

# MIT Life-Cycle Assessment Interim Report

## Answers to Frequently Asked Questions

What is the MIT Concrete Sustainability Hub?

The MIT Concrete Sustainability Hub is a research center established at MIT in collaboration with the Portland Cement Association (PCA) and Ready Mixed Concrete (RMC) Research & Education Foundation. The Hub was founded in October of 2009 with the mission of accelerating emerging breakthroughs in concrete science and transferring the best available data into engineering practices. The Concrete Sustainability Hub seeks to bring together leaders from academia, industry and government to facilitate the transfer of knowledge by aligning world-leading research with end-user needs.

What are the highlights of the study?

Some of the highlights include:

### Life-Cycle Assessment (LCA) of Highway Pavements

- For high-volume roads, the use phase of the life-cycle can account for up to 85% of carbon emissions.
- Potential for significant fuel efficiency savings for vehicles on concrete pavements over asphalt. These fuel efficiency savings could lead to substantially lower life-cycle CO<sub>2</sub> emissions.

### Life-Cycle Assessment (LCA) of Buildings

- Residential Buildings – More than 90% of the life-cycle carbon emissions are due to the use phase, with construction and end-of-life disposal accounting for less than 10% of the total emissions.
- Residential Buildings – Concrete structures built with insulated concrete forms (ICF) enjoy long-term operational energy savings of 20% or more over wood-framed buildings.
- Commercial Buildings – Concrete structures realize HVAC energy savings of between 5% and 6% annually over steel structures.

Who paid for this study?

This study was paid for by the MIT Concrete Sustainability Hub and its partners, the Portland Cement Association (PCA) and Ready Mixed Concrete (RMC) Research & Education Foundation. Initial funding from these collaborators will total \$10 million over a five-year period (2009-2014). The Portland Cement Association, based in Skokie, IL, represents cement companies in the United States and Canada. It conducts market development, engineering, research, education, and public affairs programs. The RMC Research and Education Foundation, based in Silver Spring, MD, is a non-profit organization that supports research and educational programs that will increase quality, professionalism, and environmental stewardship in the ready mixed concrete industry.

Does the fact that this study was funded by the concrete industry compromise some of the findings that favor concrete over alternative materials?

This study represents the best available data on building and paving materials from one of the world's preeminent institutions of higher learning. While funding for this research was provided by industry leaders, the mission of the MIT Concrete Sustainability Hub is and has always been to advance the

best science on concrete and similar building materials and to translate that data into innovative engineering and design practices to account for and ultimately mitigate the environmental and economic impact of these materials.

MIT is an equal partner in its collaborative efforts with industry leaders and the world-class researchers of MIT will always strive for results that reflect the highest standards of academic integrity.

Who conducted the day-to-day research on these studies?

All research was, is, and will be exclusively conducted by members of the MIT community. The findings to-date represent the work of faculty, students, and staff from five departments at the Massachusetts Institute of Technology (MIT). Professor John Ochsendorf, Co-Director of the MIT Concrete Sustainability Hub, oversaw the research efforts.

What makes this life-cycle assessment different from previous ones?

There have been numerous other life-cycle assessments released both in the U.S. and around the world. What will be unprecedented about this LCA is its extensive focus on the “use phase” of materials – the period between construction and demolition that makes up the actual in-use life of the road or building. Initial findings in the Buildings LCA have shown that more than 90% of the life-cycle carbon emissions from residential buildings are due to the operational phase, with construction and end-of-life disposal accounting for less than 10% of the total emissions. Initial findings in the Highway Pavements LCA have shown that for high-volume roads, the use phase of the life-cycle can account for up to 85% of total carbon emissions.

This use phase focus combined with a time frame (50-years for pavements; 75-years for buildings) provides for assessments that align with structures’ actual emission totals over the course of structures’ real world lifetimes.

Previous studies have produced adequate data on the initial costs of materials production and construction as well as the costs of recycling and/or demolition. But this study will explore the use phase environmental and economic costs in greater detail than any LCA on record. From HVAC savings in buildings to fuel efficiency savings on pavement types, this model will provide a much more realistic assessment of the actual costs of these materials.

When will the final results of the study be completed?

MIT’s initial life-cycle studies on building and paving materials is scheduled to be completed by August 31, 2011. At that time, the Hub will have provided the scientific community, industry, and policymakers with the most comprehensive life-cycle model to-date to quantify the environmental and economic costs of building and paving materials.

The final versions of both the building and paving materials projects will incorporate both the environmental life-cycle assessments and the economic life-cycle cost analyses. As these interim reports signal, significant progress has been made on the environmental front. In early 2011, comprehensive economic analyses of building and paving materials will supplement the existing environmental findings.

Who will be conducting the economic analysis?

The economic analysis will be in the form of a life-cycle cost analysis (LCCA). It will be conducted by MIT's research team at the Hub and will incorporate the work of academic leaders at MIT's prestigious Sloan School of Management.

What are the policy implications for MIT's current study and those to follow?

The researchers of MIT are working to provide the scientific community, industry leaders, and policymakers with a realistic understanding of the environmental and economic costs of building and paving materials. Once these leading officials have access to life-cycle costing models that account for these costs more accurately than any other model in existence – the onus is on decision-makers to make use of this groundbreaking data.

Has a third party conducted a critical/peer review of the study yet?

A rigorous third party review of all of the Hub's findings will be conducted once the studies are complete and in final form. The reports we are releasing at present are interim versions that will be more fully detailed and more conclusive when the studies are completed in August 2011 and then submitted to peer review.

The Portland Cement Association is currently suing the EPA over cement regulations. How has this impacted your work?

I think that's a question best posed to PCA.

Our work on these studies at the MIT Hub has been and will continue to be focused on developing the best possible environmental and economic life-cycle costing models for building and paving materials.

Cement plants are renowned for high emissions of pollutants like mercury and CO<sub>2</sub>. Are these studies really suggesting that cement is a sustainable option?

Concrete is one of the most sustainable materials on the planet and cement is an important part of concrete. A major component of our work at the MIT Hub is to accelerate scientific breakthroughs that will continue to advance the sustainability of concrete and cement.