February 27, 2012

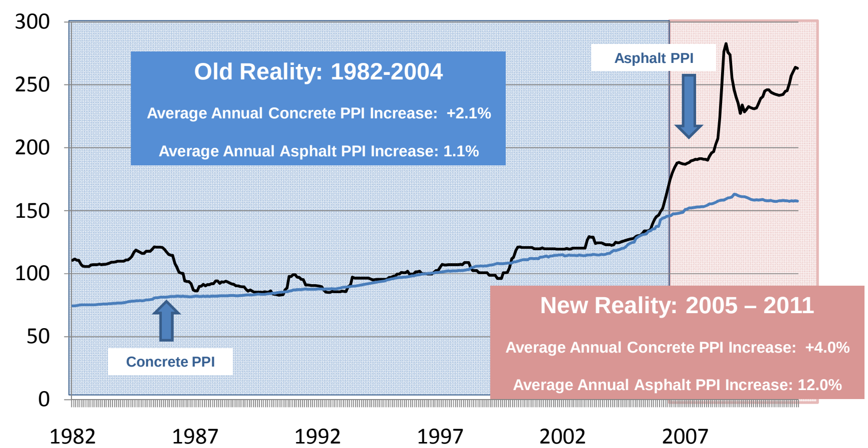
The New Paving Realities: The Impact of Asphalt Cost Escalator Clauses on State Finances

Overview

Highway maintenance costs are increasing at an accelerating rate. States' department of transportation (DOT) must not only deal with this phenomenon, but must plan to expand road systems to meet demographic trends that suggest nearly 50 million more drivers on the road during the next 25 years. These dual mandates must be accomplished with the possibility that fewer state/local funds will be dedicated toward infrastructure investments due to growing entitlement spending needs in proportion to overall state spending.

The need to spend highway investment dollars more efficiently is greater than ever before. Unfortunately, DOT policies, many which were formulated 30-40 years ago, can impair DOTs ability to make efficient decisions. Many state DOT procurement policies are biased toward asphalt and based on concepts that do not capture recent structural changes in paving material prices. Procurement distortions caused by DOT policies are partially responsible for the rise in paving and highway maintenance costs.

Paving Material PPI Price Comparisons
1996 = 100



Source: Bureau of Labor Statistics, Producer Price Indices

Among the biased paving procurement policies, many state DOTs allow for asphalt cost escalator clauses[1]. Asphalt cost escalator clauses are a price adjustment provision that allow for asphalt paving contractors to raise their construction price based on a fluctuation in liquid asphalt cost. Asphalt escalator adjustments occur after the contractor has won the bid. In the context of rising oil and asphalt prices, taxpayers generally pay more to a contractor at the time of construction than the price quoted to win the project.

Asphalt cost escalators may have been a prudent procurement policy in the 1970's when the paving market was characterized by volatile asphalt prices and there was no viable cost alternative to asphalt paved roads. Asphalt cost escalators are no longer a prudent policy. The economics surrounding paving cost dynamics have changed radically during the past ten years. DOTs now enjoy the advantage of another cost competitive paving alternative – concrete roads, and therefore are no longer bound to be the risk insurer for asphalt paving contractors. This paving procurement practice distorts free market competition, acts as a subsidy to a politically entrenched industry, and can result in DOTs choosing a more expensive paving option. This can result in significant cost over runs – costing state DOTs and taxpayers hundreds of millions annually.

The purpose of this report is to provide material specifiers accurate information about the implications surrounding the impact and cost of asphalt price escalators on state DOT budgets and taxpayers' expense. The report examines two areas of asphalt cost escalators impact on highway paving costs. The first section examines the impact on initial paving project costs. The second section examines the impact of asphalt escalators and paving material choices on longer term highway maintenance costs.

Section I. Initial Project Cost Impacts

Overview

Asphalt escalator clauses transfer the paving project cost risk associated with asphalt price changes from the contractor to the DOT and taxpayer. This eliminates the need for asphalt contractors to imbed material price risk premiums into their contracts. In theory, the reduction of contractor risk encourages more bids and hence competition. More bid competition implies lower paving project costs with savings accrued to state DOTs. Presently, competition is usually narrowly defined to include only asphalt pavers and typically excludes concrete pavers. A recent empirical study performed by the Transportation Research Board concluded that there was no clear benefit to DOTs that could be identified from using escalators[2].

The theory behind asphalt escalator clauses is based on enhancing bid competition. This concept that heightened competition leads to a DOT benefit is firmly rooted – but only if a comprehensive definition of competitors, including concrete, and on a level playing field is embraced. Now that concrete paved roads are cost competitive on an initial bid and life cycle cost basis, DOTs traditional definition of competition is flawed and can lead to higher paving expenditures.

Point 1: DOT Policies Must Adapt to the Structural Changes in Paving Market Competition.

Asphalt cost escalators were first introduced to support the asphalt industry during the oil embargo of the 1970's which resulted in volatile swings in liquid asphalt costs. These DOT procurement policies may have had some merit at the time they were introduced. At the time escalators when were introduced, oil prices averaged $30 per barrel, and concrete paved roads were not competitive on either an initial bid or life cycle cost basis according to DOT paving software calculations. In essence, since DOTs had no cost competitive alternatives to asphalt paved roads, they were forced to implement escalators and absorb the

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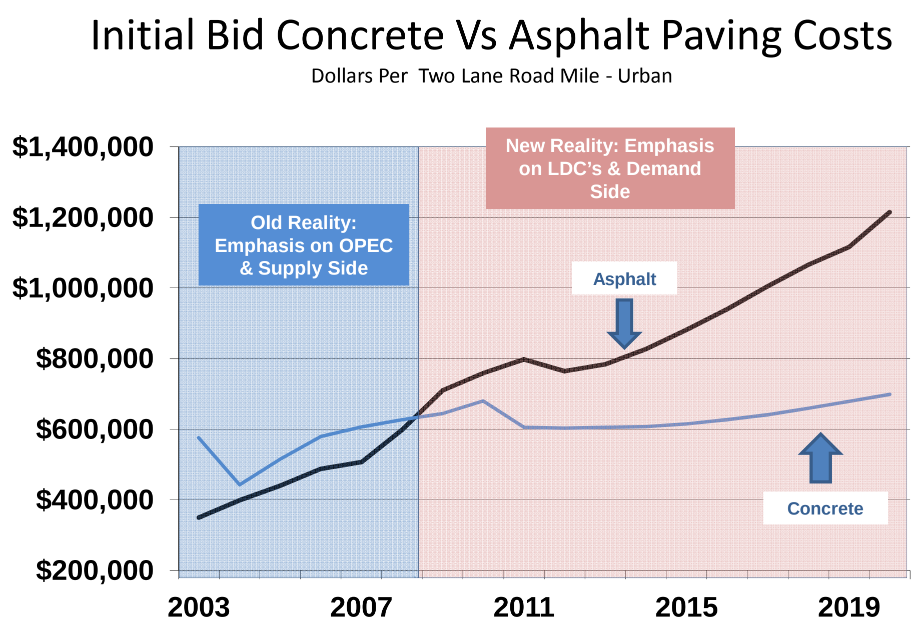
[1] According to the latest AASHTO survey (2009), 41 states currently employ asphalt cost escalators.
[2] "Price Indexing in Transportation Construction Contracts" Transportation Research Board, January 2011, page 67.

risk of material price volatility to ensure more competition and lower risk premiums incorporated into paving bids.

The dynamics of world economic growth that resulted in asphalt's paving cost advantage no longer exists. The world economy has permanently changed with the emergence of strong growth among lesser developed and transitional economies. Economic growth among these countries translates into new demand for commodities, such as oil. The days of oil at $30 per barrel are long gone.

Since asphalt is a by-product of oil refining, the new global realities suggest that asphalt's long held paving cost advantage over concrete has not only eroded, but has already reversed. This reversal has been amplified by changes in oil refining processes, further raising the cost of asphalt. The changes in the composition of world economic growth that have ushered in the new paving cost dynamics are just beginning. Increasingly, longer term global economic trends suggest that concrete will enjoy a substantial paving cost advantage over asphalt.



Source: PCA estimates using Wispave (Wisconsin DOT paving cost software)

Faced with the strain to meet short-term state budget objectives, state DOT executives sometimes place more emphasis on the initial paving cost rather than the life cycle cost of a road. Until recently, initial bid costs favored asphalt paved roads. Using DOT software to calculate initial bid costs for a one mile "standard" two lane roadway, PCA calculates asphalt enjoyed a $225,000 cost advantage over a concrete paved road in 2003 – roughly a 39% advantage[3]. Given the "old" realities, it is understandable asphalt paved roads accounted for 94% of all state and local roads. Perhaps, at that time, asphalt cost escalators made sense.

[3] Estimates based of Wisconsin Department of Transportation's WISPAV software. A standard road as designed in WisPAVE for this analysis consists of average daily traffic of 7512 vehicles with 15% of all traffic being heavy truck. Soil specifications consist of a design grade index (DGI) of 12, Frost Index of F-3, Soil Support Value of 4.2, and a Modulus of Subgrade Reaction (k) of 150. The pavements were then designed according to these parameters with an asphalt pavement depth of 6.5 inches and 15.5 inches of crushed aggregate, and an 8 inch concrete road with 6 inches of aggregate.

Past comparisons of asphalt versus concrete initial bid costs are irrelevant. The environment and dynamics of world economic growth that resulted in asphalt's paving cost advantage no longer exists. The new paving realities have taken hold. Since 2003, oil prices have increased more than 200%, coker capacity has increased 33%, and asphalt prices have increased 200%. Concrete prices during the same period increased a relatively modest 37%.

Initial bid costs now favor concrete paved roads. Based on DOT software, near parity in initial bid paving costs between asphalt and concrete was reached in fiscal 2008 (August 2007). In fiscal year (FY) 2009, concrete paved roads enjoyed an $65,000 cost advantage over asphalt paved roads. This reversal in initial bid paving costs was due largely to the $60 per barrel increase in oil prices since 2003. During 2010-2011, concrete's initial cost advantage over asphalt increased to $78,500 in FY 2010 and $192,700 in FY 2011 per one mile "standard" two lane urban roadway. These cost advantages for concrete are based on initial bids. Based on cost overruns associated with asphalt escalator clauses, the final paving cost advantage of concrete roads could be even larger. Asphalt price escalators, therefore, mask the degree of newly realized change in paving competition.

For the purposes of demonstrating the distortions caused by asphalt cost escalators in the bidding process, PCA assumes the 2008 initial bid parity cost for asphalt and concrete paved roads of $600,000 per urban two lane roadway[4]. In this example, both the concrete and asphalt paving contractor put in the same bid. The time between initial bid and project completion is assumed to be six months. During this time lag, liquid asphalt prices rise according to the average that has been experienced during 2008-2011, or 11.4%. Typically, concrete cost escalators do not exist, and where they do, the stability of the product prices renders the escalator meaningless. In other words, when a DOT receives a bid for a concrete paved road, there are no overruns. Assuming the most commonly used trigger price mechanism of 5%, the asphalt paved road would be more than 3% more expensive, or more than $19,000 at completion of the project compared to a concrete paved road. Multiply this cost excess for a one mile, two lane roadway by all the roads that must be paved, and the potential cost excesses could be substantial.

A ***permanent structural*** change has materialized with regard to paving material costs. In many instances, DOT policies have not recognized this structural shift in paving realities. The rapid structural change in cost dynamics are compelling and will grow more compelling as each year passes. Recognition of these new paving realities will eventually be reflected in DOT procurement policies. Unfortunately, the longer DOT procurement policies lag the recognition of the new paving realties, the higher the potential cost to taxpayers.

Point 2: Asphalt Cost Escalators May Reduce Competition.

The theory behind the use of asphalt cost escalators is flawed due to how DOTs perceive competition. Typically, DOTs narrowly defined competition to encompass only asphalt pavers. Because the paving cost dynamics have changed so radically during the past ten years, DOTs now enjoy the advantage of another cost competitive paving alternative – concrete roads. DOTs are no longer bound to be the risk insurer for asphalt paving contractors. Given the new realities of paving, whereby concrete pavements are cost competitive, the definition of competition must be expanded beyond encouraging more bids among asphalt contractors ***and*** among competing materials, namely concrete.

PCA tested the theory that asphalt cost escalators lead to more competition and hence lower asphalt project bid prices. A comparison of asphalt project bids were compared in states with no asphalt escalator clauses against states that employ asphalt escalator clauses. The results of this research suggest that asphalt project bids are ***far*** lower in states without asphalt escalator clauses compared to

[4] PCA estimates that initial bid paving costs between an asphalt and concrete paved road were near parity in fiscal 2008. Since that time, asphalt prices have increased nearly 37% while concrete prices have increased only 4%, according to the Bureau of Labor Statistics producer price indices.

states that utilize these procurement practices. Asphalt prices in non-escalator states were 13.9% lower than in states that employ escalators.

Point 3: Asphalt Escalator Clauses' Overruns Cost States Billions of Dollars.

PCA estimates that asphalt escalator clauses have cost states $1.1 billion in cost overruns since 2006. This estimate is based only on Oman data for state highway roads, which account for roughly 20% of total lane miles, and roughly 40% of total spending activity. If the trends observed are assumed to exist for all roads, then the cost for all roads could be between $2.75 billion (based on spending activity) to $6.11 billion (based on lane miles).

PCA collected monthly asphalt bid data and asphalt prices reported in the bid for all state projects contained in the Oman data base. PCA assumed a six month lag between the winning bid and project completion. Using the asphalt prices reported by state DOTs, the percent increase in liquid asphalt was determined. [5]

The increases in asphalt prices were compared against the prevailing trigger price used in each state as reported by AASHTO. Percent increases in asphalt prices in excess of the trigger were applied to each paving project[6]. The projects were then summed to the amount of the cost overruns for each state. For states that use a dollar volume trigger price mechanism, a similar process was undertaken. Three distortions could occur using this methodology including; 1) no provision is made for contractor lock-in price bids, 2) the lag time between bid and completion could be longer or shorter than the assumed six months, and 3) the total exposure to escalators could be larger or smaller among roads not explicitly reported in the Oman data.

This analysis concludes that the overrun costs associated with asphalt escalators are huge. Furthermore, given the Energy Information Agency's expectation for near and long-term oil prices, the potential for future asphalt escalator cost overruns could be significantly larger than those experienced during 2006-2011. Keep in mind, these estimates do not include the additional savings that could be accrued to state DOTs if they had chosen the lower cost alternative of concrete paved roads. Nor do these estimates include concrete's longer term, life cycle cost advantage attributed to its durability and lower maintenance costs.

Point 4: Cost Overruns Vary Inversely With the Level of the Trigger Price.

Asphalt cost escalators typically kick-in once a threshold of asphalt price increase has materialized since the initial bid. This threshold is referred to as a "trigger price". The trigger price is typically a percent increase from the prevailing initial bid asphalt price level but can be a dollar level as well. The cost overruns associated with asphalt price escalators vary inversely with the level of the trigger price

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[5] State DOT data from Oman Data Systems were used to estimate quantity. An average 5% value for the percent of virgin asphalt binder was assumed in all states. The change in price was measured by comparing historical asphalt price indices for each state where available. The change was measured by comparing the asphalt price index at the time of letting to the index at the time of the contract execution, which was estimated to be six months from the letting date. Four states lacked an available index, so a neighboring state's index was used instead. The escalator trigger values were determined from AASHTO's Survey on the Use of Price Adjustment Clauses. In cases where the trigger value was not a percentage, the difference between the change in the index and the trigger value was either added or subtracted, depending on whether there was a price decrease or increase. If there was no trigger value defined, it was assumed to be 0%.

[6] Regional asphalt prices do not necessarily follow a synchronized national pattern of increases and decreases. Liquid asphalt is a regional product whose prices are shaped by regional supply and demand conditions. An addition of a new coker at a local refinery, for example, could cause regional asphalt prices to skyrocket. This phenomenon would not necessarily be felt in other regions. Differences in asphalt supply and demand among regions can either favor asphalt price stability or aggravate price volatility.

	Asphalt Escalator Clause Overruns (000, $)						
State	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Total**
Alabama	71.92	(2.24)	76.10	15.02	(8.08)	66.76	219.48
Arizona	-	-	3,328.03	(156.75)	35.49	-	3,206.77
Arkansas[1]	-	-	-	-	-	-	-
California	(667.10)	12,488.44	(34,324.50)	15,280.48	36,040.57	388.26	29,206.15
Colorado	-	-	10,443.20	5,021.83	(576.91)	(1,226.88)	13,661.24
Connecticut	10,781.53	4,566.68	12,994.66	7,677.55	8,794.09	7,871.22	52,685.74
Delaware	1,137.19	1,050.84	2,492.98	825.45	579.17	834.39	6,920.01
Florida	10.94	8.23	(2.37)	8.15	8.45	8.27	41.67
Georgia	(9,281.60)	23,947.09	(13,212.57)	18,783.15	9,909.49	-	30,145.56
Idaho	827.17	4,036.33	240.55	(35.70)	37.35	-	5,105.70
Illinois	-	751.22	12,581.82	(6.33)	(16,537.48)	1,533.97	(1,676.79)
Indiana	-	-	-	7,545.97	487.40	1,115.64	9,149.01
Iowa[1]	-	-	-	-	-	-	-
Kansas	16,882.79	15,668.80	41,765.74	28,064.34	41,216.35	17,623.03	161,221.06
Kentucky	12,738.61	8,144.87	10,145.29	11,722.33	1,178.81	4,812.69	48,742.61
Louisiana[4]	21.90	14.02	(20.22)	1.56	(1.46)	8.35	24.15
Maine[5]	2,306.91	165.27	20,189.58	(4,424.12)	(1,594.40)	2,375.92	19,019.16
Maryland	7,326.23	533.53	23,300.48	2,210.88	921.03	3,116.83	37,408.99
Massachusetts	949.75	114.63	26,913.99	(841.96)	541.23	3,083.15	30,760.79
Michigan[1]	-	-	-	-	-	-	-
Minnesota[1]	-	-	-	-	-	-	-
Mississippi[4]	26.32	(5.39)	61.36	(1.36)	0.75	24.57	106.25
Missouri	(2,273.53)	7,549.37	4,322.05	9,726.56	3,946.50	7,251.67	30,522.62
Montana[1]	-	-	-	-	-	-	-
Nebraska[1]	-	-	-	-	-	-	-
Nevada[6]	90.15	304.46	(524.04)	8,830.35	6,731.11	884.28	16,316.32
New Hampshire	2,109.10	58.77	5,469.60	(3,083.66)	532.14	3,300.04	8,385.99
New Jersey[2]	-	-	-	-	-	-	-
New Mexico[7]	2,430.29	1,147.82	(11,312.46)	(978.83)	1,338.06	-	(7,375.12)
New York[8]	42,267.28	41,669.68	52,020.46	31,060.24	40,971.79	12,151.44	220,140.89
North Carolina	4,697.48	10,582.42	9,447.34	20,274.03	5,225.73	16,625.62	66,852.63
North Dakota[1]	-	-	-	-	-	-	-
Ohio	13,755.31	3,024.03	31,284.95	2,398.61	502.48	27.09	50,992.47
Oklahoma	(4,398.81)	271.33	11,021.59	1,568.62	(1,869.01)	9,412.63	16,006.35
Oregon	5,693.77	850.26	10,636.50	(897.47)	468.34	2,024.80	18,776.19
Pennsylvania[9]	24,058.33	2,453.52	47,859.53	3,299.42	527.36	330.22	78,528.39
Rhode Island[10]	135.97	366.07	(60.98)	(957.96)	(212.36)	(71.07)	(800.33)
South Carolina	2,780.56	1,479.25	(3,443.30)	8,524.58	5,595.86	2,234.50	17,171.45
South Dakota[1]	-	-	-	-	-	-	-
Tennessee	8,041.05	3,682.72	6,951.83	5,927.91	399.64	1,887.68	26,890.82
Texas[1]	-	-	-	-	-	-	-
Utah	-	76.57	68,304.43	(706.60)	-	502.94	68,177.34
Vermont[5]	880.95	297.90	4,178.60	(888.34)	(418.78)	76.33	4,126.68
Virginia[11]	2,210.34	1,045.02	11,813.73	2,155.91	(192.74)	675.04	17,707.29
Washington[3]	(0.05)	1,866.03	30,561.36	(1,534.43)	298.83	3,015.58	34,207.32
West Virginia	2,052.14	478.58	10,926.32	1,047.73	469.85	238.31	15,212.94
Wisconsin[1]	-	-	-	-	-	-	-
Wyoming	-	-	2,795.08	9.06	-	212.25	3,016.39
Total states reporting	31	33	36	37	35	33	37
Average	3,076.31	3,097.63	8,525.56	3,697.21	3,028.06	2,133.66	23,558.42
All states	147,662.89	148,686.14	409,226.70	177,466.24	145,346.66	102,415.52	1,130,804.15

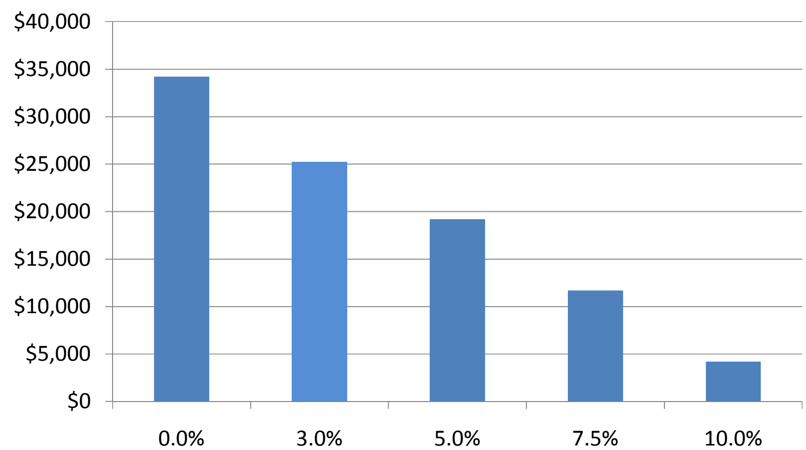
1 No Price Adjustment Clause (PAC)
2 No data
3 Includes PAC policies for both East and West Washington
4 Used Alabama price index
5 Used New Hampshire price index
6 Used California price index
7 Used Arizona price index
8 Used Connecticut price index (2006-2007 only)
9 Used Ohio price index
10 Used Connecticut price index (all years)
11 Used West Virginia price index

All business decisions are made in the context of risk and risk hedging practices are commonplace. Asphalt cost escalators shift the risk of material price increases from the contractor to the state DOT. mechanism. The lower the trigger price mechanism, the higher the potential cost overrun and burden on state DOTs and the greater the potential distortion created in the bidding process in selecting the least expensive paving option. Depending on the trigger price mechanism, the asphalt paved road would be as much as 5.4%, or $34,000 more expensive than the concrete paved road. In essence, this translates into a risk subsidy offered to asphalt contractors. The lower the trigger price threshold, the higher the implied potential state DOT subsidy[7].

The cost to DOTs and taxpayers may be amplified by paving contractor practices. According to a survey of asphalt paving contractors conducted by the Transportation Research Board, 50% of all contractors purchase their asphalt as needed, or at prevailing market prices[8]. This practice is enabled by escalators.

State's Risk of Asphalt Cost Overruns Vary Inversely with the Trigger Price

Based on a One Mile, Two Lane Urban Road, Assumes Average Percent Increase in Asphalt During 2008-2011



The potential of asphalt paving contract overruns could be eliminated by either requiring asphalt paving contractors to use locked-in liquid asphalt prices in their initial bids or by ceasing the practice of asphalt price escalators altogether. A "locked in" asphalt price guarantees the asphalt paver a firm price for liquid asphalt in the future. The locked-in price, negotiated with the liquid asphalt supplier, shifts the risk of material price increases from the asphalt paver and DOT to the liquid asphalt supplier. It is likely that this practice is more commonplace among states with a high trigger price threshold.

Section II. Highway Maintenance Costs

Overview

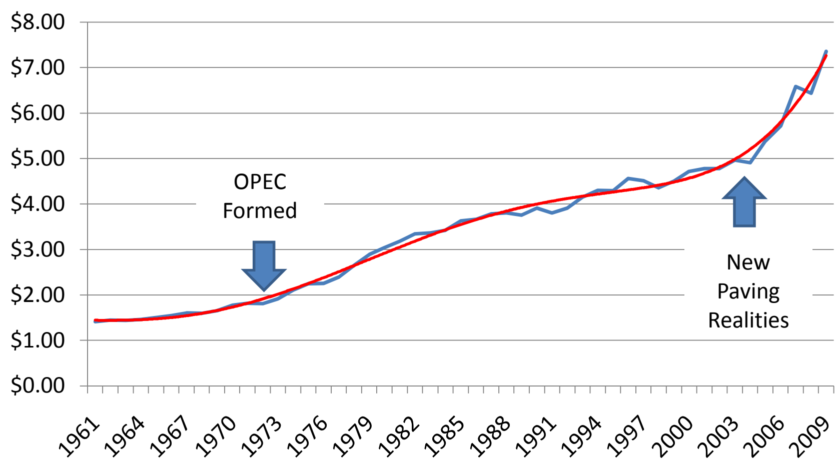
Highway maintenance costs are rising rapidly and represent huge problems for state DOTs. In the context of rapidly rising maintenance costs and constricted budgets, some DOTs have been forced to reduce their infrastructure initiatives – leading to a reduction in road and bridge quality and an elimination

[7] Economic theory may suggest discrete differences between escalators and subsidies. We leave that discussion to academic research. In any case, escalators distort the pricing mechanism and lead to a misallocation of resources by favoring higher cost paving projects.

[8] "Price Indexing in Transportation Construction Contracts" Transportation Research Board, January 2011.

of infrastructure programs that expand road systems to meet coming demographic trends and roadway needs.

Maintenance Cost
Per
Thousand Vehicle Miles Travelled



Source: FHWA

The need to accelerate highway investment, coupled with new budgetary pressures, suggests that states must re-assess how to best stretch scarce infrastructure investment dollars. The possibility of increased future federal funding, at least for now, seems remote. Much of the responsibility to maintain and expand the nation's infrastructure will inevitably fall on the shoulders of state and local governments. Updating and increasing existing highway infrastructure may be compromised by competing state entitlement responsibilities and diminished federal support. Nearly 23% of total state spending is directed at Medicaid. As the population ages, Medicaid spending will increase. Medicaid spending is expected to account for 34% of total state spending by 2030 – potentially at the expense of highway and infrastructure spending.

Given the context of increased budgetary oversight, the discussion of fiscal responsibility should not only be centered on cuts in programs and services. Fiscal responsibility should also center on efficiencies in government spending. The new paving cost dynamics are just beginning and could usher in new potential for government spending efficiencies.

Point 5: Highway Maintenance Costs are Rising.

The Federal Highway Administration found that highway construction and maintenance costs nationwide grew approximately three times faster from 2003 through 2006 than their fastest rate during any 3-year period between 1990 and 2003, substantially reducing the purchasing power of highway funds.[9] Since that report, the rate of increase has accelerated, with highway maintenance costs rising at an 8.4% average annual rate during 2007-2010, compared to 6.3% during 2003-2006.

These increases are largely the result of escalation in the costs of materials used in highway projects, such as steel and asphalt, and reflect structural, not transitory, economic changes. Since 2000, the inflation rate has averaged 2.4% growth annually. Construction wages have averaged a similar growth

[9] The Federal Highway Administration, "Growth in Highway Construction and Maintenance Costs", September 2007.

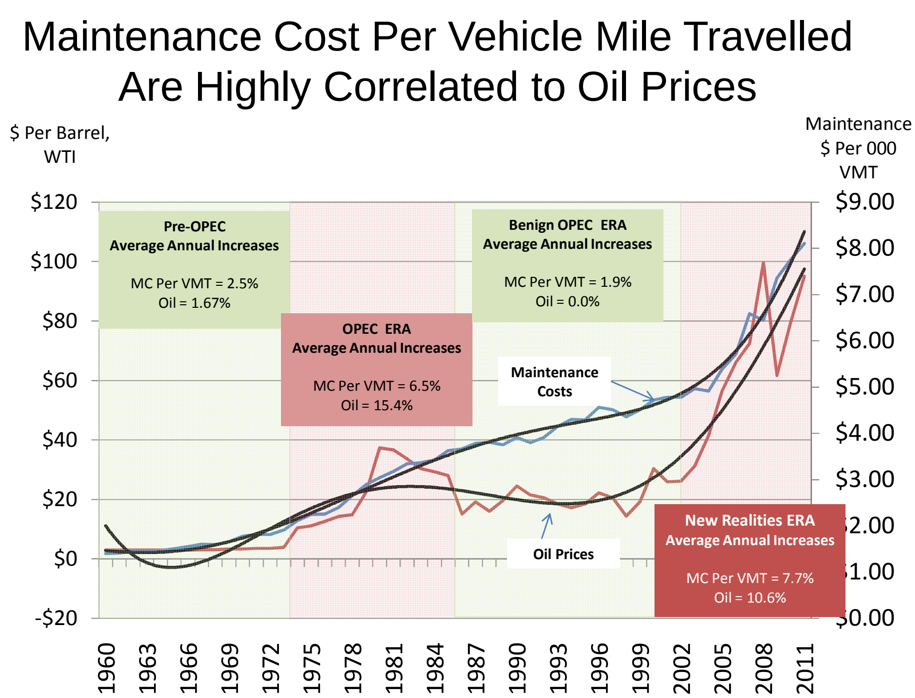
rate. Concrete prices have averaged slightly more than 4% annually.   Liquid asphalt averaged more than 11% annually. A continuation of procurement policies that bet heavily on asphalt paved roads, with lower durability than concrete roads, will accelerate these DOT pressures.

Highway maintenance spending can be influenced by road usage. Presumably, the more intensively a road is used, the more maintenance is required. State fiscal difficulties can also cause distortions in raw maintenance spending levels. PCA measures maintenance spending per thousand vehicle miles travelled (VMT). This measure minimizes distortions caused by road usage and to a lesser extent state fiscal distortions. Highway maintenance cost per thousand VMT have increased steadily during the past 50 years, albeit at an accelerating recent rate.

A large portion of the increases in highway maintenance costs per VMT can be explained by five key factors including: 1) the accelerating trend in rising asphalt prices, 2) the large dependence on asphalt paved roads, 3) the lack of durability of asphalt paved roads compared to concrete paved roads, 4) the use of flawed life cycle cost analysis tools, and 5) some state DOT procurement policies that either exclude concrete as a paving option, or bias the procurement process in favor of asphalt – which is increasingly the more expensive paving cost alternative.

Point 6: Rising Asphalt Prices Are Highly Correlated to Rising Maintenance Costs.

Increases in highway maintenance cost per thousand VMT are highly correlated to oil prices and hence asphalt prices. During 1960-1972, oil prices were low and averaged only a 1.7% annual increase. Highway maintenance costs per vehicle mile travelled during this period averaged only 2.5% annually, or roughly in-line with general inflation. With the emergence of OPEC in 1973, the ramp-up in oil and asphalt prices forced an acceleration in highway maintenance costs per vehicle mile travelled – averaging 6.5% annually during 1973-1985, well above the general inflation rate experienced during the period. During 1985-2002 oil prices remained relatively flat and highway maintenance costs per vehicle mile travelled averaged only a 1.9% annual increase – below general inflation during the period.



Source: FHWA, EIA

With the emergence of strong growth among lesser developed and transitional economies, such as China and India, new demand pressures have been imposed on world oil markets. Oil prices increased at an average annual rate of 10.6% during 2005-2011. Highway maintenance costs per vehicle mile travelled increased at an average annual rate of 7.7% during this period. This period is referred to in this report as the era of "new paving realities" because the causes of oil and asphalt price increases reflect a long-term structural demand shift – unlike transitory supply issues that resulted in cyclical fluctuation in oil and asphalt prices.

The FHWA agrees with this assessment and states "the recent run-up in oil and asphalt prices are not transitory, but rather reflect structural changes." [10] PCA believes these structural changes reflect new trends in world economic growth and new refining practices that utilize cokers enabling the production of more high margin light crude at the expense of liquid asphalt production.

Point 7: Asphalt Cost Escalators Impact Maintenance Cost Increases.

Since 2006, six states have made changes to their asphalt escalator clauses. Of these, five reduced the escalator trigger price, one increased the trigger price. If escalators have an impact on maintenance cost increases, it should be observable in the data by comparing maintenance costs before and after the escalator adjustments. Lowering the asphalt escalator trigger price places more material price risk on the shoulders of the DOT which should be reflected in highway maintenance cost data.

PCA assessed the impact of escalator changes on highway maintenance costs. Of the six changes in policy, three offered no clear evidence of an impact on highway maintenance costs. The importance of paving to total highway maintenance spending, as well as asphalt price volatility, obscured the results. Of the remaining three changes in escalator policy, a dramatic impact on highway maintenance costs were observed. Consider the following cases.

California reduced its asphalt cost escalator trigger price from 10% to 5% in 2009. California's maintenance cost per VMT increased from $2.97 per thousand VMT in 2008 to $9.72 per thousand VMT in 2009. Comparing the three year average before and after the trigger price change, maintenance cost per VMT increased 311%. It is likely that the acceleration in California's highway maintenance cost was due, in large part, to the change in the asphalt escalator trigger price.

Nevada reduced its asphalt cost escalator trigger price from 25% to 10% in 2009. Nevada's maintenance cost per VMT increased from $5.80 per thousand VMT in 2008 to $6.71 per thousand VMT in 2009. Comparing the three year average before and after the trigger price change, maintenance cost per VMT increased by nearly 43%. It is likely that the acceleration in Nevada's highway maintenance cost was due, in large part, to the change in the asphalt escalator trigger price.

Washington reduced its asphalt cost escalator trigger price from 10% to 5% in 2008. Washington's maintenance cost per VMT increased from $6.79 per thousand VMT in 2007 to $12.51 per thousand VMT in 2008. Comparing the three year average before and after the trigger price change, maintenance cost per VMT increased by nearly 40%. It is likely that the acceleration in Washington's highway maintenance cost was due, in large part, to the change in the asphalt escalator trigger price.

Point 8: Procurement Procedures That Minimize the Importance of Durability Leave Highway Maintenance Costs Vulnerable to the Risk of Material Price Increases.

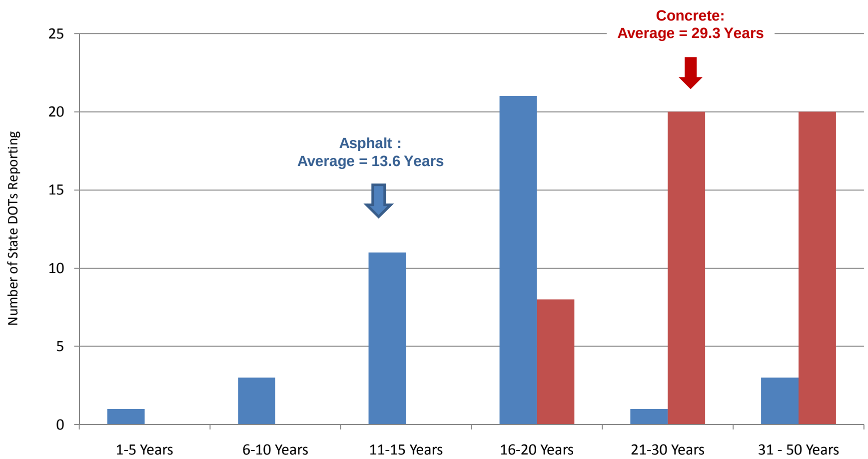
No prudent investor would place all their eggs in one basket. A financial portfolio approach that disperses risk and returns is typically recommended. America, however, has bet heavily on asphalt paved roads. Asphalt paved roads represent 94% of the portfolio of all paved roadways. These roadways are highly

[10] The Federal Highway Administration, "Growth in Highway Construction and Maintenance Costs", September 2007.

vulnerable to high maintenance cost risks in the future due to volatile asphalt prices and asphalt roads relatively short life span before a major repaving is required. Asphalt roads are not durable. According to a PCA survey of DOT officials, asphalt roads face repaving every 13.6 years. According to the same survey of DOT officials, a concrete paved road lasts nearly 30 years and therefore requires less maintenance costs. Based on a recent MIT study[11], nearly 40% of the lifetime (30 year) cost of a road paved with asphalt is tied up in maintenance, repair and repaving costs. In contrast, due to concrete's durability, maintenance and repair accounts for only 11% of the lifetime road costs.

Pavement Life Expectancy: Asphalt Versus Concrete

Years Before a Major Reconstruction is Required



Source: PCA 2008 Highway Report

Roadways where maintenance costs represent a high proportion of total lifetime cost imply that high spending risk should be attached to the total lifetime assessed cost of the roadway. Committing to roadways with low durability and requiring frequent repaving equates to betting on future commodity prices (oil) – a risky business particularly when taxpayer dollars are at stake.

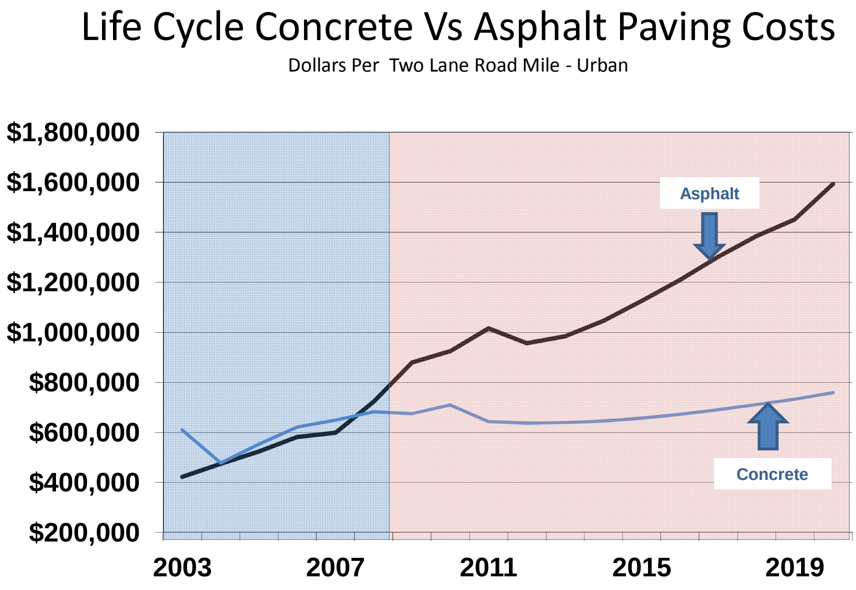
During the past ten years the price of asphalt has fluctuated greatly and is much more volatile than concrete. This volatility hinders the ability of decision makers to accurately estimate contracts values, increasing the financial risk of construction contracts. DOTs can hedge against the risk of future increases in paving materials by minimizing their portfolio of non-durable roadways. Quite simply, increased reliance on more durable concrete paved roads with less reliance on future maintenance costs equates to a paving material price hedging strategy for DOTs.

Point 9: Concrete's Long Term Cost Advantages Could Translate into Lower Future Highway Maintenance Costs.

PCA estimates concrete paved roads currently enjoy a $372,466 life cycle cost advantage (LCCA) over asphalt for a one mile "standard" two lane roadway – or roughly a 37% savings. By 2015, concrete paved roads will enjoy a $468,802 LCCA bid cost advantage over asphalt for a one mile "standard" two lane roadway – roughly a 42% savings. By 2025, concrete paved roads will enjoy a $998,682 life cycle cost advantage over asphalt for a one mile "standard" two lane roadway – roughly a 53% savings. By 2035, concrete paved roads will enjoy a $1,376,782 life cycle cost advantage over asphalt for a one mile

[11] Accounting for Inflation in LCCA, MIT Concrete Sustainability Hub, July 2011

“standard” two lane roadway – roughly a 54% savings. Given the magnitude of concrete’s cost advantage over asphalt, it is likely that other approaches to LCCA paving cost estimation, if properly constructed, will lead to similar conclusions regarding comparative life cycle cost estimates.



Source: PCA estimates using Wispave (Wisconsin DOT paving cost software)

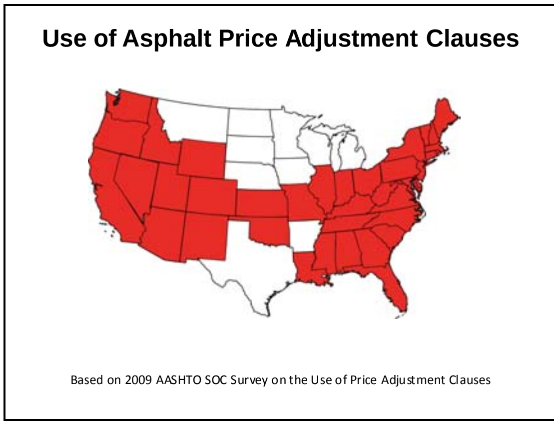
Faced with the strain to meet short-term state budget objectives, state DOT executives sometimes place more emphasis on the initial paving cost rather than the life cycle cost of a road. Until recently, initial paving costs favored asphalt and accounts for states’ road portfolio skewed toward asphalt paved roads. This procurement strategy, however, carries a longer term consequence in the form of higher maintenance costs.

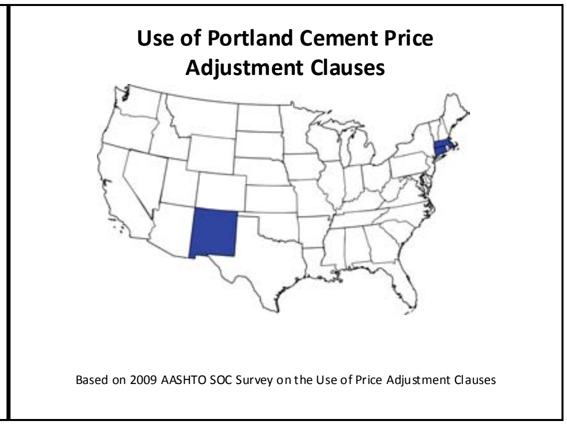
Point 10. Life Cycle Cost Analysis and Asphalt Cost Escalators Don’t Mix.

According to a recent survey of DOT officials performed by the Transportation Research Board, the rarity of portland cement cost escalators is due to the opinion that cement costs are stable and therefore require no escalator clause[12]. The same survey indicated that asphalt prices were highly volatile, and as a result escalator clauses were required.

According to the Federal Highway Administration, “LCCA’s value as a decision-support tool is contingent upon its proper use”[13]. The LCCA process begins with the development of alternatives to accomplish the structural and performance objectives for a project. The analyst then defines the schedule of initial and future paving activities involved in implementing each project design alternative. Next, the costs of these activities are estimated. The predicted schedule of paving activities form the projected life-cycle cost (LCC) stream for each design alternative. Twenty-two states use life cycle cost analysis (LCCA).

[12] “Price Indexing in Transportation Construction Contracts” Transportation Research Board, January 2011.
[13] Federal Highway Administration. Asset Management, Evaluation and Economic Investment.





Using an economic technique known as "discounting," these costs are converted into present dollars and summed for each alternative. The analyst can then determine which alternative is the most cost-effective. By using the same discount rate for all materials, LCCAs have traditionally ignored the possibility of future changes in relative prices by assuming that future price increases for asphalt will be identical to those of concrete. However, significant differences exist in the historical and expected future increases in the price of paving materials.

The use of asphalt cost escalators is based on the premise of volatile and rising prices of liquid asphalt. The lack of presence in the use of portland cement cost escalators is based on the premise that cement prices are stable and not required. Yet, when it comes to LCCA use most state DOTs use the same discount rate for both materials[14]. These are inconsistent policies and lead to biases in the paving material specified for a project. By not accurately accounting for differences in material inflation rates, a recent study estimates this could cost DOT budgets $14 billion over the next 30 years. The study was based on a subset of roads. Adjusted for all interstates, major and minor arterials, this translates into nearly $120 billion of additional costs.

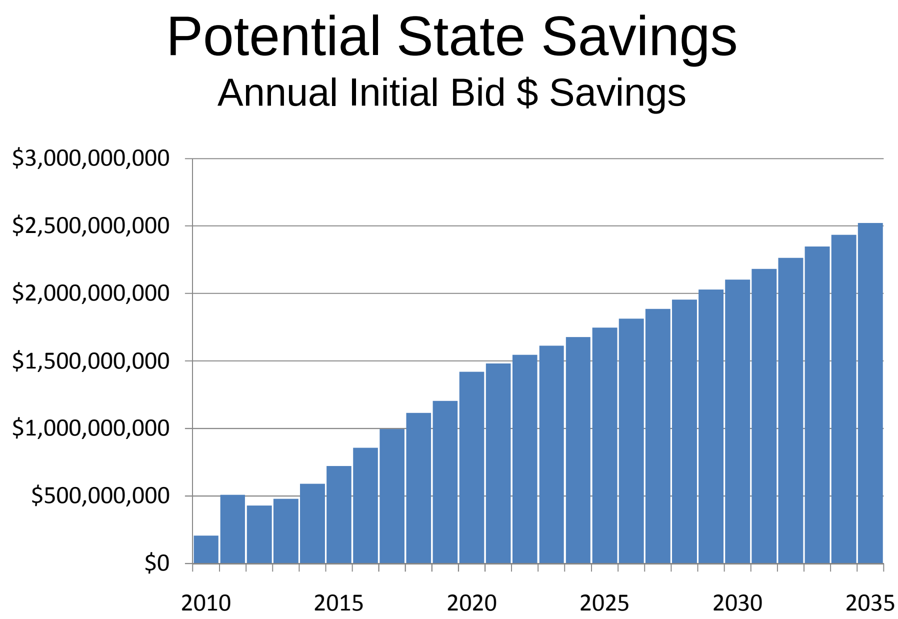
Point 11: DOT Policies That Impede Concrete's Usage Could Cost Billions of Scarce Dollars.

All state DOTs are becoming increasingly alarmed by rising highway maintenance costs. This alarm has been heightened due to near term state fiscal pressures brought on by the recession and long term pressures brought on by changing demographics and growing entitlement costs. Further, state DOTs are pressured to expand their road systems to meet these impending demographic changes that suggest 47 million additional drivers by 2030.

In the face of increasing public scrutiny, transportation agency officials are under great obligation to demonstrate their stewardship of taxpayer investments in transportation infrastructure. Many transportation agencies are investigating economic tools that will help them choose the most cost-effective project alternatives and communicate the value of those choices to the public. At the same time, DOT officials could come under increasing pressure to explain outdated procurement policies that potentially work to reduce competition or distort the bidding process to such an extent that higher initial cost of paving and longer term, high maintenance solutions continue to receive favorable policy

[14] Concrete Sustainability Hub@MIT Life Cycle Cost Analysis Brief July. MIT found that not using material specific deflators or discount rates will greatly underestimate the total cost of asphalt roads and overestimate concrete roads. MIT found that asphalt prices will increase an inflation adjusted 95% while concrete will drop 20% over a 50 year timeline. MIT stated that not using material specific cost adjustment factors can cause budget overruns of up to 4% specifically due to higher than expected asphalt prices. MIT's analysis, which points to the need to use material specific discount rates, are critically important.

treatment. Free market forces, in the context of a level playing field, are extremely powerful. Eventually, these forces will be released and dictate DOTs material paving choice.



Source: PCA Based on WISPAV Data, For Urban High Volume Roads Only

The recent economic downturn has forced states to prioritize their spending – shifting highway maintenance dollars to entitlement spending. Road quality, as a result, has deteriorated according to the FHWA's International Roughness Index (IRI). States face both the need to expand, repair, and improve roadways. Concrete paved roads could save states billions of dollars annually in initial paving costs and over the life cycle of those roads. How much concrete paving could save a state depends on the amount of paving activity undertaken by a state and how quickly DOTs recognize and react to the new paving realities and turn to the concrete alternative. Urban interstates, major arterials, and minor arterials are typically characterized by high daily traffic use – requiring durable pavements. These roads represent only 615,000 lane miles of the nation's 8.3 million total lane miles, or roughly 7.5% of all roadways. If ***only*** these major high traffic roads in urban areas rated in "poor" condition by the IRI were repaved in concrete, states and localities would have saved more than $500 million in initial paving costs and nearly $1 billion in life cycle costs ***this year.*** [15] As time wears on, and concrete's paving advantage widens, the potential annual savings grow. During a 25 year horizon, states could save $61.8 billion in lifetime paving costs. Keep in mind, PCA believes these estimates are conservative and the savings could be even larger.

[15] Federal Highway Administration defines these roads as interstates, major arterials and minor arterials. Geographically, urban areas include all roadways of these type in metropolitan areas.