Management of Uncertainties and Consequential Costs for Construction Projects in China
Dan Tong Cao, Shou Qing Wang, and Robert Tiong

ABSTRACT: With China's entry into the World Trade Organization (WTO) at the end of 2001, and Beijing's success in bidding for this summer's Olympic Games 2008, China is expected to become a huge emerging construction market that will provide opportunities for foreign developers, consultants and contractors worldwide. International companies are keen on venturing into the Chinese market. However, some of them have experienced progress delay and cost overrun in their projects. One common reason is the lack of understanding of and the failure to manage the uncertainties and consequential costs incurred because of the differing customs and practices and the relatively incomplete conditions of contracts prevailing in China's construction industry. This article reviews briefly the construction contract in China and then identifies the possible uncertainties and consequential costs embedded in the clauses of the China Construction Contract 1999, the latest construction contract in China. The existing problems in the industry's customs and practices are also analyzed to further reveal other factors that may cause uncertainties and consequential costs to be incurred. Possible improvements to the related contract clauses and a framework for managing these uncertainties and consequential costs are proposed for undertaking construction projects in China.

KEY WORDS: Cost, cost control, contract management and tender documents

Strong economic growth in China has resulted in a huge demand for basic infrastructure like roads, ports, and power generation facilities. Meanwhile, investments in sectors like residential and commercial buildings have also increased. With China's entry to the WTO at the end of 2001, and Beijing's success in bidding for this summer's Olympic Games 2008, this emerging construction market has attracted many international developers, consultants, and contractors.

The Chinese market is different in many aspects from those in western countries. International professionals have always encountered difficulties in managing construction projects, especially with regard to the uncertainties and consequential costs incurred.

These difficulties result from different customs and management practices, conditions of construction contracts in China, etc. In this research, the consequential costs refer to the costs incurred to deal with the uncertain project and site conditions, ambiguity in contract clauses or other parties' fault, and costs that are not covered explicitly in the contract price stated in the letter of acceptance.

An analysis of consequential costs for project development in China has not been carried out in detail. Therefore, it is meaningful to analyze in detail the consequential costs associated with China's construction projects and to investigate the corresponding management measures, as well as related key contract clauses. This will be of interest especially to international developers, contractors, and consultants, who are planning to venture into the Chinese market.

OBJECTIVES AND METHODOLOGY

The process of consequential cost management consists of two primary activities: consequential cost identification, and possible measures to manage the consequential cost. In this regard, the objectives of this research include the following.

- To identify the consequential costs associated with the clauses in the Conditions of Contract for Works of Building Construction (GF-99-0201), hereinafter referred to as the China Construction Contract 1999, or CCC99, the prevailing conditions of contracts widely used for construction projects in China.
- To analyze the existing problems in China construction contracting so as to further identify other factors that may cause consequential costs.
- To propose possible improvements to the contract clauses so as to better manage the consequential costs.
- To propose a framework for international developers and consultants to manage the consequential costs associated with construction projects in China.

The methodology developed for this study included the following.

- A literature review was conducted, which covers: a) past studies on China construction contracting practices to help discover any academic gap on consequential costs; b) main standard forms of contracts that are being used in developed countries. This would help the researchers analyze the CCC99 and to find out where and how the CCC99 could be improved.
- The key contract clauses of CCC99 are examined in detail to identify and analyze the consequential costs in CCC99.
- Personal interviews and discussions with senior or top management staff with expertise and experiences in construction contracts in China.
- Based on the first author's working experience for a design-and-build project in Suzhou, China, for a Singapore firm, a case project in Suzhou Industrial Park was studied to further demonstrate the identification and management of consequential costs in China.

LITERATURE REVIEW

Past Research

S.Q. Wang and Y.J. Lu, in a 1996 presentation at the CIB Beijing International Conference, introduced reforms to the construction contracting system in China [13].

L.Y. Shen and others, in a 1998 journal article, examined the development and characteristics of competitive tendering practice in Chinese construction [10].

K. L. Chan and others in a 1999 journal article, presented general information regarding the construction industry in China, especially the
management of encountered difficulties [1].


C.C. Wang, also in an undergraduate dissertation, dealt with the overall procedures of the pre-contract stage, approximate estimation, tendering procedures and the building contract management [12].

E. Knutt, in a special China report, gave a detailed account on the means of entering the Chinese market and emphasized that it is misleading to think of China as one market on its own. He noted that Beijing is vastly different from Shanghai in terms of rules and regulations, and also in their respective economic and construction focuses [5].

Y. Chow's dissertation studied more specifically the construction contract prevailing in Shanghai, the fastest growing special economic coastal city in China [2].

Z. B. Lee continued Chow's work by looking into the cost structure in Shanghai's prevailing contract and related information for cost estimating [6].

X.W. Yuan and others, in a 2000 IPM presentation, put forward the co-related function of rights and obligations between the client and general contractor under the CCC99 [19]. They concluded that being blind to the clauses of rights and obligations of the contract is a primary factor for loss and unpleasant situations for either party. To prevent both parties from evading their responsibilities, they suggested that the preconditions should be made certain to bind each party.

B Li and others, in two journal articles, identified the critical risk factors in international construction joint ventures (JVs) [7, 8]. They proposed a risk model with the aim of helping international firms to mitigate these risks through a JV with a local partner. Many of their conclusions can be applied to the construction JVs in China.

L.Y. Shen and others, in a journal article, assessed more specifically the risks for construction JVs in China and investigated practical applications of risk management in the business of JVs in China [11].

S.Q. Wang and others, in five journal articles, conducted a series of research on China's Build-Operate-Transfer (BOT) projects [14, 15, 16, 17, 18]. These articles, including a sixth article in which W.R. Zhang participated, included BOT evaluation, competitive tendering, government initiatives, and the related unique or critical risks. The articles especially considered political, force majeure risks, international exchange and revenue risks, as well as mitigating measures, corresponding contract clauses for these risks, possible improvement of these clauses, the risk management framework, and one case study [20].

Definitions of Costs

The forms of contract used in China are shown in the table 6. A review of construction contracts produces a variety of definitions of cost. There is no standard method for categorizing project costs.

There are generally the following two views in categorizing cost:

- From the point of view of project life cycle, project cost comprises the following:
  - The cost of work in the development phase including feasibility study, planning, and engineering of the project; and,
  - The client's management and overhead costs in the implementation phase during which the working drawings, specifications and contract documents are prepared, contract tendered and awarded, and construction work carried out. Some of the costs are consultant services, corporate overheads, reserve for scope changes, and financing;
  - Construction cost in the construction phase, which includes direct cost, indirect cost, preliminaries, other fees and taxes; and,
  - Operation and maintenance costs in the operation phase.

- From the point of view of construction contract, costs that are covered in most contracts comprise the contract price, additional contract amount (i.e. variation), other cost, prime cost and provisional sums. The consequential costs, which are covered by the additional contract amount and other cost, describe mainly the cost incurred to deal with the uncertainties during the construction period.

The CCC99 adopts the latter method, which separates the calculated costs (i.e., contract price) and uncalculated costs (i.e., additional contract amount and other cost). This study therefore adopts the same method so that the identification and analysis of consequential costs could be conducted in a clear way.

UNCERTAINTIES AND CONSEQUENTIAL COSTS IN CCC99

Contract Price

A common feature of construction contracts is that they define the contract price, which is the sum of money stated in the letter of acceptance or agreement as payable to the contractor for execution and completion of the works and the rectification of any defects therein in accordance with the provisions of the contract.

In general, contract price in CCC99 consists of the following costs and services:

- preliminary cost (e.g., insurance, site security)
- civil engineering (substructure, superstructure, finishes, fitting services and external works)
- installation fee (electrical, mechanical, HVAC and commissioning services)
- initial operation and temporary facilities (e.g. site office)
- project management fee (about 2 percent of total construction cost of the project in China); and,
- taxes and duties.

Additional Contract Amount

During the construction stage, there are some other costs that are not included in the contract price. These amounts are caused by instruction errors made by the engineer or the client requiring the contractor to vary the works from what is specified. In CCC99, these costs are called additional contract amount, which is necessary and agreed to by the client when signing the contract. It is calculated according to the estimating method used for the contract price.
Although the China construction contract has been introduced since 1991, it has not been fully accepted by the industry. Preference is often given to loose contract agreements. Documents are frequently characterized by the distinctly non-legalistic phrases like “all items not found in this contract will be deliberated and decided upon in a spirit of mutual understanding and trust.” These allow specific contract details to be finalized at a later date. An Australian entrepreneur commented, “We have worked in China for many years. We will be there for many years to come, but we always remember the phrase - … same bed, different dreams - to describe the way in which the Chinese will negotiate with a international party.” [3]. Nevertheless, international companies should seek to avoid any loose commitments because this will lead to misunderstanding, which will result in uncertainties and consequential costs.

### Changes in Law

“Changes in Law” includes change in government policies with respect to laws and regulations, methods to address inflation, currency conversions, rates and methods of taxation. Change of

### OTHER FACTORS CAUSING CONSEQUENTIAL COST

#### Loose Contract Agreements

China did not have its own standard forms of construction contracts until 1991. Since 1991, most of the local projects are awarded based on the standard form (i.e., CCC91) issued by the China Ministry of Construction. Despite this development, X. L. Ma, one of the editors-in-chief for the CCC99, who is from Tianjin Construction Engineering Bureau, Tianjin, China, said in an interview: “although the CCC99 are now widely used as legally binding documents in areas of high international investment, many Chinese executives still view written contracts as being of little importance - favoring personal commitment as a vehicle for business.”

His comments confirmed the Chinese way and culture of doing business as mentioned by R. Flanagan and S.R. Li that the negotiated document is frequently less important than the relationship established during negotiations [3].

### Table 1 — CCC99 Clauses that May Incur consequential Cost to the Client

<table>
<thead>
<tr>
<th>Clause</th>
<th>Event</th>
<th>Consequential Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td>Works require other than local specification</td>
<td>Proposal for special construction process</td>
</tr>
<tr>
<td>6.2</td>
<td>Error in the engineer’s instruction</td>
<td>The correction cost and cost for extension of time</td>
</tr>
<tr>
<td>6.3</td>
<td>The engineer fails to provide instruction on time</td>
<td>The cost and delay incurred</td>
</tr>
<tr>
<td>7.3</td>
<td>Emergency in complying with statutory requirement</td>
<td>Additional contract amount shall be borne by the client, if due to his responsibility</td>
</tr>
<tr>
<td>8.1(1)-(9)</td>
<td>The client’s obligations</td>
<td>Site preliminary development cost</td>
</tr>
<tr>
<td>8.2</td>
<td>Appoint the contractor to undertake extra works excluded in the contract</td>
<td>Service commission cost and delay incurred</td>
</tr>
<tr>
<td>8.3</td>
<td>The client fails to fulfill his obligations</td>
<td>The cost and delay incurred</td>
</tr>
<tr>
<td>9(1)-(9)</td>
<td>Contractor’s obligation but some costs to be borne by the client due to the latter’s faults</td>
<td>The client bears the costs accordingly</td>
</tr>
<tr>
<td>11.2</td>
<td>The client fails to give the contractor possession of site on time</td>
<td>The cost and delay incurred</td>
</tr>
<tr>
<td>12</td>
<td>Suspension caused by default of the client</td>
<td>Default cost and delay</td>
</tr>
<tr>
<td>14.3</td>
<td>Accelerating completion prior to the time prescribed in the agreement</td>
<td>Acceleration fee</td>
</tr>
<tr>
<td>16.3</td>
<td>Required by the engineer, opening up of work or testing of material or goods found to be in accordance with the contract</td>
<td>The cost and delay incurred</td>
</tr>
<tr>
<td>19.5</td>
<td>Failure of commissioning test due to: (a) default of design; (b) defects of equipment purchased by the client</td>
<td>(a) Design cost (b) Replacement cost and extension of time</td>
</tr>
<tr>
<td>19.5(4)</td>
<td>Divergence between contract documents and actual works.</td>
<td>Extra cost for commissioning test</td>
</tr>
<tr>
<td>21</td>
<td>Security and protective work</td>
<td>Cost for security work</td>
</tr>
<tr>
<td>27.3</td>
<td>Material and goods storage</td>
<td>Storage fee</td>
</tr>
<tr>
<td>27.4(3)</td>
<td>Defects of goods purchased by the client</td>
<td>Goods replacement and extension of time</td>
</tr>
<tr>
<td>27.4(6)</td>
<td>The client fails to deliver goods on time</td>
<td>The cost and delay incurred</td>
</tr>
<tr>
<td>27.5</td>
<td>Test for material/equipment supplied by the client</td>
<td>Test fee</td>
</tr>
<tr>
<td>29.1/30/31.5</td>
<td>Design variation</td>
<td>Variation cost</td>
</tr>
<tr>
<td>39.3</td>
<td>Force Majeure</td>
<td>Repay to the contractor any costs of the execution of works</td>
</tr>
<tr>
<td>40.1</td>
<td>Failure to pay insurance premium for the client’s workman and third party</td>
<td>Insurance premium</td>
</tr>
<tr>
<td>40.2</td>
<td>Failure to pay insurance premium for equipment or material</td>
<td>Insurance premium</td>
</tr>
<tr>
<td>40.3</td>
<td>Appoint the contractor to arrange insurance</td>
<td>Service commission</td>
</tr>
<tr>
<td>42.1</td>
<td>Patent right</td>
<td>Patent right cost</td>
</tr>
<tr>
<td>43.1</td>
<td>Loss and/or expense in regards antiquities</td>
<td>Cost for antiquities protection</td>
</tr>
<tr>
<td>43.2</td>
<td>Underground obstacles</td>
<td>Underground obstacles settlement cost</td>
</tr>
<tr>
<td>44.6</td>
<td>All parties are released from performance for various reasons</td>
<td>Sum payable by the client to contractor in respect to the work executed</td>
</tr>
</tbody>
</table>

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government policies and regulations is the issue of greatest concern expressed by international investors interviewed by the first author in the fall of 2000.

One international company’s senior engineer in Shanghai, China, said, “The change of government policies and regulations would affect us substantially; this is because the original plan may become obsolete and we need to get used to new regulation for a long time.” Though the CCC99 has addressed some changes in law as stated in clause 23.3, a detailed description should still be highlighted in the particular conditions when signing a construction contract in China.

Reliance on “Guanxi” (Relationship)

The negotiation and approval period for doing business in China is usually long and feedback from the Chinese is slow because of the local bureaucracy.

International firms generally have to be prepared to bear the risk and make allowances for potential delays to the project. The bureaucracy can be dealt with by establishing better relationship and mutual understanding or “Guanxi” with personnel involved.

Traditionally, Chinese people prefer to do business with friends who can be trusted by them. A good relationship between the top management team of international firms and important local officials will be beneficial to the international firms in negotiations.

When interviewed, one vice president of a Singaporean company, which has several projects in Shanghai, said, “Guanxi is one kind of network connection. Without the connection, the communication of the whole world may break down. Therefore, relationship is important, but there may be some differences in China as compared to other countries. However, while the whole process of Chinese business relies upon the Guanxi, a certain percentage of cost for maintaining such Guanxi has to be estimated as part of contingency cost.”

Cultural Difference and Language Deficiency

The Chinese culture is highly complex and requires an international business representative to have patience, understanding and flexibility for Chinese traditions and ways of doing things. International companies entering China should be aware of the “Guoqing” (Chinese characteristics). While certain forms of communication are acceptable in one country, they may be considered taboo in another one [9].

It is essential to master the local language, Mandarin, as it is the official language in China. Language deficiency could result in a lack of knowledge about the Chinese market and culture. It is not only costly and time-consuming but could also be problematic for international business representatives to obtain information efficiently. Since the local professionals are familiar with Chinese regulations and situations, forming a JV project team with local and overseas experiences will enable the team to function more effectively.

Corruption and Operating Cost

Corruption is one of the most common problems mentioned in research papers on China. It can be a very serious problem for international firms operating there. It not only undermines fair play, but may also lead to a substantial increase in costs. Consequently, the under-estimating of such costs and expenses would lead to problems of budget overrun and operation difficulties.

Some firms might regard corruption as an unavoidable fact of life for undertaking projects in developing countries including China. This presents the risks of the firms spending either too much money on corrupt officials, or spending money in the

<table>
<thead>
<tr>
<th>Factors</th>
<th>Consequential Costs</th>
<th>Managing Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loose contract management</td>
<td>Misunderstanding the scope of work can cause additional cost</td>
<td>Avoid such loose commitments; use standard form of contract and legal terms</td>
</tr>
<tr>
<td>Changes in law</td>
<td>Inflation, taxation increase, currency exchange rate</td>
<td>Detailed clauses should be highlighted in the contract agreement, e.g. how to share the risk of change in current law</td>
</tr>
<tr>
<td>Reliance on Guanxi (Relationship)</td>
<td>Business development cost</td>
<td>Estimate certain percentage of this cost as part of contingency cost</td>
</tr>
<tr>
<td>Cultural difference and language deficiency</td>
<td>Investment cost increase and translation cost</td>
<td>Use local engineers familiar with Chinese regulation and local situations</td>
</tr>
<tr>
<td>Corruption and operating cost</td>
<td>Extra cost for operation business</td>
<td>Clause for preventing corruption could be drafted out in the contract</td>
</tr>
<tr>
<td>Various policies in different territory</td>
<td>Business development costs in various territory of China</td>
<td>Feasibility study must be carried out to identify the complexity in different places of China</td>
</tr>
<tr>
<td>Non-convertible Chinese currency</td>
<td>Devaluation of Chinese RMB</td>
<td>Obtain government’s guarantees on exchange rate and convertibility, e.g. fixed rate is the most effective measure for mitigating the risk</td>
</tr>
<tr>
<td>Inflation</td>
<td>Material price fluctuation</td>
<td>List the principal materials with unit rates. For a long project period, both parties can negotiate for relevant material prices to be fixed.</td>
</tr>
</tbody>
</table>

Table 2 — Other Factors Causing Consequential Cost and Their Managing Measures
### Category A. Development cost of the site
- a) Government development and planning management fee
- b) Survey plan (including red-line survey)
- c) Soil investigation
- d) Electricity bureau consultant fee
- e) Drawing auditing and quality supervision
- f) Fire safety
- g) Temporary land using for temporary electricity access

### Category B. Utilities fee
- a) Electricity charges include
  - One time connection fee based on the quantity of KVA
  - Construction fee
  - Deposit
- b) Plumbing charges include
  - One time connection fee
  - Construction fee
  - 2 months deposit
- c) Sanitary charges include
  - One time connection fee
  - Construction fee
  - 2 months deposit

### Category C. Variation Order
- a) Client changes mind
- b) Unforeseen events (caused by government requirements/regulations)
- c) Designer
- d) Contractor

### Category D. Finance charges incurred during interim payment (difference between RMB and USD telegraphic transfer)

### Category E. Other
- a) Communication fee
- b) Commissioning fee required by Electricity Bureau
- c) Installation for transformer by licensed contractor

<table>
<thead>
<tr>
<th>Table 3 – Cost Categories of Construction Projects in China</th>
</tr>
</thead>
</table>

wrong places, or at the wrong times—all at the risk of having a government agency turn against the project developer and the project. But there are different ways of interpreting what is meant by corruption, for example, “I wouldn’t call it corruption in China, simply another way doing business which involves cost!” by a Swiss entrepreneur [3].

However, as one of the measures for dealing with corruption, clauses for prevention of bribery could be drafted out in the contract as there is not enough legislation in China dealing with this issue. For example, a sentence such as: “The firm does not condone or encourage any staff to accept bribery or bribe people in any form of gifts or entertainment from supplier, contractor or potential business associates,” could be added to the contract.

**Various Policies in Different Territories of China**

Since China is huge, having a total area of 9.6 million square kilometers and with decentralization of policies, different provinces and cities, even counties, have adopted their own sets of regulations.

The various policies in different locations of China will affect the investment decision of international investors. According to E. Knutt and a vice president of a Singaporean company in Shanghai, it is not reliable to take what has happened in one place of China and infer that it must be the same in another place [5]. Therefore, it is crucial that international companies conduct a feasibility study to identify the complex situations in different places of China.

There are other problems that are likely to be faced by international companies, such as the non-convertible Chinese currency Renminbi (RMB), and the material price fluctuation because of inflation. Table 2 summarizes the above factors that may cause consequential costs and the proposed measures to address them.

**STRATEGIES FOR TENDER DOCUMENT PREPARATION**

International clients in China could use competitive tendering through proper tender document preparation to acquire the most competitive price and to minimize the contractor's tender price as well as their markup rates for variation work. This became especially realistic after the new tendering law was implemented in 2000.

With increasing complexity of the conditions within the construction industry, it should not be assumed that any one standard document is automatically suitable for another project as each project has its own unique characteristics, e.g. different site conditions, circumstances, and technical requirements. It is essential to consider these different factors when preparing a tender document. A proper and detailed tender document preparation will reveal the uncertainties to a great extent.
<table>
<thead>
<tr>
<th>Cost Category (Refer to Table 3)</th>
<th>Clauses in General Conditions</th>
<th>Particular Conditions</th>
<th>Items to Be Added in the Bill of Quantities When Preparing Tender Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category B</td>
<td>No</td>
<td>No</td>
<td>Contractor needs to provide all costs incurred in connection with any utilities supply, e.g., water supply, gas and electricity power, etc. All related documents are required to be listed in the appendix when submitting tender.</td>
</tr>
<tr>
<td>Category C</td>
<td>No</td>
<td>Both parties agreed that RMB as currency of payment</td>
<td>The client shall fix the exchange rate as determined by the Central Bank of China on the date 28 days prior to the latest date for the submission of tender.</td>
</tr>
<tr>
<td>Category D</td>
<td>Clauses 29–31</td>
<td>No</td>
<td>Refer to CCC99 General Conditions.</td>
</tr>
<tr>
<td>Category E</td>
<td>a. Communication fee</td>
<td>No</td>
<td>The contractor shall also provide, maintain and pay for a telephone and line for the duration of the contract and allow the client's and Consultant's representatives free use of the facility for the purpose of the Works.</td>
</tr>
<tr>
<td></td>
<td>b. Commission fees</td>
<td>Clause 19.5(4) but only in general</td>
<td>Besides the Clause 19.5(4), the cost of all tests to ascertain the quality or standard of equipment purchased by the contractor to those stated in the Specification and the required of Authorities shall be borne by the contractor.</td>
</tr>
<tr>
<td></td>
<td>c. Installation of transformer</td>
<td>No</td>
<td>The contractor is to pay all costs, which may be charged by the Authorities for specialized contractor.</td>
</tr>
</tbody>
</table>

Table 4 — Cost Categories and Clauses to be Added in Contract

In this section of this article, emphasis will be placed on the strategies for exploring the consequential cost qualitatively through tender document preparation.

General Tender Document Preparation
The general tender documents for projects in China vary with the size and nature of the project, but usually include the following.

Instruction to Bidders
This is a guideline to bidders for preparing their bids, which usually include the following.

- a general description of the project;
- contractual arrangement, e.g., means of arriving at the contract sum;
- arrangement of site investigation and pre-bid meeting;
- documents to be submitted by bidders;
- place and deadline for bid submission; and,
- valid period for bids (in China, the period from bid opening to issuing of a letter of acceptance is usually a maximum of 10 days for small projects and a maximum of 30 days for medium to large projects).

Conditions of Contract
Tender document should also include the forms of contract and conditions of contract, e.g., the CCC99 or the condition of contracts by the International Federation of Consulting Engineers (FIDIC), which define both the client and the contractor's rights and obligations.

Working Drawings and Bill of Quantities
Working drawings should be provided as detailed as possible, because these drawings are the basis for taking off quantities that contribute to total contract sum. Usually the design consultant appointed by the client will also prepare the bill of quantities.

Measurement Standards and Specifications
In tender document, the client should also state the adopted necessary measurement standards and specifications that are applicable to the project.

Chinese contractors usually use the standard methods and rates for measurement (SMRM) as the basis for preparing bids. The SMRM consists of about 12 volumes; the exact number of volumes varies depending on the municipality or region. They cover all types of works, e.g., building, electrical and mechanical, drainage and plant.

One volume is an appendix, which covers details of additional percentage costs over basic costs for such things as extra floors (exceeding 20 meters high), additional area, and type of building.

The objective of the SMRM is to establish a standard for estimating the cost and quantity of work for all types of projects in China. The specifications adopted will define clearly the technical and quality requirement of the work. These standards and specifications are important documents for future inspection and audit purposes during construction.

Particular Tender Document Preparation
Because of the unique nature of each project, the particular conditions of contract for each project are necessary to state in detail and positively respond to the project's uniqueness. International clients must pay special attention to the following issues when preparing the particular conditions of contract so as to address the consequential cost which may be incurred.

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<table>
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<th>Variation Control Strategies</th>
<th>Details</th>
</tr>
</thead>
</table>
| **Detailed tender document** | • Ask the contractor to provide a list of principal materials  
  • State clearly in the contract the obligations of each parties’ obligations for the variation work and cost |
| **Variation order and variation control** | • Analyze and categorize properly the variations  
  • Follow proper format and procedure. e.g.:  
  o Channel for instructions and variation orders  
  o Authorize persons/parties for issuing them  
  o In standard writing form with serial number |
| **Valuation of variation and its control** | • Valuate variations according to CCC99  
  • Consider other factors affecting the valuation of work:  
  o A percentage or lump sum adjustments in the contract bills  
  o All preliminary items priced in the contract bills  
  o Valuation of variation by day-work |
| **Exclusion of the rules (clauses) of valuation** | • Sign separate agreements for variations under different circumstance. e.g.:  
  o Where the client requires as a necessity a fixed cost prior to execution.  
  o Where no rates exist in the contract document.  
  o Where an unrealistic and high figure exist in the contract |
| **Variation cost control** | • Check the tenders carefully  
  • Anticipate the variations in advance  
  • Get early knowledge of instructions  
  • Negotiate with the contractor |

Table 5 — Variation Control Strategies and Details

**“Ruling” Language of Contract**

The language or languages in which the contract documents shall be drawn up should be described in the contract. In China, Chinese is often the “ruling” or legal language when drafting a contract but international bidders may sometimes negotiate with the contractor the use of English as “ruling” language.

**Currency and Exchange Rate**

Constant fluctuation in currency exchange rates may lead to a big loss to the international client or the contractor. If the Chinese currency RMB is ascertained in the contract as currency of payment, the client will take the risk of the fluctuation of exchange rates.

It is suggested that both parties implement the Clause 72.1 of FIDIC so as to supplement the CCC99, “Where the contract provides for payment in whole or in part to be made to the contractor in international currency or currencies, such payment shall not be subject to variations in the rate or rates of exchange between such specified international currency or currencies and the currency of the country in which the works are to be executed.”

“*If the client will share the risk with the contractor, he/she should pre-state in the tender documents to notify the contractor that the fixed exchange rates are those prevailing, as determined by the central bank of the country in which the works are to be executed, on the date 28 days prior to the latest date for the submission of tender for the contract.*”

**Commissioning Fee**

In CCC99, Clause 19.5(4) states that costs of commissioning test are borne by the client unless such test is clearly intended by or provided for in the contract.

To avoid a claim, the client may require bidders to quote the commissioning fee and break it down into details.

**Taxes and Duties**

Tender document shall highlight that the contractor shall comply with the country law in which the project is to be executed and bear the taxes and duties the contractor is liable for.

**Communication Fee**

It is suggested to implement the clause in the CCC99 so as to confirm that the communication fee is borne by the contractor, “The contractor shall also provide, maintain, and pay for a telephone and line for the duration of the contract and allow the client's and consultant’s representatives free use of the facility for the purpose of the works.”

**Other Government’s Requirements**

In China, in addition to the requirements set in CCC99, there are other special government requirements with which the contracting parties should also comply.

- Utility works undertaken by government appointed contractors—To retain the quality of the utility works, the government issues licenses to professional contractors through a series of qualification appraisals. These licensed contractors become the special chartered contractors to execute the utility works, e.g., electricity and water supply works, and they require a higher price than the basic contractors. If the client requires bidders to consider these works as part of the project, more competitive prices may be obtained from these bidders instead of from the special chartered contractors.

- Fire safety requirements. It is important to highlight in the particular conditions of contract that the contractor shall bear the extra costs incurred for meeting the fire safety requirements, if there is any difference from the bid price.
Table 3 shows the cost categories which incorporate the above consequential costs. These cost categories are based on the first author's experiences with projects in China and are typical in construction projects in China and could therefore serve as a good reference for international clients when preparing tender documents.

Furthermore, table 4 shows the cost categories, related clauses in CCC99, and proposed items to be added in the bill of quantities, which could also be adopted for construction projects in China.

**Strategies for Variation Cost Control**

Variations of construction work and design changes required during the course of the project could cause the cost to exceed the original contract sum. The variation costs incurred to deal with the uncertainty changes will form one part of consequential cost. Implementing a proper contract management in terms of variation cost control is necessary to control this consequential cost.

**Detailed Tender Document**

Inevitably, changes to the design will take place after construction commences on site. The contract documents should cover the arrangements for negotiating the price of any changes. If not, the contractor may charge a premium for varied work of additions or omissions.

The international client should emphasize in the contract that the contractor, at the time of tender, should provide a list of the principal materials and the schedule of rates to be used in the contract. These rates will be used for valuing variation works in the contract. Meanwhile, each party's obligations for

![Figure 1 — Framework for Consequential Cost Management](image-url)
variation work should be stated clearly in the contract.

**Variation Order and Variation Control**

A complete contract is hard to achieve in the real world, which will increase the possibility of loss. The existence of a variation clause will improve the potential for securing an improved end product, but at a price, for the client. The client then has less uncertainty about the price to be paid, the completion time, and quality of the completed project.

Besides drafting proper clauses of contract for variations at tender stage, it is also necessary to monitor properly the variations and follow the right procedures during executing the contract. These procedures include the following.

- Analyze and categorize properly the variations.
- Follow proper format and procedure; for example, define the communication channel of instructions and variation orders, the authority persons/parties for issuing these instructions and variation orders, which must be in standard written form with serial numbers.

**Exclusion of the Rules (Clauses) of Valuation**

It is the common view of professionals interviewed that the CCC99 does not give the right to the engineer to agree with the contractor on the cost of a variation outside the rules of valuation, unless such authority is specifically given by the client.

The change in words must surely be intended to encourage the use of agreement between the client and the contractor prior to the work being executed. The following circumstances determine when the rules of valuation should be avoided in favor of a separate agreement to be signed.

- Where the client requires as a necessity a fixed cost for variations prior to execution. It should be noted that in theory, and often in practice, a variation can be priced in advance of execution using the clauses of valuation to give a fixed price or separate agreement.
- Where no rates exist in the contract document. If no rates exist in the contract document, it is obviously beyond the engineer's authority to exercise the valuation of variation under the conditions of contract. The client may commission an additional specific authority to the engineer; otherwise the approval power should remain with the client.
- Where an unrealistic and high rate exists in the contract. Under this circumstance, the engineer should be responsible for the coordination between the client and the contractor, rather than fix a rate or price he/she thinks reasonable and proper because it may cause disputes. It is advocated that valuing extra works in accordance with unreasonable or inapplicable rates or prices specified in the contract document should be approved by the client before the varied work is commenced.

The above is summarized in table 5.

**CONSEQUENTIAL COST MANAGEMENT FRAMEWORK**

As discussed above, the consequential cost, if not properly managed, will result in the increase of construction cost.

Since design and supervision fees are calculated as percentages of the construction cost, they will further add to the project budget overrun. Therefore, a proper framework for identifying and managing the consequential cost is important.

Based on this study, a consequential cost management framework is proposed to help international investors, developers, and design consultants to identify and manage the consequential costs. This will allow them to better manage the total project cost.

The framework as illustrated in figure 1 has summarized and embodied the main conclusions drawn previously and provides an overall picture of this research. The framework consists of the following five steps of consequential cost identification and management, each providing appropriate detailed measures and activities:

**Step 1:** When a new project is to be invested/constructed, the project client should conduct a general analysis of the consequential cost associated with the project. If CCC99 is to be used, the key related contract clauses should be examined and all
other factors that may incur consequential costs analyzed. When conducting such analysis, tables 1 and 2 should be referred to closely.

**Step 2:** It is important for the client to examine and list the unique factors to the project and related consequential costs incurred by these factors. Table 3 could serve as a good baseline for identifying, quantifying, and comparing the project cost categories and their constituents.

**Step 3:** The client should also refine his/her project requirements during the detailed tender document preparation rather than simply implementing the standard tender document. In addition, the client could collect more information on relevant fees.

<table>
<thead>
<tr>
<th>Contract</th>
<th>Key Contents</th>
<th>Relevant Fee</th>
</tr>
</thead>
</table>
| Site Investigation Contract | • Project name, location, investment and scale  
• Valid date and effective period of the contract  
• Responsibilities of client to submit fundamental information and details of requirements which include scope of work, work schedule, quality requirement and handover of final documents by prescribed dates  
• Responsibilities of investigation company  
• Calculation basis of site investigation fee  
• Payment schedule of site investigation fee  
• Default liability | Site investigation fee depends on the work done and is calculated according to the Standard for Site Investigation Work Calculation issued by the State Planning Commission |
| Design Contract         | • Project name, location, investment and scale  
• Valid date and effective period of the contract  
• Scope of design as set out in the list of entrusting design items annexed to the contract  
• Design stages to be conceptual, preliminary and detail drawings  
• Dates for production of requirements and fundamental design information by the client and design documents by the design institute  
• Design fee to be the agreed percentage of construction estimate set out in list of entrusting design items  
• Payment schedule of design fee  
• Responsibilities of design institute and the client | The design fee is negotiable ranging from 2% to 2.5% of the construction cost according to the Standard for Design Fee Calculation issued by relevant government authorities |
| Supervision Contract    | • Project name, location, investment and scale  
• Valid date and effective period of the contract  
• The basis of supervision and related laws  
• Name list of supervision staff  
• Supervision plan  
• Scope of supervision work  
• Responsibilities of client to submit relevant information within prescribed time  
• Obligation and right of client and supervision company  
• Calculation basis for supervision fee  
• Payment schedule of supervision fee  
• Bonus (if any)  
• Dispute settlement | The supervision fee is also calculated as percentage of the construction cost but varies on design stage supervision and construction stage supervision. |
| Construction Contract   | • Name and location of the project together with superficial area of construction and site handover date  
• Valid date and effective period of the contract  
• Scope of undertaking  
• Contract price  
• Type of contractual arrangement  
• Contract period. commencement and completion dates  
• Obligations of client and general contractor  
• Client's and general contractor’s respective obligations such as materials and equipment supply, etc.  
• Variation and its valuation  
• Method and schedule of payment and date for final account settlement  
• Notice of handover, certificate of inspection. general contractor’s obligation to adhere to quality and warranty period of maintenance  
• Bonus and penalty  
• Persons responsible for the project | Contract Price is attained through tendering and/or negotiation, which is mainly based on the Measurement Standards for Estimation and Measurement issued by Ministry of Construction or local construction commission (for local contractors), or foreign standards for measurement (for foreign contractors) |

Table 6— Summary of Standard Forms of Contracts in China
The main points outlined in this article were also studied. The article proposed strategies for tender document preparation and variation cost control of construction projects in China, as well as a framework for managing the consequential costs in China. It is hoped that the analysis presented would provide useful references for international developers who are planning to operate their businesses in China. The findings could be applied to other forms of construction contracts in addition to CCC99.

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Public Works Magazine Names MBP A “Top 50 AEC Firm”
McDonough Bolyard Peck, Inc. (MBP) is pleased to announce that the firm has been designated a Top 50 Architecture/Engineering/Construction (AEC) Firm by Public Works Magazine. The decision was based on public works revenue and growth for 2007.

The list, published annually by the magazine, is comprised of the top firms in the nation. As a result of a questionnaire the magazine mailed out in March to its readers, a general consensus of the companies listed also agree that public works agencies are using AEC firms for not only design, but for planning and building.

“Even with recent downturns in the market and escalation in materials costs, many companies are still flourishing. We are honored to be included amongst the finest companies in the country and those who have not allowed a weakened economy to cripple their organization”, states MBP’s Blake V. Peck, PE, CCM, President and COO.

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We define, implement and staff Project Management Offices (PMOs). We develop the Tools and Procedures for Project Controls and Program Management.

- Program and Project Solutions
- Project Management Offices “PMO”
- Scheduling, Cost Controls, Risk Management and Claims Analysis

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