

# **PRICE FLUCTUATION AND MARKET VOLATILITY IN MUNICIPAL AND TREATMENT PLANT CONSTRUCTION PROJECTS**

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## **ABSTRACT**

Construction estimates have always been a critical part of the design process, but in recent years it's become increasingly difficult to predict the bid outcome of construction projects. The construction industry has entered into a period of high market volatility, and mitigating the associated risks has become a challenge for owners and consultants alike. In the past two years many projects have bid substantially over-budget because of construction materials inflation. Oil prices, developing nations' increasing consumption of materials, natural disasters and material supply shortfalls have combined to create the "perfect storm" of market volatility in the construction industry.

Minimizing the risk of over-budget bidding is now an imposing task. When bonds and funding are solicited at a project's early stage, decisions about cost have to be made with little information and virtually no insight into potential material price increases in the time between funding and bidding. Since 2004, municipal and non-building related public works projects have increased in cost at a rate of more than 10% per year, crippling owners' capital improvement project budgets. Many owners have been caught off guard because the published rate of general inflation in the United States has been steady around 3% for the two years leading up to 2004.

This paper will discuss actions that can be taken to mitigate the risk involved in estimating projects in periods of high volatility. It will identify the key factors and material that can affect project cost and how to distinguish and locate appropriate sources of cost information.

## **KEYWORDS**

Market volatility, construction cost, budgets, municipal, paving, treatment plants.

## **INTRODUCTION**

The construction market's volatility in the past two years has been unexpected and unprecedented; unexpected by those hoping to build projects with last year's costs and unprecedented for those who have forgotten previous volatile markets because of decades of good fortune.

Every generation faces inflation; some have a few bad years, while others have a decade or two of unbearable cost increases. Consider the Great Depression, or perhaps the crushing inflation that plagued Brazil in the 1980s and 1990s (in 1994, Brazil's inflation rate was 2,700%<sup>1</sup>). To the majority of the United States workforce that did not experience the oil embargos and double-digit Carter inflation, increases like those of 2004 to 2006 have come as a surprise. Many who were around in the late 1970's were not surprised that recent years have proven difficult to manage costs.

First, I will address changes in the construction market in the past two to three years, i.e., where the changes have been and how it has affected the bottom line. Second, I'll look at some of the probable causes for sudden, drastic and uncontrollable cost increases. Finally, I'll review some discernable warning signs of impending inflation in the construction industry.

### **Discerning Inflation**

First, let's discuss some fundamental differences in the construction industry versus manufacturing in America. I choose manufacturing because when inflationary numbers are reported in the news media, they're usually related to the Consumer Price Index<sup>2</sup> and the Producer Price Index<sup>3</sup>, the Department of Labor's benchmark numbers for the economy's overall health. This number is normally approximately 3 to 4 percent per year. This is somewhat regulated by the Federal Reserve's influx of cash into the U.S. economy in order to stimulate the economy and keep the unemployment rate lower. However, adding cash to an economy always results in inflation.

Manufacturing differs significantly from construction in two main ways. First, manufacturing is always set within the confines of highly controllable circumstances. Manufacturers are not subject to drastically changing environments, surges and declines in labor needs (an exception might be Valentine's production for a candy maker), or large fuel surcharges on shipped goods. Second, and far more importantly, manufacturers are not subject to drastic changes in the price of commodities. A manufacturer will have to pass along the cost of that increase to his customer, but because any "widget" is normally comprised of multiple parts, the cost impact of one material price increase is generally low.

Take the following comparison of hypothetical costs of "Widget" Manufacturing and a PVC pipe project:

**Figure 1: Widget Manufacturing (per 1,000 Widgets)**

Description	Cost A	Cost B	Inflation
Raw Material A	\$ 1,000	\$ 1,150	15%
Raw Material B	\$ 1,000	\$ 1,000	
Raw Material C	\$ 1,000	\$ 1,000	
Raw Material D	\$ 1,000	\$ 1,000	
Manufacturing Cost	\$ 1,000	\$ 1,000	
Delivery Cost	\$ 1,000	\$ 1,100	10%
Total Cost	\$ 6,000	\$ 6,250	
<b>Widget Cost</b>	<b>\$ 6.00</b>	<b>\$ 6.25</b>	<b>4.2%</b>

**Figure 2: Construction Costs (per 50 LF of 12" PVC Pipe)**

Description	Cost A	Cost B	Inflation
Pipe Cost	\$ 1,000	\$ 1,150	15%
Installation Cost	\$ 1,000	\$ 1,000	
Delivery Cost	\$ 1,000	\$ 1,100	10%
Total Cost	\$ 3,000	\$ 3,250	
<b>Per LF Cost</b>	<b>\$ 60</b>	<b>\$ 65</b>	<b>8.3%</b>

Again, this is a purely hypothetical situation, but it illustrates the main difference between manufacturing and construction cost increases. A construction project is going to bear the cost of material price increases much more than manufacturing will, simply because construction uses a lot more of the same materials in far greater quantities.

A non-hypothetical example: From August 2005 to August 2006, the price of asphalt rose 77.4 percent and the price of Hot Mix Asphaltic Concrete (paving mixture) increased 37.9 percent<sup>4</sup>. Anyone who's been involved in an asphalt repaving project in the past two years knows that the 3 to 4 percent inflation rate doesn't apply.

The Consumer and Producer Price Indexes summarize how the economy is doing. So, just because the rate is 4 percent doesn't mean that various other sectors aren't feeling a larger piece of that as well. Computers, for instance, may only see a 1 percent increase, while grains may see a 6 percent increase. Construction, however, is still different from any manufactured product.

Accountants generally will say that construction projects are the hardest for which to account. Manufacturing can set start and end dates for a fiscal year and only include those products that were actually produced within that 365-day period. Construction projects, on the other hand, generally last more than a year and have billings of various sizes throughout the life of the project. In other words, the only consistent thing about accounting for construction is its inconsistency.

The Department of Labor has recognized this problem and, for the first time, included two new price indexes to account for construction inflation. They have chosen to track new warehouse construction and new public school construction because they are projects which generally remain constant in scope and size. That gives a better “apples to apples” comparison than choosing other kinds of construction projects. The index is still in its infancy; as of January 2007, a full year of new school construction data has not yet been gathered. New warehouse construction has increased more than 8.5 percent as of the end of 2006, compared to the published inflation rate of around 2 percent<sup>5</sup>.

### **Where the Changes Have Been**

With respect to municipal water, sewer, streets and drainage, and water/sewer plant projects, the past two years have been nearly crippling. Projects designed and funded quickly ran out of money when bid time came around. Some municipalities had to reissue bonds to cover the cost overruns, or cancel projects altogether. Newspaper articles abound about school boards with new construction shortfalls and cities unable to repair existing roads or build new treatment plants and pipelines.

What are the key culprits in municipal construction inflation in recent years?

First and foremost, asphalt and oil prices. With the drastic price increases, large asphalt paving projects barely stood a chance of staying within budget. The surge in crude oil prices over the past two years has affected highway and street construction in many ways, particularly asphalt. The oil crunch has caused fuel costs to surge as well.

The average cost of a barrel of crude oil in 2003 was \$31.08. That surged to \$66.05 in 2006. July 2006 saw the record set over \$75 per barrel. Diesel costs rose over 200 percent in the same timeframe<sup>6</sup>.

Projects of a heavy equipment-intensive nature have been hit by erratic and sudden changes in the cost of diesel. Deliveries of large materials (equipment, concrete, etc.) and dirt hauling costs have skyrocketed because of fuel surcharges over and above normal hauling costs. The price of 4,000psi concrete in Dallas, for instance, has only risen from \$87.75 to \$91.40 since December of 2004<sup>7</sup>. This number does not take into account the fuel surcharges being assessed, which in some cases are more than 5 percent of the total cost.

Tracking the impacts of these increases in heavy construction is difficult. Competition and contractual requirements have shielded some of the true cost increases from owners. Because some of the largest fuel price increases occur after a contract is in place, the contractor's stuck with the price and bearing the extra fuel cost. In some cases, competitive pricing forced contractors to bear the increasing costs of fuel. No two owners have seen the price of fuel reflected exactly the same. A good index for tracking the increasing price of dirt moving or heavy equipment usage doesn't exist, but it can be assumed that the costs of fuel increases have been passed along to owners in one way or

another whenever competition and contracts have allowed. Oil dependant costs have not been the only thing to significantly impact construction, though.

Steel costs have been wildly volatile in the past several years, but have recently cooled off. From the spring 2004 to December 2006 steel prices have increased roughly 51 percent, half of which came in 2004 (approximately 26%)<sup>8</sup>.

Copper price increases have significantly hurt the construction industry from one end to the other. Residential and commercial contractors have been forced to switch from copper to polyethylene pipe for plumbing whenever possible due to the high cost and job site theft. Electrical prices have significantly increased due to the amount of copper used in everything electrical from wiring to large equipment.

From January to May 2006, the price of copper rose 86 percent. It subsequently fell 34 percent by the end of the year and has continued to decline, but the damage was done in the peak construction season<sup>9</sup>. Price volatility is prompting contractors to include extra escalation in their bids to cover speculation of future climbing prices. In the case of copper last year, many electrical contractors held their high prices established in May for some time for fear of rebounding costs even after prices had started to subside.

The figure below illustrates that the electrical contractors were wise to do so. Even though there was a large downturn in the price of copper following the increases in the spring, it soon rebounded in July to near the May prices.

**Figure 3: 1 Year Copper Prices (Kitco Base Metals)**



This kind of price volatility is actually worse than steady increases for the market because contractors become very scared of having to cover the cost increases or erratic materials once a contract is in place. This fear causes prices to quickly escalate, high prices to last longer, and savings when material prices fall to be realized much slower than if prices were stable.

Aluminum also rose sharply in May 2006 to a 32 percent increase up from January 2006. It subsequently has fallen and risen back again to just over a 22 percent increase in January 2006. Zinc, the major component of galvanization, doubled in price in 2006.<sup>9</sup>

### **Probable Causes**

A simple, but incomplete, explanation for rising construction costs in the past several years is catastrophic weather - Hurricanes Katrina and Rita.

Hurricane Katrina shattered the Gulf region in 2005. The greatest damage to construction material prices occurred while it was still offshore. As a Category Five hurricane, Katrina devastated the offshore drilling platforms in the Gulf of Mexico. Hundreds of platforms were either completely destroyed or suffered major damage. By early 2006, many were still inoperable. A large percentage of natural gas was taken offline for a period of months, creating a supply shortfall for energy-intensive industries and products that use natural gas as a feedstock, like PVC pipe. (PVC pipe prices surged after the hurricanes shut down plants and damaged supply chains, but prices normalized at a slightly higher rate by mid 2006.)

Katrina, however, could not be blamed for asphalt, gasoline and diesel, steel, copper or aluminum increases. Geopolitical tensions, wars and increasing world consumption in addition to natural disasters are the combined culprits behind construction cost increases. As the U.S. becomes more and more dependant on materials produced overseas, the distribution of those materials becomes a critical factor.

First, consider steel. In 2004, China began the critical phases of some very ambitious building projects and began buying a substantial percentage of the world's scrap steel. As reports of China's hunger for raw steel grew, the domestic price shot up 60 percent from March of 2004 to December 2006.<sup>10</sup>

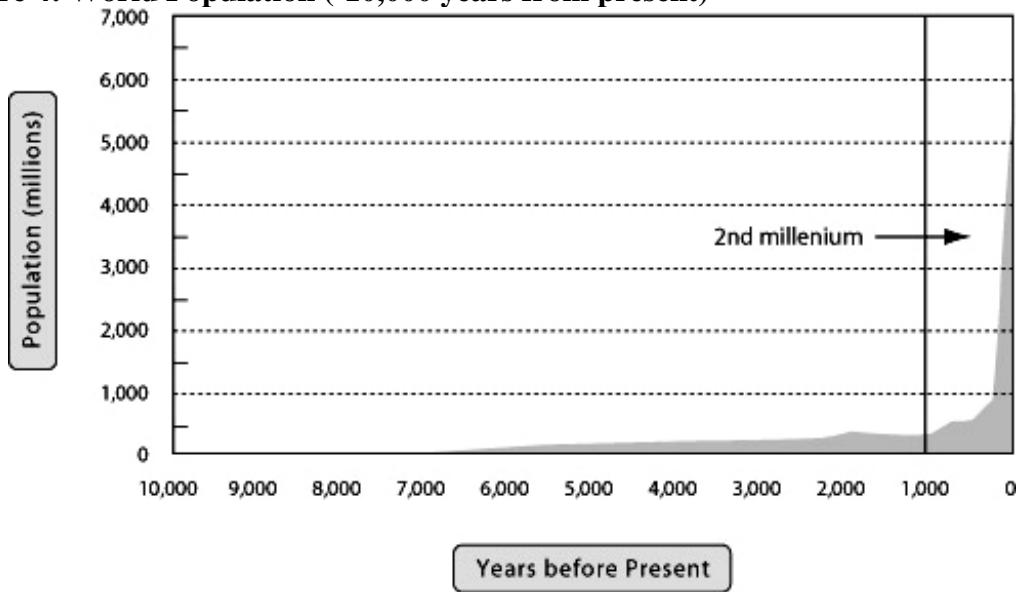
Oil and gas price increases are a result of many factors. First, messages of dwindling supply and increased demand have had the markets fearful for some time. Add to that the fear of Iran seeking nuclear technology for the purpose of making weapons, the Iraq war, the Israeli-Lebanese war and Venezuela's recent aversion to the United States, and you have a recipe for an oil pricing disaster. China and India, with combined populations near 2.5 billion people, are also to blame. The geopolitical tensions have caused prices to rise while countries like China and India have begun developing at a breakneck pace, increasing demand for cars, trucks, boats, planes and power plants all dependant on fossil fuels.

The United States has existed in a consumer bubble for the past twenty years. The recent demand for resources from other countries indicates that we're not lone consumers. Not only oil or steel, but for cement, aluminum, copper, gold and, not least of all, labor. The world is just now beginning to catch up. The ripples of competition have barely been felt.

Competition for limited resources is on the rise. The following graphs show the world's population through time. The sudden burst to over 6 billion people in the last half of the century has put a significant squeeze on how resources are distributed. With limited resources, limited production capabilities, and an explosion of population, it was only a matter of time before tensions arose in the world of supply and demand.

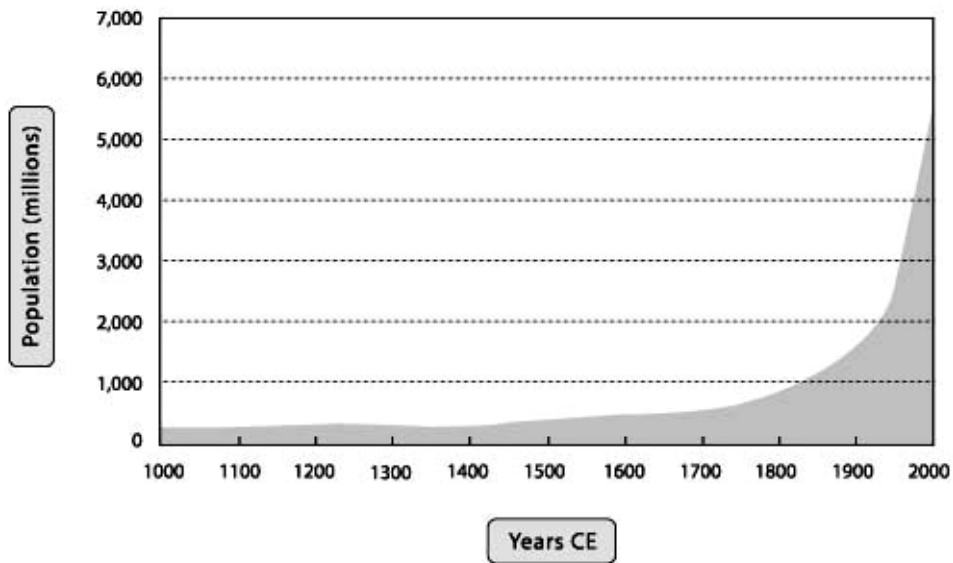
When demand goes up and supply stays relatively the same (in some cases, like steel, it has gone down), prices are sure to skyrocket.

**Figure 4: World Population (-10,000 years from present)<sup>10</sup>**



The chart above shows world population throughout history and the exponential increase in the recent past.

**Figure 5: World Population (Since 1000 AD)<sup>10</sup>**



The chart above shows the population growth in the past 1,000 years. Notice the growth since 1950.

The United States' population is currently around 300 million, while world population is around 6.5 billion. It should be no surprise that as developing nations push into the world of automobiles, communication and overall increased consumption; resources will become harder to share.

The price escalation of the past two to four years has seemingly subsided, but in light of increasing demand from a developing worldwide population, this may only be a glimpse

into the challenge of sharing our planet's limited resources. I believe we have just begun to see the implications of this.

## **Warning Signs and Mitigation Measures**

With no end in sight of geopolitical unrest or increased global consumption, how can owners protect themselves against rising construction costs? Nothing can be done to keep prices from rising. However, steps can be taken to mitigate their influence on the success of a program or project.

With knowledge in hand that price increases will come, a watchful eye is the best defense against the onslaught of rising costs. Knowing where your vulnerabilities are is a good place to start. Managers of capital improvements programs for streets, for example, should keep abreast of commodities such as oil, cement and steel. Nothing sways costs like asphalt and concrete. Reading news articles relating to upcoming changes in market conditions pertaining to your industry also can give you an advantage. Knowing supply changes four months in advance can give you eight months lead time before prices trickle down to your construction contracts. That's valuable time to make adjustments. Internet news technologies out there make it easier than ever to find information.

News articles from industry-specific sources are also helpful. Note that these are not always major media outlets. Be advised, however, that there are many new avenues for disseminating information across the Internet. Blogs are especially useful, but choose information sources wisely, and read as many as possible. When you find some that seem to be consistently accurate, a subscription service might be helpful. Really Simple Syndication (RSS) is a new Web-based technology that allows you to subscribe to online publications using a central reader of your choice. Spend the time to research options.

One of the more difficult items to stay on top of is labor. There are not many good advance warning signs of labor shortages except through the contractors themselves. Staying in good communication with reputable contractors about labor shortages can aid in a particular program. For instance, local contractors may be tapped for the upcoming nine months. Immediately letting another project may attract only high bids from local contractors and give outsiders the opportunity to move in at a premium. If the project can wait nine months it might save considerable money. Or, if you can accelerate your letting date, it might put your project first before a barrage of local contracts, giving you first dibs on lower prices while competition is high.

What are the warning signs that increased inflation is coming your way? The first indicators are the markets. Google (as well as some other internet services) has a new tool that easily allows you to track various market sectors and view related real-time news articles. If commodities are being sold, it might be an indicator that something is on the horizon in the supply chain that investors don't want to be a part of. Heavy buying could indicate expected profit-taking in a market. Either way, large trading volumes are a good first indicator.

Second, industry-insider information and speculation can be helpful. If enough people are saying that they foresee steel shortages within six months, it might be worth hedging your bets and increasing your budget to cover expected cost increases. This is where having multiple news sources pertaining to your industry handy can be very helpful.

A third indicator can be vendors and material suppliers. They generally don't know about increases until they are imminent, but they may have weeks or even a few months notice. Weeks notice can be better than nothing in many cases. Staying in touch with vendors and material suppliers can keep you up-to-date on what your budget should be.

Last, and least desirable, are cost increases themselves. It may sound silly to list cost increases themselves as an indicator of cost increases, but its surprising how often budgets are set using out-of-date costs. If steel prices rose last week and you're setting budgets this week, they'd better include the new pricing.

## **CONCLUSIONS**

Construction costs have been increasingly volatile in recent years, with only a short period of respite currently and no end in sight as developing nations continue to demand more and more resources. Understanding our global economic situation and its impacts on construction and looking for ways to mitigate impacts of unforeseen cost increases will be crucial to managing construction contracts. When it comes time to procure funding or bid a project, two to three hours a week of proactive research could net big savings and relieve some of the stresses of construction in the municipal environment.

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