Asphalt Value Proposition:

Pavement Smoothness

Specifying Smoothness for Cost Savings

When asked, highway agency leaders report that their No. 1 challenge is funding (Edelman Berland, 2013). As federal funding for infrastructure investment continues to remain inadequate compared to the need, many agencies are looking to prioritize pavement performance, life-cycle cost analysis (LCCA), and pavement durability in their decision-making processes. Simply put, agencies want to ensure they get the most pavement life possible from each precious dollar of public money.

One data point commonly used to measure performance for both asphalt and concrete pavements is smoothness. Smoother pavements provide a quieter, more comfortable ride for drivers, and smoothness is a key factor in ensuring road user satisfaction (FHWA, 2002). Research has consistently shown that pavement smoothness has a significant influence on vehicle fuel economy for trucks and passenger cars (Willis et al., 2015), yielding as much as a 4.5% improvement in fuel economy (Sime et al., 2000). Beyond improved vehicle fuel economy, pavements that are smoother from the start require less maintenance, saving road owners $1,295 annually for every lane-mile resurfaced (McGhee & Gillespie, 2006). One reason asphalt is the pavement of choice for engineers is the level of smoothness it provides. In fact, nearly 80 percent of pavement engineers and state highway agency officials say that asphalt provides the smoothest pavement (Edelman Berland, 2013). Building high-quality smooth asphalt pavements positively impacts the bottom lines of both transportation agencies and the driving public.

Nearly 70% of state agencies' LCCA processes reportedly do not account for the use of materials or practices that increase pavement service life (SAPA, 2019). However, the Virginia Department of Transportation (VDOT) has studied the economic advantages of specifying and constructing smoother pavements (McGhee & Gillespie, 2006) and used the data gained to validate maintenance and rehabilitation cycles to account for the impact of smoothness on service life and vehicle operations.

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In 1996, VDOT implemented the Special Provision for Rideability to incentivize the construction of smoother asphalt pavements. Projects in the incentive program showed an average increase in material cost of $1.03 per ton of asphalt mixture. However, VDOT observed that these pavements were on average 8.9 in/mile smoother at initial construction. Over time, this increase in initial smoothness equates to an increase of seven years of functional life compared

to pavements built outside the provision (McGhee & Gillespie, 2006). In short, the smoother pavements take seven years longer to reach a level of roughness that requires remediation.

To calculate the Special Provision's impact on pavement life and costs, VDOT used a conservative functional life extension of two years. Because of this, VDOT estimates incentivizing smoothness saves the agency about $1.3 million annually and that widespread use of the provision across its entire network could save the state an additional 15% on annual maintenance and rehabilitation costs. In fact, VDOT has used its smoothness findings, along with analysis other data tracked in the commonwealth's pavement management system, to adjust its LCCA service life periods. By using a 12-year maintenance schedule, VDOT extends pavement life and saves twice the amount it spends to incentivize pavement smoothness (McGhee & Gillespie, 2006).

Optimization of maintenance cycles based on a pavement's smoothness over time, such as VDOT has done, is an example of using performance data to inform a state agency's decision-making process. The same data can and should be used to determine LCCA inputs. DOTs may find that maintenance is needed less frequently when smoothness incentives are used, reducing the pavement's cost of ownership over its service life. By collecting and analyzing pavement ride data and applying a reliable, data-driven management strategy, agencies can better make decisions that save taxpayers money.

Recommendations:

1. Review your agency's LCCA process to determine if it accounts for materials and practices that increase pavement service life.
2. Review your agency's smoothness incentives. If none are used, conduct a local study on smoothness, service life, and long-term financial implications.
3. Collect, analyze, and retain pavement smoothness values. At a minimum, smoothness data should be collected at completion of initial construction, before and after any maintenance, then again at the end of service life.

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