

Discussion Items

CP Road Map Concrete Pavement Sustainability Track

Background

Five years ago when the CP Road Map was developed, the authors struggled to determine whether or not sustainability/environmental issues were suitable for Track status or whether these considerations should be included within each track as appropriate. It was decided at that time that environmental considerations were everyone's job and were thus considered under each of the 12 Tracks.

With the increase in national and international emphasis on sustainability and the environment, the CP Road Map Executive Committee designated the advancements in concrete pavement sustainability and the environment as a full track on September 11, 2007. They believed this topic deserved Track Status to examine in a holistic fashion how the design, materials, construction, operation, maintenance, restoration, rehabilitation, and recycling of concrete pavements can be made to be more economically, environmentally, and socially sound. This Executive Committee decision requires a planned structured and collective approach to accelerate and consolidate efforts through the CP Road Map process. It is proposed to call the new track the "Concrete Pavement Sustainability Track".

This document presents preliminary thoughts on the Track Vision and Objective, and includes milestones, initial thoughts on quantifying sustainability, and some initial projects that can be immediately implemented. It is emphasized that this document reflects the initial thoughts of the Leadership Group and it will continue to be developed and refined by them into a framework that will reflect the challenges and opportunities facing the industry.

"Sustainability," in this context, is considered to be the use of materials and practices in concrete pavement construction, operation, maintenance, restoration, rehabilitation, and recycling that reduces life cycle costs with an improved environmental footprint by reducing the use of non-renewable resources, the pollutants generated, and energy consumed, while increasing the benefits to society.

Track Vision: To identify, quantify and implement characteristics of concrete pavements that lead to greater sustainability in terms of economic, environmental, and societal needs.

Track Objective: To identify and complete research and implementation that improves concrete pavement sustainability through the pavement's life cycle (design, construction, operation, maintenance, restoration and recycling). Work may include developing:

- Materials and processes that have the potential to measurably reduce waste, energy consumption, water usage, and pollutants during all phases of the pavement's life cycle.
- Quantification data and techniques using life cycle analysis that can be used to examine the sustainability of a pavement.

- Strategy selection criteria to assist in the decision making process, allowing various alternatives to be considered,
- Condition monitoring methods that will help better understand how the pavement is performing, assisting in the timely application of maintenance, restoration, and rehabilitation treatments to extend pavement life,
- Innovative designs that make full use of the versatility of concrete as a paving material to improve pavement sustainability.
- Innovative maintenance, restoration, and rehabilitation processes.

Work in this track is to be conducted in collaboration with overlapping efforts being addressed under other tracks in the CP Road Map.

Milestones

The following milestones are proposed for 2008 to ensure that the new track is able to proceed:

- Identify a group of influential stakeholders in the concrete pavement materials, design, construction, environmental, and sustainability arena to create the Track Leadership Group. Individuals currently under consideration come from organizations including the U.S. Environmental Protection Agency (representing the Green Highway Partnership), Federal Highway Administration, State departments of transportation, the American Coal Ash Association, the Slag Cement Association, the Recycled Materials Research Center, the National Ready Mix Concrete Association, the Portland Cement Association, the American Concrete Pavement Association, the Concrete Pavement Tech Center, American Public Works Association, as well as representatives from academe and the materials and construction industry.
- Once the Track Leadership Group is formed, a first meeting will be held to begin discussion of important issue related to concrete pavement sustainability and begin preparation of the outline for the Track Framing Document.
- The Track Leadership Group will also identify a number of priority projects that will be used to jump start the environmental/sustainability track framework prioritization program.
- Hold a second Track Leadership Group meeting (1 to 2 days) to fully establish the priority framework for the environmental/sustainability track.
- Interface with researchers, research institutions, and sponsors of research to establish a collaborative research program that initiates research projects in accordance with the framework document and improves the efficiency of research expenditures for environmental projects.

Initial Thoughts on Quantifying (Measuring) Concrete Pavement Sustainability

One of the most critical challenges before us is to understand how to quantify economic, environmental, and societal benefits and impacts of various engineering solutions. There is a need to develop a quantification process that is robust and unbiased, allowing the identification of desirable solutions while creating the synergy needed to promote these solutions. It must also be flexible enough to allow for the consideration of a broad category of alternatives, including those that contain innovative features. The quantification process does not assume that one

strategy is better than another, but allows comparison of one type of solution to another over a broad range of economic, environmental, and societal factors.

The Concrete Pavement Sustainability Track therefore needs to address the following quantifying gaps:

- Develop a better understanding and establish ways to quantify impacts of various concrete pavement strategies so that different scenarios can be compared economically, environmentally, and socially versus a baseline standard. This includes the need for the parameters to be measured are selected, and methodologies to quantify them are standardized.
- Develop a better understanding and quantify the environmental factors related to the concrete pavement design, specification and purchasing process, material selection, acquisition, transport, mixing, construction, maintenance, rehabilitation, and terminal life of products and materials through the entire life-cycle as part of a full and integrated system.
- To the degree possible, develop a better understanding and quantify the social factors related to the concrete pavement design, specification and purchasing process, material selection, acquisition, transport, mixing, construction, maintenance, rehabilitation, and terminal life of product and materials, as part of a full and integrated system.
- Quantify the various inputs into the sustainability assessment and ensure that the variability of the inputs is incorporated into the model.
- Conduct scenario analyses that compare alternative strategies using a broad range of environmental and societal considerations and identify technologies that might be used to improve sustainability based on these analyses.

It is clearly recognized that the quantification methodology needs to address more than life cycle costs, looking beyond initial, maintenance, restoration, and rehabilitation costs including factors such as user costs and salvage/recycling value. In addition, construction factors that might be considered include embodied energy (both primary and feedstock), global warming potential, water (use, reuse, and treatment), noise, airborne particulate, emissions, societal disruption, etc. Further, other environmental and social factors could also be considered including tire-pavement noise, reflectivity (for lighting and urban heat), vehicular fuel consumption, treatment of air pollution, treatment of surface runoff using pervious pavement systems, etc. There is currently no consensus on how these multiple factors can or should be considered.

Other Important Considerations that Should Be Addressed

A number of other considerations exist in addition to those directly related to quantifying concrete pavement sustainability. These include:

- Establishing ways to provide incentives for the use of environmentally superior designs, materials, and processes. This should consider the governance issues that come into play to create a business model to ‘give credit’ for using more sustainable approaches for pavement design, materials, and processes.
- Provide communication and educational tools that will define concrete pavement sustainability in a clear, concise manner, educating decision makers, engineers, materials suppliers, and contractors to help them understand the linkage between economic, environmental, and societal issues.
 - Definitions of commonly used terms
 - Education about available practices that will reduce the environmental impact of pavements including CO₂ production, energy usage, raw materials usage, and pollutants generated (e.g. Hg)
 - Education about best practices and innovative approaches including materials, design, construction, maintenance, resoration, rehabilitation, and recycling as well as emerging innovations.
 - Methodologies that will allow inclusion of these practices into contracts and specifications.

Low Hanging Fruit (Initial Projects)

- 1) Develop of a Briefing Document for the various stakeholders (decision makers, engineers, material suppliers, and contractors) that defines sustainability and describes the current state-of-the-practice on implementing sustainable solutions today.
- 2) Develop a “Best Practices” training manual and implementation package for concrete pavement sustainability. This will provide detailed technical information to engineers, material suppliers, and contractors, having immediate and measureable impacts on improving the sustainability of concrete pavements.
- 3) Organize and conduct a conference on Sustainability of Concrete Pavements that addresses economics, environmental, and societal impacts, emerging technologies, and legislative/policy initiatives systematically so as to increase awareness of how the various factors interact.
- 4) Work with federal and state agencies to create Demonstration Projects that feature sustainable solutions and effectively communicate the successes of these projects.
- 5) Recommend a project to determine quantification needs for the implementation of a systems approach to consider and compare economic, environmental, and social impacts and benefits for various alternative strategies. This will be the first step in the creation of a “tool” to be used by practitioners in the sustainable design of concrete pavements.