Why Do Long Life Pavements Matter?

Having a healthy pavement network depends on strategic maintenance and taking an asset management approach.

The Federal Highway Administration (FHWA) takes the position that departments of transportation (DOTs) are obligated to preserve their assets and minimize whole life costs, operate in a financially sustainable manner and provide a framework to improve performance on a long-term basis.

Investing in concrete for pavement construction is, therefore, always a wise choice. By offering durability and longevity—along with a host of other benefits—concrete supports the FHWA goals of minimizing whole-life costs, achieving financial sustainability and ensuring long-term performance. To tap into the benefits of concrete for existing stretches of roadway, DOTs can strike a balance between minor and major improvements to their pavement networks using a "mix of fixes" approach, i.e., incorporating cement- and concrete-based solutions. Such an approach combines short, medium and long-term pavement treatment activities that provide different service lives, thus reducing the amount of pavement to be repaired at any given time. By controlling how long a given repair will last, DOTs can achieve a year-to-year balance in their workload and better meet FHWA goals for financial sustainability and consistent pavement performance.

The Benefits of Rigid, Long-Life Concrete

Concrete is known to be a durable, long-lived construction material. Concrete roads, highways, bridges and industrial sites often last more than 50 years. Concrete pavements typically require 50 percent less ongoing maintenance costs compared to asphalt and offer savings of approximately 25 percent across the life of a major road project. A study of roads in Minnesota's Olmsted and Waseca counties found that the use of concrete pavement saved up to 19 percent over time, compared to the cost of using and maintaining similar asphalt roads. The same study shows that maintenance costs were reduced by 75 percent when concrete was used to pave roads in these counties.

Not only does concrete last a long time, but it is not susceptible to potholes. To remain smooth with good rideability, concrete generally only requires preservation treatments at the 25-year mark.

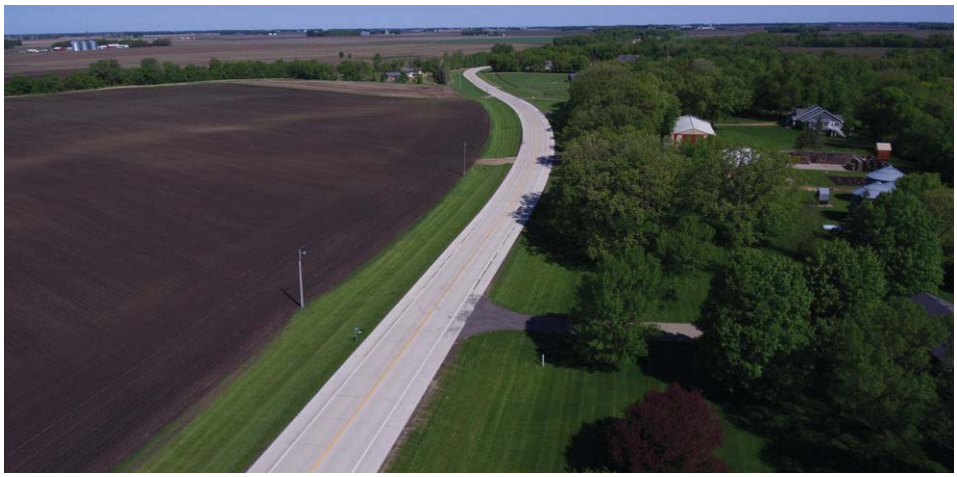
Concrete pavement offers many benefits to the traveling public. Less frequent maintenance equates to fewer traffic disruptions. Vehicles get better gas milage on concrete roads, too. Pavement vehicle interaction (PVI) has three primary factors that impact rolling resistance and the associated excess fuel consumption: pavement texture, smoothness or roughness and stiffness. While pavement texture can have a significant impact on excess fuel consumption, it also impacts safety, so there must be a balance between having a texture that is low enough to reduce fuel usage and high enough to ensure safety.

Changes in the other two aspects, smoothness and stiffness, can also result in large reductions in excess fuel consumption. Rough pavements require greater fuel usage to traverse as the vehicle's suspension is engaged to deal with the bouncing of the vehicle. The rougher a pavement is, the greater the excess fuel consumption. Concrete pavements, especially those preserved with concrete pavement preservation techniques, help the driving public save on fuel expenses, while reducing the environmental footprint associated with fuel use.

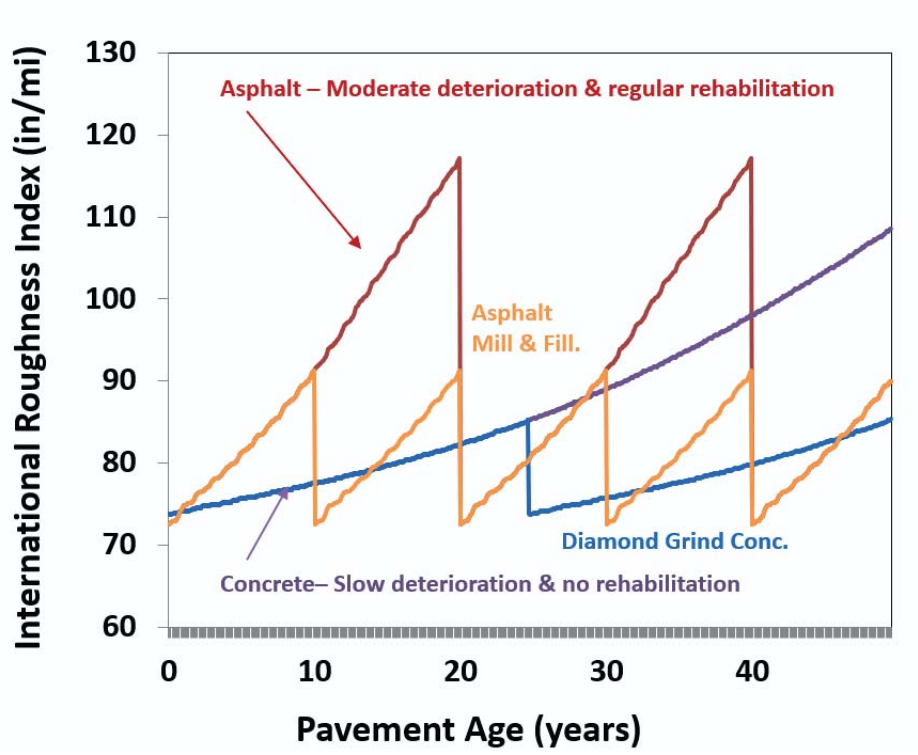
Stiffer pavements deflect less under the weight of vehicles, especially under heavy trucks, and so reduce fuel consumption. This is one of concrete pavement's biggest advantages; it is inherently stiff. It does not warp or rut from intense use or intense heat, contributing to safety. It also provides good stopping distances, especially in wet weather.

Concrete's rigidity also makes it resilient. When a concrete pavement is submerged by floodwater, it will deflect less than flexible pavements and distribute loads over a larger area, thereby maintaining its structural integrity. Resilience during a natural disaster is a key reason why long-life pavement is important. By preserving evacuation routes and ensuring airfield and ground access for rescue crews, resilience contributes to life safety. Flexible pavements, by comparison, have reduced load carrying capacity during flooding, and it can take up to a year for those pavements to sufficiently dry out and regain strength. Loading that happens during the one-year recovery period further accelerates damage to the pavement. This is especially concerning considering the fact that large numbers of extremely heavy vehicles, such as articulated trucks, are deployed as part of rescue and recovery efforts.

As warmer temperatures in cities have become a concern and municipalities search for ways to lower ambient temperatures, concrete offers a cooler alternative to dark pavements. Concrete pavement has two times the light reflectivity when new, causing it to reflect daytime heat rather than absorbing it. At night, this reflectivity increases visibility and enhances driver safety.



Obtaining the Benefits of Concrete for Existing Roads and Road Networks



The use of a remaining service interval (RSI) pavement lifecycle management framework allows state agencies to determine the best long-term strategy to efficiently plan limited financial resources and ensure sustained highway performance. Rather than focusing on the end of a pavement's life, RSI management allows for a planned, budgeted sequence of maintenance activities. It involves grouping sections of pavement together and determining when preservation or retreatment will be needed on a given section, thus giving agencies the ability to forecast pavement performance so they can plan future maintenance and rehabilitation costs most effectively.

States often perform short-term fixes, because those will be cheaper, allowing them to do more and cover more of the network. However, when that becomes an ongoing approach, problems snowball and are detrimental to the overall network. Without longer-term fixes, an agency may end up with their entire network needing to be touched about every ten years. Mixing in long-term repairs that include cement/concrete-based solutions, such as concrete overlays, full- or partial-depth repairs or any of a number of other concrete maintenance techniques, can spread out the maintenance over thirty years or more.

Research has shown that a mix-of-fixes approach can achieve the same level of road quality for tens of millions of dollars less, compared to continually relying on a "worst-first" repair strategy. Life-cycle cost analysis (LCCA), a tool used for guiding pavement investment and engineering decisions, further recognizes the importance of the mix-of-fixes approach. Software-based pavement management systems (PMS) are also useful tools for managing pavement-related data, providing insight on applicable preservation options and guiding the decision-making process. A PMS can provide valuable insight on applicable preservation options.

It's clear that avoiding funding crises and sustaining high performance across a pavement network are worthy goals for any agency. Where the challenge comes in is laying out a path to achieve those goals. Developing an understanding of pavement material options and their strengths, making use of technology-based tools and formulating long term plans are the keys to success.