

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES



FACULTY OF TECHNOLOGY
DEPARTMENT OF CIVIL AND ENVIRONMENTAL
ENGINEERING

Assessment on Prolongation Cost Estimation Practice
for Road Construction Projects in Ethiopia

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October, 2014

ADDIS ABABA UNIVERSITY
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**Assessment on Prolongation Cost Estimation Practice
For Road Construction Projects in Ethiopia**

M.Sc. Thesis

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ABSTRACT

Road construction projects in Ethiopia are used to encounter considerable time and cost overruns when compared with their planned values. And, one of the main factors for cost overrun is found to be prolongation cost. Besides, in handling the prolongation cost claim, it can remain unsettled due to the calculation and presentation of damages, even after entitlement to recover additional compensation.

Having this, the research assess the problems in relation to justifying time delay, data recording and documentations, suitability of conditions of contract and methods of estimation in prolongation cost claim administration. So that; it identifies and understand gaps (problems and challenges) in estimating prolongation cost in road construction projects.

To address the problems, a questionnaire was designed and distributed to contractors, consultants and employers participating in road construction sector. To supplement the questionnaire, a desk study was conducted on prolongation cost claim documents.

Consequently; analysis of data are processed using simple statistical approach, examining, tabulating and categorizing based on the chosen measurement scale. And, Likert's scale was used to gauge the potential factors, together with, Kendall coefficient of concordance (W) to test correlation among the parties.

As a result, the findings show that; incomplete recording and documentation, unclear estimation methods and contractual provision are the main problems in justifying time delay and estimation of prolongation cost compensation. The practice of data collection and documentation becomes a problem due to lack of competent and experienced professionals and lack of awareness.

Estimation technique currently used is found out to be actual cost records. Where, there is lack of documents to estimate head office overhead, the Direct Method is found to be suitable with %age mark up for HOOH set in the contract for current road construction projects situation in Ethiopia.

PPA condition of contract needs improvement to handle prolongation cost estimation and claim, while FIDIC condition of contract is known to be good to administer prolongation cost issues.

So that the research implies the administration practice in prolongation cost claim needs a look in relation to data collection and documentation, local conditions of contract and adopt suitable estimation formula that harmonize the current situation.

Key Words: Prolongation cost, Acceleration, Inefficiency and Conditions of Contract

ABBREVIATIONS/ACRONYMS

ADOH	Average Daily Overhead
AH	Allocated Overhead of Pool Account
CMS	Cumulative Mean score
CoPA	Condition of Particular Application
DOR	Daily Overhead Rate
DRE	Dispute resolution Expert
EoT	Extension of time
ERA	Ethiopian Road Authority
FHWA	Federal Highway Administration
FIDIC	FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS,
GC	General Contractors
HR	Research Hypothesis
HO	Hypothesis
HOOH	Head office Overhead
ISO	International Standards Organization
JCT	Joint Contract Tribunal
NEDO	National Economic Development Office
PPA	Public Procurement Agency
P.O.O.H	Project Office Overhead
SCL	Society of Construction Law
SBAM	Specific Base Allocation Method
SCC	Special Condition of Contract

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1. INTRODUCTION

1.1. General

Construction is a unique industry as it is a fast moving, complex and dynamic process which depends on the successful coordination of multiple discrete business entities. These include, among others, professionals, tradesmen, manufacturers, trade unions, investors, local authorities and specialist trade contractors to ensure the delivery of a project on time, within budget and at the required quality level. This coordination is dependent upon the application of sound planning, programming and project controls, allied to the implementation of tried and tested management techniques.

However, risk is an inherent feature of a construction process and no construction project is risk free. Also, risk cannot be ignored; it can only be managed, minimized, shared, transferred, or accepted. If it is accepted that risk is inherent in construction, then it must also be accepted that delays are also inherent in the process and should therefore be anticipated and managed and treated in a similar fashion. When delays are experienced, this is not necessarily an indication that the process or management team is breaking down. Delays are often the result of an event which must be managed by a systematic process so as to anticipate the impact of that event on the programme and to minimize the risk of further delay. Systematic management of delay during the course of the project also ensures that the cause of that delay is identified and documented at the earliest opportunity. When there is a requirement to identify the causes and effects of delay to establish entitlement to additional time or money, the results of any relevant analysis should be capable of being presented in a clear and unambiguous way.

When there is disagreement over the responsibility for unacceptable delays to project completion, major disputes can arise due to the failure to manage the impact of change and claims for additional time and/or money in a timely or effective manner during the course of the project. In these situations there is a requirement for reliable analysis and assessment of the delay impact which addresses qualitative, quantitative and entitlement perspectives to facilitate an agreement (Keane & Caletka, 2008).

Complex construction projects often take a considerable prolonged time to complete. Some require months and some need years. Within such a prolonged contract period the need for change in the design is bound to arise, along with the occurrence of other delaying factors. The authors of the standard form contracts do their best to anticipate and provide for all possible events as well as consider and draft amendments either made necessary or desirable as a result of judicial interpretation of particular clauses. This occurrence may compel the affected party, usually the contractor, to seek additional remuneration by way of damages to take account of the changed circumstances (Newman & Whitfield, 1994).

Where a disruptive event is anticipated by the contract, for example where delay in the provision of design information causes the contractor to incur a loss, the contractor will seek reimbursement under the contract. In such situations where the contractor seeks additional money the document produced encourages the employer to reimburse the contractor for the loss (Ibid.).

Paul Newman and Jeff Whitfield speculate; conflict in the construction industry is costly and the need to resolve it diverts vital project management effort away from the successful completion of the project. A serious conflict could easily add 20% or more to a project's final cost.

In developing countries construction projects were often subject to long delays and increased costs (Ofori, 1993). Factors that cause delay during implementation stage may result in additional cost to both the client and the contractor. The loss of revenue or benefit that could have been gained if the project was completed on time, consultant fees which are paid throughout the project, cost associated with head office support of the project are among the costs to be cited as the major ones incurred by the employer. Similarly, the additional cost to be incurred by the contractors could include additional over head costs, costs of extension of various bonds such as performance bond and bank guarantee, operational and maintenance cost of facilities (Abebe Dinku & Girmay Kahssay, 2003).

➤ **Prolongation Cost**

Prolongation is a delay to a critical activity, which extends the time for completion of the whole of the works. If the cause of the delay is not the responsibility of the contractor, it is highly probable that an extension of time will be justified.

Extensions of time carry with them additional costs to the contractor associated with the increase in the length of the contract period. The extra costs could arise from maintaining the contractor's site facilities, providing facilities to the engineer, extended use of equipment which might be required for another project, off site and head office costs, finance and insurance costs and other potential related costs. These all are together named prolongation costs.

One factor that has to be taken into consideration is whether the delay has resulted in an extension of the critical path, which requires an extension of time. An important point is that an extension of time is not granted if a non critical activity is delayed as this does not affect the overall time for completion. However, should this occur, a claim for additional costs may well be submitted as a disruption claim (Ethiopian Roads Authority Claims and Dispute Resolution Manual Final, 2008).

1.2. Background of the Study

As globalization is a phenomenon which is here to stay, and which will deepen in extent and effect in future, it is in the interest of the developing countries that research is undertaken on how their construction industries and firms can participate fully in, and benefit from, this 'inescapable and irreversible' process (Ofori, 2007).

The situation in the Ethiopian construction industry is following an increasing trend in recent years. However, the domestic construction industry is not benefiting much as the most key players of major construction projects in the country are foreign construction companies and consulting firms. It is the writer's belief that this research work will contribute for the promotion of domestic construction industry, prolongation cost claim administration practices and methods of prolongation cost estimation.

The construction sector plays an important role in the development not only of the sector itself but also of other economic sectors. Construction activity generally contributes much to the country's total activity, at least with the corresponding demand for materials and labor inputs. The swings in the level of construction activity tend to both amplify and lead the movements in the economy as a whole.

Construction is widely acknowledged as the most important single constituent in a developing country's investment program with about 50% of total capital formation realized through this particular sector (ERA, 2005). It corresponds to the 60% public capital investment in Ethiopia.

With such a high contribution the construction industry has a major influence on the economic growth of a country and is, conversely, dependent on the state of the economy for the realization of its potential (ERA, 2005; Tadesse, 2009). An inefficient and ineffective construction industry will, therefore, adversely affect all other sectors of the economy.

A research conducted by Turkey Wakjira (2011) indicates that from the lists of 54 factors leading to Cost Overrun in Ethiopian Federal Road Construction Projects, prolongation cost is one of the top risk factors found out in occurrence and impact on cost overrun of the projects.

It is common practice for decisions and awards on extensions of time to be made and issued before considering prolongation claims. Once an extension of time has been awarded, the intention of most construction contracts is for the contractor to be reimbursed for the additional costs which have resulted from the employer-responsible delays. Basically, this involves a comparison between the contractor's actual costs incurred and what the contractor's costs would have been had no delay occurred (Palles, 2002).

There is no such thing as an ideal format for a prolongation cost claim; each claim is dependent upon the individual facts of its own project or case. There are, however, some simple guidelines or good practices which are applicable to almost all claim submissions.

1.3. Statement of the Problem

Girmay (2003) states that the Ethiopian construction industry seriously lacks qualified engineering professionals with appropriate levels of training in construction management beside gaps in international contract administration and claims handling procedures. As a result, claims which could have been mitigated on their early stage have gone offhand costing the country several millions.

P. J. Keane and A. F. Caletka (2008) also claim that the most significant and unanticipated cost in most construction projects is the financial impact associated with delay and disruption to the works. Assessing the impact of delay and disruption, and establishing a direct causal link from a

delay event to effect, liability and the resulting damages can be difficult and complex. Contractors and subcontractors require these skills for successful evaluation and presentation of time delay claims; the employer's professional team requires similar skills and techniques when analyzing and evaluating extension of time and cost damage entitlements under a construction contract. Where these delay issues are not resolved by the contract administrator and contractor in the normal commercial way, then such issues are often left to be decided by third parties in arbitration or adjudication, before dispute review boards or, ultimately, in litigation. All these steps along the dispute resolution hierarchy have different timetables and expectations regarding the evidence required to demonstrate cause and effect. In selecting the most appropriate technique to suit the project, the relevant facts, the timetable, the nature and number of delay events, as well as size of the potential dispute to ensure the maintenance of proportionality, must all be considered.

Theodore J. Trauner (2009) notes that even after the establishment of entitlement to recover additional compensation, the change or claim can remain unresolved due to problems associated with the calculation and presentation of damages. Problems may include overstated or incorrectly calculated claim amounts, claims for damages not adequately supported with appropriate documentation, claims for damages that either contradict or expand the terms of the Contract, and claims for damages that conflict or are inconsistent with the basis for recovery and the legal aspects underpinning the claim.

Merely asserting that one has been harmed will not suffice. The calculation of damages must be properly supported by the pertinent contract provisions and the applicable facts supporting the claim, whether they come from the documents, cost records, testimony, etc (Trauner, 2009).

He is also of the opinion that many public agencies are not in a position to negotiate due to the need to justify any settlement amount to others, such as taxpayers or other agencies. Generally, these types of claims will require thorough documentation to facilitate the approval process.

Considering all this, the research looks into problems in relation to administering prolongation cost claim which includes, data recording and documentations, suitability of conditions of contract and established methods of estimation.

1.4. Significance of the Study/ Application of the Result

This research will have a contribution in facilitating the process of estimating prolongation cost and showing the gaps and challenges in estimating and analyzing the prolongation cost claims for road construction projects in Ethiopia.

1.5. Objective of the Study

The general objective of the study is to identify and explain gaps (problems and challenges) in estimating prolongation cost in road construction projects. The study also has the following objectives:

- To determine the practice in administering prolongation cost estimation and,
- To identify problems in data recording and documentation for prolongation cost estimation,
- To investigate the suitability of the condition of contracts in relation to prolongation cost determination
- To assess and recommend estimation methods for prolongation cost estimation in road construction projects.

1.6. Research Questions

The research questions to be addressed in this study are:

- What is the industry practice with respect to administering prolongation costs?
- What are the problems in relation to data collection and documentation?
- How suitable are the conditions of contract to handle prolongation cost estimation?
- What are the methods used in estimating prolongation cost?

1.7. Research Scope

The target population of this research is the owner, domestic and foreign construction contractors and consultants involved in the Ethiopian federal road construction projects in the five regions, North, South, East, West and Central. Road construction projects are suffering from delay in completion time due to different reasons, which may possibly lead to time extension and prolongation cost claim. The research generally focuses on the prolongation cost claim, and

specifically, on the estimation practice and methods, data collection and documentation, and suitability of conditions of contract. To this end, the research will be a stepping stone for further similar investigations.

1.8. Organization of the Thesis

The thesis is organized into five chapters. The first chapter begins with the discussion on background and general introduction to the research, statement of the problem, objectives, scope, methodology adopted to achieve the objectives of the study and organization of the thesis.

Chapter 2 is composed of literature review from professional journals, books, internet searches and interview with road design, construction, and contract administration experts. This chapter essentially provides a review of the current state of the art in estimating prolongation cost or delay damage in construction projects, importance of data collection and documentation for claim substantiation, professional skill for prolongation cost estimation and evaluation, and suitability of conditions of contracts in relation to prolongation cost claim.

Chapter 3 discusses the research methodology followed in order to achieve the objectives of the study. The results of the data obtained from the questioner and desk study are presented and discussed accordingly in Chapter 4.

Finally, conclusions and recommendations are forwarded based on the major findings of the study in the fifth chapter.

2. LITERATURE REVIEW

2.1. Delay of Construction Projects

The duration of a construction project is an important factor to set forth when entering into a construction agreement. If a contractor works within a planned parameter, he/she should be able to finish the construction project in a timely manner. However, compared to other industries, it is difficult to complete a construction project in which many construction trades participate and numerous unknown variables exist. When such difficulties arise, construction schedules are delayed, and consequently delay claims occur.

Delays in construction may be caused by the owner, the contractor, a third party or even due to natural factors. They may occur early or late in the job, alone, or with other delays. In such cases, negotiating a fair and timely damage settlement is beneficial to all parties (Bubshait & Cunningham, 1998). Thus, the ascertainment of the period of project delay serves as basic information for the apportionment of responsibility, which may be a highly complex operation in cases with concurrent causes (Shi *et al.*, 2001). Assigning responsibility for project delays is critical to the allocation of responsibility for time-related costs (Al-Saggaf, 1998). In this respect, when a delay claim occurs, it is very important to assign responsibility and magnitude to the delay. However, many sources and causes of construction delays exist, and it is often difficult to analyze the ultimate liability in delay claims (Kraiem & Diekmann, 1987).

2.2. Classification of Construction ‘Delays’

According to Syed M. Ahmed and Salman Azhar (1999) delays can be grouped in to the following four broad categories based on how they operate contractually:

- Non-excusable delays
- Excusable non-compensable delays
- Excusable compensable delays
- Concurrent delays

a. Non-excusable Delays

Non-excusable delays are delays, which the contractor either causes or assumes the risk for. These delays might be the results of underestimating of productivity, inadequate scheduling or

mismanagement, construction mistakes, equipment breakdowns or staffing problems. These delays are inherently the Contractor's responsibility and no relief is allowed. These delays are within the control of the contractor or are foreseeable; however, it is not necessary that they be both (Ahmed & Azhar, 1999).

In general, if the delay is found to be non-excusable, then the contractor gets no time or money and pays liquidated damages (Microsoft Project, 2000).

b. Non-compensable Excusable Delays

When delay is caused by factors that are not foreseeable, beyond the contractor's reasonable control and not attributable to the contractor's fault or negligence, it may be "excusable". This means that neither party is at fault under the terms of the contract and has agreed to share the risk and consequences when excusable events occur. The contractor will not receive compensation for the cost of delay, but he will be entitled for an additional time to complete his work and is relieved from any contractually imposed liquidated damages for the period of delay (FHWA, 1998). Sami M.Fereig and Nabil Karatam also strengthen the idea of Syed M. Ahmed and Salman Azhar stating that a contractor gets time, but not money if Non-compensable Excusable delays occur, but he is relieved from liquidated damage.

c. Compensable Excusable Delay

In addition to compensable delays that result from contract changes by Change Notice, there are compensable delays that can arise in other ways. Such compensable delays are excusable delays, suspensions, or interruptions to all or part of the work caused by an act or failure to act by the owner resulting from owner's breach of an obligation, stated or implied, in the contract. If the delay is compensable, then the contractor is entitled not only to an extension of time but also to an adjustment for any increase in costs caused by the delay (Ahmed & Azhar, 1999). In short, a contractor gets both time and money when Compensable Excusable delays occur (Fereig & Kartam, n.d.).

Scott A. Aftuck (1999) points out that if the delay could have been avoided by due care of one of the parties, the party, which did not exercise such care, is responsible for the additional costs. The contractor may be liable for the negligent acts of its subcontractors. However, if the subcontractor

has a direct contractual relationship with the owner of the project, the contractor most likely will be able to recover damages, as it was not in a position to prevent the delay.

d. Concurrent Delays

Mastrandria (1992) is of the opinion that the prime difficulty with concurrent delay is giving its clear definition (as cited in Bordoli & Baldwin, 1996). No attempt will be made here to strictly define concurrency other than, from the definition, more than one delay happens at the same time. The problem seems to decide which of the delays, if any, results in delay to the completion of the project and, if there is a multiplicity of causes, if the contractor is to recoup loss and expenses.

Brian Eggleston (1997) describes that disputes related to concurrent delay arise not so much on how long was the period of the overlap, but to what cause should it be attributed; and to what extent it is permissible to consider the knock-on effects of one delay to another. There are three principal approaches to the solution of the problem: the first in line approach, the dominant cause approach and the appointment.

The method only takes cognizance of the events that affect activities on or near the critical path (the time of the delay) that result in the project delays. In analyzing delay in chronological sequence, the earlier event causes the delays that result in the following event having no additional effect on the project completion (Bordoli & Baldwin, 1998).

2.3. Delay Claim

Claims are an inevitable feature of many projects that should be dealt with on the majority of contracts and subcontracts let. Most claims result from the project designer's inability to fully provide for all eventualities, which mean that changes will be made to the contract as it proceeds and, where these involve additional work, adjusted payments will be necessary (Gibso, 2008). Disagreements on the level of these payments will be a typical source of claims. Beside changes to the payments made, these variations may also result in delays to the works and where these delays have a knock-on effect on the project as a whole, they may give rise to extra costs. These costs result from the contractor's additional presence on site, generating additional overhead costs for the extended period.

The contractor's claim mostly relates to prolongation and/or disruption claims. Prolongation may be defined as a critical delay which results when the time necessary to complete a critical activity is prolonged, thus extending the time for completion of the whole of the works (Gibso, 2008).

The SCL Protocol also defines 'prolongation' as 'the extended duration of the works during which costs are incurred as a result of a delay'. It also states that 'unless expressly provided for otherwise (e.g. by evaluation based on contract rates), compensation for prolongation should not be paid for anything other than work actually done, time actually taken up or loss and/or expense actually suffered.'

By no means will all changes to a contract delay the project. Some will involve changes in detail that merely affect the nature of the work to be done without increasing its difficulty, requirement for resources or duration. Other changes will actually reduce the work to be carried out. There will, however, typically be changes that do delay, increase the duration of or force a change in sequence in the activities making up the contractor's programme.

Roger Gibso (2008) adds that delays in completion of the works might result in a number of added costs to the contractor and if such delay is determined by the engineer to be the responsibility of the employer, then a number of claims for financial compensation can be pursued by the contractor.

2.4. Delay Damages

2.4.1. What are Delay Damages?

The phrase "delay damages" is often used in construction change order requests, requests for equitable adjustments, and claims. When used in those instances, what exactly does "delay damages" mean?

The term "delay damages" is simply defined as "damages that are caused by delay." But this definition depends on the how one defines the term "delay". For example, when the term "delay" is defined as only critical project delay (a delay that is responsible for extending the project duration), then the term "delay damages" can be narrowly defined as only the damages that result from the project's extended duration.

If delay is defined more narrowly as only non-critical delay (a delay that is not the cause of an extended project duration), then the potential damages are still there, but would likely not include extended field overhead costs, unabsorbed home office overhead costs, and liquidated damages (<http://www.delaydamages.com/delay-damages/extended-field-overhead/> retrieved in March 2014).

2.4.2. The Contractor's Delay Damages

Paul Newman and Jeff Whitfield (1994) state that an application for reimbursement of direct loss and/or expense will usually contain one or more of the following heads of claim:

- Site overheads or preliminaries
- Head office costs
- Profit
- Inflation
- Loss of productivity or acceleration costs
- Finance charges
- Costs of preparing the claim

2.4.3. Types of Delay Damages

As described above, delay damages come in many flavors and can be results of both critical and non-critical delays. Theodore J. Trauner (2009) summarizes the delay damages as follows:

- Extended and Increased Field Costs
- Home Office Overhead
- Inefficiency or Lost Productivity Costs
- Acceleration Costs
- Other Categories of Delay Damages

2.4.3.1. Extended and Increased Field Cost

One type of additional cost that a Contractor may claim is extended field costs. For example, when a Project experiences a delay, the Contractor's field staff and field equipment may be on site longer than originally scheduled.

Any construction project entails certain indirect expenses that are charged directly to the job (New South Wales Government, 2008). These costs are sometimes known as "Preliminaries"

costs, but are most often referred to as “on-site overhead” costs. They must be distinguished from the direct costs of construction activities.

Field overhead costs consist of indirect costs that are necessary to support the work in the field and that are directly chargeable to the project. Extended field overhead costs (also called field office or jobsite overhead costs) are, by definition, costs that increase due a critical and compensable delay.

Note that the executed change orders need to be evaluated, because if the change order work caused critical project delay, then they may address or affect the contractor’s entitlement to recovery of extended field overhead costs (<http://www.delaydamages.com/delay-damages/extended-field-overhead/> retrieved in March, 2014).

These damages include the **additional labor**, **material**, and **equipment costs** resulting from project delays. These costs are typically quantified and supported by actual measurements of increased units and/or rates (Trauner, 2009).

a. Labour

Depending on the Project-specific circumstances, when a Project encounters a delay, the Contractor would typically retain its supervisory team at the job site. Personnel such as the Project Manager, Project engineer, superintendent, assistant superintendent, and administrative support positions are in this category. These personnel represent a direct labor cost to the contracting firm. Theodore J. Trauner puts the following in the category of delay-related labor costs that might arise due to the delay;

➤ Escalation of labour costs

Some delays can cause the Contractor to experience escalation of its labor costs. This may occur if the delay shifts labor into a more expensive time period than that originally scheduled. This situation is sometimes referred to as extended labor, but it should more appropriately be considered labor cost escalation.

➤ Idle labour

If a Project is delayed or suspended, the Contractor’s workers may be at the Project site but may be unable to productively work. For potential recovery of this type of cost, the Project daily

reports need to show that the Contractor's workers were on the site but were unable to perform their work. The Owner would appropriately question why the Contractor was unable or unwilling to shift those workers to other tasks or other jobs or lay them off. The Contractor should be prepared with Project daily reports to substantiate an idle labor claim. If the Owner does not retain such daily reports, there may be no basis for a challenge to the Contractor's documented claim. For this reason, both the Owner and the Contractor should diligently maintain documentation of labor activity on each day throughout the Project. It should be noted that the Contractor has an obligation under most contracts to mitigate the damages when a delay occurs; therefore, if possible, the Contractor needs to look at shifting its labor to other work during a delay.

➤ Extended field supervisory damages

In order to address the propriety of claiming damages for extended field supervisory labor, the analyst should start with a review of the Contractor's normal accounting procedures for these costs. For example, if the Contractor routinely charges the Project directly for the Project Manager, then claiming damages for him would be appropriate but subject to the Contract requirements. However, if the Contractor routinely charges the Project Manager to home office overhead, then claiming this cost as a direct field cost may require further investigation.

The Owner would likely argue that the Project Manager's salary is an overhead item when resolving the delay damages. The same principle applies to the salary of any other field supervisory personnel extended on the Project because of the delay.

b. Equipment

The amount of damages that can be claimed for idle equipment depends on the Contract provisions. In some cases, the Contract may address idle or standby equipment and allow only a reduced rate or no compensation at all. If the Contract is silent on this issue, the Contractor would likely claim damages at the full rates of the equipment during the idle time. As in the case of idle labor, the Contractor would need to identify specific equipment on the Project in the daily reports to show exactly when this equipment was idle and the duration of the idle time. The Owner will generally question whether the equipment was idle because of the delay. It is often worthwhile for the Owner to verify the Contractor's use of equipment prior to and immediately period of the delay. If the equipment was idle both before and after the delay period, then the Owner may appropriately question whether the Contractor actually sustained any damages from the delay. As

with labor costs, a Contractor's equipment costs may also be subject to escalation. If a Contractor is using rental equipment, the delay could shift the Contractor's equipment into a time period with a higher rental rate. This situation can and should be documented with invoices.

c. Material

- Escalation of material cost

The most common added material cost caused by a delay is price escalation. Because of the delay, the Contractor is forced to buy materials to be incorporated into the work in a period when the price has increased.

- Storage cost

Delays may also affect a Contractor's material costs because of storage costs. The Contractor may be forced to store materials either on or off the site as a result of a delay. For example, if the contractor is storing structural steel for the project and the start of steel erection was delayed a month, which was the owner's responsibility, then the contractor may be entitled to recover the additional cost of storing that material for an additional month.

The Contractor must support claims for these costs with invoices. In some cases, the Contractor may be able to purchase materials before they are required for installation and store them, as this may be less expensive than the escalated cost of the materials purchased at a later date. The Contractor should notify the Owner in advance of this course of action.

d. Other Delay Costs

Theodore J. Trauner (2009) states that delays on a construction Project may cause a number of different increased costs to the Contractor, such as the following:

- Temporary utility and facility costs
- Maintaining and protecting work during delays
- Extended warranties
- Inefficiencies
- Increased bond costs

And added; normally, all of these items fit into one of the general cost categories, such as field overhead, inefficiency, and so forth. The analyst structuring the claim must carefully assess all of the additional costs to the Project occasioned by the delay.

In addition, on-site overheads also cover the costs of the items a contractor must provide during construction including:

1. Salaries of site supervisory staff, including accommodation and travelling expenses;
2. General wages employees employed in providing general services and activities, including:
 - labourers engaged part-time on these activities;
 - chainmen, store men, cleaners;
 - spare drivers, dog men, crane operators;
 - maintenance scaffolders and carpenters (who maintain site access, platforms and other safety requirements); and
 - Clean-up gangs, attendance labourers.
3. General construction plant, including:
 - cranes, hoists, climbing scaffolds, compressors, generators, site vehicles; and
 - any major temporary works which cannot be readily allocated directly to work items, such as de-watering equipment, ventilation fans, water supply etc;
4. Small tools and consumables;
5. Site services including power, water, air and telephones;
6. Site offices, amenities, workshops and stores;
7. Site office expenses including couriers, postage, copying; and
8. Insurances and security charges, Work Cover charges, long service levy charges (New South Wales Government, 2008).

2.4.3.2. Home Office Overhead,

➤ What is Home Office Overhead?

According to Roger Gibson (2008), head office costs, sometimes referred to as home-office costs, are typically associated with the overall management of the business. They will usually include property costs, rent, rates, heat and light together with other central services and utilities. They also include the cost of head office staff, the directors and other senior management and support staff, their salaries and other benefits including cars and pension payments; the cost of information systems, finance and accounting departments, perhaps the in-house legal team and secretariat; and, often, the cost of a central design team as well as related selling and marketing costs.

In the event of an Owner-caused delay, a Contractor may seek to recover delay damages associated with home office overhead. Despite being a commonly sought element of delay damages, home office overhead remains a contentious issue, due in part to the lack of a universally accepted method of calculating the associated damages. Adding to the potential for conflict is the question of what constitutes home office overhead, a term that can take on different meanings given the financial structure of the Contractor's organization and the accounting principles employed (Trauner, 2009). Normally, however, home office overhead consists of the Contractor's fixed costs of operating its principal or home office. It is in the home office that executive and administrative functions are performed on behalf of the Contractor's entire organization.

Although the terms *Unabsorbed Home Office Overhead* and *Extended Home Office Overhead* are often used interchangeably, they are not the same. For example, when a project experiences a critical and compensable delay, the project does not incur additional home office overhead costs, as it would additional field office overhead costs. Rather, the project's extended duration may limit the contractor's ability to earn revenue from new projects and, as a result, the revenue of contractor's active projects are not able to fully absorb all of the contractor's home office overhead costs during the period when the delayed project is being delayed. In this circumstance, the contractor's home office overhead costs during the delay to the delayed project may be "unabsorbed" or "under absorbed," but, conceptually, not extended.

Unabsorbed Home Office Overhead is also well-known, but not well-understood delay damage and like extended field overhead is only caused by a critical project delay. Home office overhead costs are costs that are incurred to support the work, but are not directly chargeable to a specific project. Typically, the contractor's home office overhead costs are apportioned and assigned to the contractor's projects. Said another way, each project has to absorb its fair share of the contractor's home office overhead costs (<http://www.delaydamages.com/delay-damages/extended-field-overhead/> retrieved in March 2014).

Roger Gibson (2008) also explains that one aspect of a loss and expense claim which is commonly misunderstood is the loss of contribution to head office overheads and profit. In fact, many contractors forget the impact of a delayed project on their head office costs. It is, after all, the head office that provides the support and guidance to the on-site project team. Head office

costs are paid for by the money received for carrying out work on the company's projects, and head office staff and support facilities are allocated to each project accordingly. Therefore, if a project is delayed and extended in time, then the support provided by the head office must also be extended for the same duration.

Typically, claims for loss of overheads and profit are combined as one head of loss. While this is not necessarily inappropriate, it is important to consider the characteristics of head office overheads and thus to recognize when they can be distinguished as a separate head of claim from loss of profits (Gibson, 2008).

➤ **Head Office Overheads Claim**

This head of claim is for recovery of, or contribution to, the contractor's overheads and profit. While strictly speaking these are two heads, namely lost overheads and loss of profits, as stated earlier, they are usually combined and treated as one 'head of claim' (Ibid.). In essence, the logic behind a 'contribution claim' is that, as a result of delay or disruption to a given contract, head office resources inevitably become involved in dealing with the problems that arise in managing and providing support services to the contract in such circumstances. This will divert management resources from other duties, including the efficient and profitable running of other contracts, and perhaps, more importantly, looking for and winning new work.

Both of these diversions can lead to a reduction in the claimant's profit, through inefficiencies on other contracts or through failure to obtain contributions towards the overheads and profit of the business from new work.

The concept of lost contribution to overheads and profit is fairly straightforward to argue. But it is often a different matter producing sufficient robust evidence in a particular case to prove loss, even on the balance of probabilities. Again much will depend on the extent and quality of the contractor's records; and this means not just its accounting records. It can be equally important to be able to furnish contemporaneous records demonstrating the impact of the contract disruption on other parts of the business. The records could also include a schedule of tender opportunities not taken up or perhaps an analysis showing a reduction in tender success rate (Gibson, 2008).

Specifically excluded from this definition of home office overhead are the direct costs of labor, equipment, and materials expended to manage, administer, and construct a specific Project. The

cost of providing a job site trailer, for example, is not a home office cost as it is incurred specifically to support a particular Project. Roger Gibson state that the auditing or accounting standards employed by the Owner can further restrict the definition of home office overhead.

HOOH items were categorized into eight foremost HOOH categories with the base of ‘MAC Model Contract’ (MAC, 2008) and modified by brainstorming approach for application among the Sri Lankan contractors. The followings are identified as HOOH categories and all the HOOH items can be located within those appropriately;

Table 2.1: Category of HOOH

1. Staff's and Labours' (Head Office) Wages and Salaries /registrations		
➤ Payments to people for Bonuses and incentives	➤ Absence due to sickness and holidays	➤ Subsistence and lodging
➤ Allowance for working in special circumstances	➤ Statutory severance	➤ Relocation
➤ Overtime	➤ Payments made in relation to employees	➤ Medical examinations
➤ Medical Aid	➤ Travel	➤ Passport and visas
➤ Vehicle	➤ Other special allowance	➤ Death benefit
		➤ Occupation accident benefits
2. Equipment and Plants related costs		
➤ Equipment maintenance	➤ Equipment damage/ repair costs	➤ Depreciation and maintenance of equipment
➤ Unallocated plant		
3. Materials related costs		
➤ Material yard maintenance	➤ Payments for Purchasing materials	➤ Delivery to yard and removal from the yard
➤ Samples and tests		
4. Charges (Head Office)		
➤ Payment for Leasing costs	➤ Advertising, leaflet drops and the like in connection with the services	➤ Depreciation and interest of capital assets
➤ Compensation for loss of crops or buildings	➤ Payment for Specialist services (Advices etc)	➤ Supplies and consumable stores
➤ Inspection certificates	➤ Payment for Head office building rental	➤ Cleaning and maintenance
➤ Copying	➤ A/C, sanitation, power,	➤ Telephone, telex, fax, post and electronic mail
➤ Computing		➤ Marketing and other external
➤ Stationeries		
➤ Recruitment and training		

of staff ➤ Refreshments and food	lighting and water(Utilities) Security	expenses
5. Insurance (Head Office)		
➤ Head office related resources (including employee, equipments, assets etc) – premiums / Non-project-related bond or insurance expenses		
6. Fee Schedule Constituent		
➤ Payments for Franchises, Royalties, Licences ➤ Accounting and Auditing ➤ Research and Development ➤ Publicity, Marketing, Advertising	➤ Entertainment ➤ The amount of any excess borne by the contractor in respect of any claims under Employer’s liability ➤ Finance and Interest charges	➤ Quality assurance ➤ Health and safety ➤ Training ➤ Tendering ➤ Supply chain ➤ Legal costs /Corporate Taxes,
7. Vehicles and travelling expenses		
➤ Parking charges and fines	➤ Fuel charges ➤ Vehicle maintenance	➤ Vehicle damage and repair
8. Miscellaneous		

➤ **Effects of Delay on Home Office Costs**

A Contractor typically includes in its bid price for a particular Project a percentage markup through which it will recover some portion of its home office overhead. If this project were to experience a delay, project revenues may then be earned over a longer period of time, disrupting the basis under which the Contractor originally allocated its home office overhead costs.

For the Contractor who performs one Project at a time, the effect of a delay is relatively straightforward. Clearly, as the number of projects increases, the calculations become more difficult, as is apparent from the numerous articles written on this subject.

In characterizing home office overhead damages, many authors choose to distinguish between the terms extended home office overhead and unabsorbed home office overhead. Some distinguish the terms on the basis of whether a Project was formally suspended (extended home office overhead) or only partially or informally suspended (unabsorbed home office overhead). According to Theodore J. Trauner, the calculation of damages for each may differ, but in

practice, most courts and boards have not always maintained this clear distinction in terms. Regardless of the nature of the delay, the analyst should establish the damages the Contractor actually experiences.

2.4.3.3. Inefficiency

Depending on the nature of the delay, a contractor may also experience some measure of inefficiency. The resulting increased labor and equipment costs may be included within the damage claim. The delay may either directly cause the inefficiency or be caused by the inefficiency.

➤ What is Inefficiency?

Perhaps the best way to define *inefficiency* is to start with a definition of *efficiency*. Theodore J. Trauner defines Efficiency as a measure of units of work performed per units of resources consumed to perform that work. Inefficiency (also referred to as loss of efficiency or lost productivity) is a relative measurement. An operation is inefficient when it consumes more units of resources to perform a unit of work than should have been consumed or than were consumed by the same type of activity performed at another time.

➤ Ways that Delay Can Lead to Inefficiencies

Some of the more common instances of delays contributing to inefficiency will be addressed so that one will have a better understanding of the relationship and be alert to it for specific Project situations. The following are examples of how delays can lead to inefficiencies.

✓ *Construction season shift*

A delay to a Project can shift work originally scheduled for one season into a different season. For example, work scheduled for late summer and early fall may be pushed into the winter months by a delay. The effect of the delay on the Contractor's efficiency depends on the type of work. When work is shifted into adverse seasonal conditions, the analyst should evaluate the work that was shifted from that season into more favorable conditions.

✓ *Availability of Resources*

A Contractor must schedule a portion of the work during a specific interval because of the availability of certain equipment. Because of a delay to the Project, the work shifts and the

equipment are no longer available. The Contractor must now perform the work using a new method, thereby increasing Project cost. When a delay occurs, the analyst must look closely at exactly what the effects are on resources, such as equipment and manpower, and how to quantify those effects (Trauner, 2009).

In addition; the Contractor may not be able to obtain enough labor to finish the work by the revised schedule for completion. This is particularly true of weather-related work such as exterior painting, site work, and landscaping. At times delays can affect the availability of resources in the areas of manpower, subcontracts, or equipment, the Contractor may hire less-experienced crews or “travelers” and have either reduced efficiency for a portion of the work or a higher unit cost for the work.

✓ ***Manpower level and distribution***

Certain types of delays affect the level of manpower and its distribution on a Project. These changes may occur in the form of additional manpower, erratic staffing, or variations in preferred/optimum crew size. Any of these situations may affect the level of efficiency of the work as explained below by Theodore J. Trauner (2009).

▪ Additional man power

Delays to specific activities may force the Contractor to work on more activities than planned at one time and to increase the levels of manpower significantly for a specific trade. Depending on the work type, additional manpower may also require more foremen or master mechanics.

Also, as the Contractor increases the crew size, it is not uncommon for the added personnel to be less productive than the original crew. Contractors often say that as they increase more manpower, they see a decline in the level of productivity.

▪ Erratic Staffing

In the face of a delay, a Contractor may staff a Project erratically in order to address specific needs as they arise. Theoretically, a contractor would like to staff a project in a bell curve fashion: starting with a small crew, building up to optimum size, and then tapering down toward the end of the Project.

Constant fluctuations in the size of the crew on the site are not desirable. However, the contractor may in some circumstances be forced to man the project erratically in order to achieve schedule goals. In such situations, there may be a measurable reduction in efficiency.

To demonstrate the negative effect of a forced change in labor distribution, the Contractor would be well advised to plot the original schedule to graphically portray the planned distribution of labor and then plot the actual distribution of labor caused by the delay and compare the two.

- Preferred/Optimum Crew Size

Another factor that should be considered is preferred/optimum crew size. For example, a finish Contractor has a standing force of eight carpenters employed through the year. Because the crew works together throughout the year, they have established a smooth and efficient routine. If a delay now causes that Contractor to accelerate his work and increase his staff above his optimal crew, there can be some measured loss of efficiency as the original crew assimilates the new personnel and brings them “up to speed.”

- ✓ *Sequencing of works*

Delays to critical and noncritical activities can also force a Contractor to re-sequence the work. The re-sequencing itself is not a problem, but its effects may reduce the Contractor’s productivity in a number of ways. The Contractor’s crew may be hampered in their work by the presence of another trade, or the crew may be obstructed by material stockpiled in the work area. With such interferences, workers may experience some reduction in productivity (Trauner, 2009).

2.4.3.4. Acceleration Costs

A construction Project is accelerated when the Contractor must complete its original scope of work in less time. However, a construction Project may also experience acceleration when the scheduled completion date is unchanged.

Two examples are performing additional work on the critical path of the Project within the same contract performance period and performing noncritical items of work in less time than planned. The important point that acceleration and increased costs resulting from acceleration are not limited to work on the critical path.

While it is possible that acceleration may result from a change, a better view of acceleration is that it is a contract change. Like any change to a construction contract, the contractor must show that the acceleration on a project was a change in accordance with the contract clauses. After establishing that acceleration was change, the Contractor must also show that the acceleration had some definable effect and resulted in additional costs (Ibid.).

➤ **Why is a Project Accelerated?**

As indicated previously, a Project is accelerated when there is a need for the Contractor to complete some portion of the work in less time. The most common reasons a Project is accelerated relate to money. This includes saving money by avoiding delay damages or reducing overhead costs. It also includes making more money by allowing an earlier income from the facility or by freeing the Contractor to begin other work (Ibid.). Sometimes, acceleration is required to meet some other need, such as the early use of the facility or a commitment to a user. A Project is accelerated when it is necessary for the project to complete more quickly than it would otherwise. Most of the time, projects are accelerated because they are behind the required Project completion date.

➤ **Constructive Acceleration**

While Owners should grant time when it is due, sometimes an owner will not accept or resolve a legitimate time extension request. If the contractor is due an extension to the contract time but is not provided one and later accelerates its work in order to finish in the time provided, the contractor may have been constructively accelerated. Constructive acceleration, similar to a constructive change, is subtle and less readily recognized by an owner.

It should be noted that it is not necessary for the Contractor to complete the project by the earlier date required by the owner. As long as the preceding requirements are present, then constructive acceleration may exist.

2.4.3.5. Other Categories of Delay Damages

This section addresses certain points that, although not obvious, are important in defining damages related to delays. Included are some situations that frequently occur but are not well understood (Ibid).

➤ **Consulting and Legal Costs**

In general, the costs for attorneys and consultants are not recoverable in a claim situation. However, this does not mean that they will not be collected in a settlement but that they are not usually awarded in litigation or arbitration. The party asserting the claim should include legal/consultant costs as valid elements of its claim, recognizing the limited chance of recovery (Trauner, 2009).

Although these costs are typically disallowed in litigation, Trauner stipulates that the Contract may allow reasonable costs of experts expended to support a change order under the changes clause. In this case, the consulting costs would typically be connected to the administration, monitoring, or completion of extra work. The recovery of legal fees is generally precluded, but the Contract or legal statutes may provide for recovery.

➤ **Claim Preparation Costs**

Paul Newman and Jeff Whitfield state that, as a general rule, the contractor's staff will prepare the claim as the work proceeds and the preparation costs will be recovered in the preliminaries or overheads. Where the work is done in a period of prolongation, the costs are recovered under the same heads in the prolongation claim. However, there are cases where, despite the best efforts of the contractor to evidence his loss and expense, the client's representatives fail to carry out their obligation under the contract to ascertain the losses. In these circumstances, if the contractor is put to a cost which is unreasonable and is not otherwise recoverable he may wish to seek reimbursement on the grounds of the failure of the client's representatives. Architects should ensure that the employer's quantity surveyor is being reasonable in his ascertainment and is not placing a burden of proof on the contractor which is not demanded by the contract or the law. They noted that some inexperienced, or perhaps cynical, quantity surveyors seem to believe or suggest that a contractor must prove his case 'beyond reasonable doubt'. This erroneous view may result in the employer bearing unnecessary legal costs when the courts find for the contractor who has properly demonstrated his entitlement on the 'balance of probabilities'.

A further problem arises when outside claim specialists are employed to prepare a claim. In these cases the principles remain the same; their costs will only be recoverable if the employer's representatives have failed in their duty properly to ascertain the loss and expense and the outside consultant has been employed to do the work instead. Generally; however, the costs of claims

specialists are not recoverable unless they are acting in relation to case preparation and presentation in arbitration or are instructed to act as expert witnesses in either litigation or arbitration (Newman & Whitfield, 1994).

➤ **Lost Profits/Opportunity Costs**

Contractors and Owners may each seek to recover damages associated with lost profits and lost opportunities. In general, these costs are extremely difficult to recover due to their remote and speculative nature (Trauner, 2009). In order to achieve recovery, the Contractor or Owner must prove that the lost profits or lost opportunity costs are directly due to the Owner- or Contractor-caused delay. A well-supported claim that can clearly establish an economic loss (typical of a loss in bonding capacity) and prove that anticipated profits were not speculative may be able to recover these damages. Generally; the period subsequent to delay would be limited.

Theodore Trauner stated that a Contractor's chance for success in receiving compensation for its lost profits is no better than the Owner's. Some Contractors claim damages to other projects resulting from the delays to another specific Project.

➤ **Interest**

A contractor may incur interest or financing costs as a result of borrowing funds to finance the construction costs, including the damages identified in the claim. Although; these interest costs may be a real cost or damage resulting from delays, Contractors often are not successful in their recovery, as interest claims may be barred by the Contract or by statute (Ibid.). When allowable, interest may be claimed either on the overall value of the claim or as a component of the claim that represents the recovery of the cost of borrowed monies used to fund the work.

The interest claimed on the value of the claim may face several obstacles in recovery. Generally, as Theodore J. Trauner puts it, interest on an unresolved claim represents prejudgment interest and is often excluded as an allowable damage either by the Contract or by statute. He also noted Contract agreements often preclude such interest charges but typically will allow interest to be paid once a claim amount has been successfully litigated or resolved. Generally, a negotiated settlement to a claim excludes interest. If a claim is litigated, interest may also be regulated by State and Federal laws, and interest rates may be set by statute.

When interest is included as a specific cost of the work, or the cost of funds borrowed to perform the work, the chances of recovery are increased. Many interest claims are not recoverable because the Contractor has not provided adequate support or has taken shortcuts in perfecting the claim. A successful interest claim must adhere to the Contract agreement and be adequately supported (Ibid.).

➤ **Inflation**

Paul Newman and Jeff Whitfield (1994) state that, where a fixed price contract has been awarded and the contract is prolonged beyond the fixed price end date, then the contractor is usually entitled to some recompense. The value of his claim should be the excess he has had to incur as a direct result of the prolongation. He should be placed in the position he would have enjoyed had he been allowed to complete on time. Again evidence is of paramount importance. Records must be kept showing how labour and material prices were higher when the work was actually carried out compared with the prices prevailing when the work was programmed to be carried out.

Effects of Inflation add cost to a project. The time value of money can adversely affect projects when: the project completion is delayed and therefore the cost is subject to inflation over a longer duration than anticipated; and/or the rate of inflation is greater than anticipated in the estimate. The industry has varying views regarding how inflation should be accounted for in the project estimates and in budgets by funding sources.

Clause 70.2 Subsequent Legislation of FIDIC; state that particularly in periods of inflation and of instability in currency exchange rates, the Employer should not, in his own best interests, and especially on long-term contracts, ask tenderers to quote firm prices with no provision for adjustments, at least in the country in which the works are to be executed.

2.5. Provisions for Prolongation Cost Claims under PPA and FIDIC Forms of Construction Contract

Most of the standard-form of construction contracts currently in use (with the exception of those designed for relatively small projects) contain detailed provisions under which the contractor can claim against the employer for any losses suffered if the work is disrupted due to certain specified causes. These provisions often bear some resemblance to those under which an extension of time

may be claimed, but there are at least two important distinctions between the two issues. First; an extension of time will only be granted where the contract administrator believes that completion of the works is likely to be delayed, whereas compensation for disruption does not depend upon any such delay. Second, as we have already noted, clauses which deal with extensions of time for completion frequently apply to various ‘neutral’ events such as adverse weather, as well as to those causes of delay which are the employer’s responsibility. John Murdoch and Will Hughes (2000) mention that by contrast, the vast majority of contractual provisions compelling an employer to pay financial compensation to the contractor relate only to disruption that is caused by the employer.

This feature of claims provisions means that, in many cases, an event that enables a claim to be made will also entitle the contractor to recover damages for breach of contract. In particular; it may amount to a breach of the employer’s implied obligation of co-operation with the contractor. If this is so, John Murdoch and Will Hughes state that; it is for the contractor to decide whether to sue for breach of contract at common law or to claim under the appropriate clause in the contract.

The contractor’s right to choose between these remedies can only be removed by clear words in the contract itself, and this would be most unusual – indeed, JCT contracts expressly state that the contractor’s common law rights are preserved.

In deciding the better remedy to pursue, it is worth noting that the choice will not normally affect the amount of money the contractor is likely to receive.

2.5.1. Grounds for Contractual Claims

John Murdoch and Will Hughes explained; it cannot be too strongly emphasized that any contractual claim made must be based upon some specific provision of the contract in question. The mere fact that unexpected difficulties have been encountered, or that the work is proving far more expensive than was foreseen, does not entitle a contractor to be compensated by the employer. Naturally; there is considerable variation among construction contracts as to the permitted grounds of claim, although we can get a general idea from a brief consideration of some of the more important standard forms.

Before looking at specific grounds, however, an important general point must be made. Contractors' claims are often extremely complex affairs, in which it is alleged that a large number of disrupting events have resulted in an equally large number of items of loss and/or expense, but where it is difficult or impossible to attribute every item of loss to an individual cause. In such circumstances it has been held that, so long as all the causes are qualifying events under the contract, and that the impossibility of separating them is not due to the contractor's own delay in bringing the claim, they may be presented as a 'global' or 'rolled up' claim (John Murdoch & Will Hughe, 2000).

2.5.2. Prolongation Claim Provisions under PPA Form of Contract

The Federal Democratic Republic of Ethiopia Standard Bidding Document (SBD) For Procurement of Works for National Competitive Biddings (NCB) Public Procurement Agency (PPA) speculates the following clauses in relation to compensation:

Table 2.2: Compensation Clauses in PPA Condition of Contract

Sub-Clause	Title	Contractor's Entitlement
40	Payment for Variations	
40.4	If the Engineer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.	
44	Compensation Events	Contractor is Entitled to both Time and Money
44.1	<p>The following shall be Compensation Events:</p> <ul style="list-style-type: none"> (a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contractor's approved work program. (b) The Employer modifies the Schedule of Other Contractors in a way that affects the work of the Contractor under the Contract. (c) The Engineer orders a delay or does not issue Drawings, Specifications, or instructions required for execution of the Works on time. (f) The Engineer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other 	

Sub-Clause	Title	Contractor's Entitlement
	<p>reasons.</p> <p>(g) Other contractors, public authorities, utilities, or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.</p> <p>(h) The advance payment is delayed.</p> <p>(i) The effects on the Contractor of any of the Employer's Risks.</p> <p>(j) The Engineer unreasonably delays issuing a Certificate of Completion.</p> <p>(k) Other Compensation Events described in the Special Conditions of Contract or determined by the Engineer shall apply.</p>	
44.2		<p>“If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Engineer shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.”</p>
44.3.		<p>As soon as information demonstrating the effect of each Compensation Event upon the Contractor's forecast cost has been provided by the Contractor, it shall be assessed by the Engineer, and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Engineer shall adjust the Contract Price based on the Engineer's own forecast. The Engineer will assume that the Contractor will react competently and promptly to the event.</p>

2.5.3. Contract Provisions under FIDIC Form of Contract

FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS, FIDIC Conditions of Contract for Works of Civil Engineering Construction, Part II Conditions of Particular Application with Guidelines for Preparation of Part II Clauses and Supplement to FIDIC 4th A Practical Legal Guide by E.C. Corbett (c) 1991 provide the following sub-clauses which entitle the Contractor to claim additional money or time are listed below:

Table 2.3: Compensation Clauses in FIDIC Condition of Contract

Sub-Clause		Contractor's Entitlement
No	Title	
6.4:	Delays and Cost of Delay of drawings	Contractor may claim extension of time, Cost and reasonable profit if Engineer fails to issue a notified instruction or drawing within a reasonable time
12.2:	Adverse Physical Obstructions or Conditions	Contractor may claim extension of time and Cost if he encounters physical conditions which are Unforeseeable
17.1	Setting Out	Contractor may claim extension of time, Cost and reasonable profit for errors in original setting-out points and levels of reference
20.3	Loss or Damage Due to Employer's Risks	Contractor may claim extension of time, Cost and (in some cases) reasonable profit if Works, Goods or Contractor's Documents are damaged by an Employer's risk as listed in Sub-Clause 20.4
27.1	Fossils	Contractor may claim extension of time and Cost attributable to an instruction to Contractor to deal with an encountered archaeological finding
36.5	Engineer's Determination where Tests not Provided for	Contractor may claim extension of time, Cost and reasonable profit if testing is delayed by (or on behalf of) the Employer
40.2	Engineer's Determination following Suspension	Contractor may claim extension of time and Cost if Engineer instructs a suspension of progress
42.2	Failure to Give Possession	Contractor may claim extension of time, Cost and reasonable profit if Employer fails to give right of access to Site within time stated in the Contract
46.1	Rate of Progress	Wherever the Contractor has accelerated in order to overcome delays for which he is not responsible, he will seek to recover from the Employer the costs of the acceleration.
50.1	Contractor to Search	Contractor may claim Cost and reasonable profit if instructed to search for cause of a defect for which he is not responsible
65.5	Increased Costs arising from Special Risks	Contractor may claim extension of time and (in some cases) Cost if Special Risks prevents him from performing obligations

69.4	Contractor's Entitlement to Suspend Work	Contractor may claim extension of time, Cost and reasonable profit if Engineer fails to certify or if Employer fails to pay amount certified or fails to evidence his financial arrangements, and Contractor suspends work
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FIDIC 4th a Practical Legal Guide by E.C. Corbett in the introduction section of chapter 4: Extension of Time, Additional Payment and Notice intendeds to provide answer to the following question:-

How does the Contractor recover his prolongation costs and other loss and expense resulting from delays to the progress of the works which were not his responsibility?

There is no single clause which addresses the issue of the Contractor's loss and expense. The right to recover additional sums is scattered through the contract. Clause 44.1 (Extension of time completion) is not linked to any clause giving a right to payment unlike the relationship between clause 51 (Variations) and clause 52 (Valuation of variations). All the clauses (other than clause 44) giving an entitlement to extension of time also give a right to payment of additional costs. It has been submitted that in most of the cases where the Engineer is obliged to determine additional costs for the Contractor, extension of time is in fact available.

As to the events set out in clause 44.1:-

- (a) "The amount or nature of extra or additional work". If the extra or additional work has been ordered as a variation, then the Contractor may be able to recover any resulting prolongation costs if he is able to demonstrate under clause 52 (Valuation of variations), either that there is no applicable rate or that the rate has been rendered inappropriate by reason of the nature or amount of the extra or additional work. It is arguable; however, as commented under clause 51.2 that "extra" in clause 44.1 (a) includes "automatic" changes in quantities which result from any inaccuracy in the bills of quantities. To obtain additional costs the Contractor must either demonstrate under clause 52.3 (Variations exceeding 15%) that the "Effective Contract Price" has changed by 15%; or else must argue that such changes in quantities fall within the definition of "varied work" within clause 52.2 (Power of Engineer to fix rates) with the result that the Engineer may adjust the rates to take into account any additional costs incurred.
- (b) "Any cause of delay referred to in these conditions". This effectively refers to events of delay for which provision is made so that the Contractor will recover his prolongation costs under

the individual clauses. Thus for example, under clause 40.2 (Engineer's determination following suspension) the Contractor is granted an extension of time and "the amount of the cost incurred by the Contractor by reason of such suspension".

- (c) "Exceptionally adverse climatic conditions". There is no provision for payment of prolongation costs in the event of extremely bad weather. These conditions, in common with most standard forms, cause the risk to be shared between the parties so that the Employer recovers no liquidated damages and the Contractor recovers no prolongation costs.
- (d) "Any delay, impediment or prevention by the Employer". There is no express provision in the contract for reimbursement of prolongation costs flowing from the Employer's default. Various failures by the Engineer are catered for in clauses such as clause 6.4 (Delays and cost of delay of drawings) and 17.1 (Setting out). However as is mentioned in the commentary under clause 44.1 (d), it is arguable that the Engineer's defaults are not covered by the current grounds. To the extent that delays etc by the Employer are not covered by an express term, the Contractor is left to recover his prolongation costs as damages for breach of contract. The action of the Employer which invokes this ground for extension need not be a breach. The ordering of a substantial variation which delayed the works would be an example of a delay by the Employer if not also an impediment and prevention. The Contractor's prolongation costs in this event are plainly covered by the variation clause.
- (e) "Other special circumstances". Generally, it is submitted, this ground will not refer to matters dealt with in the contract so that recovery of prolongation costs will depend upon the Contractor's ability to demonstrate breach of contract by the Employer.

2.5.4. Provisions under Applicable Law

In section 2- Effect of Contract, paragraph -2 revisions of contracts, speculates the following articles;

Art. 3181. - Compensation

- a) The party who has contracted with the administrative authorities shall be entitled to compensation equal to the loss sustained by him by reason of the modification or termination of the contract.
- b) In fixing such compensation, regard shall be made to all the benefits which the party could legitimately expect to derive from the contract.

- c) The court may, however, limit the amount of compensation in so far as it refers to loss of profit, where it appears that the modification or termination of the contract is due to extraneous causes and not to a fault of the administrative authorities which have concluded the contract.

Art. 3184. - Upsetting of contract

The balance of the contract shall be deemed to be upset where new circumstances impose on the party contracting with the administrative authority's additional obligations which certainly surpass the extreme limits which could be expected by the parties on the making of the contract.

2.6. Estimating Prolongation Costs

Theodore J. Trauner (2009) concludes that, the calculation of delay damages is as much an art as a science. So that, the appropriate damage calculations are project specific and situation specific. No book can address every combination and permutation.

The starting point for the analysis of a prolongation claim should be 'in respect of what period is the contractor entitled to further payment?' What is equally important not only concerns how many weeks the contractor is entitled to be paid for, but which weeks. This is because the amount of his entitlement will depend on his actual costs, particularly his time-related preliminary costs which will vary throughout the project (Gibson, 2008).

The way in which damages are calculated and analyzed has a direct impact on a contractor's ability to collect the amount considered due. It also greatly impacts an owner's willingness to negotiate; (<http://www.capitalconstructionconsultants.com/damagecalc.php> retrieved in March, 2014).

Merely asserting that one has been harmed will not suffice. The calculation of damages must be properly supported by the pertinent Contract provisions and the applicable facts supporting the claim (whether they come from the documents, cost records, testimony, etc.) (Trauner, 2009).

The basis of calculation of compensation for prolongation under the SCL Protocol recognizes that the recovery of additional compensation for delay is based on causal links from delay events to the actual cost incurred. The time related costs must be 'work actually done, time actually

taken up or loss and/or expense actually suffered'. Where possible, the SCL Protocol suggests the option of pre-agreeing a fixed daily rate for delay (similar to a pre-agreed rate of liquidated damages) (Keane & Caletka, 2008).

The fact that damages cannot be assessed with certainty does not relieve the wrongdoer of paying damages. Where the precise evidence is obtainable the certifier, contract administrator, arbitrator, adjudicator or court naturally expects to have it; but where it is not, the certifier or court must do the best it can (Gibson, 2008).

2.6.1. For Contracts with Specified Rates for Delay Costs

In areas where a contract specifies rates for delay costs that are applicable to the events causing the delay, calculating prolongation costs is straightforward once the appropriate extension of time has been determined (New South Wales Government, 2008). The contractor is entitled to be reimbursed at the specified delay costs rate for the period by which the contract time was extended, subject to any exclusions stated in the contract.

The Procurement System states that, delay costs can be specified either for the whole of the works, or for each individual milestone. This allows the delay costs to be set at rates appropriate to the amount of work in the milestone, and hence to reflect the likely site establishment and other time related costs incurred by the contractor at the time of a delay. Delay costs reimbursements are calculated using the number of working days by which the date for completion has been extended.

On projects where the level of construction activity varies significantly between various stages of construction, the appropriate costs will be those which relate to the period(s) in which delay has occurred. To adopt average daily or weekly on-site overhead rates over the whole contract duration is not necessarily appropriate according to the New South Wales Government Procurement System for Construction.

The weekly cost of on-site overheads is related to the total work activity being undertaken on a construction site at any time and not only to work on the critical path. Although; a delay to critical work may occur at a period of maximum site activity, the effect may be to prolong only relatively few activities for additional time. The Practice Guide recommends the appropriate rate

for calculation of site overheads is that related to the sequence of activities which were delayed, together with any consequential effects attributable to the delay.

2.6.2. For Contracts without Specified Rates for Delay Costs

Elsewhere, there is also a discussion about the head of delay damage estimation where there is no specified rate for delay costs, with which calculating a contractor's entitlements can be complex and time-consuming (Ibid.). At times, contractors may claim it is difficult to assess the full impact of directions or alleged breaches on the overall contract time and may resist quantifying the delay-cost element at the time of the event. The practice guide states that, Contractors often prefer to wait until the end of the contract when, they argue, the full cost impact is known. This argument should not be accepted because; it is much more difficult to accurately assess the delay-cost element many weeks or months after the event that gave rise to prolongation costs; and it is much more difficult to accurately predict the final value of the contract.

Furthermore; by valuing the delay component of each claim when it is first submitted, the opportunity of exaggerating the quantum of such a claim is significantly reduced. In an overall delay costs claim at the end of a contract, there is more scope for including delays for which the contractor is not entitled to make a claim. It also noted that; it is often difficult to separate and identify different causes of overall delay.

2.6.3. Methods of Estimation for Prolongation Costs having No Specified Rate

To quantify a prolongation claim, a contractor must demonstrate that the delay caused damages (in the case of a breach of contract) or extra cost (in the case of a specific contract provision). The onus is on the contractor to prove that the costs claimed have been incurred and that every effort has been taken by the contractor to minimize these costs.

If a contract does not include a prescribed delay cost rate, then it is necessary to assess what delay costs are legitimate and to evaluate those costs. Determining delay costs is time consuming and expensive and can often lead to contractual disputes. Whether the principal is able to accurately evaluate the claims depends on whether the site records are adequate (New South Wales Government, 2008).

The methods of estimation for prolongation cost will be discussed in the next subsequent sections under the category of the delay damages.

2.6.3.1. Extended and Increased Field Cost Estimation Methods

Extended Field Overhead (sometimes called site overhead) is one of the most well-known and well-understood types of delay damages and only results from a critical project delay, or when the project's duration is extended; (<http://www.delaydamages.com/delay-damages/extended-field-overhead/> retrieved in March 2014).

The contractor's entitlement to payment for extended field overhead costs is based upon the presumption that its original contract price only included field office overhead costs needed to support the project during the original project duration. So, when the project duration is extended, the contractor would incur additional field overhead costs to support the project and, if the extended project duration was caused by a compensable delay, then the contractor may be entitled recovery of those costs.

In the case of equipment, labor and material cost escalation there is price adjustment formula and price difference between the current price and base price set in the contract.

i. Actual costs

One method of assessing on-site delay costs is to evaluate the actual costs incurred. If cost information is provided by a contractor to justify a claim, then this must be audited to eliminate all costs that should be included in the direct costs of construction activities.

Generally; there will be very few material costs in on-site overheads. An exception could be time-related items essential for the maintenance of the overhead staff or amenities. Costs that are not time-related would be deducted.

According to Paul Newman and Jeff Whitfield (1994) the site overhead or preliminary costs are usually readily resolved. Preliminaries include site set-up costs, time-related costs and demobilization costs. Once the time-related costs are established, then the calculation should be a simple one. The rule is that the contractor should be fully reimbursed for the expenditure of necessary additional costs. They state that, to value this entitlement it may not be appropriate for the preliminary costs in the contract bills simply to be adjusted pro rata them over the period of

delay. In a period of delay the contractor may need more or fewer staff and more or less accommodation than he properly allowed for in the tender.

It is for the engineer to decide on the facts of each case, probably in conjunction with the quantity surveyor, whether the claimed costs are appropriate (Newman & Whitfield, 1994).

The actual cost of staff and labor will generally be provided by wages or salary sheets and the cost of all external plant and services will be substantiated by invoices. These invoices should be inspected to ensure that no operating charges such as repairs or replacement parts, fuel or other incidentals are included. The delay cost is the equipment rental charge only. In some cases, there will be reduced hire rates or even no charge for standby or non-operational periods. Where contractor owned plant is involved, invoices are not likely to be available, so an analysis of the costs claimed will have to be made separately (New South Wales Government, 2008).

The Government Procurement System Practice Guide of New South Wales indicates that where the Principal has maintained good site records, the checking of the actual times claimed against a contractor's records is the ideal way of establishing costs and the best way of accurately assessing the costs.

Depending on the Project-specific circumstances, when a Project encounters a delay, the Contractor would typically retain its supervisory team at the job site. To calculate the delay-related direct labor cost to maintain these people onsite, add the daily cost of each staff member's salary, including burden (like overtime and facilities provided) and then multiply that sum by the number of days of excusable compensable delay (Trauner, 2009). Make sure that if the delay is expressed in calendar days that the costs are also expressed in cost per calendar day.

$$\left(\begin{array}{l} \text{Damages for extended field} \\ \text{labor(supervisory personnel)} \end{array} \right) = \left(\begin{array}{l} \text{Aggregate of each} \\ \text{daily Salary} \end{array} + \text{burden} \right) * \left(\begin{array}{l} \text{Number of days of} \\ \text{compensable delay} \end{array} \right)$$

While this calculation is straightforward, it is important to note that the analyst also needs to address the propriety of the Contractor's claim to recover extended field costs for supervisory personnel.

ii. Estimated costs

To minimize the administrative effort required to provide actual cost information in support of on-site overhead costs in a delay claim, a contractor will often provide estimated daily or weekly costs for the staff, plant and facilities involved (New South Wales Government, 2008).

- The amount of claim can be calculated by multiplying the cost of daily or weekly costs set by the period of claim made.

If good site records exist, it is usually possible to check such claims in broad terms and highlight inconsistencies in a contractor's claims. An examination by both parties of cost records may become essential.

2.6.3.2. Head Office Related Costs Estimation Methods;

➤ Unabsorbed Home Office Overhead

Theodore J. Trauner states that, usually, the Contractor calculates the final bid price by adding a percentage for markup to the direct cost bid amount. The exact markup depends on the amount of home office overhead costs the contractor incurs in a given period, usually one year. The number of projects the Contractor has under construction at any one time also affects the markup. For instance, if a Contractor works on only one Project at a time, 100 percent of the home office costs for the period of construction would be added to the direct Project cost. As the number of projects increases, the percentage allocated to each job would be reduced. He also put, the allocation of home office overhead costs to individual projects is typically a function of direct labor costs or total Project revenues and billings, rather than a fixed dollar markup for each Project.

The calculation of the contractor's unabsorbed home office overhead costs can be more complicated and is often quite controversial. It is usually determined through the use of appropriate apportionment formulas; (<http://www.delaydamages.com/delay-damages/extended-field-overhead/> retrieved in March 2014).

Paul Newman and Jeff Whitfield also explained about the deal under consideration that, head office costs are a little trickier to value and recover. In many contracting organizations the head office exists solely to support the site operations. The accounts department pays the wages of operatives and staff engaged in dealing with the effects of prolongation; the managers and

directors allocate time to deal with the problems arising from site delays, and the purchasing department procures additional plant and extends the rental period for cabins and certain other facilities. They noted, of course, it can be argued that the head office and its staff would incur those costs anyway, but this is not how the legal commentators generally regard the recovery of such costs. In most contracting organizations the overheads are budgeted as a percentage of planned turnovers. If work on one site is prolonged, then the staffs are not able to work elsewhere to create that turnover or its attached overhead. In short, it is generally accepted that head office overheads are a legitimate head of claim.

The contractor must first prove that had his resources not been engaged on the overrun of the project in question he would in fact have deployed his resources elsewhere to fund his overheads. Such a task is not easily accomplished, although the courts have often displayed a certain tolerance towards the contractor's duty.

In accordance to Paul Newman and Jeff Whitfield head office overheads are usually calculated by use of a formula, although, as far as practicable, the contractor's actual loss should be established. The starting point often is:

$$\frac{\text{Overhead Cost for Year}}{\text{Turnover for the Year}} * 100 = \text{Percentage Addition}$$

It is not surprising to find that head office costs are rarely adequately allocated to specific projects, nor is there any good reason why they should be (Newman & Whitfield, 1994). However, this does raise a problem when trying to determine how much of the ongoing head office cost should be allocated to the delayed project. To overcome this problem a formula is usually deployed to evaluate the proper allocation of cost.

Paul Newman and Jeff Whitfield state that, formulae to calculate head office overheads appear in many guises but they all attempt to quantify accurately a head office loss that would be either difficult or impossible to calculate in any other way.

➤ **Calculation of the Loss**

Where the evidence justifies a claim for lost contribution to head office overheads and profit, how should it be calculated? Roger Gibson, in his attempt to answer this question, claims that as a hypothetical loss there is no single right figure for any given claim by its very nature.

Roger Gibson rises that few companies are prepared to open up their accounting records to demonstrate their head office costs, so this is resolved by applying formulae based on the contract price and the duration of the extended contract period.

➤ ***Formula approaches***

The analysis and calculation of overhead figures for claims arising from delays to contract completion dates on an actual basis calls for systematic record keeping and a considerable amount of detailed presentation of accounting information if it is to be successful (Davison & Mullen, 2009). They also add that even when all the necessary information for analysis is readily to hand, there can be differences of opinion as to the relevance of portions of the figures presented, e.g. where costs for an accounting department are included in the figures there can be argument that only elements (perhaps the payroll section) are affected by any claim for delay. There is therefore a great attraction in the potential adoption of a formula that could be used to calculate the appropriate amount of the overhead charge.

The benefits of a suitable formula would obviously be the elimination of the accounting analysis and records, with a consequent saving in time and cost, and the avoidance of argument as to the relevance of any part of the costs. As for R. Peter Davison and John Mullen, there are, however, considerable problems in the adoption of formulae to calculate possible levels of overhead recovery as a consequence of the prolongation of a contract period, including:

- The formula will need to be based on the contract data for time and money, i.e. the programme and make-up of the contract sum. Where there are errors or deficiencies in either, but particularly the latter, the level of recovery can be more or less than the ‘proper’ amount.
- It is difficult, if not impossible, to structure a formula to discount elements of the contract sum that may not be applicable to the extended period of the contract.

- The adoption of a formula will generally require the assumption that the rate of activity, and therefore the rate of overhead cost, is uniform throughout the course of the project. Only in exceptional circumstances will such an assumption be valid.
- Crucially, formulae generally require the assumption that the level of overhead commitment and cost during the period of the prolongation of the contract works is the same as the average commitment and cost during the original contract period as calculated from the contract data. This is again an assumption that will be valid only in exceptional circumstances.

Paul Newman and Jeff Whitfield strengthen, 'The mathematical computations under the [formula] produce a figure, with at best, a chance relationship to actual damages, and at worst, no relationship at all.'

Generally in regard to the use of formulae by certain claims consultants as the judicial acceptance of the use of formulae, perhaps significant was the defendant employer's decision not to challenge the legitimacy of a formula-based approach. Only the particular formula used was challenged. The difficulty in precisely establishing home office overhead damages has led to the development of formulaic approaches that approximate the effect of an extended performance period on the Contractor's home office overhead costs (Trauner, 2009).

➤ *When to use a formula*

At best the use of a formula will only produce an average overhead and/or profit figure based on a number of assumptions that may, or may not, be realistic in any particular circumstances (Newman & Whitfield, 1994). And they recommend that, it must be preferable wherever possible to establish the actual overhead costs from records and accounting data but if the adoption of a formula is considered appropriate to a particular organization or project then the matter should be raised, if at all possible, before the contract is agreed between the parties. And, if the use of a formula is considered carefully at this stage it is possible for the parties to agree the relevant percentages to be applied at the outset and agree to its implementation in the event of delay requiring compensation.

Any parties to a contract agreeing the incorporation of a formula adjustment for overheads at the outset obviously need to consider carefully the shortcomings of the formula approach and accept

its deficiencies in return for the saving in time, costs and possible disputes if the actual costs have to be researched and presented for agreement after the event. In these circumstances the parties will also have the advantage of knowing from the outset what rate of overhead and/or profit is to be paid for any delay for which compensation is recoverable.

Paul Newman and Jeff Whitfield indicated if, as is mostly the case, there is no such prior agreement, the only way to establish the actual overhead costs of a delay is to produce the management records and accounting data to allow a proper analysis of the way overhead is incurred by the particular organization, and how any delay affects the recovery of that overhead. They also noted that, if, as a final resort, it is decided in particular circumstances that a formula is the only practical way to address the matter.

Paul Newman and Jeff Whitfield again give a thought, however, even if a formula such as Eichleay is to be adopted, the accounting data used should be subject to critical examination and not used without considering the trading activities represented by those figures and any adjustments required.

The following are such formulas and approaches that can be used as Head Office Overhead Recovery Techniques:

i. The Eichleay formula

The Eichleay Formula originated from a decision by the Armed Services Board of Contract appeals in 1960, Eichleay Corporation v. United States case. In its appeal before the Board, the Eichleay Corporation proposed a formula for calculating the damages. The Board accepted this formula as a reasonable method for calculating the damages (Trauner, 1990).

This formula seeks to establish the proportion of a contractor's head office overhead attributable to the project in question. It uses this proportion to compute an amount of overhead cost per week or per month and applies this to the period of delay. As Paul Newman and Jeff Whitfield explain the Eichleay formula is a three-stage calculation shown below:

- a) The total contract sum is divided by the company total revenue in the period to produce the proportion of the company revenue attributable to the contract; this is then multiplied by

the total overhead cost in the period to produce an amount of overhead attributable to the contract.

- b) The attributable overhead is then divided by the total contract period in days to produce a daily contract amount of overhead.
- c) Finally the daily overhead rate is multiplied by the period of delay in days to produce a recoverable amount.

Eichley obviously does not include profit in the formula and differs in that respect but it still suffers from the criticisms discussed above and, especially, assumes a uniform rate of spend etc. However, it does have the advantage of relating actual expenditure on overhead to all activities and then relating that expenditure to time.

The Eichley Formula first determines the allocation of HOOH for a particular project. Next, it takes a portion of the allocation and applies it to the total days of performance, which results in a daily HOOH cost. Finally, the Eichley Formula calculates compensation due to a contractor for an owner caused delay by multiplying the daily HOOH rate with the days delayed. The formula is an attempt to provide a realistic basis for allocating HOOH costs.

The Eichley formula

$$\text{Cont. Allocable O. H.} = \left(\frac{\text{Total Contract Billings}}{\text{Total Company Billings}} \right) * \left(\text{Total Head Office O. H. for Act. Cont. Period} \right)$$

$$\text{Daily Contract Allocable Overhead} = \frac{\text{Contract Allocable Overhead}}{\text{Total Extended Contract Period}}$$

$$\text{Sum Claimable} = \text{Daily Contract Allocable Overhead} \times \text{Period of Delay}$$

➤ **Problems with the Eichley Formula**

While the Eichley Formula is simple to apply, one might reasonably question its accuracy. The Eichley Formula is an estimated allocation and may, therefore, be somewhat inaccurate, yielding results that are either too high or too low.

Debate over the use of the formula has therefore led to refinements regarding its application. Theodore J. Trauner notes that, the most common argument against the use of the Eichleay Formula is that the Contractor receives compensation of home office overhead by virtue of the markup on a change. The obvious problem with this argument is that a Contractor likewise receives this same markup whether or not the change causes a delay. Unless the markup clearly contains an allocation for home office overhead, the argument that Eichleay should not be used may not be valid.

➤ **When to Apply the Eichleay Formula**

According to Theodore J. Trauner, by now the Eichleay Formula is a calculation applied at the end of the project after all the work and delays are completed. If the parties attempt to resolve the question of home office overhead during the Project, some form of a modified Eichleay Formula may be appropriate. One approach is to apply the Eichleay Formula from the beginning of the project up to the point of negotiations. Thus, the total contract billings, the total company billings, and the total number of days from the start of the project up to the approximate date of the calculation are used.

ii. Modified Eichleay Formula – Variation 1

This formula attempts to allocate HOOH for the original contract period first to the project and then on a daily basis to determine the compensation owed. However; it assumes that the HOOH rate from the original contract period should hold the same even during the delayed period.

The first modification to the Eichleay Formula is set forth below:

$$\text{O. H. Allocable to Cont.} = \left(\frac{\text{Total Contract Billings}}{\text{Total Billings for Original . Cont.Per.}} \right) * (\text{Total Company O. H. during cont. period})$$

$$\text{O. H. Allocable to Contract/day} = \frac{\text{Allocable Overhead}}{\text{Original days of contract performance}}$$

$$\text{Home Office Overhead Owed} = \text{Daily overhead} * \text{Days of Owner Caused Delay}$$

iii. Modified Eichleay Formula – Variation 2

Like the first variation to Eichleay, this formula attempts to allocate HOOH for the original contract period first to the project and then on a daily basis to determine the compensation owed. It adds into the calculation the value of contract billings during the extended period in an attempt to compensate for overhead costs spread over a longer period of time.

Eichleay Formula a later variation of the follows:

$$\left(\text{O. H. Allocable to Contract} \right) = \left(\frac{\text{Contract Billings}}{\text{Total Billings for Orig. Cont. Per.} + \text{Cont. Billings for Extended Per.}} \right) * \left(\text{Total Company O. H. during Orig. cont. peri.} \right)$$

$$\text{Overhead Allocable to Contract/day} = \frac{\text{Allocable Overhead}}{\text{Original days of contract performance}}$$

$$\text{Home Office Overhead Owed} = \text{Daily overhead} * \text{Days of Owner caused delay}$$

iv. The Hudson formula

This formula was created by the courts in the United Kingdom and later exported to Canada. This formula takes its name from Hudson’s Building and Engineering Contracts whose publication first appeared in 1970 (Davison & Mullen, 2009). It uses the percentage allowance made by the contractor in his original contract sum for head office overheads and profit as the basis for the loss of contribution to overheads (Gibson, 2008).

In other words, the formula requires the contract sum to be divided by the contract period, in weeks, to produce a weekly amount of the contract sum per week. This sum is then multiplied by the head office percentage, being the portion of the contract sum that applies to off-site overheads, to produce a weekly head office overhead sum, which is then multiplied by the period of delay, in weeks, to produce a recoverable sum of head office overhead and profit for the period. Hudson made no mention of how the applicable percentage was to be obtained, if it was not quoted in the contract or agreed between the parties, although the tenth edition, in which the formula first appeared, suggested that rates of 3–7% of the total prime cost including prime cost

and provisional sums was the range to be expected for competitively tendered projects (Davison & Mullen, 2009).

It derives its daily HOOH rate on the basis of the as-bid calculations and assumes that the bid rate should hold constant throughout the life of the project.

They also noted, the Hudson formula suffers from most, if not all, of the potential criticisms outlined above and has one further major failing:

- ✓ In applying the overhead and profit percentage to the weekly amount of the contract sum the percentage is being applied to a figure which itself includes an element of overheads and profit. The recovery being calculated therefore includes some double counting because of this failing. If the Hudson formula is to be applied at all the formula needs correcting to reduce the contract sum used in the formula to a figure net of overhead and profit.

Again Roger Gibson states that the Hudson formula is a very broad-brush approach to dealing with claims for head office overheads. However, it may not be appropriate to claim for loss of profit unless there is a clear indication that the contractor would have been able to earn profits on other contracts but for the overrun. Also it takes as its base overhead and profit percentages from the original contract price and these may not properly reflect the contractor's true overhead cost and profitability.

The Hudson Formula is set forth below:

$$(\text{HOOH. Owed}) = \text{Planned HOOH \& Profit \%} * \frac{\text{Original Contract Sum}}{\text{Original Contract Period}}$$

$$(\text{HOOH. Owed}) = \left(\frac{\text{Allocable Overhead}}{\text{Per Day}} \right) * \left(\frac{\text{Period of Owner}}{\text{Caused delay}} \right)$$

This means; the claim is based on the allowances actually made by the contractor in tendering for the contract, notwithstanding that these may of course have been unreasonably optimistic or pessimistic, as summarized by Ato Amare Assefs;

- It is based on the allowances actually made by the contractor in tendering for the contract.
- This may bear little or no relation to the actual head office costs of the contractor & therefore Hudson's formula is often criticized as unrealistic.

v. Ernstrom Formula

This formula rests on the theory that there is a direct relationship between overhead costs and labor costs that can be calculated and applied to a delay situation. That is, as labor costs grow so do the corresponding HOOH costs. Thus, by calculating this ratio and applying it to the amount of labor expenses incurred during a delay period, the amount of damages due to the delay can also be calculated. Since this is a ratio formula, it does not develop a daily HOOH cost but rather calculates a lump sum cost.

The Ernstrom Formula can best be explained with the following formula:

$$= \frac{\left(\frac{\text{Total Overhead for Contract}}{\text{Period (All Projects)}} \right)}{\left(\frac{\text{Total Labour Costs for Contract}}{\text{Period (All Projects)}} \right)} = \text{General Labour / Overhead Ratio}$$

$$= \left(\frac{\text{Labor to Overhead}}{\text{Ratio}} \right) \times \left(\frac{\text{Labor Costs during}}{\text{Delay}} \right) = \text{OH Allocable to Delay}$$

vi. Manshul Formula

This formula has also been referred to as the Direct Cost Allocation Method. It is a creature of the courts in the State of New York. When New York courts rejected Eichleay, they were challenged to pose a substitute method of calculating overhead and created this formula. It does not arrive at a daily overhead rate. Rather, it uses the as-bid HOOH rate times the cost of work performed during the delay period to determine the overhead used.

The Manshul Formula is shown below:

$$= \left(\frac{\text{Cost of Work Performed}}{\text{During Delay Period}} \right) * \frac{\text{Contract Cost \%}}{\text{Cost + Mark Up \%}} = \text{Direct Cost}$$

$$= \left(\frac{\text{Direct Cost Incurred}}{\text{During Delay Period}} \right) * (\text{Head Office Overhead \%})^* = (\text{Head Office owed})$$

* Estimated or known HOOH % portion of bid markup

vii. Carteret Formula

Carteret is a formula that comes out of the manufacturing sector, but some have attempted to apply the formula to construction delay cases. It assumes that there is a differential in overhead rates during a delay period and calculates this difference. The formula then multiplies this rate

differential times the cost of work performed during the delay period. Since this is a cost-based formula, like Manshul, it does not derive a daily rate. The problem with this approach is that if no rate differential can be shown, then no HOOH is owed.

The Carteret Formula is displayed below:

$$\text{Excess Overhead Rate} = \left(\frac{\text{Actual Overhead Rate}}{\text{During Delay Period}} \right) - \text{Normal Overhead Rate}$$

$$\text{HOOH Owed} = \text{Excess Overhead Rate} * \left(\frac{\text{Total Cost of Work}}{\text{during Delay Period}} \right)$$

viii. Allegheny Formula

Like Carteret this formula comes to the construction industry from the manufacturing sector. And, like Carteret and Manshul it is cost based, not time based. Thus, it does not derive a daily overhead rate but calculates overhead from the rate differential times the base bid cost. Again, if no rate differential can be demonstrated, then no HOOH is owed, even if owner caused delay is present.

The Allegheny Formula is set forth below:

$$\text{Excess Overhead Rate} = \left(\frac{\text{Actual Overhead Rate}}{\text{Delay Period}} \right) - \left(\frac{\text{Actual Overhead Rate during}}{\text{Entire Project Performance}} \right) \text{Period}$$

$$\text{H. O. O. H. Owed} = (\text{Excess Overhead Rate}) * (\text{Contract Base Cost})$$

ix. Emden Formula

This formula is a creature of the Canadian Courts, Emden's Construction Law. Its approach is similar to Eichley in that it attempts to allocate total HOOH to a project on first a proportionate basis and then a daily basis. It utilizes both overhead and profit costs as a part of the calculation and then multiplies the result times the amount of owner-caused delay incurred.

It also follows the same path as the Hudson formula with one important difference in that it has a first stage in which the company's total overhead cost and profit is expressed as a percentage of the company's total revenue in the period. The formula is then identical to the Hudson formula with the percentage derived from the first stage being used to calculate the weekly overhead and profit amount recoverable. This has the advantage of defining how the percentage is to be

calculated, on the company's actual overhead and profit as a proportion of total revenue, but as per R. Peter Davison and John Mullen it introduces two distinct complications that detract from the attraction of simplicity in formulae:

- The calculation of the percentage as the first stage requires the production of accounting records and data, presumably for at least one relevant financial year, and therefore the avoidance of time and cost involved in such production of data begins to be eroded.
- Secondly, and more importantly, the overhead and profit have to be identified from the accounting records thereby introducing an opportunity for disagreement as to which items in the accounts are, or are not, truly head office overhead.

In other words, it involves a two-stage calculation that applies the percentage that the contractor's total overheads and profit bear to the total revenue of the company. The second stage applies this percentage to the contract price, contract period and the period of delay to determine the weekly cost recoverable.

Roger Gibson puts the advantage of this formula as it uses a head office overhead percentage based on the contractor's total business rather than on the specific contract in dispute. Again this formula does not necessarily reflect the real effect on overhead costs arising from the delay, but it may provide a reasonable approximation particularly if some simplistic approach is looked for to assist in negotiating an out-of-court settlement.

The Emden Formula is displayed as follows:

$$= \frac{\text{Total Overhead} / \text{Profit during Act. Cont. Period}}{\text{Total Company Turnover for Act. Cont. Period}} \times \frac{\text{Orig. Contract Sum}}{\text{Orig. Contract Period}} \times \text{Period of Delay}$$

Ato Amare Assefa summarized two points as follows;

- Here the figure used is the percentage that is relevant to the contractor's whole organization, found by dividing total overhead cost and profit by total turnover.
- This formula has the advantage of using the contractor's actual head office/profit percentage rather than the one contained in the contract.

Emden's, despite its limitations, does at least refer to actual figures achieved by the contractor for his annual turnover, profit and overhead costs (Newman & Whitfield, 1994).

This approach ignores the question whether the particular contract was more or less profitable than usual.

x. Burden Fluctuation Method

This method determines unrecovered HOOH by finding the increase in the absorption rate and allocating that increase to the non contract work, which was forced to bear more than its fair share of HOOH expenses. The burden fluctuation method has been used by courts and boards to calculate manufacturers' unrecovered HOOH claims.

$$\text{Total Billings} - \text{Contract Billings} = \text{Other Contract Billings}$$

$$\text{Actual Overhead Rate} - \text{Potential Overhead Rate} = \text{Burden Fluctuation}$$

$$\text{Burden Fluctuation} \times \text{Other Contract Billings} = \text{Unrecovered Overhead Claim}$$

xi. The Canadian Method

This method is used extensively in Canada (Trauner, 1990). The Canadian Method uses the contractor's actual markup for overhead in its calculation. This markup is based on bid documents or audit records. An audit of the contractor's records will determine a percentage based on history (Ibid.).

This markup is based on either the Project bid documents or an audit of the Contractor's records. An audit would reveal the historical percentage markup for home office overhead applied to each Project. The percentage markup is multiplied by the original Contract amount and then divided by the original number of days in the Contract. This yields a daily overhead rate based on the amount the Contractor bid. This rate is then applied to the number of days of compensable delay.

$$\frac{\text{Original Contract Sum} \times \text{Percentage Markup (from bid docs or audit)}}{\text{Original number of days in the contract}} = \text{Daily Overhead Rate}$$

$$\left(\text{Compensation for home office overhead} \right) = (\text{Daily Overhead rate}) \times \left(\text{No. of days of compensable delay} \right)$$

A variation of the Canadian Method, known as the Hudson Method it can also be named Modified Canadian Method, has been used in Great Britain. In this method, the percentage markup portion of the formula includes a profit allocation. As with any method, the Contractor must demonstrate that the underlying markup and cost assumptions are reasonable before recovery under these alternate methods will be allowed.

Theodore J. Trauner noted that, because typically no consideration is given to unallowable costs, the Canadian method is simpler to apply than the Eichleay Formula.

xii. Total Direct Cost Allocation Method

The Total Direct Cost Allocation Method allocates the direct costs incurred to calculate the overhead rather than what has been billed (Hewitt, 1986). The calculation for the method is as follows.

Overhead Applicable to the Disputed Contract Direct Costs, (OHDC)

$$\text{OHDC} = \frac{(\text{Disputed Contract Direct Costs} * \text{Total Company Overhead})}{\text{All Other Contract Direct cost}}$$

$$\text{Daily Overhead Rate (DOR)} = \text{OHDC} \div \text{Days of Contract Performance (less delay days)}$$

$$\text{HOOH Cost Claim} = \text{DOR} \times \text{Days of Delay}$$

The total direct cost approach suffers from a number of weaknesses. It does not consider the differences in the cost components from a contractor's various projects. The methodology assigns the same overhead rate calculation to every project. Normally, rates are determined based on the type of work involved in the contract. Overhead rates would vary based on the level of effort required.

xiii. Specific Base Allocation Method (SBAM)

SBAM is a substantially accurate allocation approach, but is also considered the most complicated and expensive to use (Hewitt, 1986). SBAM allocates overhead costs based on the specific characteristics of a job and each overhead cost element. SBAM would only be a practical approach if the methodology for collecting data was already in place or when the claim amount

can justify the analysis expense. The method involves creating indirect cost pool accounts and a basis for allocating the accounts to each contract. This involves developing, comparing, and establishing cost relationships for all elements. The costs for overhead items are allocated to each job based on the established percentages of the overall item cost. Of the various established techniques, SBAM comes closest to counting the dollars in detail the exact way they are allocated. This is, of course, time consuming and tedious.

$$(\text{Allocation Basis (AB)}) = \left(\frac{\text{Allocation Item Cost on Disputed Jobs}}{\text{Allocation Item Cost on All Jobs}} \right)$$

$$\text{Allocated Overhead of Pool Account (AH)} = (\text{Pool Account Cost}) \times (\text{AB})$$

$$(\text{Average Daily Overhead (ADOH)}) = \left(\frac{(\text{AH})}{\text{Total Contract Days}} \right)$$

$$(\text{Claimed Overhead Costs}) = (\text{ADOH} \times \text{Days of Delay})$$

xiv. Calculation Based on Actual Records

In the calculation of damages based on actual records, the contractor needs to provide detailed accurate records of his HOOH expenses that will support his claim. In providing the records, the contractor will need to determine the percentage of effort expended for this project performance period or during the delay period. This percentage can be applied to the fixed HOOH costs, which will result in an allocation for the particular project (Trauner, 1990). This procedure requires detailed accounting procedures, from a record-keeping standpoint, which can be quite onerous. However, the effort may produce substantial benefits to the contractor, which might otherwise not be realized (Ernstrom & Essler, 1982). This method is very accurate if used precisely, and requires no formulas, which is a welcome benefit.

Some Owners are reluctant to include home office overhead costs in compensation for delays. This is particularly true when these damages are based on a formula (Eichleay or Canadian) that provides only an approximation of damages. The Contractor could strengthen its argument by maintaining accurate records in the home office that would support its specific claim for damages (Trauner, 1990).

It is summarized as follow;

$$\% \text{ age effort of the staff} = \frac{\text{Total staff time delayed}}{\text{Total Working hrs of the project for delayed period}}$$

$$\left(\begin{array}{c} \text{Home office overhead} \\ \text{cost of claim} \end{array} \right) = \left(\begin{array}{c} \% \text{age effort of} \\ \text{the staff} \end{array} \right) \times \left(\begin{array}{c} \text{Home office costs} \\ \text{during delay period} \end{array} \right)$$

xv. The Direct Method

The Direct Method is a method proposed by the U.S. Army Corps of Engineers, since it espouses a one-step calculation.

$$\text{Planned HOOH Rate} \times \text{Planned Earnings during the delay period} = \text{Unabsorbed HOOH}$$

This reflects exactly what the contractor would have earned on the home office overhead had there been no delay or standby. The expected (i.e. planned) production during period of delay can be known from client-approved contractor schedules, the information for which should be readily available. The important factor in the “Direct Method” is that the planned earnings are based on the latest updated schedule. There needn’t be any interference from Total Billings in the calculation of unabsorbed overhead for a specific project, and the Direct Method has taken this into account. The Direct Method is much less convoluted than the other methods presented. It consequently appears evident that attorneys and judges, in their ignorance of construction engineering and management, have made a simple process as complicated as possible.

➤ Which formula should be used?

The selection of a formula for head office overheads will depend on the circumstance of each case, as per Roger Gibson. And finally, it is suggested that the certifier, contract administrator, arbitrator, adjudicator or court should not be bound by the results of a particular formula, and that the use of one formula be compared with the results of another formula.

2.6.3.3. Inefficiency or Lost Productivity Costs Estimation Methods

The costs associated with inefficiency are direct costs. Since, we are discussing delays as the catalyst for the inefficiency; all indirect costs should be associated with the period of delay. Therefore; the costs associated with inefficiency will be directly related to costs of labor, equipment, or materials. As such, if the analyst can reasonably measure the magnitude of the loss of efficiency, the cost calculations are straightforward (Trauner, 2009).

There are many ways in which a Contractor's work can be affected because of changes to the work schedule. The delays may cause these problems directly or indirectly. The delays may be to critical or noncritical items. The Contractor must be able to measure and demonstrate how the delays adversely affected the workers' productivity if it is to be compensated for the additional costs. There are several methods for quantifying productivity loss. The delay analyst should be aware of each of these options. The following list ranks the different methods by their accuracy in measuring losses in productivity according to Theodore J. Trauner (2009):

1. Compare un-impacted work with impacted work
2. Compare similar work on other projects with the impacted work on the Project in question
3. Use statistically developed models
4. Use expert testimony
5. Refer to industry published studies
6. Use the total cost method

a) Compare Un-impacted with Impacted Work

Theodore J. Trauner (2009) notes that the impacted versus un-impacted method, usually referred to as a measured mile, is the preferred method to measure losses in productivity. The Contractor must show a comparison between un-impacted and impacted work.

To measure productivity in this manner, all information must be recorded in a form that can be converted into productivity units.

$$\text{Loss of productivity Cost} = \left(\text{Productivity during favorable condition} \right) - \left(\text{Productivity during shifted condition} \right)$$

b) Total Cost Method

In the total cost method, a contractor argues that it estimated a certain cost for its work. Because of the delay and the subsequent inefficiency of a shift in work seasons, the actual cost was higher. Therefore, the Contractor claims the difference in damages.

This method assumes that the Contractor's estimate was accurate. It also assumes that the Contractor in no way contributed to the reduced efficiency and that all additional costs are solely attributable to the delays cited. All of these assumptions may be challenged (Trauner, 2009).

$$\left(\text{Contractor's Claim of Damage} \right) = \left(\text{Contractor's cost of estimate for productivity} \right) - \left(\text{Actual cost of productivity} \right)$$

2.6.3.4. Acceleration Costs Estimation Methods

➤ Quantifying the Time Savings Associated with Acceleration

In order to isolate the time savings associated with acceleration, you need to determine the difference in the duration of the critical path activities before and after the acceleration. Since, the schedule is the tool used to identify the critical path; it is the schedule that is used to quantify the time savings associated with accelerating. In practice, the schedule is updated and then revised based on the acceleration plan (Trauner, 2009). The difference in length of the critical path activities being accelerated prior to and after the schedule revisions is the time savings associated with acceleration.

By using the schedule in this manner, changes in the critical path due to acceleration will be identified. Once a path is accelerated to the point where the critical path shifts, activities on the new critical path will also have to be accelerated.

➤ Quantifying the Costs of Acceleration

The cost of acceleration is the difference between what it would have cost to do the work as originally planned versus what it will cost to do the work in the accelerated time frame. After acceleration has occurred, costs can be evaluated using actual data, or, prior to the acceleration, costs can be put together based on detailed estimates. In assessing acceleration costs, there are several categories that need to be evaluated, including additional material costs, labor premiums, inefficiency, additional equipment costs, and other miscellaneous expenses.

Additional material costs are simply the difference in the cost of the materials that would have been required to execute the work prior to the acceleration plan versus the cost of the materials needed to perform the work after the acceleration plan is put in place. If an additive is used in order to accelerate the concrete cure time, then the additive is an additional material cost. Any cost for more or better material that is a direct result of the acceleration plan is an additional material cost.

Labor premiums are additional costs associated with the manpower needed to accelerate. Overtime and holiday pay are examples of labor premiums. Others include having to use higher-paid employees or higher-paid Subcontractors. As to Theodore J. Trauner, on some projects, a large-scale acceleration effort can affect the prevailing rate of local labor as the demand for

workers exceeds the supply. When the average cost of an hour of labor is increased as a result of the acceleration effort, the difference in the old and new hourly rate is part of the labor premium.

Another common cost of acceleration is additional equipment to support the additional crew. The additional rental cost of equipment and any associated delivery charge may be a legitimate acceleration cost. This may be questionable, since the Contractor may keep them and gain the full benefits of their use over time. On the other hand, a Contractor may have no need for new equipment and no desire to run additional crews on future projects. In that case, this may also be a legitimate cost of the acceleration.

Miscellaneous costs may include the costs of using express mail, the housing of additional staff and labor, the administrative costs of planning the acceleration and revising the schedule (if allowed by Contract), markups for profit and overhead, additional cleaning costs, running additional temporary power, evening meals, and other miscellaneous expenses that would not have been incurred if the work had not been accelerated. Sometimes, additional supervisors are captured as a labor expense, and sometimes they are identified as an overhead item.

Theodore J. Trauner states that one area often overlooked, is the savings associated with acceleration. The acceleration effort will decrease the amount of time required to complete the work, and as a result, any time-related costs, should also be decreased.

$$\text{Cost of Acceleration} = \left(\begin{array}{c} \text{Accelerated Cost} \\ \text{of the work} \end{array} \right) - \left(\begin{array}{c} \text{Planned Cost of} \\ \text{the work} \end{array} \right) + \left(\begin{array}{c} \text{Any time related} \\ \text{costs} \end{array} \right)$$

2.6.3.5. Lost Profits or Opportunity Costs Estimation Methods

A contractor's income will vary from time to time and although the delay on one contract may reduce the income from that contract in one financial year, the income from that contract will be received in the next financial year, and there is no permanent loss of income.

Various devices have been invented to show that if a contractor is delayed on a contract, there is a loss of profit and overheads which, if the delay had not occurred, would have been earned from other contracts (New South Wales Government, 2008). The Hudson and Eichleay formulas are two such devices.

2.6.3.6. Interest

The Contractor must support his claim by identifying increased borrowing, and the measure of interest cost is based on the actual financing cost incurred. If such interest is measured as an actual cost, recovery is usually allowable, providing the Contractor has supplied adequate proof.

When measuring interest, the period of interest may vary based on the nature of the claim. The start date may be the date a payment became due or the date a claim was filed. Ending dates may be the date of recording the judgment or the date of actual payment. Other factors to consider include the type of interest allowable (compound or simple interest).

Methods of calculating Interest;

- 1) Simple Interest – Interest calculated on the principal only.

$$F = p + (ip)N = P(1 + iN)$$

- 2) Compound Interest – In case of compound interest, the interest obtained in the preceding period is added to the principal to calculate the interest for the succeeding period.

$$F_n = p(1 + i)^n$$

2.6.3.7. Consulting and Legal Costs (Claim Preparation Costs)

Although; these costs are typically disallowed in litigation, the Contract may allow reasonable costs of experts expended to support a change order under the changes clause. In this case, the consulting and legal cost would typically be connected to the administration, monitoring, or completion of extra work, so it can be calculated from the direct cost incurred by the contractor and any invoice recorded.

2.6.3.8. Inflation

It is mentioned that a common method used by claims advisors is to deduct the fixed price from the tender sum and revert to pricing the whole job on the NEDO formula or similar. This often over compensates the claimant. In times of low inflation this head is usually less contentious (Newman & Whitfield, 1994).

A macro-economic policy measure mostly used by the countries across the world, to alleviate the adverse effects of inflation is indexation. Indexation is the periodic adjustment of money-value

(e.g. wages, salaries, pension, rent, contract amount/charge/rate, etc.) in relation to changes in a price index that reflects inflation. The principle of indexation is to enable the society to live with inflation in such a way that no individual or group suffers disproportionately.

Inflation/deflation adjustment – the unit cost must be adjusted for the time difference between the original project and final project using various indices of economic trends to support a correction.

There should be a standard method for handling inflation and a defined inflation percentage that is applied to the estimate. Estimate for long duration projects should be stated in year-of-construction costs. The estimating manual itself should be updated annually in the areas of inflation factors, contingency amounts or percentages to be used, and possibly other factors that change with time and market conditions. Inflation should be handled by applying an appropriate inflation rate to the calculated project cost.

The adjustment for inflation can be carried out by taking into account the average inflation rate which is usually based on the change of the consumer price index. According to practices in the UK, the adjustment for change in tender price index is carried out by adjusting the prices in accordance with the tender price index which is developed in each year. However, this has not been practiced in Ethiopia as the tender price index is not developed by the Central Statistical Authority (CSA) of the country (Major Railways Project Team, 2006).

2.7. General Guidelines for the Presentation and Recovery of Damages

Theodore J. Trauner (2009) outlines some basic guidelines for the Contractor in preparing its statement of damages in order to expedite the recovery of damages.

A. The initial step in formulating the damage calculation, whether caused by delays or other reasons, is to carefully review and closely follow the Contract provisions. A typical agreement will require both contracting parties to fulfill specific requirements and that a certain measure of risk or loss can accrue to either party if the requirements are not satisfied.

For example, a termination for convenience clause will likely provide rules for measuring damages, and the Contractor will be limited to the terms set forth in the Contract. It is essential that the damages claimed follow these specific rules, or recovery may be more difficult.

- B. Avoid frivolous claim items and overstated claim amounts. Although some parties believe you must start high and negotiate down, frivolous claim items and inflated claim amounts cause a Contractor to lose credibility and ultimately delay the process of resolution. Contracts often now include clauses that classify overstated claim amounts as false claims, with harsh consequences. A well-documented damage claim should satisfy any audit requirements of the Contract.
- C. Be prepared to negotiate and compromise. Just about any unresolved dispute involves shades of gray and is not a case of black and white, where one party is absolutely right and the other party is totally wrong. Consequently, settlement is seldom reached unless each party is willing and able to compromise.
- D. Carefully evaluate your opponent's ability to settle. Many public agencies are not in a position to negotiate due to the need to justify any settlement amount to others, such as taxpayers or other agencies. Generally, these types of claims will require thorough documentation to facilitate the approval process.
- E. Support damages based on the verifiable facts, and not one's expectations anticipated prior to the award of the Contract. If a Project incurs a loss, it is the reasons for the loss that are being claimed with appropriate support and measurement, not the bottom-line loss.
- F. Summarize your damages within a format that will allow subsequent updates or revisions, especially if the quantitative measure is not fully available until a future date.
- G. Avoid duplication of claimed costs and calculation or posting errors. Cross-check and double-check the calculation as it evolves over time.
- H. Remember the burden of proof is borne by the party submitting the claim. The claimant must produce facts to establish that the damages were incurred as a result of actions of the other party, along with the measure of the damages.
- I. There is always an obligation to mitigate damages. If certain damages could have been mitigated, these costs are unlikely to be recoverable.
- J. Generally a claimant's actual costs are considered reasonable when measuring damages, unless proven differently. However, actual costs do not automatically prove that damages were incurred as a result of the action of the other party.
- K. The evidence used in supporting damages must be admissible under the jurisdictional rules governing the case.

- L. The evidence supporting your damages is generally more persuasive if it is prepared contemporaneously with the actual progress of the Project, as compared to documents prepared after the fact.
- M. Remember to establish a cause-and-effect relationship to the extent possible for each component of damages being claimed. You need to show how you were damaged as a result of the other parties' actions or inactions.
- N. When feasible, submit your claim for damages using the suggested format of the Owner. This process will lessen the areas of disagreement with the Owner about the format and structure of the claim and keep the discussion focused on the content of the claim.

3. RESEARCH METHODOLOGY

3.1. General

Progress in every field of science depends on the contributions made by systematic research; thus, research is often viewed as the cornerstone of scientific progress. Broadly defined, the purpose of research is to answer questions and acquire new knowledge. Research is the primary tool used in virtually all areas of science to expand the frontiers of knowledge (Marczyk et al., 2005). Kumar (1999) defines research as a process, that is undertaken within a frame work of set of philosophies, uses procedures, methods and techniques that have been tested for their validity and reliability; and designed to be unbiased and objective. Research can either be a deductive, theory based to prove or disprove the already existing knowledge; inductive, a problem initiated for theory/knowledge contribution; or a mixed approach to research.

Research methodology is a way to systematically solve the research problem and research methodology shall identify the research basis, research hypothesis or questions, research design and research analysis (Abraham, 2008).

Accordingly, in this chapter, the research design and methodology followed to achieve the ultimate goal of the research which is specified at the beginning will be discussed. In a way; data and information sources, research instruments, sample size and method of analysis are presented. So that; using the design and methodology, the research draws up findings in a way to make conclusions and forward recommendations on prolongation cost estimation practice for road construction projects in Ethiopia.

In estimating the prolongation cost; there are many bases that need to be considered; documentation, justified time delay, suitable estimation methods and suitable contractual provisions. In each the above concepts, there are different variables that need determination on the extent/ frequency and degree of importance on the estimation practice of prolongation cost claim.

Therefore, it is necessary to identify the variables and methods based on occurrences, in order to rank their overall effects on the practice. This helps to prioritize the factors and, hence to determine the mitigation actions to be taken.

Generally, this research part is expected to be an important stepping stone for examining the various aspects of the problem under consideration, understanding and formulating guiding principles to govern the research procedure and developing and/or testing hypothesis for the enhancement of the existing situation, state or process.

3.2. Research Type and Approach

The research started as two staged study. Problem identification has been done through a preliminary unstructured literature review and informal discussion with colleagues and professionals in the sector. As an output of this initial phase, in estimating prolongation cost well recorded and organized documentations, suitable conditions of contract and well established methods of estimation is important in Ethiopian road construction industry and identified as a proposed problem to be studied; where the research questions were developed in view of investigating this problem.

Contextual and conceptual literature reviews have been done once the problem is identified to have an in depth understanding on the research topic. The review includes books, journal articles, internet sources and archival document such as issues related to prolongation cost claims in road construction projects. The document search was mainly intended to collect how prolongation cost claim issues were handled practically and to check their compliance as provided in the contract provisions.

Once the specific question was determined, a suitable research design and methodology was considered. Afterwards, the variables and research questions were operationalized into a clear measurable hypothesis. This study is therefore a mixed research which adopted both qualitative and quantitative research. It should be noted that a mixed approach of quantitative and qualitative is possible (Kumar, 1999). Bazeley (2004) states mixed methods research has regained not just acceptability, but popularity, with a significant number of studies arguing its virtues in terms of greater understanding and/or validation of results. Working with mixed methods raises a range of issues above and beyond those encountered within a particular methodology.

A qualitative research is a “subjective” assessment of a problem and takes the form of an opinion, view, perception or attitude towards objects (that are referred to as an attribute, variable, factor or

question). Quantitative research, on the other hand, is an objective measurement of the problem that investigates facts and tries to establish relationships using statistical tools.

This survey-based research design has been selected as it is useful in demonstrating the prevalence of the problem throughout the population. Once the distribution of the problem has been determined and major variables identified, it may be possible to get hints on how to prevent the challenges and problems. It also helps to identify differences among groups and to recommend possible remedies to be taken by respective stakeholders.

To this effect, a questionnaire was designed following an in-depth contextual and conceptual literature review, and distributed to randomly selected stakeholders including contractors, consultants and employers actively participating in Ethiopian road construction industry. To supplement the questionnaire, a desk study was conducted involving prolongation cost claims made by contractors, the employer's reflection, and determination by the engineer and DRE in the field. Checking, sorting and coding of gathered data has been done for the selected method of analysis. Consequently; analysis of the data obtained from questionnaires and Desk study have processed which involves simple statistical approach, examining, tabulating and categorizing based on the chosen measurement scale. After the collected data is analyzed, the findings and results are discussed. Finally, the researcher has given his conclusion and recommendation, based on the analysis and discussion.

3.3. Research Population and Sampling

The research population was drawn from three agencies which are participating in federal road construction projects-owner (ERA), contractors, and consulting firms. As much as possible attempts have been made so that the samples drawn from the population are representatives. The contractors included were all Category 1 and were either General Contractors (GC) or Road Contractors (RC). The list of contractors and consultants currently involved in road construction projects were obtained from Ethiopian Roads Authority (ERA).

The required sample size is determined using the following expression;

$$n = (Z)^2 * P*(1-P) / (E)^2$$

Where; n - Necessary Sample Size, Z - Z-score from Z-score table, P - proportion of the population with prolongation claim & 80% projects progress and E - Margin of error (Confidence Interval).

With confidence level 90%, marginal error + or – 5% and proportion of the population 0.164 as it is the most forgiving number and ensures that the sample will be large enough and the sample size is found to be 149. The variables were determined on the basis of the time available for conducting the research work, available fund for the study (project), and the reliability of the respondents, so that the overall research work would indicate the reality purposive sampling. The respondents included in the survey comprised of 23 from owner, 20 from contractors, and 20 from consulting offices.

3.4. Research Instruments

Tadesse (2009) grouped the methodology of data collections under four headings, namely opinion research, empirical research, archival research and analytical research. According to Brukley; each method has its own strength and limitation, none of the above methods is superior that of the other. The choice which one to use is decided based on the research/survey objective, the nature of the information and resources available (Jobber cited in Tadesse, 2009).

The data collection approach adopted for conducting this research includes both primary and secondary sources. Questionnaire and desk study provide the primary data for this thesis while the secondary data sources include renowned civil engineering journals those especially in project and construction management, internet sources, as well as reviewing related archival documents on contractual issues of road construction works. These different methods of data collection have been used in order that the data or information obtained from one can be supplemented by the others whereby the collected data will give multiple evidences.

3.4.1. Questionnaire

Questionnaire provides first hand information for the subject matter of a research as it is focused on issues which further serves as a survey to understand the main concerns and attitudes of respondents towards the problems (Kasiem, 2008). In this thesis, questionnaire was administered to some randomly selected stakeholders of the construction industry such as public employers,

domestic and foreign contractors and consultants. For the questionnaire survey respondents were randomly selected from employer's organization, contractors and consultants who have been involved in the contract administration and claim issues. The questionnaire which consists of both open and close ended question was distributed among these professionals.

First respondents were asked about their reflection on the existing condition on prolongation cost claim and estimation in general, and regarding Prolongation cost Administration Practice in the road construction sector (Justified time delay in relation to prolongation cost claim, Data collection and Documentation/Records for prolongation cost estimation, Prolongation cost estimation Methods, Suitability of Conditions of Contract) based on the following scale of measurements;

Strongly agree	Very Difficult	Very Good
Slightly agree	Difficult	Good
Neutral	Medium	Fair
Slightly disagree	Easy	Poor
Strongly disagree	Very Easy	

After this; they were asked regarding the administration practice of the parties in handling prolongation cost estimation based on their experience. Respondents were also asked to specify variables that most contribute to prolongation cost estimation practice.

Once these basic questions are answered by the respondents then they were asked to rate the potential variables provided regarding frequency of occurrence based on the following scales of measurements: Most Frequent, Frequent, Least Frequent, No Occurrence and Very High, High, Medium, Low, Very low

A 5-point Likert's scale (from 1-4/5) was used for the structured questionnaire to gauge the potential factors and the respondents' agreement on each variable. This was intended to identify and rank potential factors based on their rate of occurrences.

Respondents were also requested to propose possible measures which minimize challenges and problems.

Finally, open and closed ended questions which were intended for the assessment of the estimation methods and practices were directed to respondents; this is aimed to evaluate whether the estimation process itself contribute to the problem.

3.4.2. Desk Study

In addition to books, journals and internet sources, archival document and claim documents have been reviewed to understand the background of contract provisions, back up data and practices in estimation cost claims in the road construction sector. These secondary sources provide a general understanding of the subject area by presenting a wide range of ideas in the field which help to supplement other specific information obtained from the primary data sources.

In addition; desk studies on prolongation cost claims were used in this research to support or supplement responses and arguments found by questionnaire through in-depth analysis of some cases of a project. Of course, as the nature of the cases focuses on one aspect of a problem or practice, the conclusion drawn may not be generalized, but rather related to one particular event (Naoum cited in Kasiem (2008)). For this reason, desk studies under this research are used to supplement the findings obtained through questionnaire in a way to bridge the gulf.

3.5. Methods of Data analysis

Both descriptive and inferential statistics were employed in the analysis of data collected from various sources. In the analysis, the ‘mean score’ method was adopted for the structured part of the questionnaire, to establish the relative importance of factors based on frequencies of occurrence. The five point Likert scales (0, 1, 2, 3, and 4) are used to calculate the mean score for each factor and which was then used to determine the relative ranking among various factors.

The mean score (MS) for each potential factors is computed using the following expressions.

$$MS = \frac{\sum (f \times S)}{N}$$

Where:

MS = Mean score, f = frequency of response for each score, S= score given to each factor (0 to 4), and N= Total number of responses for each factor

Ranks of variables/factors based on cumulative mean score, as perceived by different parties are tested for correlation/concordance. The purpose of a correlation test is to see if there is difference in ranking between groups of respondents and to avoid being deceived by chance of occurrences and impact as ranked by single part.

In this research it is used to show the degree of agreement between the different parties involved in the survey: contractors, clients and consultants.

The Kendall coefficient of concordance (W) is used to measure the community of ranks for m observers. It is computed with the following formula (Kendall, 1970)

$$W = \frac{12 * S}{m^2 * (n^2 - n)}$$

Where S is the sum of squares of deviations of the rankings, that is:

$$S = \sum_{i=1}^N (R_i - R_{mean})^2$$

m is the number of groups of respondents, n is the number of variables being ranked, R_i is the sum of ranks for i^{th} variable and R_{mean} is mean of sum of the ranks.

W ranges between 0 and 1, when W=1 indicates a perfect agreement among the three respondent groups; but if the ranking by various groups differ very much, the sum of ranking (R_i) will be more or less equal for each of the factors and hence the value of S becomes small and so does that of W.

The hypothesis (HR) in the analysis is: ‘there are significant association in perception of different factors in prolongation cost estimation among employers, consultants and contractors.’ and the null hypothesis (HO) is: ‘there is no association in perception between three categories of respondents with regard to factors in prolongation cost estimation.’

The significance level (P) of the hypothesis (confidence level of more than 95%) is checked using CHIDIST, which returns the one-tailed probability of the chi-squared distribution. The χ^2 distribution is associated with a χ^2 test. Using the χ^2 test to compare observed and expected values. By comparing the observed results with the expected ones, it can be decided whether the original hypothesis is valid or not.

The Syntax for CHIDIST (P) in Excel spread sheet is; CHIDIST(x, degrees _ freedom) where; x - is the value at which you want to evaluate the distribution and Degrees _ freedom is the number of degrees of freedom i.e. (n-1).

$$\chi^2 = m * (n-1) * W$$

3.6. Research Limitation

As it is explained in the previous section, the target populations of this research are the contractors, consultants and employer. Although; prolongation cost claim needs protocols and guidelines to the construction industry, as it is not well studied. This has created a great deal of shortage of information for the researcher to build his knowledge. To this end, it was decided to make this research a stepping stone for further similar researches.

The major limitation of the study was the lack of willingness of professionals to complete and return the questionnaire which took too long than expected. A series of briefings on the questionnaire was conducted to motivate respondents in completing the questionnaire as its findings are for academic purpose. In addition, it is found difficult to access documents related to prolongation cost claims submitted by the contractor and determination made by the engineer and DREs.

3.7. Writing the research

This research has three major component stages. These are: Research proposal, Conducting and processing of the research and Final writing of the research

The research was started by collecting, compiling and writing conceptual matters from literatures. And the research instrument development was done parallel to the conceptual review and writing. Writing the conceptual part and the data analysis and discussion part of the research had taken the longest period of the research time. The detailed discussion and analysis of the responses from the surveyed research population is presented in this part of the research. Writing of each stage has been done in parallel with the on-going process. The final part, conclusion and recommendation with rewriting of the research is done at last. The whole research document is classified into five (5) major parts (Refer Section: 1.8).

4. ANALYSIS AND DISCUSSION

4.1. Introduction

4.1.1. Overview

The purpose of this study in general is to identify and understand gaps (problems and challenges) in estimating prolongation cost in the federal road construction projects. This chapter analyses the collected data along with the desk study assessment made on prolongation cost claims documents and presents the results of the analysis on the main issues by discussing with literature review.

The most significant unanticipated cost in most construction projects is the financial impact associated with delay and disruption to the works. Assessing the impact of delay and disruption, and establishing a direct causal link from a delay event to effect, liability and the resulting damages, can be difficult and complex. All parties require these skills for successful evaluation and presentation of delay damage claims; the Engineer/employer's professional team requires similar skills and techniques when analyzing and evaluating delay damage entitlements under a construction contract. Estimating prolongation cost needs experienced professionals to administer, well recorded and organized documentations, suitable conditions of contract and well established methods of estimation.

Based on the aforesaid crude fact, the research problem has been assessed by collecting data with the help of questionnaires and archival records regarding prolongation cost claims.

The results from the desk study and questionnaire survey has been presented, interpreted and analyzed in detail in this part. In light of the results obtained from the analysis; the General Prolongation Cost Claim and Estimation Practice, specifically; Prolongation cost Administration Practice (Justifying time delay in relation to prolongation cost claim, Data Collection and Documentation/Records for Prolongation Cost Estimation, Prolongation Cost Estimation Methods and Suitability of Conditions of Contract regarding prolongation cost estimation) issues has been assessed. Finally; discussions has been made on the basis of the identified gaps (problems and challenges).

4.1.2. Questionnaire Response Rate

The study has focused on the major construction stakeholders participating in the federal road construction projects. Organizations were selected on a cluster basis on their category i.e. Consulting, Contractors who are class-I where their list is obtained from ERA; and the solely public employer ERA. The survey included organizations mainly involved in federal road construction projects. The survey included randomly selected organizations from the cluster category where the questionnaire was distributed to professionals directly involved in contract administration and related subject.

From the 135 questionnaires distributed a total of 65 responses were received, two of questionnaires from Employers were rejected due to incompleteness; hence, out of the 65 questionnaires 63 were found to be suitable for data analysis consisting of 23 (51.1%) from the client, 20 (44.4%) from consultants and 20 (44.4%) from contractors. The overall response rate was 46.67% as shown in table below.

As compared to that of the client the response rate from the contractors (44.4%) seems to be to the lower side. But, it is still considered to be more than sufficient for analysis, based on the assertion made by Moser and Kalton (1993), in which if a response rate is lower than 20 or 30% the failing is so critical and the result will be of little value; and hence, the required effort need to be made to raise the rate above about 30 or 40%.

The details of respondent responses and its rate are summarized in Table below.

Table 4.1: Questionnaire survey response rates

Respondents Category	Questionnaires		Percentage	Valid Responses	Percentage Response Rate
	Distributed	Returned			
Employers	50	25	50.0%	23	51.1%
Consultants	49	20	40.8%	20	44.4%
Contractors	50	20	40.0%	20	44.4%
Total	149	65	43.6%	63	42.3%

4.1.3. Quality of Respondents

Professionals directly involved in contract administration activities were considered for questionnaire survey. 63% of professionals are from organizations of more than 15 years of establishment, while; 10% from 10 -15 years experience in the sector, 22% of them are from organizations of more than 5 -10 years of experience and only 5% are having less than 5 years experience.

In Addition; 16% of the respondents are from foreign companies currently involved in the road construction projects, of them 30% have an experience of 10 -15years, 60% have 5-10years and 10% are involved in the sector less than 5years. The rest 84% of the respondents are domestic companies. Tables below summarize quality of respondents;

Table 4.2: Experience of companies in Road Construction Projects

Duration	Employer	Consultant	Contractor	Sum	%age
<5 Years	0	1	2	3	5%
5-10 years	0	7	7	14	22%
10-15 years	0	3	3	6	10%
>15years	23	9	8	40	63%
Total	23	20	20	63	100%

Table 4.3: Type or origin of the Respondents' Organization

Respondents	Respondent	Domestic Origin	Foreign Origin	%age of Domestic	%age of Foreign
Employer	23	23	0	100%	0%
Consultant	20	18	2	90%	10%
Contractor	20	12	8	60%	40%
Total	63	53	10	84%	16%

Table 4.4: Experience of Foreign Companies in road construction sector in Ethiopia

Experience	Respondents			
	Consultant	Contractor	Sum	%age
< 5 years	0	1	1	10%
5-10 years	1	5	6	60%
10-15 years	1	2	3	30%
Total	2	8	10	100%

Regarding Educational status, about 30% of the respondents hold M.Sc. degree and the rest 70% have B.Sc. degree as summarized below.

Table 4.5: Educational Status of Respondents

Respondents	Educational Status				
	B.Sc.	M.Sc.	Total	%age of B.Sc.	%age of M.Sc.
Employer	16	7	23	70%	30%
Consultant	12	8	20	60%	40%
Contractor	16	4	20	80%	20%
Total	44	19	63	70%	30%

Finally; when we look at the respondent’s position in the organization, about 47% are participating in the top management position, 44% are working in middle management level and the rest 10% are other.

Table 4.6: Respondents Position in their Company

Respondent Position	Emp.	Cons.	Cont.	Employer %age	Consultant %age	Contractor %age	Average
Top Mang’t	7	7	15	30%	35%	75%	47%
Middle Mang’t	14	11	3	61%	55%	15%	44%
Other	2	2	2	9%	10%	10%	10%
Total	23	20	20	100%	100%	100%	100%

Even though the higher percentage of respondents’ position is top management (47%) they are directly involved in contract management and also the middle management (44%) includes those participating in relation to contractual cases. It is believed that the result from the survey is relatively accurate and reflects the prevailing actual situation in the road construction industry with respect to the prolongation cost estimation practices.

Therefore, the result obtained from the survey is endowed with a wealth of knowledge and expert information that can help to draw reliable conclusions and recommendations. In addition, along with the archival records assessment made on prolongation cost claims survey results give sound conclusions and recommendations.

4.2. Assessment on the Existing Condition of Prolongation Cost Claim and Estimation Practice

In this part, trial was made to assess the existing aspect of prolongation cost claim and estimation practice in the federal road construction projects. Consequently; the respondents rate as shown in fig. 4.1, the rate of occurrence of prolongation cost claim in road construction projects come into sight, in view of this; 65% of the respondents give that it can be leveled as Frequent, 32% least frequent and only 3% give there is no occurrence at all. So; it can be said that rate of occurrence of prolongation cost claims is frequent.

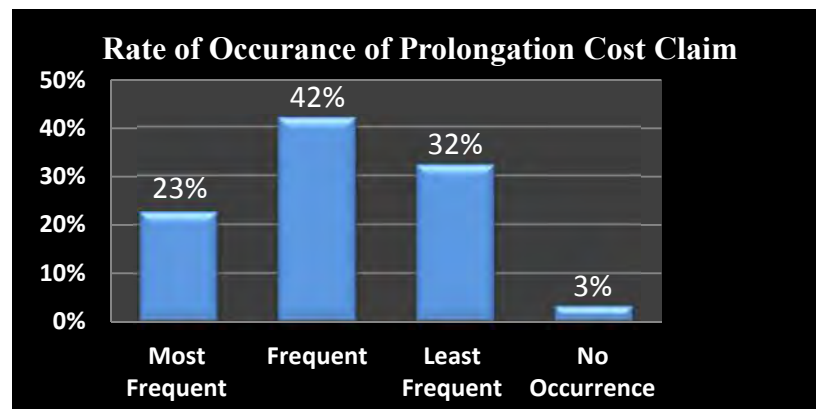


Figure 4.1: Rate of Occurrence of prolongation Cost Claims

To show the level of occurrence among the eight components of prolongation cost claim, the survey indicates that extended and increased site cost, and head office overhead cost ranked high as detailed below table: 4.7. in ranking order of the following sequences. But; when we see the desk study, inflation claim is not frequent even it can be said there is no any claim appealed.

Table 4.7: Ranking in Occurrence of Prolongation Cost Claim types,

No.	List of Cost Claims	Employer		Consultant		Contractor		Average	
		RI	Rank	RI	Rank	RI	Rank	RI	Rank
1	Extended and Increased Site Costs;(Site Overheads or Preliminaries)	2.76	1	3.21	1	3.22	1	3.06	1
2	Head office over head costs	2.76	1	2.85	2	3.00	3	2.87	2
3	Inflation	2.24	4	2.65	3	3.11	2	2.67	3
4	Inefficiency/ Lost productivity costs	2.71	2	2.50	4	2.32	6	2.51	4

No.	List of Cost Claims	Employer		Consultant		Contractor		Average	
		RI	Rank	RI	Rank	RI	Rank	RI	Rank
5	Financing Charges/Interest	2.68	3	2.27	6	2.42	4	2.46	5
6	Loss of Profit/Opportunity cost	2.00	6	2.40	5	2.37	5	2.26	6
7	Acceleration costs	2.08	5	1.95	7	2.11	7	2.05	7
8	Claim Preparation Costs	1.96	7	1.70	8	1.68	8	1.78	8

To confirm the concordance of responses among the three parties, the values of Kendall coefficient of concordance (W) and the significance level (P) are checked, and found out to be 0.8198 and 0.01606 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is good with confidence level of more than 95%.

m	n	s	w	χ^2	P
3	8	309.88	0.8198	17.216	0.01606

In addition, of the prolongation cost claims 40% of the respondents indicate that they will end up into dispute. As detailed in the following figure:

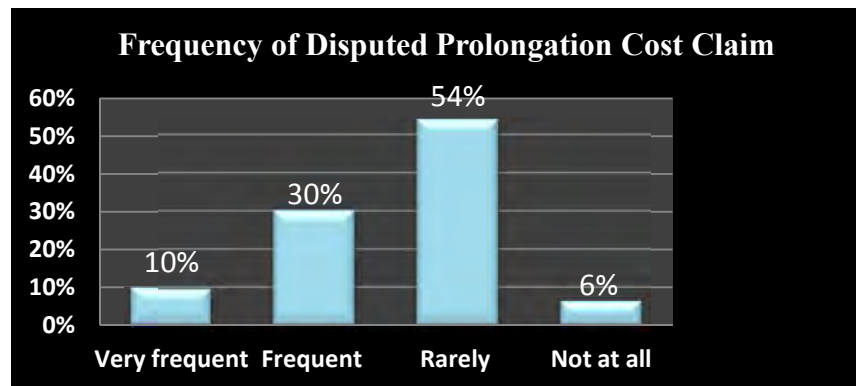


Figure 4.2: Frequency of Disputed Prolongation Cost Claims

In reflection to the above response; the research listed the reason behind to know the critical problems that let the prolongation cost claim get into dispute and table 4.8 below shows in ranking order of list of reasons. Hence, it can be concluded that, the rate of occurrence of prolongation cost claim get in to dispute due to; Lack of documentation for substantiation of the claims, Inequitable determination by the engineer or employer, Contractors attitude towards

getting additional payment, Ambiguity of contract documents and Wrong method of cost estimation in ranking order.

Table 4.8: Percentage Response on Critical Problems for prolongation cost claims get into Dispute.

No.	List of Reasons	%age Response
1	Lack of documentation for substantiation of the claims	29%
2	Inequitable determination by the engineer or employer	21%
3	Contractors attitude towards getting additional payment	21%
4	Ambiguity of contract documents	16%
5	Wrong methods of cost estimation	13%
	Total	100%

Regarding the practice of prolongation cost estimation in road construction projects, the questionnaire was developed in such a manner to let the respondents give their response to level their agreement that the practice could be described as in reasonable significance level or not. Accordingly, of the respondents; 26% agreed that the practice is reasonable and 63% has forward their disagreement that the practice is not in a reasonable significance level. The rest 11% are in between or neutral. This point also reinforced by the desk study in such a way that the estimation made by the contractor, determination given by the engineer, employers response and DRE’s decision have significant differences. In addition; the respondents have been also given their opinion regarding what challenges may have contributed to the above disagreement as shown below in the fig 4.3.

Thus, the practice of prolongation cost estimation in road construction projects can be said that it is not in acceptable significance level, with the contributing factors; Scarcity of records or documentation, No defined estimation methods, Failure by contractors to provide appropriate breakdown of contract amount, Absence of clear and suitable contractual provisions, Lack of competent and experienced professionals in the field and Problem in justifying time delay.

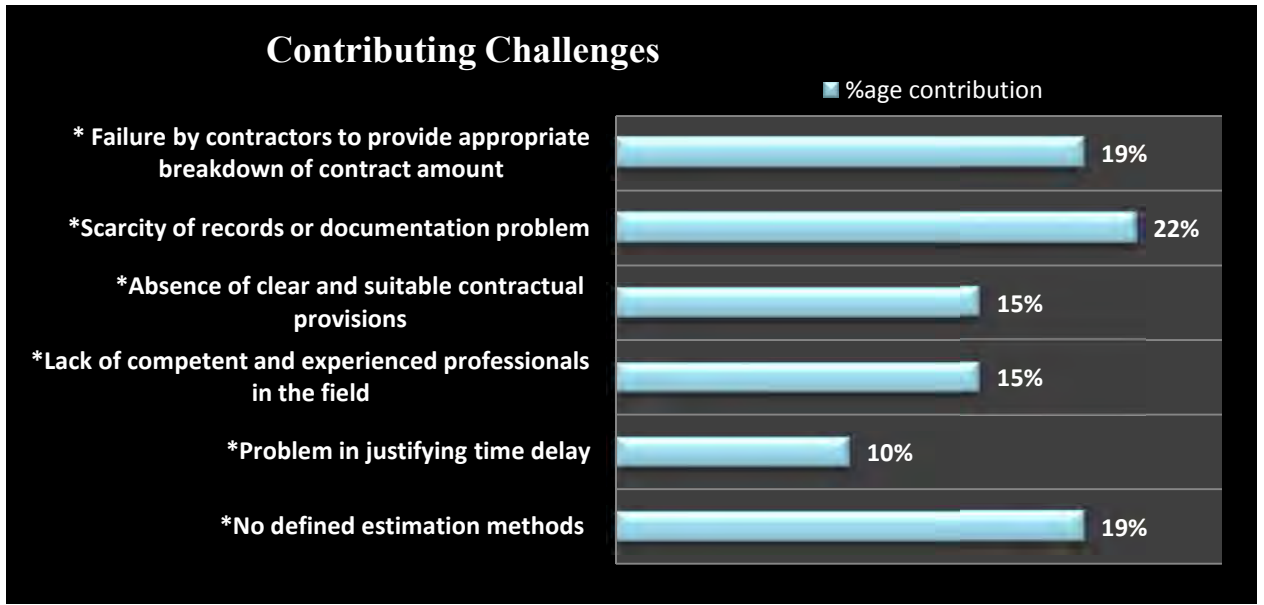


Figure 4.3: Contributing Challenges on Prolongation Cost Estimation Practice

From the solely employer point of view; that is ERA, a respondents are required to give their response towards the agreement to the statement that “the Contractors in some cases refrain from pursuing their rights stipulated in the contract provisions to claim for prolongation cost claims”. And it is found to be high level of agreement 83% towards the statement, whereas the rest 17% is in disagreement.

For those who are in agreement with the above statement, it is surveyed what possible reasons might be behind. In response, 55% put , Even though they understand their rights, they reserved in fear of jeopardizing their future work relation with the Employer and consultants, 30% agreed it is due to lack of awareness and the rest 15% is as due to unfavorable industry environment (take long time, fraudulent practices etc.)

In relation to the participation of domestic contractors in relation to prolongation cost claims, a question is raised for the respondents to get their reflection towards the statement; “in most of prolongation cost estimation and claim practices in major road construction projects in Ethiopia, the companies who are exercising prolongation cost claim are foreign companies”. Accordingly; the percentage agreement of respondents to the statement is 62% agree, 25% disagree and the rest 13% is in between. Detailed in fig 4.4 below:

To this point, it can be said that; in most of prolongation cost estimation and claim practices in major road construction projects in Ethiopia, the companies who are exercising prolongation cost claim are foreign companies. The possible reasons might be behind is found to be keeping away their future work relation with the Employer and consultants being jeopardized and due to lake of awareness.

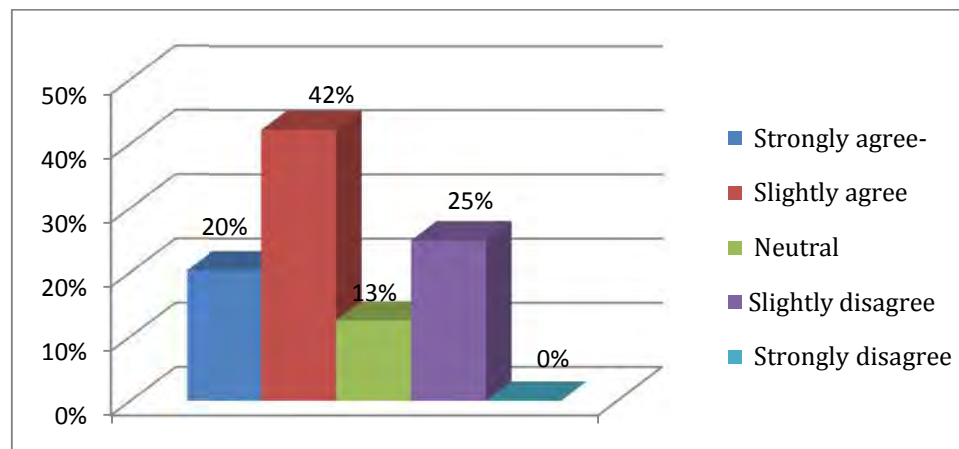


Figure 4.4: Percentage Agreement to Participation of Prolongation Cost Claims,

The prolongation cost claim types are leveled in degree of difficulty during estimation of the cost, accordingly as shown in table 4.9, Inefficiency/lost productivity, Profit loss/opportunity cost and acceleration cost are found to be the most difficult claim types that need attention during contracting.

Table 4.9: Ranking of types of Prolongation Cost Claims in Difficulty of Estimation,

No	List of Cost Claims	Employer		Consultant		Contractor		Average	
		RI	Rank	RI	Rank	RI	Rank	RI	Rank
1	Inefficiency/ Lost productivity costs	1.84	1	2.00	2	1.84	1	1.89	1
2	Profit Loss /Opportunity cost	2.13	3	1.95	1	1.95	2	2.01	2
3	Acceleration costs	2.04	2	2.20	3	2.06	3	2.10	3
4	Head office over head costs	2.40	6	2.30	4	2.33	4	2.34	4
5	Extended and Increased Site Costs	2.24	4	2.55	6	2.47	5	2.42	5
6	Inflation Cost	2.26	5	2.50	5	2.63	7	2.46	6
7	Claim Preparation Costs	2.75	7	2.65	8	2.60	6	2.67	7
8	Financing Charges/Interest	2.87	8	2.63	7	2.89	8	2.80	8

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.8942 and 0.008913 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is good with confidence level of more than 95%.

m	n	s	w	X²	P
3	8	338.00	0.8942	18.778	0.008913

Having the above list of difficulty, a list of three main problems are given to level as contributing factors to the difficulties, and found out to be in the level listed below in ranking order;

Table 4.10: Ranking of Problems to the Difficulty on Prolongation Cost Estimation,

No.	List of Contributing Factors	Employer		Consultant		Contractor		Average	
		RI	Rank	RI	Rank	RI	Rank	RI	Rank
1	Backup data and documentation	1.92	1	2.05	1	2.11	1	2.03	1
2	Suitable estimation Methods	2.16	2	2.55	2	2.47	2	2.39	2
3	Suitable contractual provision	2.92	3	3.05	3	3.05	3	3.01	3

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 1 and 0.02929 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is good with confidence level of more than 95%.

m	n	s	w	X²	P
3	4	45.00	1	9.00	0.02929

Accordingly, the following findings are drawn from the study with respect to the existing condition of prolongation cost claim and estimation practice:

- Level of occurrence of prolongation cost claim is frequent as 65% of the respondents give that it can be leveled as Frequent and 32% least frequent,
- Extended and increased site cost, and head office overhead cost are mostly occurring claims among the eight components of prolongation cost claim,

- Of the prolongation cost claims 40% of the respondents indicate that they will end up into dispute with contributing factors; Lack of documentation for substantiation of the claims, Inequitable determination by the engineer or employer and Contractors attitude towards getting additional payment
- The prolongation cost estimation practice is not in a reasonable significance level as supported by 63% of the respondents. Contributing factors; Scarcity of records or documentation, No defined estimation methods, Failure by contractors to provide appropriate breakdown of contract amount, Absence of clear and suitable contractual provisions, and Lack of competent professionals in the field.
- Inefficiency/lost productivity, Profit loss/opportunity cost and acceleration cost are found to be the most difficult claim types that need attention during contracting.

4.3. Assessment on Prolongation Cost Administration Practice

4.3.1 Justifying time delay in relation to prolongation cost claim

In administering prolongation cost, justifying time delay is one of the important parts for estimating prolongation cost claim. So; the level of difficulty in justifying time delay is rated by the respondents as shown in fig. 4.5 below. From the result, we can understand that it is difficult for the parties to entitle time extension in order to proceed for prolongation cost claims.

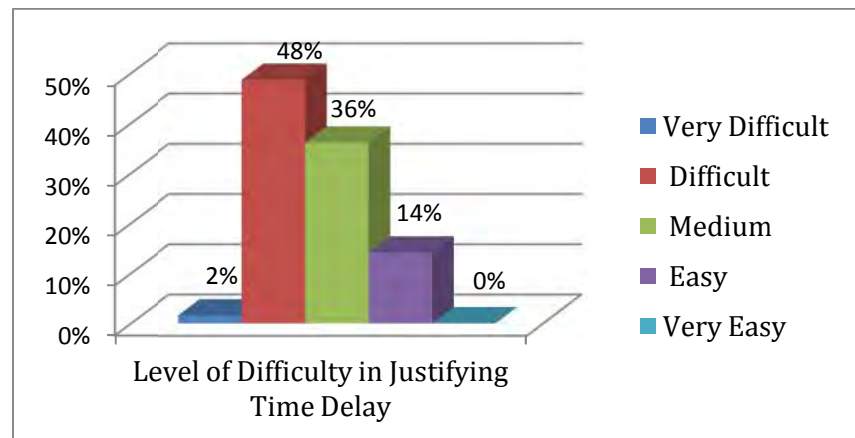


Figure 4.5: Respondents %age Reflection on Difficulty of Time Delay Justification

In addition, the research has listed out the contributing factors/problems to be ranked in their extent of contribution for the difficulty in justifying time delay. From the survey, it is concluded

that failure to maintain contemporary records is the first top problem in justifying the time delay, failure to regularly update the program is the second most important problem, poor presentation of the claim get the third stage, and fourthly, insufficient or total lack of notice of delay or likely delay. Lastly, the erroneous assumption that an extension of time automatically grants entitlement to monetary compensation by the client and the contractors is a major contributing factor as detailed below.

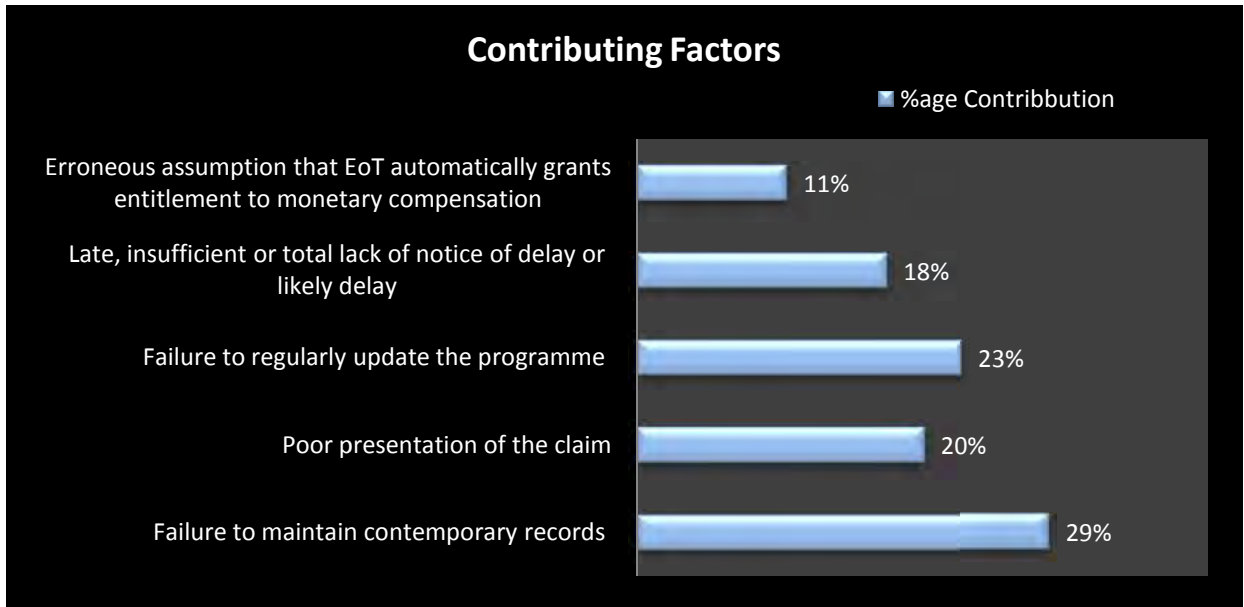


Figure 4.6: Contributing Factors for Difficulty of Time Delay Justification

4.3.2 Data Collection and Documentation/Records for Prolongation Cost Estimation

Data collection and documentation is the critical activity in administering prolongation cost claim for smooth and well progress of the cost estimation and substantiating the claim. In view of this, a survey is done to know the extent of agreement of the respondents regarding the achievement to the acceptable standard practice of data collection and documentation in road construction projects. Consequently, the data collection and documentation practice of the parties especially contractors are not up to standard as we can see from the percentage of response i.e. agreed, 35% agree and 65% Disagree.

The survey conducted to come up with a list of possible causal problems regarding data collection and documentation practice for being sub-standard gives as shown in the figure below; i.e. data collection and documentation practice of the road construction sector is not in the acceptable standard with the possible causal reasons of lack of competent and experienced professionals, Technical and managerial skill gaps, low awareness of stakeholders, Problems attributed to the Contractor capacity and Lack of conducive environment for practicing in order of influence.

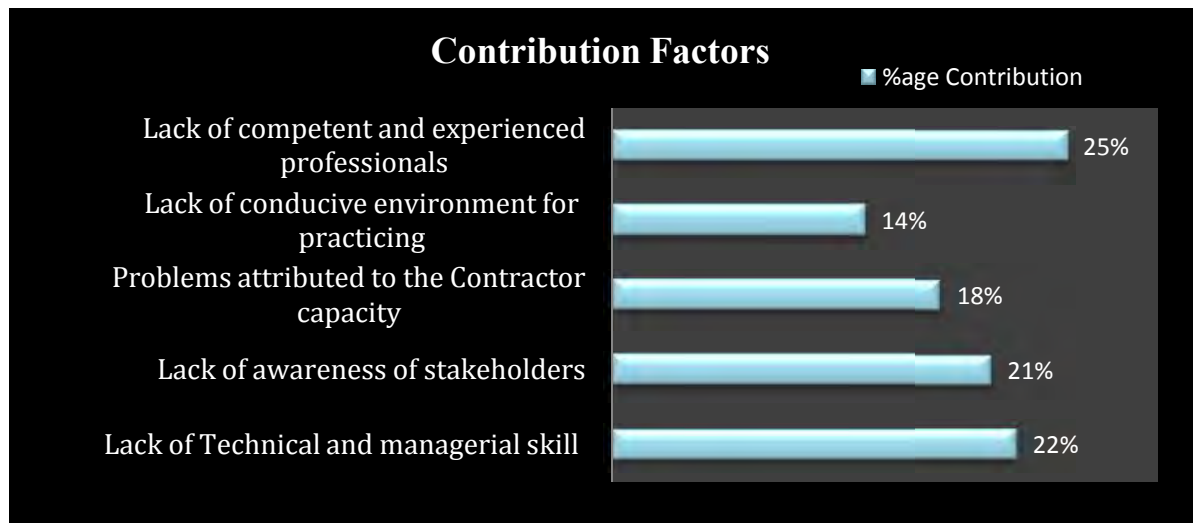


Figure 4.7: Contributing Factors on Data Collection and Documentation Problems

In addition, a survey has been done to rank in the level of extent in difficulty of getting records during prolongation cost estimation in a road construction project. In this regard, the following list of records/documents that is necessary for prolongation cost estimation and claim substantiation is drawn out from high level of difficulty to lower. The top difficult records having $RI \geq 3$ is shown below.

Accordingly, it can be summarized as site accounting records; daily reports and productivity, task and material schedule are the most difficult records to access in substantiating and estimating prolongation cost claims in sequential order.

Table 4.11: Ranking of Documents in Difficulty of Availability

No	List of Records	Employer		Consultant		Contractor		Average	
		RI	Rank	RI	Rank	RI	Rank	RI	Rank
1	Daily Force Account Records, pricing and billings	3.42	8	3.16	1	3.53	1	3.37	1
2	Task schedules and analyses	3.46	6	3.10	2	3.17	6	3.24	2
3	Forecast-to-Complete Estimate up-dates	3.63	3	2.61	16	3.44	2	3.23	3
4	Productivity Reports/Analyses	3.67	2	2.84	8	3.11	8	3.21	4
5	Construction control budget	3.54	5	2.89	6	3.18	5	3.20	5
6	Short Term Schedules and up-dates	3.29	10	2.80	9	3.17	6	3.09	6
7	Daily diary or journal entries	3.38	9	2.85	7	3.00	11	3.08	7
8	Material Delivery and Use Records, including expediting	3.22	12	3.10	2	2.89	14	3.07	8
9	Daily production logs, e.g. concrete pours etc.	3.58	4	2.55	18	3.06	9	3.07	9
10	Sub-contractor quotes, contracts, purchase orders and correspondence	3.00	17	3.10	2	3.06	10	3.05	10
11	Notes of telephone conversations	4.09	1	2.63	15	2.39	34	3.04	11

The rest of the records/documents ranked are annexed to the end of the document.

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.69 and 0.000245 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is good with confidence level of more than 95%.

m	n	s	w	X²	P
3	35	22164	0.69	70.362	0.000245

When we look at the employers' response the top difficult records having $RI \geq 3$ are shown in the table below, and most of the records are daily reports, accounting records; and task, material and financial schedule.

Table 4.12: Employers Response to Ranking of Documents in Difficulty of Availability

No	List of Records	Employer	
		RI	Rank
1	Notes of telephone conversations	4.09	1
2	Productivity Reports/Analyses	3.67	2
3	Forecast-to-Complete Estimate up-dates	3.63	3
4	Daily production logs, e.g. concrete pours etc.	3.58	4
5	Construction control budget	3.54	5
6	Daily equipment use	3.46	6
7	Task schedules and analyses	3.46	6
8	Daily Force Account Records, pricing and billings	3.42	8
9	Daily diary or journal entries	3.38	9
10	Short Term Schedules and up-dates	3.29	10
11	Actual Cost Reports, weekly or monthly, including Exception Reports	3.25	11
12	Material Delivery and Use Records, including expediting	3.22	12
13	Daily time records	3.17	13
14	Original tender estimate	3.13	14
15	Employer Inspection Reports	3.05	15
16	Accounting records: pay-roll, accounts payable and receivable, etc.	3.04	16
17	Sub-contractor quotes, contracts, purchase orders and correspondence	3.00	17

In the case of consultant the top difficult records having $RI \geq 3$ are shown in the table 4.13 below, and most of the records are site accounting records, material utilization and task schedule, documents in relation to Sub-contractor.

Table 4.13: Consultant Response to Ranking of Documents in Difficulty of Availability

No	List of Records	Consultant	
		RI	Rank
1	Daily Force Account Records, pricing and billings	3.16	1
2	Material Delivery and Use Records, including expediting	3.10	2
3	Task schedules and analyses	3.10	2
4	Sub-contractor quotes, contracts, purchase orders and correspondence	3.10	2

The top difficult records having $RI \geq 3$ are shown in the table 4.14 below to the contractors' perspective, and most of the records are site accounting records, Estimate updates and Consultants' Reports.

Table 4.14: Contractor Response to Ranking of Documents in Difficulty of Availability

No	List of Records	Contractor	
		RI	Rank
1	Daily Force Account Records, pricing and billings	3.53	1
2	Forecast-to-Complete Estimate up-dates	3.44	2
3	Consultant Inspection Reports	3.33	3
4	Any other reports, such as special consultant reports	3.29	4
5	Construction control budget	3.18	5
6	Short Term Schedules and up-dates	3.17	6
7	Task schedules and analyses	3.17	6
8	Productivity Reports/Analyses	3.11	8
9	Daily production logs, e.g. concrete pours etc.	3.06	9
10	Sub-contractor quotes, contracts, purchase orders and correspondence	3.06	10
11	Daily diary or journal entries	3.00	11

4.3.3 Prolongation Cost Estimation Methods

It is surveyed that whether the companies in which the respondents are involved in have a strict methodology to handle the prolongation cost claim during the construction planning of a project. In response of the question 73% confirm that they do not have any methodology to impose for prolongation cost claim and estimation during the construction planning of a project. Whereas, the rest 27% noted that they have a methodology to handle prolongation cost claims.

When we come to the technique of estimation that is being used currently for estimating a prolongation cost in a road construction project, it is found from the survey that 82% are using actual cost records and formulas, while the remaining 18% are using Tender allowance/Prescribed rate for prolongation cost, but from the desk study there is no contract that stipulates a rate and hypothetical formulas for any type of prolongation cost claims.

➤ **Extended and Increased Site/Field Costs**

When we come specifically to the techniques used to estimate Extended and Increased Site/Field Costs (additional labor, material, and equipment costs and Other Delay Costs), about 68% of the respondents are using actual records and the rest 32% are using estimated costs/daily or weekly cost rate. Whereas, from the desk study there is no contract that stipulates a rate for Extended and Increased Site/Field Costs.

As such, the technique of estimation that is being used currently for estimating Extended and Increased Site/Field Costs (additional labor, material, and equipment costs and Other Delay Costs) is using actual records.

➤ **Head Office Overhead Cost**

In a case, where there found lack of documents to substantiate prolongation cost claim of head office overhead and to make an estimation of the cost incurred by the claimant, it is likely to use a formula for estimating head office overhead loss. In relation to this, a survey question is made to identify which of the formulas developed and being applied in the overseas construction industry for estimating prolongation cost of head office overhead of a project is being used and requested to recommend which of them is suitable for Ethiopian road construction Industry.

Accordingly, a list of head office overhead cost estimation formulas are provided to level their reflection to the degree of use of the formulas and found out the following list in ranking order of frequency; but it is found on average 83% of the respondents have no idea regarding the formulas. The ranking is made by the 17% of the respondents; most of them are foreign constructors and consultant as listed in table 4.15 below.

Table 4.15: Ranking in use of HOOH Estimation Formulas

No	List of Records	Employer		Consultant		Contractor		Average	
		RI	Rank	RI	Rank	RI	Rank	RI	Rank
1	Hudson Formula	4.40	1	3.86	1	3.78	1	4.01	1
2	Eichley Formula	2.57	2	3.29	2	3.22	3	3.03	2
3	Calculation Based on Actual Records	2.33	4	3.08	3	3.33	2	2.91	3
4	Modified Eichley Formula – Variation 1	2.43	3	3.00	4	2.88	4	2.77	4

No	List of Records	Employer		Consultant		Contractor		Average	
		RI	Rank	RI	Rank	RI	Rank	RI	Rank
5	Modified Eichleay Formula – Variation 2	2.57	2	2.86	6	2.50	10	2.64	5
6	Ernstrom Formula	1.83	6	2.60	7	2.86	5	2.43	6
7	Total Direct Cost Allocation Method	1.50	9	2.89	5	2.73	6	2.37	7
8	Carteret Formula	1.67	7	2.40	8	2.86	5	2.31	8
9	Manshul Formula	1.67	7	2.40	8	2.71	7	2.26	9
10	Allegheny Formula	2.00	5	1.80	1	2.67	8	2.16	10
11	Emden Formula	2.00	5	2.17	9	2.29	11	2.15	11
12	Specific Base Allocation Method (SBAM)	1.60	8	2.00	10	2.63	9	2.08	12
13	Burden Fluctuation Method	2.00	5	2.00	10	2.17	12	2.06	13
14	The Canadian Method	1.60	8	2.00	10	2.17	12	1.92	14

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.82 and 0.00238 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is good with confidence level of more than 95%.

m	n	s	w	X ²	P
3	14	1681	0.821106	32.023	0.0023834054

But, in conducting the desk study no formula is used to estimate head office overhead, rather; it is used to apply the actual cost incurred in referring documents and records kept by the contractor.

And the suitability of formulas recommended by the respondents to use in Ethiopian road construction Industry, becomes Hudson, Eichleay, Total Direct Cost, Fixed Percentage Approach, Modified Eichleay Formula – Variation-1, and Emden’s Formula are suggested in sequential order of suitability.

In addition; the research has made an assessment on the formulas listed above in consideration of lack of records/documents ranked above, simplicity to use and getting rational level of confidence to the estimation value in order to recommend a formula to estimate HOOH in road construction sector in Ethiopia.

Accordingly; **Eichleay formula** requires accounting records to estimate HOOH for the project in dispute and total company billings for actual contract period for other projects in the company which may have different issues, so that; the estimation may not be in the acceptable level of significance. Additionally; the formula is used at project completion which leads to lack in contemporary records for reference and exposed the contractor to extra claims. In a similar way the **modified versions of Eichealy formula - 1 and 2** are also in need of accounting records to estimate overhead and total company billings for actual contract period which depends on other issues of projects in hand.

Manshul Formula and Total Direct Cost Allocation Method - need to use the cost of work performed during the delay period and determine direct cost, so that; we need to have accounting records; as a result this formula may become burdensome in relation to the accounting files.

The total direct cost approach suffers from a number of weaknesses. It does not consider the differences in the cost components from a contractor's various projects. The methodology assigns the same overhead rate calculation to every project. Normally, rates are determined based on the type of work involved in the contract. Overhead rates would vary based on the level of effort required.

Ernstrom Formula - this formula rests on the theory that there is a direct relationship between overhead costs and labor costs, but the theory does not apply to some projects especially road construction projects due to the reason that; road construction projects demand numerous machinery. In addition; in spite of the difficulty in getting the site accounting records, the formula requires intensive accounting records to estimate total overhead for contract period for all projects and Labor cost to a delay situation.

Carteret Formula and Allegheny Formula - assumes that there is a differential in overhead rates during a delay period and normal or actual overhead rate to calculate the difference. The problem with this approach is that if no rate differential can be shown, then no HOOH is owed, even if; owner caused delay is present. Moreover; it requires intensive accounting records to estimate actual and normal overhead rate and total cost of work executed during delay period.

Burden Fluctuation Method - determines unrecovered HOOH by finding the increase in the absorption rate and allocating that increase to the non contract work, which was forced to bear

more than its fair share of HOOH expenses. Furthermore; this method estimates the actual overhead rate, contract and total billings which necessitate detail accounting records.

Calculation Based on Actual Records - despite to the fact; in this method the contractor needs to provide detailed accurate records of his HOOH expenses that depend on accounting records. This procedure requires detailed accounting procedures, from a record-keeping standpoint, which can be quite onerous and difficult to the current road construction projects practice.

Emden Formula - it has a first stage in which the company's total overhead cost and profit is expressed as a percentage of the company's total revenue in the period. The calculation of the percentage requires the production of accounting records and data, presumably for at least one relevant financial year. Secondly, and more importantly, the overhead and profit have to be identified from the accounting records thereby introducing an opportunity for disagreement as to which items in the accounts are, or are not, truly head office overhead.

Specific Base Allocation Method (SBAM) - is a substantially accurate allocation approach, but is also considered the most complicated and expensive to use (Hewitt, 1986). And it needs item costs in all company projects which are very difficult to access as the practice of accounting data recording and documentation is not good.

SBAM would only be a practical approach if the methodology for collecting data was already in place or when the claim amount can justify the analysis expense. The method involves developing, comparing, and establishing cost relationships for all elements to create indirect cost pool accounts and a basis for allocating the accounts to each contract.

The Hudson formula - made no mention of how the applicable percentage head office overhead and profit was to be obtained, if it was not quoted in the contract or agreed between the parties. It assumes that the bid rate should hold constant throughout the life of the project.

Hudson formula suffers most in applying the overhead and profit percentage to the weekly amount of the contract sum, the percentage is being applied to a figure which itself includes an element of overheads and profit, so that; the recovery being calculated therefore includes some double counting of profit. If the Hudson formula is to be applied at all the formula needs correcting to reduce the contract sum used in the formula to a figure net of overhead and profit.

It may not be appropriate to claim for loss of profit unless there is a clear indication that the contractor would have been able to earn profits on other contracts but for the overrun. Also, it takes as its base overhead and profit percentages from the original contract price and these may not properly reflect the contractor's true overhead cost and profitability.

But; it is more suitable for competitively tendered projects, as the most cases in federal road construction projects procurement system, and it is simple to apply and needs no accounting records.

The Canadian Method - uses the contractor's actual markup for overhead in its calculation. This markup is based on bid documents or audit records. An audit would reveal the historical percentage markup for home office overhead applied to each Project.

In this method, the percentage markup portion of the formula includes a profit allocation. As with any method, the contractor must demonstrate that the underlying markup and cost assumptions are reasonable before recovery under these alternate methods will be allowed.

Typically; as no consideration is given to unallowable costs, the Canadian method is simpler to apply than the above Formulas.

The Direct Method - The calculation of unabsorbed overhead should really not be more complex than this. There needn't be any interference from Total Billings in the calculation of unabsorbed overhead for a specific project, and the Direct Method has taken this into account. The Direct Method is a simple, straightforward, and realistic method for calculating unabsorbed overhead damages and is simpler to use and apply, using, as it is, only a one-step process. The Direct Method is much less convoluted than the other methods presented.

Each alternative and technique is based on assumptions, have their own formulas, their individual issues and weaknesses, and they all result in estimates or approximations of the damage.

An exact method of calculation is probably quite impossible to develop, unless actual overhead expenses are accepted, in which case dividing the extra expenses from contractual expenses can be a knotty problem. Therefore, the goal, given the circumstances, is to determine a fair allocation for compensating a contractor for the delay. Consequently, the Direct Method is proposed as an alternate method for the calculation of unabsorbed head office overhead.

Subsequent to all the convoluted techniques studied, it appears reasonable to recommend the straightforward Direct Method, better even than the widely adopted Eichleay, Canadian and Hudson formulas.

So; having all the above discussions, in a case; where, there is lack of records/documents and simple to use with realistic figure in estimating prolongation cost of head office overhead, it is recommended by the research to adopt the Direct Method. With remark, the contract document should fix reasonable percentage allocation for head office over head.

➤ **Inefficiency or Lost Productivity Costs**

Coming to one of the prolongation cost claim types that could be made; Inefficiency or Lost Productivity Costs can also be estimated with different formulas that are being used in the construction industry. To this end; the research has gone through the formulas to know the extent of the use of the formulas in Ethiopian road construction projects, hence; we come to the ranking lists in table 4.16.

Accordingly, Compare un-impacted work with impacted work and the Total Cost Method are found to be the methods that are being exercised in the estimation of Inefficiency or Lost Productivity Costs. In view of the desk study conducted, the method mostly used is Total Cost Method.

Table 4.16: Ranking of Inefficiency/Lost Productivity Estimation Formulas

No	List of Records	Employer		Consultant		Contractor		Average	
		RI	Rank	RI	Rank	RI	Rank	RI	Rank
1	Compare un-impacted work with impacted work	3.23	1	3.08	1	3.92	1	3.41	1
6	The total cost Method	2.67	2	2.60	2	3.25	2	2.84	2
4	Expert testimony	2.33	4	2.42	3	2.73	4	2.49	3
2	Compare similar work on other projects with the impacted work on the Project in question	2.53	3	2.31	4	2.63	5	2.49	4
5	Refer to industry published studies	2.08	5	1.92	6	2.93	3	2.31	5
3	Statistically developed models	2.00	6	2.30	5	2.43	6	2.24	6

m	n	s	w	X²	P
3	8	204	0.5394	11.327	0.045274

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.5394 and 0.045274 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is good with confidence level of more than 95%.

In addition, it is required by the research to answer which formula is best suited for estimating Inefficiency or Lost Productivity cost in prolonged road construction projects in Ethiopia. Accordingly, it is found that the first most suited is Comparing un-impacted work with impacted work, Total cost method (Actual data as compared with the productivity rate indicated in the approved master work program) or Schedule Vs actual accomplishment (if there exists approved work program).

Hence, compare un-impacted work with impacted work and Total cost Methods are recommended to be suitable for estimating Inefficiency or Lost Productivity cost in prolonged road construction projects in Ethiopia as they are simple and easy to use. And the others three are difficult to use because there is no study conducted and difficult to get documented input data from other projects.

➤ **Acceleration cost**

Regarding the estimation methods for acceleration cost, the respondents give different points like to calculate the extra cost due to additional input of resources, or by calculating the direct cost plus overhead and profit, or calculate the direct cost of acceleration, machine rental cost, fuel and lubrication cost, overtime payment etc. But all can be summarized by the following formula;

$$\text{Cost of Acceleration} = \left(\begin{array}{c} \text{Accelerated Cost} \\ \text{of the work} \end{array} \right) - \left(\begin{array}{c} \text{Planned Cost of} \\ \text{the work} \end{array} \right) + \left(\begin{array}{c} \text{Any time related} \\ \text{costs} \end{array} \right)$$

➤ **Inflation**

There is no practice to estimate inflation cost claim due to the unavailability of price indexes/ inflation rate from Central Statistical Agency. But, if the indexes are available the adjustment becomes very easy.

➤ **Lost Profits/Opportunity Costs**

Generally, the method of estimation recommended in the literature is using various devices invented like Hudson and Eichleay formulas, which consider head office overhead and profit. The Hudson formula is a very broad-brush approach to deal with claims for head office overheads. However, it may not be appropriate to claim for loss of profit unless there is a clear indication that the contractor would have been able to earn profits on other contracts but for the overrun. Also; it takes as its base overhead and profit percentages from the original contract price and these may not properly reflect the contractor's true overhead cost and profitability.

As per the desk study made, the method that is being used to estimate loss on profit is the allowable rate set in the contract document, mostly 5%.

➤ **Consulting and Legal Costs**

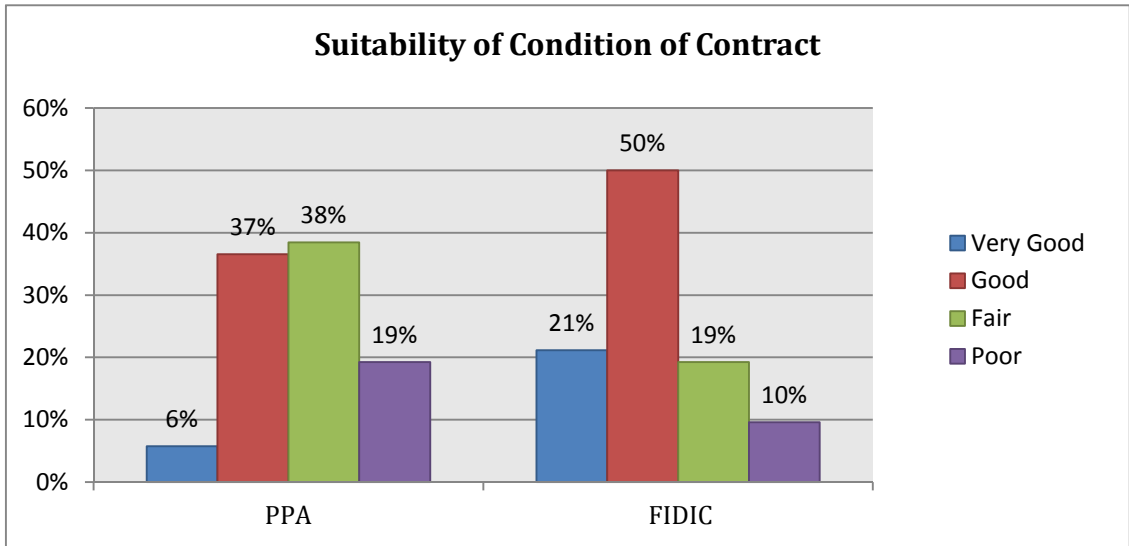
Consulting and Legal cost claim is very rare case to be claimed by the contractors. When we look to the method of estimation, it would typically be connected to the administration, monitoring, or completion of extra work. As per the percentage response from the survey, it is found to use daily labor, material, and equipment cost and invoices to estimate the cost incurred to handle the consulting and legal cost claims i.e. using actual cost records.

➤ **Interest**

The methods used to calculate the interest cost is compounding interest rather than simple interest method as per desk study conducted. And the percentage response towards rate of interest to be used for estimating cost of interest due to prolongation of a project is find out to be as follows; Interest rates set by statute - **44%**, Lending interest rate of commercial banks - **31%**, Proof of payment of interest by the contractor - **25%**.

4.3.4 Suitability of Conditions of Contract

In having suitable conditions of contract gets an affair to administer the estimation and handling of prolongation cost claims, the research has gone through a survey to know the reflection of the respondents regarding the suitability of conditions of contract i.e. PPA and FIDIC. In view of this, the survey shows that PPA condition of contract needs some improvement to handle issues



Preparation Costs, Acceleration cost and Inefficiency/ Lost productivity cost are suggested to be given attention in the standard conditions of contract.

Table 4.17: Ranking of List of Prolongation Cost Claims Types that Need Attention in Standard Conditions of Contract

No	List of Records	Employer		Consultant		Contractor		Average	
		RI	Rank	RI	Rank	RI	Rank	RI	Rank
1	Loss of Profit/Opportunity cost	2.70	1	3.00	3	3.27	1	2.99	1
2	Claim Preparation Costs	2.61	2	3.33	1	2.93	3	2.96	2
3	Acceleration cost	2.54	4	3.06	2	3.00	2	2.87	3
4	Inefficiency/ Lost productivity cost	2.58	3	2.88	4	2.87	4	2.78	4
5	Head office over head cost	2.33	7	2.71	5	2.64	6	2.56	5
6	Financial Charges and Interest	2.52	5	2.47	7	2.57	7	2.52	6
7	Extended and Increased Site Costs	2.17	8	2.65	6	2.67	5	2.49	7
8	Inflation	2.48	6	2.44	8	2.27	8	2.39	8

m	n	s	w	X²	P
3	8	318.00	0.84127	17.667	0.01357

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.84127 and 0.01357 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is good with confidence level of more than 95%.

As to make estimation of Extended and Increased Site (Site Overheads or Preliminaries) cost claim easy, the following list of points are recommended to be incorporated in the conditions of contract by the respondents in ranking order: Detailed definition of compensation delay events, Tender allowance for P.O.O.H, Updated activities schedule submission, Detailed Evaluation of variation order and Updated Resource schedule submission with the following percentage response.

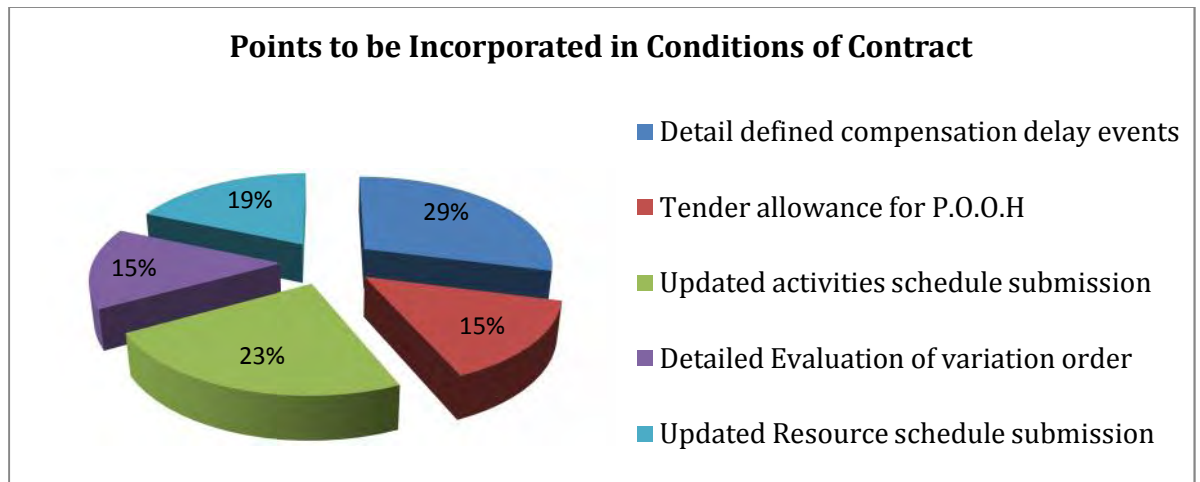


Figure 4.9: Ranking of Points to be incorporated in Contract Forms to make the Estimation of Extended and Increased Site costs easy

In the case of estimating Head office over head costs the following points in fig. 4.9 are recommended to be incorporated in standard conditions of contract to make the HOOH claim estimation easy. And the respondents are asked to give their reflection towards importance of the points listed. Then; it is found to be in the following order; to provide agreed formula, Tender allowance for H.O.O.H., Over head %age of planned turnover, Defined list of H.O.O.H. items and Discount rate.

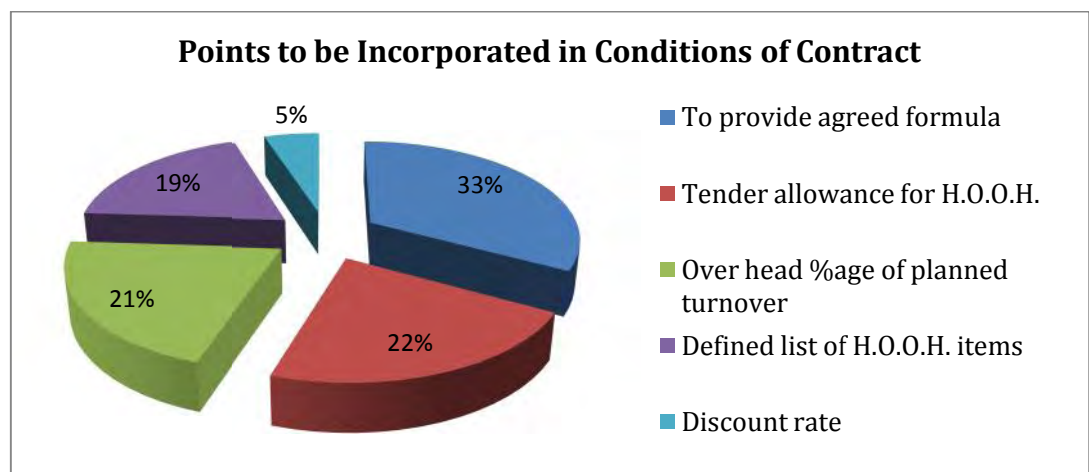


Figure 4.10: Ranking of Points to be incorporated in Contract Forms to make easy the Estimation of HOOH

For Inefficiency/Lost productivity cost claim the following points are recommended to be incorporated in conditions of contract to make the estimation easy in the order of importance as per the percentage response of 38% detailed approved original activity schedule, 31% estimated cost of productivity and again 31% detailed resource schedule.

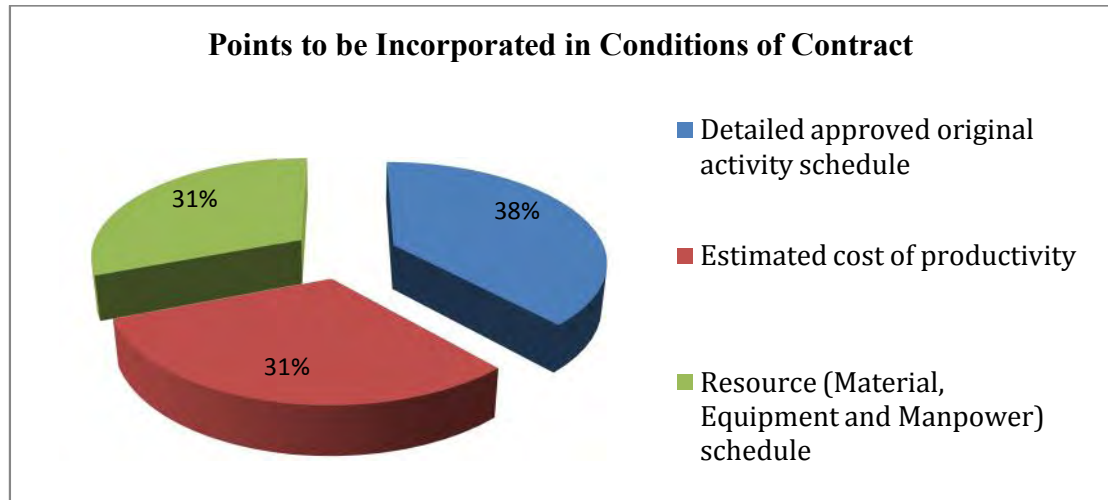


Figure 4.11: Percentage Response on Points to be incorporated in Contract Forms to make easy the estimation of Inefficiency/Lost Productivity.

➤ Prolongation Cost Administration Practice

In administering prolongation cost claim we need to look at the practice in justifying time delay, Data recording and documentation, the estimation method used and the conditions contract applied to refer. Accordingly, recapitulating the points discussed in the parts of administering prolongation cost claim we can come to the conclusion to administration practice of prolongation cost claim.

Justifying time delay; it is found difficult to entitle time extension due to the failure to maintain contemporary records, failure to regularly update the program and poor presentation of the claim.

Data recording and Documentation; in this regard the respondents claimed that the practice is not in the acceptable standard mostly caused by lack of competent and experienced professionals, and lack of awareness of the stakeholders.

Estimation practice; restating the response to the survey the estimation practice of prolongation cost claim is not in acceptable significance level with contributing factors: scarcity of records, absence of predefined estimation methods, failure to provide appropriate breakdown of the contract amount, absence of clear and suitable contractual provisions and lack of competent professionals.

In addition, the during the desk study the estimation made by contractor, determination given by the engineer, employers response and DRE decision made have significance difference which shows that the estimation practice is not in acceptable significance level.

Suitable conditions of contract; PPA condition of contract needs some improvement in clarity and some clauses are not expressing the time extensions and the cost compensations directly to handle issues regarding prolongation cost estimation and claim. While; FIDIC condition of contract is found to be better to administer prolongation cost issues with some points that need to be incorporated like Detail defined compensation delay events, Tender allowance for P.O.O.H and updated activities schedule submission, provide agreed formula, Tender allowance for H.O.O.H, Over head %age of planned turnover, Defined list of H.O.O.H. items,

So; having all these points, it can be said that the administration practice of prolongation cost claim in road construction section is not in satisfactory level.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

- In administering prolongation cost; justifying time delay is difficult due to failure to maintain contemporary records, failure to regularly update the program, poor presentation of the claim and insufficient or total lack of notice of delay or likely delay.
- The rate of occurrence of prolongation cost claim in federal road construction projects is frequent, mostly appealed by foreign companies. And; the mostly occurred prolongation cost claim types are: Extended and Increased Site Costs and Head office over head costs. Rarely; prolongation cost claims get in to dispute due to Lack of documentation to substantiation the claims, inequitable determination by the engineer or employer, Contractors attitude towards getting additional payment, Ambiguity of contract documents and Wrong method of cost estimation.
- Data collection and documentation practice of the road construction sector is not up to standard with the possible causal reasons of; Lack of competent and experienced professionals, Lack of Technical and managerial skill, Lack of awareness of stakeholders, Problems attributed to the Contractor capacity and Lack of conducive environment for practicing. Records that are found difficult to access for estimation of prolongation cost claim are summarized as site accounting records; daily reports and productivity, task and material schedule.
- PPA condition of contract needs some improvement in clarity and some clauses are not expressing the time extensions and the cost compensations directly to handle issues regarding prolongation cost estimation and claim. While; FIDIC condition of contract is found to be better to administer prolongation cost issues.
- Points that need to be incorporated and improvement to sub-clauses to the standard conditions of contract to facilitate prolongation cost estimation are found out to be: Detail defined compensation delay events, Tender allowance for P.O.O.H and updated activities schedule submission, provide agreed formula, Tender allowance for H.O.O.H, Over head %age of planned turnover, Defined list of H.O.O.H. items, Discount rate, Estimated cost of

productivity, Detailed approved original activity schedule and Resource (Material, Equipment and Manpower) schedule.

- Prolongation cost estimation practice is not in acceptable significance level, with the contributing factors; Scarcity of records or documentation, No defined estimation methods, Failure by contractors to provide appropriate breakdown of contract amount, Absence of clear and suitable contractual provisions, Lack of competent and experienced professionals in the field and Problem in justifying time delay.
- The technique of estimation that is being used currently for estimating prolongation cost estimation in road construction project is found to be Actual cost using records although not adequate. Specially; to estimate Extended and Increased Site/Field Costs (additional labor, material, and equipment costs and Other Delay Costs), acceleration cost, Consulting and Legal costs.
- In a case; where, there can be found lack of documents to make an estimation of HOOH cost incurred by the claimant. It is found suitable to adopt The Direct Method with the remarks; contract document should fix the percentage allocation for head office over head and if possible; different rate shall be set for the major construction stages like mobilization, early, middle and late stage of construction activity of the project and the like. In addition; the employer needs to assess to get clear indication that the contractor would have been able to earn profits on other contracts but for the overrun.

5.2. Recommendations and Future Research

5.2.1. Recommendations

To improve the practice in prolongation cost estimation practice for road construction projects Ethiopia the concerned parties shall bring into act the following points of recommendations:

- Contractors shall allocate claim expertise and contract engineer to handle any claim related issues and to administer record keeping of projects. In addition; every written record shall be changed into soft copy and stored in computer data base system.

- Professional association need to establish record keeping standards in general (what records should be kept), Establish custom project record requirements, and the contractors required to use established templates of international quality systems like ISO certifications.
- Creating awareness using peer discussion, forum and experience sharing among professionals, major stakeholders, public authorities, professional organizations, and academic institutions. In addition, conducting on job training to individual firms/projects; especially; to local contractors, all about capacity building issue on the industry.
- To deal with the improvement regarding clarity of the provisions towards prolongation cost issues it is recommended to prepare general guidelines /procedure for analyzing, to provide clear contractual provisions, provide glossary for contract forms with succinct and accurate contract wording and to prepare a protocol like SCL delays and disruption protocol to handle /solve complex delay issues in faith specifically for the construction industry by the government body.
- At the time of contract agreement the issue regarding prolongation cost claim and estimation methods should be raised and discussed among the parties.
- Improve the organizational capacity of contracting firms, fair and equitable administration of contracts and proper project management practice by all parties. And employers should acknowledge prolongation cost claims for fair assessment.
- The public procurement Agency need to look for Suitability of Condition of Contract Clear contractual provisions, alternative formulas to estimate the cost and Protocol should be prepared to handle prolongation cost claims.

5.2.2. Future Research

- Estimate or determine reasonable head office overhead percentage to construction companies participating in road construction projects to facilitate the prolongation cost estimation.
- Develop Statistical model to estimate Inefficiency or Lost Productivity Costs in road construction sector.
- Determine or estimate percentage rate of prolongation cost as that of liquidated damage for the employer.

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Appendix A

Questionnaire

Dear Sir,

The purpose of this survey is to obtain data for the specified research being conducted as a partial fulfillment of M.Sc. Degree in Construction Technology and Management at Addis Ababa University.

The aim of this questionnaire is to obtain professional opinion on issues of **Estimating Prolongation Costs for Road Projects in Ethiopia**, including Prolongation Cost Administration Practice; Data collection and documentation issues for estimating the prolongation cost and to justify prolongation cost claim, Methods of Estimation and Suitability of Conditions of Contract in handling the prolongation cost claim, ideally in road construction. This is to identify and understand gaps (problems and challenges) in estimating prolongation cost in road construction projects and identify suitable methods of estimation for the existing condition of the parties involved in road construction projects of the country. Specifically;

- To identify problems in data collection and documentation recording of prolongation cost estimation and claims,
- To investigate the conditions of contracts in relation to prolongation cost determination,
- To assess methods of prolongation cost estimation, and
- And forward recommendations to problems and challenges in estimating and handling prolongation cost.

The information supplied in this completed questionnaire will be used for broad research purposes only (for academic purpose). All specific company and interviewee information will be kept confidential at all times. Only generalized analysis of the information contained within this completed questionnaire will be utilized in the research process.

Your response, in this regard, is highly valuable and contributory to the outcome of the research. Thank you for your invaluable time and cooperation in advance.

Regards,

Samuel Bekele

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Addis Ababa

Section 1: General Information about Respondents

The questions below are related to your organization and yourself. Please indicate your response by ticking (X or √) the appropriate box (es), and also filling the blank spaces provided as appropriate.

- 1.1 Organization /Company Name (optional):
- 1.2 On what discipline is your company engaged for in the construction sector?
- Contractor Consultant Employer Professional institutions
Other, specify.....
- 1.3 Type or origin of your organization
- Project Owner/Client Domestic Consultant Foreign Contractor
 Foreign Consultant Domestic Contractor Financer
Others (please specify)
- 1.4 How long has your organization been involved in road construction sector:
- < 5 years 5-10 years 10-15 years >15years
- 1.5 If your company is foreign Consultant or Contractor, how long has your organization been involved in Ethiopian road Construction Sector?
- < 5 years 5-10 years 10-15 years >15years
- 1.6 Your position in the organization/ title.....
- 1.7 Educational status?
- B.Sc. M.Sc. Others; please specify.....
- 1.8 Contact addresses (Optional):
- Name (optional):
- E-mail:
- Tel:

Section 2: General on Prolongation Cost Estimation

The ensuing questions are general reflection in relation to prolongation cost estimation of road construction projects in Ethiopia. Hence, Please respond by ticking (X or ✓) in the box representing your selection (Please check all that apply in your point of view). You can also state any different proposed solutions in addition to the list in the space provided.

Please note that; prolongation cost in this research refers to the cost incurred by the contractor due to prolonged time period resulting from employer risk events.

2.1. In general, the practice of prolongation cost estimation in road construction projects could be described as reasonable. How do you level your reflection to the statement?

- Strongly agree Slightly agree Neutral
- Slightly disagree Strongly disagree
- Other (Please specify)

If your answer is Neutral, Slightly disagree, or Strongly disagree, what challenges may have contributed in your opinion? (Please check all that apply in your point of view)

- No defined estimation methods Problem in justifying time delay
- Lack of competent and experienced professionals in the field
- Absence of clear and suitable contractual provisions
- Scarcity of records or documentation problem
- Failure by contractors to provide appropriate breakdown of contract amount
- Other (Please specify)

What measures shall be taken to improve the current state of local prolongation cost estimation and claim practices?

.....

2.1. How do you level the occurrence of prolongation cost claim in road construction projects?

- Most Frequent Frequent Least Frequent No Occurrence

2.2. How do you level the frequency of prolongation cost claims get in to dispute?

- Very frequent Frequent Rarely Not at all

2.5. In most of prolongation cost estimation and claim practices in major road construction projects in Ethiopia, both the consultant and contractor are foreign companies. What is your opinion on the statement?

Strongly Agree Agree Neutral Disagree Strongly Disagree

If you agree, what is the possible measure to increase the participation of local contractors and consultants

.....

2.6. How do you level the difficulty in estimating prolongation cost for the cost claims listed below; please level them as per the degree of difficulty to estimate by ticking (X or √).

S.No.	List of cost claims	Very Diff.	Difficult	Easy	Very Easy
1	Extended and Increased Site Costs ; (Site Overheads or Preliminaries)				
2	Head office over head cost				
3	Inefficiency/ Lost productivity cost				
4	Acceleration cost				
5	Financial Charges and Interest				
6	Inflation				
7	Loss of Profit/Opportunity cost				
8	Claim Preparation Costs				

2.7. The following lists are the four main problems or constraints encountered in prolongation cost estimation? How do you level the degree of difficulty?

No.	List of Problems	Very Diff.	Difficult	Neutral	Easy	Very Easy
1	Suitable estimation Methods					
2	Backup data and documentation					
3	Suitable contractual provision					
4	If any...					
5						

Section 3: Prolongation Cost Administration Practices Issues

The subsequent questions focus on the administration practice of prolongation cost estimation as described by; data collection and documentation, Justified time delay, Contractual provisions and Estimation methods on road construction projects in Ethiopia. Hence, Please respond by ticking (X or √) in the box representing your selection (Please check all that apply in your point of view). You can also state any different proposed solutions in addition to the list in the space provided.

➤ ***Justified time delay***

3.1. In administering prolongation cost, justifying time delay is one of the important parts for estimating prolongation cost; so how do you level the difficulty in justifying time delay?

- Very Difficult Difficult Medium Easy Very Easy

If your response is Very Difficult or Difficult, which of the following do you think is the reason behind? (Please check all that apply in your point of view).

- Failure to maintain contemporary records,
- Poor presentation of the claim,
- Failure to regularly update the programme,
- Late, insufficient or total lack of notice of delay or likely delay
- The erroneous assumption that an extension of time automatically grants entitlement to monetary compensation,

If any

What do you recommend to justify time delay easily, so that; to make the prolongation cost estimation easy?

.....

➤ **Data Collection and Documentation/ records**

3.2. Data collection and documentation is critical for smooth progress to execute the prolongation cost estimation and claim. How do you level your agreement regarding data collection and documentation meet the acceptable standard?

Strongly Agree Agree Disagree Strongly Disagree
 If you are in disagreement, where do you think the problem arises?

Lack of Technical and managerial skill Lack of awareness of stakeholders

Problems attributed to the Contractor capacity

Lack of conducive environment for practicing

Lack of competent and experienced professionals,

Other (Please specify)

3.3. How do you level their extent of difficulty to access the following list of important records in prolongation cost estimation?

No	List of Records	Very Easy	Easy	Medium	Difficult	Very Diff.
1	Issued for Construction set, and all subsequent revisions					
2	Instructions to contractor					
3	Contemplated Change Notices issued by the owner, Change Estimates, and Change Orders received					
4	Sub-contractor quotes, contracts, purchase orders and correspondence					
5	Shop drawings, originals, all revisions and re-submissions					
6	Shop drawing transmittals, and transmittals log					
7	Daily time records					
8	Daily equipment use					
9	Daily production logs, e.g. concrete pours etc.					
10	Material Delivery and Use Records,					

No	List of Records	Very Easy	Easy	Medium	Difficult	Very Diff.
	including expediting					
11	Accounting records: pay-roll, accounts payable and receivable, etc.					
12	Progress Payment Billings under the contract					
13	Daily Force Account Records, pricing and billings					
14	Contract Milestone Schedule or Master Schedule					
15	Short Term Schedules and up-dates					
16	Task schedules and analyses					
17	Original tender estimate					
18	Construction control budget					
19	Actual Cost Reports, weekly or monthly, including Exception Reports					
20	Forecast-to-Complete Estimate up-dates					
21	Productivity Reports/Analyses					
22	Inter-office correspondence, including memos and faxes (all filed by topic)					
23	Contract correspondence					
24	Minutes of Contractual Meetings					
25	Minutes of Site Coordination Meetings					
26	Requests for information					
27	Notice of claims for delays and/or extra cost by contractor					
28	Government Inspection Reports					
29	Consultant Inspection Reports					
30	Accident Reports					
31	Daily diary or journal entries					
32	Notes of telephone conversations					
33	Progress Reports, weekly, monthly					

No	List of Records	Very Easy	Easy	Medium	Difficult	Very Diff.
	or quarterly					
34	Progress photographs					
35	Any other reports, such as special consultant reports					

3.4. What do you recommend to improve record keeping of road construction projects to make the prolongation cost estimation and claim easy?

.....

➤ ***Prolongation cost Estimation Methods***

3.5. Does the organization, during the construction planning of a project, impose a strict methodology to handle the prolongation cost? Yes No

If yes, would you describe? If there is a written Protocol would you provide a copy?

.....

3.6. Which method or technique do you use in estimating prolongation cost of a project?

Prescribed rate for prolongation cost/ Tender allowance

Using Actual cost records and Formulas

If any other cost estimation methods.....

Why?

3.7. What method do you use to estimate Extended and Increased Site/Field Costs i.e additional labor, material, and equipment costs and Other Delay Costs?

Actual costs Estimated costs/ daily or weekly cost rate

If any, Please specify.....

Why?

3.8. The following are list of such formulas and approaches that are used to calculate head office overhead loss, Respondents are thus asked to level the extent in use of the methods.

No	List of Formulas	No Idea	Very low	Low	Medium	High	Very High
1	Eichleay Formula						
2	Modified Eichleay Formula – Variation 1						
3	Modified Eichleay Formula – Variation 2						
4	Hudson Formula						
5	Ernststrom Formula						
6	Manshul Formula						
7	Carteret Formula						
8	Allegheny Formula						
9	Emden Formula						
10	Burden Fluctuation Method						
11	The Canadian Method						
12	Total Direct Cost Allocation Method						
13	Specific Base Allocation Method (SBAM)						
14	Calculation Based on Actual Records						
15	Fixed Percentage Approach.						

3.9. From the above list of Formulas used to estimate HOOH loss, which formula do think is best suitable for estimating HOOH cost for prolonged road construction projects in Ethiopia and Why?

.....

3.10. One of the prolongation cost claims that can be made is Inefficiency or Lost Productivity Costs, so please level their extent of use of the methods.

S.No	List of Estimation Methods	No Idea	Very low	Low	Medium	Low	Very High
1	Compare un-impacted work with impacted work						
2	Compare similar work on other projects with the impacted work on the Project in question						
3	Statistically developed models						
4	Expert testimony						
5	Refer to industry published studies						
6	The total cost Method						

3.11. Which formula do you think is best suitable for estimating Inefficiency or Lost Productivity cost in prolonged road construction projects in Ethiopia and Why?.....

3.12. Have you ever claimed acceleration cost in relation to prolongation of a project?

Yes No

If yes; how did you estimate the cost?

3.13. One of the delay damage associated with non critical delay is consulting and legal costs; have you ever claimed these costs?

Yes No

If yes; how did you estimate the cost?

3.14. Other delay damage associated with non critical delay is Lost Profits/Opportunity Costs; have you ever claimed Lost Profits/Opportunity Costs?

Yes No

If yes, which of the above HOOH formulas or if any other methods you use to estimate?

If any.....

3.15. Have you ever claimed Interest cost due to prolongation of a project?

Yes No

If yes, what documents and discount rate did you refer to?

Lending interest rate of commercial banks Interest rates set by statute

Proof of payment of interest by the contractor

If any.....

3.16. Have you ever claimed inflation cost due to prolongation of a project?

Yes No

If No; why?

If any.....

➤ ***Suitability of Conditions of Contract***

3.17. How do you level the suitability of available standard form of contract to administer prolongation cost in the road construction sector?

PPA Very Good Good Fair Poor

If it is poor, what points do you recommend to improve the form of contract to make the prolongation cost estimation and claims easy?

.....

FIDIC..... Very Good Good Fair Poor

If it is poor, what points do you recommend to improve the form of contract to make the prolongation cost estimation and claims easy?

.....

2.8. FIDIC fourth edition mentions the compensable delay situation very clearly and the provisions are less problematic to practice prolongation cost damage because; it has clearly defined the adjustment of price by stating the cost and profit provisions.

What is your reflection to the statement?

Strongly agree Slightly agree Neutral

Slightly disagree Strongly disagree

If you disagree, please state the reason.....

2.9. In Ethiopia the most popular local form of contract is PPA conditions of contract. In this form some clauses are not directly expressing the time extensions and the compensations.

What is your reflection to the statement?

Strongly agree Slightly agree Neutral

Slightly disagree Strongly disagree

If you agree, please state your recommendations.....

2.10. How clear and understandable are the concepts and ideas presented in the clauses of the conditions of contract currently used in handling prolongation cost claim?

Very Good Good Neutral Fair Poor

If the provisions are not clear enough, what do you recommend to improve them in a way to convey the intention of clauses clearly?.....

.....

2.11. How do you level the suitability of the standard forms of contract regarding the following list of prolongation cost Claims? And give your point of remarks for Very Poor and Poor levels.

No	List of cost claims	Very Good	Good	Poor	Very Poor	Remarks
1	Extended and Increased Site Costs ; (Site Overheads or Preliminaries)					
2	Head office over head cost					
3	Inefficiency/ Lost productivity cost					
4	Acceleration cost					
5	Financial Charges and Interest					
6	Inflation					
7	Loss of Profit/Opportunity cost					
8	Claim Preparation Costs					

2.12. Which of the following points do you recommend to be incorporated in conditions of contract to estimate Extended and Increased Site; (Site Overheads or Preliminaries) cost claim easy?

Detail defined compensation delay events Tender allowance for P.O.O.H

Updated activities schedule submission Detailed Evaluation of variation order

Updated Resource schedule submission

If any.....

2.13. Which of the following points do you recommend to be incorporated in conditions of contract to estimate Head office over head cost claim easy?

- To provide agreed formula
 - Tender allowance for H.O.O.H.
 - Over head %age of planned turnover
 - Defined list of H.O.O.H. items
 - Discount rate
- If any.....

2.14. Which of the following points do you recommend to incorporate in conditions of contract to estimate for Inefficiency/ Lost productivity cost claim easy?

- Detailed approved original activity schedule
 - Estimated cost of productivity
 - Resource (Material, Equipment and Manpower) schedule
- If any.....

2.15. Any other comments you wish to provide:.....
.....
.....
.....

Please kindly check no points are escaped!
Thank you very much for your time!

Appendix B

Ranking of Records with respect to difficulty to access for prolongation cost claim issues,

No	List of Records	Employer		Consultant		Contractor		Average	
		RI	Rank	RI	Rank	RI	Rank	RI	Rank
1	Issued for Construction set, and all subsequent revisions	2.73	20	2.18	31	2.94	12	2.62	23
2	Instructions to contractor	2.25	35	2.00	33	2.68	21	2.31	35
3	Contemplated Change Notices issued by the owner, Change Estimates, and Change Orders received	2.50	29	2.30	26	2.53	27	2.44	31
4	Sub-contractor quotes, contracts, purchase orders and correspondence	3.00	17	3.10	2	3.06	10	3.05	10
5	Shop drawings, originals, all revisions and re-submissions	2.46	32	2.50	19	2.63	23	2.53	25
6	Shop drawing transmittals, and transmittals log	2.50	29	2.50	19	2.58	25	2.53	26
7	Daily time records	3.17	13	2.75	10	2.47	32	2.80	17
8	Daily equipment use	3.46	6	2.65	12	2.53	27	2.88	14
9	Daily production logs, e.g. concrete pours etc.	3.58	4	2.55	18	3.06	9	3.07	9
10	Material Delivery and Use Records, including expediting	3.22	12	3.10	2	2.89	14	3.07	8
11	Accounting records: payroll, accounts payable and receivable, etc.	3.04	16	2.65	12	2.89	14	2.86	15
12	Progress Payment Billings under the contract	2.67	23	2.15	32	2.56	26	2.46	29
13	Daily Force Account Records, pricing and billings	3.42	8	3.16	1	3.53	1	3.37	1
14	Contract Milestone Schedule or Master Schedule	2.96	18	2.50	19	2.50	29	2.65	19

15	Short Term Schedules and up-dates	3.29	10	2.80	9	3.17	6	3.09	6
16	Task schedules and analyses	3.46	6	3.10	2	3.17	6	3.24	2
17	Original tender estimate	3.13	14	2.21	28	2.61	24	2.65	21
18	Construction control budget	3.54	5	2.89	6	3.18	5	3.20	5
19	Actual Cost Reports, weekly or monthly, including Exception Reports	3.25	11	2.90	5	2.83	16	2.99	12
20	Forecast-to-Complete Estimate up-dates	3.63	3	2.61	16	3.44	2	3.23	3
21	Productivity Reports/Analyses	3.67	2	2.84	8	3.11	8	3.21	4
22	Inter-office correspondence, including memos and faxes (all filed by topic)	2.83	19	2.45	22	2.67	22	2.65	22
23	Contract correspondence	2.71	22	2.20	29	2.50	29	2.47	28
24	Minutes of Contractual Meetings	2.42	33	2.20	29	2.33	35	2.32	34
25	Minutes of Site Coordination Meetings	2.58	28	2.24	27	2.50	29	2.44	32
26	Requests for information	2.65	25	2.40	23	2.44	33	2.50	27
27	Notice of claims for delays and/or extra cost by contractor	2.63	27	2.60	17	2.72	20	2.65	20
28	Government Inspection Reports	3.05	15	2.68	11	2.82	18	2.85	16
29	Consultant Inspection Reports	2.65	25	2.32	25	3.33	3	2.77	18
30	Accident Reports	2.67	23	2.40	23	2.78	19	2.61	24
31	Daily diary or journal entries	3.38	9	2.85	7	3.00	11	3.08	7
32	Notes of telephone conversations	4.09	1	2.63	15	2.39	34	3.04	11
33	Progress Reports, weekly, monthly or quarterly	2.33	34	1.90	35	2.94	12	2.39	33
34	Progress photographs	2.50	29	2.00	33	2.83	16	2.44	30
35	Any other reports, such as special consultant reports	2.73	20	2.65	12	3.29	4	2.89	13

