Update: Paving, The New Realities

Overview

PCA believes the combination of sustained high asphalt prices, challenging budgetary pressures, as well as the need to improve and expand highway infrastructure have created extremely favorable conditions for significant increases in concrete highway paving. The purpose of this Flash Report is to provide specifiers accurate information about the implications of sustained high oil prices on initial bid and life cycle paving costs and to assess the potential upside risk to PCA cement consumption projections.

State Department of Transportation (DOT) executives frequently have to choose between concrete and asphalt paving materials for roads and highways. According to liquid asphalt producers, regional shortages of asphalt materialized during 2007-2008. These shortages were created by relatively strong paving demand. In addition, asphalt supply shortfalls were generated as oil refiners adopted new equipment, called cokers, aimed at shifting the mix of refinery output toward higher margin light crudes and away from lower margin heavy crudes, such as liquid asphalt. The resulting shortfalls caused a dramatic escalation in asphalt prices – reflected in a 250% increase during 2005-2008.

Economic distress has resulted in significant fiscal difficulties facing state and local governments. As a consequence, a decline in paving activity has materialized – reducing regional shortages. It is likely that once the economic recovery gains traction, large shortages may reappear, oil prices will rise and asphalt prices will resume their upward climb.

Paving Activity in Temporary Decline

Source: US Bureau of Census, Mining & Construction Division
State DOT executives must consider these new paving cost realities in the context of competing population and demographic trends. Anticipated gains in driving age population, for example, suggest a need to expand America’s highway systems. At the same time the aging of America’s population will add to the burden of entitlement spending, such as Medicaid – potentially at the expense of state infrastructure funding.

**Point 1: Decline in paving demand is temporary.**

Paving activity has declined for seven consecutive months. By itself, the 2009 American Recovery and Reinvestment Act (ARRA) is expected to significantly increase paving activity. Due to administrative lags, however, stimulus spending is not expected to have any great impact on paving activity until fiscal 2010. This stimulus, however, must be viewed in the context of difficult fiscal budgetary pressures currently facing state governments. Weak labor market conditions directly translate into reduced state revenue (income and sales tax declines) as well as increases in entitlement spending in the form of unemployment insurance.

Huge deficits have materialized in 47 states. Faced with the choice of funding entitlement and education programs or road paving, states have reduced spending on paving. PCA expects discretionary spending on road paving will continue to contract as long as large deficits remain. This scenario is not expected to improve until a sustained period of significant job growth materializes. Unfortunately, this process will not begin until the second half of 2010. While the fiscal conditions of states will improve with the onset of job creation, for the most part, state deficits are unlikely to begin fading until fiscal year 2012 (2nd half 2011). This assessment suggests that state budget conditions will act as a drag on paving activity for another two years – moderating the potential increase in paving activity associated with ARRA.

The potential for a large increase in paving activity could materialize in late 2011 and beyond. By that time, state budget pressures will be healing – boosting discretionary highway paving activity. These gains could be amplified by the new highway bill. The current program expires September 30, 2009. PCA assumes reauthorization will be delayed one year and could be funded at $400 billion compared to $280 billion funded by the prevailing program – a 42% increase. Under the current SAFETEA-LU bill, roughly 60% of total highway spending is targeted at “system preservation” or resurfacing activity.

**Point 2: Demographic and state fiscal pressures may dictate the need for more durable paving materials.**

During the past 25 years, investment in highways and roads has not kept pace with demographic changes. Lack of investment has led to increased traffic congestion, wasted fuel, higher CO2 emissions, wasted time, and increased logistical costs to the detriment of economic growth. Demographic changes during the next 25 years suggest the need not only to repair the United States’ aging highway infrastructure, but to expand it as well. By 2030, the United States is expected to add 49 million licensed drivers, an increase of 24% over 2007 levels, vehicle registrations will increase by 58 million vehicles and total vehicle miles travelled is expected to increase 49% compared to 2007 levels.

The need to accelerate highway investment, coupled with new budgetary pressures, suggests that states must re-assess how to best stretch scarce infrastructure dollars. Even with increases in federal funding, much of the responsibility to maintain and expand the nation’s infrastructure will inevitably fall on the shoulders of state and local governments. This ability may be compromised by competing state entitlement responsibilities and diminished federal support. Currently, for example, 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.
Longer term, Federal and state budgetary pressures may compromise the adequate expansion of roadways even in the face of increased use associated with dramatic increases in vehicle miles travelled. More traffic will pass over pavement annually, accelerating wear rates and pavement fatigue. Such a scenario suggests the need for more durable longer lasting paving materials.

**Point 3: Despite weak demand and lower oil prices, asphalt paving costs remain extremely high.**

Asphalt pavement materials represent a mix of aggregate (stone), sand or gravel and crude refined Bitumen, also called liquid asphalt. Liquid asphalt is a sticky black residual material obtained from the refining of crude oil and acts as the binding agent for asphalt. Since liquid asphalt is a residual from crude oil refining, as oil prices rise liquid asphalt prices increase.

According to the Bureau of Labor Statistics, from July 2003 to July 2008 oil prices increased 334%. During the same period, liquid asphalt increased 251%. Heavy crude oil is an important feedstock to asphalt, and oil price increases are an important reason explaining rising asphalt prices. The increases in asphalt prices during this period were not only a result of rising oil prices, but also by changes in oil refining practices which has led to a reduction in heavy crude production and reduced import supply. These increases stressed state DOT budgets – forcing many to cut back on paving projects and important infrastructure improvement programs – to the eventual detriment of commuters, the environment, and commerce.

Global economic weakness has resulted in a 53% decline in oil prices during the past year. Despite reduced paving demand and lower oil prices, asphalt prices have declined only 12% from record high levels during the same period. The modest downward asphalt price movement reflects cyclical and structural supply dynamics facing the industry. The slowdown in economic activity has resulted in lower utilization rates at refineries – reducing asphalt production. Declines in domestic asphalt production have been amplified by new coker capacity brought on-line during the past year. Finally, Venezuela ended all asphalt exports in January 2008. During 2004-2005, roughly two-thirds of United States' liquid asphalt imports were sourced from Venezuela.
The declines in asphalt pricing appear to be completely dictated by lower feed costs, namely oil prices. The full pass-through of these costs, however, has been prevented by supply dynamics facing the asphalt industry. Some of these adverse dynamics, such as low refinery utilization rates, are cyclical in nature and will fade as the economy regains traction. Keep in mind, higher utilization rates are synonymous with higher oil prices and higher asphalt feed costs. Unfortunately, issues such as increased coker capacity and reduced import availability (and the potential shift of the U.S. to a net asphalt exporter) are viewed as structural and longer term market conditions.

**Point 4: A return of synchronized world growth may signal a return to high oil prices.**

Oil prices are highly volatile. While they have declined as the global economy weakened, West Texas Intermediate (WTI) oil has remained very high compared to historical standards – even in the face of the current economic slowdown. Modest increases in oil prices from current levels are expected to prevail through mid-2010.

Once stronger world economic growth returns, PCA expects oil prices will eventually return to 2008 levels. According to the latest survey of forecasts by the World Bank, United Nations, the Organization for Economic Co-Operation and Development (OECD), as well as major banks and consulting firms, world economic growth is expected to decline 1.6% during 2009, followed by modest, stimulus-induced rate of 1.2% in 2010. Stronger rates, averaging 2.5%, are expected to materialize during 2011-2012. Synchronized world economic growth may emerge for 2012 and beyond – suggesting the potential for a run-up in oil prices.

PCA’s oil price scenario reflects significant changes in global energy demand. World economic growth is no longer dictated by conditions in the United States, Western Europe and Japan. Emerging markets are increasingly becoming a major driver. While China dominates this sphere (accounting for roughly 10% of world oil consumption), it is a mistake to dismiss the strong growth conditions materializing among other emerging markets. Longer term world economic growth is expected to be characterized by buoyant growth among developing and transitional economies – adding new demand pressures on oil prices.

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**Oil Price Outlook**

Price Per Barrel of Crude

Sources:
- PCA estimates for West Texas Intermediate, fiscal calendar year (Blue).
- EIA/DOE estimates interpolated short and long term projections for imports, calendar year (Yellow).
Furthermore, international supply is constantly threatened by political instability, particularly in Iraq, Iran, Nigeria, and Venezuela. With the return in world demand and faced with limited excess capacity, upward pressure on prices could emerge rapidly as a result of political instability in both OPEC and non-OPEC regions.

Despite the current economic downturn, future economic growth among emerging economies will again result in strong and sustained increases in global oil demand that could outstrip the ability of oil producers to increase production – leading to sustained high oil prices and amplifying the future escalation in asphalt prices. By 2015 oil prices are conservatively expected to exceed $133 per barrel – re-establishing past peaks. Longer term projections made by the United States government suggest that oil prices may exceed $180 per barrel by 2030.

**Point 5: Emerging changes in refining practices will lead to a significant reduction in future liquid asphalt supply.**

The 2004-2008 price run-up in gasoline, diesel, and other fuels (light crude products) resulted in large margins for these products. In response, crude oil refineries in the United States have engaged in long-term decisions to shift production to light crude products and away from lower margin heavy crude products, such as liquid asphalt. This production shift is enabled by supplementing existing refining processes with equipment called cokers. The cokers increase the ability to refine more higher margin light crude products, such as gasoline, per barrel of oil. Refineries with installed cokers produce less lower-margin residual products such as liquid asphalt.

![Gasoline - Asphalt Margin Per Barrel Differential](image)

Based on a ten-year investment payback to make installing cokers a viable investment, PCA estimates the threshold margin differential between light and heavy crudes is roughly $14-$15 per barrel. The margin differential steadily increased above the threshold beginning in 2004 and reached more than a $90 per barrel spread in 2008. The differential has since declined to $39 per barrel but remains well above investment thresholds. As a result of these margin incentives, 21 new coker projects at refineries that currently produce liquid asphalt are expected to come on-line by 2014. In the context of sustained
high margin differentials between light and heavy crude products, as well as government mandated ultra-low sulfur diesel requirements, the incentive for crude refiners remains to add even more cokers in the years ahead.

Announced new coker capacity additions are expected to reach 535 thousand barrels per day by 2014 – reducing United States liquid asphalt supply by roughly 35% from 2006 levels. This translates into roughly 11.5 million metric tons of reduced asphalt supply. The likelihood that coker installations will accelerate as oil prices increase suggests that estimates of future coker installations are underestimated and, as a result, could lead to an overestimate of future asphalt supply.

**Point 6: Liquid asphalt import supply will likely become more expensive and unreliable.**

Future potential domestic shortages in liquid asphalt will not be “cured” by increased reliance on imports. Historically, 94% of United States liquid asphalt consumption has been supplied domestically and roughly 2 million metric tons imported. PCA estimates a 10 to 12 million metric ton shortfall in liquid asphalt supply will materialize by 2014. This implies that liquid asphalt imports would need to increase by at least five fold to close the potential gap between consumption requirements and domestic supply.

The trend toward increased use of cokers is not just a United States phenomenon – it’s global. All independent analysis surveyed by PCA suggests a reduction in world asphalt supply in the years ahead. Supply changes are expected to materialize in the context of world economic growth and growing non-U.S. paving requirements. The availability of foreign sources of liquid asphalt supply is expected to be squeezed resulting in the potential for high import prices and unreliable supply. High and volatile freight rates add uncertainty to the reliability of import supply.

During 2004-2005, roughly two thirds of United States’ liquid asphalt imports were sourced from Venezuela. Using petroleum exports as a political tool, the Chavez government has imposed asphalt export restrictions in 2008. Venezuela’s decision to cease asphalt exports not only disrupted the import

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![Current United States Coker Capacity Projects at Asphalt Producing Refineries](image)

**Source:** Various Reports, Nustar Energy
flow into the United States, but created a void of supply in South American and Caribbean markets. This supply void has been partially filled by United States liquid asphalt producers. The combined reduction in imports and the increase in exports transformed the United States from a persistent net importer to a net exporter of asphalt during 2008-2009 – to the detriment of U.S. supply and perhaps an indication of the future vulnerability of reliance on imported liquid asphalt supply.

**Point 7: Shortages will likely characterize the future asphalt market – accelerating prices.**

The installation of cokers and the shift in refining practices has resulted in regional shortages of asphalt. The emergence of the United States as a net exporter of asphalt has amplified domestic supply shortfalls. According to reports by Nustar, the third largest liquid asphalt producer, the United States was short of asphalt supply during 2007 and 2008, despite weakness in paving demand.

Near-term liquid asphalt supply reductions may be masked by weak paving demand. The current economic slowdown has worsened state budget conditions – resulting in reductions in public paving activity. As a result, the supply reductions in liquid asphalt have become less apparent (24 mbpd in 2007 versus 5.4 mbpd in 2008).

Once the economic recovery gains traction, the magnitude of looming asphalt shortages are likely to become more severe. Two key factors account for this assessment: First, paving demand will increase. This demand will be amplified by stimulus spending, and PCA expects a new, larger federal highway bill in fiscal 2011. Second, the trend toward increased implementation of cokers by refineries will continue unabated unless the margins on liquid asphalt improve dramatically – that means even higher asphalt prices. Currently, the spread between light and heavy crude (liquid asphalt) is roughly $39 per barrel. Such increases in asphalt prices will probably only be narrowed in the context of large, sustained shortages. Even if the light-heavy crude price spread is eventually eliminated, it will only arrest the trend toward additional coker installations and continued declines in asphalt supply.
These assessments are reinforced by shortage projections made by liquid asphalt producers. According to these projections, by 2012 the United States asphalt shortages will reach a level more than 10 times the severity that materialized in 2007. Shortages of this magnitude imply large price increases.

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<th>Asphalt Supply/Demand Balance by Region</th>
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<td>(Thousands of Barrel per day)</td>
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Note: Estimates from various reports by Nustar Energy (3rd largest U.S. asphalt producer)

Furthermore, shortages are expected to impact all regions of the United States – even those unaffected by the 2007 shortages. The central region of the United States, for example, enjoyed nearly a 30 mbpd surplus during 2007 and is expected to endure an 85 mbpd shortage in 2012.

**Point 8: Dramatic expansion of cement capacity ensures reliability of paving supply.**

The economic downturn has hit the cement industry hard, resulting in a 45 million metric ton decline in volume – the largest in history. Utilization rates are low, inventories are well above desired levels and some plants have been temporarily shut down. These adverse conditions are supplemented by the cement industry’s dramatic $7.3 billion capacity expansion. During 2006-2013, the cement industry will add 25 million metric tons of new clinker capacity – or roughly 27 million metric tons of cement capacity (allowing for gypsum and limestone additions). This investment will increase domestic capacity by more than 25% and dramatically reduce the industry’s dependence on imports.

This capacity expansion will likely delay a recovery in utilization rates and increased dependence on imports. Keep in mind, the ARRA stimulus bill aims at increasing infrastructure spending quickly (120 days). This favors low job-creating resurfacing activity – weighted heavily toward asphalt paving. This suggests a more moderate and prolonged delay in the recovery for cement demand compared to asphalt. According to PCA demand projections, capacity utilization rates are not expected to achieve an 80% rate until 2011, and imports are not expected to reach 2006 peak levels until the far distant future.

**Point 9: Concrete’s life cycle paving cost advantages over asphalt are likely to improve considerably in the future.**

The need to accelerate highway investment, coupled with new budgetary pressures, suggest that states must re-assess how to best stretch scarce infrastructure investment dollars. When roadways are viewed as a long-term public investment, life cycle analysis is used to provide cost estimates over the useful life of the road (roughly 30 years).
Concrete road systems are more durable and require fewer re-surfacings and lower maintenance costs during the lifetime of a road compared to asphalt roads. According to various state DOT records, asphalt pavements require resurfacing at an average age of 9.9 years, and in some cases as short as 6 years. That implies 3 to 5 resurfacings during a 30 year time horizon. In contrast, average age of a concrete pavement before any need for maintenance is 25 to 30 years or longer. That implies ONE resurfacing during a 30 year time horizon. A recent PCA survey of DOT specifiers concludes that concrete pavement on average lasts 29.4 years before a major rehabilitation is required. This compares to 13.8 years for asphalt pavement.
Even with concrete’s sustainability advantages, some estimates of life-cycle costs favored asphalt over concrete. These estimates may materialize due to estimation protocols contained in the software used by DOTs. Given the potential biases favoring asphalt and using DOT software to calculate life cycle costs for a one mile “standard” two lane roadway, PCA calculates asphalt paved roads enjoyed a small advantage over a concrete paved roads prior to fiscal 2008. Past comparisons of asphalt versus concrete, however, are irrelevant. Structural changes in the global economy and refining practices have created new paving realities.

The new paving realities now show that comparative life cycle cost assessments favor concrete in the context of higher asphalt prices. Using DOT software to calculate life cycle costs for a one mile “standard” two lane roadway, PCA calculates concrete paved roads enjoyed more than an $185,000 advantage over an asphalt paved road during fiscal 2009 – roughly a 25% savings. As the supply dynamics facing the asphalt industry continue to unfold, PCA estimates concrete’s life cycle cost advantage per one mile “standard” two lane roadway will increase to more than $730,000 – roughly a 45% savings by fiscal 2015.

**Point 10: Concrete’s initial bid paving cost have reached parity with asphalt and are likely to improve considerably in the future.**

Faced with the strain to meet short-term state budget objectives, state DOT executives sometimes place more emphasis on the initial bid paving cost of a new road. Initial bid costs have long 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 $120,000 cost advantage over a concrete paved road in 2003 – roughly a 30% advantage. Given the “old” realities, it is understandable asphalt paved roads accounted for 94% of all state and local roads. Past comparisons of asphalt versus concrete, however, are irrelevant.

The new paving realities, however, have already taken hold. Initial bid costs favor concrete paved roads. In FY 2009, concrete paved roads, according to DOT software, enjoyed an $82,000 cost advantage over asphalt paved roads. Slack paving demand through the first half of 2009 has probably eliminated many
regional shortages. These conditions reduced concrete’s initial cost advantage over asphalt paved roads to $58,500 per one mile “standard” two lane roadway for FY 2010. Both of these conditions are temporary. Longer term, for example, oil prices are expected to reach more than $180 per barrel by 2030 according to the Energy Information Agency (EIA).

Allowing for the structural supply changes facing asphalt, comparative initial bid costs will increasingly favor concrete paved roads. Using Wisconsin DOT software, PCA estimates by 2015 concrete paved roads will enjoy a $500,000 initial bid cost advantage over asphalt for a one mile “standard” two lane roadway – roughly a 41% savings. Given the magnitude of concrete’s cost advantage over asphalt, it is likely that other state paving cost software will lead to similar conclusions regarding life-cycle and initial bid comparative estimates.

**Point 11: Concrete paved roads could save state DOTs billions of scarce dollars in state spending.**

During 2008-2015, roughly 14.9 million additional licensed drivers will be on United States’ roadways. If congestion levels are to be maintained at 2007 levels, more than 75,000 highway lane miles must be added annually. Given the supply challenges facing asphalt, if all roads in 2015 were paved with concrete, state governments would save $37.5 billion in initial paving costs compared to asphalt. Over the road’s life cycle, the savings resulting from paving with concrete compared to asphalt would total nearly $55 billion dollars. These potential savings must be considered in the context of growing entitlement burdens by the states and their impact on overall fiscal conditions.