCR	UL Provided	
DATE OF ISSUE	UL Provided	
PERIOD OF VALIDITY	UL Provided	
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications	
The PCR review was conducted by:		UL Provided
		UL Provided
		UL Provided
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories		
☐ INTERNAL ☒ EXTERNAL		UL Provided
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:		
		UL Provided

Participating Members

The following ARMA members provided data for the product covered within this document:

CertainTeed
www.certainteed.com

IKO
www.iko.com

GAF
www.gaf.com

Johns Manville
www.jm.com

Malarkey Roofing
www.malarkeyroofing.com

Product Definition

Product Description

The low-slope roofing membrane included in this study consists of built-up roof (BUR) cap sheet and ply felt components.

Component	Specification	Description
BUR Cap Sheet	ASTM D3909; CSA A123.2	- Mineral-surfaced BUR cap sheets consist of asphalt-impregnated and coated glass felt roll roofing surfaced on the weather side with colored mineral granules
BUR Ply Felt	ASTM D2178; CSA A123.17	- Ply felts consist of glass felts impregnated with oxidized asphalt - A fine mineral matter parting agent is typically applied to facilitate use during installation

Manufacturing Locations

The components of the low-slope BUR roofing membrane are manufactured in the United States and/or Canada.

Applications and Uses

Low-slope roofing systems are installed on roofs with slopes less than 2:12. Low-slope roofing systems are primarily used to protect buildings and structures from the weather.

One significant benefit of BUR systems is the protection provided by the multiple water-resistant layers. These systems are durable and can stand up to weather conditions, temperature extremes, impacts, and foot traffic. BUR roofing systems can be installed in a variety of ways to meet many building design requirements.

System Description

Material Content

Table 1 shows the input materials for the BUR mineral-surfaced cap sheet and ply felt manufacturing, and the weight percentages of the components in the product system. The remainder of the system weight consists primarily of asphalt applied during installation.

Table 1: Material inputs, average, for BUR cap and ply felt manufacturing

Material Inputs*	Weight Percentage in Individual Component
BUR Mineral Cap Sheet (~~37~~39% of representative roofing system)	
Mineral granules	~~43%~~26%
Mineral stabilizers	2~~9~~5%
Asphalt	34~~21~~%
Sand	~~8~~7%
Fiberglass mat	4~~3~~%
BUR Ply Felt (10~~1~~% of representative roofing system)	
Asphalt	71%
Fiberglass mat	27%
Sand	1%
Release agent (soaps, sodium cocoate)	1%

*Total system also includes weight of ancillary materials used during installation

Manufacturing Process

BUR Mineral-surfaced Cap Sheet

Manufacture of mineral-surfaced cap sheets involves impregnating and coating a fiberglass mat with a filled asphalt coating. The filled coating mixture is produced in a separate process that involves mixing oxidized asphalt and limestone (or other suitable mineral stabilizer) in appropriate proportions. Colored mineral granules are added as surfacing. Fine mineral matter may be used as a parting agent. The product is cooled, wound into rolls, and packaged for shipment.

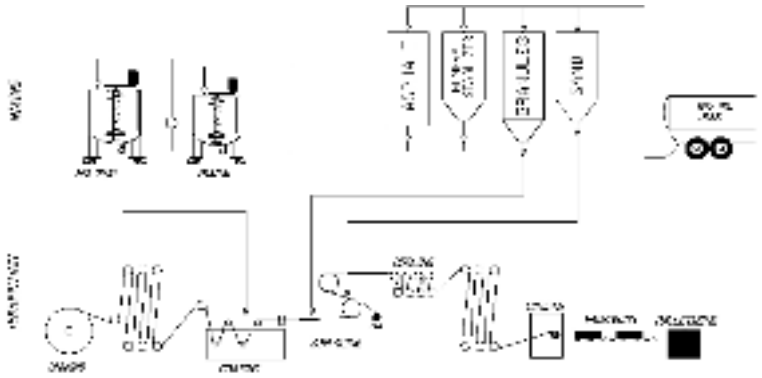

Figure 1: Mineral-surfaced cap sheet process diagram

BUR Ply Felt

Manufacture of ply felts involves impregnating a fiberglass mat with oxidized asphalt. A fine mineral matter parting agent is typically applied to facilitate installation. The product is cooled, wound into rolls, and packaged for shipment.

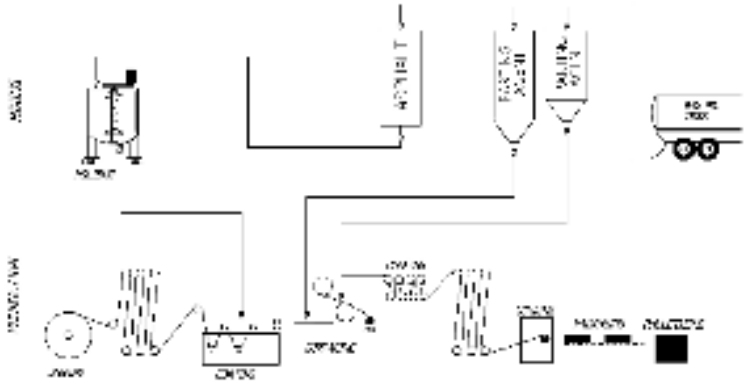

Figure 2: Ply felt process diagram

Installation

For this EPD, a BUR membrane consists of three ply felts and a mineral-surfaced cap sheet. Hot-mopped BUR installation requires hot asphalt to be mopped onto the roof surface and the ply felts unrolled directly into the asphalt and broomed into place. Asphalt kegs are heated in a propane-fueled kettle to the required temperature and viscosity for their application. This process is repeated until three layers of ply felts have been installed. The same process is used to install the mineral-surfaced cap sheet on top of the three-ply layer of felts. Mineral granules are applied to the asphalt that has migrated out of the cap sheet seams to protect it from UV and for aesthetic reasons.

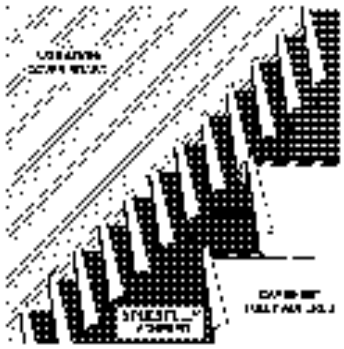

Figure 3: Built-Up roofing system installation detail

The table below presents the installation details for the membrane. The effective coverage includes the required overlap of sheets while the scrap rate accounts for material wasted during installation. The VOC emissions from the asphalt kettle are calculated using the US Environmental Protection Agency (EPA) Area Source Category Method.

Table 2: Roofing system installation inputs and outputs, per 1 m²

	Weight of Material [kg / m²]	Effective Coverage [m² of Material / 1 m² of Roof]	Scrap Rate	Required Quantity of Material [kg / 1 m²]
Inputs				
Cap sheet	~~3.44~~3.6	1.06	5%	4.1~~3.83~~
Ply felt	0.33	3.14	5%	1.1~~08~~
Flashing	0.10	N/A	10%	0.11
Asphalt[1]	4.89	N/A	5%	5.13
Mineral granules (at seams)	0.08	N/A	-	0.08
Propane	5.0 (MJ)	N/A	-	5.0 (MJ)
Diesel (pump to roof)[2]	0.001 (MJ)	N/A	-	0.001 (MJ)
VOCs from asphalt kettle[3]	0.02	N/A	-	0.02
Outputs				
Installed System				9.95~~74~~
Waste				0.5~~49~~

[1] 1.22 kg / 1 m² per layer
[2] Assumes 4-story building[1] and 3.95 m story height[2]
[3] 3.1 kg VOCs/metric tonne of asphalt

[1] http://buildingsdatabook.eren.doe.gov/docs/xls_pdf/3.2.3.pdf
[2] http://www.pnl.gov/main/publications/external/technical_reports/PNNL-20380.pdf

End-of-Life

At the end-of-life, the low-slope membrane is removed by manual labor, often with roofing shovels. The debris is collected and transported off-site via truck. The waste is brought to a landfill.

Life Cycle Assessment – Product Systems and Modeling

Declared Unit

The declared unit of this study is 1 m^2 (10.8 ft^2) of the installed roofing membrane. The associated reference flow (the quantity of material required to fulfill the declared unit) is 9.~~74~~ 95 kg/m^2.

Life Cycle System Boundaries

The life cycle study encompasses the cradle-to-gate production, construction, and end-of-life (EoL) stages of a low-slope, hot-mopped BUR roofing membrane, including raw material extraction and processing, product manufacturing, and installation, plus material disposal at EoL. Transportation between stages has been accounted for, including raw material transport to the manufacturing facility, finished product transport to the construction site, and transport of the roof system at EoL to the landfill. Use, maintenance, repair, or replacement of the roof system over a building's service life is not included in this evaluation. In addition, production, manufacture and construction of manufacturing equipment and infrastructure; repair and maintenance of the production system; energy and water use related to company management and sales; delivery vehicles and laboratory equipment; as well as maintenance and operation of support equipment are all outside of the scope of the study.

Product Stage			Construction Stage		Use Stage					End-of-Life Stage			
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4
Raw materials supply	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	De-construction	Transport	Waste processing	Disposal
X	X	X	X	X	MND	MND	MND	MND	MND	X	X	X	X

MND = module not declared

Assumptions

The analysis uses the following assumptions:

- Mineral granules can be made in a variety of colors, which affects the composition of the required mineral granule coating. White mineral granules were selected as a representative product for this study because the pigment used for white products, titanium dioxide, generally has a higher impact than other pigments; therefore, using white is a conservative assumption.

- Where a manufacturer was unable to calculate an average distance for the distribution of its final product from its facility, it provided a best estimate.
- Due to lack of data availability some proxy background data were used, specifically in the context of the geographical scope of the study.

Cut-off Criteria

No cut-off criteria were applied in this study. All reported data were incorporated and modeled using best available LCI data.

Transportation

Production-weighted averages for the transportation distances and modes of transport associated with each participating company are included for the transport of the raw materials to production facilities and the transport of the finished products to distribution centers. The transport of finished products from distribution center to the construction site and of waste from the construction site to landfill were each assumed to be 20 miles.

Temporal, Technological, and Geographical Coverage

Temporal: Primary data, collected from the participating ARMA member companies, is representative of the year 2012.

Technological: At least 75% of the production market is estimated to be represented within this study.

Geographical: The geographic coverage represented by this study is the United States and Canada, though some manufacturers source their raw materials from outside this region. Whenever US background data were not readily available, European data or global data were used as proxies, depending on appropriateness and availability. Results are presented as production weighted averages for the US and Canada.

Background Data

The LCA model was created using the GaBi ts Software system for life cycle engineering, developed by thinkstep AG (previously PE INTERNATIONAL). The GaBi 2013 database provides the LCI data for several of the raw and process materials obtained from the background system. Secondary data, information from relevant literature, are from a range of sources between 1977 (asphalt oxidation information) and 2013.

Data Quality

As the relevant foreground data is primary data or modeled based on primary information sources of the owner of the technology, no better precision is reachable within this product. Seasonal variations and variations across different manufacturers were balanced out by using yearly averages and weighted averages. All primary data were collected with the same level of detail, while all background data were sourced from the GaBi 2013 databases. Allocation and other methodological choices were made consistently throughout the model.

Allocation

As several products are often manufactured at the same plant, participating companies used mass allocation to report data since the environmental burden in the industrial process (energy consumption, emissions, etc.) is primarily governed by the mass throughput of each sub-process.

All packaging waste generated during installation, as well as 40% of the wooden pallets used for shipping of products,

are assumed to be sent to landfill and the system credited with any avoided production of electricity generated from the combustion of landfill gas.

The impacts due to the use of any recycled materials during manufacturing come only from further processing required during the recycling process. Where in-house recycling is used to create other products, co-product allocation by mass is used and any additional processing steps required for use of the recovered materials are accounted for. It is conservatively assumed that all roofing materials disposed at EoL are sent to landfill. This will vary from job site to job site as some roofers may recycle metal components.

Life Cycle Assessment – Results and Analysis

Environmental Product Declarations (EPDs) created under a different Product Category Rule (PCR) are not comparable. Additionally, EPDs based on a declared unit shall not be used for comparisons between products, regardless of the EPDs using the same PCR.

Use of Material Resources

The material resource consumption associated with the installed roofing membrane is presented below for the production, construction, and EoL stages. Water consumption values are negative due to waste sent to landfill at EoL. A landfill introduces blue water to the watershed because it collects rainwater during its lifetime that is eventually released back into the ground, therefore more blue water is coming out of the process than going in. Rainwater is not blue water and is therefore not included in the water consumption metric.

Table 3: Resource use results for each life cycle stage, per 1 m²

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Renewable materials	kg	21.4~~21.7~~	3.3	1.2	**25.9~~26.1~~**
Nonrenewable materials	kg	7.8~~8.9~~	1.9	2.4~~2.3~~	**12.1~~13.1~~**
Water consumption	L	13.3~~0.01~~	2.4~~0.002~~	-21.8~~-0.02~~	**-6.1~~-0.004~~**

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Commented [MW1]: The values here had mistakenly been reported in m3, not L. They are now in L

Primary Energy by Life Cycle Stage

The primary energy demand associated with the installed roofing membrane is presented below for the production, construction, and EoL stages. Results are given as higher heating value (HHV), per the PCR. Renewable energy is negative for construction due to the credit given for reusing pallets.

Table 4: Primary energy demand results for each life cycle stage, per 1 m²

Primary Energy	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Nonrenewable fossil	MJ (HHV)	154~~129~~	275~~273~~	7.9~~7.7~~	**437~~411~~**
Nonrenewable nuclear	MJ (HHV)	3.7~~3.6~~	1.0	0.2	**4.9~~4.8~~**
Renewable (solar, wind, hydro, geo)	MJ (HHV)	3.8~~4.3~~	-0.05~~-0.2~~	0.3	**4.0~~4.4~~**
Renewable (biomass)	MJ (HHV)	2×10^{-11}	1×10^{-5}	5×10^{-12}	**1×10^{-5}**

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Life Cycle Impact Assessment

The environmental impacts associated with the installed roofing membrane are presented below for the production, construction, and EoL stages.

Table 5: Life cycle impact category results, per 1 m² (TRACI 2.1)

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Global warming potential	kg CO_2-eq	3.9	3.13.0	0.5	**7.57.3**
Smog creation potential	kg O_3-eq	0.30.2	0.3	0.04	**0.6**
Acidification potential	kg SO_2-eq	0.02	0.02	0.002	**0.04**
Eutrophication potential	kg N-eq	0.001	7E-046 x 10 $^{-4}$	3 x 10 $^{-4}$	**0.002**
Ozone depletion potential	kg CFC-11 eq	4 x 10^{-10}	3 x 10^{-9}	1 x 10^{-11}	**4 x 10^{-9}**

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Waste Generation

The waste generation associated with the installed roofing membrane is presented below for the production, construction, and EoL stages.

Table 6: Waste generation results, per 1 m²

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Non hazardous waste generated	kg	0.40.5	0.5	10.09.8	**10.910.8**
Hazardous waste generated	kg	0.0010.002	2 x 10^{-4}	2 x 10^{-4}	**0.002**

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Additional Environmental Information

Reflective Roofs

Reflective roofs are defined as roofing products with high solar reflectance. Many in the construction industry define “cool roofs” as roofing products with high solar reflectance and high thermal emittance. Asphalt-based products have the inherent property of having high emittance, regardless of their reflective properties. Asphaltic roof systems typically have thermal emittance values greater than 0.80. Reflectance is a deliberate product characteristic, and varies based on the surfacing used.

There are reflective roof options available for virtually any roof and any building. Because of asphalt roofs’ longevity, asphalt-based products provide excellent value for homeowners and building owners by delivering superior durability and sustainability at reasonable cost.

BUR membranes provide options for varying levels of reflectivity. The reflectivity is related to color of the cap sheet surface, surfacing material, or field applied coating. While reflective roofs are an increasingly popular roof option, they represent one of many approaches to help building owners and consumers reduce building energy use and address contemporary environmental concerns.

Individual Component Results

The material resource consumption, primary energy demand, environmental impacts, and waste generation results associated with each individual component (excluding ancillary materials used during installation) of the roofing system are presented below for the production stage (A1-A3).

Table 7: Production stage (A1-A3) impact results for each system component, per 1 m² of individual component

Impact Category	Units	Ply Felt	Mineral Cap sheet
Renewable materials	kg	3.3	9.13
Nonrenewable materials	kg	0.6	5.36.2
Water consumption	L	1.6	8.67.5
Nonrenewable fossil	MJ (HHV)	17.418.7	56.987.7
Nonrenewable nuclear	MJ (HHV)	0.5	1.87
Renewable (solar, wind, hydro, geo)	MJ (HHV)	0.5	1.82.3
Renewable (biomass)	MJ (HHV)	2 x 10^{-12}	89 x 10^{-12}
Global warming potential	kg CO^2-eq	0.6	2.11.8
Smog creation potential	kg O^3-eq	0.04	0.42
Acidification potential	kg SO^2-eq	0.003	0.01008
Eutrophication potential	kg N-eq	2 x 10^{-4}	7.6 x 10^{-4}
Ozone depletion potential	kg CFC-11 eq	6 x 10^{-11}	2 x 10^{-10}
Non hazardous waste generated	kg	0.04	0.32
Hazardous waste generated	kg	1 x 10^{-4}	0.0018 x 10^{-4}

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References

- ASTM (2014). "Product category rules for preparing an environmental product declaration for product group: Asphalt Shingles, Built-up Asphalt Membrane Roofing and Modified Bituminous Membrane Roofing." (http://www.astm.org/CERTIFICATION/DOCS/152.PCR_ASTM_Asphalt_Roofing_PCR_073114.pdf)
- LBP, University of Stuttgart and thinkstep GmbH, Leinfelden-Echterdingen (2013). GaBi 6 dataset documentation for the software-system and databases (http://documentation.gabi-software.com/)
- thinkstep (formerly PE INTERNATIONAL) (2015). "Life Cycle Assessment of Asphalt Roofing Systems: Cradle-to-grave LCAs of a steep-slope and four low-slope industry-average asphalt roofing systems."
- US EPA. "Area Source Category Method Abstract – Asphalt Roofing Kettles." (2000). (https://www.epa.gov/sites/production/files/2015-08/documents/asphalt.pdf)

LCA Development

thinkstep

The EPD and background LCA were prepared by thinkstep, Inc. (previously PE INTERNATIONAL).

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Environment

Contact Information

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Suite 750
Washington, DC 20045
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Environment

ENVIRONMENTAL PRODUCT DECLARATION

SBS-MODIFIED BITUMEN ROOFING MEMBRANE

INSTALLATION: HOT ASPHALT

Low-slope roofing membrane installed using hot asphalt and consisting of a SBS-modified bitumen cap sheet and base sheet.

The Asphalt Roofing Manufacturers Association (ARMA) is a trade association representing North America's asphalt roofing manufacturing companies and their raw material suppliers. The association includes the majority of North American manufacturers of asphalt shingles and asphalt low slope roof membrane systems. Information that ARMA gathers on modern asphalt roofing materials and practices is provided to building and code officials, as well as regulatory agencies and allied trade groups. Committed to advances in the asphalt roofing industry, ARMA is proud of the role it plays in promoting asphalt roofing to those in the building industry and to the public.

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PROGRAM OPERATOR	UL Provided
DECLARATION HOLDER	UL Provided
DECLARATION NUMBER	UL Provided
DECLARED PRODUCT	SBS-Modified Bitumen Roofing Membrane (Installation: Hot Asphalt)
REFERENCE PCR	UL Provided
DATE OF ISSUE	UL Provided
PERIOD OF VALIDITY	UL Provided
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications
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☐ INTERNAL ☒ EXTERNAL	UL Provided
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	
	UL Provided

Participating Members

The following ARMA members provided data for the product covered within this document:

CertainTeed
www.certainteed.com

Firestone Building Products
www.firestonebpco.com

GAF
www.gaf.com

Henry Roofing Products
henry.com

IKO
www.iko.com

Johns Manville
www.jm.com

Malarkey Roofing
www.malarkeyroofing.com

Siplast
www.siplast.com

SOPREMA
www.soprema.us
www.soprema.ca

Product Definition

Product Description

The low-slope roofing membrane included in this study consists of a styrene-butadiene-styrene (SBS)-modified bitumen cap sheet and a base sheet.

Component	Specification	Description
SBS Cap Sheet	ASTM D6162, D6163, D6164, CSA A123.23	- Polyester and/or fiberglass mat coated with polymer-modified asphalt and colored mineral granule surfacing
SBS Base Sheet	ASTM D6162, D6163, D6164. CSA A123.23	- Polyester and/or fiberglass mat coated with polymer-modified asphalt - A fine mineral matter may be applied as a surfacing or parting agent to both sides of the base sheets

Manufacturing Locations

The components of the low-slope SBS-modified bitumen roofing membrane are manufactured in the United States and/or Canada.

Applications and Uses

Low-slope roofing systems are installed on roofs with slopes less than 2:12. Low-slope roofing systems are primarily

used to protect buildings and structures from the weather.

In addition to providing beauty, affordability and reliability, modified bitumen roof systems are trusted to protect against weather conditions, temperature extremes, impacts, and foot traffic. Multiple layers of roofing materials including engineered reinforcements provide strength and durability. It is a versatile solution, able to adapt to many roof design challenges.

System Description

Material Content

Table 1 shows the input materials for SBS-modified bitumen cap sheet and base sheet manufacturing, and the weight percentages of the components in the product system. The remainder of the system weight consists primarily of asphalt applied during installation.

Table 1: Average material inputs for SBS-modified bitumen cap and base sheet manufacturing

Material Inputs*	Weight Percentage in Individual Component
SBS-Modified Cap Sheet (47% of representative roofing system)	
Asphalt	35%
Mineral granules	30%
Mineral stabilizers	154%
Sand	76%
Fire retardant (colemanite, alumina trihydrate)	6%
Mat (fiberglass, polyester, fiberglass/polyester)	4%
Styrene butadiene styrene (SBS) polymer	4%
SBS-Modified Base Sheet (2829% of representative roofing system)	
Asphalt	415%
Mineral stabilizers	259%
Sand	21%
Mat (fiberglass, polyester, fiberglass/polyester)	4%
Styrene butadiene styrene (SBS) polymer	4%

*Total system also includes weight of ancillary materials used during installation

Manufacturing Process

SBS Cap Sheets

Manufacture of SBS polymer-modified bitumen cap sheets involves impregnating and coating a fiberglass or polyester mat with a polymer-modified asphalt. The polymer-modified asphalt is produced by mixing appropriate proportions of polymer, non-oxidized or lightly oxidized asphalt, and limestone or other suitable mineral stabilizer. An appropriate surfacing material is applied. SBS cap sheets typically use a colored mineral granule surfacing. The product is cooled, wound into rolls, and packaged for shipment.

SBS Base Sheets

Manufacture of SBS polymer-modified bitumen base sheets involves impregnating a fiberglass and/or polyester mat and subsequently coating the mat with polymer-modified asphalt. The polymer-modified asphalt is produced by mixing appropriate proportions of polymer, non-oxidized or lightly oxidized asphalt, and limestone or another suitable mineral stabilizer. Fine mineral matter may be applied as a surfacing agent or as a parting agent to both sides of the base sheets. The product is cooled, wound into rolls, and packaged for shipment.

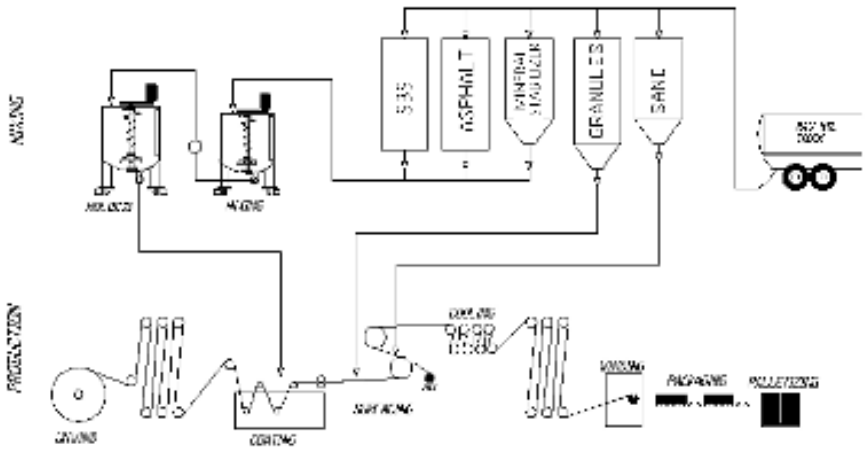

Figure 1: Modified bitumen sheet process diagram

Installation

For this EPD, a hot-mopped SBS-modified bitumen roofing membrane consists of one base sheet and one cap sheet. Hot-mopped SBS installation requires hot asphalt to be first mopped onto the roof surface and the SBS-modified bitumen base sheet to be unrolled directly into the asphalt and pressed into place. This same process is used to install the SBS-modified bitumen cap sheet on top of the base sheet. A weighted roller follows the sheet, securing the seam. Mineral granules are applied to the asphalt that has migrated out of the cap sheet seams to protect it from UV and for aesthetic reasons.

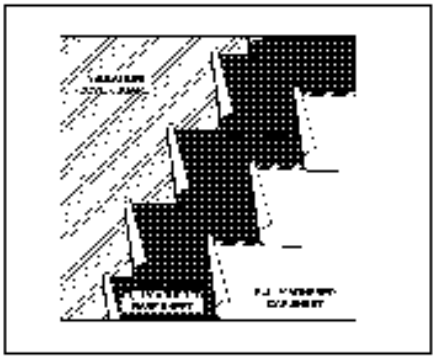

Figure 2: SBS modified bitumen roof membrane system installation details

The table below presents the installation details for the membrane. The effective coverage includes the required overlap of sheets while the scrap rate accounts for material wasted during installation. The VOC emissions associated with heating the asphalt in a kettle are calculated using the US Environmental Protection Agency (EPA) Area Source Category Method.

Table 2: Roofing system installation inputs and outputs, per 1 m²

	Weight of Material [kg / m²]	Effective Coverage [m² of Material / 1 m² of Roof]	Scrap Rate	Required Quantity of Material [kg / 1 m²]
Inputs				
Cap sheet	4.5	1.10	5%	5.2
Base sheet	2.87	1.10	5%	3.21
Flashing	0.1	N/A	10%	0.1
Mopping asphalt[1]	2.4	N/A	5%	2.6
Mineral granules (at seams)	0.08	N/A	-	0.08
Propane for kettles	2.6 (MJ)	N/A	-	2.6 (MJ)
Diesel (pump to roof)[2]	5.0×10^{-4} (MJ)	N/A	-	5.0×10^{-4} (MJ)
VOCs (asphalt kettle[3])	0.008	N/A	-	0.008
Outputs				
Installed System				10.76
Waste				0.5

[1] 1.22 kg / 1 m² per layer
[2] Assumes 4-story building[1] and 3.95 m story height[2]
[3] 3.1 kg VOCs / metric tonne of asphalt

[1] http://buildingsdatabook.eren.doe.gov/docs/xls_pdf/3.2.3.pdf
[2] http://www.pnl.gov/main/publications/external/technical_reports/PNNL-20380.pdf

End-of-Life

At the end-of-life, the low-slope membrane is removed by manual labor, often with roofing shovels. The debris is collected and transported off-site via truck. The waste is brought to a landfill.

Life Cycle Assessment – Product Systems and Modeling

Declared Unit

The declared unit of this study is 1 m^2 (10.8 ft^2) of the installed roofing membrane. The associated reference flow (the quantity of material required to fulfill the declared unit) is 10.756 kg/m^2.

Life Cycle System Boundaries

The life cycle study encompasses the cradle-to-gate production, construction, and end-of-life (EoL) stages of a hot-mopped low-slope SBS-modified bitumen roofing membrane including raw material extraction and processing, product manufacturing and installation, plus EoL. Transportation between stages is accounted for, including raw material transport to the manufacturing facility, finished product transport to the construction site, and transport of the roof system at EoL to the landfill. Use, maintenance, repair, or replacement of the roof system over a building's service life is not included in this evaluation. In addition, production, manufacture, and construction of manufacturing equipment and infrastructure; repair and maintenance of the production system; energy and water use related to company management and sales; delivery vehicles and laboratory equipment; as well as maintenance and operation of support equipment are all outside of the scope of the study.

Product Stage			Construction Stage		Use Stage					End-of-Life Stage			
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4
Raw materials supply	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	De-construction	Transport	Waste processing	Disposal
X	X	X	X	X	MND	MND	MND	MND	MND	X	X	X	X

MND = module not declared

Assumptions

The analysis uses the following assumptions:

- Mineral granules can be made in a variety of colors, which affects the composition of the required mineral granule coating. White mineral granules were selected as a representative product for this study because the pigment used for white products, titanium dioxide, generally has a higher impact than other pigments; therefore, using white is a conservative assumption.

- Where a manufacturer was unable to calculate an average distance for the distribution of its final product from its facility, it provided a best estimate.
- Due to lack of data availability some proxy background data were used, specifically in the context of the geographical scope of the study.

Cut-off Criteria

No cut-off criteria were applied in this study. All reported data were incorporated and modeled using best available LCI data.

Transportation

Production-weighted averages for the transportation distances and modes of transport associated with each participating company are included for the transport of the raw materials to production facilities and the transport of the finished products to distribution centers. The transport of finished products from distribution center to the construction site and of waste from the construction site to landfill were each assumed to be 20 miles.

Temporal, Technological, and Geographical Coverage

Temporal: Primary data, collected from the participating ARMA member companies, is representative of the year 2012.

Technological: At least 75% of the production market is estimated to be represented within this study.

Geographical: The geographic coverage represented by this study is the United States and Canada, though some manufacturers source their raw materials from outside this region. Whenever US background data were not readily available, European data or global data were used as proxies, depending on appropriateness and availability. Results are presented as production weighted averages for the US and Canada.

Background Data

The LCA model was created using the GaBi ts Software system for life cycle engineering, developed by thinkstep AG (previously PE INTERNATIONAL). The GaBi 2013 database provides the LCI data for several of the raw and process materials obtained from the background system. Secondary data, information from relevant literature, are from a range of sources between 1977 (asphalt oxidation information) and 2013.

Data Quality

As the relevant foreground data is primary data or modeled based on primary information sources of the owner of the technology, no better precision is reachable within this product. Seasonal variations and variations across different manufacturers were balanced out by using yearly averages and weighted averages. All primary data were collected with the same level of detail, while all background data were sourced from the GaBi 2013 databases. Allocation and other methodological choices were made consistently throughout the model.

Allocation

As several products are often manufactured at the same plant, participating companies used mass allocation to report data since the environmental burden in the industrial process (energy consumption, emissions, etc.) is primarily governed by the mass throughput of each sub-process.

All packaging waste generated during installation, as well as 40% of the wooden pallets used for shipping of products,

are assumed to be sent to landfill and the system credited with any avoided production of electricity generated from the combustion of landfill gas.

The impacts due to the use of any recycled materials during manufacturing come only from further processing required during the recycling process. Where in-house recycling is used to create other products, co-product allocation by mass is used and any additional processing steps required for use of the recovered materials are accounted for. It is conservatively assumed that all roofing materials disposed at EoL are sent to landfill. This will vary from job site to job site as some roofers may recycle metal components.

Life Cycle Assessment – Results and Analysis

Environmental Product Declarations (EPDs) created under a different Product Category Rule (PCR) are not comparable. Additionally, EPDs based on a declared unit shall not be used for comparisons between products, regardless of the EPDs using the same PCR.

Use of Material Resources

The material resource consumption associated with the installed roofing membrane is presented below for the production, construction, and EoL stages. Water consumption values are negative due to waste sent to landfill at EoL. A landfill introduces blue water to the watershed because it collects rainwater during its lifetime that is eventually released back into the ground, therefore more blue water is coming out of the process than going in. Rainwater is not blue water and is therefore not included in the water consumption metric.

Table 3: Resource use results for each life cycle stage, per 1 m²

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Renewable materials	kg	39.940.6	2.01.9	1.3	**43.243.8**
Nonrenewable materials	kg	14.514.6	1.5	2.5	**18.518.6**
Water consumption	~~L~~m³	0.070.06	5 x 10⁻⁴4.5 x 10⁻⁴	-0.02	**0.04**

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Primary Energy by Life Cycle Stage

The primary energy demand associated with the installed roofing membrane is presented below for the production, construction, and EoL stages. Results are given as higher heating value (HHV), per the PCR. Renewable energy is negative for construction due to the credit given for reusing pallets.

Table 4: Primary energy demand results for each life cycle stage, per 1 m²

Primary Energy	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Nonrenewable fossil	MJ (HHV)	285274	148146	8.48.3	**441428**
Nonrenewable nuclear	MJ (HHV)	7.16.6	0.6	0.2	**7.97.5**
Renewable (solar, wind, hydro, geo)	MJ (HHV)	6.56.8	-0.6	0.4	**6.36.6**
Renewable (biomass)	MJ (HHV)	8 x 10⁻¹¹	1 x 10⁻⁵	6 x 10⁻¹²	**1 x 10⁻⁵**

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Life Cycle Impact Assessment

The environmental impacts associated with the installed roofing membrane are presented below for the production, construction, and EoL stages.

Table 5: Life cycle impact category results, per 1 m² (TRACI 2.1)

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Global warming potential	kg CO_2-eq	6.7	2.2	0.5	**9.4**
Smog creation potential	kg O_3-eq	0.4	0.2	0.05	0.7~~0.6~~
Acidification potential	kg SO_2-eq	0.02	0.01	0.002	**0.04**
Eutrophication potential	kg N-eq	0.002	6×10^{-4}	3×10^{-4}	**0.003**
Ozone depletion potential	kg CFC-11 eq	6×10^{-10}	3×10^{-9}	1×10^{-11}	**4×10^{-9}**

Waste Generation

The waste generation associated with the installed roofing membrane is presented below for the production, construction, and EoL stages.

Table 6: Waste generation results, per 1 m²

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Non hazardous waste generated	kg	0.91~~.0~~	0.70~~.6~~	10.710~~.6~~	12.3~~12.2~~
Hazardous waste generated	kg	0.0030~~.004~~	8×10^{-5}	2×10^{-4}	**0.004**

Additional Environmental Information

Reflective Roofs

Reflective roofs are defined as roofing products with high solar reflectance. Many in the construction industry define “cool roofs” as roofing products with high solar reflectance and high thermal emittance. Asphalt-based products have the inherent property of having high emittance, regardless of their reflective properties. Asphaltic roof systems typically have thermal emittance values greater than 0.80. Reflectance is a deliberate product characteristic, and varies based on the surfacing used.

There are reflective roof options available for virtually any roof and any building. Because of asphalt roofs’ longevity, asphalt-based products provide excellent value for homeowners and building owners by delivering superior durability and sustainability at reasonable cost.

Modified bitumen membranes provide options for varying levels of reflectivity. The reflectivity is related to the color of the modified bitumen membrane surface, surfacing material, or field applied coating. While reflective roofs are an increasingly popular roof option, they represent one of many approaches to help building owners and consumers reduce building energy use and address contemporary environmental concerns.

Individual Component Results

The material resource consumption, primary energy demand, environmental impacts, and waste generation results associated with each individual component (excluding ancillary materials used during installation) of the roofing system are presented below for the production stage (A1-A3).

Table 7: Production stage (A1-A3) impact results for each system component, per 1 m² of individual component

Impact Category	Units	Base sheet	Cap sheet
Renewable materials	kg	13.12.6	21.722.5
Nonrenewable materials	kg	3.76	8.99.0
Water consumption	L	21.511.3	37.641.5
Nonrenewable fossil	MJ (HHV)	85.2108	14835
Nonrenewable nuclear	MJ (HHV)	2.31.9	3.98
Renewable (solar, wind, hydro, geo)	MJ (HHV)	1.89	3.84.0
Renewable (biomass)	MJ (HHV)	2×10^{-11}	5×10^{-11}
Global warming potential	kg CO^2-eq	2.51	3.79
Smog creation potential	kg O^3-eq	0.21	0.32
Acidification potential	kg SO^2-eq	0.0108	0.01
Eutrophication potential	kg N-eq	76×10^{-4}	0.001
Ozone depletion potential	kg CFC-11 eq	2×10^{-10}	3×10^{-10}
Non hazardous waste generated	kg	0.3	0.6
Hazardous waste generated	kg	78×10^{-4}	0.002

References

- ASTM (2014). “Product category rules for preparing an environmental product declaration for product group: Asphalt Shingles, Built-up Asphalt Membrane Roofing and Modified Bituminous Membrane Roofing.” (http://www.astm.org/CERTIFICATION/DOCS/152.PCR_ASTM_Asphalt_Roofing_PCR_073114.pdf)
- LBP, University of Stuttgart and thinkstep GmbH, Leinfelden-Echterdingen (2013). GaBi 6 dataset documentation for the software-system and databases (http://documentation.gabi-software.com/)
- thinkstep (formerly PE INTERNATIONAL) (2015). “Life Cycle Assessment of Asphalt Roofing Systems: Cradle-to-grave LCAs of a steep-slope and four low-slope industry-average asphalt roofing systems.”
- US EPA. “Area Source Category Method Abstract – Asphalt Roofing Kettles.” (2000). (https://www.epa.gov/sites/production/files/2015-08/documents/asphalt.pdf)

LCA Development

thinkstep

The EPD and background LCA were prepared by thinkstep, Inc. (previously PE INTERNATIONAL).

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170 Milk Street, 3rd Floor
Boston, MA 02109
info@thinkstep.com
www.thinkstep.com

Environment

Contact Information

Asphalt Roofing Manufacturers Association
529 14th Street, NW
Suite 750
Washington, DC 20045
Tel: (202) 591-2450

Environment

ENVIRONMENTAL PRODUCT DECLARATION

SBS-MODIFIED BITUMEN ROOFING MEMBRANE

INSTALLATION: COLD ADHESIVE

Low-slope roofing membrane installed using low-VOC adhesive and consisting of a SBS-modified bitumen cap sheet and base sheet.

The Asphalt Roofing Manufacturers Association (ARMA) is a trade association representing North America's asphalt roofing manufacturing companies and their raw material suppliers. The association includes the majority of North American manufacturers of asphalt shingles and asphalt low slope roof membrane systems. Information that ARMA gathers on modern asphalt roofing materials and practices is provided to building and code officials, as well as regulatory agencies and allied trade groups. Committed to advances in the asphalt roofing industry, ARMA is proud of the role it plays in promoting asphalt roofing to those in the building industry and to the public.

ARMA's vision and mission is to be an association committed to the long-term sustainability of the asphalt roofing industry and to advocate and advance the interests of the asphalt roofing industry by leveraging the collective expertise of its members.

SBS-MODIFIED BITUMEN ROOFING MEMBRANE
INSTALLATION: COLD ADHESIVE

According to ISO 14025

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Provided
DECLARATION HOLDER	UL Provided
DECLARATION NUMBER	UL Provided
DECLARED PRODUCT	SBS-Modified Bitumen Roofing Membrane (Installation: Cold Adhesive)
REFERENCE PCR	UL Provided
DATE OF ISSUE	UL Provided
PERIOD OF VALIDITY	UL Provided
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications
The PCR review was conducted by:	UL Provided
	UL Provided
	UL Provided
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	
	UL Provided
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	
	UL Provided

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Participating Members

The following ARMA members provided data for the product covered within this document:

CertainTeed
www.certainteed.com

IKO
www.iko.com

Firestone Building Products
www.firestonebpco.com

Johns Manville
www.jm.com

GAF
www.gaf.com

Malarkey Roofing
www.malarkeyroofing.com

Siplast
www.siplast.com

Henry Roofing Products
henry.com

SOPREMA
www.soprema.us
www.soprema.ca

Product Definition

Product Description

The low-slope roofing membrane included in this study consists of a styrene-butadiene-styrene (SBS)-modified bitumen cap sheet and a base sheet.

Component	Specification	Description
SBS Cap Sheet	ASTM D6162, D6163, D6164, CSA A123.23	- Polyester and/or fiberglass mat coated with polymer-modified asphalt and colored mineral granule surfacing
SBS Base Sheet	ASTM D6162, D6163, D6164. CSA A123.23	- Polyester and/or fiberglass mat coated with polymer-modified asphalt - A fine mineral matter may be applied as a surfacing or parting agent to both sides of the base sheets

Manufacturing Locations

The components of the low-slope SBS-modified bitumen roofing membrane are manufactured in the United States and/or Canada.

Applications and Uses

Low-slope roofing systems are installed on roofs with slopes less than 2:12. Low-slope roofing systems are primarily

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used to protect buildings and structures from the weather.

In addition to providing beauty, affordability and reliability, modified bitumen roof systems are trusted to protect against weather conditions, temperature extremes, impacts, and foot traffic. Multiple layers of roofing materials including engineered reinforcements provide strength and durability. It is a versatile solution, able to adapt to many roof design challenges.

System Description

Material Content

Table 1 shows the input materials for SBS-modified bitumen cap sheet and base sheet manufacturing, and the weight percentages of the components in the product system. The remainder of the system weight consists primarily of adhesive applied during installation.

Table 1: Average material inputs for SBS-modified bitumen cap and base sheet manufacturing

Material Inputs*	Weight Percentage in Individual Component
SBS-Modified Cap Sheet (50% of representative roofing system)	
Asphalt	35%
Mineral granules	30%
Mineral stabilizers	145%
Sand	76%
Fire retardant (colemanite, alumina trihydrate)	6%
Mat (fiberglass, polyester, fiberglass/polyester)	4%
Styrene butadiene styrene (SBS) polymer	4%
SBS-Modified Base Sheet (301% of representative roofing system)	
Asphalt	415%
Mineral stabilizers	259%
Sand	21%
Mat (fiberglass, polyester, fiberglass/polyester)	4%
Styrene butadiene styrene (SBS) polymer	4%

*Total system also includes weight of ancillary materials used during installation

Manufacturing Process

SBS Cap Sheets

Manufacture of SBS polymer-modified bitumen cap sheets involves impregnating and coating a fiberglass or polyester mat with a polymer-modified asphalt. The polymer-modified asphalt is produced by mixing appropriate proportions of polymer, non-oxidized or lightly oxidized asphalt, and limestone or another suitable mineral stabilizer. An appropriate surfacing material is applied. SBS cap sheets typically use a colored mineral granule surfacing. The product is cooled, wound into rolls, and packaged for shipment.

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SBS Base Sheets

Manufacture of SBS polymer-modified bitumen base sheets involves impregnating a fiberglass and/or polyester mat and subsequently coating the mat with polymer-modified asphalt. The polymer-modified asphalt is produced by mixing appropriate proportions of polymer, non-oxidized or lightly oxidized asphalt, and limestone or other suitable mineral stabilzer. Fine mineral matter may be applied as a surfacing agent or as a parting agent to both sides of the base sheets. The product is cooled, wound into rolls, and packaged for shipment.

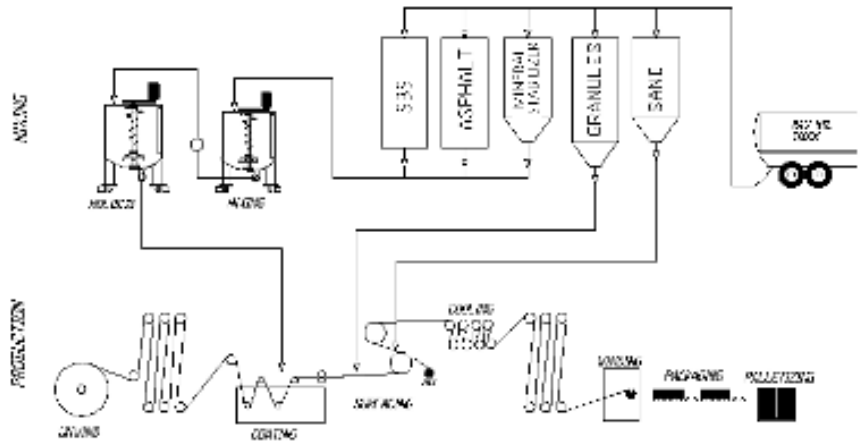

Figure 1: Modified bitumen sheet process diagram

Installation

For this EPD, a cold-adhered SBS-modified bitumen roofing membrane consists of one base sheet and one cap sheet. In the case of the cold-adhered SBS system, low-VOC cold adhesive is applied onto the roof surface and the SBS-modified bitumen base sheet is unrolled directly into the adhesive. A weighted roller follows the sheet to ensure adhesion. The same process is used to install the SBS-modified bitumen cap sheet on top of the base sheet. Mineral granules are applied to the adhesive that has migrated out of the cap sheet seams to protect it from UV and for aesthetic reasons.

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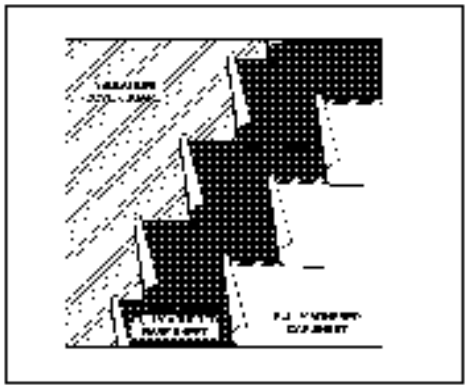

Figure 2: SBS modified bitumen roof membrane system installation details

The table below presents the installation details for the membrane. The effective coverage includes the required overlap of sheets while the scrap rate accounts for material wasted during installation. NMVOC (non-methane VOC) emissions from adhesive were calculated from material safety data sheets associated with the assessed adhesives.

Table 2: Roofing system installation inputs and outputs, per 1 m²

	Weight of Material [kg / m²]	Effective Coverage [m² of Material / 1 m² of Roof]	Scrap Rate	Required Quantity of Material [kg / 1 m²]
Inputs				
Cap sheet	4.5	1.10	5%	5.2
Base sheet	2.87	1.10	5%	3.21
Flashing	0.1	N/A	10%	0.1
Mineral granules (at seams)	0.04	N/A	-	0.04
Adhesive	1.9	N/A	5%	1.9
NMVOCs from adhesive[2]	0.4	N/A	-	0.4
Outputs				
Installed System				9.98
Waste				0.5

[1] 0.815 L adhesive / 1 m² per layer; Density: 1.1 kg / L
[2] 226 g NMVOCs / L adhesive

End-of-Life

At the end-of-life, the low-slope membrane is removed by manual labor, often with roofing shovels. The debris is collected and transported off-site via truck. The waste is brought to a landfill.

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Life Cycle Assessment – Product Systems and Modeling

Declared Unit

The declared unit of this study is 1 m^2 (10.8 ft^2) of the installed roofing membrane. The associated reference flow (the quantity of material required to fulfill the declared unit) is 9.~~84~~ 94 kg/m^2.

Life Cycle System Boundaries

The life cycle study encompasses the cradle-to-gate production, construction, and end-of-life (EoL) stages of the cold-adhered, low-slope SBS-modified bitumen roofing membrane, including raw material extraction and processing, product manufacturing and installation, plus material disposal at EoL. Transportation between stages is accounted for, including raw material transport to the manufacturing facility, finished product transport to the construction site, and transport of the roof system at EoL to the landfill. Use, maintenance, repair, or replacement of the roof system over a building's service life is not included in this evaluation. In addition, production, manufacture and construction of manufacturing equipment and infrastructure; repair and maintenance of the production system; energy and water use related to company management and sales; delivery vehicles and laboratory equipment; as well as maintenance and operation of support equipment are all outside of the scope of the study.

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Assumptions

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- Mineral granules can be made in a variety of colors, which affects the composition of the required mineral granule coating. White mineral granules were selected as a representative product for this study because the pigment used for white products, titanium dioxide, generally has a higher impact than other pigments; therefore, using white is a conservative assumption.
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Cut-off Criteria

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Production-weighted averages for the transportation distances and modes of transport associated with each participating company are included for the transport of the raw materials to production facilities and the transport of the finished products to distribution centers. The transport of finished products from distribution center to the construction site and of waste from the construction site to landfill were each assumed to be 20 miles.

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during the recycling process. Where in-house recycling is used to create other products, co-product allocation by mass is used and any additional processing steps required for use of the recovered materials are accounted for. It is conservatively assumed that all roofing materials disposed at EoL are sent to landfill. This will vary from job site to job site as some roofers may recycle metal components.

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Environmental Product Declarations (EPDs) created under a different Product Category Rule (PCR) are not comparable. Additionally, EPDs based on a declared unit shall not be used for comparisons between products, regardless of the EPDs using the same PCR.

Use of Material Resources

The material resource consumption associated with the installed roofing membrane is presented below for the production, construction, and EoL stages. Water consumption values are negative due to waste sent to landfill at EoL. A landfill introduces blue water to the watershed because it collects rainwater during its lifetime that is eventually released back into the ground, therefore more blue water is coming out of the process than going in. Rainwater is not blue water and is therefore not included in the water consumption metric.

Table 3: Resource use results for each life cycle stage, per 1 m²

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Renewable materials	kg	39.940.6	3.3	1.2	**44.445.0**
Nonrenewable materials	kg	14.514.6	2.0	2.42.3	**18.9**
Water consumption	~~L~~m³	0.070.06	0.001	-0.02	**0.050.04**

Primary Energy by Life Cycle Stage

The primary energy demand associated with the installed roofing membrane is presented below for the production, construction, and EoL stages. Results are given as higher heating value (HHV), per the PCR. Renewable energy is negative for construction due to the credit given for reusing pallets.

Table 4: Primary energy demand results for each life cycle stage, per 1 m²

Primary Energy	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Nonrenewable fossil	MJ (HHV)	285274	9896.3	7.8	**391378**
Nonrenewable nuclear	MJ (HHV)	7.16.6	1.1	0.2	**8.48.0**
Renewable (solar, wind, hydro, geo)	MJ (HHV)	6.56.8	-0.05	0.3	**6.87.1**
Renewable (biomass)	MJ (HHV)	8×10^{-11}	1×10^{-5}	5×10^{-12}	**1×10^{-5}**

Life Cycle Impact Assessment

The environmental impacts associated with the installed roofing membrane are presented below for the production, construction, and EoL stages.

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Table 5: Life cycle impact category results, per 1 m² (TRACI 2.1)

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Global warming potential	kg CO_2-eq	6.7	2.12.0	0.5	**9.49.2**
Smog creation potential	kg O_3-eq	0.4	1.31.2	0.04	**1.7**
Acidification potential	kg SO_2-eq	0.02	0.01	0.002	**0.04**
Eutrophication potential	kg N-eq	0.002	6 x 10^{-4}	3 x 10^{-4}	**0.003**
Ozone depletion potential	kg CFC-11 eq	6 x 10^{-10}	3 x 10^{-9}	1 x 10^{-11}	**4 x 10^{-9}**

Waste Generation

The waste generation associated with the installed roofing membrane is presented below for the production, construction, and EoL stages.

Table 6: Waste generation results, per 1 m²

Impact Category	Units	Production (A1-A3)	Construction (A4-A5)	EoL (C1-C4)	Total
Non hazardous waste generated	kg	0.91.0	0.6	10.09.9	**11.5**
Hazardous waste generated	kg	0.0030.004	2E-041 x 10^{-4}	2 x 10^{-4}	**0.004**

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Additional Environmental Information

Reflective Roofs

Reflective roofs are defined as roofing products with high solar reflectance. Many in the construction industry define “cool roofs” as roofing products with high solar reflectance and high thermal emittance. Asphalt-based products have the inherent property of having high emittance, regardless of their reflective properties. Asphaltic roof systems typically have thermal emittance values greater than 0.80. Reflectance is a deliberate product characteristic, and varies based on the surfacing used.

There are reflective roof options available for virtually any roof and any building. Because of asphalt roofs’ longevity, asphalt-based products provide excellent value for homeowners and building owners by delivering superior durability and sustainability at reasonable cost.

Modified bitumen membranes provide options for varying levels of reflectivity. The reflectivity is related to the color of the modified bitumen membrane surface, surfacing material, or field applied coating. While reflective roofs are an increasingly popular roof option, they represent one of many approaches to help building owners and consumers reduce building energy use and address contemporary environmental concerns.

Individual Component Results

The material resource consumption, primary energy demand, environmental impacts, and waste generation results associated with each individual component (excluding ancillary materials used during installation) of the roofing system are presented below for the production stage (A1-A3).

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Table 7: Production stage (A1-A3) impact results for each system component, per 1 m² of individual component

mpact Category	Units	Base sheet	Cap sheet
Renewable materials	kg	12.613.1	22.521.7
Nonrenewable materials	kg	3.76	8.99.0
Water consumption	L	21.511.3	41.537.6
Nonrenewable fossil	MJ (HHV)	10885.2	14835
Nonrenewable nuclear	MJ (HHV)	2.31.9	3.98
Renewable (solar, wind, hydro, geo)	MJ (HHV)	1.89	3.84.0
Renewable (biomass)	MJ (HHV)	2 x 10^{-11}	5 x 10^{-11}
Global warming potential	kg CO^2-eq	2.1	3.79
Smog creation potential	kg O^3-eq	0.12	0.32
Acidification potential	kg SO^2-eq	0.0108	0.01
Eutrophication potential	kg N-eq	76 x 10^{-4}	0.001
Ozone depletion potential	kg CFC-11 eq	2 x 10^{-10}	3 x 10^{-10}
Non hazardous waste generated	kg	0.3	0.6
Hazardous waste generated	kg	87 x 10^{-4}	0.002

References

- ASTM (2014). “Product category rules for preparing an environmental product declaration for product group: Asphalt Shingles, Built-up Asphalt Membrane Roofing and Modified Bituminous Membrane Roofing.” (http://www.astm.org/CERTIFICATION/DOCS/152.PCR_ASTM_Asphalt_Roofing_PCR_073114.pdf)
- LBP, University of Stuttgart and thinkstep GmbH, Leinfelden-Echterdingen (2013). GaBi 6 dataset documentation for the software-system and databases (http://documentation.gabi-software.com/)
- thinkstep (formerly PE INTERNATIONAL) (2015). “Life Cycle Assessment of Asphalt Roofing Systems: Cradle-to-grave LCAs of a steep-slope and four low-slope industry-average asphalt roofing systems.”

LCA Development

thinkstep

The EPD and background LCA were prepared by thinkstep, Inc. (previously PE INTERNATIONAL).

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www.thinkstep.com

Environment

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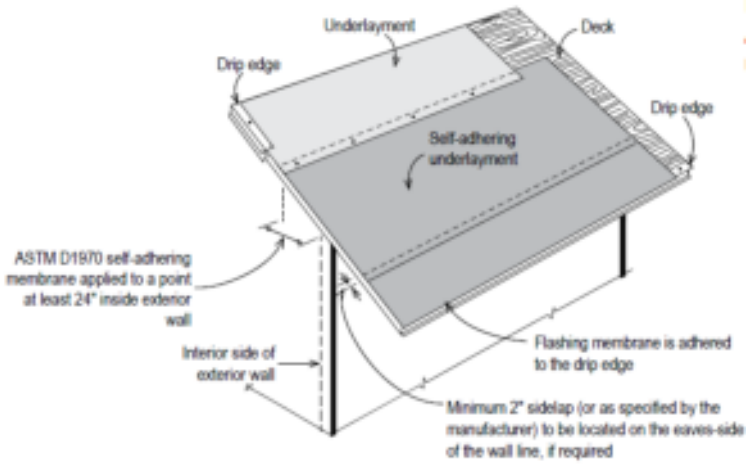
Protecting Against Damage from Ice Dams

Snow and ice accumulation on steep-slope roofs can lead to ice dams at the roof eaves. Ice dams are typically formed by the repeated thawing and freezing of melting snow or backing up of frozen slush in gutters. When ice dams occur, water can be forced under the roofing materials and may cause damage to a home's ceilings, walls and insulation, and long-term damage to structural components.

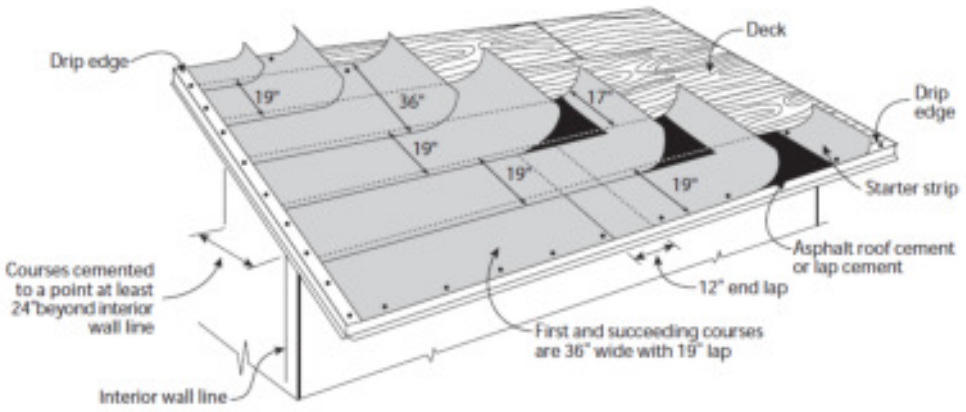
The installation of an ice dam protection layer along eaves is recommended to protect against leakage from ice dams. Per the International Building Code and the International Residential Code (IBC and IRC), in areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier shall be installed. The International Residential Code (IRC) refers back to the local authority having jurisdiction. There are two methods of creating an ice dam protection layer. The installation of a polymer modified bitumen self-adhering underlayment that complies with ASTM D1970 (one layer) is one approach, as recognized by the current version of the IRC. It is ARMA's recommendation that the product should be extended a minimum of 24 inches (610 mm) inside the interior wall line of the building. There are some jurisdictions that will require eave protection to extend further up the roof slope, and other jurisdictions that will call for less. In all cases, apply per the roofing manufacturer's installation instruction and refer to your local building code.

As an alternative, use two layers of asphalt saturated felt as the ice dam protection. Thoroughly adhere the felts to each other with a continuous bed of plastic cement from eaves to a point at least 24 in. inside the interior wall line of the building. Begin by applying the felt in a 19 in. (483 mm) wide strip along the eaves, overhanging the drip edge by ¼ to ¾ in. (7 to 19 mm). Place a full 36 in. (900 mm) wide sheet over the 19 in. (483 mm) wide starter piece, completely overlapping it. All succeeding courses will be positioned to overlap the preceding course by 19 in. Refer to the roofing manufacturer's installation instruction and the local building code for any additional requirements.

Self-adhesive as Ice Dam Protection



Double felt application for Ice Dam Protection



Product Category Rule (PCR) Guidance for Building-Related Products and Services

Part B: Asphalt Shingles, Built-up Asphalt Membrane Roofing and Modified Bituminous Membrane Roofing EPD Requirements

Publisher:
UL Environment

Tracking of versions

Version	Comments	History

This PCR is valid for a period of five (5) years, set to expire in xxxxxxxx, 2023.

I. Background Information and Acknowledgements

These sub-category Product Category Rules (PCR) were developed to address the product specific rules for the creation of Environmental Product Declarations (EPD) for asphalt shingles, built-up asphalt membrane roofing, modified bituminous membrane roofing products, and hot-applied rubberized asphalt membrane, collectively referenced throughout this PCR as “asphalt roofing products”. When used to self-reference this document, “PCR” refers to “sub-category PCR.”

Other PCRs considered in the development of this PCR include:

- Product Category Rule for Asphalt Shingles, Built-up Asphalt Membrane Roofing and Modified Bituminous Membrane Roofing. ASTM. July 2014.
- Part A: Life Cycle Assessment Calculation Rules and Report Requirements UL Environment (February 2018, version 3.1)
- ISO 21930: 2017 - Sustainability in building construction -- Environmental declaration of building products
- EN 15804: 2012-04 - Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction product.

The scope of this PCR differs from the previously published ASTM PCR in that it conforms with ISO 21930:2017 and a Part A/Part B structure. This PCR assumes a 75 year building service life to be consistent with ASHRAE 189.1 (2014, Section 9.5.1).

Interested Parties

This Part B has been prepared with input from the following stakeholders:

Trade associations

- Asphalt Roofing Manufacturers Association (ARMA)

Manufacturers/Consultants

- Atlas Roofing
- Building Products of Canada
- Saint-Gobain (CertainTeed)
- GAF
- Firestone Building Products
- Soprema
- PABCO Roofing Products
- Johns-Manville
- Malarkey Roofing
- Owens Corning
- TAMKO
- IKO Industries

Governance

There are a number representatives of asphalt roofing manufacturers participating in the update of this Product Category Rule ("PCR") for asphalt roofing products, including the Asphalt Roofing Manufacturers Association (ARMA). These parties represent a majority of the companies in their particular sector of the asphalt roofing industry. Moreover, the manufacturing parties participating in the PCR update represent the vast majority of the asphalt roofing sold in North America in the product categories included in this PCR. The very purpose and function of a trade association is to inform its members of important industry developments and to represent their interests in projects such as the update of a PCR affecting their products. This is important because it effectively demonstrates that a large percentage of the asphalt roofing industry is represented in the effort to renew the PCR for asphalt roofing products.

The role of participants is to establish requirements and procedures to be applied in the development of EPDs for asphalt roofing products. This is an update to an existing PCR, and therefore, this effort begins with the vetting of required changes in scope and structure. A fundamental aspect of the utility of an LCA is understanding a product's environmental impact, so maintaining applicability of EPDs certified under the existing PCR is a critical consideration for participants. In the development of this document, Part B, participants are responsible for ensuring alignment with Part A and conformance with the scoped standards: EN 15804, ISO 21930, and ISO 14025.

Involvement of Interested Parties

UL Environment shall be responsible for producing the PCR document by establishing an open consultation process that includes the involvement of interested parties (ISO 21930 Section 5.2 and 6.2.1). Reasonable efforts were made to achieve a consensus throughout the process (ISO 14020:2000, 4.9.1, Principle 8 and cited in both ISO 14025 and ISO 21930), demonstrated by a vote of participating interested parties.

ARMA informed their memberships of the PCR creation through their regularly scheduled association committee meetings, newsletters, e-mail messages, and similar types of outreach. Trade associations operate at the behest of its members, and the fact that trade associations are participating in the update of a PCR for asphalt roofing products is an indication that their memberships are aware of this project and have authorized their association to represent them in this important endeavour.

UL Environment posted an open call for participation in this PCR update in May 2018 via its standards website, social media outlets, and outreach to original committee stakeholders.

XX% of the industry as represented by number of participating industry companies was included in the update to this PCR with a minimum of three companies.

Update Process

The PCR is valid for a duration of five (5) years from the publication date, at which time it may be revised at the request of industry stakeholders. The PCR may be revised before the five year date if the following

occurs in the industry:

- The industry desires an update
- Core governing standards ISO 14040, 14044, 14025, 21930, or EN 15804 are updated with substantial material changes

Note: When the PCR is updated, the Program Operator shall communicate with the original committee, any new EPD participants, and initiate a new public call for interested parties.

Public Consultation

Public consultation was utilized during the PCR review process. The public consultation of the completed draft PCR included a minimum 30-calendar-day period for comments to be submitted to UL Environment. After public comments were submitted, the PCR committee reviewed and developed responses for all comments. All comments from the review panel and public consultation were addressed and satisfactorily resolved by the PCR committee prior to the publication of this PCR.

Review

The review process of this Part B PCR included a review through public consultation in xxxxxxx – xxxxxxx 2018 and a panel review, comprised of the following individuals:

TBD **TBD** **TBD**

II. Scope

This document contains the Product Category Rule (PCR) requirements for Asphalt Shingles, Built-up Asphalt Membrane Roofing and Modified Bituminous Membrane Roofing Environmental Product Declarations (EPDs) published in coordination with the EN 15804 and ISO 21930 standards. The requirements for the background Life Cycle Assessment (LCA) project report used to inform the EPD are contained in UL Environment's Part A: Life Cycle Assessment Calculation Rules and Report Requirements. This Part B document, coupled with the Part A, conforms to the EN 15804, ISO 21930, and ISO 14025 sustainability standards for EPD reporting in addition to the US Green Building Council PCR Guidance.

This PCR has been updated to align with international standards with the intent of allowing manufacturers to create EPDs which are global in scope.

General Guidance

The scope of this PCR applies to the product group "asphalt roofing products" and includes all residential and commercially available installed asphalt roofing products according to the standards or technical approvals shown under Section 8, including asphalt shingles applied over underlayment, and low-slope roofing assemblies consisting of various combinations of factory-produced asphalt-saturated/coated base sheets, ply sheets and cap sheets together with specified viscous asphalt coatings, adhesives and surfacings.

This PCR applies to the entirety of a packaged product intended for individual sale, including but not limited to adhesives and sealants.

Applicable Products

The following Construction Specification Institute (CSI) Masterformat codes cover the scope of this Part

B:

- 07 31 13 Asphalt Shingles
- 07 31 13.13 Fiberglass-Reinforced Asphalt Shingles
- 07 51 13 Built-Up Asphalt Roofing
- 07 51 13.13 Cold-Applied Built-Up Asphalt Roofing
- 07 51 23 Glass-Fiber-Reinforced Asphalt Emulsion Roofing
- 07 55 51 Built-Up Bituminous Protected Membrane Roofing
- 07 55 52 Modified Bituminous Protected Membrane Roofing
- 07 55 56.13 Hot-Applied Rubberized Asphalt Protected Membrane Roofing

Non-Applicable Products

Products that may provide the same function in a different application, e.g. waterproofing products, are not within the scope of this PCR. These excluded CSI codes are:

- 07 12 13 Built-Up Asphalt Waterproofing
- 07 12 16 Built-Up Coal Tar Waterproofing
- 07 13 13 Bituminous Sheet Waterproofing
- 07 13 52 Modified Bituminous Sheet Waterproofing
- 07 13 26 Self-Adhering Sheet Waterproofing
- 07 13 52 Modified Bituminous Sheet Waterproofing
- 07 14 13 Hot Fluid-Applied Rubberized Asphalt Waterproofing

System Boundary

The system boundary for EPDs created using this PCR is either cradle to gate, cradle to gate with options (end of life), or cradle to grave.

The EPD requirements include:

- ISO 21930:2017 standard
- EN 15804 standard (optional)
- ULE General Program Instructions v 2.3, February 2018 (available upon request)
- The calculation rules for the Life Cycle Assessment and Requirements on the Project Report are specified in a separate document as Part A of the Product Category Rules, available at http://industries.ul.com/environment/transparency/product-category-rules-pcrs

III. Industry-Average EPD Requirements

Industry-Average EPD Scope

The products represented within an single industry-average EPD created using this PCR are limited to the primary materials defined in the product specification standards in Section 9 that characterize the specific product in commerce.

Involvement of Interested Parties

A call for involvement of interested parties in the creation of an industry-average EPD shall be published in at least one industry trade publication. At a minimum, at least three (3) different manufacturing locations from no less than three (3) companies should be involved and represented in an industry-average EPD. The method for determining representativeness shall be justified and described per the requirements listed in Section 2.2.4.1.

Industry-Average EPD Participation

A manufacturer qualifies for participation in an industry-average EPD created using this PCR if the manufacturer provides LCA data used to calculate the EPD average.

Retroactive participation:

When determining a manufacturer's participation eligibility, the EPD Program Operator shall follow the rules and recommendations of the primary sponsor(s) of the industry average EPD and participating manufacturers unless the Program Operator has information to the contrary, in which case the Program Operator, LCA practitioner, primary sponsor of the industry average EPD, and manufacturer shall confer in an effort to reach consensus.

Pending all criteria set forth by the primary sponsor of the industry average EPD are met, a manufacturer desiring retroactive inclusion in the industry average EPD shall provide manufacturing and product data information of the same representativeness submitted in the original industry average EPD to the LCA practitioner. The LCA practitioner will then recommend to the Program Operator a determination for inclusion in the industry average on the basis of results falling within a reasonable range for any impact category. The maximum and minimum should be reported in the LCA background report for each impact category based on the highest and lowest impact product or facility within the original industry-wide LCA.

Governance

An industry organization, such as a trade association, shall inform possible industry participants through association meetings, newsletters, e-mail messages, and similar types of outreach, including public notices in the trade press publications. Confidential business information shall be collected by a third party. Data from the third party shall be provided to the facilitator as aggregated data with no trace to the original source of data.

The development of an industry-average EPD and or update of an EPD should involve a series of meetings and exchanges in which all participants are invited and kept apprised of the developments. Notices of these meetings should be given to all possible participants regardless of their commitment to active involvement. Minutes of meetings, along with meeting notices, should be preserved as documentation of the process and due diligence observed in the creation or renewal of the EPD.

Data Responsibility/Ownership

Trade associations that lead the development of industry-average EPDs may need to collect confidential business information from individual members. This data can include proprietary chemical formulations and processes or other confidential information. In this case, a designated third-party entity such as an LCA practitioner shall be identified as the "industry agent". The industry agent shall be responsible for activities including collection, secure storage and analysis of such data needed for the EPD development, and will preserve the privacy of individual company information while executing these duties.

Per ISO 21930 Section 5.4, the manufacturer, or group of manufacturers, of the construction product is the sole owner of the EPD and is responsible for developing the EPD of the construction product according to the PCR. Only the manufacturer or group of manufacturers is authorized to declare the environmental performance of the construction product using an EPD.

The group of manufacturers responsible for developing an industry-average EPD shall be responsible for, including but not limited to, ensuring industry-average EPD updates are made based on the most recent LCA modeling software version and impact assessment version available.

Industry-Average EPD Updates

Industry-average EPDs created using this PCR shall expire five (5) years after publication. An update to the existing EPD, or new EPD, may need to be developed prior to the five years if: 1) significant changes have occurred in the manufacturing process; 2) new industry participants; 3) significant changes or alterations in raw materials; 4) major regulatory changes that mandate or trigger changes to operational procedures; or 5) major technological changes would also justify creation of an updated EPD.

Additional companies may be added to an existing industry-average EPD at the scheduled review by submitting data required for retroactive participation. However, this shall not automatically trigger a recalculation of the industry average impacts.

1. General Information

EPD Program and Program Operator Name, Address, Logo, and Website	**Program Operator Provided**
General Program Instructions and Version Number	**Program Operator Provided**
Manufacturer Name and Address	
Declaration Number	**Program Operator Provided**
Declared Product & Functional Unit or Declared Unit	
Reference PCR and Version Number	
Description of product's intended application and use (as identified when determining Product RSL)	
Product RSL Description (if appl.)	
Markets of Applicability	
Date of Issue	**Program Operator Provided**
Period of Validity	**Program Operator Provided**
EPD Type	**[Industry-average or product-specific]**
Range of Dataset Variability	**[Industry-average only; mean, median, standard deviation]**
EPD Scope	**[Cradle to gate, cradle to gate with options (specify options), or cradle to grave]**
Year(s) of reported manufacturer primary data	
LCA Software & Version Number	
LCI Database(s) & Version Number	
LCIA Methodology & Version Number	

The sub-category PCR review was conducted by:	**Program Operator Provided** **Program Operator Provided** **Program Operator Provided**
This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," v3.2 (September 2018), in conformance with ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017) **☐INTERNAL ☐ EXTERNAL**	**Program Operator Provided**
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	**Program Operator Provided**
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	**Program Operator Provided**

LIMITATIONS

Environmental declarations from different programs (ISO 14025) may not be comparable.

Comparison of the environmental performance of Asphalt roofing Products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR.

Full conformance with the PCR for Products allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

2. EPD Content

2.1. DESCRIPTION OF COMPANY/ORGANIZATION

The name of the manufacturing entity(ies) as well as the place(s) of production shall be provided. General information about the manufacturing entity(ies) may be provided, such as the existence of quality systems or environmental management systems, according to ISO 14001 or any other environmental management system in place.

2.2. PRODUCT DESCRIPTION

A narrative description of the product shall be provided that enables clear identification of the product. This description will include:

2.2.1 Product Identification

The declared product(s) in an industry-average EPD shall be identified by material type(s) and by simple visual representation, which may be by photograph or graphic illustration.

The declared product(s) in a manufacturer-specific EPD shall be identified by brand name(s), by material type(s), by production code(s) (if applicable), and by simple visual representation, which may be by photograph or graphic illustration.

2.2.2 Product Specification

Similar products grouped and reported as an average product in the same EPD satisfying the variation criteria of Part A, Section 5 shall constitute an individual declared product. For each declared product, list the physical characteristics defined by the standards in Section 2.5 – in the form that the product would be installed – along with the reference to the test standard for each. When pertinent, provide a description of the asphalt roofing product. Mass shall be based on the total amount of material needed to produce 1 m² of the given product, i.e. prior to yield losses, including any and ancillary materials. Other relevant product specification values may be provided here.

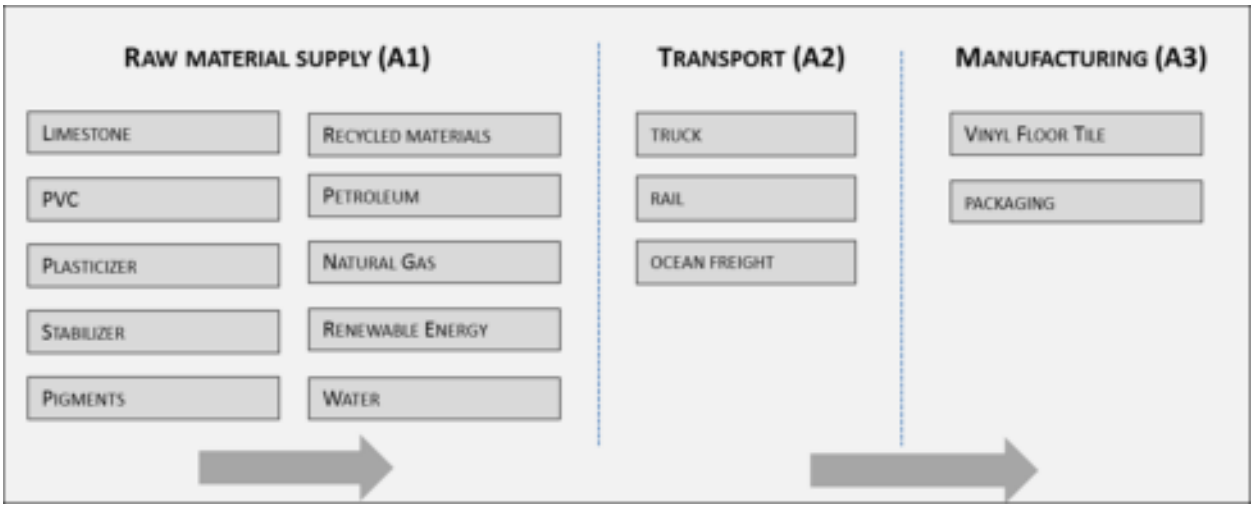
The appropriate ASTM or CSA product specification shall be provided, including additional pertinent physical properties and technical information.

2.2.3 Flow Diagram

A graphical depiction of a flow diagram illustrating main production processes according to the scope of the declaration shall be included such as the examples in Figure 1.

Figure 1. Example Product Flow Diagram – xxxxxx[1]

[1] This example flow diagram is specific to xxxxxxx product and other product types covered in this PCR will differ.



2.2.4 Product Average

2.2.4.1 Industry-Average EPD (if relevant)

The method for creating an industry-average EPD shall be described per Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Section 2.5.1.

2.2.4.2 Product Specific EPD

The method for creating a company specific individual product/product group EPD shall be described, including the method for determining a weighted average across products based on production volume as described in Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Section 2.5.2.

2.3. APPLICATION

The intended application(s) for the referenced product(s) shall be specified, along with the functional unit and RSL.

2.4. DECLARATION OF METHODOLOGICAL FRAMEWORK

The following items shall be specified: the type of EPD with respect to life cycle stages, and the life cycle stages covered and not covered (i.e. B2B, cradle-to-gate with modules A1-A3 and C1-C4 included or B2C with all modules included).

The reference conditions for achieving the declared technical and functional performance and the Reference Service Life (RSL) shall be included, per Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Section 2.8.2.

The cut-off and allocation procedures shall be described according to the requirements of Sections 2.9 and 3.3 of Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Include the statement “no known flows are deliberately excluded from this EPD.”

2.5. TECHNICAL DATA

The following technical data for the product as delivered shall be provided with reference to the applicable test standard.

TABLE 2. TECHNICAL DATA

Product Category	Product	Description/Specification (as applicable)

Asphalt Shingles	Roof Cover	ASTM D3018 ASTM D3462 CSA A123.5
	Shingle Underlayment	ASTM D226, ASTM D4869, ASTM D6757, CSA A123.3, ASTM D1970, CSA A123.22
Built-up Asphalt Membrane Roofing	Base Sheet	ASTM D4601 ASTM D4897 ASTM D2626
	Ply/Cap Sheet	ASTM D2178 ASTM D226 ASTM D3909 UL55A CSA A123.2 CSA A123.3 CSA A123.16 CSA A123.17
	Built-Up Roof Accessory	ASTM D41 ASTM D312 ASTM D6152 ASTM D4586 ASTM D1863 CSA A123.4
Atactic-Polypropylene (APP) Membrane Roofing	Roof Cover/Inter-ply	ASTM D6222 ASTM D6223 ASTM D6509 CSA A123.23

Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing	Roof Cover/ Inter-ply	ASTM D6162 ASTM D6163 ASTM D6164 ASTM 6298 CSA A123.23
Hot fluid applied rubberized asphalt		TBD
Polymer Modified Bituminous Steep Slope Membrane Roofing	Roof Cover	ASTM D7505 ASTM D7530

2.6. Market Placement / Application rules

The respective standard and/or general technical approval or comparable national regulation shall be indicated. Standards shall be quoted as shown in Section 8.

The product(s) declared in this document complies with the following codes or regulations.

- Example: AATCC Test Method 134-2011 Electrostatic Propensity of Carpets (Normative value ≥ 3.5 kV)

Note: Compliance with model building codes does not always ensure compliance with state and local building codes, which may be amended versions of these model codes. Always check with local building code officials to confirm compliance.

The final evaluation report/certification/ registration is available at: [Insert link]

2.7. Properties of Declared Product as Delivered

The dimensions/quantities of the declared product(s) as delivered to the site of installation/application shall be indicated.

2.8. Material Composition

The main product components or materials that make up the asphalt roofing product shall be described and given in percentage by mass.

Statements of material non-inclusion, such as "… is free of …" may not be used. Ancillary materials and additives remaining in the product shall also be declared. If additives such as flame retardants, softeners or biocides are used, their functional chemical group shall be indicated.

Regulated Hazardous substances and dangerous substances shall be reported per Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Section 4.11.

Note: This disclosure is intended to enable the user of the EPD to understand the composition of the product in delivery condition and support a safe and effective installation, use and disposal of the product. With appropriate justification, this requirement does not apply to confidential or proprietary information relating to materials and substances that apply due to a competitive business environment or covered by intellectual property rights or similar

legal restrictions. It also might not be appropriate for information concerning intangible products.

2.9. MANUFACTURING

The manufacturing process and locations shall be described. If the EPD applies to several locations, the production processes for all locations shall be described and reference to quality management systems may be included.

2.10. PACKAGING

Information on product-specific packaging: type, composition and possible reuse of packaging materials (paper, strapping, pallets, foils, drums, etc.) shall be included in this Section. The EPD shall describe specific packaging scenario assumptions, including disposition pathways for each packaging material by reuse, recycling, or landfill disposal based on packaging type.

In the absence of specific primary data, the data assumptions from Part A, Section 2.8.5, Table 2 shall be used.

In the case of reusable packaging designed to last for multiple reuse cycles, one reuse shall be assumed in the absence of primary manufacturer data. At the end of its reuse cycle, reusable packaging shall be assumed to go to landfill.

2.11. PRODUCT INSTALLATION

A description of the type of processing, machinery, tools, dust extraction equipment, auxiliary materials, etc. to be used during installation shall be included. Information on industrial and environmental protection may be included in this section.

Any waste treatment included within the system boundary of installation waste should be specified.

2.12. USE CONDITIONS

Any relevant information may be provided in this section regarding specific product use conditions and/or limitations relevant to each product application and/or use, including a description of any maintenance, repair, replacement or refurbishment processes and/or a reference to where such descriptions may be found.

Roofing underlayment shall be assumed to be entirely replaced when the roofing is replaced during the building ESL.

All quantitative information related to this section shall be reported in Section 4 “Scenarios and additional technical information”.

2.13. PRODUCT REFERENCE SERVICE LIFE AND BUILDING ESTIMATED SERVICE LIFE

The indication of the Reference Service Life (RSL) is imperative for EPDs covering the complete use stage (modules B1-B7), or if a use stage scenario is described, which refers to the lifetime of the product.

The reference service life and building estimated service life shall be indicated according to Section 2.8.2 of Part A: Life Cycle Assessment Calculation Rules and Report Requirements.

The assumptions upon which the designated RSL is based and for which the RSL exclusively applies shall be provided in the Section 4, Table 6. Influences on ageing, when applied, shall be in accordance with the state of the art.

2.14. RE-USE PHASE

The possibilities of re-use, recycling and energy recovery shall be described. If an Extended Producer Responsibility initiative such as a product take-back program exists, this may be included.

2.15. DISPOSAL

The possible disposal channels shall be indicated in accordance with disposal routes and waste classification

referenced in Part A, Section 2.8.5 and 2.8.6.

2.16. Further Information

A reference source for additional information may be provided here, e.g. homepage, reference source for safety data sheet.

3. LCA Calculation Rules

3.1. Functional Unit

For EPDs covering the complete life cycle, a functional unit shall be defined based on the functional use or performance characteristics of the product integrated into a building or other type of construction in the use phase. The functional unit shall be 100 m² [1076.4 ft²] of constructed area using the product, including all layers required to achieve the expected performance. Explanation of the selected functional unit shall be stated clearly, including the reference service life, installation methods and all ancillary materials such as, but not limited to, ballasting, fasteners and adhesives.

3.2. Declared Unit

For EPDs not covering the complete life cycle, e.g. leaving out the use stage, a declared unit is defined. A declared unit shall be applied if the precise function of the product is not stated or not known. Conversion factors (e.g. density, thickness, moisture content, etc.) shall be provided in order to allow the users to conduct further calculations (e.g. transport impacts, energy simulations). A declared unit shall be 1 m² [10.8 ft²]. A weighted average thickness or other applicable aspects of the product shall be stated when the EPD deals with a generic or representative product group with different thicknesses. The weights shall reflect the relative production volumes for the relevant materials.

The functional or declared unit, mass, and thickness to achieve the functional or declared unit shall be indicated in Table 1 as declared.

Table 1. Functional or Declared Unit Properties

Name	Value	Unit
Functional or Declared unit		
Mass		kg
Thickness to achieve Functional or Declared Unit		m

3.1. System boundary

The type of EPD shall be specified as either cradle to gate with end of life or cradle to grave. The modules considered in the LCA shall be described in brief as per “System boundaries” outlined in Part A, Section 2.8. It should be apparent as to what processes are considered in what modules per the module descriptions in Section 2.8 of Part A. Any relevant aspects or impacts not included in an information module shall be supported with relevant additional environmental information and the omissions shall be justified.

Capital goods and infrastructure flows for asphalt roofing do not significantly affect the results and conclusions of the LCA or additional environmental information and shall be excluded from unit processes used to model the LCIA.

3.2. Product specific Calculations for use phase (Modules B1-B7)

Use-stage environmental impacts of asphalt roofing products during building operations depend product maintenance. Guidance for determining use phase impacts is included in this section.

3.2.1. Product Maintenance

Information on

maintenance shall be provided based on the manufacturer's recommendations. In the absence of primary data, cleaning assumptions shall be documented.

3.3. Units

SI units are required for all LCA results. Other units commonly used in a regional market may be optionally included in addition to the required SI units.

3.4. Estimates and Assumptions

Key assumptions and estimates in this section should be included in the Life Cycle Assessment, provided that they are not dealt with in Section 3 "LCA: Calculation rules", or Section 4 "LCA: Scenarios and additional technical data".

Transport, installation, and deconstruction procedures are common to all products within the category. In the absence of primary data, the following assumptions should be used for products sold in North America. Any deviations from these assumptions (e.g. different geographies) shall be justified and explained.

Table 7. Transport, Installation, and Deconstruction Procedures

Product transport from point of purchase to building site	Product transport from building site to waste processing	Installation & deconstruction procedures
Mode: Diesel-powered truck/trailer Distance: 800 km	Mode: Diesel-powered truck/trailer Distance: 161 km	Manual (no operational energy use)

3.5. Cut-off Rules

Cut-off rules as specified per the PCR, Part A: Life Cycle Assessment Calculation Rules and Report Requirements Section 2.9 shall be used and documented. All known mass and energy flows shall be reported. No known flows should be deliberately excluded.

3.6. Data Sources

Data sources shall be documented per Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Section 3.1.

3.7. Data Quality

An evaluation shall be provided regarding data quality, including temporal, geographical, technological representativeness, and completeness and shall follow the requirements outlined in PCR, Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Section 3.1.1.

3.8. Period under Review

The period under review and ensuing averages shall be documented.

3.9. Allocation

Part A, Section 3.3 shall be used as the basis for allocation decisions, and mass should be used as the primary basis for co-product allocation in this Part B. Allocation methods deemed more appropriate than on the basis of mass may be used but only when justified. The allocations of relevance for calculation (appropriation of impacts across various products) shall be indicated, at least:

- Allocation in the use of recycled and/or secondary raw materials
- Allocation of energy, ancillary and operating materials used for individual products in a factory

whereby reference shall be made to the modules in which the allocations are performed.

3.10. Comparability and Benchmarking

Comparison of EPD results between non-competitive products may be included this section per the requirements in

Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Section 9.

4. LCA: Scenarios and additional technical information

The following information shall be reported for declared modules. Irrelevant or non-applicable module rows may be excluded in the EPD; additional information may also be listed if necessary

The following technical information is a basis for the declared modules or may be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

TABLE 11. TRANSPORT TO THE BUILDING SITE (A4)

Name	Value	Unit
Fuel type		
Liters of fuel		l/100km
Vehicle type		
Transport distance		km
Capacity utilization (including empty runs, mass based)		%
Gross density of products transported		kg/m³
Weight of products transported (if gross density not reported)		kg
Volume of products transported (if gross density not reported)		m³
Capacity utilization volume factor (factor: =1 or <1 or ≥ 1 for compressed or nested packaging products)		-

TABLE 12. INSTALLATION INTO THE BUILDING (A5)

Name	Value	Unit
Ancillary materials		kg
Net freshwater consumption specified by water source and fate (e.g., X m3 river water evaporated, X m3 city water disposed to sewer)		m³
Other resources		kg
Electricity consumption		kWh
Other energy carriers		MJ
Product loss per functional unit		kg
Waste materials at the construction site before waste processing, generated by product installation		kg
Output materials resulting from on-site waste processing (specified by route; e.g. for recycling, energy recovery and/or disposal)		kg
Biogenic carbon contained in packaging		kg CO_2
Direct emissions to ambient air, soil and water		kg
VOC emissions		µg/m3

The VOC emissions shall be determined in accordance to “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers- version 1.2” CA Specification 01350.

TABLE 13. REFERENCE SERVICE LIFE

Name	Value	Unit
RSL		Years
Declared product properties (at the gate) and finishes, etc.		Units as appropriate
Design application parameters (if instructed by the manufacturer), including references to the appropriate practices and application codes)		Units as appropriate
An assumed quality of work, when installed in accordance with the manufacturer's instructions		Units as appropriate
Outdoor environment, (if relevant for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature		Units as appropriate
Indoor environment, (if relevant for indoor applications), e.g. temperature, moisture, chemical exposure)		Units as appropriate
Use conditions, e.g. frequency of use, mechanical exposure.		Units as appropriate
Maintenance, e.g. required frequency, type and quality of replacement components		Units as appropriate

TABLE 14. MAINTENANCE (B2)

Name	Value	Unit
Maintenance process information (cite source in report)		-
Maintenance cycle		Cycles/ RSL
Maintenance cycle		Cycles/ ESL
Net freshwater consumption specified by water source and fate (e.g., X m3 river water evaporated, X m3 city water disposed to sewer)		m^3
Ancillary materials specified by type (e.g. cleaning agent)		kg
Other resources		kg
Energy input, specified by activity, type and amount		kWh
Other energy carriers specified by type		kWh
Power output of equipment		kW
Waste materials from maintenance (specify materials)		kg
Direct emissions to ambient air, soil and water		kg
Further assumptions for scenario development (e.g. frequency and time period of use, number of occupants)		

4.1. TABLE 15. REPAIR (B3)

Name	Value	Unit
Repair process information (cite source in report)		-
Inspection process information (cite source in report)		-
Repair cycle		Cycles/ RSL
Repair cycle		Cycles/ ESL
Net freshwater consumption specified by water source and fate (e.g., X m3 river water evaporated, X m3 city water disposed to sewer)		m^3

Ancillary materials specified by type (e.g. cleaning agent)		**kg**
Energy input, specified by activity, type and amount		**kWh**
Waste materials from repair (specify materials)		**kg**
Direct emissions to ambient air, soil and water		**kg**
Further assumptions for scenario development (e.g. frequency and time period of use, number of occupants);		

4.2. REPLACEMENT (B4) / REFURBISHMENT (B5)

The number of replacements of product expected during the building ESL of 75 years shall be declared. Required or expected maintenance are to be modelled according to manufacturer's guidelines. Assumptions and key parameters shall be clearly stated and the manufacturer is to submit supporting documentation to justify the assumptions made.

If the RSL is less than the building's ESL of 75 years, the number of replacements that will be necessary to fulfil the required performance and functionality over the building ESL shall be identified.

Replacements should be rounded-up to the nearest tenths of the ESL of the building; e.g., 1.47 rounded to 1.5.

TABLE 16. REPLACEMENT (B4)

Name	Value	Unit
Reference Service Life		**Years**
Replacement cycle		**(ESL/RSL) - 1**
Energy input, specified by activity, type and amount		**kWh**
Net freshwater consumption specified by water source and fate (e.g., X m3 river water evaporated, X m3 city watert disposed to sewer)		**m^3**
Ancillary materials specified by type and amount (e.g. cleaning agent)		**kg**
Replacement of worn parts, specify parts/materials		**kg**
Direct emissions to ambient air, soil and water		**kg**
Further assumptions for scenario development, e.g. frequency and time period of use		**As appropriate**

TABLE 17. REFURBISHMENT (B5)

Name	Value	Unit
Refurbishment process description (cite source in report)		
Replacement cycle		**Cycles/ RSL**
Replacement cycle		**Cycles/ ESL**
Energy input, specified by activity, type and amount		**kWh**
Net freshwater consumption specified by water source and fate (e.g., X m3 river water evaporated, X m3 city watert disposed to sewer)		**m^3**
Material input for refurbishment, including ancillary materials specified by type (e.g. cleaning agent)		**kg**

Waste material(s), specified by material		kg
Direct emissions to ambient air, soil and water		kg
Further assumptions for scenario development (e.g. frequency and time period of use, number of occupants);		

4.3. TABLE 18. OPERATIONAL ENERGY USE (B6) AND OPERATIONAL WATER USE (B7)

Name	Value	Unit
Net freshwater consumption specified by water source and fate (e.g., X m3 river water evaporated, X m3 city water disposed to sewer)		m^3
Ancillary materials		kg
Energy input, specified by activity, type and amount		kWh
Equipment power output		kW
Characteristic performance (e.g. energy efficiency, variation of performance with capacity utilization)		Units as appropriate
Direct emissions to ambient air, soil and water		kg
Further assumptions for scenario development (e.g. frequency and time period of use, number of occupants);		As appropriate

4.4. TABLE 19. END OF LIFE (C1-C4)

Name		Value	Unit
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)			
Collection process (specified by type)	Collected separately		kg
	Collected with mixed construction waste		kg
Recovery (specified by type)	Reuse		kg
	Recycling		kg
	Landfill		kg
	Incineration		kg
	Incineration with energy recovery		kg
	Energy conversion (specify efficiency rate)		
Disposal (specified by type)	Product or material for final deposition		kg
Removals of biogenic carbon (excluding packaging)			kg CO_2

TABLE 20. REUSE, RECOVERY AND/OR RECYCLING POTENTIALS (D), RELEVANT SCENARIO INFORMATION

Name	Value	Unit
Net energy benefit from energy recovery from waste treatment declared as exported energy in C3 (R>0.6)		MJ
Net energy benefit from thermal energy due to treatment of waste declared as exported energy in C4 (R<0.6)		MJ

Net energy benefit from material flow declared in C3 for energy recovery		**MJ**
Process and conversion efficiencies		
Further assumptions for scenario development (e.g. further processing technologies, assumptions on correction factors);		

5. LCA: Results

In Table 21, "Descriptions of the system boundary modules," all declared modules shall be indicated with an "X".

Modules A1, A2, and A3 may be declared as one aggregated module A1-A3.

Per Part A, life cycle impact assessment (LCIA) results shall be reported for each declared module as follows. Results shall be declared with three digits using scientific notation (e.g. 1.23E-5 = 0.0000123) for each module. A uniform format shall be used for all indicator values.

- North America (Part A, Section 4.7, Table 7, TRACI indicators)
- EU (Part A, Section 4.8, Table 8, CML indicators)
- Rest of World (Part A, Section 4.9, Table 8, indicators as provided)

Results derived from the product life cycle inventory (LCI) shall be reported as follows:

- Resource use indicators (Part A, Section 4.1, Table 4)
- Output flows and waste category indicators (Part A, Section 4.1.2, Table 5)
- Carbon emissions and removals (Part A, Section 4.6, Table 6)

Table 21. Descriptions of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND SYSTEM BOUNDARY
	A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Bldg. Operational Energy Use During Product Use	Bldg. Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
Cradle to grave	Required					Required (based on scenarios)							Required				Optional

.

6. LCA: Interpretation

Interpretation requirements for the Project Report are provided in Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Section 5.

An interpretation shall be provided in the EPD which discusses the assumptions and limitations associated with the interpretation of results as declared in the EPD, both methodology and data related.

This interpretation shall also include a description of the time frame and/or variance of the LCIA results if the EPD is valid for several products. An illustration of the results with figures is recommended in the EPD, e.g. for the dominance analysis, the distribution of impacts across the modules, the CO_2-balance, etc. as appropriate for a reader's understanding of the environmental profile of the declared product.

7. Additional Environmental Information

7.1. Environment and Health During Manufacturing

Measures relating to environmental and health protection during the product manufacturing process extending beyond national guidelines (of the production country) may be described, e.g. reference to a product safety data sheet (SDS), description of Environmental Management Systems or similar, programs addressing air emissions, wastewater, noise, etc.

7.2. Environment and Health During Installation

Information should be provided in this section on the relationship between the product, the environment and health, including any possible harmful substances or emissions e.g. reference to a product safety data sheet (SDS). Any recommendations concerning cleaning, maintenance, etc. of the declared product should be listed in Section 4 “Technical information on scenarios”.

7.3. Extraordinary Effects

Fire

Information should be included on the product’s fire performance and possible impacts on the environment e.g. reaction-to-fire, other relevant fire tests as applicable, and emissions to air, including smoke toxicity.

Water

Information should be included on the product’s performance and possible impacts on the environment following unforeseeable influence of water, e.g. flooding.

Mechanical destruction

Information should be included on the product’s performance and possible impacts on the environment following unforeseeable mechanical destruction.

7.4. Delayed Emissions

If a manufacturer wishes to declare quantitative or qualitative information on delayed emissions used to calculate Global Warming Potential within the EPD, information may be provided here. See Part A, Section 4.4 for more information.

7.5. Environmental Activities and Certifications

Other environmental activities, such as participation in recycling or recovery programs along with the details of these programs and contact information, may be provided.

For certifications applied to the product and listed in the EPD, a statement shall be included on where an interested party can find details of the certification program.

7.7. Further Information

A reference source for additional information may be provided here, e.g. homepage, reference source for safety data sheet.

8. Supporting Documentation

The Project Report Content, Structure, and Accessibility requirements to support an EPD created using this document are provided in Part A: Section 2. Project Report elements include general information (Part A: Section 2.1), study goal (Part A: Section 2.2), study scope (Part A: Section 2.8), and the life cycle inventory analysis, impact assessment,

and interpretation (Part A: Section 3, 4, and 5). Additionally, the Project Report shall include additional required supporting documentation specified in this sub-category Part B and according to Part A: Section 6.

If relevant to the scope of the declared product, or due to the product material composition, it is recommended to provide sufficient supporting documentation in the EPD and Project Report. When providing documentation, testing protocols and other relevant information shall be indicated. If supporting documentation is not provided, the reasons shall be indicated in the EPD and Project Report.

As a general rule, all statements shall be documented with measured data (presented by the corresponding test certificates). In the case of non-verifiable substances, the limit of detection shall be included in the declaration. Interpreting statements such as "… free of …" or "… are entirely harmless …" are not permissible.

9. References

The literature referred to in the Environmental Product Declaration shall be quoted in full from the following sources. Standards and standards relating to evidence and/or technical features already fully quoted in the EPD do not need to be listed here. This Part B PCR document shall be referenced.

UL ENVIRONMENT

UL Environment General Program Instructions April 2017, version 2.1

Part A: Life Cycle Assessment Calculation Rules and Report Requirements UL Environment (September 2018, version 3.2)

CHARACTERIZATION METHODS

IPCC. 2014. CLIMATE CHANGE 2013. THE PHYSICAL SCIENCE BASIS. CAMBRIDGE UNIVERSITY PRESS. HTTP://WWW.IPCC.CH/REPORT/AR5/WG1/

Hauschild M.Z., & Wenzel H. Environmental Assessment of Products. Springer, US, Vol. 2, 1998

Heijungs R., Guinée J.B., Huppes G., Lankreijer R.M., Udo de Haes H.A., Wegener Sleeswijk A. Environmental Life Cycle Assessment of Products: Guide and Backgrounds. CML. Leiden University, Leiden, 1992

Jenkin M.E., & Hayman G.D. Photochemical ozone creation potentials for oxygenated volatile organic compounds: sensitivity to variations in kinetic and mechanistic parameters. Atmospheric Environment. 1999, 33 (8) pp. 1275–1293

WMO. 1999. Scientific Assessment of Ozone Depletion: 1998, World Meteorological Organization Global Ozone Research and Monitoring Project – Report No. 44, WMO, Geneva

USE PHASE ASSUMPTIONS

United States Environmental Protection Agency, WaterSense, Office of Wastewater Management (4204M), 2014 https://www.epa.gov/aboutepa/about-office-water#wastewater

SUSTAINABILITY REPORTING STANDARDS

EN 15804: 2012-04 - Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction product.

ISO 14025: 2006 - Environmental labels and declarations — Type III environmental declarations — Principles and procedures

ISO 14040: 2006 - Environmental management – Life cycle assessment – Principles and framework

ISO 14044:2006 - Environmental management – Life cycle assessment – Requirements and guidelines

ISO 14046:2013 - Environmental management- Water footprint- Principles, requirements and guidelines

ISO
15392:2008 -

Sustainability in building construction- General principles

ISO 15686-1:2011 - Buildings and constructed assets- Service life planning- Part 1: General principles

ISO 15686-2:2008 - Buildings and constructed assets- Service life planning Part 2: Service life prediction procedures

ISO 15686-7:2008 - Buildings and constructed assets- Service life planning Part 7: Performance evaluation for feedback of service life data from practice

ISO 15686-8:2008 - Buildings and constructed assets- Service life planning Part 8: Reference service life and service life estimation

ISO 21930: 2007 - Sustainability in building construction -- Environmental declaration of building products

Product Category Rule Guidance Development Initiative. Guidance for Product Category Rule Development. (August 28, 2014, version 1.0).

TESTING AND CLASSIFICATION REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH®) Threshold Limit Values and Biological Exposure Indices

Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers- version 1.2, January 2017.

RELEVANT FEDERAL STANDARDS AND SOPS

Environment Canada, National Pollutant Release Inventory (NPRI) (http://www.ec.gc.ca/inrp-npri/)

EPCRA 313 Toxic Release Inventory Reporting (U.S.) (https://www.epa.gov/toxics-release-inventory-tri-program) Accessed 08 December 2017.

US EPA, ORD/NRMRL/Sustainable Technology Division, Systems Analysis Branch, SOP No. S-10637-OP-1-0- Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI), Software Name and Version Number: TRACI version 2.1, USER'S MANUAL, 24 July, 2012

US: Resource Conservation and Recovery Act (RCRA), Clause C (https://www.epa.gov/rcra) Accessed 08 December 2017.

40 CFR 50 Protection of Environment - Part 50: National Primary and Secondary Ambient Air Quality Standards (U.S.) (https://www.epa.gov/criteria-air-pollutants/naaqs-table) Accessed 08 December 2017.

Clean Air Act (CAA) Section 112(r): Accidential Release Prevention/Public Management Rule (https://www.epa.gov/sites/production/files/2013-10/documents/caa112_rmp_factsheet.pdf) Accessed 08 December 2017

CERCLA Hazardous Substances (U.S.) (https://www.epa.gov/epcra/epcracerclacaa-ss112r-consolidated-list-lists-march-2015-version) Accessed 08 December 2017.
U.S. Department of Labor, Occupational Safety & Health Administration (OSHA 1910.1200 Hazard Communication Standard—Toxic and Hazardous Substances (U.S)
(http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10099)

RELEVANT PCRS

ISO 21930: 2017 - Sustainability in building construction -- Environmental declaration of building products

Part A: Life Cycle Assessment Calculation Rules and Report Requirements UL Environment (September 2018, version 3.2)

Part B: Requirements on the EPD for Bathtubs and showers made of steel enamel or acrylic. Institute of Construction and Environment e.V., Königswinter (July 2014, version 1.6)

PCR Guidance-Texts for Building-Related Products and Services, From the range of Environmental Product Declarations of Institute of Construction and Environment e.V. (IBU), Part B: Requirements for the EPD for Floor coverings,v1.6, November 2017

Dispelling Myths of RAS vs. RAP

Summary

Reclaimed Asphalt Pavement (RAP) and Reclaimed Asphalt Shingles (RAS) dominate the recycled raw material market in the asphalt road paving industry. The use of recycled materials is a practice of good stewardship, extends the life of rock quarries, reduces the use of our limited natural resources, preserves landfill space and is less expensive than virgin materials.

Since 2009, the National Asphalt Paving Association (NAPA) has documented over 12.73M[1] tons of Reclaimed Asphalt Shingles (RAS) used as a recycled raw material in Hot Mix Asphalt (HMA), Warm Mix Asphalt (WMA) and cold mix, contributing both to asphalt content (AC) and replacing virgin aggregates. RAS is a proven component in mix designs of over 250M[2] tons of roads in the USA.

In 2017, 99% of the available RAP, or 76.9M tons, were integrated into new asphalt roads in 46 states, saving $2.127B. In the same period, 8.5% of the available RAS, or 944,000 tons, replaced virgin materials in 32 states[3], saving $74M. Per ton, RAP has a savings value of $27.91 per ton. RAS savings value is $78.39 per ton.

- RAP has availability of 77.7M tons, RAS has ~11M tons.
- RAS as a road paving raw material is 2.8 times more valuable, per ton, than RAP.
- RAS has an 91.5% landfill rate with an unrealized opportunity value of $789M.

Table 1 Most Used Recycled Materials in the Paving Industry

Material	Material Quantity, Million Tons		% Agg.	% AC	Aggregate Cost Savings, $ Billion		Asphalt Binder Cost Savings, $ Billion		Total Cost Savings, $ Billion	
	2016	2017			2016 ($9.87)	2017 ($10.04)	2016 (346.68)	2017 (365.62)	2016	2017
RAP - 99% Recycled	76.9	76.2	95%	5%	$ 0.721	0.734	1.333	1.393	2.055	2.127
RAS - 8.5% Recycled	1.39	0.944	50%	20%	$ 0.007	0.005	0.096	0.069	$ 0.103	0.074
*RAS - Est. Landfilled	9.61	10.056	50%	20%	$ 0.047	0.0532	0.666	0.735	$ 0.714	0.789

Notes:
NAPA reports RAS as 50% Agg. Includes granules and limestone filler (30% is fines aggregate, miscible in liquid asphalt)
Processing Cost includes RAP fractionating or RAS Reduction
RAS - NAPA reports 8.5% recycling rate leaving 91.5% unrecycled or landfilled.

Source: Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage 2017, *RAS – Est. Landfilled value independently calculated*

[1] *Source:* Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage 2017, page 22, Figure 10
[2] Typical percentage of RAS is 5%. 12.73M tons of RAS @ 5% = 254.66M tons of asphalt pavement.
[3] *Source:* Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage 2017, page 24, paragraph 2, Approved in some or all mixtures by the Department of Transportation in 32 states

Valuable Raw Material Resources

Asphalt paving and asphalt shingles are both highly engineered materials, designed to perform under the harshest conditions. They are comparable in their raw material make-up of aggregates and asphalt, are exposed to extreme outdoor elements and must perform.

Asphalt paving requires a base mix and a surface mix. Reclaimed Asphalt Pavement, in general, takes material from the surface course. The example mix design, includes three aggregates of different properties and size distributions. The aggregates will vary based on the geography of the road, and raw material sources, but this is not a concern as the recyclate is used as a raw material in the same market in which it was originally installed. The asphalt binder is typically 6%, depending on the state, and has a Performance Grade (PG) which is designed to perform under the conditions in which they are to be used. The asphalt binder example used is PG64-22, which is defined as the maximum seven-day pavement temperature of 64˚C (147˚F) and the minimum pavement design temperature likely to be experienced of -22 ˚C (-7.6 ˚F). Recycled asphalt binder in RAP is closer to the performance grade specified in new roads but the aged value of the binder requires a compensating PG virgin asphalt binder[4].

Table 2 Mix Design Example, Asphalt Pavement Surface Layer

Mix Design	Material Description
48%	AASHTO No. 57 - Primary Raw Aggregate, 1 1/2" top size, with 95% smaller than 1" with very little powder or fines. Clean. W
10%	AASHTO No. 8 - Crushed Stone Dust, 3/8" top size, with sizes down to silt material. Will not compact.
36%	AASHTO No. 10 - 1/2" top size. Clean. Will not compact.
6%	PG 64-22 Asphalt Binder

Asphalt shingles are complex, with each manufacturer protecting their proprietary blend of materials and designs. The key raw materials are consistent and easily added to asphalt paving virgin materials to produce high performance roads. The example mix design of a roofing shingle contains aggregates that are smaller than the RAP mix design aggregates shown in *Table 2 – Asphalt Pavement Top layer.* The aggregates are very specific, without variance, based on the geography of collected roofing product; therefore, predictable in its contribution to new road mix design. The asphalt is designed to perform at high top temperatures, therefore the asphalt is oxidized at the roofing plant. The asphalt binder grade example was measured on post-consumer shingles in Wisconsin or in other words, aged asphalt shingles, as PG124 (255.4˚F)[5]. Post Industrial binder grade ranged from PG109-111 (228.4-232.1˚F). Recycled asphalt binder in RAS is a Performance Grade that is much higher than necessary in new road specifications and larger quantities will require compensation with softer virgin asphalt binder.

[4] Performance of Recycled Asphalt Shingles in Hot Mix Asphalt, Federal Highway Administration Pooled Fund Study, IA State University, Pg. 47, Table 11 Mix Design Performance Grade

[5] Performance of Recycled Asphalt Shingles in Hot Mix Asphalt, Federal Highway Administration Pooled Fund Study, IA State University, Pg. 24, Table 8

Table 3 Mix Design Example, Asphalt Roofing Shingle

Mix Design	Material Description
36%	Granules - Trap Rock, 8 mesh (.093") top size, clean with tight size distribution to 35 mesh (.0165")
40%	Limestone - Powder, 42 mesh (.039) top size, size distribution to less than 325 mesh (.0017")
2%	Fiberglass Mat
20%	PG 124 Asphalt Coating
2%	Miscellaneous

- RAP aggregate varies based on region.
- RAS aggregate physical properties do not vary.
- Both RAP and RAS asphalt binder will require a compensation in Performance Grade virgin asphalt binder, based on quantities of recyclate blended with virgin materials.

Test Pavements

Recycled materials, in asphalt road paving, are tested around the world, in both academic settings and in roads we travel on daily. Full scale test tracks, with road sensors, as seen at MnRoad and NCAT, evaluate different technologies, including RAS, RAP, and RAS/RAP mix designs and record consistent data points measuring performance. The key failures, roughness, cracking (fatigue, transverse or miscellaneous), edge deterioration, bituminous patching and raveling/weathering are studied at different points in life and stress cycles.

The objective is to meet or exceed state agency quality assurance requirements and perform similarly to mixes without RAS or RAP[6].

MnRoad published results of six field projects, in March 2010, Research Project Final Report #2010-08[7], recommending "…binder grades should be limited to PG64-28, PG58-28 and PG 51-34 until further research can determine effects of shingles on modified binders."

IA State completed a comprehensive eight state mix design study, in September 2013, which tested variable designs. The report, sponsored by Federal Highway Administration and the Transportation Pooled Fund Partners, concluded that "…SMA pavements with RAS were successfully produced and constructed while meeting IDOT's quality assurance requirements. The SMA's did not have any binder drain-down when 5% RAS was utilized as a stabilizer."[8]

NCAT published Report NCAT14-06 in July 2014 concluding, in part, that "While some stakeholders fear that the use of recycled materials in asphalt may produce inferior mixtures to virgin asphalt mixtures, state agencies who have spent the time and resources into

[6] Performance of Recycled Asphalt Shingles in Hot Mix Asphalt, Federal Highway Administration Pooled Fund Study, IA State University, Pg. 3, Abstract

[7] Incorporation of Recycled Asphalt Shingles in Hot-Mixed Asphalt Pavement Mixtures, Office of Materials and Road Research, Minnesota Department of Transportation

[8] Performance of Recycled Asphalt Shingles in Hot Mix Asphalt, Federal Highway Administration Pooled Fund Study, IA State University, Pg. 206, G9. Conclusions

understanding material characterization, mix design and mixture production have seen significant economical and raw material savings."[9]

The University of IL and University of MA, Dartmouth, in October 2015, published a report on Stone Matrix Asphalt (SMA) containing RAS or RAP and found a better performing product[10] but the costs are 20-30% higher than typical dense graded mixtures. SMA is a gap graded hot mix asphalt (HMA) that is designed to maximize rutting resistance and durability by using a structural stone on stone contact. Because the aggregates are all in contact, rutting resistance relies on aggregate properties versus the asphalt binder properties. Aggregates do not deform as much as asphalt binder under load, therefore this stone on stone contact reduces rutting. RAS is a good solution as the smaller limestone gradation is like virgin limestone specification. and RAS can help offset a percentage of this greater expense[11]. In SMA, fibers are added as a stabilizer. RAS material does contain fiberglass and may reduce or negate the need for virgin fiber stabilizers.

King County, Washington published a Performance and Progress Report, January 2018[12] indicating Excellent (99 score) in performance on test pavements installed in 2009, reported in *Shingles in Paving*[13], August 5, 2014.

NCAT Report 18-03 evaluated performance and Life Cycle Cost benefits of stone matrix asphalt and found that in IL, MD and AL, the cost for SMA was lower when compared to polymer modified Super Pave mix designs. These three states use both or either RAS and RAP in their mix designs. "In general, SMA is used on state and interstate routes with high traffic volumes and projects where frequent maintenance is costly and disruptive to high traffic volumes."[14] Furthermore, "…reduced recycled materials contents, reduced plant versatility, and shortened paving windows could also contribute to the higher cost of SMA."[15]

- RAP and RAS has been thoroughly tested and is an accepted solution. A typical dense graded hot mix asphalt mixture may require a compensating softer PG asphalt as percentages of recyclate is increased.

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[9] Case Studies on Successful Utilization of Reclaimed Asphalt Pavement and Recycled Asphalt Shingles in Asphalt Pavements, pg. 28 Conclusion

[10] Performance space diagram for the evaluation of high- and low-temperature asphalt mixture performance, William G. Buttlar, Brian C. Hill, He Wang and Walaa Mogawer, page 10-11, Table 4 and 5

[11] 2018-08 NCAT Performance and Life Cycle Cost Benefits of Stone Matrix Asphalt Report 18-03, pg. 12, 2.4SMA Cost

[12] Use of Recycled Shingles in Hot Mix Asphalt on King County Unincorporated Roads, King County Road Services Division, Renton, WA, page 3, table 3 and 4

[13] King County, Department of Road Services Division*, Recycling and Paving with Recycled Asphalt Shingles,* August 5, 2014

[14] Performance and Life Cycle Cost Benefits of Stone Matrix Asphalt, pg 13, Figure 5 and 2.5 SUMMARY paragraph

[15] Performance and Life Cycle Cost Benefits of Stone Matrix Asphalt, pg 14, paragraph 1

- RAS is a practical solution for production of SMA hot mix asphalt as limestone is present in the required gradation and fiberglass adds stabilizers.
- RAS or RAP in a more expensive Stone Matrix Asphalt hot mix asphalt road can offset some of the higher costs of a higher performance road.

Asphalt Binder Replacement and Mix Design Specifications

If mixes are designed properly, RAP and RAS can improve performance, i.e. rutting resistance and increased stiffness but a more brittle mix may accelerate cracking and raveling[16]. Each state's Department of Transportation has an established approach to acceptance of RAS and RAP. The mix designs published by the state insures high performance roads with an acceptable amount of recyclate. The foundation of the state's spec is the asphalt binder replacement (ABR). For example, if a specification calls for 6% asphalt binder, the percentage that comes from a recycled material may be 20% or 1.2% of the total mix.

The state may require a bump downward on virgin binder, i.e. PG64-22 to PG 58-28.

A common state specification allows use of RAS to no more than 5%. If the RAS material contains 20% asphalt (asphalt content) than this will contribute 1% (16.6% of a 6% asphalt binder specification) asphalt binder replacement to the mix design.

Table 4 Mix Design Example, 5% RAS content hot mix asphalt (non-SMA)

Mix Design	Lbs.	Material Description, RAS Only
48%	960	AASHTO No. 57 - Primary Raw Aggregate, 1 1/2" top size, with 95% smaller than 1" with very little powder or fines. Clean. Will not compact.
6%	120	AASHTO No. 8 - Crushed Stone Dust, 3/8" top size, with sizes down to silt material. Will not compact.
36%	720	AASHTO No. 10 - 1/2" top size. Clean. Will not compact.
5.0%	100	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
5%	100	RAS measured as 20% asphalt content (1%)
0%	0	RAP, 6% asphalt content (1%)
100%	2000	

Asphalt Binder Analysis	Lbs.	Material Description
83%	100	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
17%	20	RAS, 20% asphalt content, 17% asphalt binder replacement
0%	0	RAP, 6% asphalt content, 0% asphalt binder replacement
100%	120	

A common state specification allows use of RAP to no more than 20%. If the RAP material contains 6% asphalt (asphalt content) than this will contribute 1.2% (20% of a 6% asphalt binder specification) asphalt binder replacement to the mix design.

[16] Testing Protocols to Ensure Performance of High Asphalt Binder Replacement Mixes Using RAP and RAS, IL Center for Transportation, pg. ii, Executive Summary

Table 5 Mix Design Example, 20% RAP content hot mix asphalt (non-SMA)

Mix Design	Lbs.	Material Description, RAP Only
48%	960	AASHTO No. 57 - Primary Raw Aggregate, 1 1/2" top size, with 95% smaller than 1" with very little powder or fines. Clean. Will not compact.
7%	144	AASHTO No. 8 - Crushed Stone Dust, 3/8" top size, with sizes down to silt material. Will not compact.
20%	400	AASHTO No. 10 - 1/2" top size. Clean. Will not compact.
4.8%	96	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
0%	0	RAS measured as 20% asphalt content (1%)
20%	400	RAP, 6% asphalt content (1%)
100%	2000	

Asphalt Binder Analysis	Lbs.	Material Description
80%	96	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
0%	0	RAS, 20% asphalt content, 17% asphalt binder replacement
20%	24	RAP, 6% asphalt content, 20% asphalt binder replacement
100%	120	

A third common state specification allows use of a combination of RAP and RAS, allowing no more than 20% asphalt binder replacement. Each recycled material contributes 10% asphalt binder replacement to the mix.

Table 6 Mix Design Example, 3% RAS/10% RAP content hot mix asphalt (non-SMA)

Mix Design	Lbs.	Material Description, RAS and RAP
48%	960	AASHTO No. 57 - Primary Raw Aggregate, 1 1/2" top size, with 95% smaller than 1" with very little powder or fines. Clean. Will not compact.
6%	120	AASHTO No. 8 - Crushed Stone Dust, 3/8" top size, with sizes down to silt material. Will not compact.
28%	564	AASHTO No. 10 - 1/2" top size. Clean. Will not compact.
4.8%	96	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
3%	60	RAS measured as 20% asphalt content (1%)
10%	200	RAP, 6% asphalt content (1%)
100%	2000	

Asphalt Binder Analysis	Lbs.	Material Description
80%	96	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
10%	12	RAS, 20% asphalt content, 17% asphalt binder replacement
10%	12	RAP, 6% asphalt content, 0% asphalt binder replacement
100%	120	

- The Federal Highway Administration and 32 individual states have written specifications to allow both RAP and RAS in their roads.
- Following these RAP and RAS mix designs will mitigate risks of using both RAP and RAS.

Economics

From August 1997 to August 2018, the price of virgin asphalt, used to manufacture both roads and roofing shingles, has increased over 500%[17]. In the same period, a barrel of oil has increased over 300% from $19.95 to $68.06[18].

Recognizing this trend, in the 2009-2010 paving season, the National Asphalt Paving Association (NAPA) began surveying the use of recycled asphalt, harvested from both reclaimed asphalt pavement (RAP) and reclaimed asphalt shingles (RAS), in new paved roads. "Asphalt mixture producers remain the country's most diligent recyclers, with more than 99 percent of asphalt

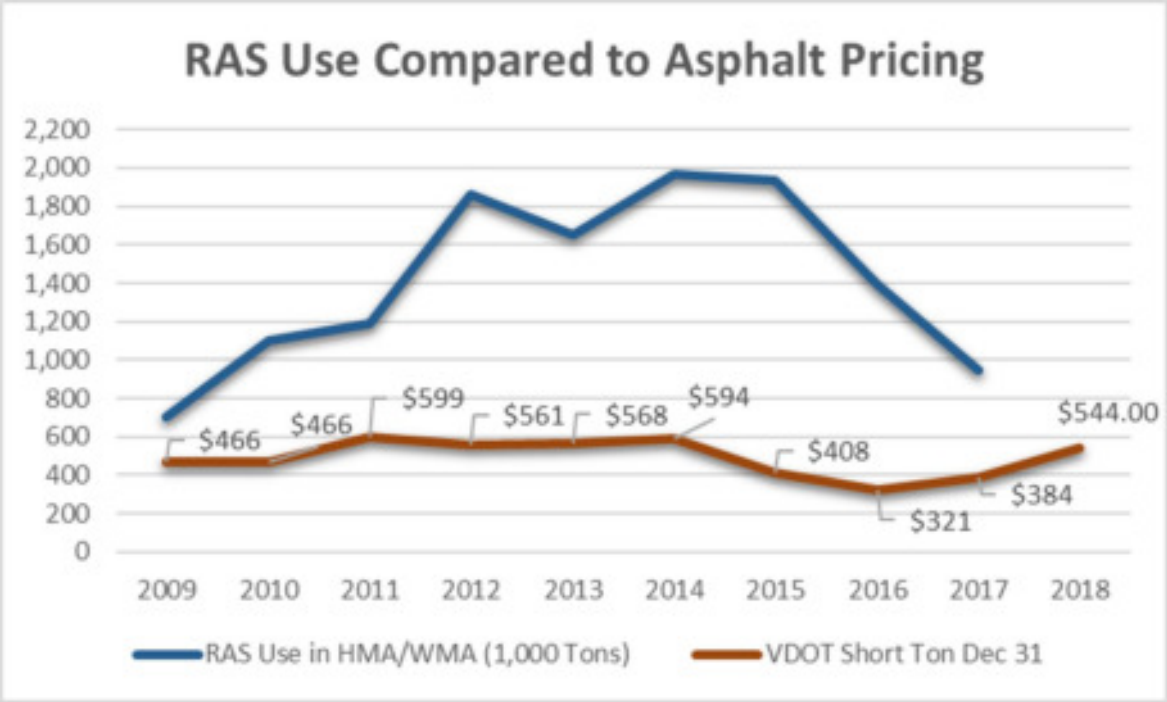
[17] *Source: U.S. Energy Information Administration & VDOT Adjustment for Asphalt & Fuel Indices PG64-S-22 Short Ton*

[18] *Source:* Cushing OK WTI Spot Price FOB Dollars per Barrel

mixture reclaimed from old asphalt pavements being put back to use in new pavements."[19] RAP is a waste stream that is easy for the paving contractor to recycle as he is removing and replacing the material, and the properties allow for immediate processing.

In general, post-consumer RAS is a waste stream that is collected one roof job at a time, or in 3-ton increments. Post-industrial RAS is collected in 22 tons increments. The reclaimed material is not always ready to process, meaning deleterious material must be removed. Reducing the shingle to the most common State Department of Transportation specification of <3/8" can be a one-step process. RAS contains over 3 times the asphalt per ton than RAP but is more intensive to reclaim; therefore, the lower the virgin material costs, the least attractive the paving manufacturer sees the process of reclaiming asphalt shingles.

The prevalence of RAS in asphalt mix designs follows virgin asphalt pricing. From December 31, 2014 to December 31, 2015, the Virginia Dept of Transportation virgin asphalt pricing dropped 31% and further dropped 15% in 2016, leveling off in 2017. In 2018, pricing has increased to near levels of the 2010-2014. In the subsequent years, RAS use dropped from 2.0M tons to less than 1.0M.



[19] 2017 Survey Exec Summary Asphalt Pavement Industry Survey Recycled Materials and Warm Mix Asphalt usage, Reclaimed Asphalt Pavement, pg. 1

- RAP is a waste stream that is easy for the paving contractor to access, therefore a 99% recycle rate.
- RAS waste stream and processing is more complex, lowering recycle rate when the value of virgin asphalt decreases.

Summary

Both RAP and RAS have been well studied, over many years, and successfully placed in asphalt roads throughout the USA.

The motivation for using recycled materials is one of good stewardship and low raw material pricing.

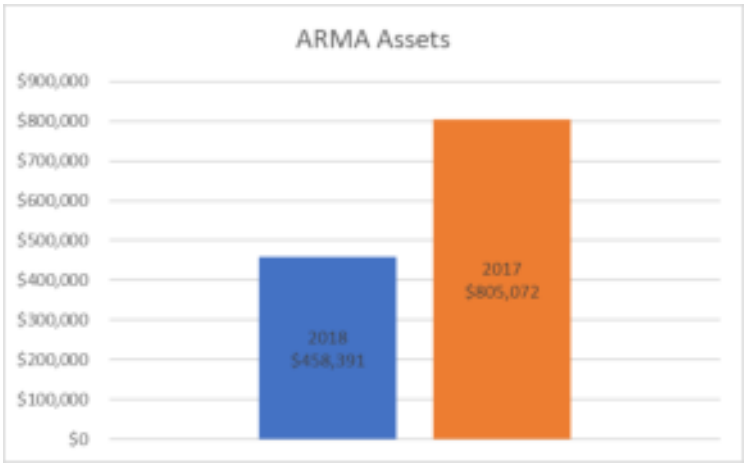
RAS is a raw material that is well accepted in governmental and academic communities, as a valuable resource, with superior aggregate material and over 3X asphalt content as compared to RAP.

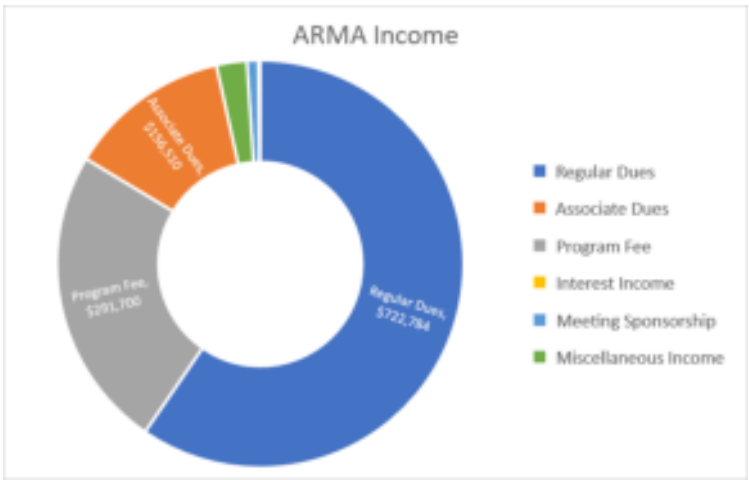
RAP/RAS combination is a common mix design solution.

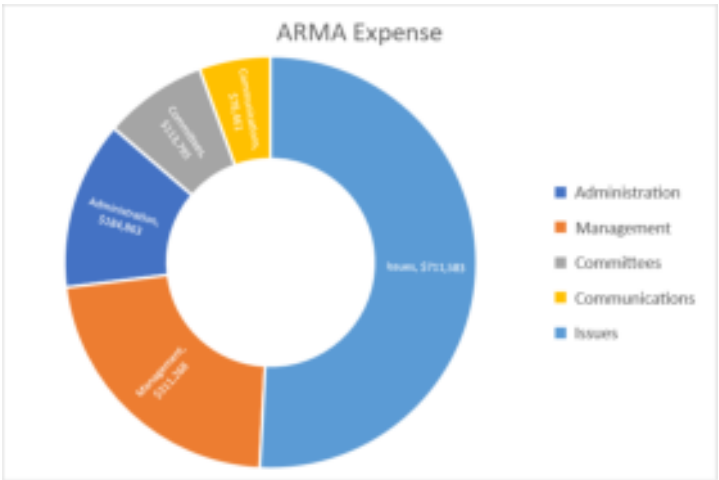
ARMA Financial Statements

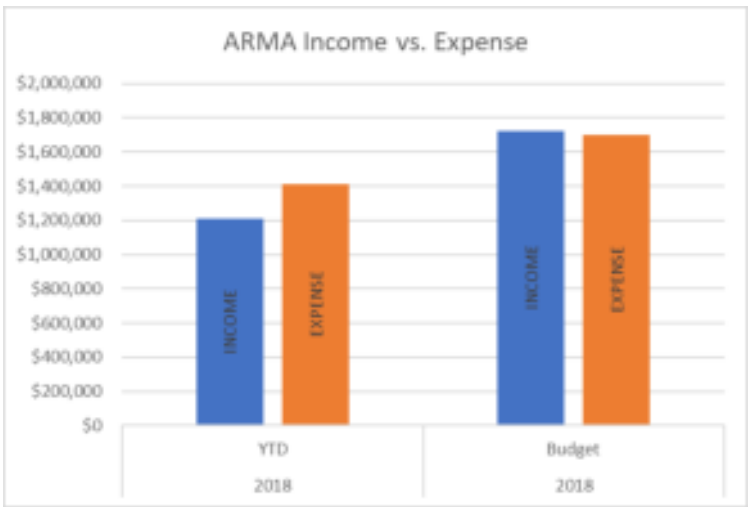
Asphalt Roofing Manufacturers Association September, 2018 Financial Dashboard

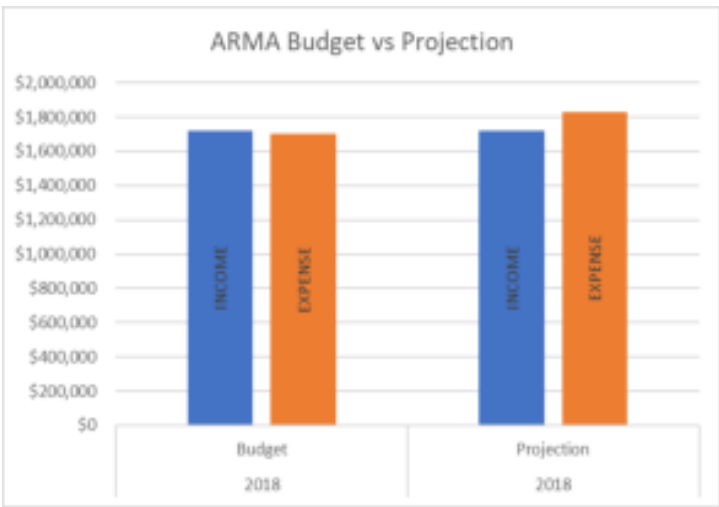
Note that the September, 2018 Statements Represent 75% of ARMA's Fiscal Year











Asphalt Roofing Manufacturers Association September, 2018 Exception Report

Note that the September, 2018 Statements Represent 75% of ARMA's Fiscal Year

Statement of Financial Position (Balance Sheet)

1 – Unrestricted Cash Assets is substantially lower than the same period in 2017. This is primarily due to the timing of 3rd and 4th quarter invoices being sent. We should see that line normalize with the October and November financial statements. The negative number here is just a matter of timing, and not an indication of overall negative financial position.

2 – Industry Issues (FTC investigation) payments have all been received and the account is again in the positive by $5,565. We will likely ask for an additional $25K draw at the fall Board of Directors meeting.

Statement of Activity (Profit and Loss Statement)

ARMA's September financial statements include projections for the remainder of 2018 which were prepared and are maintained as part of our year-end financial and 2019 budgeting processes. Where there are large dollar variances from budget those projections are discussed below. Current projection is a draw of $112K from reserves, against a budgeted increase of reserves of $21K, or a net of -$133K largely attributable to approved, unbudgeted regulatory activity.

1 – Miscellaneous Income includes a large ($25K) refund from the Asphalt Institute for money that had been set aside for a joint communications program in 2014/2015. $18K of this has been allocated by the EC to the strategic planning consultants facilitating the planning discussion at the fall meeting (projected as an additional expense under "Executive Committee"). There is a possibility the strategic planning expense will be reduced by $5,000 pending discussion.

2 – Publications have not performed to expectations for 2018, and the year-end projection is a negative ($1300) due to expenses to manage the program. Additional promotion of publications we charge for is included in the proposed 2019 PR program.

3 – Legal Expense is trending ahead of budget, largely due to activity requiring – at direction of the EC – scrutiny by ARMA counsel. This includes review of all meeting agendas, minutes, and association communications in addition to general legal activities.

4 – Committees & Meetings has already met budget for the year, but does not include they yet to happen EC and Board meetings. Additionally, as discussed under #1 above, the fall EC meeting will include an additional $13-18K expense for strategic planning. The current projection for this entire category based on the increase in hotel costs plus this strategic session is $142K, or $32K over budget.

5 – Internet Development and Maintenance includes an expense of $5K which was being carried as a liability on the balance sheet for no apparent reason, and has now been expensed.

6 – Cool Roof Activity continues to exceed budget in light of increased activity on CRRC (D. Higgs Consultant) for retesting protocols and CRRC management matters, travel to Sacramento for cool roof activity, and City of Denver in addition to the EC-approved contribution to the EPDM Roofing Association ($7,500) in support of lobbying activity in the City of Denver. Current projection is that we will exceed this budget item by approximately $20,000, or 60% due to this increased activity.

7 – Sustainability/LCA work has already exceeded budget by about $11,000 or 58% due to Board direction to move forward with additional EPD work. At this point we have ballparked approximately $30,000 for this work, or about $12K above budget after rebilling those companies who were added to the existing sustainability documents.

8 – Environmental/Regulatory continues to exceed budget substantially almost primarily due to the Asphalt and Fiberglass Mat RTR work and associated expenses for consultants including A. Sampson, Ramboll, and Terracon (NRCA Silica Study), in addition to increased activity from Sampson on management of ARMA regulatory activities in the first half of the year. There was an offset to this from funds are received for AI's share of the Asphalt RTR project, but at present we anticipate exceeding budget by approximately 127%.

Asphalt Roofing Manufacturers Association
Statement of Financial Position
September 30, 2018

	September 2018	September 2017
ASSETS		
Current Assets:		
Unrestricted Cash Assets		
Checking - SunTrust	$90,605	$232,190
Money Markets/Investments	($131,445)	$66,591
Total Unrestricted Cash Assets	**($40,840)**	**$298,781**
Temporarily Restricted Funds		
Board restricted	$481,479	$480,999
Total Temporarily Restricted Funds	**$481,479**	**$480,999**
Operations Receivables		
Accounts Receivable	$0	$0
Accrued Interest	$292	$292
Total Operations Receivables	**$292**	**$292**
Prepaid Expenses		
Prepaid Expenses	$99	$0
Fixed Assets - Website	$17,361	$25,000
Total Operations Assets	**$458,391**	**$805,072**
OPERATIONS LIABILITIES AND NET ASSETS		
Operations Liabilities:		
Accounts Payable	$34,371	$48,309
Industry Issues	$5,565	($16,107)
Tota Liabilities	**$39,936**	**$32,202**
Net Assets:		
Beginning Net Assets	$598,334	$608,328
Beginning Temporarily Restricted Net Assets	$18,501	$18,501
Change in Net Assets	($198,379)	$146,041
Total Net Assets	**$418,456**	**$772,870**
Total Operations Liabilities and Net Assets	**$458,392**	**$805,072**

Asphalt Roofing Manufacturers Association
Statement of Activity
September 30, 2018 - 75% of FY

	September 2018	2018 YTD	2018 Budget	2018 Projection	YTD Actual/Budget Variance
INCOME FROM OPERATIONS:					
Regular Dues	$54,516	$722,784	$1,034,638	$1,034,638	69.86%
Associate Dues	$0	$156,510	$205,499	$185,847	76.16%
Program Fee	$23,792	$291,700	$450,000	$450,000	64.82%
Interest Income	$253	$1,903	$2,600	$2,860	73.19%
Meeting Sponsorship	$1,500	$11,000	$20,000	$15,000	55.00%
Miscellaneous Income	$0	$29,266	$1,000	$32,000	2926.60%
Total Income	**$80,061**	**$1,213,163**	**$1,713,737**	**$1,720,345**	**70.79%**
Association Publications:					
Sales of Publications	$167	$884	$8,000	$1,200	11.05%
Cost of Sales	($19)	($1,857)	$0	($2,500)	0.00%
Net Income from Sales	**$148**	**($973)**	**$8,000**	**($1,300)**	**-12.16%**
Total Income from Operations	**$80,209**	**$1,212,190**	**$1,721,737**	**$1,719,045**	**70.41%**
OPERATIONS EXPENSES:					
Administration:					
Legal	$17,160	$125,927	$125,000	$155,000	100.74%
Accounting/Audit	$0	$11,146	$13,000	$11,146	85.74%
Professional Liability Insurance	$0	$4,449	$4,600	$4,449	96.72%
Stationery & Printing	$36	$1,461	$6,000	$2,600	24.35%
Telephone & Fax	$3	$2,160	$11,000	$4,351	19.64%
Office Supplies	$0	$1,166	$1,100	$1,500	106.00%
Postage	$12	$1,274	$2,500	$2,800	50.96%
Dues & Subscriptions	$12	$5,473	$7,000	$7,000	78.19%
Employment Taxes	$3,559	$28,713	$0	$53,882	
Workman's Comp	$21	$180	$0	$450	
Interest/Miscellaneous Expense	$493	$2,914	$1,500	$3,500	194.27%
Total Administration Expense	**$21,296**	**$184,863**	**$171,700**	**$246,678**	**107.67%**
General Management:					
Management Fee	$8,000	$72,000	$96,000	$96,000	75.00%
Executive Director Salary	$12,802	$57,610	$0	$96,016	
Support Services	$10,148	$181,658	$265,653	$250,000	68.38%
Total Management & Support	**$30,950**	**$311,268**	**$361,653**	**$442,016**	**86.07%**
Committees & Meetings					
Travel	$3,689	$25,165	$30,000	$30,000	83.88%
Board of Directors	$2,972	$23,877	$33,000	$33,000	72.35%
Executive Committee	$11,500	$21,631	$18,000	$36,000	120.17%
Technical Affairs Committee	$5,722	$14,312	$14,000	$14,312	102.23%
HSE Committee	$6,282	$14,950	$9,500	$14,950	157.37%
CMEC	$4,274	$13,860	$5,500	$13,860	252.00%
Total Committees & Meetings	**$34,439**	**$113,795**	**$110,000**	**$142,122**	**103.45%**

	September 2018	2018 YTD	2018 Budget	2018 Projection	YTD Actual/Budget Variance
Communications:					
Internet Development Maintenance	$954	$8,872	$3,000	$10,000	295.73%
Industry Trade Public Relations	$6,161	$69,589	$125,000	$120,000	55.67%
Total Communications	**$7,115**	**$78,461**	**$128,000**	**$130,000**	**61.30%**
Budgeted Issues:					
Codes & Standards	$36,524	$202,769	$281,500	$260,000	72.03%
Asphalt Fumes Issue	$1,853	$67,383	$132,500	$65,000	50.86%
Cool Roof Activity	$3,598	$49,004	$40,000	$60,000	122.51%
Sustainability/LCA Work	$15,700	$46,043	$18,350	$30,000	250.92%
Lobbying/Legislative Activity	$9,535	$22,425	$30,000	$15,000	74.75%
Environmental/Regulatory	$47,704	$258,477	$155,000	$353,413	166.76%
Consulting Services	$0	$65,482	$246,028	$65,482	26.62%
Total Budgeted Issues	**$114,914**	**$711,583**	**$903,378**	**$848,895**	**78.77%**
Shipment Report	$0	$10,600	$26,000	$21,200	40.77%
Total Operations Expenses	**$208,714**	**$1,410,570**	**$1,700,731**	**$1,830,911**	**82.94%**
Change in Net Assets	**($128,505)**	**($198,380)**	**$21,006**	**($111,866)**	

				Current Year						
	DRAFT FY19 Budget		% Chg FY18 Pro - FY19 Bud	FY18 Projected	FY18 Budget	FY18 Proj-Bud Variance	FY17 Actual	FY16 Actual	FY15 Actual	FY14 Actual
INCOME FROM OPERATIONS										
Dues Income										
Regular Member Dues	$1,112,236		7.50%	$1,034,638	$1,034,638	$0	$1,039,142	$1,052,653	$1,031,087	$1,031,087
Associate Member Dues	$195,139		5.00%	$185,847	$205,499	($19,652)	$178,766	$207,934	$202,805	$186,072
Total Dues Income	**$1,307,375**	1	**7.12%**	**$1,220,485**	**$1,240,137**	**($19,652)**	**$1,217,908**	**$1,260,587**	**$1,233,892**	**$1,217,159**
Program Fees										
Program Fee	$600,000		33.33%	$450,000	$450,000	$0	$453,352	$450,029	$550,002	$550,002
QARC	$0	2		$0	$0	$0	$0	$0	$0	$0
Total Program Fees	**$600,000**	3	**33.33%**	**$450,000**	**$450,000**	**$0**	**$453,352**	**$450,029**	**$550,002**	**$550,002**
Other Income										
Interest Income	$2,600	4	-9.09%	$2,860	$2,600	$260	$2,486	$2,573	$1,518	$1,633
Accelerated Aging/Insulated Deck	$0			$0	$0	$0	$0	$0	$0	$0
Meeting Sponsorships	$15,000	5	0.00%	$15,000	$20,000	($5,000)	$18,200	$22,450	$20,400	$19,085
Ventilation Coalition Income	$0	6		$0	$0	$0	$0	$0	$0	$0
Miscellaneous Income	$1,000	7	-96.88%	$32,000	$1,000	$31,000	$1,354	$4,172	$4,489	$2,388
Net Income from Sales	$3,000	8	-330.77%	($1,300)	$8,000	($9,300)	$2,484	$5,086	$3,419	$7,066
Total Other Income	**$21,600**		**-55.52%**	**$48,560**	**$31,600**	**$16,960**	**$24,524**	**$34,281**	**$29,826**	**$30,172**
TOTAL INCOME FROM OPERATIONS	**$1,928,975**		**12.21%**	**$1,719,045**	**$1,721,737**	**($2,692)**	**$1,695,784**	**$1,744,897**	**$1,813,720**	**$1,797,333**

	DRAFT FY19 Budget		% Chg FY18 Pro - FY19 Bud	Current Year FY18 Projected	Current Year FY18 Budget	Current Year FY18 Proj-Bud Variance	FY17 Actual	FY16 Actual	FY15 Actual	FY14 Actual
OPERATIONS EXPENSES										
Administration										
Legal	$135,000	9	-12.90%	$155,000	$125,000	$30,000	$135,229	$142,551	$169,320	$145,063
Accounting/Audit	$13,000		16.63%	$11,146	$13,000	($1,854)	$12,596	$11,358	$10,121	$10,161
Insurance	$4,600		3.39%	$4,449	$4,600	($151)	$4,521	$4,496	$4,480	$4,480
Stationery & Printing	$4,000		53.85%	$2,600	$6,000	($3,400)	$3,500	$2,989	$11,795	$3,947
Telephone & Fax	$6,000		37.90%	$4,351	$11,000	($6,649)	$6,972	$8,239	$8,528	$11,969
Office Supplies	$1,100		-26.67%	$1,500	$1,100	$400	$458	$1,117	$808	$840
Postage & Shipping	$3,000		7.14%	$2,800	$2,500	$300	$1,296	$2,324	$3,064	$1,833
Dues & Subscriptions	$7,000		0.00%	$7,000	$7,000	$0	$6,305	$5,839	$8,620	$5,909
Employment Taxes (employer)	$20,000		79.91%	$11,117	$0					
Workman's Comp	$900		100.00%	$450	$0					
Amortization Expense	$0			$0	$0	$0	$0	$0	$0	$0
Miscellaneous	$2,000		-42.86%	$3,500	$1,500	$2,000	$2,547	$2,732	$2,093	$2,058
Total Administration Expense	**$196,600**		**96.41%**	**$203,913**	**$171,700**	**$32,213**	**$173,424**	**$181,645**	**$218,829**	**$186,260**
General Management										
Management Fee	$96,000		0.00%	$96,000	$96,000	$0	$332,066	$322,394	$313,004	$303,887
Executive Director Salary + Benefits	$222,050		60.00%	$138,781	$0					
Support Services	$265,653		6.26%	$250,000	$265,653	($15,653)	$247,941	$205,104	$235,404	$243,111
Total General Management	**$583,703**	10	**20.41%**	**$484,781**	**$361,653**	**$123,128**	**$580,007**	**$527,498**	**$548,408**	**$546,998**
Total Administration and Management	**$780,303**		**13.30%**	**$688,694**	**$533,353**	**$155,341**	**$753,431**	**$709,143**	**$767,237**	**$733,258**

	DRAFT FY19 Budget		% Chg FY18 Pro - FY19 Bud	Current Year FY18 Projected	Current Year FY18 Budget	Current Year FY18 Proj-Bud Variance	FY17 Actual	FY16 Actual	FY15 Actual	FY14 Actual
Committees & Meetings										
Travel	$30,000		0.00%	$30,000	$30,000	$0	$29,013	$31,496	$29,161	$25,958
Board of Directors	$33,000		0.00%	$33,000	$33,000	$0	$18,453	$29,975	$38,176	$32,806
Executive Committee	$18,000		-50.00%	$36,000	$18,000	$18,000	$11,038	$17,245	$16,973	$13,392
Steep-slope Committee	$0			$0	$0	$0	$0	$10,864	$10,864	$10,647
Low-slope Committee	$0			$0	$0	$0	$0	$8,077	$8,077	$8,223
Technical Affairs Committee (fmr Steep+Low)	$10,000		-30.13%	$14,312	$14,000	$312	$5,565	$13,727	$18,941	$18,870
Health Safety and Environment Committee	$10,000		-33.11%	$14,950	$9,500	$500	$10,089	$9,382	$5,823	$5,949
Communications Committee	$8,000		-42.28%	$13,860	$5,500	$2,500	$2,026	$4,683	$5,160	$5,635
QARC Meetings/Travel	$0			$0	$0	$0	$0	$0	$0	$0
Total Committees & Meetings	**$109,000**	11	**-23.31%**	**$142,122**	**$110,000**	**$32,122**	**$76,184**	**$106,508**	**$114,234**	**$102,610**
Communications										
QARC Public Relations Program	$0			$0	$0	$0	$0	$0	$0	$0
Internet Development & Maintenance	$3,000		-70.00%	$10,000	$3,000	$7,000	$2,409	$2,352	$2,607	$4,318
Industry Trade Public Relations	$175,000	12	45.83%	$120,000	$125,000	($5,000)	$108,973	$118,972	$89,657	$96,681
Asphalt Fumes Program	$0			$0	$0	$0	$0	$0	$0	$0
100th Anniversary Campaign	$0			$0	$0	$0	$0	$0	$54,828	$0
ARMA-AI Communications Initiative	$0			$0	$0	$0	$0	$0	$0	$45,000
Total Communications	**$178,000**		**36.92%**	**$130,000**	**$128,000**	**$2,000**	**$111,382**	**$121,324**	**$147,092**	**$145,999**
Budgeted Issues										
Codes and Standards	$270,000	13	3.85%	$260,000	$281,500	($21,500)	$298,899	$274,576	$271,869	$203,885
Asphalt Fumes	$90,000	14	38.46%	$65,000	$132,500	($67,500)	$97,411	$169,001	$239,344	$291,964
Accelerated Aging/Insulated Deck	$0			$0	$0	$0	$0	$0	$0	$0
Ventilation Coalition	$0	6		$0	$0	$0	$0	$70	$5,546	$0
Other Issues										
Cool Roof Activity	$40,000	15	-33.33%	$60,000	$40,000	$20,000	$28,117	$19,508	$52,532	$149,300
Lobbying/Legislative Activity	$23,500	16	56.67%	$15,000	$30,000	($15,000)	$25,462	$12,000	$12,860	$13,103
Sustainability/LCA Work	$10,000	17	-66.67%	$30,000	$18,350	$11,650	$19,200	$7,250	$28,450	$45,600
PM 2.5	$0			$0	$0	$0	$465	$5,886	$0	$0
Environmental/Regulatory	$400,000	18	13.18%	$353,413	$155,000	$198,413	$224,909	$178,722	$68,807	$138,150
Consulting Services	$0	19	**-100.00%**	$65,482	$246,028	($180,546)	$0	$0	$0	$0
Total Budgeted Issues	**$833,500**		**-1.81%**	**$848,895**	**$903,378**	**($54,483)**	**$694,463**	**$667,013**	**$679,408**	**$842,002**

	DRAFT FY19 Budget	% Chg FY18 Pro - FY19 Bud	Current Year FY18 Projected	FY18 Budget	FY18 Proj-Bud Variance	FY17 Actual	FY16 Actual	FY15 Actual	FY14 Actual
Other Operations Expenses									
Shipment Report	$21,200	0.00%	$21,200	$26,000	($4,800)	$21,200	$21,200	$21,200	$21,200
Total Other Operations Expenses	**$21,200**	**0.00%**	**$21,200**	**$26,000**	**($4,800)**	**$21,200**	**$21,200**	**$21,200**	**$21,200**
TOTAL OPERATIONS EXPENSES	**$1,922,003**	**4.98%**	**$1,830,911**	**$1,700,731**	**$130,180**	**$1,656,660**	**$1,625,188**	**$1,729,171**	**$1,845,069**
NET INCOME (LOSS)	**$6,972**		**($111,866)**	**$21,006**	**($132,872)**	**$39,124**	**$119,709**	**$84,549**	**($47,736)**
ARMA Year-end RESERVES (Target: $850,000)	**$560,610**		**$553,638**	**$686,510**		**$665,504**	**$626,380**	**$506,671**	**$422,122**

NOTES TO 2019 DRAFT Budget

1. Propsosed 7.5% regular dues increase (last increase was 2014)
2. Original QARC Program discontinued. Shown here for historical purposes
3. Program fees increased by $150K from 2018 level in light of anticipated higher than normal codes and regulatory activity
4. Budgeted interest income consistent with recent history
5. Meeting sponsorships budgeted conservatively against prior years
6. Ventilation Coalition has been rolled-under ARMA, shown for historical purposes
7. 2017 Misc Income was anomolous due to refund from AI from past PR project
8. Small projected increase
9. Legal estimate based on discussion with counsel
10. No change from 2018 in management fees or EVP compensation (now annualized vs 7.5 months in 2018)
11. Committees expenses reduced from 2018 projection based on one meeting co-located with Board/EC
12. Communication budget increased by $50K based on proposal including substantial increase in activity
13. Codes and Standards Budget consistent with 2016 in consideration of similar anticipated activity (ICC Group B Cycle - ARMA's busiest, ASHRAE, ASTM, M-D, etc.)
14. Asphalt Fumes activity to include consultant fees ($75K); IH Program Expenses ($15K); Slight increase in activity expected compared with 2018
15. Continued participation in cool roof regulatory activities (CEC, LA, Denver, etc.) and CRRC ($40K)
16. Assumes Brightup retainer ($12k) and out of pocket plus Monroe County Lobbying Retainer
17. Administrative Expenses for maintenance of EPDs, possible sponsorship of Recycling Forum
18. Includes consultant time ($270K), regulatory monitoring program ($25K), WA state rainwater follow-up ($25K), silica study placeholder ($50K), and emissions factors database update ($30K).
19. Consulting Services related to additional consulting/management expense during 2018 management transition

New and Other Business Items

Whereas the Asphalt Roofing Manufacturers Association (ARMA) and the entire roofing industry lost its longtime trusted advisor and legal counsel, a highly esteemed colleague and a great friend with the death of Wendell Alcorn on September 29, 2018;

Whereas Wendell Alcorn was a highly respected and wise counselor to ARMA and the asphalt roofing industry;

Whereas Wendell Alcorn provided ARMA with wise and thoughtful advice in his role as ARMA Legal Counsel from 1985 until 2013;

Whereas Wendell Alcorn faithfully represented ARMA and the asphalt roofing industry with a genuine and dedicated commitment to guiding ARMA through the ever-increasing complexity of legal and regulatory issues in all manner of industry issues with honesty, integrity, and expertise;

Whereas, Wendell Alcorn was much loved and respected by his family, friends, colleagues, and all who knew him; and

Whereas, Wendell Alcorn was a loyal and good friend, a quiet resolve and wonderful sense of humor, and an always engaging smile for his friends at ARMA; and

Whereas his wisdom and thoughtful advice spanned decades and his lasting impact on ARMA has left a legacy of respect for such wise counsel, he has been a profoundly positive influence not only on ARMA but also on those fortunate enough to know and work with him, and to call him "friend", now, therefore, be it

Resolved that the Asphalt Roofing Manufacturers Association (ARMA), on behalf of its members and all those who had the privilege of working with Wendell Alcorn over the course of his long and distinguished career at ARMA, gratefully recognizes his lasting contributions to ARMA and the roofing industry and mourns his death; and extends its sincerest condolences to his wife Sarah and to all of his family and friends.

ARMA President

ARMA Executive Vice President

To: **ARMA Board of Directors**

From: **ARMA Nominating Committee**

Re: **Report of 2018 Nominating Committee**

Date: **November 1, 2018**

The ARMA Nominating Committee met via teleconference on September, 18, 2018 and convened again electronically on October 12, 2018. Pursuant to those discussions, the ARMA Nominating Committee offers the following recommendations to the ARMA Board of Directors:

1 – Recommend that the ARMA Board of Directors approve a one-year exception to the two-year Executive Committee terms specified by the ARMA bylaws that would allow for ARMA Executive Committee members and ARMA Officers be elected to a term of one year for 2019.

2 – Recommend the following slate of ARMA Executive Committee members for a one-year term from January 1, 2019 – December 31, 2019:

- Jim Schnepper, GAF
- Gunnar Smith, Owens Corning
- Tom Smith, CertainTeed Corporation
- Joe Smith, Johns Manville
- Ken Farrish, Atlas Roofing Corporation
- David Humphreys, TAMKO Building Products
- Dave Lucchetti, Pacific Coast Building Products
- David Koschitzky, IKO
- Steve Ratcliff, Tarco, Inc.
- Greg Malarkey, Malarkey Roofing
- Tim Kersey, SOPREMA

3 – Recommend the following slate of ARMA Officers for a one-year term from January 1, 2019 – December 31, 2019:

- ARMA Executive Committee Chair – Greg Malarkey, Malarkey Roofing
- ARMA President – Tim Kersey, SOPREMA
- ARMA Treasurer/Secretary – Jim Schnepper, GAF

The 2018 ARMA Nominating Committee:

David Humphreys, TAMKO; Ken Farrish, Atlas Roofing; Greg Malarkey, Malarkey Roofing

3M
21520-G Yorba Linda Boulevard, Unit 534
Yorba Linda, CA 92887
Randy Morgan

3M
3M Center, Building 0209-01-W-14
St. Paul, MN 55144-1000
Frank Klink

Atlas Roofing
2000 RiverEdge Parkway Suite 800
Atlanta, GA 30328
Ken Farrish

Building Products of Canada
9510 Saint-Patrick
LaSalle, Quebec H8R 1R9
Riad Mia

CertainTeed Corporation
20 Moores Road
Malvern, PA 19355
Anthony Diodati

Crafco Inc.
6165 West Detroit Street
Chandler, AZ 85226
Jeffrey Stermer

Crafco Inc.
3110 Belmont Way
Celina, TX 75009
Biff Smith

GAF
1 Campus Drive
Parsippany, NJ 7054
Matthew Loncar
Helene Hardy Pierce
James Schnepper

Gibraltar Industries
4117 Pinnacle Point Drive #400
Dallas, TX 75211
Chuck Jerasa
Donnie Anderson

Infiana USA, Inc.
2400 Continental Blvd
Malvern, PA 19355
Keith Fedewa

Malarkey Roofing Products
3131 North Columbia Boulevard
Portland, OR 97217
Gregory Malarkey
James Fagan

Mid-States Asphalt
1637 51st Avenue
Tuscaloosa, AL 35401
Robert Almon
Gregory Schill

MTi Polyexe Corp.
27 Salt Spray Lane
Cape Elizabeth, ME 4107
Mike Sullivan
Sarah Boss-Sullivan

Owens Corning
1 Owens Corning Parkway
Toledo, OH 43659
Brian Chambers
Greg Keeler
Bradley Link
Gunner Smith
Devlin Whiteside

PABCO Building Products, LLC
1476 Thorne Road
Tacoma, WA 98421
John Corbett
Sid Dinwiddie

Pacific Coast Building Products, Inc. (PABCO)
10600 White Rock Road, Suite 100
Rancho Cordova, CA 95670
David Lucchetti

Reichel & Drews
1025 West Thorndale Avenue
Itasca, IL 60143
Curtis Maas

Siplast
1111 Hwy 67 South
Arkadelphia, AR 71923
Kirk Goodrum

SOPREMA, Inc.
310 Quadral Drive
Wadsworth, OH 44281
Tim Kersey
Sara Jonas
Todd Jackson
Mark DeFreitas
Jean-François Côté

Specialty Granules LLC
13424 Pennsylvania Avenue, Suite 303
Hagerstown, MD 21742
Justin Dunlap
Robert Toth

TAMKO Building Products, Inc.
220 West Fourth Street
Joplin, MO 64801
Aaron Phillips
David Humphreys
Susan Frieze

Tarco Roofing
One Information Way, Suite 225
Little Rock, AR 72202
Steve Ratcliff

ARMA Staff, Counsel, Consultants & Speakers

529 14th Street NW, Suite 750
Washington, DC 20045
Sam Furlong
Dan Quinonez

355 Lexington Avenue, 15th Floor
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Mike Fischer
George Fischer
Tim McQuillen
Ralph Vasami

Reed Hitchcock, ARMA Executive Vice President
C Michael Deese, ARMA General Counsel
James Hilyard, ARMA Consultant
Arthur Sampson, ARMA Regulatory Counsel

Ralph Shirts, ExxonMobil
Clayton Traylor, Leading Builders of America

ARMA Proxy Voting Form

ASPHALT ROOFING MANUFACTURERS ASSOCIATION
PROXY VOTING FORM

We have forwarded to you this proxy voting form along with the appropriate background information to solicit your vote for the following actions to be considered during the ARMA Board of Directors Meeting to be held November 1, 2018. For this meeting, the extent of our authority to vote in your absence will be limited to the items contained on this form. **YOUR VOTE IS VERY IMPORTANT. WHETHER OR NOT YOU EXPECT TO ATTEND THE MEETING, PLEASE SIGN AND DATE THE ENCLOSED PROXY AND FAX A COPY OF IT PROMPTLY TO THE ARMA HEADQUARTERS.**

[Background documents are included for reference in the ARMA Board of Directors Meeting read-ahead materials]

Being a Regular Member of ARMA, we hereby appoint (and thereby revoke any previous appointment) the Executive Vice President of ARMA, or, in the stead of said Executive Vice President, Mr./Ms. _____, of _____ [company affiliation], as my proxy until further notice for quorum purposes and for voting on the following specific items as indicated, at the meeting of the ARMA Board of Directors noticed to be convened May 17, 2018, until adjournment.

1. Approval of the ARMA Spring, 2018 Board Meeting Minutes as presented?

   For [ ] Against [ ] Abstain [ ]

2. Accept the Regulatory Update report as presented?

   For [ ] Against [ ] Abstain [ ]

3. Accept the Health, Safety and Environment Committee report as presented?

   For [ ] Against [ ] Abstain [ ]

4. Accept the Communication, Marketing, and Education Committee report as presented?

   For [ ] Against [ ] Abstain [ ]

5. Accept the Codes Steering Group report as presented?

   For [ ] Against [ ] Abstain [ ]

6. Accept the Technical Affairs Committee report as presented?

   For [ ] Against [ ] Abstain [ ]

7. Accept the ARMA Treasurer's Report as presented?

   For [ ] Against [ ] Abstain [ ]

8. Approve the ARMA Nominating Committee recommendation of a one-year exception to the 2-year election cycle for Executive Committee members and officers to allow for a one-year term for 2019?

For [ ] Against [ ] Abstain [ ]

9. Approve the ARMA Nominating Committee's recommended slate of Executive Committee members?

For [ ] Against [ ] Abstain [ ]

10. Approve the ARMA Nominating Committee's recommended slate of ARMA officers?

For [ ] Against [ ] Abstain [ ]

Signature: _____

Name (printed):_____

Company: _____

Date: _____

PROXY FORMS SHOULD BE RETURNED TO THE ATTENTION OF REED HITCHCOCK, ARMA EXECUTIVE VICE PRESIDENT, AND RECEIVED IN THE ARMA OFFICE BY 5:00 P.M. ET ON TUESDAY, OCTOBER 30, 2018
By Email: rhitchcock@asphaltroofing.org
By Regular Mail: 529 14th Street, NW
Suite 750
Washington, D.C. 20045