# Price and Supply of Asphalt – Setting the Record Straight

The Portland Cement Association (PCA) recently issued a "flash report" on asphalt pavement price and supply entitled Paving: The New Realities.[1] Ironically, the "new realities" referred to in the title seem to be based on an economist's assumption that crude oil would be priced at $100 to $125 a barrel for the foreseeable future. Today (December 22, 2008) the price is under $45 a barrel and many analysts expect it to continue to fall.

In the PCA report, a cement industry economist attempts to build an economic case in favor of concrete pavements by presenting an economic model that includes U.S. demographic changes, Medicaid financing, economic growth projections, oil price projections, refinery economics, and political uncertainty. This analysis is then used to justify a life-cycle cost comparison between asphalt and concrete pavement with no reference to the assumptions used.

The growth in construction costs in highway projects has had a significant impact on state transportation department budgets over the past few years. From 1997 to 2003, highway construction and maintenance costs remained relatively flat. Since 2003, however, rapid growth in costs for highway construction and maintenance substantially outpaced inflation in the rest of the economy. According to a Federal Highway Administration report, Growth in Highway Construction and Maintenance Costs (Report Number CR-2007-079),[2] the growth in costs for commodities in highway projects – aggregates, asphalt, Portland cement, and steel – has been the primary driver of the recent escalation in highway construction and maintenance costs.

The PCA report is based on biased assumptions and jumps to far-fetched conclusions. This attack on the asphalt pavement industry follows an attack on asphalt's environmental sustainability made in July 2008 by the American Concrete Pavement Association before the U.S. House of Representatives' Subcommittee on Technology and Innovation.

**There Is No Shortage of Asphalt Cement**

One of the PCA report's core messages is that there is a shortage of asphalt cement in the U.S. This simply is not the case. Tightness of supply may occur in the market for any material, and the asphalt industry experienced this in some U.S. markets in 2008. Even so, most areas of the country were adequately supplied with asphalt cement.

Asphalt cement is one ingredient in the engineered material known as asphalt pavement. Asphalt cement is mixed with stone, sand, and gravel (aggregates) according to scientifically engineered proportions. Typically, this is in the range of 5 to 6 percent asphalt cement and 94 to 95 percent aggregate by weight.

Asphalt cement is one of many products derived from a barrel of crude oil. Others range from light products, such as gasoline, to heavy products, such as asphalt cement. The market values of the various products change constantly with normal market forces of

supply and demand. Portland cement, steel, and aggregates are also subject to the same supply and demand pressures.

Despite a decrease in the total number of U.S. refineries over the past few decades, the actual crude distillation capacity has grown since 1995. Likewise, in terms of U.S. asphalt production, while the number of U.S. refineries that produce asphalt cement has decreased over the past few decades, the actual capacity to produce asphalt cement from those refineries has remained steady or slightly risen between 2000 and 2008.

Forecasting the future price and supply of commodities including oil-based products is difficult at best, as can be seen with the recent rapid price de-escalation and oversupply of crude oil.

**All Construction Material Costs Have Risen Since 2000**

The FHWA report cited above concludes that "structural economic changes have largely been responsible for the escalation in commodity input costs." For example, the international demand for steel scrap, the primary input to the production of steel used in highway projects including that which is used in concrete pavement, doubled from 2003 to 2006.

Cement and concrete are not immune to price escalation. The FHWA report states, "The price of [Portland] cement is following the shift to higher oil prices, as its production is a highly fuel-intensive process." Cement kilns must be heated to extremely high temperatures, between 2400$^{o}$ F and 2800$^{o}$ F, and considerable power is required for grinding. The cement industry, with its energy-intensive production process, is subject to the volatility in the price of energy very directly. International demand has also had a direct impact on the price and supply of cement, which typically makes up about 12 percent by weight (8 percent by volume) of concrete. For instance, there were spot shortages of cement in 2004 and 2005 due to demand in China and other developing countries.

In addition to acquisition of raw materials, there are, of course, other costs to building and maintaining a highway. These include the costs of labor, overhead, transportation, diesel fuel, equipment, insurance, right of way acquisition, and engineering, to name but a few. Any of these factors can exert a significant impact on the cost of constructing and maintaining a highway project.

**The Ups and Downs of Predictions**

Asphalt is no different from any other hydrocarbon-based product produced from crude oil at a refinery. While crude prices peaked over $140 per barrel in the summer of 2008, so did prices for gasoline, diesel, fuel oil and asphalt. This same relationship occurs when crude prices drop, as they have drastically over the past quarter. On October 30, 2008, the United Bank of Scotland (UBS) estimated that oil prices for the next several years will range from $50 to $80. As of this writing (December 22, 2008), the price of crude is below $45 a barrel.

The downturn in the global economy is likely to last several years and will continue to be a major factor in crude price. Demand for oil will continue to be repressed. The Energy Information Agency (EIA) of the U.S. Department of Energy is predicting that in 2009, world demand for crude will be 450,000 barrels per day less than in 2008 and 500,000 barrels per day less than in 2007.[3] This is a significant reduction.

The PCA report boldly predicts a tightening in the supply of liquid asphalt, based largely on an assumption that more cokers will be installed. A coker is an extremely expensive piece of complex equipment in a refinery that converts asphalt to lighter petroleum products, and costs, depending on the size, in excess of $1 billion. The decision to construct a coker, like other major refinery decisions, is based on forecasted economics, considering future supply and pricing of all petroleum products. The results of these decisions are very difficult to predict. Recently, one major asphalt producer in the Midwest installed a coker as part of an overall refinery upgrade, with the end result being that more asphalt was produced due to increased efficiency and running a new crude slate. Typically, when a coker is added, one reason is to be able to run heavier, sour crude to reduce material costs. This in turn increases production of residual material which is blended for the production of asphalt. The installation of a coker does not necessarily reduce the asphalt output for a refinery.

Asphalt inventory, though slightly lower in 2008 relative to 2005-2007, has followed the same trends throughout the year as compared to historical monthly inventory. In fact, as recently as 2007, asphalt inventories were higher than average. Since the 1980s, asphalt supply has kept pace with demand.[4]

Supply tightness can be illustrated by referring to the Portland Cement Alliance's own 2004 Flash Report,[5] which described a serious shortage in the cement industry. They stated that "many producers currently hold very lean inventories," "29 states are affected by cement shortages," and "imported cement represented 22.6 percent of total consumption." Additionally, they predicted that the ability of their industry to meet demand would be further hampered by their inability to make good on increased supply predictions due to zoning, environmental, and economic considerations.

**Not a One-to-One Relationship**

The effect of oil price fluctuations on asphalt paving projects is diluted, because asphalt pavement material contains only about 5 to 6 percent liquid asphalt cement by weight, with the remainder being aggregate. When reclaimed asphalt pavement (RAP) is incorporated into the mix, the asphalt cement is reactivated, reducing the need for new asphalt cement. If, for example, 15 to 30 percent RAP is used, then 15 to 30 percent less virgin asphalt cement is required. Concrete pavement material is around 12 percent Portland cement, 80 percent aggregate, and 8 percent other materials (water and admixtures, such as fly ash). When concrete is recycled, the Portland cement cannot be re-hydrated; reclaimed concrete cannot reduce the amount of cement in the final concrete mixture.

A recently released report by the Washington State Department of Transportation comparing bid prices in 2007 and 2008 shows that for concrete pavement, the average unit bid price for the first three quarters in 2008 was $236.27, compared to $140.65 per cubic yard for the same period in 2007. The average unit bid price for steel reinforcing bar was also up, at $1.33 per pound in 2008, compared to $1.15 per pound in 2007.

While the price of liquid asphalt increased in 2008, it is noteworthy that all commodity inputs into highway pavements including aggregates, cement, and steel rebar have increased during the SAFETEA-LU reauthorization period (2004-2008). Just as there were shortages of Portland cement in 1998, 2004, and 2005, there was supply volatility with liquid asphalt in 2008.

Many variables affect the price and supply of commodities. These include the overall economy, regional factors, government road spending, housing development, international demand, specifications, and natural disasters, just to name a few.

**There Are Many Reasons To Choose Asphalt Pavements**

Asphalt is not only affordable and abundant, it is the best material for pavements. Here are a few key points:

***1. Asphalt pavements have the lowest carbon footprint of any pavement type.*** Producing and placing asphalt pavements consumes 40 percent less energy than continuously reinforced concrete pavements. In comparing the two pavements, it is worthwhile to note that production of Portland cement is the number three source of greenhouse gases in the United States, and that about 5 percent of all $CO_2$ comes from cement production, according to the *Journal of Cleaner Production*.[6] An average of one ton of greenhouse gases is produced for each ton of Portland cement manufactured.[7]

***2. The asphalt industry is America's recycling leader.*** Asphalt is by far the most reused and recycled pavement material in America. About 100 million tons of asphalt pavement is reclaimed every year, and more than 95 percent of the reclaimed material is reused or recycled.

***3. When RAP is reused in asphalt pavements, the asphalt cement is reactivated and becomes part of the binder (or glue) for the new pavement.*** This reduces the amount of virgin asphalt cement that is required. By contrast, when concrete is recycled, the cement cannot be re-hydrated, so recycling concrete does not reduce the demand for virgin Portland cement.

***4. Asphalt can provide Perpetual Pavements that virtually never need to be completely removed and replaced.*** The fact that asphalt pavements can be left in place indefinitely, and maintained with infrequent milling and resurfacing, gives asphalt the advantage in sustainability.

***5. Between 1970 and 1999, the asphalt industry increased production by 250 percent while reducing total emissions by 97 percent.*** Ongoing innovations by the asphalt industry, such as warm-mix asphalt, continue to reduce fuel consumption and emissions even further.

***6. The asphalt industry even helps to recycle concrete pavements.*** When a concrete pavement needs reconstruction or major rehabilitation, rubblizing the concrete and topping it with an asphalt overlay is the easiest, lowest-cost, and most effective way to rehabilitate the pavement in the shortest amount of time. This saves energy and landfill space as well.

***7. Perpetual Pavements constructed of asphalt can last indefinitely.*** Perpetual Pavements are constructed in layers that are designed to limit distress to the surface, so that routine maintenance is a simple matter of infrequent milling followed by an overlay. The material that is reclaimed is reused or recycled. A Perpetual Pavement never needs to be removed and replaced. A Perpetual Pavement is there for a lifetime, making it the most economical choice

***8. Asphalt pavements offer the lowest life-cycle cost.*** A new asphalt pavement will probably last 15 to 20 years before needing maintenance. When maintenance and rehabilitation are needed, the process is economical and simple.[8]

***9. Construction is faster with asphalt.*** Newly constructed asphalt pavements can be opened to traffic as soon as they have been compacted and cooled, without curing time.

***10. With asphalt, maintenance and rehabilitation can be accomplished in off-peak hours.*** Sometimes, commuters never see an orange barrel; they find out about road work when they drive on a new, smooth, quiet pavement the next day.

## Conclusion

The asphalt industry is committed to working with owner agencies at all levels to provide the best possible value for building and maintaining America's roads and highways. When considering whether to choose asphalt or concrete for new construction, specifiers should consider the most economical use of the taxpayers' money. They should also keep in mind what happens to concrete pavements at the end of their lives. With even the newest, best-constructed concrete pavement, one thing is certain: at some point in the future, it will become, at best, the base for a new asphalt road.

**Endnotes**

1. Sullivan, Ed, "Paving: The New Realities," *PCA Flash Report,* October 14, 2008, Skokie, IL.
2. Federal Highway Administration report, Growth in Highway Construction and Maintenance Costs (Report Number CR-2007-079)
3. Derived from information in the *Oil & Gas Journal* and Energy Information Agency (EIA) of the U.S. Department of Energy
4. Derived from information in the *Oil & Gas Journal* and Energy Information Agency (EIA) of the U.S. Department of Energy
5. Sullivan, Ed, and Dave Czechowski, "Cement Shortage Assessment Update," *PCA Flash Report,* June 8, 2004, Skokie, IL.
6. Huntzinger, Deborah N. and Thomas D. Eatmon, *Journal of Cleaner Production,* http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VFX-4SWP1TT-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=b0d842769dba93030f5915f9888b6c82, downloaded December 22, 2008.
7. http://www.buildinggreen.com/features/flyash/appendixa.cfm.
Downloaded December 22, 2008.
8. Von Quintus, Harold L., et al., *Expected Service Life and Performance Characteristics of HMA Pavements in LTPP,* Asphalt Pavement Alliance, Lanham, Maryland, February 2005.