

# How Agencies can Reduce Costs by Improving the Competitiveness of their Bid Environments



**Myth:** *Given current supply chain challenges and materials cost increases, there's no way to lower the unit cost of a pavement.*

**Fact:** *Encouraging competition between paving materials would cause costs for all materials to go down.*

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*Research has shown that, as inter-industry competition increases, unit costs of both concrete and asphalt paving materials fall significantly—particularly those of concrete. For example, if a state with a low concrete market share (e.g., 1 %) were to increase its concrete market share to 25%, it would lower concrete and asphalt paving material unit costs by around 29% and 8%, respectively.*

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## **Is Concrete a Viable Alternative to Asphalt?**

Concrete has a proven record of being a viable paving material. In fact, in the mid-twentieth century when the interstate system was new, concrete was the most common paving material. Its decline in use is largely attributable to a decline in information dissemination on concrete repair, maintenance and replacement—a situation that occurred gradually with the rising use of asphalt. With renewed education efforts, however, inter-industry levels of competition (that is, competition between firms that pave with different materials) can increase, and costs across the board will lower.

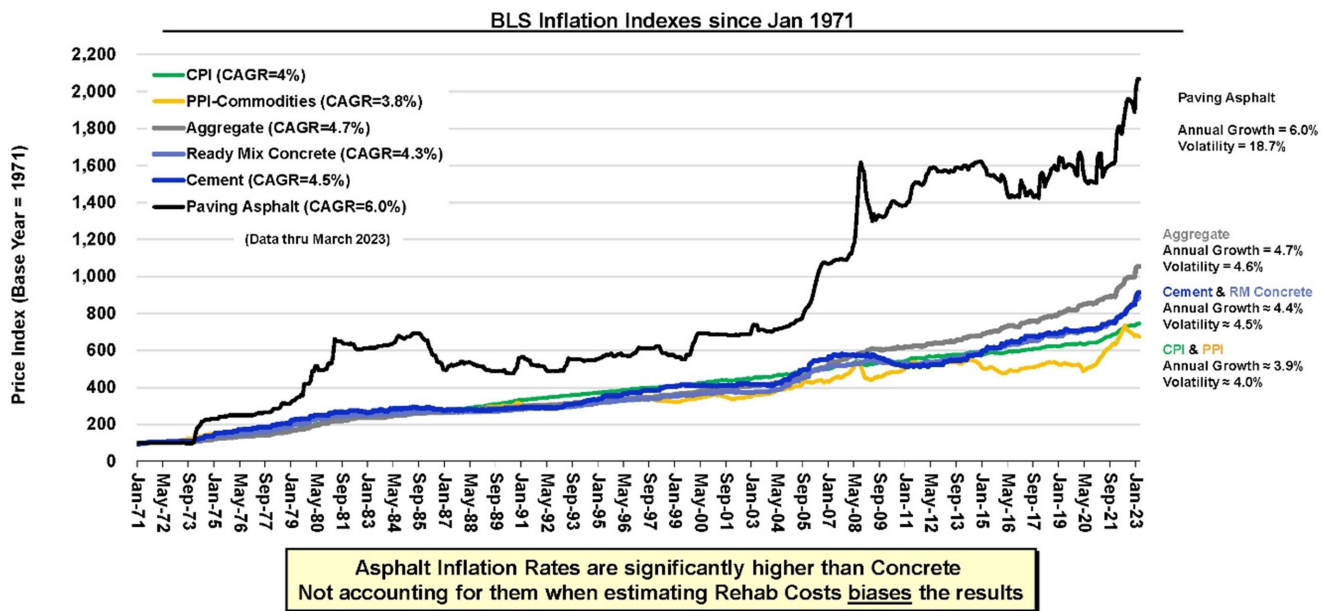
## **Why Improving Competition Works**

Improving inter-industry competition would bring both additional contractors to the bidding process and a second level of competition into the supply chain between the suppliers (e.g. the asphalt, concrete and cement suppliers). While these suppliers may not directly compete against one other, the sustained competitive pressures between the industries will drive costs lower as skilled personnel develop, supply chains get established, construction quality improves, innovation is spurred and risks decline. See the sidebar on research that supports this.

## Connecting the Dots: What Led to an Unchecked Rise in Prices

Data from the Bureau of Labor Statistics (BLS) (See Fig. 1) show that the 50-year price trend for paving with asphalt has gone up starkly when compared to general inflation rates and concrete. In addition to the higher growth, paving asphalt also has over 4 times more volatility primarily because the liquid asphalt (a key ingredient in HMA) can have yearly swings that exceed 40%. Beyond the cost increases associated with inflation, when only one material is being used in a state or region, high demand can cause local or regional saturation, which increases the price further. Particularly when it comes to a high-demand product like asphalt, when local and regional asphalt plants become engaged, saturation occurs, and prices will rise in the absence of new entrants or alternative materials to compete and drive prices back down. These price impacts can be offset if there are alternative materials in the market.

When agencies do choose concrete pavement, they often make the selection based on concrete's durability and longevity (qualities that contribute to cost reductions over the pavement's life cycle). Recent bids across the U.S., however, have illustrated that concrete can also be successful on an initial cost basis—and this has been the case even with accelerated construction projects. The key is to make materials decisions early and create job-specific designs. An example is work done by the Impactful Resilient Infrastructure Science and Engineering (IRISE) Consortium, established through the University of Pittsburgh. IRISE helped one project team in Pennsylvania lower the initial cost of concrete by eliminating a high early strength concrete mix and testing and using, instead, a maturity method for determining the concrete's strength gain.



1. Real Price change is also known as aka changes in relative prices, differential inflation rates, material specific inflation, & constant dollar changes.
2. U.S. Department of Labor, Bureau of Labor Statistics, <http://www.bls.gov/ppi/home.htm>
3. CAGR = Compound Annual Growth Rate

### Figure 1:

50-Year Trends in Paving Materials Mapped Against General Inflation Rates.  
Image courtesy of Jim Mack, CEMEX.

## Starting a Competitive Paving Program

Planning and communication are the first steps for agencies wishing to establish a program that will foster competition. When the team identifies projects in which concrete or asphalt could each provide a viable solution, they should make a deliberate decision to go with the less dominant material on the project to create a competitive market. Cement-based solutions should be tried in multiple applications, such as new concrete

pavement, concrete overlays, etc. Interstates, state highways, rural roads, intersections and ramps are all locations in which concrete projects can be successfully installed. The agency should let a given number of concrete projects each year and develop a project pipeline that covers several years. Technical task forces will be needed to address issues with specifications, design procedures and other issues that arise.

## Pavement Treatments

### CONCRETE- AND CEMENT-BASED TREATMENT TECHNIQUES FOR:

CATEGORY	EXISTING CONCRETE PAVEMENT	EXISTING ASPHALT PAVEMENT
Maintenance	Crack/Joint sealing	-
Preservation	Partial-/Full-depth repair and slab replacement	-
	Joint LTE restoration	-
	Diamond grinding and grooving	-
	Concrete overlay - bonded (2-4")	Full-depth reclamation with cement
Repair	Thin concrete overlay (4-8")	Ultrathin concrete overlay (2-4")
	Thin roller-compacted concrete (RCC) overlay (4-8")	Thin concrete overlay (4-8")
	-	Thin RCC overlay (4-8")
	Concrete overlay (8-12")	Concrete overlay (8-12")
Rehabilitation	RCC overlay (>8")	-
	New concrete	New concrete
Replacement	New roller-compacted concrete	New roller-compacted concrete

For individual pavement projects, helpful strategies for achieving value include optimizing concrete designs to avoid over-design, life cycle cost analysis (which quantifies the total cost of ownership over a pavement life) and alternate pavement bidding (a bidding process where two equivalent pavement

designs are developed for a given project and the contractor then chooses which pavement to submit for his bid). To implement an alternate pavement bidding program, agencies should follow the process outlined by FHWA in their [Guidance on Alternate Pavement Bidding](#).

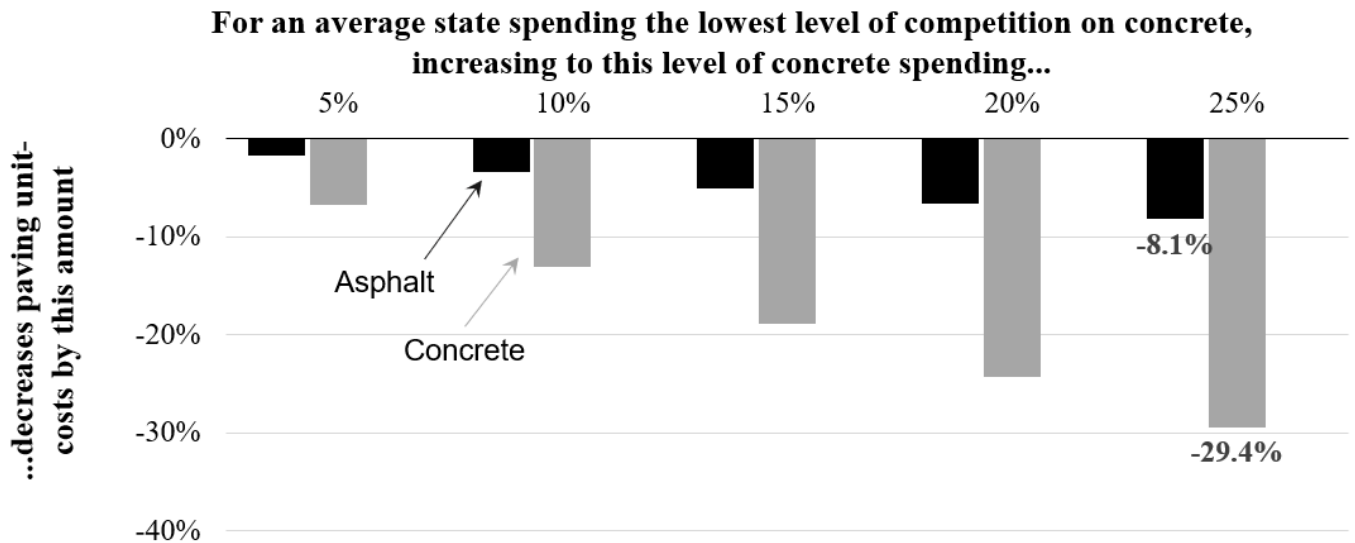
Several states have a successful history of creating project pipelines that include both asphalt and concrete, and their practices can serve as models. Some states use a strategy of designating a target number for concrete installations. For its new roads, the Florida DOT targets approximately 40 miles of concrete pavement per year. Similarly, Texas DOT has an established practice of bidding approximately 5 million square yards of concrete every year, which represents approximately 26% of their projects. Other states programmatically balance the market based on a defined metric such as volume. Wisconsin and Michigan provide examples of this; both attempt to balance the tonnage of asphalt in a given year to the square

yards of concrete pavement that is placed. The advantage is both industries participate in times when funding is plentiful, and both take similar reduction when funding levels are lower.

Another approach is to use traffic or road classifications to designate specific markets for each product. In the past, Minnesota DOT based product decisions on equivalent single axle load (ESAL) values, with projects under 1 million ESALs being constructed of asphalt, projects over 7 million ESALs being constructed of concrete and projects between one and seven million ESALs going through a life cycle cost analysis to determine the most appropriate material.

## INTER-INDUSTRY COMPETITION LOWERS UNIT COSTS

### Allows Highway Agencies to do More with their Budgets



**States with high industry competition pay ~ 8% and 29% less for asphalt and concrete pavements respectively vs. states with the low competition (increasing competition between contractors only lowers cost ~ 5%)**

**Figure 2:** The Benefits of Competition & A Balanced Paving Program A Business Case for a Two-Pavement System. Image courtesy of Jim Mac & the MIT Concrete Sustainability Hub.

## Sidebar

The MIT Concrete Sustainability Hub (CSHub) examined state Department of Transportation (DOT) pavement bid data collected between 2005 and 2018 to see how the split of DOT paving expenditures between industries impacted paving unit costs. The first result the MIT CSHub found was that while DOT spending on concrete and asphalt paving materials varied greatly from state to state, only two states (Iowa and Wisconsin) spent more than 40% of their paving budget on concrete pavements while 22 states spent more than 90% of their paving budget on asphalt pavements. Similarly, the amount of intra-industry competition is not as high as it could be. Some states often had only one or two bidders for many of their projects. Yet the key to competition is having a healthy multi-bidder environment.

Next, MIT evaluated and analyzed the bid results for the given time period, comparing weighted unit costs versus a five-year average balance of DOT pavement type usage for both asphalt and concrete pavements. The analysis involved developing statistical models to determine what factors have a significant influence on paving material costs, including items like project size, the amount of paving material used, the number of bidders (a metric of intra-industry competition) and the average share of spending in a state on concrete (a metric of inter-industry competition). Bid costs were adjusted to account for year-to-year cost change.

For asphalt paving, the most influential factors impacting unit costs are project size followed by inter-industry competition. For concrete paving,

the most influential factors are inter-industry competition followed by project size. The fact that inter-industry competition was the first or second most influential item clearly shows that when competition between paving industries increases, with asphalt and concrete applications being more evenly split, there is a clear trend toward lower unit costs for both concrete and asphalt pavements. Results also showed a decrease in variability in unit costs for both materials that accompanied increasing levels of inter-industry competition. It is important to note that states with higher levels of competition tended to be the states with stable and predictable paving programs, which implies that sustained programs, for both concrete and asphalt, are important in maintaining predictable and low unit costs.

Once researchers determined the key factors, they again used statistical modelling to estimate how increasing inter-industry competition would impact paving costs.

***Overall, they found that as inter-industry competition increased, the unit costs of both concrete and asphalt paving materials fell significantly—particularly those of concrete. For example, if a state with a low concrete market share (e.g., 1%) were to increase its concrete market share to 25%, it would lower concrete and asphalt paving material unit costs by around 29% and 8%, respectively.***