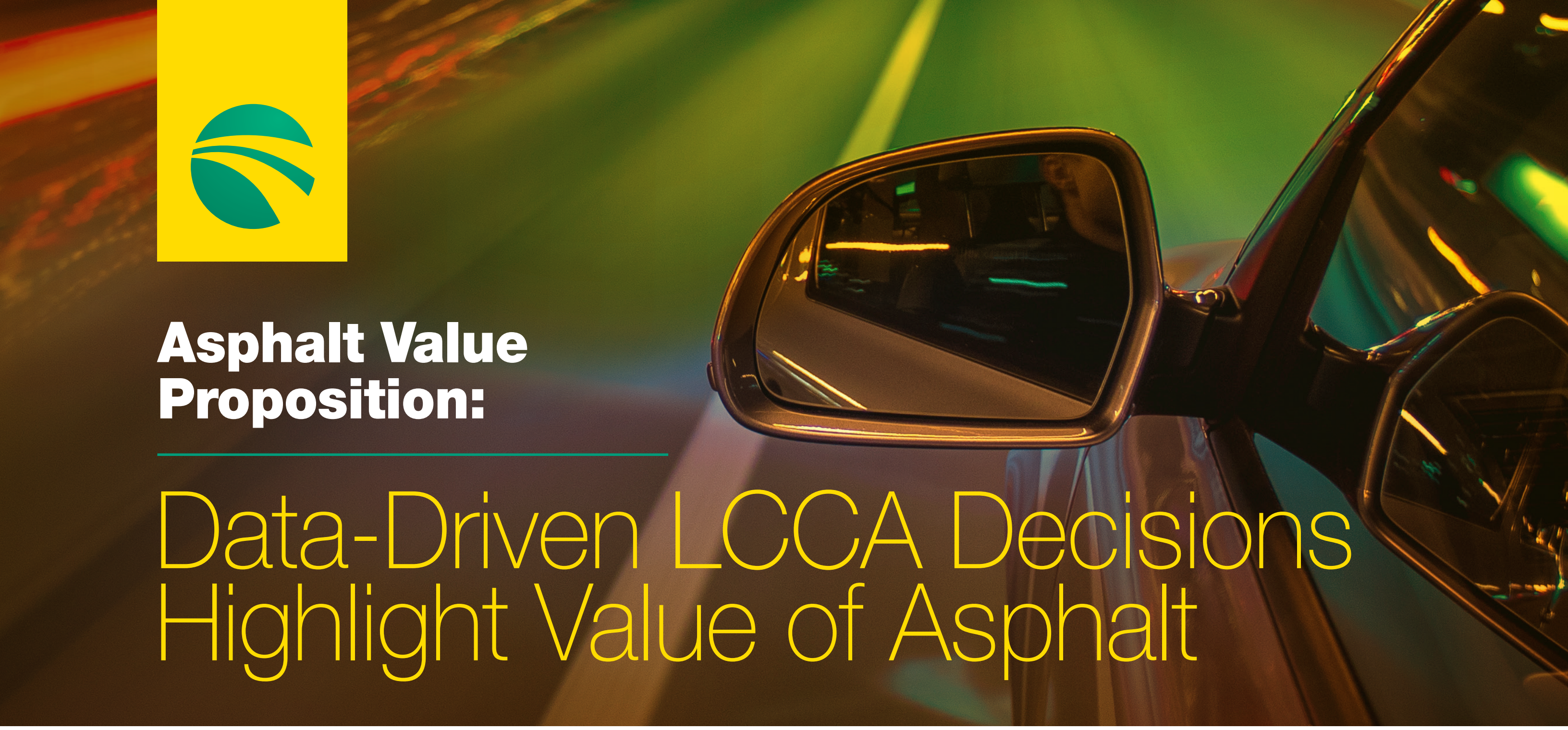

Asphalt Value Proposition:

Data-Driven LCCA Decisions Highlight Value of Asphalt

Every year, millions of dollars are invested in the maintenance and improvement of the nation's roads and bridges. When choosing the most cost-effective design, construction materials, and products for a project, transportation agencies often use life-cycle cost analysis (LCCA), an economic decision-support tool, to help identify cost-effective project alternatives. However, challenges in collecting, storing, analyzing, and accessing pavement performance data leave engineers and asset managers making assumptions for several significant LCCA inputs. According to the American Society for Civil Engineers (ASCE), effective use of LCCA is hindered by this lack of consistent data (ASCE, 2014). Similarly, a recent survey of State Asphalt Pavement Associations (SAPAs) revealed that 73.3% of respondents felt that data quality, management, and capture are barriers to effective implementation of LCCA in their state (SAPA, 2019).

Typical LCCA data inputs include initial and future maintenance costs, performance periods, analysis periods, removal and demolition costs, and other agency costs (West et al., 2013). It's common that when assumptions are made about these inputs, engineers err on the conservative side and do not account for specific materials' or mixtures' actual performance. Furthermore, overly conservative assumptions can lead to inaccurate LCCAs that rule out proven innovative materials and mixtures during project selection. For LCCA to truly improve decision-making, actual performance data should be used to determine LCCA inputs.

Asphalt pavements are scientifically engineered for each project where they are constructed, and mixture performance life and maintenance needs vary depending upon these conditions. Furthermore, because asphalt pavements are built in layers and can avoid complete from-the-ground-up reconstruction in the future, they are easily maintained to high specifications for safety and smoothness. During maintenance, the top layers of pavement are typically reclaimed for reuse in future pavements, yielding significant cost savings compared to the use of all-new materials. By capturing this value, using project-specific data, and analyzing the performance, agencies can discover performance trends and identify winning solutions. In other words, by using real-world data instead of conservative estimates, management of the state's pavement network becomes more effective and efficient.

Many state DOTs use estimated initial performance periods of 10 to 15 years for asphalt pavements; however, a review of Long-Term Pavement Performance program data finds that asphalt pavements perform for nearly 18 years, on average, before requiring their first maintenance (Robbins & Tran, 2018).

For example, an analysis of the state of Maryland's Pavement Type Selection process found that

Maryland State Highway Administration estimates a 15-year performance period for asphalt pavements from initial construction to first rehabilitation (MDSHA, 2013). In Maryland's analysis, it assumes rehabilitation occurs before the pavement reaches a terminal service life for any distress. A recent study using project-specific data found that innovative mixtures, such as stone-matrix asphalt (SMA) or polymer-modified Superpave mixtures, placed on principal arterials in Maryland have an average service life of 32 years and 24 years respectively (Yin & West, 2018). By gathering and using mixture-specific data in LCCAs, DOTs can account for the differing road maintenance intervals when highly durable asphalt mixtures are utilized. This would improve decision-making and allow states to redirect spending to other critical areas while still providing the level of pavement performance the traveling public demands.

While agencies will gain the greatest benefit from project- and mixture-specific data, network performance data can also improve LCCA. In recent years, the Federal Highway Administration (FHWA) has outlined performance measures for both asphalt and concrete pavements, and state highway agencies are now required to collect and report pavement performance data within their asset management systems. This real-world data can be used to accurately quantify some significant LCCA inputs (such as performance periods), giving state highway administrations the ability to make data-driven business decisions based on their pavement system and fiscal management practices.

DOTs regularly collect and act upon a wide range of real-time traffic data from intelligent transportation systems (ITS) to improve safety, mobility, and sustainability (Greer et al., 2018). The same data-driven approach to asset management and project decisions, and using pavement management system and project- and mixture-specific historical data to develop a robust set of inputs for LCCA methodologies, has the potential to help DOTs realize millions of dollars in cost savings.

Recommendations:

1. Review state agency LCCA process to ensure data inputs are based on pavement management system and historical data.
2. Develop data collection, retention, and analysis policies that quantify a specific mixture's performance given the traffic, climate, and underlying pavement condition. This data can be used to improve maintenance activities, as well as to calibrate LCCA inputs.

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