SECOND ASSESSMENT REPORT FOR THE "USE OF FOAM STABILIZED BASE (FSB) AND EMULSIFIED ASPHALT MIXTURES IN PAVEMENT APPLICATION"

Document Prepared by SCS Global Services

Methodology Title	Use of foam stabilized base (FSB) and emulsified asphalt mixtures in pavement application.	
Version	1.9	
Methodology Category	Methodology	X
	Methodology Revision	
	Module	
	Tool	
Sectoral Scope(s)	Sectoral Scopes 4 and 6 (Material Manufacturing, Construction)	

Report Title	Second assessment report for the "Use of foam stabilized base (FSB) and emulsified asphalt mixtures in pavement application."
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Summary:

This report describes the second assessment of the "Use of foam stabilized base (FSB) and emulsified asphalt mixtures in pavement application" (the "methodology"), which was developed for the purpose of providing a methodological framework for the quantification and reporting of GHG emission reductions and removals attributable to production and installation of Foam Stabilized Base (FSB) and asphalt emulsions as substitutes for Hot Mix Asphalt (HMA). The purpose of the assessment is to assess the conformance of the methodology to the VCS rules and current best practices for quantification of GHG emission reductions and removals. The assessment was performed through a desk review of the methodology and other relevant documents. The criteria for the assessment was the VCS Version 3. The conclusion of the assessment report is stated in Section 4 below, and the conclusion of the final assessment report is stated in Section 5 below. No uncertainties are associated with the assessment. Eighteen findings and two observations were issued during the course of the assessment.

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1 INTRODUCTION

1.1 Objective

The purpose of the audit activity was to conduct the second assessment of the methodology "Use of foam stabilized base (FSB) and emulsified asphalt mixtures in pavement application" in accordance with the guidance documents listed in Section 1.2 of this report.

1.2 Summary Description of the Methodology

The methodology which was developed for the purpose of providing a methodological framework for the quantification and reporting of GHG emission reductions and removals attributable to the use of foam stabilized base (FSB) and emulsified asphalt mixtures in pavement applications. The methodology covers construction activities in the United States.

2 ASSESSMENT APPROACH

2.1 Method and Criteria

In accordance with the Methodology Approval Process, the scope of the assessment included the following:

- Applicability conditions: Assessment of whether the proposed methodology's applicability conditions are appropriate, adequate and in compliance with the VCS rules.
- Project boundary: Assessment of whether an appropriate and adequate approach is provided for the definition of the project's physical boundary and sources and types of GHGs included.
- Procedure for determining the baseline scenario: Assessment of whether the approach for determining the baseline scenario is appropriate, adequate and in compliance with the VCS rules.
- Procedure for demonstrating additionality: Assessment of whether the approach/tools for determining whether the project is additional are appropriate, adequate and in compliance with the VCS rules.
- Baseline emissions: Assessment of whether the approach for calculating baseline emissions is appropriate, adequate and in compliance with the VCS rules.
- Project emissions: Assessment of whether the approach for calculating project emissions is appropriate, adequate and in compliance with the VCS rules.
- Leakage: Assessment of whether the approach for calculating leakage is appropriate, adequate and in compliance with the VCS rules.
- Quantification of net GHG emission reductions and/or removals: Assessment of whether the approach for calculating the net GHG benefit of the project is appropriate, adequate and in compliance with the VCS rules.
- Monitoring: Assessment of whether the monitoring approach is appropriate, adequate and in compliance with the VCS rules.
- Data and parameters: Assessment of whether the specification for monitored and not monitored data and parameters is appropriate, adequate and in compliance with the VCS rules.
- Adherence to the project principles of the VCS Program: Assessment of whether the methodology adheres to the VCS Program principles set out in the VCS Standard.
- Relationship to approved or pending methodologies: Assessment of whether any existing methodology could reasonably be revised to serve the same purpose as the proposed methodology.

The proposed revision was assessed for conformance against the VCS Version 3, including the following documents:

- VCS Standard, Version 3.7
- VCS Methodology Approval Process, Version 3.7, 21 June 2017
- VCS Standard, Version 3.7, 21 June 2017
- VCS Program Guide, Version 3.7, 21 June 2017
- VCS Program Definitions, Version 3.7, 21 June 2017
- VCS Guidance for Standardized Methods, Version 3.3, 8 October 2013
- VCS Validation and Verification Manual, Version 3.2, 19 October 2016
- VCS Methodology Report Template, Version 3.1, 8 October 2013

The primary method used for this assessment was document review, as described in Section 2.2 of this report. During the course of the first assessment the new versions of the VCS documents listed above were published and used.

2.2 Document Review

The assessment activity included a detailed review of the methodology against the criteria of the guidance documents listed in Section 1.2 of this report. In addition, the proposed methodology was assessed for logical coherence, internal consistency, completeness, and consistency with current best practices for quantification of emission reduction and removals.

Review of the methodology was complemented by a review of the provided resources and published literature relevant to the development of the methodology. The following articles or reports were reviewed to ensure the conformance of the proposed revision with the guidance documents listed in Section 1.2 of this report:

AASHTO (1998). AASHTO Guide for Design of Pavement Structures, 4th edition. Relevent information is available at http://www.pavementinteractive.org/the-aashto-reliability-concept/ (13 July 2017)

Bemanian, S., Polish, P., Maurer, G. (2006). “Cold-In-Place Recycling and Full-Depth Reclamation Projects by Nevada Department of Transportation – State of the Practice.” Transportation Research Record, Journal of the Transportation Research Board No. 1949, pages 54-71.

Carnegie Mellon University Green Design Institute (CMUGDI) (2008). "Economic Input-Output Life Cycle Assessment (EIO-LCA), US 1997 Industry Benchmark model ". (available at http://www.eiolca.net/cgi-bin/dft/use.pl)

Dixon, W.J. (1951). “Ratios involving extreme value”. The Annals of Mathematical Statistics 22(1): 68-78.

EPA (2000). “Hot mix asphalt plants emission assessment report”. United States Environmental Protection Agency.

EPA (2012). "Engine Certification Data for Heavy Truck, Buses, and Engines." <http://www.epa.gov/oms/certdata.htm#largeng>. (26 November 2012).

EPA (2015). “US EPA Archive Document: Asphalt Concrete.” <https://www3.epa.gov/warm/pdfs/Asphalt_Concrete.pdf> (13 July 2017)

EPA (2017). “Emissions & Generation Resource Integrated Database (eGRID) summary tables.” < https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid > (24 March 2017)

Hammond, G., and Jones, C. (2011). "Embodied carbon: The Inventory of Carbon Energy (ICE)." Building Services Research and Information Association (BSRIA), Berkshire, UK.

IPCC (2007). "Climate Change 2007: Synthesis Report ", R. K. Pachauri, and A. Reisinger, eds., International Panel on Climate Change (IPCC), Geneva, Switzerland.

Morian, D.A., Zhao, Y., Arellano. J,, Hall, D.E. (2005). “Asphalt Pavement Rehabilitation Treatment – Analysis of 20 Years of Performance.” Transportation Research Record, Journal of the Transportation Research Board No. 1905, pages 36-43.

Mundt D.J., Marano K.M., Nunes A.P., Adams R.C. (2009). A review of changes in composition of hot mix asphalt in the United States, Journal of Occupation Environmental Hygene.

National Center for Asphalt Technology (2010). “Properties and Performance of Warm Mix Asphalt Technologies.” Auburn University, AL. volume 26 No.1.

NAPA (2006). National Asphalt Pavement Association Comments to Midwest Regional Planning Organization: Interim White Paper on Candidate Control Measures to Reduce Emissions from Hot Mix Asphalt Plants. Page 1.

NAPA (2012). Manual of NAPA’s Greenhouse Gas Calculator. National Asphalt Pavement Association, Lanham, MD. <https://www.asphaltpavement.org/ghgc/GHGC%20v4%20instructions.pdf>. (21 June 2014). Page 3.

NAPA (2013). Annual asphalt pavement industry survey on recycled materials and warm-mix asphalt usage: 2009-2012. National Asphalt Pavement Association.

NAPA (2017). Asphalt pavement industry survey on recycled materials and warm-mix asphalt usage:2014. National Asphalt Pavement Association.

Schwartz, C.W., Khosravifar, S. (2013). “State Highway Administration Research Report: Design and Evaluation of Foamed Asphalt Base Materials”. University of Maryland, College Park.

Sinden, G. (2008). "PAS 2050: 2008, Specification for the Assessment of the Life Cycle Greenhouse Gas Emissions of Goods and Services." British Standards Institute (BSI). pages 12-16.

TCR (2015). 2015 Default emission factors. The Climate Registry. < https://www.theclimateregistry.org/wp-content/uploads/2015/04/2015-TCR-Default-EF-April-2015-FINAL.pdf> (March 2016)

UNFCCC (2006). “Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol”. Framework Convention on Climate Change. page. 17.

It should be noted that the EPA 2012 referenced web page with a link to the report was removed on 20 January 2017. The EPA 2015 document is an archive version with no link through the current EPA web pages also. The referenced reports were found, and the assessment was completed.

2.3 Interviews

Additional information regarding the basis for the criteria and procedures contained within the methodology was provided by Ms. Diana M. Gutierrez, Straughan Environmental, Inc., Dan Shaw and Harold Green of Chamberlain Contractors during a conference call on 25 January 2018, 3 May 2018, and via email.

2.4 Assessment Team

Barbara Toole O’Neil led the second assessment and performed or directly supervised all aspects of the work, including assessment, interviews and report writing. Ms. Toole O’Neil has been the lead assessor or part of the assessment team for the following VCS methodologies:

- VM0025: Campus Clean Energy and Energy Efficiency, Version 1.0; VMD0038: Campus Clean Energy and Energy Efficiency: Campus-Wide Module, Version 1.0 and VMD0039, LEED-Certified Buildings Module (12 February 2014).
- VMR 001, Revisions to ACM0008 to Include Methane Capture and Destruction from Abandoned Coal Mines
- VMR002, Revisions to ACM0008 to Include Pre-drainage of Methane from an Active Open Cast Mine as a Methane Emission Reduction Activity
- VM0014, Interception and Destruction of Fugitive Methane from Coal Bed Methane (CBM) Seeps
- VM001, Infrared Automatic Refrigerant Leak Detection Efficiency Project Methodology

Ms. Toole O'Neil is also a VCS approved standardized methodology expert. In the past year, she participated as the standardized methodology expert for the "VM0007 REDD+ Methodology Framework (REDD-MF), v1.5" module.

Tiffany Mayville assisted the Lead Assessor with various aspects of the assessment, including coordinating the team and activities and reviewing the report. Ms. Mayville is competent in numerous GHG offset and footprint standards and methodologies. She is responsible for managing the GHG Program's quality systems to ensure compliance with the applicable ANSI accreditation. Ms. Mayville holds a Bachelor of Arts in Environmental Studies from the University of California, Santa Barbara.

Zane Haxtema served as the "appropriately qualified, independent technical reviewer" as requested by Section 5.1.2 of the Validation and Verification Manual." Mr. Haxtema holds a M.S. in Forest Resources from Oregon State University (Corvallis, Oregon, USA). Mr. Haxtema is well versed in a wide variety of methodological approaches for carbon accounting, having served as a lead auditor on a wide variety of projects under the Climate Action Reserve, the Air Resources Board, the Verified Carbon Standard and the Climate, Community and Biodiversity Standards. He is a VCSA-approved AFOLU expert for the IFM project type.

2.5 Resolution of Findings

Potential material discrepancies identified during the assessment process were resolved through the issuance of findings. The types of findings issued by SCS were characterized as follows:

Non-Conformity Reports (NCRs) were issued in response to material discrepancies in the proposed revision. A material discrepancy could be defined as:

- An instance of nonconformance to the guidance documents listed in Section 1.2 of this report;
- An instance where the language of the methodology element required clarification in order to avoid ambiguity;
- An instance where the proposed methodology lacked internal consistency; or
- An instance where formulae in the proposed revision were not consistent with mathematical convention.

An adequate response for each issued NCR, including evidence of corrective action, was required before a positive assessment opinion could be reached.

New Information Requests (NIRs) were issued to the client when more information was needed to determine whether a material discrepancy existed. Issuance of an NIR did not necessarily signify the presence of a material discrepancy. However, an adequate response to all issued NIRs was required before an assessment opinion could be reached.

Observations (OBSs) were issued to the client when an opportunity for improvement in the proposed revision was identified. Such opportunities for improvement did not constitute material discrepancies. OFBSs were considered resolved on issuance, and therefore a response to issued OBSs was not required before an assessment opinion could be reached.

In total, 18 findings and two observations were issued during the assessment. All issued findings are described in Appendix A below.

The main findings identified during the assessment process were related to the application and clarity of the methodology. The supporting references and analysis were reviewed with no identified findings.

The methodology was modified in response to issues raised during the assessment process for clarity and in order to conform to the VCS rules.

3 ASSESSMENT FINDINGS

3.1 Relationship to Approved or Pending Methodologies

No existing pending or approved methodology that was available 60 days before the methodology was submitted to the VCSA for public consultation, in accordance with Section 5.2.1(1) of the Methodology Approval Process could reasonably be revised to serve the same purpose as the methodology. Approved and pending VCS, Climate Action Reserve (CAR), and Clean Development Mechanism (CDM) methodologies for all sectoral scopes were reviewed for the appropriate sectoral scopes. No methodologies were identified that could reasonably be revised to serve the same purpose as this methodology.

This methodology provides a framework for the quantification of emission reductions associated with the production and installation of FSB and asphalt emulsions as substitutes for hot mix asphalt. Two VCS methodologies that reference a baseline for typical HMA applications are:

- VM0030 - Methodology for Pavement Application using Sulphur Substitute, v1.0., 2015
- VM0031 - Methodology for Precast Concrete Production using Sulphur Substitute, v1.0., 2015.

The use of FSB and asphalt emulsions is not included in either methodology. Neither methodology could be revised to accommodate the use of FSB and asphalt emulsions as detailed in this new methodology.

3.2 Stakeholder Comments

No comments were received during the public comment period.

3.3 Structure and Clarity of Methodology

The methodology element is written in a clear, logical, concise and precise manner. Procedures and criteria are logically presented and easily understood. The methodology contains a high level of internal consistency. Equations are mathematically sound, and parameters are presented consistently throughout the text of the methodology element. Furthermore, this report affirms that:

- **The developer has followed the instructions in the methodology template and ensured that the methodology's various criteria and procedures are documented in the appropriate sections of the template**. The methodology was written clearly and logically in a style that ensure consistent application by intended users.

- **The terminology used in the methodology is consistent with that used in the VCS Program, and GHG accounting generally**. All definitions are consistent with those in the VCS program definitions, ISO 14064-2:2006, or other VCS guidance documents (e.g., standardized methodologies).

- **The key words must, should and may have been used appropriately and consistently to denote firm requirements, (non-mandatory) recommendations and permissible or allowable options, respectively.** This convention is very intentionally followed throughout the methodology element.

- **The criteria and procedures are written in a manner that can be understood and applied readily and consistently by project proponents**. The criteria and procedures are quite clearly presented and should be readily accessible to users with the necessary competencies.

- **The criteria and procedures are written in a manner that allows projects to be unambiguously audited against them.** The criteria and procedures are not, in many cases, highly prescriptive; however, they are sufficiently prescriptive as to allow unambiguous assessment of projects, particularly in combination with other VCS requirements. For example, the methodology does allow for regional variability in the mixtures of materials used for paving.

In conclusion, the methodology element is structurally sound and of adequate clarity.

3.4 Definitions

The assessment team concludes, overall, that the definitions for terms used by the methodology element are appropriate and in conformance with the VCS rules. The definitions are clearly and appropriately set out in Section 3 of the methodology and are consistently used within the methodology.

3.5 Applicability Conditions

The assessment team concludes, overall, that the applicability conditions are appropriate and in conformance with the VCS rules.

3.5.1 Assessment of Conditions as a Whole

An assessment of the applicability conditions, as a whole, follows.

Criterion	Assessment findings
Are the applicability conditions appropriately specified?	**Yes**; as described for each condition in Section 3.5.2 below, all conditions are specified with appropriate clarity and precision
Are the applicability conditions appropriate for the project activities targeted by the methodology and the quantification procedures set out within the methodology?	**Yes**; the conditions ensure the following: 1. Project activities include the construction of all types of roads and parking lots (including parking lot patching projects) in the United States. 2. Production plants may serve multiple pavement types, including, but not limited to, roadway and parking lots.

	3. Project activities may have an HMA or WMA surface layer but must have at least one FSB or asphalt emulsions base layer
Are the applicability conditions as a whole sufficiently clear for determining which project activities are eligible under the methodology, and which are not?	**Yes**; the conditions make use of clear and commonly-used terminology to clarify which project activities are eligible
How do the applicability conditions address environmental integrity and practical considerations?	The conditions limit applicability to the United States and only projects that must have at least one FSB or asphalt emulsions base layer.

3.5.2 Assessment of Each Applicability Condition

An identification and discussion of each conditions follows.

		Explanation of whether…	
Condition	**Overall applicability condition**	**The applicability condition is written in a sufficiently clear and precise manner**	**Conformance with the applicability condition can be demonstrated at the time of project validation**
1.	Project activities include the construction of all types of roads and parking lots (patching projects) in the United States.	Condition is written with adequate clarity and precision.	The requirement can thus be assessed against at time of validation.
2.	Project activities should use any of the following methods: • FSB produced using the CCPR process, • FSB produced using the CIR process, • FSB produced using the FDR process, • CCPR process using asphalt emulsions, • CIR process using asphalt emulsions, or • FDR process using asphalt emulsions	Condition is written with adequate clarity and precision, as the terms are defined in the methodology and readily understood in a construction setting	The conditions relate to specific project activities and conformance can be demonstrated at time of validation.
3.	Production plants may serve multiple pavement types, including, but not	Condition is written with adequate clarity and precision but allows for other	The condition relates to the specific production facility that is defined in the project

		Explanation of whether…	
Condition	**Overall applicability condition**	**The applicability condition is written in a sufficiently clear and precise manner**	**Conformance with the applicability condition can be demonstrated at the time of project validation**
	limited to, roadway and parking lots.	construction types to be included.	and conformance can be demonstrated at time of validation
4.	Project activities may have an HMA or WMA surface layer but must have at least one FSB or asphalt emulsions base layer.	Condition states, with adequate clarity and precision what must be included in the base layer to be an applicable project	The condition relates to the specific design of the project activity and conformance can be demonstrated at time of validation.

3.6 Project Boundary

The approach for identifying the project boundary is appropriate for the project activities covered by the methodology. The assessment team concludes, overall, that the specification of the project boundary is of adequate clarity and in conformance with the VCS Standard. Further identification and discussion of the project boundary is provided below.

3.6.1 Spatial Boundary

Project boundary element(s)	Assessment findings
The spatial extent of the project boundary encompasses the stages from raw material acquisition to product installation.	• Clearly specified and consistent with VCS Standard § 4.4. The spatial extent of the project boundary complies with the cradle-to-gate assessment principles. Maintenance and excavation of the new pavement are not included due to the high variability of practices in each region.
Boundary for HMA projects: The emission estimation starts with the production of raw materials at manufacturer sites and ends with the delivery of the final pavement product to the customer	• Clearly specified and consistent with VCS Standard § 4.4. The criteria and procedures for describing the project boundary and identifying and assessing GHG sources, sinks and reservoirs relevant to the project and baseline scenarios are identified. Justification for GHG sources, sinks and reservoirs included or excluded was provided.
Boundary for CCPR projects: CCPR transports milled materials from an existing jobsite to a central plant where FSB or asphalt emulsions are processed through a pug mill.	• Clearly specified and consistent with VCS Standard § 4.4. The criteria and procedures for describing the project boundary and identifying and assessing GHG sources, sinks and reservoirs relevant to the project and baseline scenarios are identified. Justification for GHG sources, sinks and reservoirs included or excluded was provided.

Project boundary element(s)	**Assessment findings**
Boundary for CIR and FDR systems: CIR or FDR uses one or more mobile recycling machines for milling, production, and placement in a continuous operation at the pavement site	• Clearly specified and consistent with VCS Standard § 4.4. The criteria and procedures for describing the project boundary and identifying and assessing GHG sources, sinks and reservoirs relevant to the project and baseline scenarios are identified. Justification for GHG sources, sinks and reservoirs included or excluded was provided.

3.6.2 Greenhouse gases

The procedures for determination of the GHG sources included in the project boundary conform to the VCS rules, as specifically discussed for each GHG source below.

Source		Gas	Selected	Assessment Comments
HMA (Baseline)	Raw material acquisition	CO_2	Yes	CO_2 is appropriately included; methane and nitrous oxide are negligible.
		CH_4	No	
		N_2O	No	
	Raw material transport	CO_2	Yes	CO_2 from fuel consumption is appropriately included; methane and nitrous oxide are negligible.
		CH_4	No	
		N_2O	No	
	In-plant production	CO_2	Yes	CO_2 from natural gas consumption, diesel equipment and plant electricity is appropriately included; methane and nitrous oxide are negligible
		CH_4	No	
		N_2O	No	
	To-site transport	CO_2	Yes	CO_2 from fuel consumption is appropriately included; methane and nitrous oxide are negligible
		CH_4	No	
		N_2O	No	
	Installation	CO_2	Yes	CO_2 from diesel fuel consumption by construction equipment is appropriately included; methane and nitrous oxide are negligible.
		CH_4	No	
		N_2O	No	
	Maintenance	CO_2	No	Emissions from maintenance and rehabilitation are outside the project boundary due to uncertainty of breakdowns and repair cycles.
		CH_4	No	
		N_2O	No	
	Excavation	CO_2	No	The emissions from maintenance and rehabilitation are outside the project boundary due to uncertainty in the disposition choice at the end of the pavement life which can be decades.
		CH_4	No	
		N_2O	No	
CCPR (Project Scenario 1)	Raw material acquisition	CO_2	Yes	CO_2 is appropriately included; methane and nitrous oxide are negligible.
		CH_4	No	
		N_2O	No	
	Raw material transport	CO_2	Yes	CO_2 from fuel consumption is appropriately included; methane and nitrous oxide are negligible.
		CH_4	No	
		N_2O	No	
		CO_2	Yes	CO_2 from natural gas consumption, diesel equipment and plant electricity is appropriately
		CH_4	No	

Source		Gas	Selected	Assessment Comments
	FSB production	N_2O	No	included; methane and nitrous oxide are negligible
	To-site transport	CO_2	Yes	CO_2 from fuel consumption is appropriately included; methane and nitrous oxide are negligible
		CH_4	No	
		N_2O	No	
	Installation	CO_2	Yes	CO_2 from diesel fuel consumption by construction equipment is appropriately included; methane and nitrous oxide are negligible.
		CH_4	No	
		N_2O	No	
	Maintenance	CO_2	No	Emissions from maintenance and rehabilitation are outside the project boundary due to uncertainty of breakdowns and repair cycles.
		CH_4	No	
		N_2O	No	
	Excavation	CO_2	No	The emissions from maintenance and rehabilitation are outside the project boundary due to uncertainty in the disposition choice at the end of the pavement life which can be decades.
		CH_4	No	
		N_2O	No	
CIR or FDR (Project Scenario II)	Raw material acquisition	CO_2	Yes	CO_2 is appropriately included; methane and nitrous oxide are negligible.
		CH_4	No	
		N_2O	No	
	Raw material transport	CO_2	Yes	CO_2 from fuel consumption is appropriately included; methane and nitrous oxide are negligible.
		CH_4	No	
		N_2O	No	
	FSB Production & Placement	CO_2	Yes	CO_2 from natural gas consumption, diesel equipment and plant electricity is appropriately included; methane and nitrous oxide are negligible
		CH_4	No	
		N_2O	No	
	Maintenance	CO_2	No	Emissions from maintenance and rehabilitation are outside the project boundary due to uncertainty of breakdowns and repair cycles.
		CH_4	No	
		N_2O	No	
	Excavation	CO_2	No	The emissions from maintenance and rehabilitation are outside the project boundary due to uncertainty in the disposition choice at the end of the pavement life which can be decades.
		CH_4	No	
		N_2O	No	

3.7 Baseline Scenario

The criteria and procedures for determining the baseline scenario are appropriate for the project activities covered by the methodology. The assessment team concludes, overall, that the criteria and procedures for determining the baseline scenario are in conformance with the VCS Standard §4.5. and particularly §4.5.3.

Through use of the baseline/additionality tool, the methodology complies with the relevant requirements within the VCS Standard for identification of the baseline scenario, as described below.

VCS Standard reference	Assessment findings
Section 4.5.4	• The standardized methodology approach used an aggregated baseline scenario and supported the approach with data from appropriate associations and agencies.
Section 4.5.5	• The performance benchmark used current practices and appropriate data from the asphalt paving industrial sector. The dataset used should be updated annually as noted in the methodology.
Section 4.5.16	• Appropriate data sources for developing performance methods from primary and secondary sources that that accurately reflect available technologies and current practices within the asphalt paving industrial sector. The data is appropriate to the geographic scope which is the US.
Section 4.5.17	• The procedures in the methodology establish the criteria and procedures using the data and for establishing specific performance benchmarks for specific project types. The procedures in the methodology are sufficient to maintain the dataset in accordance with the applicable requirements in the VCS Standard §4.5.6.

3.8 Additionality

This methodology uses a standardized methodological approach to determine additionality. The standardized approach uses the performance method for this methodology and requires a two-step process. Step 1, Regulatory Surplus, requires the project proponent demonstrate regulatory surplus in accordance with the rules and requirements regarding regulatory surplus set out in the latest version of the VCS Standard, §4.1.11 and 4.6.3. Step 2, Performance Benchmark, establishes performance benchmark metric for determining additionality and/or the crediting baseline. Sufficient information was provided to evaluate the benchmark process for this methodology, Data was provided in the development of the methodogy per §4.5.7 and assessed by the standard methodology expert. The analysis was provided to the assessment team and summarized in the appendix of the methodology.

The assessment team concludes, overall, that the criteria and procedures for determining additionality are in conformance with the VCS Standard and VCS Guidance for Standardized Methods.

3.9 Quantification of GHG Emission Reductions and Removals

3.9.1 Baseline Emissions

The assessment team concludes, overall, that the procedures for calculating baseline emissions and removals are in conformance with the VCS rules.

An assessment of the criteria and procedures for calculating baseline emissions and removals, as a whole, follows.

Criterion	Assessment findings
Are procedures for calculating baseline emissions and removals are appropriate for the project activities covered by the methodology?	**Yes**; procedures comply with all VCS rules for the category of project activities covered by the methodology. Baseline GHG emissions come

Criterion	Assessment findings
	from emissions embodied in material production and fuel consumption from transportation.
Are all algorithms, equations and formulas used appropriate and without error?	**Yes**; the assessment team carefully reviewed procedures and confirmed that all equations are appropriate and without mathematical errors; equations are consistent with best practices for GHG accounting.
Do procedures for calculating baseline emissions and removals cover all GHG sources, sinks and reservoirs (and carbon pools) included in the project boundary?	**Yes**; procedures include all sources, sinks and reservoirs included in project boundary.
Are all models or default factors used are appropriate and in conformance with VCS requirements on same?	**No** specific models are used by methodology; default factors are in conformance with VCS requirements.

3.9.2 Project Emissions

Project emissions are calculated in one of two ways. If the project is performed using CCPR, the calculation must follow the process in Section 8.2.1 of the methodology. For a project using CIR or FDR, the calculations follow the process in Section 8.2.2 of the methodology. The basic process is documentation of the equipment and vehicles used for preparation of the paving materials, transport and application at the jobsite. The assessment team concludes, overall, that the procedures for calculating project emissions and removals are in conformance with the VCS Standard.

Criterion	Assessment findings
Are procedures for calculating project emissions and removals appropriate for the project activities covered by the methodology?	**Yes**; procedures comply with all VCS Standard rules for the category of project activities covered by the methodology, as described in Section 3.9.1 above.
Are all algorithms, equations and formulas used appropriate and without error?	**Yes**; assessment team carefully reviewed procedures and confirmed that all equations are appropriate and without mathematical errors; equations are consistent with best practices for GHG accounting.
Do procedures for calculating baseline emissions and removals cover all GHG sources, sinks and reservoirs included in the project boundary?	**Yes**; procedures include all sources, sinks and reservoirs included in project boundary, as listed below: • Raw material acquisition • Raw material transport • FSB production • FSP production and placement • In-plant production

Criterion	Assessment findings
	• To-site transport • Installation
Are all models or default factors used are appropriate and in conformance with VCS requirements on same?	No specific models are used by this methodology; default factors are in conformance with VCS requirements (see Section 3.10 below for more details)
Are procedures for estimating parameters related to the quantification of project emissions appropriate	**Yes**; see Section 3.10 below for more details

3.9.3 Leakage

SCS concurs with the first assessment that there is no leakage in the proposed methodology as the only differences in the baseline and project are within the project boundary.

3.9.4 Net GHG Emission Reductions and Removals

The assessment team concludes, overall, that the procedures for calculating net GHG emission reductions and removals are in conformance with the VCS Standards and the VCS Guidance for Standardized Methods.

An assessment of the criteria and procedures for calculating net GHG emission reductions and removals, as a whole, follows.

Criterion	Assessment findings
Are procedures for calculating net GHG emission reductions and removals appropriate for the project activities covered by the methodology?	**Yes**; procedures comply with all VCS Standard rules for the category of project activities covered by the methodology. Baseline GHG emissions come from emissions embodied in material production and fuel consumption from transportation.
Are all algorithms, equations and formulas used appropriate and without error?	**Yes**; assessment team carefully reviewed procedures and confirmed that all equations are appropriate and without mathematical errors; equations are consistent with best practices for GHG accounting.
Are uncertainties associated with the quantification of net GHG emission reductions addressed appropriately?	**Yes**; uncertainties are addressed through explicit accounting and through procedures for selection of conservative values.

Further identification and discussion of the procedures for calculating net GHG emission reductions and removals is provided below.

Procedure	Sec.	Assessment findings
Calculation of net GHG emissions reductions	8.4	• Equations 15-26 are used for the calculation of net GHG emissions reductions. The crediting baseline is the same as the additionality performance benchmark. The basic approach
Estimation of uncertainty	8.4	• The uncertainty is addressed in Appendix A, where the development of the standardized methodology and performance benchmark is described. It is consistent with §4.1.11 of the VCS Standard
Calculation of verified carbon units	8.4	• Calculation of verified carbon units is accomplished using equations 15-26, the same equation used for the calculation of net GHG emissions reductions. The crediting baseline is the same as the additionality performance benchmark.

3.10 Monitoring

The assessment team concludes, overall, that the procedures for monitoring are in conformance with the VCS Standard, §4.8.1-4.8.4. including data and parameters to be reported, sources of data and units of measurement and are discussed below. The procedures for monitoring are appropriate for the project activities covered by the methodology, as further described for each data/parameter below.

Further identification and discussion of the procedures for monitoring is provided below.

Procedure	Sec.	Assessment findings
Requirements for monitoring plan	9.2	• Sets out purpose of monitoring, as required by § 4.8.4(1) of VCS Standard • Introduces requirements for monitoring plan (not required by assessment criteria but helpful to ensure consistency in terms of information provided by monitoring plans)
Uncertainty and quality management	9.2	• Establishes appropriate procedures for managing data quality, as required by §4.8.4of VCS Standard • Contains guidance regarding quality assurance/quality control methods that is consistent with Volume 1, Chapter 6 of IPCC 2006 Guidelines
Expert judgment	9.2	• Provides criteria for sourcing values from expert judgment • From review of VCS Standard and Guidance for Standardized Methods, assessment team agrees that guidance therein is applicable to methodology and will help to ensure that values are appropriately sourced

Procedure	Sec.	Assessment findings
		from expert judgment and updated as appropriate for the performance benchmark.
Monitoring of project implementation	9.2	• Monitoring is required to ensure ongoing conformance with the applicability conditions as required by §4.8.4 of VCS Standard • Methodology contains procedures for the required monitoring • Assessment team agrees that procedures for monitoring project implementation are appropriate.

3.10.1 Parameters available at validation for HMA and CCPR

An identification of each data/parameter available at validation, and an assessment (as requested) of how each piece of information provided in the parameter table is appropriate, is provided below.

Data / Parameter:	EF_M
Data unit	$kgCO_2e/kg$
Equations	2
Source of data	CMUGDI (2008)
Value applied	RAP: 0 Cement: 0.83 Bitumen: 0.48 Water: 0 Crushed rock: 0.056 Sand: 0.005 Manufactured aggregates: 0.006
Justification of choice of data or description of measurement methods and procedures applied	CMUGDI (2008) is a national economic input-output models and publicly available resources use the emission data. The input-output models are powerful in material emission calculation because they account for material emissions as well as all the relevant upstream emissions. This is a publicly available independent model of high quality.
Purpose of Data	Calculation of material production emissions
Comments	Data to be updated when the material emissions factors are updated

Data / Parameter:	EF_T
Data unit	$kgCO_2e/mile$
Equations	3,4
Source of data	TCR (2015)

Value applied	10.2
Justification of choice of data or description of measurement methods and procedures applied	Emission factors for the ruck's emission per mile travelled from TCR are compiled from publicly available data sources and updated each year to ensure that project proponents have the most accurate and up-to-date greenhouse gas data.
Purpose of Data	Calculation of baseline delivery emission Calculation of CCPR delivery emission
Comments	Data to be updated when the diesel emissions factors are updated

Data / Parameter:	EF_{EQ}
Data unit	$kgCO_2e/hr$
Equations	6,8
Source of data	EPA (2012). "Engine Certification Data for Heavy Truck, Buses, and Engines."<http://www.epa.gov/oms/certdata.htm#largeng>.
Value applied	Appendix B
Justification of choice of data or description of measurement methods and procedures applied	The engine emission (per hour) information is obtained from the EPA off-road engine certification database and further stratified equipment types by engine maker and horsepower rating. The database created for equipment emission estimation is presented in Appendix B
Purpose of Data	Calculation of baseline emissions Calculation of CCPR emissions
Comments	Data was collected one time and should be updated when standards change.

Data / Parameter:	EF_{EL}
Data unit	$kgCO_2e/kWh$
Equations	7
Source of data	EPA (2017)
Value applied	Refer to EPA's eGRID summary tables for electricity emission factors for different regions
Justification of choice of data or description of measurement methods and procedures applied	Emission factors from eGRID summary tables, compiled by the EPA and updated yearly. Region-specific emission factors are available for use.
Purpose of Data	Calculation of baseline emissions Calculation of CCPR emissions
Comments	The project proponent should use the most recent eGRID tables available.

Data / Parameter:	CF
Data unit	Between 0 and 1
Equations	9
Source of data	On-site observations
Value applied	Milling machine: 0.66 Backhoe: 0.33 Loader: 0.33 Sweeper: 0.55 Paver: 0.50 Roller: 0.59 Truck: 1
Justification of choice of data or description of measurement methods and procedures applied	A selection of projects was assessed for utilization. The percentage utilization (PU) was calculated. According to a study by Lewis et al. (2009), the emission rate of idling equipment is about one quarter of the emission rate of the operating equipment. This difference is simplified and incorporated into the emission calculation as an average conversion factor (CF), which equals *PU+0.25(1-PU)*.
Purpose of Data	Calculation of baseline equipment emissions Calculation of CCPR equipment emissions
Comments	

Data / Parameter:	DF
Description	For conservativeness, a discount factor (DF) between 0 and 1 should be applied when a map distance calculator is used rather than logged miles. DF is equal to 0 if using actual logged miles.
Equations	3,4
Source of data	On site observation
Value applied	0.1
Justification of choice of data or description of measurement methods and procedures applied	Hauling distance = Map distance × (1+DF)
Purpose of Data	Calculation of baseline equipment emissions Calculation of CCPR equipment emissions
Comments	

3.10.2 Parameters available at validation for CIR or FDR

Data / Parameter:	EF_T
Data unit	$kgCO_2e$/mile
Equations	3,4
Source of data	TCR (2015)
Value applied	10.2
Justification of choice of data or description of measurement methods and procedures applied	Emission factors from TCR are compiled from publicly available data sources and updated each year to ensure that project proponents have the most accurate and up-to-date greenhouse gas data.
Purpose of Data	Calculation of CIR or FDR delivery emissions
Comments	Data to be updated when the diesel emissions factors are updated

Data / Parameter:	EF_M
Data unit	$kgCO_2e$/kg
Equations	2
Source of data	CMUGDI (2008)
Value applied	RAP: 0 Cement: 0.83 Bitumen: 0.48 Water: 0
Justification of choice of data or description of measurement methods and procedures applied	CMUGDI (2008) is a national economic input-output models and publicly available resources use the emission data. The input-output models are powerful in material emission calculation because they account for material emissions as well as all the relevant upstream emissions. This is a publicly available independent model of high quality.
Purpose of Data	Calculation of material production emissions
Comments	Data to be updated when the material emissions factors are updated

Data / Parameter:	EF_{EQ}
Data unit	$kgCO_2e$/hr
Equations	6,8
Source of data	EPA (2012). "Engine Certification Data for Heavy Truck, Buses, and Engines."<http://www.epa.gov/oms/certdata.htm#largeng>.

Value applied	Appendix B
Justification of choice of data or description of measurement methods and procedures applied	The engine emission (per hour) information is obtained from the EPA off-road engine certification database and further stratified equipment types by engine maker and horsepower rating. The database created for equipment emission estimation is presented in Appendix B
Purpose of Data	Calculation of CIR or FDR emission
Comments	Data was collected one time and should be updated when emissions standards change.

3.10.3 Data and Parameters Monitored for HMA, CCPR, CIR or FDR

An identification of each data/parameter monitored, and an assessment of how each piece of information provided in the parameter table is appropriate, is provided below

Data / Parameter	W_M
Data unit	Kg
Equations	2
Source of data	Data monitored
Description of measurement methods and procedures to be applied	The data can be obtained from plant production records
Frequency of monitoring/recording	Once per project
QA/QC procedures to be applied	Cross-checking of reported quantity versus trucking manifests to confirm quality measurement.
Purpose of Data	Calculation of HMA material emissions Calculation of CCPR material emissions
Comments	

Data / Parameter	Distance
Data unit	Miles
Equations	3,4
Source of data	Data derived from monitoring
Description of measurement methods and procedures to be applied	Distance can be obtained from the daily report of truck drivers or measured by approximation

Frequency of monitoring/recording	Once per project
QA/QC procedures to be applied	Cross-checking of reported mileage versus trucking manifests to confirm quality measurement.
Purpose of Data	Calculation of HMA to-plant delivery emissions Calculation of CCPR to-plant delivery emission
Comments	

Data / Parameter	C_{EL}
Data unit	*kWh*
Description	Electricity consumption of the whole plant
Equations	7
Source of data	Data derived through monitoring
Description of measurement methods and procedures to be applied	The use of electricity can be obtained from plant's utility bills
Frequency of monitoring/recording	Utility bills should be collected monthly or quarterly
QA/QC procedures to be applied	Cross-checking of reported consumption versus utility bills to confirm quality measurement.
Purpose of Data	Calculation of CCPR in-plant production emissions
Comments	

Data / Parameter	Project amount
Data unit	t
Description	Output quantity of FSB and asphalt emulsions
Equations	2,3,4,6,7,8
Source of data	Data derived through monitoring
Description of measurement methods and procedures to be applied	Data can be reported according to plant production records
Frequency of monitoring/recording	Once per project
QA/QC procedures to be applied	Cross-checking of reported amount versus production logs to confirm quality measurement.
Purpose of Data	Calculation of CCPR emission

Comments	

Data / Parameter	HR_{EQ}
Data unit	Hour
Description	Total operating hours of on-site use of equipment
Equations	8
Source of data	Data derived through monitoring
Description of measurement methods and procedures to be applied	Data can be obtained from daily report of on-site contractors
Frequency of monitoring/recording	Once per project
QA/QC procedures to be applied	Cross-checking of reported data versus labor hours to confirm quality measurement.
Purpose of Data	Calculation of HMA equipment emissions Calculation of CCPR equipment emissions
Comments	Data does not need to be updated

Data / Parameter	HR_{LA}
Data unit	Hour
Description	Total labor hours of on-site use of equipment
Equations	9
Source of data	Data derived from monitoring
Description of measurement methods and procedures to be applied	Labor hours can be obtained from the daily reports of contractors
Frequency of monitoring/recording	Once per project
QA/QC procedures to be applied	Cross-checking of reported hours versus daily reports to confirm quality measurement.
Purpose of Data	Calculation of HMA installation emissions Calculation of CCPR installation emission
Comments	

Data / Parameter	DE
Data unit	lb/cu.ft

Description	Density of FSB or asphalt emulsions
Equations	14
Source of data	Data derived from monitoring
Description of measurement methods and procedures to be applied	Density data can be obtained from project specifications
Frequency of monitoring/recording	Once per project
QA/QC procedures to be applied	Cross-checking of reported data versus theoretical density to confirm quality measurement.
Purpose of Data	Calculation of CCPR emission reduction
Comments	

Data / Parameter:	L
Data unit	Miles
Description	Length of damaged pavement
Equations	11
Source of data	Data derived from monitoring
Description of measurement methods and procedures to be applied	The data can be obtained from project records
Frequency of monitoring/recording	Once per project
QA/QC procedures to be applied	Cross-checking of reported mileage versus map distance to confirm quality measurement.
Purpose of Data	Calculation of CIR or FDR installation emissions
Comments	

Data / Parameter	LC
Data unit	
Description	Layer coefficient of FSB or asphalt emulsions
Equations	14
Source of data	Data derived from monitoring
Description of measurement methods	Layer coefficient can be obtained from project specifications

and procedures to be applied	
Frequency of monitoring/recording	Once per project
QA/QC procedures to be applied	Cross-checking of reported data versus DOT commonly used coefficients to confirm quality measurement.
Purpose of Data	Calculation of CCPR emission reduction
Comments	

Data / Parameter:	S
Data unit	Mph
Description	Running speed of cold recycler
Equations	11
Source of data	Data derived from monitoring project site
Description of measurement methods and procedures to be applied	The data can be obtained from project records
Frequency of monitoring/recording	Once per project
QA/QC procedures to be applied	Cross-checking of reported speed versus driver's log to confirm quality measurement.
Purpose of Data	Calculation of CIR or FDR installation emissions
Comments	

4 ASSESSMENT CONCLUSION

The SCS assessment team concludes that the Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, (Methodology v. 1.96) adheres to the methodology assessment criteria established for the second assessment. SCS concludes without qualifications or limitations that the Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, (Methodology v. 1.96) meets the requirements of the VCS Program Guide, VCS Standard, VCS Guidance Standardized Methods, and the VCS Methodology Approval Process. As a result, SCS recommends that VCSA approve the methodology as prepared by GRR.

5 REPORT RECONCILIATION

This section is not applicable for this draft second assessment. If the methodology is further revised as a result of the first assessor's response to revisions that were made during this second assessment a brief summary and assessment of the revisions made during the reconciliation process will be provided in this section.

6 EVIDENCE OF FULFILMENT OF VVB ELIGIBILITY REQUIREMENTS

The following evidence of fulfilment of SCS' eligibility requirements is presented in accordance with Section 5.2 of the Methodology Approval Process.

SCS has completed ten project validations under ANSI sectoral scope 1 and 2 (fuel consumption, industrial processes). This methodology falls under Verra sectoral scopes 4 and 6 (Material Manufacturing and Construction), which fall under ANSI sectoral scopes 1 and 2, respectively. A summary of the first ten project validations performed by SCS is as follows:

Project and Project ID	Date validation report issued	Name of GHG program under which project registered
Giant Eagle Infra-Red Automatic Refrigerant Leak Detection Efficiency Project, VCS440	27 March 2013	Verified Carbon Standard
Improvement in Vehicle Efficiency at Crete Carrier, ACR207	24 Aug 2014	American Carbon Registry
Improvement in Vehicle Efficiency for Marten Transport, ACR204	24 Aug 2014	American Carbon Registry
SOU/UIC LEED Buildings Clean Energy Efficiency Group Project, VCS1436	30 June 2015	Verified Carbon Standard
University of Illinois Urbana-Champaign Campus Wide Clean Energy & Energy Efficiency Project, VCS1407	21 March 2016	Verified Carbon Standard
EOS HFC 310, ACR310	21 March 2016	American Carbon Registry
Replacement of SF_6 as a Cover Gas at US Magnesium, ACR261	3 April 2016	American Carbon Registry
Transformer Oil Reclamation Project, ACR223	29 July 2016	American Carbon Registry
University of Wisconsin Milwaukee Campus Wide Clean Energy & Energy Efficiency Project, VCS1675	29 August 2017	Verified Carbon Standard
Whirlpool HFO Amana 362, ACR362	21 March 2018	American Carbon Registry

The identity and role of the VCS experts utilized in the course of the assessment are described in Section 2.4 of this report.

7 SIGNATURE

Signed for and on behalf of:

Name of entity:	SCS Global Services
Signature:	
Name of signatory:	Christie Pollet-Young
Date:	29 June 2018

APPENDIX A

The following tables include all findings issued during the course of the methodology assessment. It should be noted that all language under "Project Personnel Response" is a verbatim transcription of responses provided by the methodology developer.

NCR 1 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 5

Finding: Please clarify "GHG emission reductions for producing FSB and asphalt emulsions versus HMA are as follows:

• Consists of 50% of liquid asphalt/bitumen by weight and 2.5% of asphalt/bitumen by volume required for HMA production reducing the reliance on resources

Project Personnel Response: Updated sentence for clarity to show that the percentages represent 50% and 2.5% less material used in FSB and asphalt emissions than in HMA.

Please note that page numbers are slightly different due to updating T/C after formating Section 8 equations.

Auditor Response: The clarification explaining the percentages of materials is sufficient. The finding is closed.

NCR 2 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 5

Finding: Please clarify ". Emission reductions of FSB and asphalt emulsions are the differences of actual project emission and the performance benchmark.

Project Personnel Response: Added the word "between" to show that the emissions reductions are based on the differences between the project emissions and the performance benchmark (HMA emissions).

Auditor Response: The clarification of the approach to the calculation is sufficient. The finding is closed.

NCR 3 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 7

Finding: Please clarify the project types both new and patching projects. "1. Project activities include the construction of all types of roads and parking lots (patching projects) in the United States " This implies only patching projects for parking lots.

Project Personnel Response: Updated to state both parking lots and parking lot patching projects.

Auditor Response: The expanded explanation is appropriate and sufficient. The finding is closed.

NCR 4 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P.7

Finding: Please clarify and expand the explanation of why "Maintenance and excavation of the new pavements are not included due to the high variability of practices in each region. "

Project Personnel Response: Depending on whether the emphasis is on repairing distresses or preventing them before they happen, maintenance can involve different approaches and are associated with different GHG emissions. The emission differences cannot be captured until the maintenance activities have been done. As the structural performance of FSB is comparable to the baseline HMA method, the frequency of pavement maintenance should be roughly the same (this has been confirmed by Ruby Canyon). There should not be significant difference of post-installation emissions between project and baseline scenarios. Please see the changes on page 8.

Auditor Response: The explanation and modifications are sufficient and add clarity to the methodology. The finding is closed.

NCR 5 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 8 onward

Finding: Please add references for all figures and tables beginning on p. 8.

Project Personnel Response: All original drawings are created by the authors. all materials with citation are original by default.

Auditor Response: The explanation is sufficient. The finding is closed.

NCR 6 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 10

Finding: Table 2, please explain why methane and nitrous oxide are excluded.

Project Personnel Response: As the emissions of CH4 and N2O are minimal in pavement projects, these emission sources are excluded from project boundary. The exclusion of these emissions were suggested and confirmed by Ruby Canyon (please refer to their comment CL 3)

Auditor Response: The first assessment reference was cross-checked and found complete. The explanation is sufficient. The finding is closed.

NCR 7 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 13

Finding: Please clarify "This can, then, be understood as the process of manufacturing HMA being uniform throughout the country irrespective of the mix designs"

Project Personnel Response: Details were added to this sentence to break down the argument that HMA production is similar throughout the country.

Auditor Response: The expanded explanation is appropriate and sufficient. The finding is closed.

NCR 8 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 14 top

Finding: In this page and in Appendix A, the survey information is not clearly provided. Some background and more detail would clarify the process. A sample of HMA producers and projects are surveyed to represent the sectoral emission performance and determine performance benchmarks.

Project Personnel Response: More detailed information about the surveyed projects have been added to Appendix A. Please see the changes on page 35 and page 14 (footnote).

Auditor Response: The additional and more detailed information adds to the clarity of the methodology. The finding is closed.

NCR 9 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 14 middle

Finding: Please clarify ' Projects that emit less than the predetermined benchmark are determined to have additionality. ' A project eitehr meets the requiremets to be additional or not, it does not 'have' additionality.

Project Personnel Response: Sentence rephrased to avoid using the term "have additionality"; instead stating how a project meets the requirements of additionality.

Auditor Response: The revised explanations are sufficient and add clarity. The finding is closed.

NCR 10 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 14 middle

Finding: Please clarify' The Additionality additionality performance benchmark changes over time. This changing trend is decided in the following way: use of recycled raw materials saves significant GHG by eliminating the emissions from mining, processing, and transporting crushed stone and bitumen binder. According to NAPA (2012), when the use of RAP increases by 1 t, 10kg emission can be avoided accordingly. As such, if the percentage of RAP increases by 1%, 0.1kg emission can be avoided for producing 1t HMA. Also according to NAPA (2017), the use of RAP in HMA is expected to increase by 1.1% every year. Therefore, the performance benchmark decreases by 0.1kgCO2e/t annually."
This explanation is not specific enough to understand how the benchmark is recalculated every year. And will the methodology be updated with a new benchmark? Other methdologies rely on publicly available benchmarks.

Project Personnel Response: This paragraph has been rephrased to make it easier to understand. Please see the change on page 15.

Auditor Response: The revisions are sufficient and add clarity about the importance of certain information. The finding is closed.

OBS 11 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 17 and 18

Finding: The footnotes contain important information and add to the clarity of the calculation methodology. Please consider including the footnotes in the text.

Project Personnel Response: Include the footnotes in the text and removed the footnotes.

Auditor Response: The revision to include the pertinent information in the text ensures notice for project developers and adds clarity. The finding is closed.

NCR 12 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 19

Finding: Please clarify the equation format for Equation 11 and other equations(18-26 as an example). They are not formatted in the same manner as the other equations and do not use the equaitoin editor.

Project Personnel Response: Equation 11 has been reformatted to be consistent with other equations. Please see the change on page 19. In addition, Equations 18-26 have been formatted with the equation editor.

Auditor Response: The revisions are sufficent and add consistency to the document. The finding is closed.

OBS 13 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 19

Finding: The units throughout the document are mixed between SI and English units. VCS only requires CO2 be in metric tons. Consider consistency throughout. E.g. gal(liters) could be included as an option.

Project Personnel Response: Change to english units. Confirmed that document throughout was consistent with English units.

Auditor Response: The revisions are sufficent and add consistency to the document. The finding is closed.

NCR 14 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 22

Finding: Please clarify 'Section 9.3 outlines some techniques for outlier treatment. ' Section 9.3 discusses the moitoring plan and does not discuss statistical treatment of the data. A discussion of data treatment could be included as an appendix.

Project Personnel Response: The description of outlier treatment was removed from the methodology as suggested by Ruby Canyon. This sentence has been changed to "Section 9.3 describes a general guidance for collecting and reporting all data and parameters listed in Section 9.2". Please see this change on page 22.

Auditor Response: The first assessment comments were reviewed and the explanation is sufficient. The finding is closed.

NCR 15 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 22, justification

Finding: Please only include relevant factual information 'CMUGDI (2008) is comprised of national economic input-output models and publicly available resources use the emission data. The input-output models are powerful in material emission calculation because they account for material emissions as well as all the relevant upstream emissions. They have been accessed over 1 million times by researchers or business users. '

Project Personnel Response: As suggested, we revised the sentences and only kept relevant factual information. Please see the changes on pages 23 and 26.

Auditor Response: The revisions are sufficient and add clarity to the document. The finding is closed.

NCR 16 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 22, justification

Finding: Th efinding worksheet was sent with this empty box - an error. We agreed to leave it here and not go through re-numbering since the client had completed the Client Sheet.

Project Personnel Response:

Auditor Response:

NCR 17 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 24, CF justification

Finding: CF Justification - please provide references 'Three out of ten projects were selected for a manual assessment of the utilization rate of each individual piece of equipment. '

Project Personnel Response: We personally observed the three projects on site to count the effective operation time of each piece of equipment. We didn't refer to any publications for that information. The sentence you mentioned has been rephrased to make it clearer. Please see the change on page 24.

Auditor Response: The enhanced explanation adds clarity and specificity. The finding is closed.

NCR 18 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 34

Finding: Please clarify the and specify the data used in Appenidx A. What years were the data collected and in what states. Table A-4 lists highways, but is not clear. The appendix should be a accurate and clear as possible.

Project Personnel Response: Baseline emissions for roadways are generated from the Project Emission Estimator (PE-2). PE-2 collected and organized construction and rehabilitation data from 11 MDOT HMA pavement, re-construction, rehabilitation, and maintenance projects throughout the State of Michigan in 2011, which has been added on page 38. Baseline emissions for parking lot projects are based on the survey of sixteen plants and ten projects from Maryland, Virginia, and Pennsylvania in 2013. More detailed information about the survey data has been added in Appendix A on page 35.

Auditor Response: The additional and more detailed information adds to the clarity of the methodology. The finding is closed.

NCR 19 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 37

Finding: The following URL was not functional: 'http://www.construction.mtu.edu/cass_reports/webpage/inventory.php'

Project Personnel Response: This link was functional when Ruby Canyon reviewed this methodology, but it doesn't work now. Therefore, we removed this link from the methodology.

Auditor Response: The finding is closed.

NCR 20 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 38

Finding: Please clarify ' Given the sampled projects approximate a normal distribution, the performance benchmark should be 121.9 kgCO2e/t HMA (equals to μ- 0.84σ) for HMA projects (< 40mi), which is illustrated in Figure 5. The performance benchmark is 142.4 kgCO2e/t HMA for HMA projects (>40mi). Data has been provided and analyzed. The narrative should be more specific.

Project Personnel Response: The calculation follows a standard cumulative distribution function using normal distribution mean and standard deviation.

Auditor Response: The explanation is sufficient. The finding is closed.

NCR 21 Dated 25 Apr 2018

Standard Reference: VCS Standard, Version 3.7, 21 June 2017

Document Reference: Use of Foam Stabilized Base (FSB) and Emulsified Asphalt Mixtures in Pavement Application, v1.9 P. 38

Finding: Please clarify the following sentences ' Throughout the country, HMA production is being done in the same way with the exception of differences in additives, such as crumb rubber, polymers, antistripping agents etc. (Mundt DJ et.al, 2009). This can be understood as the process of manufacturing HMA being the same throughout the country irrespective of the mix designs.

Project Personnel Response: Details added to this sentence to break down the argument that HMA production is similar throughout the country.

Auditor Response: The explanation adds clarity to the methodology. The finding is closed.