

Minnesota DOT EPD Pilot Project: Development of a Sustainable Procurement Roadmap

Amlan Mukherjee, Principal Investigator
Michigan Tech Transportation Institute

September 2019

Research Project
Final Report 2019-39

To request this document in an alternative format, such as braille or large print, call [651-366-4718](tel:651-366-4718) or [1-800-657-3774](tel:1-800-657-3774) (Greater Minnesota) or email your request to ADArequest.dot@state.mn.us. Please request at least one week in advance.

Technical Report Documentation Page

| | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1. Report No. MN/RC 2019-39 | | 2. | | 3. Recipients Accession No. | |
| 4. Title and Subtitle Minnesota DOT EPD Pilot Project: Development of a Sustainable Procurement Roadmap | | | | 5. Report Date September 2019 | |
| | | | | 6. | |
| 7. Author(s) Amlan Mukherjee, Lianna Miller | | | | 8. Performing Organization Report No. | |
| 9. Performing Organization Name and Address Michigan Tech Transportation Institute, Lakeshore Center, 1400 Townsend Drive, Houghton, MI 49931 Trisight, LLC, 101 W. Lakeshore Dr., Houghton, MI 49931 | | | | 10. Project/Task/Work Unit No. | |
| | | | | 11. Contract (C) or Grant (G) No. 1003321, WO #2 | |
| 12. Sponsoring Organization Name and Address Minnesota Department of Transportation Office of Research & Innovation 395 John Ireland Boulevard, MS 330 St. Paul, Minnesota 55155-1899 | | | | 13. Type of Report and Period Covered Final Report | |
| | | | | 14. Sponsoring Agency Code | |
| 15. Supplementary Notes http://mndot.gov/research/reports/2019/201939.pdf | | | | | |
| 16. Abstract (Limit: 250 words) The Minnesota Department of Transportation (MnDOT) funded this project to assess the current state of Environmental Product Declarations (EPDs) in pavement material manufacturing and the feasibility of their inclusion in the pavement procurement process in the state of Minnesota. As EPDs have only recently become available, their readiness and suitability for project procurement is currently under consideration. Specifically, this project intended to educate stakeholders regarding Life Cycle Assessment (LCA) and EPDs and co-develop an EPD Pilot Project implementation plan. This pilot project conducted two high-level stakeholder education and planning workshops. The stakeholders included both MnDOT staff that would administer an EPD program in the long term and industry organization representatives, key manufacturing representatives, and other individuals whose buy-in will be necessary for the project's success. The project developed a roadmap for the implementation of EPDs in procurement along with identification of barriers and challenges in doing so. | | | | | |
| 17. Document Analysis/Descriptors Environmental Product Declaration (EPD), pavement material manufacturing, life-cycle assessment (LCA) | | | | 18. Availability Statement No restrictions. Document available from: National Technical Information Services, Alexandria, Virginia 22312 | |
| 19. Security Class (this report) Unclassified | | 20. Security Class (this page) Unclassified | | 21. No. of Pages 18 | 22. Price |

MINNESOTA DOT EPD PILOT PROJECT: DEVELOPMENT OF A SUSTAINABLE PROCUREMENT ROADMAP

FINAL REPORT

Prepared by:

*Amlan Mukherjee, PhD, PE
Associate, Professor, Department of Civil & Environmental Engineering
Michigan Tech Transportation Institute*

*Lianna Miller
Partner, Trisight, LLC*

September 2019

Published by:

Minnesota Department of Transportation
Office of Research & Innovation
395 John Ireland Boulevard, MS 330
St. Paul, Minnesota 55155-1899

This report represents the results of research conducted by the authors and does not necessarily represent the views or policies of the Minnesota Department of Transportation, Michigan Tech Transportation Institute or Trisight. This report does not contain a standard or specified technique.

The authors and the Minnesota Department of Transportation do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to this report.

ACKNOWLEDGMENTS

Thank you to the following Technical Advisory Panel members:

- Curt Turgeon, MnDOT Office of Materials and Road Research
- Matt Zeller, CPAM
- Kevin Kosobud, MnDOT Construction & Innovative Contracting
- Fred Corrigan, Aggregate and Ready Mix Association of MN
- Timothy Sexton, MnDOT Transportation Planning
- Bob Simons, City of Bloomington
- Beth Klemann, MnDOT Research & Innovation

TABLE OF CONTENTS

| | |
|-----------------------------------------------------|-----------|
| CHAPTER 1: Introduction..... | 1 |
| 1.1 Benefits to Minnesota Taxpayers | 1 |
| CHAPTER 2: Workshop Outcomes | 3 |
| 2.1 Workshop 1 Outcomes | 3 |
| 2.2 Workshop 2 Outcomes | 4 |
| CHAPTER 3: Roadmap Detail | 6 |
| CHAPTER 4: A Plan for Pilot of EPD Use | 8 |
| Additional Reading | 10 |
| APPENDIX A - Workshop Agendas..... | 11 |

LIST OF TABLES

| | |
|-------------------------------------------------------------------------------------------|---|
| Table 3.1: Resources available to support the implementation of EPDs for procurement..... | 6 |
| Table 3.2: Leading drivers for the implementation of EPDs for procurement | 7 |

LIST OF FIGURES

| | |
|-------------------------------------------------|---|
| Figure 4.1: Recommended Roadmap for MnDOT | 9 |
|-------------------------------------------------|---|

EXECUTIVE SUMMARY

This project assesses the current state of Environmental Product Declarations (EPDs) in pavement material manufacturing and the feasibility of their inclusion in the pavement procurement process in the State of Minnesota. As EPDs have only recently become available, their readiness and suitability for project procurement is currently under consideration. Specifically, this project intended to educate stakeholders regarding Life Cycle Assessment (LCA) and EPDs and co-develop an EPD Pilot Project implementation plan.

This pilot project conducted two high-level stakeholder education and planning workshops. The stakeholders included both MnDOT staff that would administer an EPD program in the long term and Industry organization representatives, key manufacturing representatives, and other individuals whose buy-in will be necessary for the project's success. The project developed a roadmap for the implementation of EPDs in procurement along with identification of barriers and challenges in doing so.

CHAPTER 1: INTRODUCTION

Environmental Product Declarations (EPDs) play a role in design, procurement, and management of pavement systems. As EPDs have only recently become available, their readiness and suitability for project procurement is currently under consideration.

In this pilot project we assessed the current state of EPDs in pavement material manufacturing and the feasibility of their inclusion in the pavement procurement process in the State of Minnesota. The objectives of this project were to:

1. Educate stakeholders regarding Life Cycle Assessment (LCA) and Environmental Product Declarations (EPDs) and co-develop an EPD Pilot Project implementation plan
2. Evaluate the state of affairs, challenges and opportunities in using EPDs in sustainable procurement in Minnesota
3. Develop a roadmap of that Minnesota DOT can use to identify strategies for integrating the use of EPD into sustainable procurement.

Two tiers of stakeholders were included in this project: Tier 1: MnDOT staff that would administer an EPD program in the long term, and Tier 2: Industry organization representatives, key manufacturing representatives, and other individuals whose buy-in will be necessary for the project's success. Two high-level stakeholder education and planning workshops were conducted to educate stakeholders and plan the next project phase. The first workshop focused on Tier 1 stakeholders. The second workshop focused on Tier 1 and Tier 2 stakeholders. The outcomes of this work are as follows:

1. Educational material (information briefs and slides)
2. Identification of barriers and challenges in integrating EPDs into sustainable procurement
3. A roadmap for implementation and next steps.

1.1 BENEFITS TO MINNESOTA TAXPAYERS

This study will help MnDOT to proactively assessing the feasibility of using EPDs in the pavement procurement process. It lays the foundation for developing a system that takes advantage of the knowledge already gathered in this topic. Notably there are resources developed by the FHWA Sustainable Pavements Technical Working Group (SPTWG). In addition, there are experiences that peer institutions have had into the area. For example the Buy Clean Act (2017) in the State of California, has led to the development of infrastructure and processes to integrate the use of EPD in the procurement process. Similarly, Oregon Department of Environmental Quality have implemented a plan to support contractors in the use of EPD for concrete materials in the procurement process.

Learning from these experiences will help develop an approach that is uniquely suited for the context of Minnesota. It will help avoid the exposing MnDOT to risk from future changes, while ensuring that the most innovative processes are identified. This is important as the drivers of change in Minnesota are already there, including the Governor's Executive Order 17-12 "Directing State Agencies to Conserve Energy and Water, and Reduce Waste to Save Money," 2018; and the recently introduced Minnesota Bill HF2203 "Buy Clean Minnesota Act," 2019; and Minnesota Bill HF2204 "Maximum Acceptable Global

Warming Potential,” 2019. These efforts point to the eventual adoption of EPDs or similar LCA based instruments to inform the procurement process.

CHAPTER 2: WORKSHOP OUTCOMES

2.1 WORKSHOP 1 OUTCOMES

Workshop 1 focused on Tier 1 stakeholders, i.e. stakeholders internal to MnDOT, including pavement design and construction engineers and managers responsible for procurement and environmental decision-making. Representatives from FHWA Mn Division Office and Office of Infrastructure were also present. The agenda for the meeting can be found in *Appendix 1*. The workshop focused on providing educational resources and introducing attendees to the fundamentals of LCA and the use of EPDs in the pavement industry. Once the attendees were familiar with the topics, during the afternoon session an interactive activity was conducted. It included a guided discussion to identify stakeholder opportunities and challenges, of creating a draft roadmap for EPD usage in pavement procurement in Minnesota.

The following questions were used to seed brainstorming and discussion:

1. How do you envision the use of EPDs in design/procurement/construction (or your area of expertise)?
2. What are the current barriers to using EPDs within MnDOT?
3. What are the immediate opportunities that will facilitate the use of EPDs within MnDOT?
4. What are the long-term opportunities that will facilitate the use of EPDs within MnDOT?

The brainstorming and discussion identified several strategies and potential guidelines for moving forward with evaluating EPD use in pavement procurement in Minnesota.

The summary of the discussion is as follows:

- MnDOT and the pavement industries are leading the way in EPD development and should therefore drive the development of the EPD process rather than being driven by a legislative push.
- To begin the process, EPD use should be piloted simply as a data collection tool, without driving any decisions. This concept of data collection without value judgements must be very clearly communicated to industry stakeholders.
- Once beyond the data collection phase, EPDs should not drive pavement selection between different industries, but could be used to drive specific mix selection within a given pavement type.
- Several challenges exist in selecting the appropriate step within the pavement procurement process to collect EPDs, including what database resources and administrative support would be necessary to collect and store the documentation.
- Best value procurement (BVP) was discussed as a way to include EPDs but ultimately identified as being too early stage for inclusion in BVP.
- The ICE (Infrastructure carbon estimator) tool from FHWA was discussed as a potential complementary tool to any EPD collection process. The ICE tool is being used by Minnesota to provide annual updates to emissions estimates. EPDs could be used to support these estimates; this would be a topic of study in an EPD pilot study. This was marked as a topic for analysis prior to the second workshop.

- Education is a crucial need to attain buy in from industry partners. Since EPDs are not currently required, industry awareness in some areas is low, and any use of EPDs will need to clearly identify the benefits to industry.
- Within MnDOT, a committee would need to be formed to provide leadership and drive towards long term acceptance of any EPD program. Additionally, the decentralized nature of MnDOT will require an internal education plan to inform and include city and county engineers and administrators.
- The Approved Product List (APL) initiative was identified as a model of an internally led initiative. A similar approach to committee creation and championing was recommended for EPD use.

The workshop ended by identifying external stakeholders to include in the second workshop.

2.2 WORKSHOP 2 OUTCOMES

The second workshop focused on Tier II, i.e. external stakeholders including contractors and construction materials industry stakeholders. The goals of the meeting were as follows:

- Develop an applied understanding of LCA and EPD
- Review the current state of the art and practice in the pavements industry
- Identify process for using EPD in procurement
- Create draft timeline for Phase 2 & identify potential participants
- Create a roadmap for Minnesota

The agenda for the meeting has been provided in *Appendix 2*. The morning session focused on educational activities including a brief introduction to LCA and EPD. In addition, a peer experience exchange activity was conducted for the stakeholders to learn from the experiences of other agencies. Jackie Wong and Deepak Maskey from Caltrans provided their perspectives on the experience of Caltrans in adapting to the requirements of the Buy Clean Act (2017). Jordan Palmeri from the Oregon Department of Environmental Quality (DEQ) presented experiences with providing support to the concrete industry regarding EPDs. The presentations are part of this deliverable.

The afternoon session was interactive and was driven by group discussions. The following questions were used to seed the discussion. The responses of the discussion have been classified as responses to each of the questions, as follows.

At what point in the construction process do you see EPDs being required?

- Start with using EPDs as available information before decision is made
- Collect up front as estimate and have an "as-built"
- With mix design
- During the pre-qualification phase
- Before construction starts, but not at bidding
- Post construction.

How should EPDs be included in contracts?

- As incentives and/or through alternative contracting methods

- Add points to a technical score in design/bid
- Use for information purposes to support decision-making
- Develop partnerships between contractors and DOT as in the case of Oregon.

What would be appropriate between facility-specific EPDs participating in an industry average EPDs?

- Use plant specific EPDs instead of industry average as all industries do not have an average yet. Industries with industry averages are prepared to use industry averages.
- Ensure that there are accommodations for small operations, so that they are treated fairly
- Use them as an incentive with closeout document
- Provide numbers that can be used meaningfully in decision-making (“relatable”: provide context for what the savings/reduction in environmental impacts indicate/signify).

What aspects should be highlighted when communicating the use of EPD in procurement to potential participants?

- Identify goals of program
- Contractors are interested but need help in adapting – a few case studies may be helpful
- Ensure that all the information is uniformly available to all participants at the same time
- Avoid explicit or implicit comparisons between pavement types
- Industry/MnDOT must be aware and prepared for when it is mandatory, and work together on messaging and communication
- Avoid requiring EPDs through legislation as it can reduce the potential creativity of solutions.

Additional questions raised in the discussion:

- If a *Special Provision* is used to integrate EPDs into contracts, how would it be drafted?
- How to meaningfully include contractors in implementing any efforts at using EPDs in procurement?
- What is the appropriate benchmarking values if EPD benchmarks are used?
- What unintended consequences, such as changes in the supply chain, can impact this effort?
- How to develop appropriate balance and tradeoffs between reported impact categories, when EPDs are used in decision-making?

Based on these discussions a roadmap for moving ahead was prepared. It is discussed in the next section.

CHAPTER 3: ROADMAP DETAIL

The proposed roadmap is a recommendation for MnDOT to consider adopting for the implementation of EPDs in procurement. It is based on the understanding arrive at from the workshops conducted. Broadly speaking, the foundational components of the roadmap are as follows:

Background Knowledge: Table 3.1, establishes the resources and references that are available to MnDOT to build upon.

Drivers: Directives and Starting Points: Table 3.2 provides the primary directives and legislative drivers necessitating this enquiry. They lay the foundation as they provide the objectives of the roadmap.

Knowledge gaps: The knowledge gaps are related to yet to be resolved technical issues. These include questions regarding the appropriateness of the underlying databases being used to develop EPDs and conduct the supporting LCAs. This includes the development of process maps for pavement LCAs as well as mapping of unit LCA processes to available publicly accessible databases. In the context of MnDOT, this work will be conducted as a case study for an already ongoing FHWA project.

Based on these components a timeline is being recommended for implementing a pilot plan to evaluate the most effective way to integrate EPDs into sustainable decision-making for MnDOT.

Table 3.1: Resources available to support the implementation of EPDs for procurement

| Resources & References | Description |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Asphalt EPD Program: National Asphalt Pavement Association Emerald Eco-Label EPD software tool | https://asphaltpd.org/about/ |
| Concrete Ready Mix EPD Program: National Ready Mix Concrete Association EPD software Tool | https://www.nrmca.org/sustainability/EPDProgram/ |
| Aggregate EPD Program: Also provided within the National Ready Mix Concrete Association EPD software tool. | https://www.nrmca.org/sustainability/EPDProgram/ |

| | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FHWA Pavement LCA Framework | https://www.fhwa.dot.gov/pavement/sustainability/hif16014.pdf |
| ISO 14025 Environmental Labels and Declarations – Type III Environmental Declarations – Principles and Procedures. | https://www.iso.org/standard/38131.html <i>ISO is the International Standards Organization</i> |
| ISO 21930 Sustainability in Buildings and Civil Engineering Works – Core Rules for Environmental Product Declarations of Construction Products and Services. | https://www.iso.org/standard/61694.html <i>ISO is the International Standards Organization</i> |
| EN 15804 Sustainability of construction works, Environmental product declarations, Core rules for the product category of construction products | https://www.usgbc.org/resources/en-15804%E2%80%942012-sustainability-construction-works-environmental-product-declarations-core-ru <i>EN denotes a European Standard</i> |
| Peer Experiences | Caltrans, Washington, Oregon |

Table 3.2: Leading drivers for the implementation of EPDs for procurement

| Drivers: Directives | |
|----------------------------------|------------------------------------------------------------------------------------------------|
| Minnesota Bill HF2203 | “Buy Clean Minnesota Act”, 2019. |
| Minnesota Bill HF2204 | “Maximum Acceptable Global Warming Potential”, 2019. |
| Governor’s Executive Order 17-12 | “Directing State Agencies to Conserve Energy and Water, and Reduce Waste to Save Money,” 2018. |

CHAPTER 4: A PLAN FOR PILOT OF EPD USE

A plan for MnDOT to integrate EPDs into existing business practices in each stage of the project lifecycle would require the following:

- Identify risks and rewards for internal and external stakeholders
- Communicate ways in which EPDs are likely to be used (e.g., as a tool for mixture selection rather than pavement design selection)
- A timeline and for Phase 2 would include the following steps

Step 1: Implement Plan for Pilot of EPD Use (Proposed Phase 2)

This implementation will reflect the outcomes of Phase 1, and will include actions items such as:

- Create a baseline by piloting EPDs with small number of contractors
- Create initial EPD repository or database
- Create data management and process flow
- Identify mechanisms to include EPDs in contracts and specifications
- Identify administrative infrastructure for the program (who will collect EPDs?)
- Include distributed MnDOT jurisdictions and districts (counties and cities)
- Develop educational plan and materials for contractors to develop capacity
- Assess inclusion of EPDs in Approved Product List (APL) system
- Assess inclusion in Best Value Procurement (BVP) Process
- Assess inclusion in specifications

Step 2: Identify Potential Impact on External Business Contractor Practices by Piloting EPD Use

- Pilot use of EPDs with small number of contractors
- Identify early partners for pilot study
- Quantify cost to create EPD
- Identify benefits to contractors
- Establish disclosure rules

Step 3: Establish How EPDs Will Be Used in Future

- Codify outcomes of pilot study
- Baseline of environmental impacts
- Evaluate integration potential within MnDOT / other agencies
- Integration with cradle-to-gate MnDOT systems
- Balance with other procurement processes – e.g. pollution control agency has an interest
- Data verification requirements to meet Code of Federal Regulations
- Determine program vs. project level interactions
- Identify benefits from partners

- Consider evaluating environmental impacts. Select categories for evaluation.

Each of these steps will explicitly consider the organizational questions involved in implementing EPDs in the procurement process. Figure 4.1 sketches the recommended roadmap.

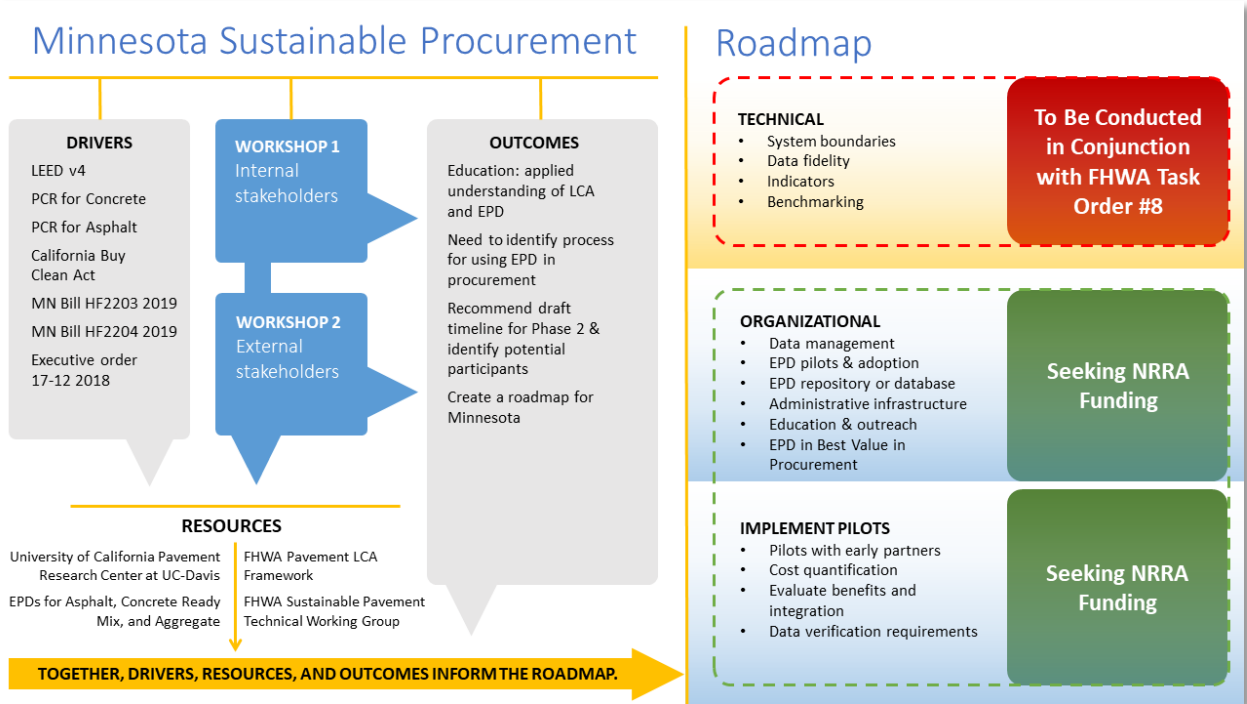


Figure 4.1: Recommended Roadmap for MnDOT

CHAPTER 5: ADDITIONAL READING

[FHWA Pavement Life Cycle Assessment Framework](#)

[State of Minnesota Executive Order 17-12](#)

[Minnesota Bills HF2203](#) and [HF2204](#)

APPENDIX A
WORKSHOP AGENDAS

STAKEHOLDER WORKSHOP 1 AGENDA

September 21, 2018
MnDOT Training Center
Arden Hills, MN

GOALS

- Develop an applied understanding of LCA and EPD
 - Review fundamentals of LCA, PCR and EPD
 - Discuss functional unit, allocation and comparability of EPD and LCA results
 - Review the current state of the art and practice in the pavements industry
- Identify challenges and opportunities for using EPD in procurement
- Identify Tier 2 stakeholders
- Create a roadmap for Minnesota

SCHEDULE

| Session #: | Time | Topic |
|------------|---------------------|-------------------------------------------------------------|
| S0 | 8:00 am – 9:45 am | Introductions & procurement overview |
| S1 | 8:45 am – 9:15 am | Fundamentals of LCA, PCRs, EPDs |
| S2 | 9:15 am – 9:45 am | Current state of EPDs in pavements |
| S3 | 10:00 am – 11:30 am | Brainstorming session: EPDs & materials procurement |
| | 11:30 am – 12:30 pm | Lunch |
| S4 | 12:30 pm – 1:30 pm | Applying results of brainstorming session |
| S5 | 1:30 pm – 2:30 pm | Identification of Tier 2 Stakeholders, next steps & wrap-up |

STAKEHOLDER WORKSHOP 2 AGENDA

March 22, 2019

MnDOT Central Office, Transportation Building B27 and B37
395 John Ireland Boulevard, Saint Paul, MN 55155

GOALS

- Develop an applied understanding of LCA and EPD
- Review the current state of the art and practice in the pavements industry
- Identify process for using EPD in procurement
- Create draft timeline for Phase 2 & identify potential participants
- Create a roadmap for Minnesota

SCHEDULE

| <i>Session #:</i> | <i>Time</i> | <i>Topic</i> |
|-------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| S0 | 8:00 am – 9:00 am | Fundamentals of LCA, PCRs, EPDs |
| | | |
| | | <i>Resources for contractors</i> |
| S1 | 9:00 am – 9:40 am | Concrete EPD Program Brian Killingsworth, Executive Vice President, NRMCA |
| S2 | 9:40 am–10:20 am | Asphalt Mixtures EPD Program Joseph Shacat, Director of Sustainable Pavements, NAPA |
| | | |
| | | <i>Current state of EPDs in pavement procurement:</i> |
| S3 | 10:30am–11:15 am | Efforts at the Oregon Department of Environmental Quality Jordan Palmeri, Materials Management Program Oregon Department of Environmental Quality |
| S4 | 11:15 am – Noon | Buy Clean California Act and Efforts at Caltrans Jacquelyn Wong, Materials Engineering and Testing Services, and Deepak Maskey, PMPC Single Focal Point Pavement Program, Caltrans |
| | | |
| | Noon – 12:30 p.m. | Lunch |
| S5 | 12:30 – 1:30 pm | Breakout groups |
| S6 | 1:30 – 2:30 pm | Identification of Tier 3 stakeholders, next steps & wrap up |