The *Competitive Materials Report (CMR)* focuses on construction sub-segments and developing strategies for promotion around potential growth. It attempts to assess future cement volume opportunities, or risks, posed by changes in the competitive environment among major building material products. The *CMR* first defines concrete’s material competitors, and then examines the construction sub-segments as the competitive arena in which promotion takes place.

Lumber, for example, is a material competitor of concrete in the housing market. The residential sector is expected to grow rapidly during 2014-2018. This would seem to suggest aggressive promotional activity be undertaken today to capitalize on future opportunities, but there are additional issues to consider. It is important to assess if the potential opportunities for concrete volume gains still exist if lumber prices decline dramatically from current levels, or if non-price factors (e.g. code or public perception) move against concrete’s competitive position.

This report takes the perspective of concrete as a material competing in construction sub-segments, as well as perspective of PCA as concrete producers competing against other material producers. Not much may distinguish the two approaches, but concrete competes against other materials as well as strategies employed by their promoters. This competitive perspective of the concrete market blends well with PCA’s recent promotion initiatives.

The *CMR* assesses concrete’s competitive position with respect to three key competing building materials: steel, lumber, and asphalt (as well as a small section for clay). For each competing material PCA assesses:

- The competitive arena of concrete against the competing material and the outlook,
- A brief overview of the cost structure and competitive characteristics facing the competing material,
- The price outlook for the competing material,
- Non-price factors affecting concrete’s competitive position versus the competing material,
- Potential market share gains and cement volume assessments,
- Identification of issues that could lead to an amplification of opportunities, and/or risks for changes in concrete volume,

The *CMR* focuses on potential competitive changes among building material producers in three time horizons, including perspectives and assessments in the near-term (2014-2015), medium-term (2016-2018), and long-term (beyond 2018).

The hope is that by better understanding the environment in which concrete competes with other building materials, PCA can adjust its promotion efforts to maximize their marketplace impact. The ultimate aim is to compete more effectively with steel, asphalt, and wood.
Key Findings

- PCA expects 2014 construction activity to gain momentum in the second half of the year. There is considerable evidence that the economy’s growth path softened during the past several months, but PCA believes underlying economic fundamentals are stronger than recent data suggests.

- Competitive conditions within the United States building material market will be increasingly influenced by global economic conditions. Current global economic conditions indicate continued growth in the U.S. and a recovery in Europe, but there is potential for a decline in demand from China as their rate of growth is slowing.

- PCA expects concrete’s relative price position will be mixed against each of its material competitors by 2018. Concrete’s relative price position is expected to improve against lumber, but wane against steel and asphalt.

- PCA’s analysis suggests a gradual weakening in concrete’s competitive position in terms of relative prices versus steel. This conclusion is based on the scenario that reduced Chinese demand will result in an over-supply of an already saturated market, along with the availability of cheaper iron ore. This scenario suggests steelmaking costs will soften through 2015 and then stabilize as the market imbalance is corrected.

- PCA’s analysis suggests a temporary reduction in concrete’s competitive position in terms of price versus asphalt. This conclusion is based on projected near-term declines in the price of oil. When oil prices start to rise again after 2017, concrete’s relative price position will once again improve.

- PCA’s analysis suggests that lumber’s relative price position will sharply decline against concrete in the near-term. Given the magnitude of the recent disparity in price movement, near-record level lumber prices caused significant tightening in relative price and will continue to do so through 2014. PCA believes increased housing starts will force capacity expansion, eventually relieving upward pressure on price; however, U.S. supply and Canadian imports may be restricted by the mountain pine beetle epidemic, forcing what would be an eventual price correction to become a less rapid, but consistent rate of growth.

- Non-price competitive factors may cause potential market variation that might not otherwise be anticipated, even if relative price changes occur as expected.
Global Growth Risk Assessment

Overview

Continued troubles facing some economies in Europe, coupled with a slowdown in the Chinese economy, are expected to curb 2014 growth rates. Average expected growth in world GDP for 2014 as projected by the World Bank, International Monetary Fund (IMF), and the United Nations is 3.2%, 3.6%, and 3.0%, respectively. PCA expects real world GDP will grow by 3.3% in 2014. These rates are expected to be much lower than the average annual growth rates achieved during the ten years preceding the great recession.

By 2015, the United States recovery will have advanced, and distressed European economies are expected to record marginal economic growth. The gradual strengthening among industrialized economies is expected to improve the export outlook among transitional and emerging economies – strengthening their economic growth prospects. By 2016, synchronized world economic growth is expected to re-emerge.

Global Economic Outlook

PCA’s current world economic forecast reflects weaker growth compared to our last forecast. Four key factors account for this adjustment, including: 1) greater economic distress associated with European sovereign debt adjustments; 2) slow job creation among developed countries; 3) slower export opportunities for emerging and transitional economies due to slower growth among industrial economies; and 4) the lagged response of tight monetary policy on economic growth among emerging economies in reaction to high commodity prices and inflation. The third and fourth factors are critical ingredients in China’s growth rate slowdown.

Gradual economic recoveries are expected to characterize developed economies. The United States’ economic recovery is gaining strength and real GDP growth is expected to accelerate from 2.4% in 2013 to an average of more than 3.0% during the remainder of the forecast horizon. Hampered by the sovereign debt issues, Euro Zone economies are weak and regional growth is expected remain meager throughout the forecast horizon. Overall, developed economies annual economic growth is expected to average less than 2% growth through 2015.

PCA considers the impact of any one of these risks to global growth to be cyclical and not structural in nature. In other words, the long-term underlying support for sustained growth is expected to remain intact. In light of this, PCA expects that growth will accelerate in a largely synchronized fashion beyond 2014.

Commodity Prices Outlook

Commodity prices had been steadily declining alongside the deceleration in world GDP growth. The impact of global economic activity among the major materials – lumber, steel, and asphalt (oil) – is expected to be mixed. According to the IMF, weak growth in advanced economies and sharp slowdowns in many emerging economies are contributing to declines in metal prices. The global slowdown is expected to moderate increases in lumber prices, steel, and asphalt. As global growth accelerates, concrete’s competitive position is expected to be enhanced.
Global Growth Risk Assessment - continued

**Implications on the Competitive Materials Environment**

**The near-term outlook (2014-2015).** PCA assumes that global demand for basic materials like oil and lumber will grow at a measured pace as the European debt crisis and inflation cooling in China continue.

**The medium-term outlook (2016-2018).** All major world regions are expected to be on an economic path of growth or recovery. Europe’s economic growth, however, is assumed to be slowed by austerity measures put in place from the debt crisis. China’s potentially weaker domestic demand from tighter monetary policy measures will be offset by strong export growth from a resumption of synchronized world growth.

**The long-term outlook (beyond 2018).** During this period, the world economy continues to find its stride. European growth, no longer suffering from the effects of the debt crisis, will add more demand to an already crowded global market. Prices for construction materials more exposed to foreign markets continue to accelerate providing strength to the competitive position for concrete.
Near-term global economic conditions are temporarily weakening concrete’s relative cost advantages. Steel prices decreased 6.3% in 2013 from 2012 while concrete rose 2.7% to a record high, according to the Bureau of Labor Statistics. In 2014, steel prices are expected to fall 6.0%. By 2018, PCA expects steel prices to be 2.1% below its 2014 level.

Steel prices were relatively steady month-to-month in 2013. In April of 2012, the steel PPI started to decline but it proceeded to level off. The decline is assumed to be a result of sluggish economic conditions, which are expected to turn around in the U.S., but it may deepen as China’s growth slows.

PCA’s outlook for steel prices is based on expectations that slowing Chinese growth and excess raw material supply will temporarily diminish prices, before an increase in global demand will prompt increases in steel scrap prices, iron ore, and dry bulk carrier costs for steel imports.

The key U.S. construction markets, in which concrete competes against steel are expected to begin recovery in 2014.

Concrete’s competitive price position is expected to be curtailed through 2018. The concrete-steel competitive arena may not be very sensitive to relative price changes below a certain threshold. Non-price factors could also hinder market share gains. Attitudes and perceptions, codes and standards, and sustainable development all sway cement consumption. According to PCA surveys, steel holds a perceived advantage as being more flexible in design and quicker to build.
Concrete-Steel Competitive Arena

While concrete’s competitive position may change due to price or non-price conditions, this does not necessarily translate into a significant near-term promotional opportunity/risk in terms of concrete volume. Potential volume opportunities or risks are dependent on the performance of the specific construction sub-markets in which the materials compete. This section serves to put into context the potential opportunities and risks in terms of volume and the timing of these potential gains or losses resulting from changes in concrete’s competitive position.

Concrete competes directly with steel building materials in key market sub-segments including nonresidential buildings, public buildings, and bridges. The concrete-steel competitive arena typically accounts for an estimated 29% of total cement/concrete consumption and roughly 36% of total construction activity. In terms of promotional activity, a successful campaign targeting a 1% gain in market share across all sub-segments within the concrete-steel competitive arena would translate into roughly 269,000 additional metric tons under “normal” construction market conditions.

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1 Bureau of the Census Annual Construction Spending Put-In-Place, PCA estimates for the Apparent Use of Portland Cement and Real Construction Spending
2 A normal market is defined here as an average of the last ten years.
Outlook for Concrete-Steel Competitive Arena

The near-term outlook (2014-2015) calls for softened prices the second half of 2014 while uncertainties around a growing surplus of iron ore (a basic component of steel) emerge. The uncertainties stem from a reduction in anticipated demand from China, coupled with increased production. United States steel, usually one of the highest-priced markets, could see price pressure from cheaper, imported steel.

- U.S. nonresidential construction activity has started its recovery and is projected to grow over 8% in 2014. Office worker employment and vacancy rates are improving. Additionally, it is possible that some of the global demand for steel that was lost to China may be recouped by a recovering Europe.

The medium-term outlook (2016-2018) for construction activity in the concrete-steel competitive arena is unfavorable as well. Potential changes in concrete’s competitive position relative to steel could represent significant risks associated with market share changes. Steel prices may still be declining from China’s over-supply and lessened demand, but are expected to level off over this period. Long-term concrete price growth ranges between 2-3% when there is economic growth. A return to this pace against a flat steel price will mean gains for steel in its competitive price position. Nonresidential construction gains are to continue at close to a 10% year-over-year rate through 2018, relieving the pent-up-demand brought on by the prolonged economic downturn.

- While nonresidential construction typically lags the recovery in other construction sectors, once it returns, it is often marked by large sustained percentage gains. Sustained job creation improves occupancy and usage rates, firm leasing rates, resulting in modest appreciation of commercial asset prices and an easing in commercial lending standards.

The long-term outlook (beyond 2018). Construction activity in the concrete-steel competitive arena could show modest-to-moderate growth. By 2018, the combination of solidified recoveries in the US and Europe, and the balancing of the Chinese market’s supply and demand should allow the price of steel to return to a growth trend, thereby increasing concrete’s competitive positioning. Nonresidential construction will settle to moderate growth rates generated by economic growth and demographic changes. Bridge construction will be largely dictated by the size of future highway bills and state fiscal conditions. At this time, both segments are expected to experience modest-to-moderate long-term growth.
Structure of the United States Steel Industry

One facet of steel prices can be understood through the cost structure of steel. This helps to identify the key factors relating to movements in steel prices.

There are two steel making processes that characterize the steel industry – the Basic Oxygen Furnace (BOF) and the Electric Arc Furnace (EAF). Each process has different manufacturing inputs and, as a result, faces different cost pressures.

**EAFs** represented 60% of United States' steel production in 2013.\(^3\) Most of the steel used in the United States' building and bridge industry is produced in EAF mills (including almost 100% of beams and columns and 80% of the plate used for bridge construction).

- Steel scrap is the dominant material input for EAF steel production accounting for roughly 75% of EAF production costs. PCA estimates that a 5% increase in the cost of steel scrap will roughly translate to a 3.8% increase in overall steel making costs at an EAF plant.

- Electricity costs account for 6%-7% of overall EAF steel production costs. PCA estimates that a 5% increase in the cost of electricity roughly translates to a 0.3% increase in overall steel making costs at an EAF plant.

**BOFs** represent 40% of United States steel production in 2013.\(^3\) BOFs do not supply a great deal of steel to the construction industry, but do, however, influence overall steel costs.

- Iron ore, coking coal, steel scrap, and fluxes account for roughly 90% of BOF total production costs and 80% of variable costs.

- PCA estimates that a 5% increase in the cost of iron ore, coking coal, and steel scrap roughly translates to a 1.7%, 1.0%, and 0.5% increase, respectively, in overall steel making costs at a BOF plant.

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\(^3\) USGS Iron and Steel Mineral Commodities Summary
United States Steel Cost Situation

Cost Inputs

Cost inputs to steel manufacturing have fallen in price. Steel scrap, a major cost input to EAFs, had declined in 2012 but have since leveled off. Electricity costs calmed along with them, but are projected to increase slightly through 2018.

- Steel scrap accounts for 75% of total costs for EAF steel manufacture. According to the Bureau of Labor Statistics, the producer price index for steel scrap in 2013 was down 7% from 2012, but up nearly 10% in the early months of 2014.

- Electricity accounts for 6% to 7% of total costs for EAF and roughly 3% for BOF steel manufacture. According to the Energy Information Agency, the price of industrial electricity is expected to show marginal increases from 2014 to 2018.4

- Pig iron (the intermediate product of iron ore) accounts for 43% of the total BOF manufacturing costs. PCA expects the price of iron ore to decrease 3% on average annually from 2014 to 2018, based on a composite forecast of BREE and the World Bank.

Global Impacts

The United States’ steel industry is intensely competitive and is highly exposed to international competition. The United States imported 30 million metric tons of steel in 2013, translating into a 33% share of domestic consumption. From 2009-2012, Canada, Mexico, Korea, and Brazil constituted over 50% of total imports.5

Local cost increases that are not shared globally are likely to result in profit margin erosion by the domestic players and not be reflected in steel prices. PCA’s focus on cost pressures, therefore, is from a global perspective.

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4 Energy Information Agency Annual Energy Outlook 2014
5 USGS 2014 Mineral Commodity Summary Iron and Steel
PCA price assessments focus on changes in the global cost fundamentals as they may impact foreign steel’s competitiveness in the United States’ construction market. Key areas of analysis include:

- Change in dry bulk freight rates impact the landed cost of imported steel. A 10% increase in freight rate prices translates into a 1% increase in steel prices. As of mid 2013, freight rates were roughly half of their peak levels. By 2018, they are expected to be 70-75% of the peak, with increasingly rapid growth coming in 2016 and 2017.

- The value of the dollar can have significant impact on the level of price competition in the United States steel industry. A weaker dollar diminishes foreign price competition – enhancing the ability of domestic steel manufacturers to pass on cost increases.

- Assuming a mild but positive growth rate for the exchange value of the U.S. Dollar, demand for cheaper imported steel would place price pressure on domestic producers.

Freight rate demand growth is unlikely to eat away the existing supply glut in the near term. Lower raw material (iron ore) costs and an oversupplied market, combined with a steady dollar suggest steel prices are unlikely to rise in the coming years.

**China’s Influence**

As of 2012, China’s steel production represented nearly 47% of total world steel production.\(^6\) China’s steel exports to the United States have more than doubled since 2010, to 1.7 million tons.

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\(^6\) World Steel Association
Changes in China’s steel production can have a substantial impact on global steelmaking costs.

Furthermore, a slowdown in China’s economic growth could lead to the venting of excess capacity onto world markets – depressing steel prices to the detriment of concrete’s competitive position.

Current forecasts for China’s gross domestic product by the IMF and The World Bank show continued deceleration in the rate of growth throughout their respective forecast horizons.\(^7\)\(^8\) This deceleration could reduce anticipated demand, creating a surplus and thus force price of steel to stay flat if not decline.

**Correlation Between Cost Changes and Steel Price Changes**

Small-scale econometric tests were performed to establish a correlation between changes in these cost drivers and changes in steel prices during 2001-2011. The initial results showed an extremely high correlation between costs and prices – suggesting a strong ability for domestic manufacturers to pass on cost increases. This indicates that any shrink in steel production cost will reduce the price of steel, and as a result, hinder concrete’s competitive position.

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<th>Average Steel Price</th>
<th>Global Steel Production</th>
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<td>2011</td>
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</tr>
</tbody>
</table>


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\(^7\) IMF April 2014 Outlook
\(^8\) World Bank Global Economic Prospects June 2014
Impact of Relative Price Changes in the Concrete-Steel Arena

During the past ten years, relative steel-concrete price movements have not resulted in substantial changes in market share. PCA conducted several econometric tests regarding relative price movements against market share changes. The initial findings indicate:

- Bridges are the least sensitive to changes in the relative price. The FHWA’s Annual Materials Reports on New Bridge Construction and Bridge Rehabilitation show little change in the number of concrete bridges from 2003-2009, despite significant movement in concrete’s competitive position.

- Low-rise buildings are relatively insensitive to changes in relative price. With the exception of low-rise public buildings and hotels, all other low-rise sectors exhibit declines in concrete consumption when there is an upward shift in relative price. The low-rise public buildings sector is noteworthy in its large gains in consumption from small gains in market share.

- High and mid-rise buildings tend to be relatively sensitive. Retail high-rise, public building high-rise, and office high-rise are very sensitive to relative price increases.

- The concrete-steel relative price changes imply gains in market share resulting in roughly 400,000 metric tons of cement consumption in the concrete-steel competitive arena if relative steel prices increase 10%.

Steel Content in Reinforced Concrete Buildings

Some types of reinforced concrete buildings require only 10% less steel than a similarly designed steel building. Although rebar is much less expensive than structural steel on a per ton basis, an increase in steel prices will also result in an increase in reinforced concrete – mitigating an improvement in concrete’s competitive advantage. As a result, the existence of viable substitutes other than steel or concrete causes relative price increases in steel over concrete to have negative effects on cement consumption.
Impact of Relative Price Changes in the Concrete-Steel Arena - continued

Generally, as the number of stories increases, the number of substitutes for either concrete or steel framed buildings diminishes. An increase in relative costs causes concrete to gain in its competitive advantage in buildings greater than four stories. Under four stories, the presence of lumber as a viable substitute diminishes the beneficial gains from an increase in relative price.

As shown in the table on the previous page, three out of the four sectors showing negative cement consumption growth are low-rise sectors. An exception to the rule of the low-rise substitution effect is public buildings. The public buildings market tends to have either concrete or steel and does not have a large wood presence. Therefore, increases in relative prices will net a positive gain in low-rise public buildings.

Even with the substitution effect there is still a net gain in cement consumption from increases in relative price. Overall consumption is expected to increase by around 400,000 metric tons should the relative price of steel increase by 10%.
Other Price and Non-Price Factors for Concrete-Steel

While relative prices play an important role in concrete’s competitiveness, other pressures also play a role. These other non-price factors have the potential to overwhelm the effects of an increase in relative steel prices. This section identifies major factors affecting concrete’s competitive position other than relative price.

Attitudes and Perceptions

According to PCA’s 2006 survey of material specifiers\(^9\), the top five criteria for material selection were:

- Cost Effectiveness
- Material Availability
- Construction Time
- Delivery Time
- Design Flexibility

Of these criteria, steel holds a definitive advantage over concrete in construction time and design flexibility categories, with cost effectiveness being a less important factor (see graph below). The survey results clearly show that steel is perceived as easier to design, quicker to build, and relatively less costly to put in place. These perceptions, although disputable, may be contributing to the erosion of the use of reinforced concrete in construction.

The survey also indicates that there is not enough expertise in the field to carry out designs specifying reinforced concrete. The survey results suggest that the number of contractors that were qualified to build steel structures were greater than those who were qualified to build with reinforced concrete. The direct influence that contractors have on material specification is thought to be small. The indirect influence contractors have, due to their availability, appears to be substantial. When decision makers were asked if they would design more reinforced concrete buildings if more qualified contractors were available, 52% of respondents replied that they would.

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Other Price and Non-Price Factors Concrete-Steel - continued

In a separate PCA survey for low-rise buildings, the majority of respondents who indicated a lack of qualified contractors for projects also indicated that they would be inclined to design more buildings with concrete (75% of respondents) and masonry (65% of respondents). Conversely, 60% of respondents indicated that they would not be inclined to design with structural steel or wood even if there were more contractors in their area.

![Would Design More Concrete Buildings If More Contractors In Area](image)

**Codes and Regulations**

Building codes and standards impact building costs. Increased costs resulting from codes and standards can impact expected returns on the investment of building construction. Developers generally strive to construct buildings with the lowest permitted standards in order to manage their costs and increase margins. Lumber is typically thought to have a smaller initial cost and is used in buildings not requiring high safety standards. In terms of codes and standards, steel and reinforced concrete building materials generally have a poorer competitive posture versus wood when standards for building designs are lowered.

**Sustainability**

It is difficult to measure the effect of sustainability on the competitive environment; however, its impact should not be ignored. Construction industry professionals are integrating sustainability concepts in their material selection process. At the same time, there is an ongoing debate as to how sustainability is best measured. This section identifies several key elements that influence the potency of concrete’s sustainability message in relationship to steel.

Perceptions on sustainable materials are liable to change. Based on a 2008 PCA survey, concrete was viewed as a more sustainable material than steel. Approximately 32% of people agree that concrete structures are more sustainable than other materials as opposed to only 27% agreeing the same in favor of steel. According to the same survey, more people were more likely to recommend concrete as a sustainable material rather than steel. In a PCA survey published two years later, 63% of the respondents indicated they would be more likely to recommend concrete as a sustainable material, opposed to 55% of respondents indicating steel.

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Perceptual volatility is in part a function of the differing approaches to measuring sustainability. Organizations have engaged resources in order to understand the best approach to identifying the sustainability of construction materials. Some organizations have focused on the production aspects to measure sustainability, while others have taken a more rounded approach measuring the material’s cradle-to-cradle life cycle.

The Massachusetts Institute of Technology (MIT) has studied the total amount of carbon emissions of buildings from manufacturing to disposal as a means of measuring sustainable building materials. MIT believes concrete has great potential in solving sustainability problems. In a 2010 release, MIT reported that concrete structures can save 5-6% annually in carbon emissions resulting from HVAC energy savings compared to steel.¹³

¹³ Life Cycle Assessment (LCA) of Buildings Concrete Sustainability Hub Massachusetts Institute of Technology Report, December 2010
PCA expects synchronized world growth will occur in the medium-to-long-term, despite a slowing in pace of the Chinese economy. Some economies in Europe are facing continued troubles. By 2015, strengthening of the United States’ recovery is foreseen, and distressed European economies are expected to record marginal economic growth. Over the course of the next few years, steel prices are expected to weaken and then become relatively flat, which will sap some of the competitive advantage concrete has gained. However, global demand is anticipated to increase substantially through 2018, which could mitigate some of the downward pressure resulting from cheaper raw material prices.

PCA’s analysis concludes that the concrete-steel nonresidential competitive arena is relatively insensitive to changes in the relative price of concrete to steel in terms of market share. This is due in part to the fact that reinforced concrete contains rebar steel. An increase in steel prices, therefore, will also result in an increase in reinforced concrete prices – mitigating an improvement in concrete’s competitive advantage. Some sectors could experience decreases in cement consumption volume with a decrease in the relative price of steel.

PCA’s analysis contains substantial risk if China’s internal demand for steel increases more than many experts are currently anticipating. This scenario suggests steel making costs would remain steady or rise somewhat during 2014-2018. In addition, planned steps taken to reduce capacity would help the market reach equilibrium much sooner, especially with a growing Europe. Reduced capacity could raise steel prices – leading to an improvement in concrete’s competitive position relative to steel.

Non-price factors also play a role in diminishing the impact of market share changes resulting from changes in the concrete-steel relative prices.

- Perceptions in favor of steel’s quicker build times and design flexibility have negative impacts on concrete’s market share. Some perceptions, such as the cost effectiveness category, are shifting in favor of concrete.

- The scarcity of local concrete contractors may be an impediment to capturing market share in some regional markets.  

- Codes and standards have almost an equal impact on steel and concrete.

- Sustainability issues are extremely relevant to the future of concrete construction. It is important to continue to comprehend sustainable measurement practices and improve concrete’s voice in the sustainability conversation.

### Conclusion

Construction activity in the concrete-steel competitive arena is expected to grow throughout the forecast horizon. At the same time, relative price decreases to steel and potential share loss present risks to cement volume gains associated with a market recovery. It is possible losses may be impeded by decreases in rebar prices, diminishing the net changes in construction cost disparities between steel and concrete. Further, non-price factors could diminish share gains.

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14 Contact Michelle Wilson (Director of Concrete Knowledge) (847-972-9034) for information about PCA efforts to increase concrete knowledge within the construction industry.

15 Contact Steve Szoke (Director of Codes and Standards) (847-972-9078) for information about recent PCA initiatives in advancing concrete through codes and standards.

16 Contact David Shepherd (Director of Sustainable Development) (847-972-9070) for information about recent PCA initiatives in advancing concrete through sustainability.
PCA expects asphalt prices to remain elevated. In the short-to-medium term, asphalt prices will likely decline due to falling oil prices. On average, asphalt prices have risen 9.5% annually since 2005. They will begin to rise again, though more gradually, in 2017.

It is believed a structural shift within the asphalt industry is occurring. Coker capacity has expanded aggressively in the last five years. According to the EIA, U.S. product supplied of asphalt and road oil has decreased almost 41% since 2005. The asphalt supply decreases due to coker expansion are applying upward price pressure.

Future sustained high asphalt prices may change future paving materials selection. Initial bid costs that once favored asphalt are now in concrete’s favor. In terms of life cycle cost, concrete roads require less frequent maintenance, and last more than twice as long.

Changes in the relative price of asphalt versus concrete could result in market share gains for concrete paving. However, some DOT material selection practices hinder competition between asphalt and concrete. Asphalt cost escalators and nonmaterial specific inflation rates in life cycle cost analyses create an unequal playing field in which these two materials compete.

These factors essentially prevent the free market price mechanism from fully operating – at least initially. In time, given the magnitude of the expected improvement in concrete’s competitive price position and in the context of long-term state entitlement spending pressures, some state DOTs may turn away from such impeding practices.

Source: U.S. Bureau of Labor Statistics

Source: Bureau of Labor Statistics

Bureau of Labor Statistics
Concrete – Asphalt Competitive Arena

The competitive paving arena is a key market for the concrete industry. Based on State Department of Transportation (DOT) bid data alone, the annual potential for cement consumption is an estimated 18 million metric tons – if all state DOT projects are paved with concrete. Projects known as design-build and alternate design/ alternate bid (AD/AB) projects could add considerably more cement consumption potential to the DOT market. Given that the DOT’s market segment is limited – estimated at 20% of the total paving market – the full cement potential in the paving market is likely much larger. Local roads and streets make up the majority of the market, where asphalt has held the lion’s share for several years. Based on the pavement type composition of the stock of lane miles, the share of concrete paved jobs compared to asphalt is between 4 and 8%. Approximately 65% of state agency spending goes to local road capital outlays and maintenance. Even with a smaller spending budget, local road building agencies are expected to pave more lane miles in a year than DOTs and other state agencies, based on historical lane mileage by system and agency ownership. PCA estimates the local road market’s full potential exceeds the 18 million metric tons estimated for DOT jobs; however, the fragmented nature of this market segment makes it cumbersome to focus promotion efforts in this arena.

17 Department of Transportation bid data aggregated by Oman Systems averaged from 2005 to 2013
18 Federal Highway of Transportation Annual Highway Statistics Table SF-21
Outlook for the Concrete-Asphalt Competitive Arena

*The near-term outlook (2014-2015):* Concrete’s relative price position against asphalt is projected to retract from a 2012 peak as oil prices gradually decrease through 2016. Roadway construction activity for 2014 is expected to remain close to current levels. Policy decisions will influence spending activity, tax revenue, and job creation during this year. The Highway Trust Fund is on pace to run dry at the end of the summer and without replenishment, construction could slow to a standstill. However, it is very unlikely that this would happen and some form of fund replenishment is expected soon.

*The medium-term outlook (2016-2018)* is expected to show a return to growth in asphalt prices. Oil prices are expected to rise once again, beginning in 2017, but will still be outpaced by concrete’s price growth (2-3% long-term average). During this period, healthier state budgets will allow for increased infrastructure spending. PCA expects a new long-term highway bill to be in place following the expiration of MAP-21.

*The long-term outlook (beyond 2018)* in the paving arena is expected to show moderate growth. Oil prices are projected to push upward, leading to higher asphalt prices and the strengthening of concrete’s relative price position. Road construction will be largely dictated by the size of future highway bills and state fiscal conditions. Pent-up demand for road expansion projects is expected to vent in this period, through improved state budget conditions and the passage of a long-term highway bill.
Structure of the United States Asphalt Industry

The environment in which asphalt suppliers operate determines the costs associated with asphalt paving and competitive positioning in the paving arena. Understanding this environment aids in determining the past, present, and future direction of asphalt costs.

Asphalt bitumen is a byproduct of oil refining, and represents around 2% of all refining output in the United States. In 2013, there were 138 refineries in 27 states that produced asphalt. These refineries have an estimated annual capacity of 741,000 barrels of asphalt per stream day, or roughly 270 million barrels per year.19

In 2013, an estimated 321,000 barrels of asphalt per stream day were produced from refineries implying an extremely low utilization rate of 43.3%. This low rate reflects recently installed coker equipment’s impact on asphalt production. While asphalt capacity remains in place, production is bypassed by the coking process, which yields higher margin, lighter fuels such as gasoline.

Asphalt prices are determined by two major factors:

- The price of oil – PCA estimates for every 10% increase in the price of West Texas Intermediate, the price of asphalt increases roughly 7%. 20

- Reduced supplies – Refineries are installing cokers that use asphalt’s feedstock to refine more profitable, lighter distillates. The result has been a decrease in asphalt product supplies.

19 Energy Information Agency Petroleum and Other Liquids
20 Based on regression analysis between oil and asphalt prices since 2005.
United States Asphalt Cost Situation

Asphalt Pavement Cost Structure

Liquid asphalt composes 5 - 6% of the material in a typical asphalt pavement mix. The remainder is made up of sand and aggregate. Despite this low composition, liquid asphalt accounts for 55 - 65% of the cost of asphalt concrete, depending on the mix design. Global demand for oil is increasing, particularly among developing economies.

Global Oil Markets

Oil prices have a direct impact on asphalt’s cost structure. WTI Oil prices are expected to average in the $93-$96 per barrel range in 2014-2015. In the years after, oil prices are forecast to increase well over the $100 per barrel mark. By 2025, the price per barrel of oil is expected to increase to over $130.

Cyclical variations in oil prices are brought about by unsustainable short-term movements in world demand or supply. For oil prices, these variations are often short-lived and explain the volatility.

Structural variations in oil prices are brought about by sustainable long-term movements in world demand or supply. PCA believes the structural nature of world demand has changed and that it has resulted in overall sustained acceleration in oil prices, aside from cyclical volatility.

World economic growth will eventually become synchronized. Global expansion will be characterized by high rates of economic growth among emerging and developing economies. This is expected to result in strong increases in consumption among the emerging middle class populations – driving up long-term oil prices.

The combination of a global business cycle recovery and accelerating structural growth among emerging economies plays a critical role in PCA’s oil price outlook.
Coker Investment

Cokers are equipment installed by oil refineries that increase the ability to refine higher-margin crude oil products, such as gasoline, per barrel of oil. The “bottoms,” which are the heavier, less-valuable products of the refining process can be further refined into higher-margin products, increasing profitability for the refinery. Less asphalt is produced because of coking as it is considered one of these “bottom” products.

Cokers become attractive investments as the price of gasoline and diesel increase relative to asphalt. The expected future margins between light and heavy crude oils help determine the decision to bring more cokers online and reinforce the upward movement in the cost of asphalt. In 2012 and in early 2013, three large-scale delayed coker units went online in the Midwest, significantly adding to U.S. coking capacity.

Domestic oil production has grown rapidly in the last three years. According to the EIA, 96% of the 1.8 million barrels-per-day growth consisted of lighter, sweeter crude – API gravity above 40 degrees with sulfur content under 0.3%. Light, sweet crude oil is preferred for refining because it is easier to produce more higher-margin products than with heavier, sour crudes.

The increased production and availability of domestic light sweet crude has caused prices to fall recently, thus narrowing the light-heavy spread – currently around $8 per barrel. However, with growing global demand for oil and its refined products, incentives for cokers remain. In addition to increased production of gasoline and other high margin products, the result of the coking process, petroleum coke, is sold for fuel and other uses across multiple industries. According to the EIA, 19% of U.S. petroleum product exports through October of 2012 were petroleum coke. Petroleum product exports have increased 230% since 2005. During the same period, average annual asphalt production has decreased over 40%.

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21 U.S. Energy Information Administration
**Estimate of Sensitivity of Relative Price Changes in the Concrete-Asphalt Arena**

**Liquid Asphalt vs. Asphalt Paving Costs**

Analysis suggests that the price of liquid asphalt is expected to rise. Liquid asphalt is the dominant component in asphalt paving mixture production costs (55 - 65%). An increase in the cost of liquid asphalt has a dramatic impact on asphalt paving costs. PCA estimates that a 10% increase in liquid asphalt cost translates to a 6% increase in the cost of paving asphalt.

**Initial Bid Cost Comparisons**

Prior to 2008, asphalt long enjoyed an initial bid cost advantage over concrete pavement. This advantage played a key role in asphalt’s dominant market share in road paving.

Oil price changes and refining practices have changed the cost environment. PCA estimates that concrete paved roads now enjoy a competitive initial and life cycle cost advantage over asphalt paved roads. The change in the initial cost advantage represents a significant turn in the competitive environment.

Asphalt paving prices have risen 9.4% since 2008. As oil prices rise and more cokers come on-line, concrete’s initial bid cost advantage will continue to improve its competitive position.

**Impact on Market Share**

PCA conducted several econometric tests to determine the relationship between changes in relative prices and market share. Initial findings indicate that market share changes have been insensitive to relative price changes.

Several non-price competitive hurdles may account for this insensitivity. These include the presence of asphalt price escalators, the lack of alternative bid processes, and the lack of equivalent structural designs. (See non-price factor section for asphalt). These factors essentially prevent the free market price mechanism from fully operating-- at least initially. In time, given the magnitude of the expected improvement in concrete’s competitive price position and in the context of long-term state entitlement spending pressures, some state DOTs may turn away from specifying practices that impede concrete paving share gains.
Other Price and Non-Price Factors: Concrete-Asphalt

The current cost environment facing the paving industry is changing rapidly. Asphalt prices have increased to levels well above historical averages, while concrete prices have remained steady. This dynamic would normally point to a growth in competitive advantage and market share increases; however, this scenario has not yet materialized. Non-price factors may significantly hinder short-term gains in concrete-asphalt relative cost advantages. The factors below are assessed by PCA as contributing to the market's insensitivity to relative cost changes.

Material Selection Practices

Asphalt paved roads account for roughly 92 - 94% of existing roads. State Department of Transportation (DOT) road designers are comfortable with asphalt, having used it almost exclusively for decades. Material specifications for pavements typically favor asphalt due to past cost advantages. Lending support to the asphalt tradition are several DOT material selection practices that tilt the competitive arena in favor of asphalt.

Most material selection policies were developed decades ago when the cost environment for asphalt and concrete was completely different than it is today. Material costs underwent many changes since these policies went into effect, but unfortunately, policy has remained largely intact. Since the onset of the new cost realities facing the paving industry, these policies have kept asphalt from fully competing with concrete paved roads fairly. These policies (explained below) involve price adjustment clauses, alternative bid policies, and material specific inflation rates in life cycle cost analysis.

1. Asphalt Cost Escalators

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

Asphalt cost escalators were first introduced to support the asphalt industry during the oil embargo of the 1970’s, which had dictated volatile swings in liquid asphalt costs. These DOT procurement policies may have had some merit when they were first introduced. At that time, 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 risk of material price volatility.

The dynamics of world economic growth that resulted in asphalt paving cost advantages no longer exist. The world economy has permanently changed with the emergence of strong growth among developing and transitional economies. Escalator clauses in the new global environment are in effect distorting market signals that would otherwise have caused DOTs to look for alternatives to current paving practices.

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. In this example, both the concrete and asphalt paving

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22 According to the latest AASHTO survey (2009), 40 states currently employ asphalt cost escalators.
23 PCA estimates that initial bid paving costs between an asphalt and concrete paved road were near parity in fiscal 2008.
A **permanent structural** change has materialized with regard to paving material costs. In many instances, DOT policies have not formally recognized this structural shift in paving realities. The structural change in cost dynamics is compelling and it will continue to affect the paving market in years to come. Recognition of these new paving realities will put concrete on even ground with asphalt and eliminate a large distortion in what otherwise needs to be a free market.

### 2. Alternative Bidding

Alternative pavement bidding is a process in which initial and life cycle costs are compared for both asphalt and concrete pavement designs in order to assess the lowest cost solution. Alternative bidding is an important function in fostering a competitive environment—reducing costs, improving quality, and driving innovation. Alternative bids allow concrete and asphalt paving materials to be compared side by side for cost merits, which as of 2008, concrete has generally been gaining in advantage. Without such an explicit policy, concrete will not be given a forum to compete in markets where, traditionally, asphalt held a cost advantage.

In December of 2012, the Federal Highway Administration (FHWA) issued a Technical Advisory (TA) on alternate pavement type bidding. This TA marks a significant change in the FHWA’s stance on alternate pavement type bidding. Since 1999, the FHWA’s position on alternate bidding has been to discourage its use due to a lack of truly equivalent designs between two pavement types. However, with new technology and increasing costs in asphalt paving, many state DOTs, along with PCA and the American Concrete Pavement Association (ACPA), have pushed for changes in policy. ACPA and PCA have been engaged in the formulation of the new policy which now considers alternate bidding as a, “suitable approach for determining pavement type when engineering and economic analysis does not indicate a clear choice…” 24 This reversal in position is expected to encourage the use of alternate pavement type bidding within markets where concrete was not previously considered.

### 3. Specific Material Costs In LCCA

Life cycle cost represents the aggregated costs a construction project is expected to incur over its lifespan. Life cycle cost analysis (LCCA) looks into these aggregated costs under multiple scenarios to determine the most cost effective path during the entire life of the project. LCCA is typically performed on structures that expect to have a life span in which present day decisions will affect future costs. Highway construction frequently requires LCCA, as roads are planned to be in place for decades, and public agencies (a majority of road building entities) must find cost effective solutions to meet transportation infrastructure needs.

LCCA in road building has shed light on cost influences over the life span of our road system; however, a major pitfall for current LCCA practice is the use of a general inflation adjustment factor for material price changes. Most LCCAs set equal price increases, indiscriminate of the pavement material, to assess future costs. In other words, a typical 50-year LCCA would assume that the price of concrete and asphalt would increase at the same rate for the duration of the analysis.

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24 Contact Lauren Schapker (*Legislative Director*) (202-408-9494) for information about recent PCA initiatives in alternative bidding practices.
Analysis of historical data makes it clear that asphalt and concrete prices move in very different ways. Liquid asphalt prices have increased an average of 9.5% per year while concrete only managed an average 0.8% increase per year in the last four years.

A recent report from MIT found that relative material costs of asphalt and concrete will likely shift in dramatically different ways over the next half century. The report predicts the real cost of concrete will decline by 20% over the next 50 years while the real cost of asphalt will increase 95%.

Moreover, the MIT report states that using a constant inflation rate for all materials will likely lead to cost overruns in excess of 4%, mostly because asphalt paving turns out to be more expensive than concrete paving. MIT advises that by not using separate inflation factors for each pavement material, the LCCA can substantially miscalculate future costs – underestimating asphalt costs while overestimating concrete costs.

Refining practices that reduce asphalt production, in favor of producing higher distillates, are reducing the supply of asphalt. Incentives for coker usage remain, with global demand for refined petroleum products continuing to grow each year. U.S. coking capacity has increased by almost 1 million barrels per day since 1997, and almost a quarter million barrels per day since 2010. Oil prices are also likely to rise in light of increasing global demand. These two factors are working together to create an entirely new environment for asphalt prices. PCA expects this new environment will represent a huge shift from historical asphalt price trends.

In 2012, congress enacted the Moving Ahead for Progress in the 21st Century Act (MAP-21) -- a new surface transportation bill aimed at transforming investment practices in transportation programs. Part of this new legislation requires the Government Accountability Office (GAO) to investigate LCCA best practices that could provide guidance in policy formulation within the FHWA. MAP-21 requires the GAO to utilize input from various groups, including industry representatives such as PCA. The PCA response to GAO’s inquiries has addressed the concrete industry’s desire to remove free market impediments – the nonuse of material specific inflation factors in LCCA and the lack of transparency in methodology. PCA’s response also addressed the industry’s position on alternative bidding and the specified timeframe for a valid road-building LCCA.

PCA and other industry leaders have met with the GAO representatives. There has been additional PCA outreach by the Washington D.C. office to discuss with the GAO technical issues in standard LCCA methodology. In June of 2013, the GAO released a report with their findings regarding FHWA LCCA best practices. The results of their analysis demonstrated that FHWA guidelines aligned moderately with best practices, with significant improvement suggested in two of the four phases of an LCCA. The four phases are Initiation, Assessment, Analysis, and Presentation. The two areas where improvement was suggested were the Assessment and Presentation phases. Obtaining the proper data and utilizing third party sources for cost estimates were of greatest importance, along with how the end approval process is performed. It is believed that the FHWA will use these findings to inform road construction policies for years to come.

In addition to these efforts, PCA has specifically sought out clarification from the Office of Management and Budget (OMB) on policies regarding inflation for specific materials in LCCA, and the timeframe in which LCCA should be conducted. The OMB’s response has been to validate that government policy, as it currently exists on LCCA, specifically allowing for the inclusion of material specific inflation rates where suitable methods exist, based on the professional judgment of those executing the LCCA. The response to the LCCA timeframe designation was also positively received. The OMB clarified that “the time horizon…should normally be long enough to encompass the likely life span of the most durable alternative being compared.” These responses give the concrete industry more legitimacy when seeking changes to policies that impede fair competition in the paving market.

25 Accounting for Inflation and LCCA; Concrete Sustainability Hub @ MIT LCCA Brief July 2011
26 Contact Lauren Schapker (Legislative Director) (202-408-9494) for information about recent PCA initiatives with LCCA.
PCA expects construction activity in the concrete-asphalt competitive arena will experience slow growth through 2015. This assessment reflects our assumption that large state deficits will characterize the near-term horizon. Beyond 2015, moderate growth in paving activity is expected as state fiscal conditions improve, potentially releasing pent-up demand in state paving activity.

PCA’s historical econometric analysis concludes that the concrete-asphalt competitive paving arena is relatively insensitive to changes in the relative price in terms of market share. PCA believes two factors account for this insensitivity. First, initial bid parity was not achieved until 2008 and favored asphalt up until that time. Observed changes in relative price do not have a potential impact on market share gains until parity is reached. PCA believes the parity achieved in 2008 will continue. Increased sensitivities to relative price changes are anticipated during the years ahead.

Secondly, despite competitive pricing advantages favoring concrete, gains in paving market share may be initially constrained due to non-price factors – particularly surrounding the material selection processes in state highway administrations. Policies such as price escalators, the lack of an alternative bidding system, and/or equivalent designs mitigate the natural market effects that would normally give concrete a more favorable position.

Risks associated with PCA’s analysis surround the expectancy of synchronized world growth. Slower economic growth in China could a large impact on world economic growth, and as a result, oil and asphalt prices. PCA estimates initial bid parity at roughly $75 per barrel of oil. Oil prices below that parity threshold suggest an initial bid paving advantage may favor asphalt.

**Conclusion**

Construction activity in the concrete-asphalt competitive arena is expected to remain flat through 2014. Thereafter, moderate volume gains are expected to be observed in this market segment. Relative price increases in asphalt and potential share gains offer an opportunity to amplify the cement volume gains associated with the market recovery. These potential share gains; however, will likely be impeded by entrenched paving material selection practices. To accurately compute future costs of paving materials in life-cycle cost analyses, material specific inflation rates must be used, rather than a general inflation metric for both pavement types. Non-price factors such as asphalt cost escalators and the absence of alternative bidding and equivalent design processes also obstruct fair competition in the paving market. All these factors must be addressed and rectified if concrete is to maximize potential share gains.
The demand dynamics that shape lumber prices, such as housing starts, are slated to reach 1 million in 2014 and improve at about a 20% annual pace through 2016. This suggests that lumber prices, currently near their peak, will remain under upward pressure. Furthermore, this implies that lumber will likely lose some of its immediate competitive pricing position versus concrete.

The price of softwood lumber is roughly 10% off its peak in 2004. Lumber prices spiked in late 2012, but the trough that followed in 2013 was equivalent to 2006 levels. The price of lumber is expected to rise as the housing market in the United States regains its footing and supply constraints are realized.

PCA expects continued benefit to concrete in the lumber-concrete competitive arena in 2014. Housing construction is expected to maintain a strong rate of growth through 2017.

Beyond 2014, concrete will retain the pricing advantage gains it had made over the previous 2 years, and increase incrementally through 2016. At that point, the residential building market is expected to begin to decelerate in its rate of growth, at the same time lumber’s production capacity will reach its limit. Those factors combine to suggest further increases in lumber prices, albeit at a lesser pace.

Given the low barrier to entry, the lumber industry responds quickly to changes in demand with an appropriate adjustment to supply, which is why many price spikes are met with a correction in the following year or two. The potential for longer-term improvement for concrete’s relative price position to lumber depends on other non-price factors such as codes and standards, the mountain pine beetle epidemic in B.C., and future legal outcomes of the current Softwood Lumber Agreement dispute that could influence the competitive arena.

27 Bureau of Labor Statistics PPI report
Concrete – Lumber Competitive Arena

Variations in competitive factors such as price do not always indicate substantial opportunities (or risks) associated with the promotion of concrete products in market segments where concrete and lumber compete. The potential for absolute volume fluctuations can depend on the movement of the construction sub-segments. This section details potential opportunities and risks in terms of volume and the timing of these potential gains or losses resulting from changes in concrete’s competitive position.

Concrete competes with lumber in construction market segments such as single-family homes, lodging, multifamily buildings, and retail stores - all of which are buildings below five stories. The competitive arena is composed of around 29% of total cement consumption, and roughly 34% of total construction activity. A successful promotion of concrete yielding a 1% gain in all the concrete-lumber market segments would result in the consumption of 4.7 million additional metric tons under “normal” construction market conditions.

Outlook for the Concrete-Lumber Competitive Arena


• With the employment sector gaining momentum, the nonresidential building sector is expected to continue to improve. In the first four months of 2014, nonresidential spending was up 6%, and forecasted to reach 8.7% by the end of the year. Job growth is projected to reach nearly 2.5 million in 2014 and 2.7 million in 2015.

The medium-term outlook (2016-2018). Construction activity in the concrete-lumber competitive arena is expected to experience significant growth. Concrete’s competitive advantage will flatten during these years.

• Sustained job creation could dramatically increase housing starts activity. PCA expects housing starts will reach more than 1.5 million annually to begin this period, and finish over 1.8 million, compared against an average of 1.2 million during 2014-2015.

• The lumber industry responds quickly to price spikes. Usually, a sudden uptick in lumber prices is followed by a downward correction as supply catches up with demand. PCA anticipates the ensuing correction from the near-term price spike to slow the rate of lumber price appreciation, not decrease the price, as has historically been the result. This is due to a tightening of supply in terms of production and limited imports. PCA projects lumber production to reach a ceiling (ostensibly observed during the housing boom when home starts were over 2 million), and the pine mountain beetle to restrict the amount of imported Canadian lumber – both of which would curb lumber supply.

The long-term outlook (beyond 2018). The concrete-lumber competitive arena is expected to show moderate growth in this period. Concrete’s position against lumber could see a slight downturn.

• An assumed long-term economic growth rate of 2.5% ensures a steadily climbing concrete price. A reduced rate of housing stock expansion should lessen lumber price pressure, as PCA assumes the long-term trend for housing starts to be around 1.6 million housing starts a year.

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28 Bureau of the Census Annual Construction Spending Put-In-Place, PCA estimates for the Apparent Use of Portland Cement and Real Construction Spending
29 McGraw-Hill Contract Awards
Lumber products are categorized into two wood types; hardwood and softwood. Softwood lumber is the product used in construction that competes against concrete.

**Manufacturing Process**

Softwood lumber is first harvested, debarked, sorted, and cut into specific lengths according to the dimensions and defects of the timber. Lumber then moves to finishing mills where it is sawed, dried, and planed. The lumber is then graded based on the amount of defects. There are four grades ranging from highest quality (structural select) to grade 3. High grade lumber is typically used for construction while the lower grades are used for crates and containers.

**Foreign Competition**

Foreign competition is fierce in the United States' lumber market. Imports account for a high share of the United States' lumber market (35%). Most lumber imports into the United States originate from Canada – accounting for more than 80% of United States’ lumber imports.

Canada’s lumber industry enjoys lower production costs compared to the United States’ lumber industry due to the low price of stumpage fees the industry pays the government. This low cost serves as a subsidy making Canadian lumber relatively less expensive compared to their United States counterparts.³⁰

**Canadian Softwood Lumber Agreement**

Canada’s stumpage policy has given rise to the Softwood Lumber Agreement (SLA). Its intent is to limit the flow of Canadian softwood lumber into the United States by giving each Canadian province the choice to accept a quota at a fixed tariff or an adjustable rate tariff with no quota. As with any tariff or quota, the impact has been to reduce the competitive environment and provide some support to United States’ lumber prices.

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³⁰ [http://www.uslumbercoalition.org/general.cfm?page=4](http://www.uslumbercoalition.org/general.cfm?page=4)
United States Lumber Price Situation

Lumber costs have been pushed down due to a lack of domestic demand, and intense competition from Canadian lumber imports. PCA forecasts a strong outlook for housing starts as demand conditions improve. In addition, Europe is expected to return to a pattern of economic growth.

United States Single Family Market

The single-family construction market is the single largest market for softwood lumber. The recovery that began in 2012 is expected to continue throughout the forecast horizon. The increases in housing starts are assumed to have a direct impact on lumber costs, much of which we have already seen in 2013 and 2014.

Foreign Competition

The SLA limits aggressive pricing actions by the lower cost Canadian producers. In 2012 the current SLA agreement was extended for an additional two years. However, there are still alleged breaches in the agreement that are under pursuit. In 2011, the United States sought arbitration for a violation, which involved artificially lowering the price of trees killed from the mountain pine beetle.

China’s Demand for North American Lumber

In 2008, Russia imposed a large export tariff on lumber. As an alternative to Russian lumber, Canada and some parts of the United States had helped fill the void, but most of the supply came from the E.U. China’s future demand remains to be seen in light of a recently reduced GDP outlook.

Mountain Pine Beetle Epidemic

A mountain pine beetle epidemic is afflicting British Columbia. By 2020, it is estimated that they will kill 60% of all the pine trees in the BC interior. Reduced Canadian import availability and higher domestic utilization rates imply upward pressure on lumber prices.

31 International Wood Markets Group
Impact of Relative Price Changes in the Concrete-Lumber Arena

During the past ten years, relative lumber-concrete price movements have not resulted in significant changes in market share. PCA has conducted several econometric tests regarding relative price movements against market share changes. The initial findings indicate:

- Retail construction is the most sensitive construction sector to changes in the relative price of concrete versus lumber. According to PCA estimates, a 10% increase in relative price of lumber against concrete results in roughly a 1.6% increase in market share. Under "normal" construction market conditions, this translates to roughly a 49,000 metric ton increase in cement consumption.

- Single family residential construction is insensitive to changes in relative prices. Due to the size of the market, however, even small changes can result in significant increases in cement consumption. A 10% increase in lumber’s relative price, for example, results in only a 0.7% gain in market share, but translates into a 2.3 million metric ton increase in cement consumption.

- The lodging construction sector is the most insensitive to changes in relative prices. According to PCA estimates, a 10% increase in the relative price of lumber versus concrete results in roughly a 0.4% increase in market share. Under “normal” construction market conditions, this results in a 69,000 metric ton increase in cement consumption.

- Multifamily residential construction is also insensitive sector to changes in relative prices. According to PCA estimates, a 10% increase in the relative price of lumber yields a 0.4% gain in market share. This translates to roughly 20,000 metric tons of cement consumption.

Source: USITC.gov
Non-Price Factors Affecting Concrete’s Competitive Position to Lumber


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Attitudes and Perceptions

The most recent survey of homebuilders performed by PCA indicates that homebuilders believe energy efficiency is the most sought after quality by homeowners. While concrete is a much more efficient material in terms of energy consumption, low material costs are most likely playing a more significant role than what the survey indicated – especially in light of historically low lumber prices.

In a separate survey given to homeowners, durability, energy efficiency, and low maintenance were the three highest ranked priorities for a homeowner. Low initial cost was ranked the seventh most important factor after insect resistance. These results indicate a somewhat favorable environment for concrete consumption in the housing market although the impact of these perceptions are difficult to estimate.

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<th>Importance Ratings - Homeowners</th>
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<td>Ease of Construction</td>
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<td>Material Availability</td>
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<td>Low Initial Cost</td>
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<td>Energy Efficiency</td>
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*Mean Rating (1 = Not At All Important, 5 = Very Important)*

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32. 2007 Measurement Criteria; The Homebuilder Report, March 2008
33. 2008 Measure Criteria; The Homeowner Report, December 2008
Lumber Industry Promotion Activity

The lumber industry has been promoting the use of lumber as a primary building material at an increasingly aggressive rate. Coalition based initiatives such as reTHINK WOOD\(^3\) have been increasing in number and activity. Recent initiatives by the Wood Products Council and other affiliate organizations including the United States Department of Agriculture have put on a well-organized effort to gain market share in traditionally non-lumber markets such as mid-rise multifamily buildings. These efforts are well funded and are engaged in promotion through multiple channels including professional education, local advocacy, and consumer marketing.

The inclusion of government entities puts concrete at a promotional disadvantage. Taxpayer funding for technical and market research resources are not similarly matched for the concrete. In addition, government sponsorship of lumber as a sustainable green material puts concrete (without similar recognition) at a disadvantage.

The Wood First campaign advocates legislation and code regulations to increase the acceptance of taller wood frame buildings. Current building code requirements tend to limit wood frame construction to four stories in height. The wood industry’s advocacy campaign is targeting state and local jurisdictions and facilitates for the use of wood-frame construction for five and six-story buildings. This market has historically been dominated by concrete and masonry construction. The Wood First program has the potential to significantly erode market share in what is considered a strong market for concrete.

The concrete industry suffered market share loss when building requirements for four story wood frame construction were relaxed in the 1980’s. A market that was predominantly concrete and masonry was quickly overtaken by wood frame. Concrete experienced a 15% drop in market share for four story construction from 1993 to 2010 and the wood frame market share increased nearly 25% over the same period. Steel frame construction also lost market share to wood frame. Relaxation of building code requirements is expected to have the same type of negative impact on the concrete and masonry industries, if eased, as wood is a relatively cheaper alternative.

The cement intensity for mid-rise construction is approximately 7.3 tons per 1,000 square feet of concrete frame and load-bearing concrete construction. The cement intensity for similar wood frame construction is approximately 1.8 tons per 1,000 square feet. The difference in cement intensity is 5.5 tons per 1,000 square feet. In a healthy economy, such as 2007, the 15% loss of the 178 million square foot four story construction market equated to approximately 150,000 tons.

Like many other significant changes to the building codes, this campaign is first gaining momentum at the local and state level. Similar approaches have been used to introduce building requirements for fire sprinklers and green buildings. The Wood First program, initially successful in British Columbia, is now being considered in Ontario, Oregon, and Washington. Once successful in several states, similar requirements may advance in the national building codes and spill over to other states and local jurisdictions. Without appropriate industry action at the state and local level, 350,000 tons annually could be at risk.\(^3\)

In October of 2012, Governor Kizhaber of Oregon issued an executive order to promote the use of wood stating that “Oregon is a leader in products that come from sustainably managed forests.” The order calls on state agencies to work with private counter parts to use more wood products in government construction as well as work toward obtaining a competitive sustainability rating.\(^3\)

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\(^3\) Excerpts from Wood Advocates for Taller Buildings, April 3 2011

\(^3\) Contact Don Clem (Executive Director of the Northwest Cement Group) (303-649-2222) for information about PCA responses to the Wood First initiative and other related issues.
Guidance & Key Risks

Construction activity in the concrete-lumber arena has increased and will continue to do so. In 2013, residential spending grew at an estimated 15.2% while nonresidential activity grew by 3.6%. Activity in this arena is expected to continue recovery in 2014 and expected to improve throughout the forecast horizon.

PCA anticipates record high lumber prices in 2014. This will improve concrete’s position through 2016. This assessment reflects demand increases arising from a recovery in housing and nonresidential construction as well as supply restrictions. The increases in lumber prices could be magnified if the mountain pine beetle epidemic is unrestrained, or the recent pace of economic growth from China returns.

In the near-term, rising lumber prices will aid in concrete’s relative price, but not enough to achieve parity. Potential longer-term improvement in the concrete-lumber relative price competitive arena is mixed, with sensitive and insensitive sectors; therefore, the net gain in cement consumption from a run up in lumber prices relative to concrete is not believed to be substantial. The single family home market dominates this arena in terms of volume and lumber market share.

The building segment of the home will determine market share gains from an upturn in the relative price of lumber versus concrete. Areas, like siding, where cement-based products hold an initial cost advantage to lumber products are expected to gain in market share with an increase in relative prices. Other building products like insulated concrete form (ICF) above grade walls are considerably more expensive than a traditional lumber framed home. While a relative price increase will support promotion efforts in these areas, the price gap will remain significantly wide, and possibly worsen. It is important therefore to consider non-price features such as energy savings and existing codes and standards when pursuing promotional efforts.

Current lumber industry promotion efforts like the Wood First campaign pose a significant threat to concrete use in the residential construction market. Proposals from the Wood First Initiative to allow wood buildings taller than four stories have already been approved in British Columbia and are starting to spread into the United States. Cement/concrete industry resources will be necessary in the future to stem the momentum the lumber industry has been gaining.

Conclusion

Construction activity in the concrete-lumber competitive arena is expected to recover in 2014 and 2015, possibly into 2016. Thereafter, significant volume gains could materialize in this market segment. Lumber’s degree of relative price position favorability is expected to tighten over the next few years, but fall considerably short of parity. Given the magnitude of the drop in lumber prices from 2005-2009, the potential of concrete share gains will be incremental at best. The rapidity and size of the swing in concrete-lumber relative prices will largely be determined by three factors: (1) the timing and steepness of the recovery in housing, (2) the level of China’s demand for North American lumber, and (3) the potential damage posed to North American lumber supply by the mountain pine beetle epidemic. Finally, the Wood First campaign could further impede market share gains even in the context of relative price movements favoring concrete.
Concrete-Clay and Brick Competitive Arena

Overview

The concrete-clay and brick competitive arena is mostly contained within the residential exterior siding market with a small percentage occurring in the nonresidential markets. PCA estimates that significant opportunities for cement consumption volume gains are not present within the concrete-clay competitive arena. Several factors drive this conclusion.

- The concrete-clay and brick arena is currently very small — representing around 2% of all cement consumption. PCA estimates that a complete conversion of all clay consumption into concrete consumption would increase cement consumption 0.8%.

- Additionally, the concrete-clay and brick competitive arena is characterized by the presence of many other competitors, which increases the resources needed to realize incremental improvements in market share.

- Most clay products are heavily complementary to cement consumption meaning that cement products need to be used in the consumption of clay products. Market share gains will be partially muted as a result of the complementary nature of most clay based products.

A best case promotion outcome scenario in which concrete products successfully captured 1% of the concrete-clay and brick competitive arena is estimated to yield a net gain of a mere one thousand tons nationally. A much lower cement consumption gain is more likely due to the many competitors present in the market place.
### U.S. Producer Price Indices

#### Producer Price Indices - Competitive Building Materials

<table>
<thead>
<tr>
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<td><strong>Steel Mill Products</strong></td>
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(p) = Preliminary data  
Base Year: 2002 = 100
Relative Steel Price

Steel PPI
(Base: 2002 = 100)

Source: Bureau of Labor Statistics

Relative Cost Steel/Concrete PPI
(Base: 2002 = 100)

Source: Bureau of Labor Statistics

Steel Industry PPI & Cost Indicators

Steel Scrap PPI
(Base: 1982 = 100)

Source: U.S. Bureau of Labor Statistics

Industrial Electricity (¢/kWh)

Source: U.S. Energy Information Administration

Iron Ore PPI
(Base: 1982 = 100)

Source: U.S. Bureau of Labor Statistics

World Steel Price Index
(Base: 2005 = 100)

Source: Estimated using World Bank Commodity Price Data (Pink Sheet) and MEPS Composite Steel Price Index
### Relative Lumber Price

**Lumber PPI**
(Base: 1982 = 100)

Source: U.S. Bureau of Labor Statistics

**Relative Cost Lumber/Concrete PPI**
(Base: 1982 = 100)

Source: U.S. Bureau of Labor Statistics

### Lumber Industry PPI & Cost Indicators

**Capacity Utilization: Wood Product**
(\% Capacity, SA)

Source: U.S. Board of Governors of the Federal Reserve System

**Single Family Starts**
(000, SAAR)

Source: U.S. Census Bureau

**U.S. Lumber Imports from Canada (Mil. \$)**

Source: USITC.gov

**Exchange Rate (Can $/U.S. \$)**

Source: U.S. Board of Governors of the Federal Reserve System: Exchange Rates - G.5 (405)