CSHub
MIT CONCRETE SUSTAINABILITY HUB

LIFE CYCLE THINKING - PAVEMENTS

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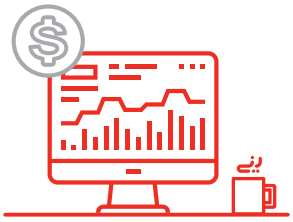
Future costs of a paving project can comprise more than **50 percent of its total cost.**

Using MIT's cost projection models, Colorado saw a **32% improvement in their 20-year cost estimates** and LCCA results for roadway projects.



CSHub tools use probabilistic price projections compatible with existing software tools used by pavement designers, such as the Federal Highway Administration's RealCost tool.

At a time when federal and state funding resources are scarce and infrastructure needs are great, **it is more important than ever to understand the full cost of project decisions**. To achieve sustainable, long-term solutions, engineers, designers, and policy makers must account for all economic and environmental costs over the lifetime of a project and need the right tools and approaches to do so. Methodologies, known respectively as life cycle cost analysis (LCCA) and life cycle assessment (LCA), allow environmental and economic impacts to be studied and quantified.

Pavement Life Cycle Cost Analysis – evaluates the total economic burden of a pavement over its lifetime.

- LCCA helps planners understand the full cost of a paving project, leading to a **more accurate planning and cost decisions**.
- By incorporating LCCA into the design stage, which takes into account factors like weather, traffic levels and maintenance schedules, **planners can improve performance and lower costs**.
- **CSHub models incorporate material-specific price projections**, which produce more accurate cost estimates than traditional models and ensure that the LCCA is more representative of an agency's most likely expenditures.
- Further, CSHub research shows that not **taking different inflation rates among construction materials** into account can have significant impacts on LCCA estimates and, as a result, the allocation of DOT resources.

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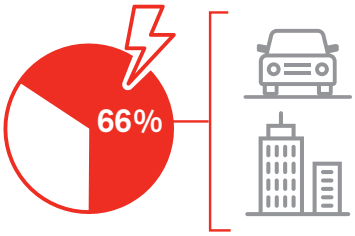
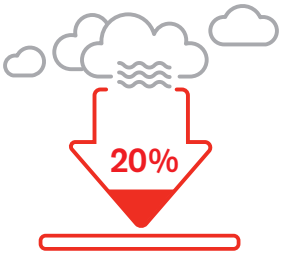


Transportation and building operations account for **two-thirds of energy consumption in the U.S.**



One study of roadway networks in Virginia using a LCA approach yielded a **20 percent reduction in CO_2 emissions** by maintaining just over 4 percent of the most critical pavement areas, versus a random approach that would have maintained roughly 19 percent of the roadway.

Pavement Life Cycle Assessment - quantifies the environmental impacts of a pavement over its entire life.

- **LCA evaluates and accounts for the total impacts of a paving choice** by examining the contributions of all activities associated with the project including material choice, design and construction activities, the use of the pavement, long-term maintenance needs and, ultimately, removal or disposal.
- LCA also takes into account factors such as **traffic levels and delays, geographic location, and weather conditions**.
- Two-thirds of a pavement's total environmental impact over its lifetime occur during the phase in which the pavement is in use -- well after material and design selections are made. CSHub research has found that **optimizing pavement with expected use and pavement performance conditions in mind can improve costs and reduce CO_2 emissions**.

ABOUT MIT CONCRETE SUSTAINABILITY HUB

The MIT Concrete Sustainability Hub, CSHub, is a dedicated interdisciplinary team of researchers from several departments across MIT working on concrete and infrastructure science, engineering, and economics since 2009. The MIT CSHub brings together leaders from academia, industry, and government to develop breakthroughs using a holistic approach that will achieve durable and sustainable homes, buildings, and infrastructure in ever more demanding environments. To learn more, visit **https://cshub.mit.edu/**.

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