IMIA Working Group Paper 96(16)
Cost Overrun in Construction Projects
49th Annual IMIA Conference, September 2016, Qatar

Working Group Members
Caroline Hairsine, CNA Hardy – Chairperson
Roman Emelyanov, Sogaz
Vitaly Valyuk, Sogaz
Cedric Wong, Swiss Re
Marina Zyuganova, Renaissance Insurance Group

IMIA EC Sponsor: Olivier Hautefeuille, SCOR
Table of Contents

Executive Summary .................................................................................................................. 3

Cost overrun in the Construction Industry .................................................................................. 4
- What is Cost Overrun ............................................................................................................ 4
- The challenges for construction industry .............................................................................. 4
- What are the causes of Cost overrun? ................................................................................... 8
- Does the type of contract have an impact on cost overrun? .................................................. 12
- Liquidated Damages and it’s interface with cost overrun ....................................................... 13
- Feasibility Studies & Risk Management as a means to mitigate cost overrun ..................... 13
- Project Finance Issues ......................................................................................................... 14

Cost and Schedule overruns and their impact on the insurance contracts ........................... 15
- Type of impact on the insurance contracts ............................................................................. 15
  - Sum Insured ..................................................................................................................... 15
  - Risk exposure .................................................................................................................. 16
  - Claims settlement procedure .......................................................................................... 17
- What can be done to reduce the risk as part of the underwriting process? ......................... 17
- Reasons for cost overrun which may not increase the risk ............................................... 17
- Reasons for cost overrun which may increase the risk ...................................................... 18

Insurance Clauses .................................................................................................................... 18
- Automatic Increase Clause ................................................................................................ 18
- Average Clause ................................................................................................................ 19
- Premium Adjustment ......................................................................................................... 19
- Project Alterations and Amendments ................................................................................. 20
- Time Extension .................................................................................................................. 20
- DSU ..................................................................................................................................... 20

What additional insurance solutions could be offered or developed? ................................ 22
- Reinsurers view of cost overrun ......................................................................................... 22
- Liquidated Damages (recovery from Contractors and LD products available) .................. 23
- Cost Overrun Insurance specific product offered by Munich Re. ....................................... 25
- Integrated Project Insurance (IPI) ..................................................................................... 26
- Professional Indemnity insurance ........................................................................................ 28

Conclusion ................................................................................................................................ 29

Information Sources .................................................................................................................. 30
Executive Summary

For most construction projects, everything runs well, the project finishes on time, within budget delivering what the client intended however some do not run well, finishing years after planned completion date with a significant cost overrun.

Significant cost overrun can impact the client, the contractor as well as insurers yet the problem appears to be on the increase and almost accepted throughout the construction industry.

How do these cost overruns arise and are they within the control of the contracting parties? How does insurance provide protection for cost overrun and any associated factors?

This paper attempts to identify the main reasons of cost overruns in construction projects, how these are currently addressed by contractors, project owners and insurers and identify measures that can be taken to help prevent cost overrun as well as looking at some of the insurance solutions available currently and may be available in the future to help alleviate what is becoming a growing concern for all in the construction sector.
Cost overrun in the Construction Industry

What is Cost Overrun

Cost overrun can be defined as a cost increase or budget overrun, including unexpected expenses incurred in excess of the budget amount due to an underestimation of the actual cost budgeting of construction projects. Generally, cost overruns have several reasons: errors in budgeting, expenses required beyond the scope of works, tools and equipment costs exceed project allocation. Cost overrun was discussed briefly as part of the IMIA WG Paper 77(12)-Entrepreneurial Risks.

The challenges for construction industry

Construction has become an important player in the economy of many countries, especially the developing ones. This industry contributes to the Gross domestic product (GDP) and employment rate of many nations and for this reason it is considered vital for economic development of any nation. Moreover, construction activities have become a significant market due to the fact that this industry procures products and material from other businesses in other sectors, locally, nationally and internationally.

Construction can be considered as a dynamic industry which is constantly facing uncertainties. With continuing instability of the world’s economic growth the difficulties connected with implementation of large investment projects are increasing. These uncertainties along with a large number of stakeholders in the projects can make cost and risk management challenging which consequently can result in cost overruns. Therefore, cost overruns are considered to be one of the most critical issues during the implementation of construction projects, after health and safety.

Over the years, there have been improvements in the management of construction projects; however, the problem of cost overrun is still a critical issue in the construction industry. But how big an issue is Cost Overrun?

There are a number of reports and studies relating to the issue of cost overrun and some of the findings of these are outlined below.

Cost overrun is prevalent on infrastructure projects, predominantly in the construction of pipelines and roads. Data obtained by Aalborg University (Denmark) during the study of 260 international investment projects, implemented between 1910 and 1998, found that in the majority of them (90%) the construction was completed with a cost overrun. The average
amount of overrun was 50%-100% of the original costs, but reached 1000%-2000% for some projects.

Some of the largest costs overruns that have occurred include the construction of the Suez channel (19 times), «Big Dig» highway in Canada (5 times), Engineering of supersonic airliner «Concorde», Great Britain - France (11 times). This isn’t just a recent area of concern, as most of the committee meetings on the construction of the Siberian railway started in 1897 were related to the increase of the original estimate (350 mln RUB). The final overrun (including the construction of China-Eastern railway) was 186%.

Table 1 below shows further examples of significant cost overruns.

Table 1: Examples of cost overrun as a percentage of the original estimated contract price

<table>
<thead>
<tr>
<th>Project</th>
<th>Cost overrun (% in comparable prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humber Bridge (UK)</td>
<td>175</td>
</tr>
<tr>
<td>Railway, Boston – Washington – New York (USA)</td>
<td>130</td>
</tr>
<tr>
<td>Big Belt railway tunnel (Denmark)</td>
<td>110</td>
</tr>
<tr>
<td>Chapel-en-le-Frith Motorway (UK)</td>
<td>100</td>
</tr>
<tr>
<td>Channel Tunnel (UK / France)</td>
<td>80</td>
</tr>
<tr>
<td>Metro line in Mexico</td>
<td>60</td>
</tr>
<tr>
<td>Oeresund line (Denmark)</td>
<td>70</td>
</tr>
</tbody>
</table>

For transport infrastructure project, where 9/10 projects experience cost overrun, final construction costs are on average 30% higher than initial cost (in particular, railways – average of 45%, tunnels and bridges – on average 34%, highways – on average 20%).

According to the expert’s cost overrun of around 20%-30% is quite acceptable for the construction of large projects, and during the construction of more complex projects such as underground or underwater tunnels, cost overruns of double the estimated cost is “normal”.

What is interesting to note is that high profile projects such as the construction of Olympic Games venues and infrastructure are often beset by cost overrun.

Almost all Olympic games have resulted in cost overrun. For example, Olympic games in Montreal in 1972 were 796% over budget. [Flyvbjerg B. Stewart A., 2012].

What is unique for projects such as the Olympics is that they have fixed start dates, there is no opportunity for slippage in the programme. The figures demonstrate the balance
between time, quality and cost: with a fixed delivery date and a desire to maintain quality, what results is a cost increase, i.e. cost overrun.

The Table overleaf shows information about Olympic expenses. In order to ensure comparability the following data is included into this category:

a) Expenses for organization and holding of the Olympic Games (for example, contribution to the organizing committee, security, ceremonies, management and other expenses).

b) Construction of Olympic objects (stadiums, tracks, media-centers, Olympic villages) and supporting infrastructure. Non-Olympic expenses, such as costs of construction of railways and highways, airports, hotels, development of tourist infrastructure and other for provision of comparability of data are not included into Olympic expenses. Nevertheless the reference data for Olympic Games of 2004, 2008, 2010 and 2014 are presented including all these costs (costs for the Olympic Games in general).

c) All the costs are shown in USD and from 2012.
Table 2. Expenses and over expenditure for Olympics 1988-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Olympic</th>
<th>City</th>
<th>Country</th>
<th>Olympic expenses (USD bn)</th>
<th>Over expenditure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Plan</td>
<td>Actual</td>
</tr>
<tr>
<td>1988</td>
<td>XV Winter</td>
<td>Calgary</td>
<td>Canada</td>
<td>0,67</td>
<td>1,07</td>
</tr>
<tr>
<td>1992</td>
<td>XVI Winter</td>
<td>Albertville</td>
<td>France</td>
<td>0,86</td>
<td>2,03</td>
</tr>
<tr>
<td>1992</td>
<td>XXV Summer</td>
<td>Barcelona</td>
<td>Spain</td>
<td>0,69</td>
<td>2,93</td>
</tr>
<tr>
<td>1994</td>
<td>XVII Winter</td>
<td>Lillehammer</td>
<td>Norway</td>
<td>0,54</td>
<td>2,03</td>
</tr>
<tr>
<td>1996</td>
<td>XXVI Summer</td>
<td>Atlanta</td>
<td>USA</td>
<td>1,64</td>
<td>4,05</td>
</tr>
<tr>
<td>1998</td>
<td>XVIII Winter</td>
<td>Nagano</td>
<td>Japan</td>
<td>1,57</td>
<td>2,45</td>
</tr>
<tr>
<td>2000</td>
<td>XXVII Summer</td>
<td>Sydney</td>
<td>Australia</td>
<td>2,36</td>
<td>4,48</td>
</tr>
<tr>
<td>2002</td>
<td>XIX Winter</td>
<td>Salt Lake City</td>
<td>USA</td>
<td>1,90</td>
<td>2,45</td>
</tr>
<tr>
<td>2004</td>
<td>XXVIII Summer</td>
<td>Athens</td>
<td>Greece</td>
<td>2,00</td>
<td>3,20</td>
</tr>
</tbody>
</table>

Reference data of Olympic expenses in common

<table>
<thead>
<tr>
<th>Year</th>
<th>Olympic</th>
<th>City</th>
<th>Country</th>
<th>Olympic expenses (USD bn)</th>
<th>Over expenditure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4,65</td>
<td>13,50</td>
</tr>
</tbody>
</table>

2006 | XX Winter | Torino | Italy | 2,40 | 4,37 | +82,0%                |
| 2008 | XXIX Summer | Beijing | China | 5,64 | 5,86 | +4,0%                |

Reference data of Olympic expenses in common

<table>
<thead>
<tr>
<th>Year</th>
<th>Olympic</th>
<th>City</th>
<th>Country</th>
<th>Olympic expenses (USD bn)</th>
<th>Over expenditure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16,30</td>
<td>43,19</td>
</tr>
</tbody>
</table>

2010 | XXI Winter | Vancouver | Canada | 2,10 | 2,45 | +17,0%                |

Reference data of Olympic expenses in common

<table>
<thead>
<tr>
<th>Year</th>
<th>Olympic</th>
<th>City</th>
<th>Country</th>
<th>Olympic expenses (USD bn)</th>
<th>Over expenditure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2,88</td>
<td>6,08</td>
</tr>
</tbody>
</table>

2012 | XXX Summer | London | Great Britain | 3,93 | 15,39 | +290,0%               |

All Olympics on average

<table>
<thead>
<tr>
<th>Olympic</th>
<th>Olympic expenses (USD bn)</th>
<th>Over expenditure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,02</td>
<td>4,06</td>
</tr>
</tbody>
</table>

Summer Olympics on average

<table>
<thead>
<tr>
<th>Olympic</th>
<th>Olympic expenses (USD bn)</th>
<th>Over expenditure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,71</td>
<td>5,98</td>
</tr>
</tbody>
</table>

Winter Olympics on average

<table>
<thead>
<tr>
<th>Olympic</th>
<th>Olympic expenses (USD bn)</th>
<th>Over expenditure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,43</td>
<td>2,41</td>
</tr>
</tbody>
</table>

2014 | XXII Winter | Sochi | Russia | 5,14 | 13,9 | +171,0%               |

Reference data of Olympic expenses in common

<table>
<thead>
<tr>
<th>Olympic</th>
<th>Olympic expenses (USD bn)</th>
<th>Over expenditure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13,10</td>
<td>51</td>
</tr>
</tbody>
</table>
What are the causes of Cost overrun?

The majority of causes of cost overruns originate during the feasibility / planning stage of a project. The below shows some of the main reasons for cost overruns on construction projects.

![Cost overruns diagram](image)

**Figure 1: Reasons for Cost overrun occurring on a construction project**

Project specific causes on transportation construction projects are characterised by a number of features which are also inherent for most large projects. They are typically:

- Have a high contract value;
- Influenced by complicated natural conditions and sufficient territorial extension;
- Involve a high level of legal regulation;
- Include a complicated system of relationship with suppliers and contractors, forming the chain of inter-sectoral interactions;
- Impact of the project on the vital activity of the population living in the construction area;
- Can have a high level of influence on environment
Table 3 below shows some examples of major projects that experienced cost overrun and the reason for these cost overruns.

<table>
<thead>
<tr>
<th>Project</th>
<th>Original cost</th>
<th>Growth %</th>
<th>Rise in cost primary reasons</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The communication tunnel across the river Irtysh, Kazakhstan</td>
<td>$ 3,5 mln</td>
<td>71,4</td>
<td>Change of design solutions for improving environmental safety (replacement of crawl space to tunnel)</td>
<td>Facts of tunnel flooding and the suspension of construction due to lack of funding from the Kazakh government, is likely to lead to a further rise in the project cost</td>
</tr>
<tr>
<td>The elimination of the site “Razmyv” (reconstruction work in the St. Petersburg Metro construction), Russia</td>
<td>1,0 bln. Rub.</td>
<td>46,4</td>
<td>Downtime due delays in funding from the city authorities</td>
<td>Rise in price evaluated within the amount of financing for 2004</td>
</tr>
<tr>
<td>Ring road (KAD), St. Petersburg</td>
<td>24,0 bln. Rub.</td>
<td>457,0</td>
<td>Clarification of the technical solutions in connection with complex geological conditions, a long chain of suppliers, downtime due to</td>
<td>Ring Road Construction had to be completed in 2005, the full commissioning was scheduled for 2007. Construction was finished in 2013. Cost about 135 bln. Rub. There is plans for broadening and modernisation.</td>
</tr>
<tr>
<td>Highway “Big Dick”, Boston</td>
<td>$ 2,6 bln</td>
<td>461,5</td>
<td>Rising prices, additional ecological requirements, the cost of maintaining order and security</td>
<td>Estimation is made according to the April 2003 - at the time of bridge and tunnel commissioning, and the almost total completion. Massachusetts Administration is currently conducting a detailed investigation of the causes of rise in price</td>
</tr>
</tbody>
</table>

Table 3: Examples of Cost Overrun and associated reasons

The data in Table 3 allows us to make the following conclusions. Lack of clarification of technical solutions at design stage is the most frequent reason for the rise in the cost of project. Stoppages and delays in construction process, which lead to fines, penalties and even obsolescence of already constructed buildings is also a frequent cause of cost overrun. Changes in building regulations and specifications during the construction phase can have an impact on the overall cost of the project, quite often resulting in an increase. The longer
the duration of the project, the higher possibility of changes in legislation, affecting the overall cost of delivery.

With regards to the cost overrun on the Olympic Games the main reasons for these were:
- High cost of the project;
- Inflation., typical for economics;
- Devaluation of national currencies;
- Unique objects, requiring unique construction methods, designers, materials, etc.;
- Influence of complicated environmental conditions and sufficient territorial extension e.g. Large temperature differences, soil conditions, strong winds, large linear risks (i.e. pipelines, railways)
- Corruption;
- Unexpected expenses connected to the land acquisition;
- High level of influence on environment.

Whilst prevalent in infrastructure projects cost overrun occurs across all construction projects including those in the oil and gas industry but the reasons for cost overrun can be heavily influenced by the fluctuation and sometimes volatile cost of the raw material.

Forecasting of the cost of development of raw material deposits is complicated by a range of economical, territorial and macro economical specialties. The process of commissioning of raw material deposits in the beginning of the 21st Century is more complicated than in the 1970s and the cost price of a ton of explored reserves of hydrocarbon feed is increasing year on year.

Oil field development is usually implemented in very severe environmental conditions, a great distance from large settlements. The delivery of equipment and labour to the construction site may only be possible for short periods owing to seasonal access by road, meaning any delay may require air shipment thereby resulting in potential unexpected cost increase. Other factors include lack of power lines needed for a continuous energy source which, for projects requiring significant energy consumption, could lead to a serious increase of cost of a project cost. Inaccessibility of most oilfields (or mines) requires expensive road (and or rail) infrastructure to be developed at the first stage of the project, the cost of which can be underestimated if proposed routes are challenging to construct.

The rise in cost of construction have been further exacerbated by the tightening of the regulatory framework in respect of meeting the ecological requirements in all areas of construction and increase of expenses connected with protection of the environment have become a serious factor over the past decades. These are shown in Table 4 below.
Table 4: Examples of Cost Overrun in EAR projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Original cost</th>
<th>Growth, %</th>
<th>Rise in cost primary reasons</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Baku-Tbilisi-Ceyhan&quot; (Azerbaijan, Georgia, Turkey)</td>
<td>3,2</td>
<td>12,5</td>
<td>The adoption of additional security measures in Georgia, the depreciation of the dollar against other major world currencies, the rise in prices of equipment and services in the oil sector, environmental violations</td>
<td>Project consideration will continue</td>
</tr>
<tr>
<td>The development of gas condensate field &quot;Shah Deniz&quot; (Azerbaijan)</td>
<td>3,2</td>
<td>25,0</td>
<td>Rise in cost of construction materials, the devaluation of the US dollar - the currency in which has been estimated project cost</td>
<td>According to a project partner, BP, appreciation mainly affected the construction of TPG-500 platform</td>
</tr>
<tr>
<td>&quot;Snovit&quot; project - construction of a liquefied natural gas (Norway)</td>
<td>5,8</td>
<td>30,0</td>
<td>A significant change of design decisions, changes in tax conditions</td>
<td>X</td>
</tr>
<tr>
<td>Trans-Alaska Pipeline System (USA)</td>
<td>0,9</td>
<td>788,9</td>
<td>Additional costs for the poles installation for the land part of the pipeline, according to pipeline protection measures against explosion in an earthquake, rise of prices</td>
<td>X</td>
</tr>
<tr>
<td>Construction of a major pipeline system (first stage) (Russia)</td>
<td>0,4</td>
<td>20,7</td>
<td>Rise of prices, change in the design of hydraulic structures, clarification of technical solutions to improve the reliability and ecological security of the system, cost of necessary port infrastructure</td>
<td>Along with the overruns on individual articles there was a significant savings</td>
</tr>
<tr>
<td>Caspian Pipeline Consortium (CPC) (Russia, Kazakhstan)</td>
<td>2,1</td>
<td>76,0</td>
<td>Lack of coordination of positions of shareholders, mismanagement, price increases</td>
<td>Largest Oil Project in Kazakhstan is being developed under the terms of the production sharing agreement (PSA). The initial cost calculation was made at the beginning of the last decade</td>
</tr>
<tr>
<td>Experimental-industrial Programme offshore field Kashagan (Kazakhstan)</td>
<td>7,0</td>
<td>114,0</td>
<td>Rise in prices, the need to additional geological surveys, tightening in obtaining (or absence ) of necessary approvals and permits etc.</td>
<td></td>
</tr>
</tbody>
</table>
Does the type of contract have an impact on cost overrun?

The type of contract used for the construction can play an important factor with regards to cost overrun as it can determine where the risk lies (contractor or project owner) and the impact of cost overrun on all parties in terms of financial recovery and fines and penalties (e.g. Liquidated Damages (LDs)).

The main types of construction contracts and who is responsible for cost overrun are shown in Table 5 below.

<table>
<thead>
<tr>
<th>Contract Type</th>
<th>Brief Description</th>
<th>Responsibility for Cost overrun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guaranteed Maximum price</td>
<td>Cost type contract, contractor compensated for actual costs incurred plus a fixed fee subject to a predetermined ceiling</td>
<td>Contractor unless agreed by formal change order</td>
</tr>
<tr>
<td>Lump Sum</td>
<td>Project of a specified scope delivered for a fixed price</td>
<td>Contractor unless agreed by formal change order</td>
</tr>
<tr>
<td>Unit Price</td>
<td>Based on estimated quantities and their unit price</td>
<td>Project Owner if quantities and values increase from originally estimated</td>
</tr>
<tr>
<td>Cost Plus</td>
<td>Based on actual cost plus an amount for contractor overhead and profit</td>
<td>Project Owner if quantities and values increase from originally estimated</td>
</tr>
<tr>
<td>Cost-reimbursable Alternative</td>
<td>Contractors are paid for the work with a mix of reimbursable and fixed or incentive costs</td>
<td>Project Owner as this type of contract is used when on the general scope of work is defined and there is uncertainty around the detail.</td>
</tr>
<tr>
<td>Integrated / Alliance</td>
<td>Owner, contractors and key stakeholders are equal partners – see later in the paper for more detail on this new contractual approach</td>
<td>All Alliance parties</td>
</tr>
</tbody>
</table>
Liquidated Damages and its interface with cost overrun

Liquidated Damages (LD) are pre-agreed fixed sums payable by a contractor to an owner in the event of a contractor caused delay. They are a benefit to the owner as they provide an incentive for the contractor to complete the project on time. Most often, the term "liquidated damages" appears in a contract, and often is the title for a whole clause or section. Parties to a contract use liquidated damages where actual damages, though maybe real, are difficult or impossible to prove.

It should be noted that the intention of LDs is not to provide a revenue stream for the owner to recover project cost overruns, unless the cost overrun occurs as a result of contractor caused delay. An example of this could include use of incorrect equipment (that which was not specified) resulting in a delay in completion arising from the requirement to replace it.

There are already a number of reference documents on liquidated damages produced by IMIA should you want more information on this topic:

- IMIA Presentation 2008 – Liquidated Damages (Oscar Treceno and Richard Radevsky)
- IMIA WGP 77(12) – Entrepreneurial Risks
- IMIA WGP 88 (14) – Holistic Covers in Engineering Insurance

Feasibility Studies & Risk Management as a means to mitigate cost overrun

As explained previously there are various reasons cost overrun can occur to a construction project, many of which are within the control of the project team to mitigate from the initial bid stage. Below are some examples of reasons, as well as possible solutions that can be implemented by the project team.

<table>
<thead>
<tr>
<th>Reason for cost overrun</th>
<th>Possible solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of formal procedures, systems and management for tender submissions and estimates</td>
<td>Adopted tender procedure with reviews and approvals at key management levels.</td>
</tr>
<tr>
<td>Lack of full comprehension of the complexity / scope of the project including labour and equipment requirements as well as the buildability.</td>
<td>Checklists / reviews / signoffs to ensure all aspects of the project have been estimated.</td>
</tr>
<tr>
<td>Reason for cost overrun</td>
<td>Possible solution</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Utilisation of outdated unit price data</td>
<td>Ensure most up to date unit prices are used for estimating contract price</td>
</tr>
<tr>
<td>Lack of full appreciation of the contract conditions including liquidated damages provisions and variation orders.</td>
<td>Ensure tender documents and contracts are reviewed at the appropriate level with cost management involvement.</td>
</tr>
<tr>
<td>Poor communications and coordination between the various contracting parties</td>
<td>Ensure regular ongoing communication throughout the bidding and execution stages of the project</td>
</tr>
</tbody>
</table>

This isn’t meant to be an exhaustive list but a selection of some of the easier to manage risks that if addressed at an early stage can help to reduce, if not eliminate cost overrun and one solution that can be applied to many of the reasons for cost overrun is the provision of an adequate contingency within the budget for the project.

Underlying all of the reasons for cost overrun is either a lack of risk management or control of risk management. Most, if not all of the reasons for risk management can be mitigated, if not eliminated entirely if adequate risk management is embedded within the project team from the start.

**Project Finance Issues**

Many large projects rely on project finance to fund the construction of the project. This amount will be agreed prior to inception of the project as many projects cannot commence construction until financial close is achieved. Should there be an increase in the cost of delivering the completed project there could be a shortfall in finance available, potentially resulting in a further delay to the construction period whilst additional finance is sought.
Cost and Schedule overruns and their impact on the insurance contracts

Consistent cost and time overruns are not the best use of the financial resources. To manage cost overruns properly is very important both for public and private funded projects. In the current economic downturn they are particularly detrimental.

The problem can be summarized as follows: managing medium to large scale construction projects is a very difficult due to:

1. Misinformation and a lack of statistics about the cost overruns
2. Systematic investigation into the different explanations for cost overruns has not yet been conducted.

Various reasons for construction costs and schedule overruns have been discussed in Section 1 and this section will focus on what impact these cost overruns have on the insurance contract and what can be done to reduce the risks and exposures to insurers.

Type of impact on the insurance contracts.

In line with the conventional methodology, the inaccuracy of cost estimates is measured as the size of cost overruns. Cost overrun is measured as actual out-turn costs minus estimated cost as a percentage of estimated costs. Actual costs are defined as real, accounted construction costs determined at the time of project completion; estimated costs are defined a budgeted or forecasted construction costs determined at the time of the decision to build.

Taking into consideration the given definition, we can underline several parts which are under the impact of the cost overrun:

- Sum insured
- Risk exposure
- Claims settlement procedure

As cost overrun is normally associated with delay, the project period could also be affected.

Sum Insured

As the sum insured is usually defined in the inception of the policy, it is equal to the TCV (ECV)/total contract value (estimated contract value). The premium under the policy is calculated on this basis and can be changed only if the sum insured has been changed. That's why it is so important for the insurer to monitor the change of TCV and change the sum insured in case the cost overrun is noted. If the TCV is not increased as it escalates, if
a claim occurs there could be underinsurance and a reduction in the claim settlement amount, not to mention a lack of premium for insurers. For example, underwriters could ask the insured to inform Insurers quarterly about the progress in contract works, about any changes in the construction budget and in construction schedule. In most cases it is obvious that the prolongation of the construction period causes the increasing of the budget.

As we know in some cases Insured and Insurer agreed on the provisional sum insured or escalation clause to help the Insured with the avoidance of Underinsurance Clause. In cases where the projects are susceptible to cost overrun underwriters should be very careful in granting this extension.

Also as discussed earlier cost overrun can be caused by the project change. In this case the underwriter should be very attentive to the description of the insured object. Usually some changes should be made to the Policy to reflect the change in the insured construction works.

**Risk exposure**

If cost overrun is caused by major changes in the project scope, and not just poor management / non damage delay, there could some underestimated exposure. For example during the road construction the design plan could be changed to include piling. This can lead to the increase in both the construction budget (sum insured) and in risk exposure. This should be considered during discussion of the additional premium payment.

Also it should be noted that cost overrun connected with the changes in project design can cause difficulties when discussing the question of material change of risk. This question is very important if the policy period has to be increased or in case of claim settlement. Example of material change of risks: the road reconstruction project initially hasn’t included the tunneling and after some changes in design and increase in costs the underground structure became the part of the project.

In most cases the cost overrun is linked with schedule overrun. Of course for the Insurer this means an increase in exposure, skewed premium earning patterns and accumulations, particularly with regards to nat cat.

One of the key points of the underwriting risk assessment is the construction costs and its detailed components. Possible maximum loss (PML) calculations are not possible without an understanding of the object and costs. With an increase in construction cost there could also be an increase in the PML, thereby increasing the exposure of the insurer, leaving them potentially over-lined. If this is the case then additional capacity may be required to ensure the insured has coverage for the whole project and this is extremely challenging to obtain.
after a project has started and may even not be possible if the project has had losses or is close to testing and commissioning for EAR projects.

Claims settlement procedure

The discussion of the material change of risk with the Insured prior to a loss occurring is very important to avoid any disputes regarding material change in risk and value insured.

**What can be done to reduce the risk as part of the underwriting process?**

It should be highlighted that as one of the main causes of the cost overrun is the lack of detailed information of the project and the description of worst case scenario, additional feasibility study should be made by the risk engineers and underwriters before granting the coverage. This is of extreme importance especially when granting DSU coverage.

Through continuous monitoring of the progress of the construction it will be easier to identify if any significant cost overrun will occur and the reasons behind it.

Reasons for cost overrun could be divided into those that do not increase the degree of risk and those that do, for which premium and contract changes may be required.

**Reasons for cost overrun which may not increase the risk**

- Inflation, sharp inflation in the country where the construction is done.
- Significant changes in exchange rates of national currencies.
- Sudden and unseasonable changes of climatic conditions (abnormal for this time of year cold, heat, the amount of precipitation exceeding the climatic norm, etc.).
- Changes in the cost of raw material extraction used in the manufacture of construction materials.
- Changes in the tax system. For example, changing the order of tax payments or tax deductions size.
- Strikes of freight transport workers, construction personnel or workers of other areas, which could increase the duration of construction.
- The sudden need to drain the area of building, supply additional infrastructure, carrying out forced irrigation, etc.
- A sharp change in the cost of third party services used in the construction process.

In our opinion, the approach to such an increase could be on a pro-rata basis without changes in insurance coverage.
Reasons for cost overrun which may increase the risk

- The emergence of innovative/prototype technology in construction or in manufacture of materials and equipment.
- New facilities, which are not included in the original budget.
- Changes in the project, affecting the design and manufacturing processes of objects.
- Changes in construction legislation, which can stop the process of object construction for a time of additional documentation registration and/or enforcement of construction procedures in accordance with new regulatory requirements.
- Natural disasters: fires, tsunamis, hurricanes, tornadoes, earthquakes, etc. which degree of influence has not been considered in the original project.
- And other factors significantly affecting the risk increase.

However, if the following changes to the project are identified then Underwriting requires an individual approach, and the changes to the coverage should be considered.

As mentioned in Section 1, the second important focus should be regular risk monitoring. This can help to avoid a lot of problems with the initial assessment of the risk and it should also address any material change of risk.

Close cooperation with the Principal/Contractor can help underwriters with the assessment of risk and dialogue should be frequent.

Insurance Clauses

Cost overrun can impact the construction insurance policy as there will be changes to the original policy in terms of increase in sum insured, period and potentially a material change in the risk, and thereby exposure to insurers.

Below are some ways the impact of cost overrun can be covered by an insurance policy.

Automatic Increase Clause

Automatic increase clause is widely used in many project insurance policies and is almost standard.

According to many underwriters 10% increase is a border area, where the rise in the cost of projects occurs due to inflation and not big project changes, that have not much impact on the risk component, however the percentage allowed has been increasing over the past few years up to 30% in some cases.

Example of Automatic Increase of Sum Insured clause:
If at any time during the Period of Insurance the value of the Insured Property exceeds the value declared to the Insurers at inception then the Sum Insured shall be automatically increased by a similar amount not exceeding 10% (per cent) of the Sum Insured (without notification to the Insurers), or further amount as may be subsequently agreed by Insurers, subject to payment of the appropriate additional premium in accordance with General Condition 5 of this Policy.

Herewith underwriters agree to Automatic Increase of Sum Insured up to 10% of the original value of the project for free. Any increase in Sum Insured exceeding 10% of the values declared to Insurer at inception will attract additional premiums to be agreed by the Insurer.

In this case the underwriter must clearly identify increase reasons and its risk component.

In case of significant changes (in the general practice it's more than 10-15%) it can become a big problem for «one location site construction» insurance where PML starts to grow proportionally to the value of the object.

**Average Clause**

In practice, it's quite difficult for the Insured to calculate the actual cost of the project at the beginning and even during the construction period.

At the time when the loss occurs, the actual cost of object/part of it reconstruction may be higher than originally declared to the Insurers. The Insurers may reasonably apply the pro rata rule, using the condition of proportional payment.

*Example of Average clause:*

*This Policy is subject to the condition of average, that is to say, if the property covered by this Insurance shall at the time of any loss be of greater value than the Sum Insured hereby, the Assured shall only be entitled to recover hereunder such proportion of the said loss as the Sum Insured by this Policy bears to the total value of the said property.*

The use of this cause can however be controversial and not result in an agreeable solution for either party to the insurance. A more positive outcome for all parties could be reached by the Insurer's rejection of pro rata rule by claims payment provided there is open and transparent communication between all parties throughout the claim process.

**Premium Adjustment**

*Example of Premium Adjustment Clause:*

*The premium to Sections I and II hereon is a deposit calculated at the agreed rate applied to the Estimated Contract Value at inception.*
As soon as reasonably practicable after the completion of the Project the Insured shall advise the Insured(s) of the final insurable project cost. The Deposit Premium will be adjusted by applying the agreed premium rate to the final insurable project cost and any difference between the final and deposit premiums will be paid to the Insurers or repaid to the Insured as the case may be.

Even though the above conditions and endorsements may be applied to the policy, in any case, an appropriate control of the construction process by the Insurer is required: regular surveying activities, keep in touch with the Insured, analysis of reports on the progress of construction and other activities that allow to handle risk control.

**Project Alterations and Amendments**

To ensure that Insurers are kept informed of changes to the scope of the project (and thereby monitor potential cost overrun) a clause such as the one below could be included in the construction insurance policy.

*Example of Alterations and Amendments Clause:*

*Insurer/ Reinsurers agree to hold covered all amendments and alterations to the Project specification subject to the terms and conditions of the Policy for a period of 60 days from the date of such amendments and/or alterations, subject to the Principal Assured notifying Insurer/ Reinsurers of any material and/or significant alterations promptly within the 60-day period. In order for coverage for such material and/or significant amendments and alterations to extend beyond 60 days, the Principal Assureds and Insurer/ Reinsurers must agree upon the additional premium to be applied.***

**Time Extension**

As cost overrun is normally associated with time overrun / project delay, the wording of the policy period within a construction insurance policy normally allows for an element of period extension, an example of which is given below.

*Example of Period of Insurance section of construction insurance policy:*

*From XXXXXX to Practical Completion or as defined in the Contract (anticipated at XXXX days). All dates inclusive in Local Standard Time at the Project Site at 00.01am. Extensions in anticipated construction Period of Insurance to be covered at pro-rata additional premium.*

This will give a degree of comfort to the Insured in ensuring insurance coverage remains in force should there be a non-damage delay to the project.

**DSU**

Delay in Start-up coverage provides indemnity for fixed costs, debt service or loss of profits as a result of a delay to the completion of a construction project arising out of a material loss or damage event.
In the event that there is cost overrun on a project, and additional project finance is obtained to ensure funds are available for the full contract cost, this could have an impact on the DSU coverage provided in that the full DSU limit of indemnity could be used to offset additional costs incurred by the project owners for the additional finance obtained.

It is therefore important that if the contract value starts to increase above an acceptable level (of say 10% the original cost) discussions are had with the Insured regarding any impact on project funding and hence DSU. Changes to the DSU policy may be possible with open and honest dialogue but it may also be worth considering an average clause in the DSU section to mitigate insurer’s exposure in the event of underinsurance by the Insured.
What additional insurance solutions could be offered or developed?

Reinsurers view of cost overrun

Many insurers rely on reinsurance in order to grow and develop their insurance offering so before new products can be developed and written their view is often sought.

For many insurers cost overrun is a specific exclusion on their construction insurance treaty policy. Below are the views of 2 of the largest engineering lines treaty reinsurers on why this is the case.

“Insurance coverage has the intention to indemnify the insured for losses, occurred in a sudden an unforeseen manner and thus impossible to prevent. Cost overrun in general is a controllable risk (as discussed above), if the contractor does a diligent work and maintains a sustainable business. Almost all reasons for a cost overrun are related to bad planning, negligence, ignorance or incompetence. Some of the major reason for cost overrun are the following ones:

1. Scope change
2. Faulty contractual management system
3. Underestimating the Project Complexity
4. Lack of backup plan
5. Lack of resource planning
6. Inaccurate or overly optimistic initial estimates
7. Movements in "the economy"
8. Poor project management
9. Poor cost control
10. Inappropriate and inadequate procurement
11. Incomplete or inaccurate engineering

None of the above results from a sudden and unforeseen physical damage to any one of the insured equipment. Therefore as a general rule it can be said, that cost overrun forms part of the entrepreneurial risk. It is the entrepreneur/contractor/insured, who is responsible for controlling and maintaining the project schedule and the budget and thus avoid any kind of cost overrun. If such kind of cost overrun coverage will be given to an insured, it will reduce his attention/commitment and increases his temptation to neglect a proper planning and supervision of the project.

Therefore, the coverage of cost increase has to be excluded and can’t be given via an Engineering insurance policy.”

“Cost Overrun Insurance is a specific exclusion on construction treaties based on both poor lost history on contingency covers such as this one in the past (losses in excess of $100m for one reinsurers’ share) as well as our view on this cover and its insurability. We view cost
overrun as an entrepreneurial risk with potential for moral hazard. The alignment of interest is not always there and re/insurers are clearly disadvantaged when it comes to accessing information and the ability to assess the risk. From a risk transfer perspective, there are influence factors that could potentially be insured (i.e. factors clearly outside of the contractor's control) but assessing all potential factors is virtually impossible."

Until cost overrun is viewed more positively by engineering lines reinsurers it is unlikely that a market wide product will be developed and marketed by insurers. That being said there are some products available that can cover cost overrun exposure but these are mainly for smaller construction projects. Details of these are given below.

**Liquidated Damages (recovery from Contractors and LD products available)**

As mentioned in Section 1 LDs are not intended to be a mechanism for recovering cost overrun, however if cost overrun arises out of a contractor caused delay then the LDs could be used to offset any increase in project cost experienced by the contractor.

LD's are widely regarded as a type of entrepreneurial risk and therefore uninsurable – and is usually excluded from the Third Party Liability sections of construction policies (see sample exclusions from Swiss Re and Munich Re policies)

**Exclusions**

**Swiss Re EPI Wording – TPL Section**

*Insurers will not indemnify the Insured in respect of:*

- any liability arising under penalty or liquidated damages clauses in any contract, or any punitive of exemplary damages;

- any liability assumed under contract which imposes upon the Insured liability which would not otherwise have been incurred by the Insured;

**Munich Re Comprehensive Project Insurance Policy – Section 2 TPL**

*The following shall be excluded from the cover provided by this section:*

- Any fines, penalties, liquidated damages or damages for breach or non-performance of contract;
Liquidated Damages in insurance policies

However, LD cover is commonly requested – especially with increasing Public Private Partnership contracts – where the contractor is also part of Special Purpose Vehicle – and takes on more risk (build, own, operate, maintain). LD cover will help to keep the contractor solvent in the event that high damages are triggered due to late completion. The engineering insurance market has previously provided liquidated damages cover – but suffered unsustainable and disproportionately poor underwriting results.

Underwriting Considerations

Thorough underwriting is required in order to provide LD cover: The first aspect is to understand what liabilities the contractor holds within the contract – and the contractual risk share between parties. Second is to underwrite the project in detail – competency, programme (and amount of float), technique – etc.

A potential for moral hazard arises because the financiers, clients and contractors have access to much larger information than insurers – this may lead to anti-selection, i.e. only buying LD cover for high risk cases. A potential way of reducing this risk is to provide LD cover on an annual basis for a contractors’ entire portfolio of work.

Liquidated Damages and DSU coverage

As the DSU cover is purchased by the main principal, the DSU policies are usually structured to offset the LD payments. The contractor pays the LD’s to the client and this amount reduces the amount of indemnity paid by insurers. However, LD’s exclusions are gradually being bought back in. An example of buyback clauses is shown below:

Subject otherwise to the Terms of this Contract of Insurance, the following Memoranda are to be incorporated in and are deemed to form part of this Contract of Insurance:

1. Liquidated Damages
   Subject to any contractual obligation to the contrary, the indemnity hereunder shall be reduced by the amount of any liquidated damages for Delay received by the Principal from the Contractor in respect of the Indemnity Period. Provided that:

   i) such reduction shall not apply in respect of any such liquidated damages received in respect of the Waiting Period hereunder;
   ii) in respect of each day of the Indemnity Period subsequent to the Waiting Period such reduction shall not exceed the daily amount of the indemnity otherwise payable hereunder;
   iii) such reduction shall not apply to the extent that the Principal himself has an uninsured obligation to pay liquidated damages for delay in accordance with the terms of an off-take, “take or pay” or similar contractual agreement.
Liquidated Damages and Professional Indemnity coverage

Policies may specifically exclude LD’s or allow a wider coverage LD’s through a contractual liabilities exclusion – "liability which the insured has assumed under a contract unless such liability would have attached in the absence of such contract". Since LD’s are the pre-estimation of sustained losses, this clause could be interpreted to cover LD’s.

Liquidated Damages Key Messages

- LD’s are a contingency type cover – and generally seen as an entrepreneurial risk of the contractor. It is usually excluded from engineering insurance policies.
- If provided, a high level of due diligence is required throughout the underwriting process – in order to fully understand the risk.
- Financiers, clients and contractors have a greater level of information. In order to diversify risk and prevent anti selection, it may be more suited to provide overarching LD cover to a contractor across their whole portfolio on an annual basis.
- LD cover has been provided in the past – and there are case studies (Wembley Stadium UK) – where the broad and complex nature of the cover have led to large insurance losses.

Cost Overrun Insurance specific product offered by Munich Re.

Getting accurate budget at the outset of the project to secure funding is critical component of project success – and decisions made at this funding stage can drive the level of risk for cost overrun.

Despite the statistics given in Section 1 showing that this is outside the range of insurable interests – and more in the entrepreneurial risk taking arena, there is an insurance product on the market which covers "cost overrun":

Basis of cover

The cover is for unplanned cost increases in the construction phase of a project. The insurer works in partnership with a software provider – who are experts in Building Information Modelling (BIM) – construction planning with integrated cost and time controls.

The cover requires intensive work at the planning phase of the project – data required includes: planning data, material requirements, statement of work, requests for quotes, schedules and costs. All parties work together at this planning stage to mitigate interface problems. Using the BIM software, planning errors and missing information is identified early – thereby transferring trouble shooting to the planning stage and giving better cost
certainty. A complete virtual simulation of the project is run through the BIM software – establishing a baseline for the project. Then, if all preconditions are met, insurance cover is provided for the cost difference between the virtual simulation and the actual cost incurred for the project.

As can be seen from the description above, intensive due diligence at the very start of the project – even more than technical inspection services for IDI coverage. Complete access as part of the project team. In order to provide confidence on the risk share, a good alignment of interests should be in place – through a substantial self-insured retention and co insurance arrangement.

**Key Messages**

- Cost overrun on projects is a common occurrence with increased costs being a substantial percentage (or even multiple) of the original project cost. The cost overrun can be caused by a number of factors and this makes underwriting challenging.
- A product is available – but requires intensive due diligence and collaboration with project parties throughout the underwriting stage. The project team will consist of insurers and professional input from external parties (software providers) to understand the baseline conditions and underwrite the cost overrun risk. In terms of monitoring, ongoing involvement by insurers is required throughout the project period.

At the time of writing information surrounding whether any projects had been bound were not available.

**Integrated Project Insurance (IPI)**

The IPI product is a new concept in construction insurance that has been developed in the UK for projects that have an Alliance contract structure. The Alliance contract is key for the product to be available as it relies on the collective commitment of all members of the alliance, and the no blame / no claim culture to exist.

The idea behind the IPI product is that there is a seamless product for a project that provides coverage for all parties within the Alliance covering CAR, TPL, Latent Defects and Financial Loss, an element of this being cost overrun.
The thinking behind the product is that by virtue of the contract form being an Alliance, all parties are working towards a common goal sharing both the pain and the gain. As a result of this there will be collaborative working from project conception which will assist in mitigating many of the factors identified in section 1 of this paper as being the cause of cost overrun.

The below illustrates how the cost overrun element could be insured as part of the IPI policy.

![Image: Figure 2: The cover to be provided by the IPI product]

![Image: Figure 3: How cost overrun is covered within the IPI product]
Essentially, the Alliance team confirms the agreed target cost (being the solid line and the cost to the Client). The column on the left shows the reduction (waste reduction) in the project cost achieved through the collaboration of the Alliance members.

A gain share / pain share mechanism is agreed that incentivises all Alliance members to achieve the targeted outcomes. The central column shows how the gain share would operate should the actual cost be less than the target cost.

The final column shows how the cost overrun would be recoverable under the IPI product. Should the actual cost be greater than the target cost, the Alliance would retain up to a certain level (being the excess of the construction insurance policy) and the split of this would be determined in the gain share / pain share mechanism. Above this level, any cost overrun would be recoverable under the insurance policy up to the level of indemnity insured under the policy.

As with the Munich Re policy it is important that full underwriting information is obtain to allow interrogation of the sum insured, project programme and method statements can be undertaken to ensure that the targets of the Alliance are achievable and the level of cover provided is appropriate for the risk.

At the time of writing it is believed that one small UK Government project has been undertaken as an Alliance with the purchase of an IPI policy however no details could be found as to the exact details of the coverage provided.

**Professional Indemnity insurance**

Professional indemnity (PI) insurance is a product available for architects, engineers and designers to provide indemnity to them in the event the work and advice they undertake (or provide) results in a loss to their clients (and a claim is made against them in this respect).

Should an engineer’s estimate for the contract value be significantly underestimated (resulting in cost overrun) there may be a possibility of some financial recovery under their PI policy as a result of deficient advice.

An example of the wording in a PI policy is given below:

“The Insurer shall indemnify the Insured up to the Limit of Indemnity, for the Insured’s liability for compensatory damages, claimant’s legal costs and expenses and Defence Costs and Expenses arising out of, based upon or attributable to the failure of the Insured in the course of the Professional Services, to bring to the attention of any client any deficiency, alleged or otherwise, in the professional services of others, which failure gives rise to a Claim, first made against the Insured during the Period of Insurance and notified in accordance with the relevant terms and conditions of the Policy.”
Conclusion

The issue of cost overrun is clearly an issue for the construction industry and one that needs addressing at all levels of the project chain.

Ultimately responsibility for managing cost overrun lies with the risk management undertaken by the project delivery team and should be part of risk management meetings to monitor any severe unexpected rise in project cost.

For an insurance solution to be delivered insurers would need to be embedded into the project team at an early stage to ensure the information needed to underwrite the risk is available and understood fully by underwriters.

However until reinsurers are willing to accept cost overrun as a product for the construction insurance market any insurance solution will be slow and difficult to develop.
Information Sources

(Please note; some Links are to sites in Russian Language)


4. https://books.google.ru/books?id=RAV5P-50UjEC&pg=PA14&lpg=PA14&dq=Chapel-en-le-Frith+cost+overrun&source=bl&ots=RYAk1g4YbX&sig=aiJIB-6J_f-shIWSFL-7WOXld8&hl=ru&sa=X&ved=0ahUKEwiQ0LvShIrPAhUGWywKHWnYB6MQ6AEIHDA#v=у碌e&q=Chapel-en-le-Frith%20cost%20overrun&f=false


7. Jennings W. Mega-Events and Risk Colonisation Risk Management and the Olympics // CARR. - 03.2012. - [http://soton.academia.edu/WillJennings/Papers/248726/Mega-Events_and_Ris...](http://soton.academia.edu/WillJennings/Papers/248726/Mega-Events_and_Ris...)


11. Russian Federation Government Decree of 08.06.2006 №357 "On the Federal Target Program "Development of Sochi as a mountain and climatic health resort (2006 - 2014)".


14. Winter Olympic games 2014 [https://ru.wikipedia.org/wiki%D0%97%D0%B8%D0%BC%D0%BD%D0%B8%D0%B5_%D0%9E%D0%BB%D0%B8%D0%BC%D0%BF%D0%B8%D0%B9%D1%81%D0%BA%D0%B8%D0%B5_%D0%B8%D0%B3%D1%80%D1%8B_2014](https://ru.wikipedia.org/wiki%D0%97%D0%B8%D0%BC%D0%BD%D0%B8%D0%B5_%D0%9E%D0%BB%D0%B8%D0%BC%D0%BF%D0%B8%D0%B9%D1%81%D0%BA%D0%B8%D0%B5_%D0%B8%D0%B3%D1%80%D1%8B_2014)


16. Correcting the course of capital projects – PWC –October 2013