2010-06-29

Best Practices for Dealing with Price Volatility in Utah Commercial Construction

Justin Earl Weidman
Brigham Young University - Provo

Best Practices for Dealing with Price Volatility

In Utah Commercial Construction

Justin Weidman

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Master of Science

Kevin R. Miller, Chair
Jay P. Christofferson
Jay S. Newitt

School of Technology

Brigham Young University

August 2010

ABSTRACT

Best Practices for Dealing with Price Volatility

In Utah Commercial Construction

Justin Weidman

School of Technology

Master of Science

In the commercial construction industry, the problem of price volatility as it pertains to materials and labor is a consistent problem. The changing instability of market conditions presents a challenge for construction companies to accurately estimate and complete projects within budget. This volatility can lead to higher costs and more risk to suppliers, contractors, and owners which can cause financial distress for all parties involved in the construction process. As lump sum contracts are typically being used on many projects, the owners seem to have the upper hand and are forcing contractors to honor lump sum contracts even when prices increase significantly. Owners are also using their position to reap the benefits of price decreases by basing future work relationships with the contractor as an incentive to pass on any savings of price decreases.

Volatility in construction will continue to be a risk that participants in the construction industry in Utah will face. Commercial construction projects will continue to be built as the population increases and as more buildings are needed to service other industries. Price volatility can be economically dangerous when price changes affect the assumptions on which the contract is based. While there is no proven method to remove the risk of price volatility, methods have been developed to control the risk participants are exposed to in various contracting methods. Contractors, owners, and suppliers need to coordinate with each other and use best practices that will distribute the risk to the party that has the capability to handle the risk.

Keywords: Justin Weidman, volatility, price, fluctuation, construction

ACKNOWLEDGMENTS

Upon completion of this research topic, I wish to express my gratitude to the professors and graduate committee for their encouragement and guidance, the panel members for their willingness to share their expertise and knowledge, and my wife and family for their continuing support and patience.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

1 INTRODUCTION

1.1 Background of the Problem

In the commercial construction industry, the problem of price volatility, which is also referred to as price fluctuation, as it pertains to materials and labor is a consistent problem. The changing instability of market conditions present a challenge for construction companies to accurately estimate and complete projects within budget. This volatility can lead to higher costs and more risk to suppliers, contractors and owners which can cause financial distress for all parties involved in the construction process. Materials typically account for 40-45% of construction costs. (Li, 2001) Maintaining an efficient and effective materials procurement system and purchasing the materials at the right prices, the specified quality and on schedule are critical for contractors to stay competitive.(Li, 2001) The risk of labor and material prices fluctuating after the contract has been signed can erode profits of the contractors or cause the owners to pay premiums over current market prices.

In the commercial construction industry, materials price volatility is increasing the risk for owners, contractors and suppliers. Some construction projects are capable of fluctuating as much as 10% or more over periods a short as six months.(Haughey,2009) Owners want the best price possible and contractors and suppliers are trying to survive on small margins. Traditionally

fixed-price contracts have been commonly used and accepted in the commercial construction industry. Fixed-price contracts put the risk on the contractor to deliver the project for the amount agreed upon. The major risks and reward of losses or gains have been accepted by the contractor once the fixed-price contract is signed. Historically this reward has been greater than the risk when it comes to materials and labor price volatility. Owners of the projects have had the benefit of locking in the price and then holding the contractor to the prices given despite any changes in current market pricing. Owners are hesitant to sign escalation clauses that relieve the contractor of the risks and shifting risk back to the owner.

Due to the current economic downturn, prices for materials and labor have begun to decrease at a dramatic rate. In New York, construction costs have decreased by 10% for materials and labor.(Fung,2009) This decrease in pricing has caused a new shift in owner contractor relationships. Owners who have traditionally benefitted from the protection of fixed-price contracts are now questioning whether they are being treated fairly as material prices deflate. Some owners are going to the extent of shutting down projects, and re-bidding projects to take advantage of the current market pricing. This process has removed the risk and reward component of construction contracts for the contractors. Contractors are still responsible for the risks of materials price increases but are not benefitting in the rewards of materials and labor price decreases.

Price escalation clauses have been used as a method for contractors to deal with certain materials and volatility in commercial construction. The volatility of materials such as crude oil and steel are commonly dealt with using escalation clauses in contracts. These clauses are difficult for a contractor to get the owner to sign due to the owner not wanting to accept the risk. Some owners have seen the volatility and work to implement strategies that minimize financial

risk to contractors so that competitive bidding will take place and for future project planning. Inflation from 1991-2001 remained steady at 1.5% per year. From 2002 to 2006 it jumped to 13.1% per year. Crude oil prices were the majority of the changes especially in hot mix asphalt.(Article # 1 GNB 9/30/2007) Escalation clauses typically are activated by a price change above a certain percentage as compared to an mutually accepted price index or stated price in the contract as based off of supplier invoices.

Construction prices are volatile and are very unpredictable. Economic swings are unpredictable and there are many factors that affect the prices of commercial construction projects. Materials costs can be affected by fuel prices, other markets such as residential construction and the strength of currency at the time of bid. (Michael Moore,2008) When steel prices between 2004 and 2006 surged 15-20%, this unpredicted surge caused many contractors financial strain and caused an increase in concrete prices that was unexpected. As steel prices rose, people chose concrete as an alternate building material which caused the demand for concrete to increase and thus inflated the price of concrete. (McGoldrick, 2007)

1.2 Statement of the Problem

The main problem with price volatility is the financial risks that it places on the parties involved. Owners want the best price while the contractors and suppliers are trying to survive on decreasing margins. As fixed-price projects are typically the contracting method being used, the owners seem to have the upper hand and are forcing contractors to honor lump sum contracts even when pricing increases. Owners also want to reap the benefits of price decreases and some owners are not letting the contractor benefit from the rewards that might occur. When prices change, contractors and suppliers beneath the contractor are seeing their risks increase while the

risk to the owner is being lessened. Some owners are shutting down projects and re-bidding them to take advantage of the current economic downturn. Contractors can no longer count on their back-log in this current situation and often times lose bids and re-bids to contractors who may or may not be qualified to perform the work. Consequences include dramatic contract losses and defaults, severely impacted and delayed projects, and litigation resulting from efforts to mitigate, shift or recover unanticipated losses. The problem with the current way of doing business is that the owners are the only ones benefitting from price volatility in most traditional commercial construction contracts. Contractors take the majority of the risk and are trying to find effective ways of distributing risk more equally to provide benefits for all involved in the project. The economic market continues to have swings and there is no way of accurately predicting future prices of labor and materials. The financial risks associated with construction can never completely be eliminated. The fixed-price contracting system will need to be re-defined or re-vamped to better distribute the risks to all parties involved. The current system does not consistently distribute the risk to the party which is most able to handle the risk and leaves one or more of the parties at a disadvantage. There is very little that can be done to undo a fixed-price contract.

1.2.1 Question

What are the current best practices owners, contractors and suppliers in the state of Utah are using to handle the risks of construction cost volatility in commercial construction and what new methods will be implemented in the future?

1.2.2 Rationale

Commercial construction projects continue to be built as the population grows and as more buildings are needed to service other industries. Fixed-price contracts can become economically dangerous when price changes affect the assumptions on which the contract is based. Contractors, owners and suppliers need to coordinate with each other and come up with methods that will distribute the risk to the party that has the capability to handle the risk and provide incentives for quality work and higher industry standards. Construction pricing has always been volatile but with the recent peaks and valleys that have been more unpredictable, these changes have drastically changed the traditional practices of contractors and suppliers. These new risks and the long durations of some projects change the dynamics that have traditionally existed in the construction industry. Bidding practices, change management and documentation all have to change as a result of price volatility. The industry is looking for new ideas and methods to deal with the increased risk in all aspects of the construction process.

1.3 Purpose of the Research

The purpose of the research was to identify the current best practices being implemented for dealing with the risk associated with price volatility in Utah commercial construction. Through the analysis of these best practices, one may gain insight into the direction of future commercial construction bidding and contracting methods.

1.4 Research Objectives

The objectives of this research were to identify the following:

1. The past systems of contracting in the construction industry and what risk they put on the parties involved.
2. The current best practices that companies are using to mitigate risk as it pertains to price volatility
3. The effectiveness of the best practices being implemented for price volatility.
4. The factors that impact price volatility.
5. Indications of future contracting methods and practices pertaining to price volatility.

This research was conducted through the Delphi method. The use of this method provided the most current data regarding the best practices used in the commercial construction industry in Utah as it pertains to price volatility. It also provided a greater insight into trends and future contracting methods in the construction industry.

1.5 Assumptions

- The current methods of contracting in commercial construction do not spread risk to all parties.
- Traditional methods for dealing with price volatility in construction no longer provide appropriate risk to contractors and suppliers.
- The financial burdens carried by parties in these types of transactions are substantial enough to warrant research.
- The commercial construction participants in this study are no different than those in other states.

1.6 Delimitations

- This research addresses only commercial construction and not residential, heavy highway and industrial construction.
- This Delphi procedure focuses on professionals and trends in the state of Utah.

1.7 Definitions

Contract: The written agreement executed between an owner and the successful bidder covering the performance of the work and the furnishing of labor and materials by which the contractor is bound to perform the work, and by which the owner is obligated to compensate the contractor at the mutually established and accepted rate or price.

Contractor: The person or entity holding the prime contract in a construction project. The individual, firm or corporation undertaking the execution of the work under the terms of the contract. A person or company who agrees to furnish materials and labor to do work for a certain price.

Sub-Contractor: Trade specialists such as electricians, plumbers, framers, etc. that are retained by the contractor to install portions of a project.

Owner: The owner of a project such as a government agency; the person, firm or corporation with which a contract has been made for the payment of the work performed under that contract.

Bid: An offer submitted in a prescribed manner to furnish all labor, equipment and materials to perform the specified work within the time prescribed therein for the consideration of payment at the prices stated in the bid schedule.

Supplier: A person or organization who supplies materials, or equipment for the work.

Fixed-Price Contract: A contract which provides that the owner pays the contractor a specified sum of money for the completion of the project. - Also called a lump-sum contract.

Escalation Clause: A clause in a contract that allows for increased compensation to the contractor if a price change exceeds a specified amount stipulated in the contract. These clauses are typically triggered by a percentage increase above the amount mutually agreed upon at the date of the signing of the contract.

Guaranteed Maximum Price: Amount established in an agreement between owner and contractor as the maximum cost of performing specified work on the basis or cost of labor and materials plus overhead expense and profit.

CHAPTER 2

2 REVIEW OF LITERATURE

The study of what methods have been practiced in the commercial construction industry in dealing with price volatility is essential in understanding the best practices that should be used in today's changing market. Generally, contractors have worked in an environment of risk and uncertainty caused by the changes in materials and labor prices and economic shifts. While there is no one proven way, contractors and owners have tried various methods to reduce risk as it pertains to price changes.

2.1 Past History of Construction Pricing

Construction materials and labor costs have been tracked for many years. The principal method of estimating projects has been to review past costs of materials and labor then predict what the next project will cost based on historical data. Steel, concrete, lumber, copper, and asphalt are some of the more volatile commodities in the construction industry and there has been instances where these items rise or fall in price rapidly. Construction materials costs have the ability to fluctuate as much as 10% or more over as short a period as six months which is

long enough for the economic, construction or materials price cycles to shift. Price cycles in construction have typically lasted 4 years. Over the past decade this trend has been less predictable and the volatility in pricing has experienced larger shifts. (Haughey, 2009) In commercial construction, all bidders do not estimate projects the same and as a result, there can be great fluctuations in bid amounts. Resources needed on each project typically vary and are often specialized for and individual project. The price fluctuations leave the bidding contractors at risk since the volatility of construction materials and labor prices cannot be predicted. Contractors over the years have typically expected a 3% increase in costs per year and have built that into their estimates. (Bob Moore,2008). In cases where materials fluctuated more than the expected amount, owners have left the contractor to absorb the cost increases. The construction industry has come to expect volatility in pricing but has no way to determine how much volatility will occur. In 2005, the steel pricing spike peaked and started to reverse itself although it remained 20-30% higher in 2005 than it was in 2004. (Bob Moore,2008). In Gillette Wyoming, in just 10 days, copper prices drove the materials to build Cam-plex's Wyoming center by more than one $1 million. With hurricanes affecting the oil prices and steel prices rising, the cost to build the new multi-event center was $16 million more than originally planned. Demand for materials in China and India is affecting the American construction materials market and causing prices to shift. (Bisbee, 2008)

2.1.1 External Forces

External Forces are influencing the construction price volatility in the United States. Hurricanes and natural disasters are unpredictable and cause damage that affects the construction commodities. In 2005, Hurricane Katrina caused at least $125 billion in

damage that could cost the insurance industry upwards of 60 billion dollars in claims.(Bob Moore, 2008) During the aftermath of this hurricane, the construction and rebuilding process caused heavy demands on building materials such as lumber, steel, concrete and other materials. Concrete which was expected to have a decreased demand due to the lack of new construction in New Orleans has been affected adversely since New Orleans is one of the largest importers of Portland cement and the decreased functionality of the city has caused the demand to remain high. In 2004, the Chinese demand for steel went up by 38 million tons. With this massive increase in demand, the price of steel rose by 66% in one six-month period which made long term forecasting of steel prices very difficult. International construction affects the availability of materials and diminishes the supply which in turn causes prices to rise. (Bob Moore, 2008) Another external influence is the volatility caused from rising oil prices. The effect the rapidly changing oil price has on the construction industry is devastating. Oil cost increases cause significant impacts to all aspects of construction ranging from construction operating costs, logistics and transportation costs, production and manufacturing costs and many other areas. (Wong, 2005)

2.1.2 Declining Prices

Overall construction costs in 2009 in the United States have begun to experience the first significant sustained declines since the early 1990s. Pricing is showing that everything from materials to labor has dropped an estimated 10% from 2008. (Fung 2008) The decreased demand for construction projects is creating a greater supply of materials and labor and an increased competition for work which is causing bids to come

in at lower prices. Prior to this decline, construction projects had been increasing by double digit percentages over the past two years. While the decrease in construction pricing has been good for owners in bidding new projects, the decline is still not enough to create opportunities for development due to increased financing regulations which are resulting in less project starts due to lack of finances. (Fung 2008) Contractors that could be benefiting from the decreasing prices on their lump sum contracts by buying items at a lower cost than originally bid are not seeing the anticipated benefits of the cost declines on current projects. Owners of current projects want the cost savings to be passed on to them and are willing to shut down or re-bid projects if the savings are not passed on. Suppliers are at risk with decreasing prices because their inventory may have been bought at higher prices than what they can sell it for if prices decline.(Fung, 2008)

2.2 Contracting Methods

2.2.1. Fixed-Price Contracts

Fixed-price contracts are typically used in the traditional design-bid-build approach. The owner hires an architect to design a project which is then sent out to bid and the contract is awarded to the lowest qualified bidder. This is the cheapest way to award a project. The more bidders that are involved in the process, the greater chance the owner has for increased savings. This method locks the two parties into an agreement when the contract is signed and the price will only increase based on scope of work changes. The contractor bears the most risk in this type of contract.

"Under a well established principle of common law, a contractor assumes the risk of unexpected increases in the cost of materials and supplies necessary for performance absent an express contract provision shifting risk to the owner."(Loulakis, 1992)

2.2.2. Cost-Plus Contracts

A cost-plus contract is an agreement where the owner agrees to pay the contractor the cost of the work price plus a fee. The fee on cost-plus contracts can be fixed or variable depending on the contract. Variable fee structures might provide incentives to the contractor for providing the project ahead of schedule and under budget. This system of contract is employed when it is difficult for the contractor to quote the contract price because the design may not be completed or there has been no precedent he may take as a basis for pricing the project. It is also employed where the work to be done is not fixed at the time of placing the order for the contract. Owners are reluctant to enter this type of contract due to the risk that they take in not having a firm fixed price for the project. This style of contract poses a large risk on the owner if the materials and labor prices increase. There is also no incentive for the contractor to eliminate waste and tightly manage the contract.

The contractor on a cost-plus contract may not put his best men on the job or be tempted to let costs increase since profit is dependent on the overall cost of the project.(Griffis,1988) The contractor may also be at some risk since the agreed upon fee to cover overhead and profit is dependent on materials and labor prices. If materials and labor prices decrease significantly, then the contractor's fee may not be sufficient to cover all of the contractor's costs at his specified rate of return. Cost-plus contracts can save the owner money because it eliminates the need for the contractor to carry a

contingency which is a common practice in fixed-price contracts used by contractors to mitigate some risk. (Griffis, 1988)

2.2.3. Design/Build Contracts

Design/Build contracting is done when one company performs the design and construction of a project. Design/build is touted to be beneficial to all parties involved in construction contracts including owners, architects and engineers, and contractors. Owners who are open to innovation often choose to use this method. The greater value of Design/Build contracts comes from obtaining more product for the money that is spent. The risk spreads more among all parties; however the contractor faces the primary concern of increased financial risk. The contractor sets a maximum price based off a conceptual design which is risky. The contractor has the benefit of having input early on in the project which can help with design and material choices that may save the owner money. Design/build contracts have shown to allow companies to achieve lower labor costs, but at the same time have shown to create more risks through materials price volatility. (Ernzen, 2000)

2.3 Price Adjustment Clauses

Contractors who enter into fixed-price contracts assume the risk of materials price increases. “Even substantial increases in price do not entitle a contractor to relief under the contract absent a price adjustment clause transferring this risk to the other party.”(Loulakis, 1992) Price adjustment clauses which are often referred to as escalation clauses in construction contracts take into account the volatility of materials at the beginning of a project and allow a

certain degree of flexibility to respond to price changes. These clauses are typically found in most road and highway projects for items such as asphalt, paving, steel, cement, diesel fuel and other materials. Price adjustment clauses need to be drafted carefully and used with caution. These clauses need to identify specific materials that might be affected during construction and are at a high risk for change. Owners and contractors need to agree on the terms of the price adjustment clause and what will enact the clause as well as a proper notification system. Properly drafted price adjustment clauses in commercial construction contracts present a way for all parties to minimize risk and promote cooperation and can reduce conflicts between the contracting parties. Price adjustment clauses typically are used in one of three ways.(Loulakis, 1992)

2.3.1 Invoice Method

> "*Invoice Method* – A contractor uses documentation in the form of an invoice or certification from a supplier to substantiate the changes in materials price. It must demonstrate the change in material price from the time the contract was signed to the time of the actual purchase." (Williams, 1994)

The problem which occurs with this method is that suppliers or contractors might produce fraudulent invoices in order to re-coup costs overruns that might have occurred due to outside influences. There must be a clearly defined starting price from the supplier included in the contract for materials that are under the price adjustment clause and proper checks need to be done by the owner to validate the claims for increased materials pricing.

2.3.2 Index Method

> *"Index Method*- The index method is used when an increase in the contract price is tied to a price index such often called a Construction Cost Index or CCI. This method should allow for the contract to be adjusted to the index price as it pertains to regional and local fluctuations and conditions for major commodities on projects such as steel, concrete, copper, asphalt, and fuel." (Williams, 1994)

In certain volatile markets, suppliers may be reluctant to provide firm prices for long periods of time. Some suppliers will stipulate that their bids may only be good for one day or a certain time frame since they must lock in their prices or risk changes in prices as well. The index method is often the best option for the owner and contractor to come to an agreement when a supplier is unwilling or unable to provide a fixed price quote until the material is actually purchased.

2.3.3 Hybrid Method

> "*Hybrid Method*- The hybrid method contains both the invoice methods and the index method. This method is centered on a "certified bid cost" in which the contractor certifies the bid of specified material called out in a project based on current pricing and or a listed price in a CCI. In the event that a certified bid price for a material fluctuate by a percentage greater than outlined in the contract as agreed upon by the owner and contractor, the contract would then be adjusted accordingly. In most contracts the price adjustment trigger percentage is between 5-10% of the contract price for specified materials." (Williams, 1994)

2.3.4 Construction Cost Indexes (CCI)

There is no method available to accurately predict the future cost of materials in construction. A common practice in setting up price adjustment clauses is to refer to a construction cost index. Construction cost indexes are created from composite of unit price information using historical bids from contractors and historical materials prices and provide for a comparison of cost changes from period to period of certain materials.

Cost indexes account for normal inflation and give an estimated range of what materials should cost in given years. In relation to hot mix asphalt in the state of Washington, “the average annual growth rate of the CCI held steady at about 1.5% per year from 1990 to 2001. Beginning in 2002 and continuing to 2006, the growth rate increased to 13.1% per year.”(GNB, Sept 30 2007) The rapid fluctuations in materials pricing has caused construction cost indexes to become unreliable and inaccurate at predicting the future cost of materials.

Cost indexes have several limitations. Indexes are based on average values which in some cases the actual value of the materials could vary significantly from the listed index price. A small remote town may be included in the same index area as a large city which could vary the price greatly due to increased shipping costs and extra resource costs.

Predicting changes in construction cost indexes is complex and has not been accomplished effectively.

> “Back-propagation models have been developed to attempt to predict the changes in the highly used ENR construction cost index for periods of one to six months ahead. A training set of macroeconomic data was developed using information from cost indexes from the period from 1967 to 1991. The neural-network program model attempted to use various factors affecting construction including recent trends in the index, the prime lending rate, the number of housing starts and the month of the year. The information output from the model was compared with predictions made by exponential smoothing and simple linear regression. The predictions that were produced by the neural-network program yielded greater errors in prediction than either exponential smoothing or lineal regression. It can be concluded that the volatility in materials pricing is largely unpredictable and cost indexes that predict the prices of materials cannot be predicated accurately by using a back-propagation neural-network model.”(Williams, 1994)

2.4 Valuing a Price Cap Contract for Material Procurement as a Real Option

In commercial construction projects, materials are purchased with short term agreements that are executed close to the time the materials are going to be installed on the project. This current method is subject to high volatility in materials pricing. Contractors solicit bids from suppliers but do not place specific material orders until the owner has awarded the contract. This current method is resulting in lower profit margins for contractors. Studies have shown that contractors typically purchase a stable quantity of certain commodities materials per year such as concrete, steel and lumber that is relative to the size of company they operate.

A materials contract with a price cap is similar to a financial call option because the material purchaser pays the price cap amount when the current market price is more than the agreed upon price cap. This cap provides the contractor an option to buy the material at a cap price but does not obligate him to do so. If the current market rate is lower than the cap price then the contractor pays the current market price. If the current market rate is greater than the cap price then the contractor can purchase the materials at the agreed upon cap price. Contractors who are able to negotiate a price cap with suppliers for these materials reduce the risk of volatility without being forced to purchase a certain quantity. Suppliers who enter into price cap contracts have the stability of having a steady demand and bigger market shares. This system requires long term purchase agreements in lieu of the traditional spot purchases being used throughout the commercial construction industry. Relationships between contractors and suppliers become increasingly important and must be maintained in order to effectively use the price cap method.(NG,2003)

2.5 Principal Items Ratio Estimating Method (PIREM)

Current estimating practices used in the industry are based off of historical costs and best practices. These practices include contingency plans and a company's views on how to manage their risk. In these methods, estimates are lacking in accurate real time prices of materials, labor and equipment as the market fluctuates.

> "It is concluded from wide ranging literature that the inaccuracy of construction cost estimating is due mainly to insufficient experience in similar types of projects, insufficient time available for cost estimation, price changes in resources over time, and incomplete project information even for detailed estimation." (Yu,2005)

Construction estimates based on previous projects may be inaccurate due to the volatility in pricing. Studies are being conducted to see if a principal items ratio estimating method can successfully be used to enhance the accuracy of construction estimates by allowing contractors to estimate using the prevailing unit prices in the market place for principal building materials and comparing them with ratios that have been derived in the PIREM model.

Using a PIREM based model becomes difficult because contractors must decide which items are principal items on their projects and how many items are considered to be the critical ones. It has been found that between 5 and 10 items is a good number to use in the PIREM models of estimating. (Yu,2005) The formulas for mapping PIREM estimates are complicated and have not yet proven to be accurate and unit price databases must be constantly kept up to date to provide accuracy on estimates. This system of estimating is useful in providing real time estimates for construction projects as long as the unit price databases are current. This method is not an effective method of predicting volatility in materials or labor pricing in the future. (Yu,2005)

2.6 E-commerce System for Construction Materials Procurement

Obtaining materials at proper times during construction can impact the profitability of construction contractors and keep costs lower to owners. With the typical costs of materials on construction projects being between 40-45%, procurement of materials in a volatile market can be critical to keeping project costs and risk low. (Li,2001) The advancement of the internet technologies and use has enabled information to be transferred at great speed and at low cost. E-commerce refers to business activities involving consumers, manufacturers, service providers, using computer networks.

"E-commerce has provided a marketplace where buyers and suppliers can communicate directly with each other. Online construction materials trading markets are not limited by store spaces and can carry a larger variety of products. This direct communication between potential buyers and sellers can cut out the middle men and reduce costs and often delivery times for certain commodities." (Li,2001)

E-commerce is an emerging way that contractors, owners and suppliers are working together to deal with price volatility. E-commerce eliminates some barriers such as working within confined business hours and only having access to local commodities. It allows for product catalogs to be continuously updated and prices shown in real time as it relates to the current construction market prices. (Li,2001) Using the internet to secure prices and materials can benefit those in the construction industry because it connects buyers with multiple sellers and can increase the competition and speed by which materials are procured and implemented into commercial construction projects.

2.7 Materials Management and Control

Many current materials management and control systems being used by contractors are unsatisfactory and are exposing contractors to greater risks. Many of these current management

systems are inaccurate, require a lot of labor hours, and are prone to mistakes. This mismanagement of materials procurement and management causes lost time, excess waste, decreases in productivity and the lack of up-to-date information regarding the status of materials and pricing on commercial construction projects. The lack of materials management causes low productivity and delays in construction projects. One of the primary reasons for delays and lost productivity is the absence of the right materials on site at the right times. The inability of contractors to effectively plan the construction work and materials needed is often limited according to available materials on-site due to lack of up-to-date information and proper prior planning. With materials prices varying greatly throughout the duration of projects, materials need to be managed closely as to when they are ordered, when they arrive and in the proper quantities.(Navon, 2005)

Managing materials waste on projects has been found to increase the profits of construction projects. In a research study conducted by Thomas and Sandivo (2000) it was concluded that inefficient materials management could lead to an increase in the field labor hours of 50% or more.(Navon,2005)With price volatility having such an effect on the construction industry, materials management becomes key in ensuring contractors profit margins are met. Mismanagement of materials can greatly increase the effects of price volatility in the event that materials are damaged and have to be reordered or if the products are not ordered at the right time and have to be expedited at a higher cost or have been affected by inflation. Proper materials management can be a way that contractors and suppliers are able to lower their risk and increase their profit margins on projects.(Navon,2005)

2.8 Fair and Reasonable Mark-up Pricing Model

> "The Fair and Reasonable Markup (FaRM) is the smallest markup that satisfies the Required Rate of Return (RRR) of the contractor for a particular project at hand. The model is based on reasonable and easily accessible information, and will result in a Minimum Acceptable Price (MAP). Once a FaRM pricing model has been implemented, contractors can make more intelligent decisions. Instead of using a subjective markup, which may ignore cash flow differences of various jobs, contractors using a FaRM pricing model can bid lower on projects which may be more attractive and become more competitive while still maintaining their RRR. This effort should result in lower costs to owners and lower risk to contractors. The determining of what a fair and reasonable markup is difficult because there is no universally accepted definition of what a fair and reasonable markup should be."(Farid, ASCE)

This system is typically delivered in a cost plus contract format where the owner and contractor negotiate to determine the FaRM and add it to the cost of the project. This model of contract would provide the contractor with a risk free project fee based on what the project requirements entail. The owner would know exactly what the contractor is making on profit on the job and would be able to control their costs as the project went along with the choices in materials and subcontractors that are chosen. The FaRM would satisfy the contractor's rate of return based on the risk taken and the owner would agree to pay the mark-up on what they choose for their project. This method is similar to cost plus contracting and is not a commonly accepted contracting method used in commercial construction.(Farid, ASCE)

2.9 Integrated Project Delivery

> "As design and construction budgets shrink and clients demands for quicker, more efficient design and delivery continue to escalate, many architects and construction firms are embracing integrated project delivery, an approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction."(Yoders, 2009)

Integrated Project Delivery (IPD), brings owners, contractors and designers together to create a team approach to delivering complicated projects in shorter durations and with better design. The team is established prior to the design of the project. Having all the players in the construction process on one team allows for more timely decision making, and allows the team members to contribute to the success of the project from the start. IPD moves all parties to the same side of the table. IPD changes the traditional approach of construction and allows the team to work together to draft the building program and the program costs. The parties then agree to share the risk and not sue each other in the process.(McKew,2009)

This new delivery method is starting to be used more on projects using building information modeling (BIM) design projects. IPD allows the contractor to better understand the project intricacies and specifications through being involved in the development of the specifications on the projects from the beginning. (Miletsky,2010) This type of agreement allows for a team atmosphere and decisions to be made by all members of the team. IPD creates this team based on five factors:

> "1) collaboration; 2) increased communication to build trust among team players, 3) creating networks of commitment, with accountability written into the agreement; 4) optimizing the whole project, not the needs of any single player; and 5) coupling learning with actions."(Yoder,2009)

There will be growing pains with IPD as it becomes a more implemented method of project delivery. The agreements between the parties need to be worked out and as the team members form new companies for certain projects, the organization and communication between the parties could be difficult to establish.(Miletsky,2010) Each member of the IPD team is expected to be open and honest and the team agrees to share in the benefits and savings as well as the risk of the project. This is different than the traditional approach and will take some forward thinking by the parties that enter into this new delivery method. While IPD has its

challenges, the process has the potential to advance the construction delivery process while sharing the risk between the team members and diminish the amount of claims that are arising on construction projects.(Miletsky,2010)

CHAPTER 3

3 METHODOLOGY

3.1 The Method

The purpose of the research was to identify the current best practices that are being used to control the risk associated with price volatility in the Utah commercial construction industry. Through the analysis of these best practices, gain insight into the direction of future commercial construction bidding and contracting methods. It is for this reason that the research was done through a series of Delphi rounds. The Delphi method "may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem."(Okoli,2004) The Delphi method is an effective way to collect knowledge from a group of individuals, who are regarded as experts in their field through gained experience and knowledge in a certain field, by a means of questionnaires and additional opinion feedback. This method allows for a number of experts to express their opinions without being in a group setting where one might feel uncomfortable or pressure from other group members. This questioning of experts is done using anonymity, iteration, controlled feedback and the statistical compilation of the group response.(Rowe, 1999)

The number of experts needed to complete a Delphi study is not specified in literature and ranges from very small groups to groups over 50 members. "The majority of Delphi studies

have used between 15 and 20 respondents."(Hsu,2007) The Delphi process provides both quantitative and qualitative data. Qualitative data is derived from the open ended question responses where opinions of the experts are conducted in the first round. The second iteration is used to narrow down responses and hopefully achieve a desired level of consensus. The major quantitative statistics measured in a Delphi study are "measures of central tendency (means, median, and mode) and level of dispersion (standard deviation and inter-quartile range) in order to present information concerning the collective judgments of respondents." (Hsu, 2007)

The Delphi method of obtaining information is administered through the following steps:

1. Identifying and selecting a panel of experts to participate in the exercise.
2. Developing the first round of Delphi statements that will be administered to the panel for their opinion and feedback
3. Testing the statements for proper wording (e.g., ambiguities, vagueness) prior to distributing the statements to the panel members
4. Administering of the statements for the first round to the panel members.
5. Analyze the first round responses.
6. Preparation of the second round statements (and possible testing)
7. Transmission of the second round of statements to the panelists.
8. Analysis of the second round of responses (Steps 6-8 are repeated as long as desired or necessary to achieve stability in the results.).
9. Preparation of the consensus and conclusions (IIT,2005)

The Delphi method provides advantages over conventional face-to-face conference as a communication tool in conducting research.

> "By allowing the individual group members to express their opinions privately, undue social pressures – as from dominant or dogmatic individuals, or from a majority – should be avoided."(Rowe, 1999)

This method also allowed for the participants to change their answers and opinions over a number of rounds given new information without having to face the other group members.

3.2 The Process

3.2.1 Step One- Selection of the Panel Members

The selection of the panel members is crucial to the validity of the research. Panel members have been randomly selected from a list of pre-qualified candidates who were chosen based on their expertise in the field of commercial construction. There is no exact criterion listed in literature as to the selection of panel members.

> "Individuals are considered eligible to be invited to participate in a Delphi study if they have somewhat related backgrounds and experiences concerning the target issue, are capable of contributing helpful inputs."(Hsu, 2007)

These subjects should have a competent knowledge of the industry and to be considered as a panel member for this study, each member must have exhibited a high level of expertise in the commercial construction industry, have at least a minimum of ten years of construction experience and still be actively involved in commercial construction today. A broad perspective from contractors, owners and suppliers was desired. The panel members have been chosen from the following disciplines:

- *Contractors- recommendations of participants from the members of the leadership from the Brigham Young University Construction Management Industry Advisory Council, as well as the Utah chapter Associated Builders and Contractors (ABC) trade organization.*
- *Sub-Contractors- recommendations from the members of the leadership of ABC and Utah Mechanical Contractors Association (UMCA) chosen as affinities to the research.*
- *Owners – Private sector*
- *Owners – Public sector*
- *Suppliers- suppliers of materials who are subject to high volatility including, lumber, steel, concrete and hot mix asphalt.*

The research primarily addressed the best practices being used in dealing with price volatility and how they are being implemented in commercial construction projects. The general contractors selected for the panel represent contractors who have distinguished themselves as having a high level of expertise in commercial construction. See appendix A for a list of the selected panel members.

3.2.2 Step Two- Development of the First Round of Delphi Statements

The first round of Delphi statements has been developed to gain the best practices traditionally and currently being used by panel members. Ten statements/questions have been prepared with both open ended and multiple choice responses. These statements have been designed to acquire best practices being used to achieve the purposes of this research. In an attempt to avoid limiting the panel members to the answers given in the

questions, and thus assuming inaccurate practices, each question has an option to write in the candidates own response. See appendix B for a list of the statements.

3.2.3 Step Three- Testing the Statements

The statements and questions have been reviewed by the Brigham Young University Institutional Review Board in the Office of Research and Creative Activities to ensure that no one would be embarrassed or injured during the study. Each statement has gone through multiple corrections to ensure the responses from panel members will be accurately depicted. Once the validation edits had taken place and the questions and statements corrected, the statements were reviewed by a panel of professors at Brigham Young University who tested the statements and questions and substantiated them as being correct and unbiased.

3.2.4 Step Four- Administration of the First Statements

Once the statements had been tested, they were distributed to the panel members for the first round in order to gain the desired information. To accomplish this, panel members were called and asked to participate in a phone or face to face interview to provide timely and accurate responses to the statements. This process allowed for greater response rate and opportunities for the responses to be documented in a timely manner.

3.2.5 Step Five- Analysis of the First Round

After accumulating the responses which the panel members felt were correct according to the first round of statements, the data was collected, formatted, and analyzed. The data for the statement was organized in a way such that the mean, median, and mode could be derived from quantitative questions and that qualitative data could be reviewed.

3.2.6 Step Six-Preparation of the Second Round of Statements

The second round of statements was generated based off the responses of the first round of statements. In addition to any inconclusive statements reissued, a few new questions were added to gather additional information regarding the statements which were determined to be conclusive. See Appendix C for second round statements.

3.2.7 Step Seven-Administration of the Second Statements

The second round statements were presented to the panel in the same manner as the first round.

3.2.8 Step Eight-Analysis of Second Statements

After accumulating the responses which the panel members felt were correct according to the second round of statements, the data was collected, formatted, and analyzed. The data for the statements were organized in a way such that the mean, median, and mode could be derived from quantitative questions and that qualitative data could be reviewed. (Hsu,2007)

CHAPTER 4

4 FINDINGS

The following is a compilation of the results of the Delphi method questionnaire rounds conducted with 24 panel members (see appendix A for a list of the responding panel members). The response rate for the 24 participating panel members was 100% for the first round with all 24 members completing the questionnaire. The panel was selected out of 45 possible experts contacted from the recommendations of Utah construction trade organizations. All possible participants were contacted through phone and email messages and 21 never responded to the messages. The first round questionnaire consisted of 10 questions which included 3 multiple choice response questions and 7 fill in the blank questions that required the respondent to provide their opinion on the subject matter. The questionnaire was distributed to various participants in the commercial construction industry including owners, general contractors, subcontractors and material suppliers. The reader may work from the understanding that the responses fell along the lines of the participants' classification. It has been observed that while the majority of the responses did reflect the position of the classification, there were some mixed, unbiased answers given that did not correlate to the classification of each respondent.

The data compilation is divided into 5 categories. The categories are: 1) background information; 2) current contracting method trends; 3) the current practices for dealing with price fluctuation; 4) the risk of price fluctuation as viewed by each party; 5) potential problems with decreasing prices.

4.1 Background Information

The respondents in the survey varied as to the classification within the construction industry they fall under as well as the amount and quantity of work they perform. The panel members were asked to identify their role in the industry as well as their average volume of work in millions of dollars as well as what amount of work their company self performs on commercial construction projects. Of the 24 respondents, the classification of each party is as follows and is represented in Figure 4.1: Owners – 4, General Contractors – 9, Subcontractors – 4, and Materials Suppliers – 7.

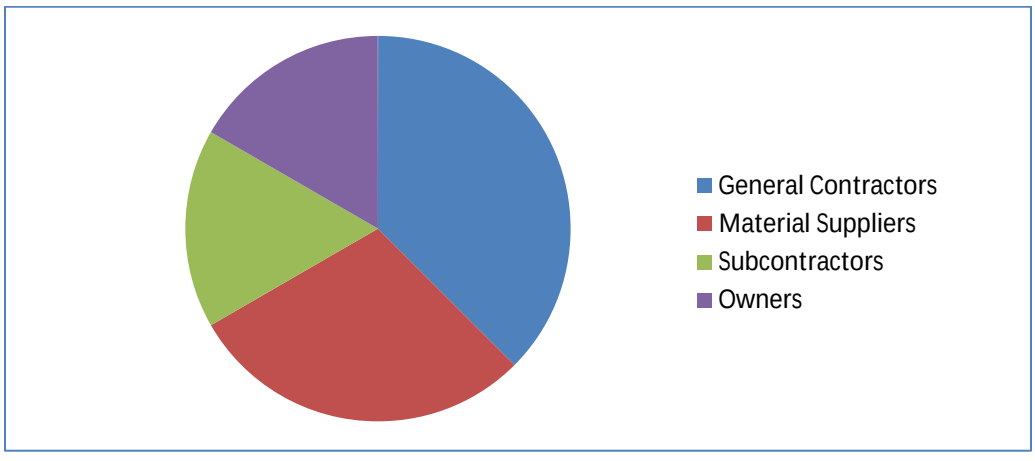


Figure 4-1: Classification of Respondents

The general contractors ranged in volume from 10 million dollars annual volume to 700 million dollars annual volume with a mean of 227 million and a median of 100 million dollars in average company volume. Owners ranged from 100 million dollars to 1.5 billion dollars of annual construction project work with a mean of 650 million and a median of 500 million dollars of average company volume. Subcontractor respondents ranged from 5 million to 40 million dollars with a mean company volume of 19 million dollars and a median of 15.5 million dollars of annual company volume. Material Supplier respondents ranged from 45 million to 1 billion dollars in volume with a mean of 252 million and a median of 99 million dollars in volume.

The percentage of construction work actually performed in their contracts the respondents varied by profession. Owners, general contractors and materials suppliers performed a much lower percentage of actual construction work than subcontractors performed which was expected. Subcontractors responded that they performed greater than 50 percent of actual construction work in their contracts while owner companies performed less than 10 percent, general contractors typically performed less than 30 percent and material suppliers also averaged less than 30 percent. Material suppliers who supply steel products such as rebar and structural steel performed a greater percentage of construction work than suppliers who supplied other building materials.

4.2 Current Contracting Method Trends

Respondents were asked to give the percentage of business they perform using various widely used contracting methods in the commercial construction industry. The respondents were asked to provide the amount of work they perform using the listed contracting methods.(See appendix B for round 1 questionnaire) The data was used to find out what methods are being

used most frequently and then follow-up questions were used to determine the level of risk the parties felt were associated with each type of contracting method. According to the data the answers of the panel showed that 62 percent of the commercial construction contracts are currently being performed using fixed-price contracts with 5 percent performed using cost-plus contracts, 9 percent using unit-price contracts, 20 percent using guaranteed maximum price contracts and 4 percent using other contracting methods specifically listed as design/build.

The breakdown of the various parties and the percentage the four groups as a whole are using the various contracting methods are shown below in Tables 4.1-4.4

Table 4-1: Percentages of Construction Contracts Using Fixed-Price Contracting Method

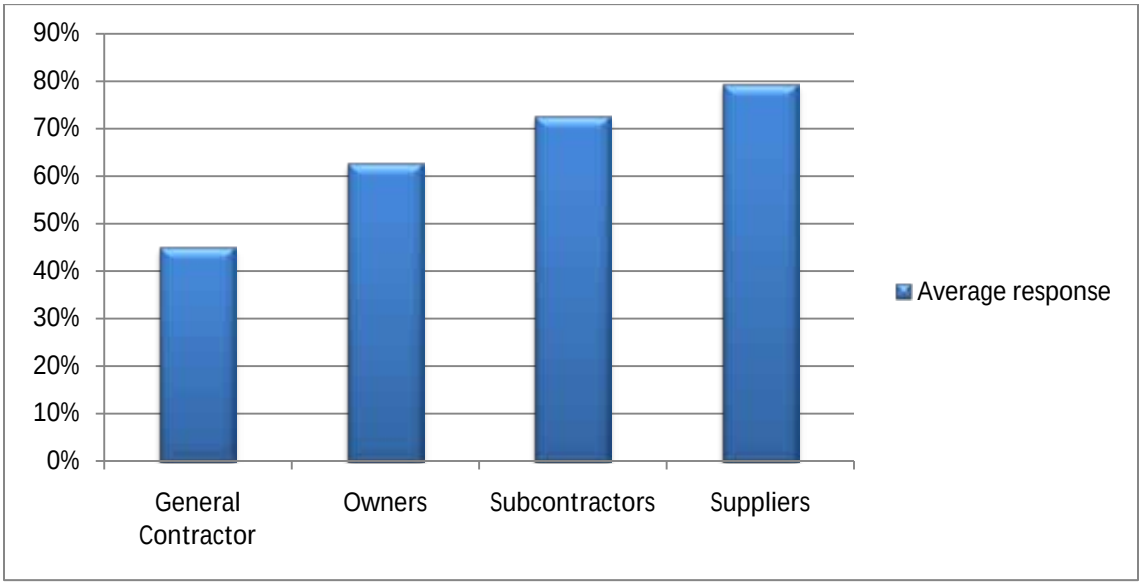


Table 4-2: Percentages of Construction Contracts Using Cost-Plus Contracting Method

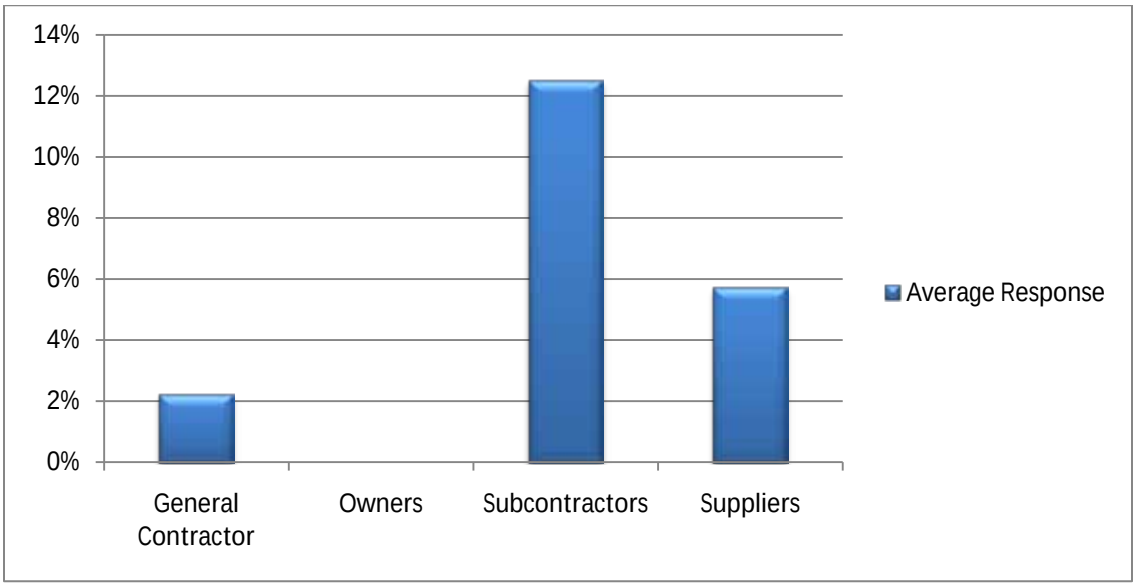


Table 4-3: Percentage of Construction Contracts Using Unit-Price Contracting Method

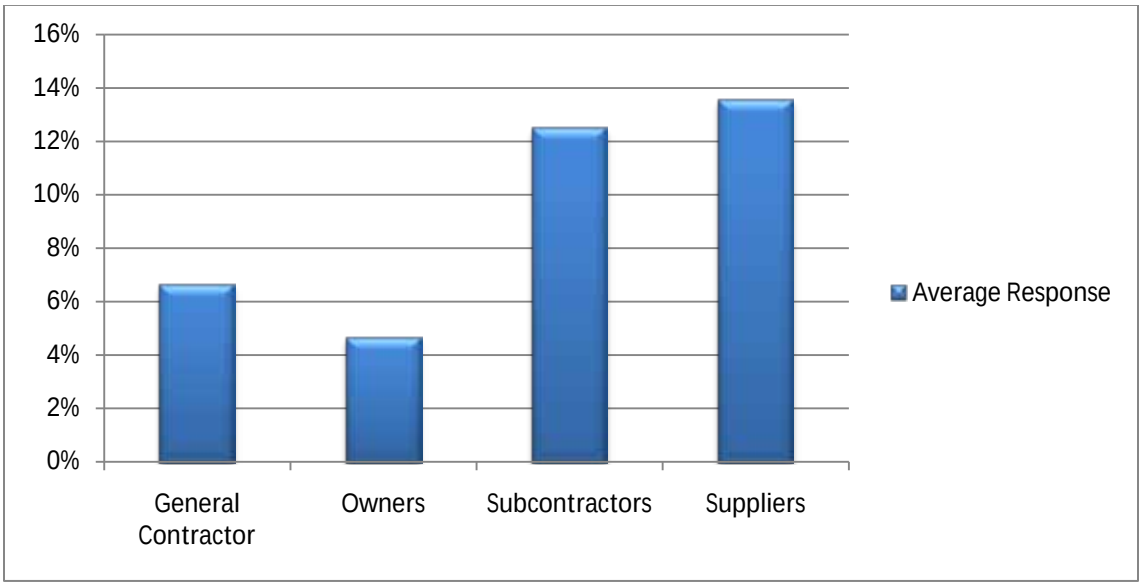
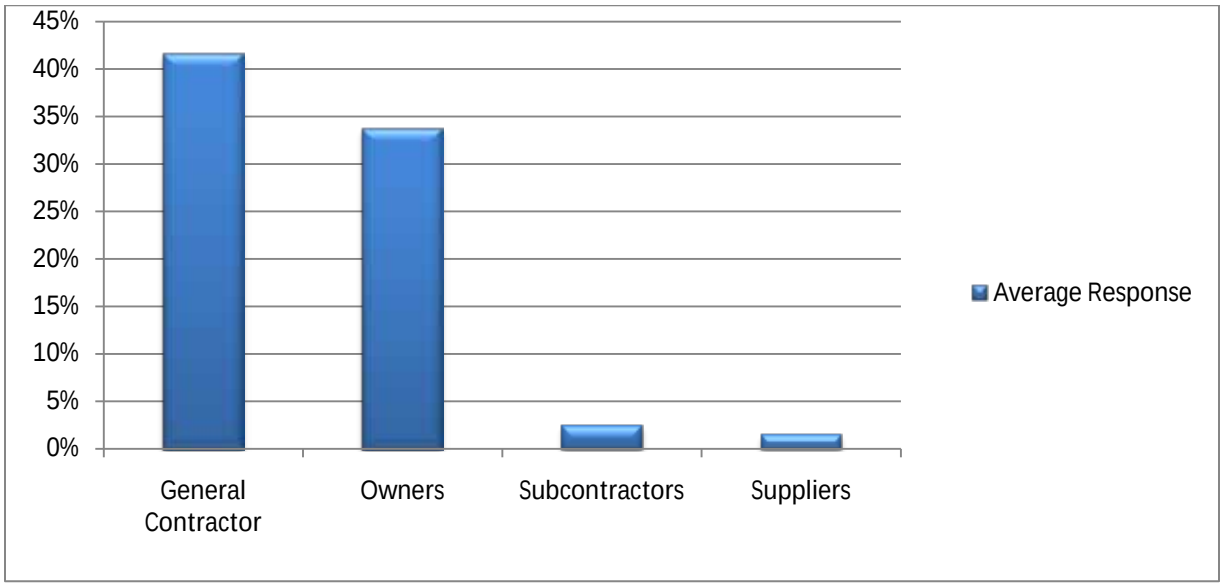


Table 4-4: Percentage of Construction Contracts Using Guaranteed Maximum Price Contracting Method



The data shows the majority of the commercial construction contracts being used are fixed-price contracts that lock the parties into specific pricing at the time of bid. Many members of the panel noticed a shift toward fixed-price contracting with the current economy in relation to the previous years where guaranteed maximum price contracts had been used and preferred by more contractors and owners. Panel members noted that owners have gone away from the team approach on projects and just want to get the lowest price possible. This has created the problem of less qualified contractors and subcontractors taking on projects they may not be able to handle.

4.3 Current Practices for Dealing with Price Fluctuation

In the first round of the Delphi study, panel members were ask to list in order of priority the 3 most important methods they use to control the risk of price fluctuation. The responses

varied with the classification of the panel members and there was not one clear way that parties were using to control risk. The most common answers given are described below at the following response rates:

- **Timely buyout**- 50% of the respondents responded that timely buyout is an important method in controlling the risk of price fluctuation. Timely buyout is a common practice used in the industry and can be described as issuing contracts or purchase orders in a timely manner to lock in certain prices for the duration of the job.
- **Contract language**- 50% of the respondents responded that contract language is an important way of controlling the risk of price fluctuation. Contract language can typically include price adjustment clauses for certain materials or can be used to shift the risk of price fluctuation to another party in the construction process.
- **Communication**- 36% of the respondents responded that communication with the other players in commercial construction is an important way to control their risk of price fluctuation. Communication involves relationships with subcontractors and suppliers to know what prices are doing and what they could possibly do. It also involves negotiating with other players to control the fluctuation and get the best prices possible for the project. Having good communication and being involved with the other players can help to build relationships that can help control the amount of fluctuation in certain situations.
- **Stockpiling materials**- 32% of the respondents responded that stockpiling materials was an effective way to control the risk of price fluctuation. Panel members noted that buying materials when they view the price as low and storing the materials until needed can help control their risk. The problem associated with this practice is storage space and not all

companies have the cash flow to purchase materials they are not going to immediately use or sell.

- **Time stipulations on bids**- 18% of the respondents responded that they use time stipulations on their proposals to control the risk they are exposed to with price fluctuation. An example of a time stipulation panel members are using is “this price is good for 30 days.” This allows the bidder to readjust their pricing after the stipulated time if a contract has not yet been awarded.

Other responses given by the panel members that were listed as good practices to use to control the risk of price fluctuation that were not common among respondents are listed as follows.

- Value based selection- ensuring that the bidder that is selected has the scope covered and is qualified
- Hire consultants that follow the bids historically and have success predicting cost fluctuation
- Risk management process
- Accelerate construction
- Continuous estimates through pre-construction- live estimates and what-if scenarios
- Study the market trends
- Have owners agree to purchase certain materials or negotiate to allow contractors to purchase materials up front and get paid for them even though they might not be needed on the job until later in the project
- Work with owners to create allowances

- Explore alternative materials
- Make sure to use detailed specifications
- Make sure the bidders understand the work they are bidding on
- Receive updated pricing every two weeks on volatile commodities
- Secure a fixed price from a supplier on a job-by-job basis, especially long duration jobs
- Hedge the quoted price based on experience
- Increase awareness of better efficiencies among employees. When things are volatile you need to make sure you are able to produce the product more efficiently and for less money without sacrificing quality.
- Always sell at replacement costs
- Make sure inventory is turning quickly
- Carry a contingency
- Use average costs
- Get competitive pricing
- Budget using an inflation factor with a contingency to cover
- Pass risk to contractor bidding the project
- Hold off on bidding during times of extreme price fluctuation

Another practice commonly used in the construction industry is to add a percentage of the bid price to cover any risk of fluctuation that might occur. The panel was asked to list the percentage amount they add to the various costs of construction in the different contracting methods in order to control the risk of fluctuation. Participants were asked specifically to note the percentage they add to bids for materials, labor, equipment, subcontractor prices and other areas. Some of the respondents noted that currently they are unable to add any costs to bids to

account for fluctuation due to the competition in the market being so intense. These respondents were contractors, subcontractors and suppliers who felt that adding in any costs would prevent them from winning bids and securing work for their companies. This was also the case among subcontractors particularly as it pertained to labor costs. The response results are listed in the following tables by each type of contracting method explored in round 1.

For fixed price, unit price and GMP contracts, on average each profession adds some percentage to their bids in order to control materials price fluctuation. This data shows that adding costs to protect against fluctuating prices is a way being used to control risk. The data does not necessarily represent a corresponding increase in price of the entire project due to the different levels of self performed work the parties may be involved in. The data does suggest that there may be more than one party accounting for the risk of materials and labor fluctuation which would affect the overall price of the contract in some way. General contractors listed adding a small percentage to their labor costs which could be a significant amount for those contractors who self-perform large amount of work or could be minimal if they self perform a small amount of work.

The following tables illustrate the average percentage of costs the different types of respondents add to the components of their bids in the various contracting methods. Table 4.5 shows the percentage respondents listed as adding to their materials and labor costs.

Table 4-5: Average % of Cost Added to Materials and Labor by Panel

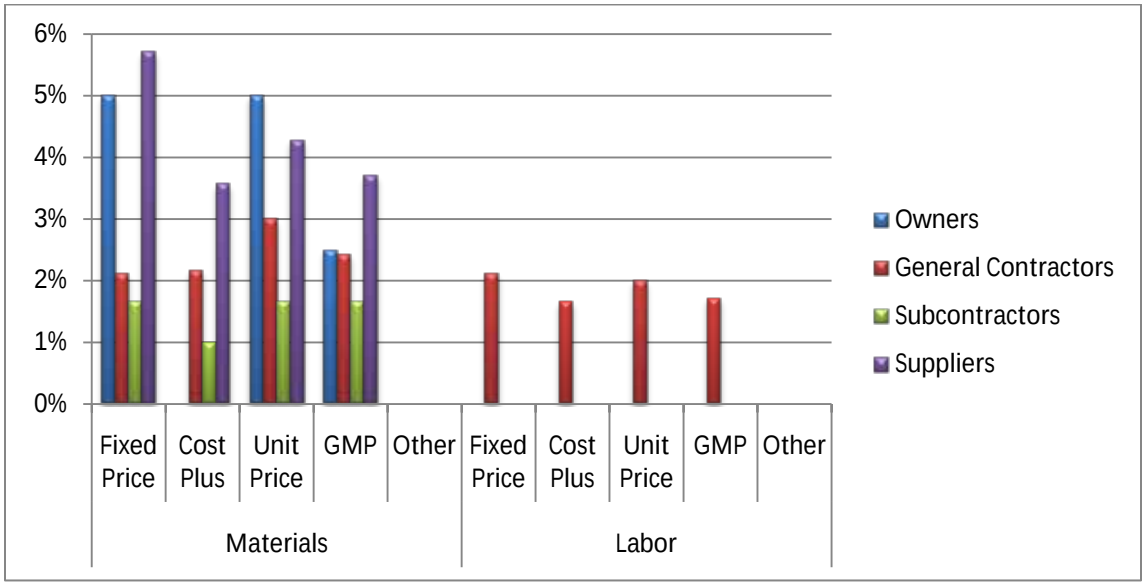
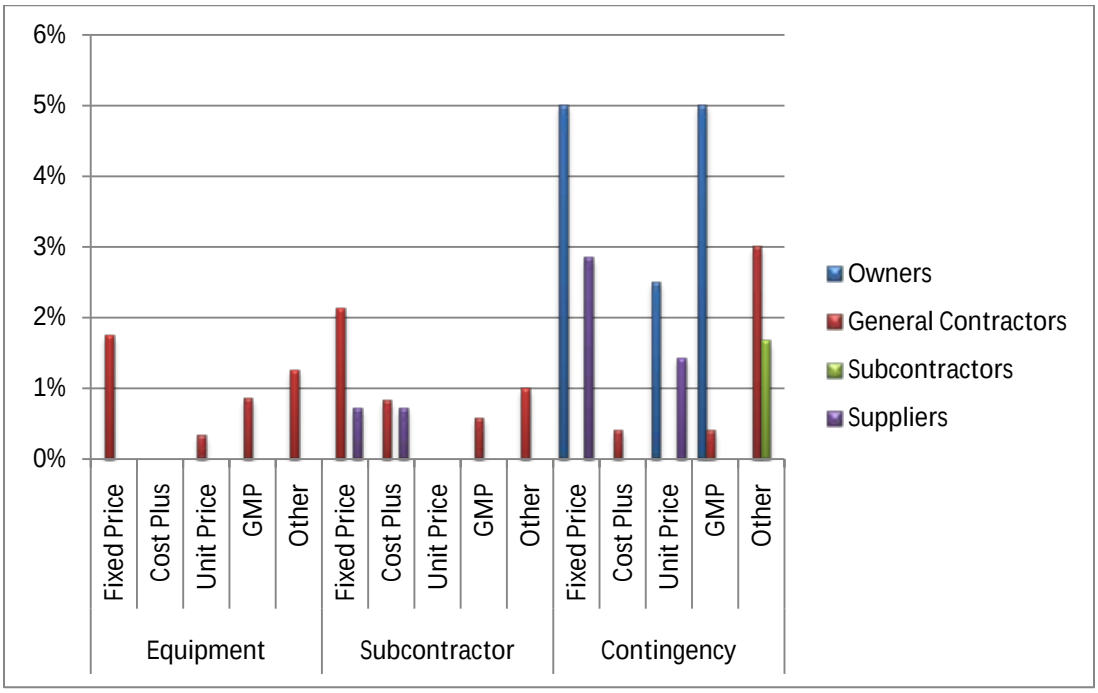


Table 4.6 shows the percentage respondents listed as adding to their equipment, subcontractor and other costs. Other costs as described by the respondents were an overall project contingency amount. The figure shows that all parties are likely to add some type of contingency to account for price fluctuation. In Tables 4.5 - 4.6 the general contractor on average has accounted for the risk of price fluctuation in all areas on all types of contracts. The other parties add percentages to certain areas to control their own risk but may this may cause the owner to pay for the risk of fluctuation more than once if they do not clearly assign who will carry the risk of fluctuating market prices.

Table 4-6: Average % of Cost Added to Equipment, Subcontractors and Other areas



4.3.1 Effective Methods

In round 2 of the Delphi method, panel members were again given questions that were intended to further understand the best practices being used by the parties involved in commercial construction. Questions were generated using some of the most common responses in round 1 to try and generate which of the methods currently being used are the most effective at controlling the risk of price fluctuation. Round 2 was distributed to the 24 responding panel members of round 1 via email. Of the 24 possible respondents to round 2, 18 (75%) participated in the round 2 questionnaire. The 7 members of the panel who did not participate in round two were contacted via phone and email and did not respond to the questionnaire. Of the 18 responding participants, 6 were material suppliers, 5 were general contractors, 4 were owner's representatives and 3 were

subcontractors. Of the 7 members who chose not to participate in round 2, 4 were general contractors and 1 was a subcontractor and 1 was a material supplier.

The participants were asked to rank in order of effectiveness the five most frequent answers given in round 1 from the data obtained when asked what the most effective methods used to control the risk of price fluctuation were. (See Appendix C for Round 2 Questionnaire) The participants used a 1 thru 5 scale to rate the effectiveness of each method as to how important the method was to control the risk of price fluctuation. Answers given a 1 were considered to be the most effective of the methods to be used in controlling risk, while answers receiving a 5 were considered to be the least effective of the five most common responses as it related to controlling the risk of fluctuation. The results of the rankings were varied with no one method receiving the complete consensus of the entire group. The results of the participant rankings are as follows:

The method that received the highest mean ranking among the participants with a mean ranking of 1.8 was the practice of completing timely buyout which is described as the practice of locking in prices with contracts or purchase orders that keeps the price constant for the duration of the project. The method for controlling the risk of fluctuation that received the second highest ranking was that of using contract language that outlines price fluctuation clauses or language in the contract that relates who carries the risk of price fluctuation and how it is handled. Using contract language mean ranking was 2.4. The third highest ranked method for controlling fluctuation was using proposal time tables that stipulated the amount of time a bid price will be valid. An example of a proposal time table would be “This bid is good for 30 days.” The mean ranking for using proposal time tables as a method to control the risk of fluctuation was 3.2.

The two methods of the 5 most frequent responses from round 1 that received the lowest mean ranking as it pertained to the participants' perception of the effectiveness of each method in controlling the risk of price fluctuation were stockpiling materials and communication. Stockpiling materials is described as purchasing large quantities of materials and storing them until needed. Stockpiling can be difficult due to the space available to store materials and to lack of cash that companies have on hand to buy large quantities of materials to avoid price fluctuation. This method received a mean ranking from the panel of a 3.9. Communication between the various participants involved in commercial construction can be used to gain a better understanding of what the market prices are doing and what they might possibly do in the future is the final of the 5 most common methods listed as being used to control the risk of price fluctuation. This method received a mean ranking of 3.9.

The rankings of the effective methods have been further segmented by respondent category to allow for additional data comparison.

Owners- Of the 4 responding owners the highest ranking methods used to control the risk of price fluctuation were the practices of timely buyout and using contract language to control risk with both methods receiving a mean ranking of 2. Timely buyout had a median ranking of 1.5 while the contract language method had a median of 2. The third highest ranking method as viewed by owners was the method of using proposal time tables to control risk. Proposal time tables received a mean ranking of 3 with a median ranking of 3. Stockpiling materials was the fourth highest ranked method for controlling risk among owners with a mean rank of 3.5 with a median rank of 3.5. The lowest ranked method of the five most frequent methods obtained from the data in round 1 was using

communication to control risk. This method received a mean ranking of 4.5 with a median rank of 5.

General Contractors- Of the 5 responding general contractors the highest ranking methods used to control the risk of price fluctuation were using timely buyout and using contract language to control risk with timely buyout having a mean ranking of 1.6 an contract language methods receiving a mean ranking of 2. Timely buyout had a median ranking of 2 while the contract language method had a median of 1. The third highest ranking method as viewed by general contractors was using proposal time tables to control risk. Proposal time tables received a mean ranking of 3.6 with a median ranking of 3. Communication was the fourth highest ranked method for controlling risk among general contractors with a mean rank of 3.6 with a median rank of 4. The lowest ranked method of the five most frequent methods obtained from the data in round 1 was stockpiling materials to control risk. This method received a mean ranking of 4.2 with a median rank of 5.

Subcontractors- Of the 3 responding subcontractors, the highest ranking methods used to control the risk of price fluctuation were using timely buyout and using contract language to control risk with timely buyout having a mean ranking of 1.5 and contract language methods also receiving a mean ranking of 1.5. Timely buyout and contract language methods both had a median of 1.5. The third highest ranking method as viewed by subcontractors was the method of using proposal time tables to control risk. Proposal time tables received a mean ranking of 3.6 with a median ranking of 3. Communication was the fourth highest ranked method for controlling risk among subcontractors with a mean rank of 3.6 with a median rank of 4. The lowest ranked method of the five most

frequent methods obtained from the data in round 1 was stockpiling materials to control risk. This method received a mean ranking of 4.2 with a median rank of 5.

Material Suppliers- Of the 6 responding material suppliers the highest ranking methods used to control the risk of price fluctuation were using timely buyout and proposal time tables to control risk with timely buyout having a mean ranking of 1.7 and proposal time table methods receiving a mean ranking of 2.5. Timely buyout had a median ranking of 1.5 while the proposal time table method had a median of 2. The third highest ranking method as viewed by material suppliers was the method of using contract language to control risk. Contract language received a mean ranking of 3.2 with a median ranking of 3. Communication was the fourth highest ranked method for controlling risk among material suppliers with a mean rank of 3.5 with a median rank of 4. The lowest ranked method of the five most frequent methods obtained from the data in round 1 was the practice of stockpiling materials to control risk. This method received a mean ranking of 4.2 with a median rank of 4.

The overall mean rankings of the panel and the breakdown per respondent classifications shows that timely buyout is the general consensus method that parties feel is the most effective way to control the risk of price fluctuation. The practices of contract language and setting limits on the duration bids are good for through the use of proposal time tables are appear to be the other most effective methods being used among all classifications. Stockpiling materials and communication may be effective methods used in controlling risk however these methods ranked lower by all parties in their effectiveness in relation to using the other most common methods of controlling risk.

4.3.2 Contract Language

Contract language was one of the most common responses listed in round one as an effective method of controlling the risk of price fluctuation. In order to gain a better understanding of how contract language is being used in commercial construction, panel members were asked in round 2 if there was any typical contract language that they used to control the risk of price fluctuation. The responses were varied and there was no typical language that was widely used by the participants. Not all of the panel members provided a response to this question due to either not having typical contract language or desiring to not divulge specific business practices, or failing to answer the question. One of the general contractor respondents specifically declined to provide an answer to the question. As contract language can vary by contract type, company and project, the answers that were provided as data for this study have been compiled and generalized to reflect examples of contract language used to control the risk of price fluctuation.

In response to contract language that is written in contracts to owners from general contractors, subcontractors and suppliers, the following responses were obtained:

- Product escalation clauses, for products such as steel, oil, fuel, cement and other commodities which are tied to market indices. Escalation clause compares indices on the day of the bid to the index at the time of cost occurrence. If there is a change of X %, then the owner agrees to adjust the amount of the contract.
- If contracted materials are not delivered by (X-Date) we reserve the right to re-price remaining materials.
- Excluded: Material costs beyond the control of the contractor

- Using proposal time tables at the time of bid stating how long the bid is good for and that if not met, the price can be altered.

In response to contract language that is written in contracts to general contractors from owners, subcontractors and suppliers, the following responses were obtained:

- Contractor agrees to perform all contracted work for the sum stated herein
- Cost escalation allowance:
    A. The present construction budget has been established at present estimated construction cost.
    B. Owner will hold a contingency, which is not part of the project budget, which may be available to the project by modification to the budget, to account for legitimate material and labor cost escalation costs as may be determined by the project team, consisting of Owner, Architect, Engineer and Contractor, until the results of a bid package is obtained for a particular scope of work.
    C. Following the results of the bid package, the contractor is solely responsible for material and labor escalation costs
    D. The owner reserves the right to reject any bid package where escalation is excessive in the opinion of the owner, at which time scope reduction or value engineering will be considered by the project team and submitted to owner for acceptance.
    E. The contractor's fee will not be adjusted due to material or labor cost escalations experienced at any phase of this Project. Escalation adjustments will be made only to cover the increased cost of materials and labor

- An adjustment in price may be made to the contract at the request of either party if the original quantities change by more than 25%. The contractor may invoke a fuel cost adjustment at anytime during the contract by written notification to the Engineer. The Contractor may invoke an asphalt cost adjustment at any time during the contract by written notification to the Engineer
- If contracted materials are not delivered by (date), we reserve the right to re-price remaining materials.
- As typically the schedule is known, the contractor can be required to hold his bid price for the duration of the project. It is feasible that price fluctuations which are beyond anyone's control, creates a situation where the owner may have to adjust accordingly and this situation should be handled in the contract.
- Commodity X pricing is based on current market levels. Pricing subject to change due to escalation or de-escalation in market levels. Pricing subject to change without notice.

In response to contract language that is written in contracts to subcontractors from owners, general contractors and suppliers, the following responses were obtained:

- Subcontractor is responsible for the risk of price fluctuation once contract is signed. Subcontractor will perform the contracted work for the fixed price sum of X
- Commodity X pricing is based on current market levels. Pricing subject to change due to escalation or de-escalation in market levels. Pricing subject to change without notice.
- Issuing a price quote with a time qualifier- example- 3000 psi/5.5 bag Eng/Air $XX.00/cyd – Price Escalation: 01/01/20XX $X.00/cyd

In response to contract language that is written in contracts to suppliers from owners, general contractors and subcontractors, the following responses were obtained:

- Supplier is responsible for the risk of price fluctuation once contract is signed. Supplier will perform the contracted work for the fixed price sum of $X

The nature of most contract language used among all parties is that once the contract is signed then the contracting parties are accepting the risk of price fluctuation for their work. All parties view getting contracts written and materials and labor costs locked in as a highly effective way to control the risk of price fluctuation. The contract language that is being used is typically for long duration projects and highly volatile materials such as hot-mix asphalt.

4.3.3 Stockpiling

Stockpiling materials was one of the most common responses listed in round 1 as an effective method of controlling the risk of price fluctuation. In order to gain a better understanding of how the practice of stockpiling materials is being used in commercial construction, panel members were asked in round 2 if they stockpile materials, what materials they stockpile and how they determine the amount of materials they stockpile. Of the 17 respondents, 13 (76%) responded that they did stockpile materials. Of the remaining 4 who do not stockpile materials, there were 2 general contractors, 1 owner's representative and 1 supplier. One general contractor whose company does not stockpile, responded that he would never see a scenario where a general contractor would ever stockpile although he thought that it was a common practice among some subcontractors.

Stockpiling was ranked by the panel as a whole as being the fourth most effective of the methods most commonly reported as effective ways to control price fluctuation risk. While not being ranked as the most effective method of controlling risk, It can be seen by the responses of various classifications that stockpiling is an important practice that does help to control the risk of fluctuation.

The materials stockpiled by the panel members varied by classification and the types of projects and materials that each participant dealt with. The following is a list of materials that participants listed as materials that they have or are likely to stockpile:

- Rebar
- Paint
- Aggregate
- Lumber
- Steel
- Cement
- Wide flange steel shapes
- Rock products
- Chip seal material
- Pavement marking tape
- Girders
- Traffic signs
- Pipe
- Geotech fabric
- Copper

- OSB
- Drywall
- Conduit
- Duct

The panel members were also asked how they determined the amount of materials they stockpile. The open ended question did not yield a consensus answer due to the different size and classification of the respondent companies. There were some common determining factors such as room to store stockpiled materials and available cash that could be used to purchase stockpiled materials. Within the limits of this research, it is not possible to determine the best way to calculate the amount of materials a certain company within a classification should stockpile to control their risk of price fluctuation. Based on panel member responses, stockpiling can be effective in helping to control risk. The responses of the panel members as to how they determine the amount of material to stockpile are listed as follows:

- We stockpile when there is a high probability of price increase. This is mostly applicable to rebar because it is a universally used product whereas structural steel is more dependent on job requirements so it is more difficult to stockpile without getting stuck with inventory that sits for quite a while
- Stockpiling is usually done by field measurements or surveys of what might be needed for the project
- We stockpile as little as we possibly can. Our goal is to make as many turns as we possibly can on our materials
- We purchase the steel subcontract and get it onsite

- We stockpile what it would take to complete the project and whatever the minimum mill order is. If we need to fill a rail car to get the best pricing then we will buy the extra materials and store them until needed.
- We estimate the quantity that will be needed for the job
- Stockpiling is determined by the length of the project and how much the owner is willing to pay up front to store materials on site.
- It generally depends on upcoming projects and available space. We do not rent space for stockpiling. If we don't have the space we don't stockpile materials
- The economy determines the amount stockpiled. If the economy is slow then they will stockpile less materials
- Stockpiling amounts depend on the current price and the current rate of escalation.
- Only on jobs we can get paid for and have room to hold materials at.

4.3.4 Proposal Time Tables

Proposal time tables are a common method used to control the risk of price fluctuation in commercial construction. Time tables also known as time stipulations limit the amount of time a proposal is good for which allows for prices to be held for a certain period of time. The common use of these time stipulations serves as notice to all parties that prices are subject to change and that time is of the essence for the proposal to be accepted at the proposed price. The panel members were asked if they used time stipulations in their proposals as well as if they accepted time stipulations from those with whom they contract with. All 17 (100%) of the respondents responded that they do have some form of time limit placed on their proposals. Owners typically require that

proposals submitted be honored for a certain amount of time while contractors, suppliers and subcontractors submit their proposals with a stipulation that it is good for a certain amount of time and after that time has elapsed, they reserve the right to adjust their pricing. Time stipulations can still create some risk for those who submit them due to the increased competition in the market. If a contractor or supplier adjusts their price after the stipulated time period, they may be in danger of losing the bid to another contractor or supplier who is willing to hold to their original bid price thus placing and uncertain risk on those who are unable or unwilling to hold their prices in a volatile market.

Panel members were asked if they accepted proposal time tables from those with whom they contracted with. In certain proposals, the owner might not allow time stipulations on bids or might require contracting parties to hold their proposal longer than might currently be able for contractors and suppliers to hold their price. This might prevent contractors from submitting time stipulations from those they contract with into a proposal. For example, a typical time stipulation listed by panelists on a proposal is 30 days. On some highly volatile commodities, some suppliers have given time stipulations of 5 or 10 days and in extreme cases of volatility, time stipulations might say “this price is good for today only.” Participants were also asked how they handled receiving time stipulations from those they contract with if they are not allowed in the requirements of the proposal to submit a time stipulation themselves. An owner might have a requirement of 30 days and a contractor who receives a stipulation from a supplier of 5 days may not be able to pass that stipulation on. (See Round 2 Questionnaire Appendix ___) The respondents were broken down into classification to better understand how the use of

proposal time stipulations is being used among the various participants in commercial construction.

***Owners*-** Of the four responding owners, three of them (75%) responded that they do not accept time stipulations from those they contract with. As owners, they set the bid date and they also can set the time stipulations. If contractors and suppliers want the work, they must comply with the owner's time requirements and build into their price any adjustment needed to cover additional risk they feel they are incurring to meet the owner's requirements. One owner (25%) said they work with contractors and ask for any stipulations prior to bid and try and incorporate the time stipulations into the schedule of awarding the project.

***Contractors*-** All five (100%) of responding general contractors responded that they generally accept time stipulations from those with whom they contract with. Subcontractors and suppliers submit time stipulations on their proposals and contractors work hard to contract with these parties quickly when awarded the project to ensure that the contract is completed prior to the stipulated time. In certain cases, proposals contractors will be submitting may required the absence of time stipulations or might require them to hold their price longer than the supplier or subcontractor has stipulated they will hold theirs. When asked how contractors are handling price stipulations from others if they are not allowed to submit them, two (40%) of the contractors responded that they do not allow the time stipulation if they can't pass it on equally to the owner. The remaining three contractors dealt with the risk as follows.

- The contractor takes on the risk- example asphalt. If the Owner won't let them put an escalation clause in their bid for asphalt and the asphalt subs won't sign a contract for a fixed price without an escalation clause then he as the GC has to take on the risk of escalation
- Using communication and timely buyout
- By having the subcontractors include cost escalation based upon the timing of when the project would start. Once awarded he would lock in that price through the contract.

Subcontractors- One of the two subcontractor respondents in round 2 did not provide input on whether or not they accepted proposal time stipulations from those they contracted with. The other respondent noted that he didn't have to deal with time stipulations from his suppliers. Both respondents did respond that they added a percentage of cost to cover any fluctuation as a way to cover any costs that could occur if they were required to submit a proposal that excluded time stipulation.

Suppliers- All six of the responding suppliers responded that they did accept time stipulations from the parties they contract with. Three of the six (50%) responded not applicable to the question regarding how they deal with receiving proposals with time stipulations where they are not allowed to submit them. This can be expected since they are the supplier of the materials and typically don't have many classifications below them. The remaining suppliers responses for how they deal with time stipulations they receive that they are unable to pass on are as follows:

- We determine as closely as we can what the market is going to do with pricing of our raw materials. If it appears certain that prices will increase and we cannot bid in an escalator then we will pro rate the pricing so that it covers early some of the anticipated price increase. Example: If we think cement will go up $4.00/ton and we cannot get an price escalator on our concrete then we will bid the price $1.00 higher now and carry it through the job rather than bidding a price now and having a $2.00 price increase in the future.
- Good communications are necessary in every contract/bidding situation. We would talk to our suppliers, informing them of the stipulations, and ask for their compliance.
- Require a purchase order from contractors that will allow them to lock in a price with suppliers

4.4 The Risk of Price Fluctuation as Viewed by Each Party

According to the data gathered, the risk of price fluctuation as viewed by the participants in commercial construction is hard to define. The panel was asked to assign the level of risk each party currently carries as it pertained to price fluctuation in relation to each contracting method. The reader may work from the understanding that the individual responses generally fell along the lines of the classifications. It has been observed however that the average responses were varied. The overall average view of how the panel viewed the current risk that is placed on each party is outlined in Table 4.7.

Table 4-7: Viewed Current Risk Placed on Each Classification

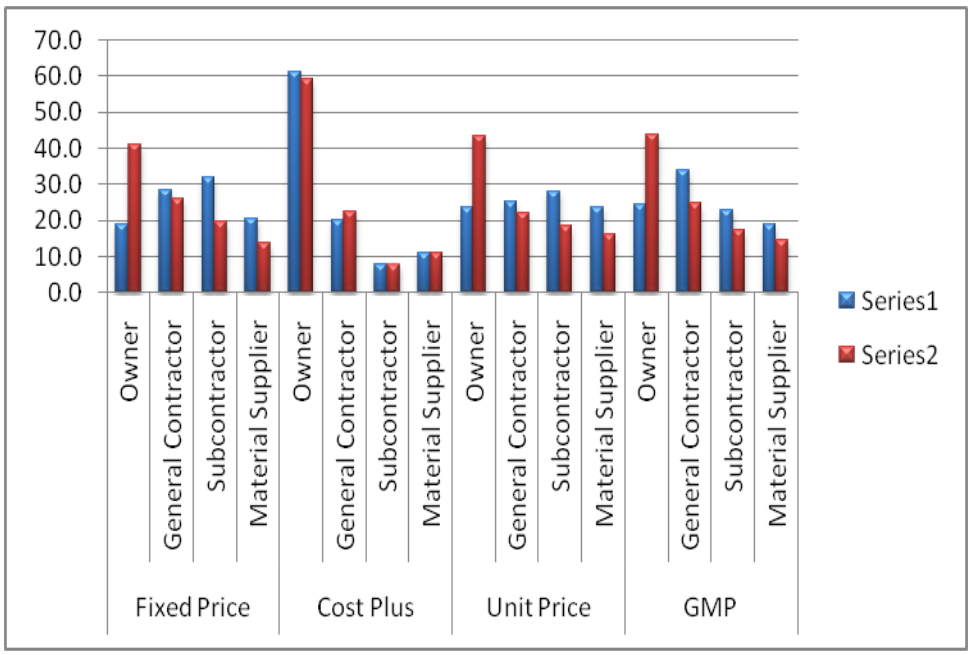
	Fixed Price	Cost Plus	Unit Price	GMP
Owner/Developer	18.9%	61.3%	23.6%	24.4%
General Contractor	28.4%	19.9%	25%	33.8%
Subcontractor	32.1%	7.8%	27.9%	22.8%
Material Suppliers	20.6%	11%	23.6%	19.1%
Other (please specify)	%	%	%	%
Total	**100%**	**100%**	**100%**	**100%**

The panel was then asked to assign the level of risk each player should be responsible to carry as it pertains to price fluctuation in relation to each contracting method. The reader may again work from the understanding that the responses fell generally along the lines of the classification. It has been observed however that the responses were mixed and did not always correlate to the chosen profession of the respondent. The overall average view of how the panel felt should be the risk placed on each party is outlined in Table 4.8. The relationship between who the industry players currently bears the risk of price fluctuation and who they feel should bear the risk is shown in Table 4.9

Table 4-8: Level of Risk that Should be Placed on Construction Parties

	Fixed Price	Cost Plus	Unit Price	GMP
Owner/Developer	40.9%	59.2%	43.2%	43.8%
General Contractor	25.8%	22.4%	22.1%	24.7%
Subcontractor	19.5%	7.6%	18.5%	17.2%
Material Suppliers	13.8%	10.8%	16.2%	14.4%
Other (please specify)	%	%	%	%
Total	**100%**	**100%**	**100%**	**100%**

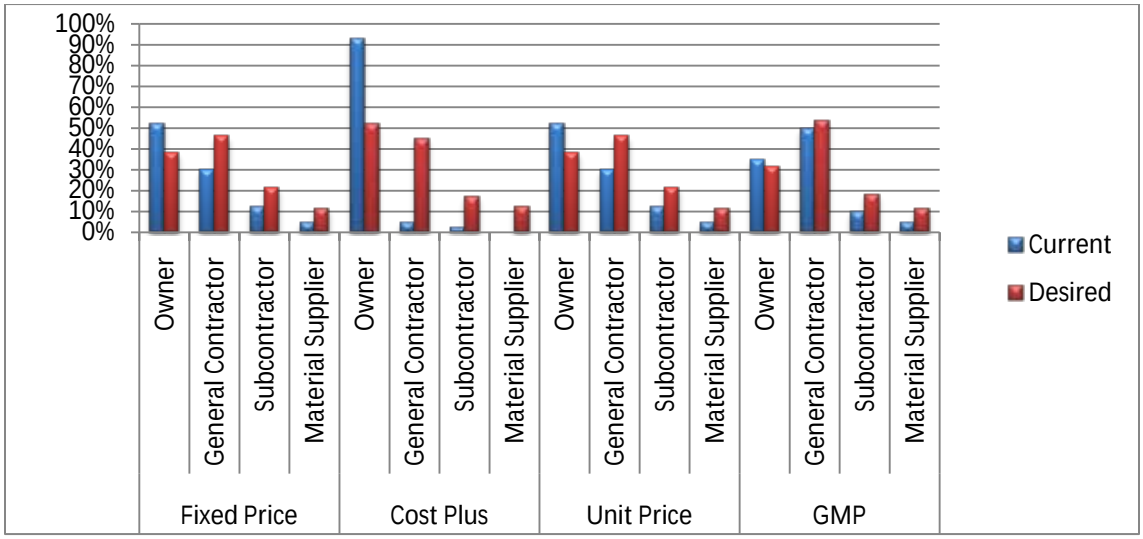
Table 4-9: Total Comparison of Average View of Risk Currently and Opinion of Who Should Carry Risk



The average responses indicate that the owners currently are carrying less risk for price fluctuation than the respondents feel that owners should be responsible for. When broken down further, respondents that classified themselves as owners viewed the current breakdown of risk and how it should be as follows:

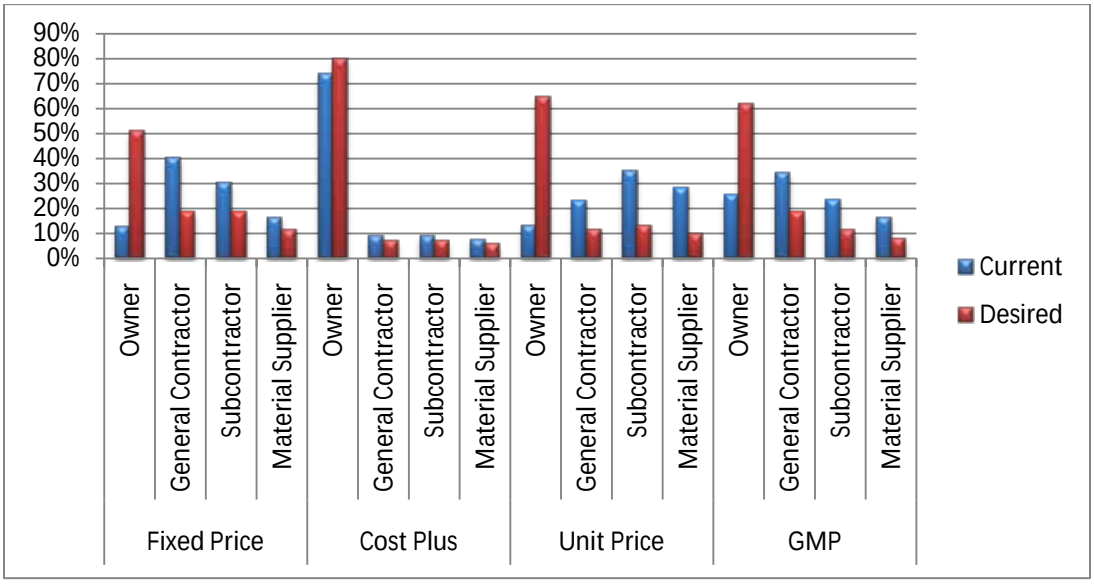
As expected, the owners responded that they carry the majority of the risk in all contracting methods. The view of the owners is that GMP contracts distribute more of the risk of price fluctuation among the parties than the other contract methods.

Table 4-10: Owner Opinion of the Risk They Carry and What Risk They Feel They Should Carry



Respondents, who classified themselves as general contractors, average answers on how they viewed the current breakdown of risk and how they desire it to be distributed are shown in Table 4.11.

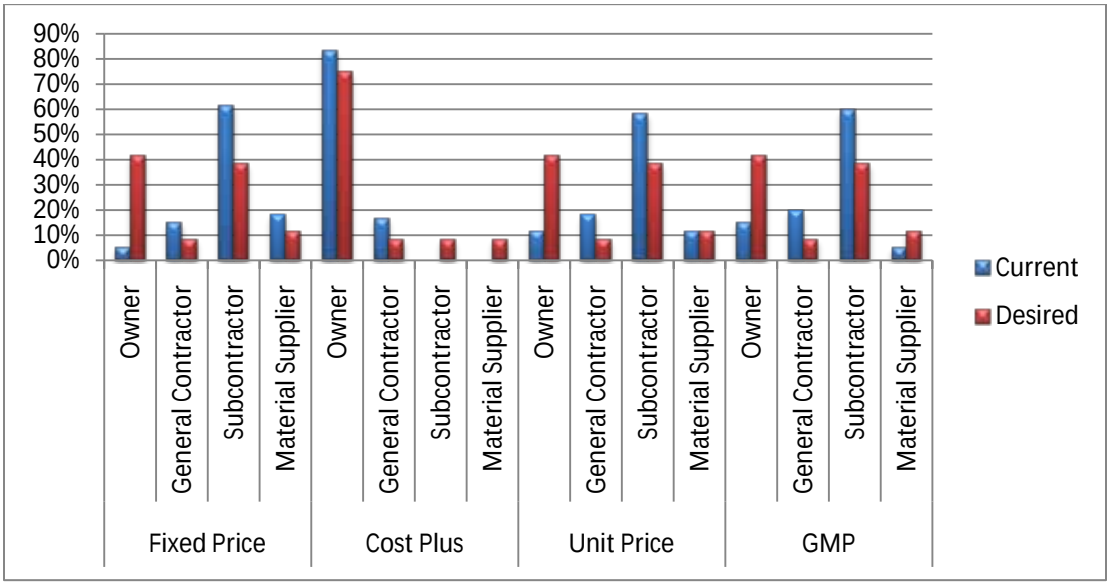
Table 4-11: General Contractor Opinion of the Risk They Carry and What Risk They Feel They Should Carry



Contractors feel that they take on a portion of risk on all contract methods but are able to distribute that risk down to subcontractors and suppliers and did not generally feel they bore an unfair share of the risk on projects. When asked who should carry the risk in the different contracting methods the data shows that the general contractors feel strongly that the owners should bear all of the risk of price fluctuation. When asked why they felt this way they felt that the owner was the party that is benefitting the most from the project so they should have to bear the risk of any fluctuation.

Respondents, who classified themselves as subcontractors, average answers on how they viewed the current breakdown of risk and how they desire it to be distributed are shown in the Table 4.12.

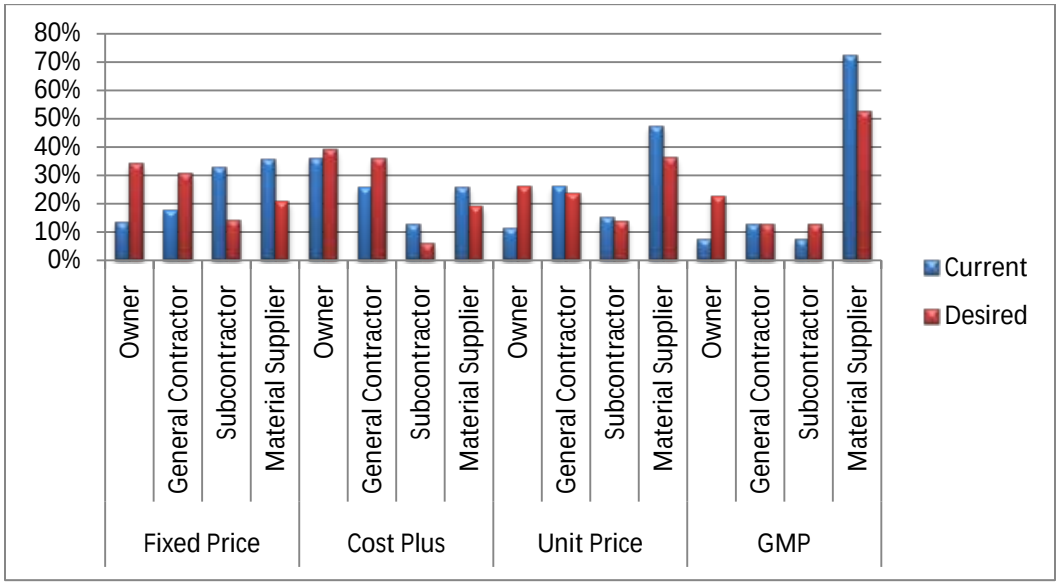
Table 4-12: Subcontractor Opinion of the Risk They Carry and What Risk They Feel They Should Carry



As expected, the subcontractors responded that in the majority of contract methods in construction they feel they currently carry the majority of the risk for price fluctuation. The only exception to this view is the cost-plus contracting method where subcontracts view the owner as bearing the majority of the risk. The data shows that the subcontractors also believe that the owners should carry more of the risk of price fluctuation in fixed price, unit price and GMP contracts. In regards to the cost plus method of contracting, the subcontractors felt that some of the risk should be carried by subcontractors and suppliers and not just the owner and contractor as they feel it currently is being placed.

Respondents, who classified themselves as material suppliers, average answers on how they viewed the current breakdown of risk and how they desire it to be distributed are shown in the following Table:

Table 4-13: Material Supplier Opinion of the Risk They Carry and What Risk They Feel They Should Carry



According to the data, the material suppliers feel that they currently carry a large amount of risk as it pertains to price fluctuation on all contract methods. Their results show that when asked who should carry the risk they did not shift all of the risk away from themselves, rather they wanted to distribute the risk more among the various parties so that no one person carried the sole risk on the project. In regards to the GMP contract method, only 3 of the 7 panel members answered the question since most suppliers don't work with GMP contracts. The high percentage the suppliers feel they carry could be reflective of a high percentage given by one of the 3 respondents.

Overall the data shows that the different players feel that they currently are asked to bear the majority of the risk in most contracting methods. Cost-Plus contracting is the exception to this where all participants agree that the owner is responsible for the majority of the risk as it pertains to fluctuation. The participants, when given the chance to give their opinion on who they think should be the risk all shifted the risk away from themselves to some degree. Some shifted the risk completely away from themselves while others shifted some of the risk to the other parties.

To determine the view of panel members as to the effectiveness of each contracting method's ability to equitably spread risk among the parties of a commercial construction contract, the panel members were asked to rate each method on a scale of 1 to 5. The scale of the rating was determine as follows: (1) very inequitable in its ability to spread risk, (2) inequitably spreads risk, (3) somewhat equitable in spreading risk, (4) equitable spreads risk, and (5) very equitable in its ability to spread risk.

In rating the fixed price contract method, Fourteen (58%) of the respondents rated this method as a 1, two (8%) rated it a 2, six (25%) rated it as a 3, one (4%) rated it as a 4, one respondent chose not to answer the question. With an average rating of 1.7, the data reflects that the panel feels that the fixed-price contracting method is very inequitable in its ability to spread risk to different players. Of the 24 responding members of the panel, 23 of them chose to answer this question with one respondent choosing not to provide an answer to the question which accounts for approximately 4% of the response.

In rating the cost-plus contracting method, 8 (33%) gave a rating of 1, one (4%) gave a rating of 2, three (12.5%) gave a rating of 3, six (25%) gave a rating of 4, and two (8%) gave a rating of 5. The average of the responses equated to a 2.8. The varied response resulted in a lack of

consensus among the respondents and shows the overall opinion of the group to show that cost-plus contracting may be considered somewhat equitable in spreading risk. Of the 24 responding members of the panel, 22 of them chose to answer this question with two respondents choosing not to provide an answer to the question which accounts for approximately 8% of the response.

In rating the unit price contracting method, 7 of the 24 respondents chose not to answer this question. The reason many of the participants declined to answer this question is due to their lack of experience and use of this contracting method in their company. Of the seven who declined to respond, five were general contractors, one was a subcontractor and one was a material supplier. Of the remaining 17 respondents, two (12%) gave a rating of 1, five (29%) gave a rating of 2, eight (47%) gave a rating of 3, and two (12%) gave a rating of 4. The average responses equated to a 2.8. The varied response resulted in a lack of consensus among the respondents and shows the overall opinion of the group to show that cost-plus contracting may be considered somewhat equitable in spreading risk.

In rating the GMP contracting method, 6 of the 23 respondents chose not to answer this question. The reason many of the participants declined to answer this question is due to their lack of experience and use of this contracting method in their company. Of the six who declined to respond, 4 were material suppliers, and two were subcontractors. This result correlates to the contracting methods previously listed by subcontractors and suppliers in this chapter. Materials suppliers and subcontractors typically do not use the GMP contracting method. Of the remaining 18 respondents, one (6%) gave a rating of 1, two (11%) gave a rating of 2, four (22%) gave a rating of 3, seven (39%) gave a rating of 4, and four (22%) gave a rating of 5. The average responses equated to a 3.6. The varied responses resulted in a lack of consensus among the

respondents however shows that in the opinion of the group, the GMP contracting method can be considered as a method that equitably spreads risk among the parties in commercial construction.

4.5 Potential Problems with Decreasing Prices

Commercial construction is a broad and complex field. Within the limits of this research, it is not possible to determine all of the factors creating price fluctuation or the problems fluctuation creates in the industry. In the past the greatest concern in price fluctuation has been rapidly increasing prices on materials due to short supply or high demand for volatile products. In this research, panel members were asked to identify the problems that are or could potentially be created when materials prices decrease rapidly. The question was an open ended response to determine if decreasing prices creates risk for the parties involved in the industry. The opinions of the respondents were varied and no clear consensus was reached.

Seven (29%) of the respondents listed potential problems with owner relationships as a potential problem that occurs with price decreases. Of the seven, four were general contractors, two were suppliers and one was a subcontractor. The responses of these classifications indicated that when prices decrease significantly owners want the savings and are not always getting them depending on the contracting method. Owners are asking contractors for money back or wanting to renegotiate contracts that have already been signed. One supplier noted that owners have cancelled orders if they were not able to renegotiate and then went to another supplier to take advantage of better pricing. Contractually much of the risk the players in the construction industry face when faced with rapid decreases in prices are protected if there is a signed contract. Contractors, subcontractors and suppliers that have signed contracts should be entitled to be rewarded for the risk they have taken if the prices decrease just as they would be held liable if

the prices increase significantly. The problem several respondents mentioned was that they feel they have to give up the reward and share the savings with the owners in order to maintain relationships while hoping to secure future work. When prices decrease owners get used to the lower prices they are able to get their projects for and then become frustrated when the prices begin to rise again.

Six (25%) of the respondents felt a potential problem with decreasing prices could be increased competition creating lower profit margins. This response was given by all classifications of participants, of the six, two were subcontractors, two were suppliers, one was an owner and one was a general contractor. When prices decrease, the demand for materials and labor is low and when demand is low, competition for work increases. For union shop contractors labor decreases are a particular concern. When labor prices for non-union companies decrease then the union contractors are at a disadvantage due to their labor prices being set. This causes union contractors to have to cut margins in order to compete and in some cases could prevent them from winning projects.

Contractors have to become more aggressive in their pricing strategies and cut their fees and labor rates to remain competitive. This creates financial strain on companies trying to operate on lower margins while performing the same work. One owner's response was that owners now have to worry about the viability of the contractors to stay in business. The competition has become so great that contractors are taking projects at or below costs just to have work. Contractors are willing to take on more risk than they should. For example, contractors taking on under qualified subcontractors in order to become the low bidder. This causes a potential for lower quality work being done on projects. Companies are also getting creative in cutting costs. Some companies have created an LLC where all employees are an

owner which allows them to get away with not paying worker's compensation insurance. This practice may be legal but could be considered a questionable practice of ethics.

Three (12.5%) of the panel members responded that there could be significant financial loses if prices decrease rapidly. Two of the three were materials suppliers and one was and owners representative. Decreasing prices result in devaluation of current inventory. Current materials that are already being stored might have to be sold at prices that are less than what they were purchased for. Another problem that could occur when prices decrease significantly is that suppliers are not able to drop the prices of their products as quickly as market prices are dropping. Concrete for example is a volatile material that is made up of various other materials. There are many concrete suppliers but relatively few cement suppliers. Concrete suppliers may not always be able to lower their prices as fast as the cement suppliers are lowering their prices. This causes a decrease in profitability due to the concrete supplier having to try and stay competitive in the market.

Another financial implication of dropping prices is a reduction in efficiency. With the current market, prices have fallen and work is scarce. People want any job they can find and so companies may be hiring overqualified people for construction jobs. This could present a problem in labor efficiency. If people feel that they are overqualified for a position they will not always give their best effort and may not be passionate about their job and so efficiency decreases as well as margins.

Three (12.5%) of the panel members responded that there were no problems that could arise from materials and labor prices decreasing. Of these three respondents, two were general contractors who had the two lowest dollar volume of all general contractor participants and one

was a supplier who also had one of the lowest volume companies of all suppliers. The remaining responses from the panel when asked what problems are or could be created when prices decrease rapidly are listed below:

- You never see suppliers credit back when materials go down. It becomes a win for the supplier
- If materials prices drop then the labor costs could increase to cover the cost of the gap on lost materials
- Unless the owner has agreed to pay escalations they should not be entitled to ask for any credits if materials prices drop after the bid.
- Many subcontractors are unwilling to hold their bid after the project is awarded, while some are willing to work for less money than what you think is safe.
- It becomes difficult to predict the costs of the project and establish the project budget and set aside contingency funding.
- Owner loses the benefit of reduced costs in a fixed, unit price or GMP set contract

CHAPTER 5

5 CONCLUSIONS AND RECCOMENDATIONS

5.1 Best Practices for Controlling the Risk of Price Volatility

In the field of commercial construction, there are a variety of ways for dealing with the volatility of labor and materials prices that occur. Volatility will continue to be a problem in the construction industry due to many factors that can influence the price of commodities. Materials costs can be affected by fuel prices, other markets such as residential construction and the strength of currency at the time of the bid. (Michael Moore, 2008) Economic changes, the growth of other countries and natural disasters are other items that can significantly affect price volatility in construction projects. The supply and demand of materials and resources that varies can change the way construction companies do business and increase the risk they incur on projects. Understanding the risk and implementing effective controls should be something that all participants in construction contracts practice due to the effect that it has on all classifications of companies. While there is no clear method that equitably spreads the risk of volatile prices among the participants in construction contracts, the results from this research show there are some effective methods that could be considered “Best Practices” that when used together can help to control the risk of volatility.

5.1.1 Timely Buyout

According to the responses of the panel, and average of 62% of the commercial construction contracts are based on a fixed-price or lump-sum contract. With such a high percentage of work being done with this method, it becomes critical for all parties to lock in their prices to meet the project budget. If a participant fails to lock in a quoted price then the risk that the price will change is increased. Timely buyout was listed by 50% of the panel as a best practice used to control the risk. If prices are locked in at the beginning of the project then the risk of financial losses from price increases is virtually eliminated. This method works effectively for all participants in a construction project and should be implemented as a best practice to control any risk of price volatility. This method makes reaping the rewards of any savings that might occur difficult but strongly protects against the risk of price increases.

5.1.2 Contract Language

Another best practice that is commonly being used in the commercial construction industry to control the risk of price volatility is the use of contract language. Contract language can be used in various ways to control risk. Price adjustment clauses can be written into contracts that stipulate actions to be taken in the event of price fluctuation. Typically if a price adjustment clause is incorporated into a contract, the price will be set at a certain level and then during the project if the price changes by a stipulated percent then the contract will be adjusted accordingly. Price adjustment clauses typically are written in the contract for both price inflation and deflation so that the contractor is not at risk if the price goes up and the owner gets the cost benefits if the prices decrease. This

method works well for extremely volatile items that contractors may not be able to lock prices in for the duration of projects such as hot-mix asphalt or cement.

Contract language can protect certain parties from any or all risk while shifting or sharing the risk to other participants. This method is effective and can be an excellent way to control risk. Contract language can also be used to exclude items from contracts that may be beyond the control of a participant or give indication as to what is included in particular scopes of work. While the panel did not present a consensus on exact language that should be included in contracts to control the risk of volatility, they agreed that using contract language to delineate who carries the risk and what actions will be taken in the event of fluctuation is an effective method that should be used to control risk.

5.1.3 Proposal Time Tables

Participants in commercial construction contracts are commonly using proposal time tables as a best practice when bidding that helps to control risk against fluctuation. All of the panel members use proposal time tables as a common practice. This gives a certain time frame that a proposal price will be honored which gives the various parties time to consider the proposals and get contracts written to the low bidders. Using proposal time tables limits risk as long as the proposal is accepted and locked in within the proposed time. If the proposal is accepted then it become the responsibility of the participants to lock in the prices with their subcontractors and suppliers using timely buyout that meets within the time tables that they may have been given on certain materials and labor.

Problems that exist with proposal time tables are that they are not always accepted and often have to be extended beyond the date stipulated. Participants in construction may try and hold another participant to a price after the time table. If there is a lot of competition then contracting parties might feel pressured to hold their price even though they may be at risk of their supplier not holding their price in order to maintain their status as low bidder. This could increase the risk to contractors of highly volatile materials if they are not able to pass on price increases in order to keep the work.

5.1.4 Stockpiling Materials

Stockpiling materials is another best practice being used by participants in the commercial construction industry as a way to control the risk of price fluctuation. Stockpiling can be a very effective way to control risk and also a way to possibly increase the profitability of a project. If a company is able to purchase large quantities of common materials at a low price and store the materials until needed, they can absorb the risk of fluctuation in that material for the project. If the price of a stockpiled material goes up then a company might be able to be more competitive in bidding or if awarded the project may have a chance for greater profitability on the project.

The difficulty of stockpiling materials is that participants need to have the money to purchase and hold the materials as well as the space to store materials. The materials that can be stockpiled are limited to common items that can be used on a variety of projects. While stockpiling can be an effective method for controlling risk of price volatility, it only controls the risk against price increases. Stockpiling could create a new risk to participants if they buy a large quantity of materials and the price of that material

decreases. This puts the person stockpiling at a disadvantage and could make their bid less competitive due to the fact that they have an inventory of material that they need to get rid of that was purchased at a higher price.

5.1.5 Communication

Communication is an essential best practice for all aspects of the commercial construction industry. The relationships that are built and the ability to understand what you are working on and who you are working with is a critical component to having successful projects. Communication can also be a best practice used to control the risk of price fluctuation. One material supplier on the panel noted as it pertained to communication that building personal relationships with those you work with can help you to control what the fluctuation risk you have is going to be. While not being able to completely eliminate the risk of fluctuation, you can work with people to limit the affect it is going to have on your project.

Making sure that all parties know what is expected of them on a project and that each party fully understands the risks involved can help all participants to better manage the risk. Without communicating with the other participants, the risk of fluctuation might not be assigned to the proper person who is able to handle the risk. Lack of communication might also lead to multiple participants accounting for the risk and driving the price of construction projects up. Communication is important in controlling risk because participants need to be using communication constantly so that they know what is going on in the market at all times and what they can expect the market to do. Communicating with the other participants in construction is beneficial so that you can

gather information from those who may be closer to a specific market and can make informed decisions on how much risk the participants are taking on and how to handle the risk.

Negotiating is an important part of communication. Participants in commercial construction can negotiate with other participants in order to share or shift the risk of price volatility. Negotiation can also be used to get the most competitive pricing and allow for participants to set limits on the risk they must take in certain areas and can help to mitigate risks that may be too great if the participants had to be responsible for all of the risk. This type of communication is an example of setting expectations that is an important part of the construction process. Using communication to set the participant's expectations as to prices that have been quoted and also what options are available if the prices change can help participants to better control the risk of price volatility.

One possible option of negotiation that could become a practice in construction is that of using a price cap contract. In the commercial construction industry, materials are usually bought using a project based and short term procurement. This leaves contractors subject to high price volatility. It has been observed that contractors purchase a relatively stable amount of commodity materials such as concrete, steel, and lumber year after year.(Ng, 2004) A price cap option is similar to a financial call option because the buyer will pay the going market price as long as it is under the agreed upon cap price but will only pay the cap price if the market price exceeds the cap. The panel members did not mention using price caps as a way to control the risk of fluctuation but some members were interested in finding out more about this method. This new way of negotiating

might be an effective method that contractors in Utah may begin to utilize to gain a competitive advantage and better control the risk of price volatility.

5.2 Recommendations for the Industry

Recommendations for the professionals who work in the commercial construction industry have been formulated based on the results of the research process. The problem of price volatility in commercial construction is very broad and complex. As such, it is recommended that the participants in the construction industry communicate on a project-by-project basis to control any risk of price fluctuation that may be of concern so that no conflicts occur. The risk of volatility should be placed on the party with the best ability to handle the risk.

It is recommended that the commercial construction industry needs to continuously work toward a higher level of communication and collaboration. The success of construction projects relies heavily upon the communication that the participants engage in. Understanding what the different participants are expecting of one another and the expertise of the participants can be better utilized to control risks and keep construction prices as low as possible. A team approach to handling risk could be the most beneficial practice for all parties due to the repeated nature of commercial construction. Many owners in commercial construction do more than one project so maintaining good communications and relationships can be beneficial for all parties. Collaborating on who the risk will be handled by and using a team approach to share and mitigate risk will help participants obtain better pricing if others will be willing to work with them again.

It is recommended that there be specific contract language used in the industry to assign the risk of price volatility to the various participants. The failure to effectively assign and

communicate the participant who bears the risk of price volatility has the potential to increase the cost of commercial construction. The results of this study showed that of the participating classifications, owners, general contractors, subcontractors and materials suppliers, each classification felt that they carried the majority of the risk as it pertained to price volatility. This perception has led multiple participants to add costs to their prices which could result in multiple participants adding costs to cover the same risk and thus increasing the overall price of construction contracts. The implementation of effective contract language that assigns the risk to one classification could eliminate any possibly double-ups on prices as it pertains to covering the risk associated with price volatility.

It is recommended that the participants in the construction industry use multiple methods to deal with the risk of price volatility. Using a combination of the best practices found in this study will help participants in the industry to better control their risk. Controlling risk allows for greater profitability potential and allows for strong competition. Using multiple methods protects participants from various situations that might occur and can allow for greater rewards to be achieved in exchange for risks taken.

5.3 Recommendations for Additional Study

The intent of this research was to determine the best practices being used in the commercial construction industry for dealing with the risk of price volatility. The research attempted to find the best method that should be used to control risk. Many of the factors creating the risk of price volatility and the methods that should be used to control them require a more intensive study to form additional conclusions. The following are suggestions for additional research topics.

Additional research is recommended to address the percentage of contract amounts that are being added to the contract to cover the risk of price volatility. Multiple classifications responded that they add a certain percentage to cover their perceived risk of volatility. For subcontractors who self perform the majority of their work this could be a substantial amount. For general contractors and owners who self-perform varying amounts of work, the percentage added to materials prices or labor costs to cover any volatility could be minimal or substantial. There is a potential that multiple classifications are adding a percentage of cost to the contract price that another classification has already covered which would increase the overall cost of the project. A study of the amount of cost being covered by multiple classifications and how it in turn affects the overall costs of construction could provide insight into how to lower construction costs.

Additional research of contract language and contracting methods is recommended to address the relationships of the contracting parties and how to assign the risk to the party who is best able to handle the risk. There are various contracting methods used in commercial construction and the evolution of contracting methods and could provide added protection to all participants in construction contracts as it pertains to price volatility. Modifying current contract language used in the widely used fixed price contract to allow for some relief of the affects of volatility to contractors may reduce any added costs that participants add to cover their risk. A productive study would be to examine the possible contracting methods and the level of teamwork and repeat contracts that are achieved by each contracting method.

Additional research of how union shop contractors compete with non-union shop contractors when labor prices decrease is recommended. This research study addressed the possible effects of labor price decreases. An interesting study would be to determine the effect

that labor price decreases have on union shop contractors due to union labor rates being fixed for certain periods of time.

5.4 Implications

The information obtained in this research has provided insight into the best practices being used in the commercial construction industry to control the risk of labor and material price volatility. After analyzing the data obtained from the opinions of experts and the results of the study, a number of implications have been made.

Price volatility continues to be a concern in the construction industry. Participants in the industry are concerned about the risk of volatility and are using methods to control their risk. However, there is no one method that all classifications can use to eliminate or control the risk of price volatility. The use of various methods must be used in different ways depending on contracting method, and the current state of the market. The best practices that are being used that have been found to be the most effective and are being used by all parties are: timely buyout, contract language, proposal timetables, stockpiling and communication.

The risk of volatility is a great concern as materials and labor prices are subject to change in short periods of time. If the construction industry is going to effectively control costs and manage the risk of price volatility, there must be improved communication and collaboration among the participants in the industry so that the risk is handled in a proper way by the party who is best able to handle the risk. If the risk is placed on a participant that is unable to handle the risk then there is a greater risk placed on the other parties if the risk bearer fails and is unable to complete the contract.

Construction projects require a team approach. There is both a desire and a need for better communication and coordination in the construction industry as it relates to dealing with price volatility. The final success of a project will depend on the level of communication that goes on during the project and how well all parties work together to handle all of the risk that is involved in the process. Making sure that each participant clearly understands what is expected of them and writing the contracts to reflect these expectations will help to lower the amount of risk placed on the various parties and in turn lower costs and conflicts that may arise over price volatility in commercial construction.

REFERENCES

Bisbee, L. “Rising Materials Prices Elevate Construction Costs”. *Wyoming Business Report (July 1, 2008)* http://www.wyomingbusinessreport.com/article.asp?id=94871

Chan, E. H. W. and Maria C. Y. A. “Factors influencing building contractors' pricing for time-related risks in tenders”. *Journal of Construction Engineering and Management* 135, no. 3 (03, 2009). : 135-145.

Choi. “A study on the price escalation system in a construction contract”. *KSCE Journal of Civil Engineering* 10, no. 4: 227.

Ernzen, J. J. and C. Schexnayder. “One company's experience with design/build: Labor cost risk and profit potential”. *Journal of Construction Engineering & Management* 126, no. 1 (Jan, 2000). : 10.

Farid, F. “Fair and reasonable markup(FaRM) pricing model: A present value approach to pricing of construction contracts”. *Dissertation Abstracts International* 42, no. 91982). : 1982.

Fung, A. “Construction Costs Tumble in NYC”. *Crain’s New York Business.com. Published September 16th,2009* http://www.crainsnewyork.com/article/20090916/FREE/909169985

GNB. “Cross Cutting Management Issues”. *GNB-Measures, Markers and Mileposts Washington State Department of Transportation*. Published September 30,2007 www.wsdot.wa.gov/biz/construction/GNB/3q2007graybook.pdf

Griffis, F. H. B and F. M. Butler. “Case for cost-plus contracting”. *Journal of Construction Engineering and Management* 114, (03, 1988). : 83-94.

Grogan, , T. “Materials: Supply side pricing”. *ENR* 240, no. 131998). : 36.

Grogan, , T. “Increased material price volatility”. *ENR* 231, 1993). : 25.

Hasson, F., S. Keeney, and H. McKenna. “Research guidelines for the delphi survey technique”. *Journal of Advanced Nursing* 32, no. 4 (10, 2000). : 1008-1015.

Haughey, J. “Construction deflation’s impact on project cost estimates”. *Reed Construction Data* Published September 18, 2009 http://www.reedconstructiondata.com/news/2009/09/construction-deflations-impact-on-project-cost-estimates/

Hsu, C. C. “The delphi technique: Making sense of consensus”. *Practical Assessment, Research Evaluation* 12, no. 102007). : 1.

Ichniowski, T. and T. Grogan. “Economics: Escalation eases but costs remain high”. *ENR* 258, no. 11 (03/19, 2007). : 35-36.

Illinois Institute of Technology. (2005) www.iit.edu/~it/delphi.html.

Keller, A. Z. “Optimal Polices for Claiming Payment Under Price Escalation Clause Types of Contracts”. *Engineering Costs and Production Economics* 7, no. 11982). : 69.

Knight, , K. “A preliminary study of the factors affecting the cost escalation of construction projects”. *Canadian Journal of Civil Engineering* 27, no. 12000). : 73.

Korman, R. “The art of negotiating price relief”. *ENR* 252, no. 26 (06/28, 2004). : 29-29.

Li, H., C. W. Kong, and Y. C. Pang. “Internet-based geographical information systems system for E-commerce application in construction material procurement”. *Journal of Construction Engineering and Management* 129, no. 6 (November, 2003). : 689-697.

Loulakis, ,M. C. “Using price adjustment clauses to reduce risk”. *Civil Engineering* 62, 1992). : 40.

Matsumoto, A. Let it be: “Chaotic price instability can be beneficial”. *Chaos, Solitons & Fractals* 18, no. 4 (11, 2003). : 745-758.

McGoldrick, T. “Material price increases: What can you do?” *The Chemical Engineer* no. 7862006). : 18.

McKew, H. “Integrated project delivery”. *Engineered Systems* 26, no. 1 (01, 2009). : 108-108.

Miletsky, R. J. “Can integrated project delivery work for you?” (cover story). *Contractor's Business Management Report* 2010, no. 2 (02, 2010). : 1-10.

Moore, B. “Construction Cost Estimating Presents New Challenges”. *Retrieved April 27,2010* http://www.generalcontractor.com/resources/articles/construction-costs.

Moore, M. A. “Build Local, Price Global”. *California Construction-McGraw Hill Construction* (July 2008) http://california.construction.com/features/archive/0807_feature1.asp

Navon, R. “An automated model for materials management and control”. *Construction Management and Economics* 24, no. 62006). : 635.

Ng, F. “Valuing a price cap contract for material procurement as a real option”. *Construction Management and Economics* 22, no. 2 2004). : 141.

Okoli, Chitu and S. D. Pawlowski. “The delphi method as a research tool: An example, design considerations and applications”. *Information & Management* 42, no. 1 (12, 2004). : 15-29.

Rowe, G. “The delphi technique as a forecasting tool: Issues and analysis”. *International Journal of Forecasting* 15, no. 41999). : 353.

Setzer, S.. “Renegotiations make bad times worse”. *ENR* 262, no. 9 (03/23, 2009). : 33-33.

Tulacz, G. J. “The top 100 design-builders, construction managers for-fee, construction managers at-risk & the top 40 project managers volatility leads to new thinking”. *ENR* 256, no. 23 (06/12, 2006). : 34-36.

Wen-Der Y. “PIREM: A new model for conceptual cost estimation”. *Construction Management & Economics* 24, no. 3 (03, 2006). : 259-270.

Williams, T. “Predicting changes in construction cost indexes using neural networks”. *Journal of Construction Engineering and Management* 120, no. 21994). : 306.

Wong, G. “The Construction Industry Dilemma-Price Fluctuations of Cement & Steel”. *Master Builders* (4th Quarter 2005). :84-85

Yoders, J. “Bim + ipd”. *Building Design & Construction* 50, no. 4 (04, 2009). : 26-40.

APPENDIX A

SELECTED PANEL MEMBERS

Owner's representative-	Reuel Alder- Utah Department of Transportation
Owner's representative-	Lynn Hinrichs- State of Utah Division of Facilities and Construction Management
Owner's representative-	Jared Doxey- Church of Jesus Christ of Latter-Day Saints
Owner's representative-	Tom Christensen- University of Utah
General Contractor-	Greg Fix- Big D Construction
General Contractor-	Scott Okelberry- W.W. Clyde Companies
General Contractor-	Dan Pratt- Hughes General Contractors
General Contractor-	Steve Nelson- Jacobsen Construction
General Contractor-	Gary Griffith- Christensen and Griffith
General Contractor-	Ron Peck- Peck Ormsby Construction
General Contractor-	Spencer Bradley- Wadman Construction
General Contractor-	Reed Ewell- Layton Construction

Subcontractor- Matt Clark- Clark Mechanical

Subcontractor- Troy Salmon- Salmon HVAC

Subcontractor- Mark Porter- Hunt Electric

Subcontractor- Camron Morgan- Morgan Paving

Supplier- Dan Bell- GEM Buildings

Supplier- Jay Richie- Geneva Rock

Supplier- Pam Foote- Steel Encounters

Supplier- Glen Anderson- Stock Building Supply

Supplier- Bill Rands- Bowman & Kemp Steel

Supplier- Jared Weston- Wheelright Lumber

Supplier- Nick Holt- Codale Electric Supply

APPENDIX B

DELPHI ROUND 1 QUESTIONS

Price Fluctuation in Commercial Construction

Introduction:

The purpose of this research is to find the best practices that are being used to control the risk associated with price fluctuation in commercial construction. All responses to this survey will be held confidential and used only for research purposes to determine how commercial construction in Utah is dealing with price fluctuation.

For the purpose of this study, price fluctuation is defined as: unpredictable price changes in materials, labor, and/or equipment that could potentially affect construction contracts and actual project cost.

Questions

1. Which of the following best describes your company's role in the construction industry?
    a. Owner
    b. General Contractor
    c. Subcontractor
    d. Supplier
    e. Other (please specify):_____

2. What is your average annual company volume in dollars?

3. What percent of actual construction work does your company self perform in your contracts?
    a. 0-10%
    b. 10-20%
    c. 20-30%
    d. 30-50%
    e. Greater than 50%

4. What percentage of your company's business is done under the following types of contracts? (total should equal 100%)

Fixed Price	%
Cost Plus	%
Unit Price	%
Guaranteed Maximum Price	%
Other (please specify):	%
Total	**100%**

5. In order of priority, what are the 3 most important methods you use to control the risk of price fluctuation?

   (1)

   (2)

   (3)

6. Assign the level of risk you feel is <u>currently</u> placed on the following parties for each type of contract, as it pertains to price fluctuation in commercial construction. (total for each column should equal 100 %)

	Fixed Price	Cost Plus	Unit Price	GMP
Owner/Developer	%	%	%	%
General Contractor	%	%	%	%
Subcontractor	%	%	%	%
Material Suppliers	%	%	%	%
Other (please specify)	%	%	%	%
Total	**100%**	**100%**	**100%**	**100%**

7. Assign the level of risk you feel should be placed on the following parties for each type of contract, as it pertains to price fluctuation in commercial construction. (total for each column should equal 100 %)

	Fixed Price	Cost Plus	Unit Price	GMP
Owner/Developer	%	%	%	%
General Contractor	%	%	%	%
Subcontractor	%	%	%	%
Material Suppliers	%	%	%	%
Other (please specify)	%	%	%	%
Total	**100%**	**100%**	**100%**	**100%**

8. Using a scale of 1-5 rate the various contracting methods as to their ability to equitably spread/share the risk of price fluctuation among all parties on a commercial construction project? 1 being very inequitably spreads risk and 5 being very equitably spreads risk.

- Fixed Price - 1 2 3 4 5
- Cost Plus – 1 2 3 4 5
- Unit Price - 1 2 3 4 5
- GMP - 1 2 3 4 5
- Other (specify) - 1 2 3 4 5

9. For each of the contracting methods, what percentage do you add to bids for potential price fluctuation in the following areas?

	Fixed Price	Cost Plus	Unit Price	GMP	Other
Materials	%	%	%	%	%
Labor	%	%	%	%	%
Equipment	%	%	%	%	%
Subcontractors	%	%	%	%	%
Other (please specify)	%	%	%	%	%

10. What issues are or could be created when labor and materials prices decrease rapidly?

APPENDIX C

DELPHI ROUND 2 QUESTIONS

Price Fluctuation in Commercial Construction

-Introduction to Round 2-

When asked in Round 1 about the 3 most important methods used to control the risk of price fluctuation, respondents consisting of owner's representatives, general contractors, subcontractors, and material suppliers from Utah's commercial construction market gave a variety of answers. The most frequent responses have been used to create this follow up questionnaire. These questions are an attempt to better understand how the different parties are using these practices to control the risk associated with price fluctuation.

Round 2 Questions

1. The 5 most frequent responses of the panel have been listed below in no particular order. According to your experience, rank the following methods in order of their effectiveness in controlling the risk of price fluctuation. (1 being the most effective of the methods, 2 being the next most effective…etc.)
    - **Timely Buyout**- Locking in prices with contracts or purchase orders that will keep the price constant for the duration of the project. _____
    - **Contract Language**- Price fluctuation language or clauses in contracts that relate who has the risk for fluctuation and how it will be handled _____
    - **Stockpiling Materials**- Purchasing large quantities of materials for a certain price and storing them until needed. _____
    - **Proposal Time Tables**- Stipulating the amount of time a bid is good for. For example, "this bid is good for _30_ days" _____
    - **Communication-** Communicating with Subs and Suppliers to know what the market will do and negotiating good prices. _____

2. Many of the respondents listed contract language provisions as a way to control the risk of fluctuation. If contract language is something you use to control risk of price fluctuation:

   What is some typical contract language used to control risk? Answer applicable to your company's experience-

   Language to the Owner:

   Language to the Contractor:

   Language to the Subcontractor:

   Language to the Material Supplier:

3. Many of the respondents listed stockpiling and storing materials as an effective way to control risk.

   Do you stockpile materials?

   If so, what materials do you stockpile?

   How do you determine the volume or amount of material you stockpile?

4. Many of the respondents listed using proposal time stipulations as a method to control risk. A typical example would be: this price is good for ___ days.

   Do you use time stipulations in your proposals?

   Do you accept time stipulations from those you contract with?

If bidding requirements prevent you from submitting a time stipulation, how do you deal with time stipulations on bids you may receive from subcontractors and/or suppliers?