

# Sustainable Pavements: The Role of Concrete

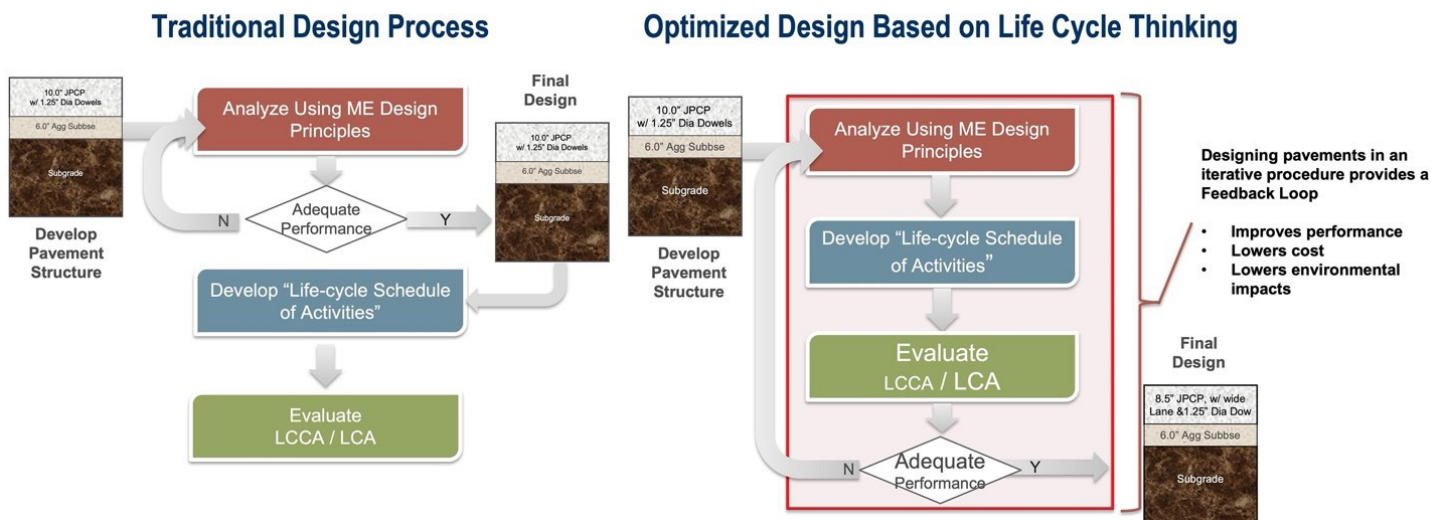
*Sustainability is a primary consideration in the construction, maintenance, rehabilitation and expansion of the nation’s infrastructure. Because pavement makes up a significant part of that infrastructure, road owners and other decision makers must make sustainability—and its evolving metrics—a priority.*

Assessment of a pavement’s sustainability must take into account its resilience. Sustainability and resilience work in tandem. While sustainability deals with known events that can be quantified, resilience is the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly after a disruptive event. Unlike sustainability, resiliency deals with unknown events that have high negative impacts like loss due to flood, earthquake, etc. In a changing climate where extreme weather events are greater in frequency and intensity than in the past, it is impossible to have sustainable infrastructure without resilience.

In addition to having other sustainability benefits, concrete is one of the most resilient building materials available.

To design pavements that realize concrete’s full benefits, it is important to:

1. Consider all three pillars that comprise sustainability: economic, environmental and social (a framework commonly known as the triple bottom line).
2. Design with a life-cycle approach that contemplates the pavement’s entire life span. This confers benefits in terms of both sustainability and resilience.



**Figure 1:** Design process to incorporate life cycle thinking, adapted from MIT CSHub

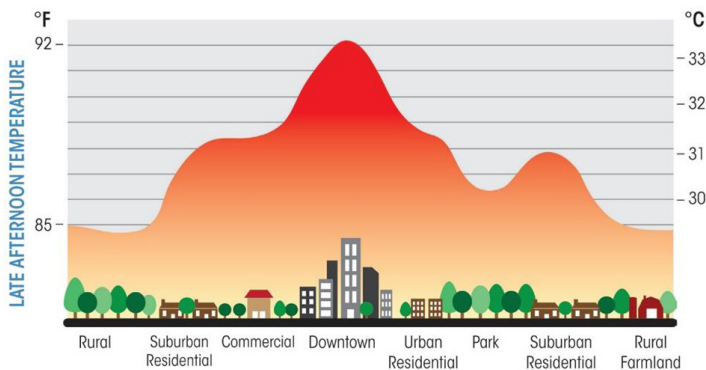
## Sustainability in Manufacturing

Achieving sustainability begins with addressing the embodied environmental impact of concrete and its mix ingredients. The concrete pavement industry and others across the concrete value chain are working together to implement the PCA's Roadmap to Carbon Neutrality, with a goal of achieving net zero carbon emissions by 2050. Current efforts focus on reducing the carbon footprint of cement (the ingredient with the most significant environmental impact) by using portland-limestone cement or supplementary cementitious materials (SCMs) to replace all or part of the ordinary portland cement in a mix. Performance-engineered concrete mixtures take the process a step further by not only optimizing the use of SCMs and portland-limestone cement content in the mix, but optimizing aggregate gradation and sourcing, as well.

## Concrete Offers Use-Phase Sustainability Gains

One of the greatest benefits in choosing concrete over other paving materials is the long life span it can achieve. Concrete can last 30 years or more before requiring a maintenance cycle. These years of service translate into:

- **Economic sustainability.**
  - Offers the greatest value over the long term for taxpayers and end users.
- **Social sustainability.**
  - Provides a smooth, safe roadway for the traveling public.
  - Reduces the hazards associated with work zones throughout the life of the pavement.
  - Supports safety and wellbeing with its ability to withstand, respond to, and recover rapidly after a disruptive event.
- **Environmental sustainability.**
  - Improved fuel efficiency (which also provides economic and societal benefits for drivers).
  - High albedo (improving the earth's energy balance and urban heat island effect, both of which lead to cooling impacts and CO<sub>2</sub> reduction).
  - CO<sub>2</sub> absorption.



**Figure 2:**  
Concrete's high albedo can reduce urban heat island (UHI) impacts and surrounding temperatures, from Clean Air Partnership

A resilient as well as sustainable material, concrete is well-positioned to address the planet's climate change considerations.

To learn more, read the ACPA white paper, **"Concrete Pavement's Role in a Sustainable, Resilient Future."**

