TOWARDS A DECISION FRAMEWORK FOR THE ANALYSIS OF CONSTRUCTION DELAY CLAIMS

By

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DECLARATION

I declare that this research is my own work, except where otherwise stated and referred to.

This thesis is being submitted in fulfilment of the requirement for the degree of PHD [Construction Management] at the University of Pretoria. It has not been submitted before for any other degree or examination at any other university.

H.F. Prinsloo

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Signature of acceptance and confirmation

by student

ABSTRACT

Title of thesis:	Toward a decision framework for extension of time claims.
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The assessment of extension of time (EOT) claims as part of a construction project can have far-reaching consequences. For the contractor, the rejection of EOT claims might have a significant impact on the financial success of a project and the profitability of his business. On the other hand, for the employer, the awarding of an EOT claim may increase the cost of the project and possibly impact on the financial success of the project. In major projects time-related preliminary and general costs can very significantly aggregate the negative impact for the contractor and the employer. With so much at stake, it is understandable that EOT claims are a major source of disputes in the construction industry. The proper and transparent assessment of EOT claims is therefore an essential component in the success of any project.

The assessment of EOT claims can be a daunting task – not only because of the severe impact the outcome of the claim would have on the parties involved, but also as a result of the many complexities faced in the assessment process.

The main purpose of this study was to develop a user-friendly guideline by making use of decision-tree analysis, to assist practitioners to navigate this potential minefield of complexities in the process of the assessment of EOT claims. The decision trees are well suited to be utilised as guidance tools in decision-making. One of the main benefits of decision trees is that they are simple and easy to understand. The decision trees make use of a sequential process, in order to consider different decisions. This is very much in line with the process normally followed in the assessment of EOT claims.

Keeping in mind that the research is taking place within an applied-science environment, a qualitative approach was deemed the most appropriate for delivering the required results. An action-research approach, a very specific qualitative approach, was followed to achieve the objectives of the study.

The starting point was to conduct a comprehensive literature review, in order to produce the relevant decision-support frameworks for EOT claim analysis in the form of decision trees. The data gathered, as part of the action-research process, contributed to the objective of providing a decision-support tool that could be effectively utilised in practice. The participation of practitioners regularly involved in the assessment of construction-delay claims was of much value. Focus groups, consisting of industry practitioners, with specialist knowledge in construction contracts, contributed to the development of the decision-support frameworks, and ultimately to the findings.

One of the major conclusions was the development of a universal decision-tree analysis framework for EOT claims. The universal nature of the decision-tree framework allows it to be utilised as a holistic framework for any of the three different construction contracts reviewed, namely: FIDIC, GCC and JBCC. In addition, decision trees have been developed for these contracts, in order to assess the key considerations in the EOT claim-analysis process.

The iterative process followed assisted in producing a tool that can be used in practice as a guideline for the analysis of EOT claims.

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ACRONYMS AND ABBREVIATIONS

CART	Classification and Regression trees
CPM	Critical Path Method
DAM	Delay Analysis Method
DD	Delay and Disruption
EOT	Extension of Time
GCC	General Conditions of Contract for Construction
FIDIC	International Federation of Consulting Engineers, Conditions of Contract for Construction for Building and Engineering works designed by the employer
JBCC	The Joint Building Contracts Committee, Principal Building Agreement
MARA	Majlis Amanah Rakyat, Malaysian governmental agency
SCL	Society of Construction Law
SCL Protocol	Society of Construction Law Delay and Disruption Protocol
SAICE	South African Institute of Civil Engineers
UK	United of Kingdom of Great Britain and Northern Ireland
WEATHER	Computer-based system, to quantify the impact of weather conditions on construction productivity

DEDICATION

Without support this involved but satisfying journey would not have been possible. First and foremost I need to give thanks and praise to my Lord and Saviour, Jesus.

I am indebted to my study leader, Prof. Tinus Maritz, who agreed to assist me even though he is on the brink of retirement. I am extremely grateful for his advice and guidance. I have tremendous respect for his incredible dedication and the immense knowledge he shared with me.

A large number of people assisted me along the way; and I want to express my heartfelt gratitude to them. My hard-working research assistant, Marlize Kruger who tirelessly contributed – even after she had started in a new position. Prof. McCrindle from the Research Innovation Department, who was instrumental in the formulation of the research methodology. Dr Goldstone, for assisting with the language editing. All my colleagues from the Department of Construction Economics for their assistance and encouragement. A special word of gratitude goes to the industry specialists who contributed their time and knowledge without asking anything in return.

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CHAPTER 1 - **INTRODUCTION**

1.1 INTRODUCTION

It is often said that for a building or construction project, there are three objectives, which the owner of the project is aiming to achieve. These are: cost, quality and time. Any project faces delays and disruptions, especially with the complex projects of today. These frequently entail many interfaces between the installations and any overlapping activities (Eizakshiri, Chan & Emsley, 2011).

Many researchers in the field of construction project management have undertaken to study the causes and effects of construction delays. These studies have a habit of focusing the attention on explaining the causes, which in turn would help guide practitioners to identify possible measures for mitigating (or even eliminating) such delays in construction projects. Regardless of the multitude of research cases, finding the causes of such delays, and the possible remedies for reducing delays in projects, the failure of many projects to finish on time remains problematic on a global scale (Eizakshiri *et al.*, 2011).

It is clear that delays in construction projects are a common occurrence in projects, and that little has changed – regardless of numerous research studies conducted on the mitigation of such delays (Assaf & Al-Hejji, 2006); (Odeyinka & Yusif, 1997), (Sambasivan & Soon, 2007), (Klopper & Brümmer, 2000) and (Aiyetan, Smallwood & Shakantu, 2011).

Delays where the contractor is not at fault would normally constitute a valid claim for extension of time (EOT). If the delay affects the critical path of the project, it would normally result in the revision of the contractual-completion date of the project. However, confirming a delay and/or disruption is not an easy task; and furthermore, it is a time-consuming process, especially in multifaceted projects with thousands of activities, a lot of details, as well as the involvement of many stakeholders (Alnaas, Khalil & Nassar, 2014).

In any construction contract, the contractor has a legal obligation to complete a project by a stipulated date. However, various delays almost always disrupt the performance of the contractor's work (Braimah, 2008), (Abd El-Razek, Bassioni & Mobarak, 2008) and (Danuri, Othman & Lim, 2006).

Generally, the contractor would only be entitled to an EOT if the delay is caused by the employer or by neutral events. The general principle in law is that the contractor would not be entitled to claim for EOT or loss and expense, if the delaying event is as a result of the contractor’s actions. EOT is a very vital provision in any construction contract. This provision affects the degree of the contractor's liability to pay for liquidated damages, if there is a delay in the date of practical completion. If the provision is clearly drafted, it would also provide the contract administrator with the power to extend the time for completion due to prevention by the employer (Danuri et al., 2006).

In practice, delays and disruption to contractors’ progress constitute a major source of claims and disputes in the construction industry (Braimah, 2008) and (Croeser, 2010). Construction disputes mainly involve the following issues: delays, time-extensions, loss and expense. All of which have to be detailed, documented and proved in the subsequent proceedings (Cheung & Yeung, 1998).

However, according to Yang and Kao (2012), none of the existing delay-analytical methods is perfect; because they all include an element of assumptions, subjective assessment and theoretical projection.

1.2 THE PROBLEM STATEMENT

Delays and disruptions to contractors’ progress, often resulting in time and cost overruns, are a major source of claims and disputes in the construction industry. At the heart of the matter in dispute is often the question of the extent of each contracting party’s responsibility for the delayed-project completion, and for the extra cost incurred. Various analytical methodologies have been developed over the years as aids to determine the extent of the delay. Whilst much has been written about delays and disruptions, there is limited information on the extent of use of these methodologies in practice, and their impact on the construction process (Braimah, 2008).

To determine the extent of the delay is only one aspect in a minefield of elements that should be addressed, in order to ultimately determine whether a delay would result in a valid claim of EOT. Before the extent of the delay can even be considered, it should firstly be determined whether the contractor has complied with all the relevant contractual conditions. In addition, it should also be determined whether the cause of delay can be considered to be the responsibility of the client in terms of the contractual risk allocation. Furthermore, the issue of compensation would also have to be addressed in terms of the evaluation of the claim.

Although much has been written about the various issues to be considered in terms of EOT claims little information is available in terms of an overall framework or procedure to follow to assess EOT claims. Previous research in terms of the various issues to be considered is fragmentary in nature and it would typically investigate one of the aspects in isolation of the others.

Many problems are encountered in practice in the application, preparation and assessment of EOT claims. In many cases these problems might result in disputes. The lack of clear guidance on how to assess EOT claims can be seen as a major contributing factor to disputes (Danuri *et al.*, 2006).

The delay in dispute settlement has various negative effects on the project, as given below (Iyer, Chaphalkar & Joshi, 2008):

- It hampers the project's progress when disputes arise during the execution stage;
- It is detrimental to the relationship between the owner and contractor; and
- It contributes to the cost-and-time overruns.

The main purpose of this study is to develop a framework with the use of a decision tree analysis to provide guidance for the assessment of delay claims. The framework would assist in providing a platform to standardise the assessment of delay claims. This approach will contribute to expediting the evaluation process; and it will limit the negative impacts associated with any prolonged process for concluding delay claims. As a result of the standardisation, it would also contribute to an improved perception of fairness in the evaluation of delay claims, which could lead to the reduction in claims being subjected to dispute resolution.

1.2.1 RESEARCH QUESTIONS

The research questions can be summarised as follows:

1) What are the main causes of construction EOT claims?
2) What level of guidance is available to practitioners assessing construction delay claims?
3) How should a decision support framework be structured to assist with the effective assessment of construction-delay claims?
4) How should contractual compliance in terms of EOT claims be assessed?
5) What process should be followed to determine whether a delay is excusable?
6) What process should be followed to determine whether a delay is critical?
7) What steps should be taken to determine whether a delay is compensable?

1.2.2 RESEARCH AIM

The overall research aim is to provide a decision support framework for the analysis of construction delay claims.

1.2.3 RESEARCH OBJECTIVES

The research objectives can be summarised as follows:

- To conduct a literature review to develop a preliminary decision support framework for the assessment of EOT claims;
- To substantiate the proposed decision support framework by using different construction contracts;
- To evaluate the decision support framework for assessment by obtaining feedback from focus groups of key stakeholders;
- To update the decision support framework to accommodate suggestions from focus groups; and
- To finalise the decision support framework as a practical tool for assessment of EOT claims.

1.3 IMPORTANCE OF THE STUDY

According to Kumaraswamy (1997b), many construction disputes can be linked to claims or potential claims. In recent decades, projects have become more time-constrained; and the ability to deliver a project on time is becoming increasingly important. There is an increasing emphasis on fast-track contracts, which are coupled with heavy liquidating damages or penalties for late completion. Thus, it is becoming all the more important for a contractor, when faced with delays caused by the client or other factors, to ensure that the claim for an EOT is duly made and appropriate to obtain an adjustment to the contractual completion date. Otherwise, the contractor would find himself subject to liquidated damages or penalties (Williams, 2003).

Most standard contracts contain provisions that list the relevant events that would enable the contractor to apply for an EOT. Unfortunately, there is no specific explanation with regard to the assessment of the claim; and this is often left to the professionals involved in the project. The absence of clear guidelines is also one of the contributing factors to the late submission of claims, which, in turn, leads to the late assessment of claims by the contract administrator, especially when the responsibility in assessing the claim rests on the shoulders of a newcomer, or an individual with insufficient experience in dealing with such claims (Yusuwan & Adnan, 2013).

It has been established that current delay-analytical methods are to a large extent not effective – for a number of reasons (Farrow, 2007). Although some studies were done internationally on the different delay methods (Arditi & Pattanakitchamroon, 2006), (Yusuwan & Adnan, 2013), (Braimah, 2008), (Yang & Kao, 2012) and (Williams, 2003), no specific research studies to investigate the effectiveness of delay analytical methods are available for the South African construction industry. Therefore, this study should prove to be of importance, because it will:

- Set out procedures which may help in the assessment of EOT claims;
- Provide guidance for the assessment of EOT claims; and
- Provide a decision tree framework, which would attempt to streamline and standardise the assessment of EOT claims.

1.4 DELIMITATIONS

A number of different claim-analysis models are currently being utilised in the industry. The purpose of the research is not to develop a new model, but rather to provide a decision tree framework to streamline and simplify the current claim-analysis process. The decision tree framework will strive to establish a guideline to ensure that the current models are utilised more effectively. This should ultimately facilitate the standardisation in the claim evaluation process.

The decision tree frameworks only focus on the JBCC, FIDIC and GCC forms of contract.

Delays in the construction industry have a far-reaching impact on various aspects of a project. The main aim of this study is to focus on the evaluation of delay claims, but not on any other aspects of such delays.

1.5 PROPOSED RESEARCH APPROACH AND STRATEGY

The research approach will consist of a comprehensive literature review to substantiate the decision tree framework proposed for the assessment of EOT claims. An assessment process involving focus groups consisting of industry specialists will follow. The main aim of this process will be to validate the decision tree framework by industry practitioners. The decision tree framework will be refined by the input of industry specialists; and conclusions will be drawn on the appropriateness of the framework. The proposed approach and strategy is shown in Figure 1.

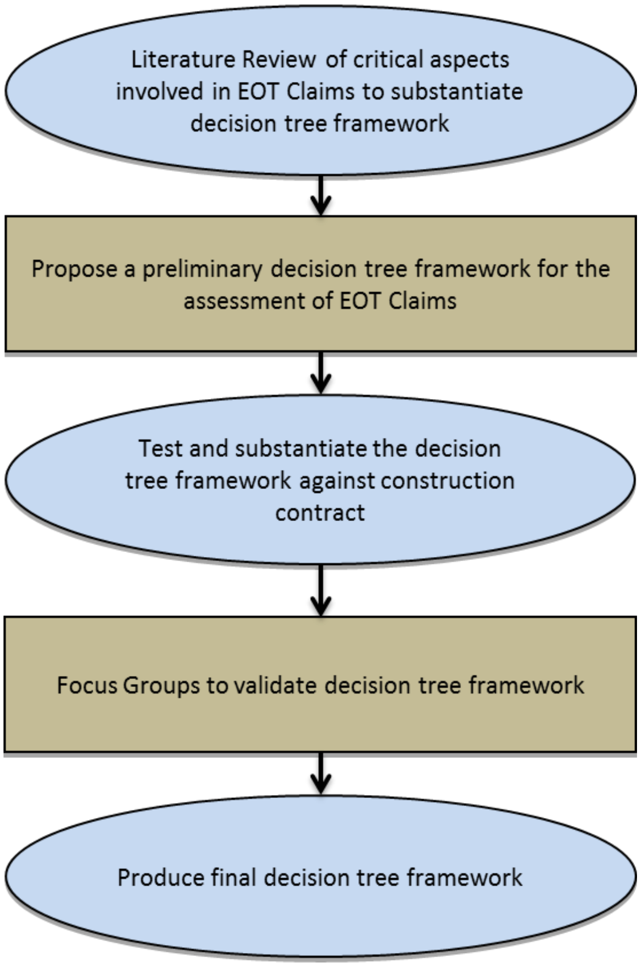


Figure 1 – Proposed research approach and strategy

The research approach and methodology are set out in more detail in Chapter 3.

1.6 STRUCTURE OF THESIS

The body of the thesis was structured in such a way as to reflect the sequence of the research method. The first chapter provides an introduction to the assessment of EOT claims. It highlights the current problems with the assessment process; and it states the research questions and objectives. Chapter 1 also provides a brief introduction to the research approach and strategy.

The main focus of Chapter 2 is to provide an overview of the relevant literature dealing with construction delays; and how these are addressed, as part of the EOT-assessment process.

Chapter 3 explains the research methodology, with specific emphasis on the research design, the methodology, the research instruments, the data gathering, the analysis, the limitations and the ethical considerations.

Chapter 4 starts with an explanation of decision trees; it continues to discuss the formulation of decision trees as support tools for the assessment of EOT claims, making use of input received during the focus groups and interviews, the relevant literature, as well as the three different construction contracts as means of substantiating the decision trees.

The main purpose of Chapter 5 is to present the evidence of the findings of the focus groups and of the interviews, which were conducted as part of the research process. The chapter does not summarise all aspect of the findings, but rather focuses on the contributions received during the focus-group and interview processes. It is important that this chapter should be read in conjunction with Chapter 4.

The main emphasis of Chapter 6 is twofold, firstly to provide an overview of the data gathered via the focus-group and interview processes; and secondly, to explain how the data helped to shape the decision trees to become more effective as decision-support tools. The final chapter provides a summary of the findings in relation to the research problem; a conclusion is provided; and suggestions for further research are made.

CHAPTER 2 - **DELAYS**

2.1 INTRODUCTION

Previous studies conducted on the topic of delays and the EOT tend to focus more on the causes and not too a large extent on the delay-claim process and associated problems. Table 1 provides an overview of previous studies conducted.

Table 1 – Studies on methodologies for analysing delay & disruption claims (adapted from Braimah, 2008)

Aim of study/problem addressed	**Literature**
Development of productivity charts/models for assessing the impact of disruption due to:	
Adverse weather	Grimm and Wagner (1974); NECA (1974); Harris and McCaffer (1975); Hancher and Abd-Elkhalek (1998); Thomas et al. (1999).
Variation or change orders	Moselhi et al. (1991); Thomas and Napolitan (1995); Thomas and Oloufa (1995); Ibbs (1997); Hanna et al. (1999a, 1999b); Hanna and Gunduz (2004); Ibbs (2005); Moselhi et al (2005)
Overtime	BRT (1980); CII (1988, 1994); Blomberg (1988); Thomas (1992); Hanna et al. (2005).
Learning curve effects	Verschuren (1985); Thomas et al.(1986); Everett and Farghal (1994)
Acceleration and congestion	Thomas and Jansma (1985); Thomas *et al.* (1989); Horner and Talhouni (1995)
Improvements to existing DAMs	Zink (1990); Finke (1997a, 1998a, 1998b); Thomas and Zavrski (1999); Presnell (2003); Gulezian and Frederick (2003); Norfleet (2005); Ibbs and Liu (2005)
Development or refinements to existing DAMs to address issues of:	
Concurrent delays	Kraiem and Diekman (1987); Arditi and Robinson, (1995); Galloway and Nielsen (1990); Alkass et al., (1996); Ng et al. (2004); Mbabazi et al.(2005)
Migration of the critical path	Reams (1989); Bordoli and Baldwin (1998); Finke (1997b, 1999); Shi et al. (2001); Sandlin et al. (2004); Hegazy and Zhang (2005); Kim et al. (2005); Ottesen, (2006).
Ownership of float	Chehayeb et al.(1995); Gothand (2003); Al-Gahtani and Mohan (2005)
Disruption, accelerations and resources allocation	Arditi and Patel (1989); Ryu, et al. (2003); Lee et al.(2005); Ibbs and Nguyen (2007)

Application of Information and Communication Technology in delay analysis:	
Knowledge-based systems	Moselhi and Nicholas (1990); Raid et al. (1991); Diekmann and Kim (1992)
Decision-support systems	Reams (1987); Bubbers and Christian (1992); Yates (1993); Moselhi and El-Rayes (2002)
Computer-aided approaches	Mazerolle and Alkass (1993); Battikha and Alkass (1994); Alkass et al.(1995); Lucas (2002); Oliveros and Fayek (2005)
Applications of systems Dynamics in DD analysis	Williams et al. (1995); Ackerman et al. (1997); Chapman (1998); Howick and Eden (2001); Williams et al. (2003); Eden et al. (2004); Cooper et al. (2004).
Surveys into aspects of delay analysis including practitioners views' on DAMs, concurrent delays and float ownership.	Scott (1993a); Scott (1997); Bordoli and Baldwin (1998); Harris and Scott (2001); Scott and Harris (2004); Kumaraswamy and Yogeswaran (2003)

2.2 CONSTRUCTION DELAYS

At the heart of any claim for extension of the contract period is the presence of an event that would cause a delay. Therefore an in-depth understanding of this primary building block of the claim-evaluation process is essential. This chapter explores how a construction delay can be defined, the different types of delays; how different forms of contract deal with delays. And ultimately, it investigates the common reasons for delays: both in Southern Africa and internationally.

2.2.1 WHAT IS A CONSTRUCTION DELAY?

There are a number of definitions for a delay: to make something happen later than expected; to cause something to be performed later than planned; or to not act timeously. Each of these definitions can describe a delay to an activity of work in a schedule. On construction projects, as well as on other projects, where a schedule is being used to plan work, it is not uncommon for delays to occur (Trauner Jr, 2009).

It is critical that the term "construction delay" should be defined – before proceeding to discuss the various types of delays, or the impact of delays, etc.

In the study of Assaf and Al-Hejji (2006), a construction delay is defined as: "the time overrun, either beyond the completion date specified in a contract, or beyond the date that the parties agreed upon for [the] delivery of a project."

Delay is also defined as "an act or event, which extends the required time to perform or complete the work of the contract, and manifests itself as additional days of work" (Zack, 2006). In addition, "any occurrence that affects the contractor's progress, or makes it work less efficiently than would otherwise have been the case" (Ndekugri, Braimah & Gameson, 2008).

The building law encyclopaedia defines a delay as follows: "To cause something to be carried out or provided later than envisaged. In the context of building contracts, the term ' delay ' is typically used to indicate that the work is not progressing as intended, or according to the programme. Generally, it means that completion of the work may not be achieved by the date specified in the contract documents" (Chappell, Dunn & Cowlin, 2009).

2.2.2 WHAT IS A CONSTRUCTION DISRUPTION?

According to the Building Law Encyclopaedia, a disruption is a term commonly used by contractors when making a claim for additional monies. The ordinary meaning of disruption is 'violent destruction or dissolution '. Therefore, in the context of a building contract, it cannot cover minor interferences with or minor delays to the progress. Progress has to be materially affected (Chappell *et al.*, 2009).

A claim for disruption costs can be distinguished from a claim for prolongation costs; in that a disruption claim can be legitimately made – even though the works were completed in time (Chappell *et al.*, 2009).

Typically, a disruption claim is for wasted labour time incurred on-site, e.g. waiting for instructions or late information. By contrast, a prolongation claim (or delay claim) would seek to recover the contractor's costs for being on-site beyond the agreed date for completion. For example, an architect's instruction may result in material disruption to a contractor's programme; but by efficient re-organisation, the contractor may be able to complete the contract on time. Or the time taken to carry out certain activities may be extended by an instruction; but there is no impact on the completion date; because the affected activity is not critical; and the extended activity time is absorbed in the available float.

Despite having completed on time, the contractor may have incurred additional costs, for which he is entitled to be reimbursed over and above any value of the instruction. In all such cases, it is necessary for the contractor to prove the loss and/or expense incurred as the consequence of a unavoidable disruption (Chappell *et al.*, 2009).

2.3 TYPES OF DELAYS

The evaluation of construction EOT claims is, to a large extent, influenced by the type of delay. A number of studies have attempted to categorise delays in terms of the impact, risk and cause of the delay. Figure 2 provides an overview of different types of delays.

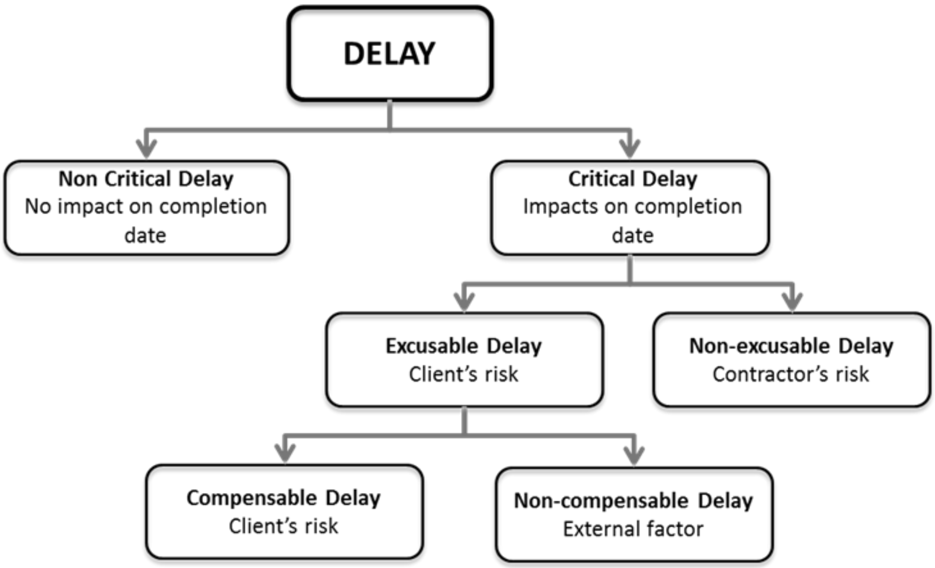


Figure 2 – Types of delays

An in-depth understanding of the different types of delays is essential in the successful execution of delay-claim analysis. Therefore, the types of delays will be discussed in detail in the sections to follow.

2.4 EXCUSABLE DELAYS

2.4.1 INTRODUCTION

Most contracts provide for an extension of the contract period – but only if a delay is deemed to be excusable (McKenzie, McKenzie & Ramsden, 2009). When a claim is being evaluated, it is essential that the person involved should understand the difference between excusable and non-excusable delays.

2.4.2 DEFINITION – EXCUSABLE AND NON-EXCUSABLE DELAYS

A non-excusable delay is defined as a delay caused by the contractor, or any aspect that is within the sphere of control of the contractor. The contractor would not be entitled to any additional time or compensation for this type of delay (Tumi, Omran & Pakir, 2009).

An excusable delay, on the other hand, can be described as a delay caused by either of the following two factors:

1) Third parties or incidents beyond the control of the client and the contractor; and
2) The client or the client's agents.
(Alaghbari, Kadir & Salim, 2007), (Hamzah, Khoiry, Arshad, Tawil & Che Ani, 2011) and (Tumi *et al.*, 2009).

Figure 2 above depicts the relationship between non-excusable delays and excusable delays.

2.4.3 CONTRACT CLAUSES DEALING WITH EXCUSABLE DELAYS

To determine whether a delay is excusable, it is required to assess the root cause of the delay. Contract provisions for excusable circumstances, which entitle the contractor to EOT, fall generally into the following categories:

- Contracts where no provision is made;
- Contracts that provide a brief list of excusable delays, which is further divided into compensable and non-compensable delays; and
- Contracts that provide single clauses, which by reference and cross-reference give circumstances that give rise to changes in the parties' rights (McKenzie *et al.*, 2009).

2.4.3.1 JBCC EDITION 6.1

The JBCC edition 6.1 addresses the excusable delays in three main clauses. In clause 23.1, several causes of delay are provided that would provide for a valid basis of an extension of the contract period, without any increase of the contract value. The causes of delay provided for in this clause are similar; in the sense that they refer to incidents beyond the control of the client and the contractor.

23.1. The contractor is entitled to a revision of the date of practical completion without an adjustment of the contract value, where a delay to practical completion has been caused by one or more of the following events:

23.1.1. Adverse weather conditions;

23.1.2. The inability to obtain materials and goods, where the contractor has taken reasonable steps to avoid or reduce such a delay;

23.1.3. Making good any physical loss, and repairing damages to the works, where the contractor is at risk; and such risk is beyond the reasonable control of the parties;

23.1.4. The exercise of statutory power by a body, state, or public or local authority that directly affects the execution of the works;

23.1.5. A default by a nominated subcontractor, where the contractor has taken reasonable steps to avoid or reduce such a delay;

23.1.6. Force majeure.

Clause 23.2, in turn, provides a list of events caused by the client or those for which the client is responsible. The events listed fall outside the sphere of the contractor's control; and as a result, they would lead to an extension of the contract period, and an increase of the contract's value.

23.2. The contractor is entitled to a revision of the date for practical completion and the adjustment of the contract value, where a delay to practical completion has been caused by one or more of the following events:

23.2.1. Delayed possession of the site;

23.2.2. Making good any physical loss, and repairing damages to the works, where the contractor is at risk;

23.2.3. A contract instruction not caused by the contractor's default;

23.2.4. The opening up and testing of works and materials and goods, where such work is in accordance with the contract documentation;

23.2.5. The late and incorrect issue of construction information;

23.2.6. The late supply of free issue, materials and goods, for which the employer is responsible;

23.2.7. The late supply of prime cost-amount items, where the contractor has taken reasonable steps to avoid or reduce such a delay;

23.2.8. The late acceptance by the principal agent and/or agents of a design undertaken by a selected subcontractor, where the contractor's obligations have been met;

23.2.9. The insolvency of a nominated subcontractor;

23.2.10. The suspension or termination by a subcontractor, due to default of the employer, the principal agent and/or any agent;

23.2.11. An act or omission of a direct contractor;

23.2.12. The execution of additional work, for which the quantity in the bills of quantities is not sufficiently accurate;

23.2.13. Suspension of the works.

In addition to clauses 23.1 and 23.2, clause 23.3 also addresses the issue of the causes of delay.

23.3. *Further circumstances, for which the contractor may be entitled to a revision of the practical completion and an adjustment of the contract value, are delays due to any other cause beyond the contractor's reasonable control that could not have reasonably been anticipated and provided for. The principal agent shall adjust the contract value, where such delay is due to the employer and/or agents.*

Clause 23.3 does not provide a list of possible causes; but it rather provides the opportunity to the contractor to claim for any other cause (not mentioned in clauses 23.1 and 23.2), provided that it complies with the following conditions:

1) The cause of the delay is beyond the contractor's reasonable control; and
2) The cause of the delay could not have been reasonably been anticipated and provided for.

The conditions (1 and 2 above) are in line with the general definition of an excusable delay. It is, therefore, clear that if the cause of the delay is not specifically listed in clauses 23.1 and 23.2; or if it does not comply with the test provision in clause 23.3, that the cause of the delay is not excusable.

2.4.3.2 GCC 2015

The GCC 2015 deals with delays in a number of clauses and clauses in the contract. Clause 5.12 can be seen as the primary clause addressing delays.

It is not clear if clause 5.12 specifically refers to excusable delays. This clause allows the opportunity for the contractor to submit an EOT claim for any circumstance, which in the opinion of the contractor would delay practical completion.

5.12. Extension of time for practical completion

5.12.2.1. If the contractor considers himself entitled to an extension of time for circumstances of any kind whatsoever which may occur that will, in fact, delay practical completion of the works beyond the due completion date, the contractor shall claim in accordance with clause 10.1 such extension of time as is appropriate. Such extension *of time shall take into account any special non-working days and all relevant circumstances, including concurrent delays or saving of time which might apply in respect of such claim.*

5.12.2.2. Abnormal climatic conditions;

5.12.2.3. Any provision of these conditions which allows for an extension of time; and

5.12.2.4. Any disruption which is entirely beyond the Contractor's control.

Clause 5.12.2 provides for some possible delay circumstances but the clause is clear that the circumstances mentioned are not meant to be exhaustive. However, clause 5.12.4 to some extent restricts claimable delays by making provision for disruptions which are entirely beyond the contractor's control. This description is in line with the definition of excusable delays.

2.4.3.3 FIDIC 2010

Types of excusable delays are clearly defined in clause 8.4 and in clause 17.3 of FIDIC. Clause 8.4 provides for further circumstances, which would entitle the contractor to an EOT.

8.4. *The Contractor shall be entitled, subject to Clause 20.1 [Contractor's Claims], to an extension of the time for completion if and to the extent that the completion for the purposes of clause 10.1 [Taking-Over of the Works and Sections] is or would be delayed by any of the following causes:*

(a) A variation (unless an adjustment to the Time for Completion has been agreed under clause 13.3 [Variation Procedure]), or other substantial change in the quantity of an item of work included in the contract;

(b) A cause of delay, giving an entitlement to extension of time under a clause of these conditions;

(c) Exceptionally adverse climatic conditions;

(d) Unforeseeable shortages in the availability of personnel or goods caused by an epidemic or governmental actions; or

(e) Any delay, impediment or prevention, caused by or attributable to the employer, the employer's personnel, or the employer's other contractors.

Clause 8.4 (d) specifically mentions any delay caused by the employer or the employer's agent/contractor. The description is in line with the generally accepted definition of an excusable delay. Clause 17.3 defines in more detail the employer's risk; and provision is made in clause 17.4 (a) for the contractor to claim for EOT, if any of the employer's risk events cause a delay in the completion.

17.3. The risks referred to in clause 17.4 [Consequences of Employer's Risks] below, insofar as they directly affect the execution of the works in the country, are:

(a) War, hostilities (whether war be declared or not), invasion, act of foreign enemies;

(b) Rebellion, terrorism, sabotage by persons other than the contractor's personnel, revolution, insurrection, military or usurped power, or civil war, within the Country;

(c) Riot, commotion or disorder within the country, by persons other than the contractor's personnel;

(d) Munitions of war, explosive materials, ionising radiation or contamination by radio-activity, within the country, except as may be attributable to the contractor's use of such munitions, explosives, radiation or radio-activity;

(e) Pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds;

(f) The use or occupation by the employer of any part of the permanent works, except as may be specified in the contract;

(g) The design of any part of the works by the employer's personnel, or by others for whom the employer is responsible; and

(h) Any operation of the forces of nature, which is unforeseeable, or against which an experienced contractor could not reasonably have been expected to have taken adequate preventive precautions.

2.5 CRITICAL DELAYS

2.5.1 INTRODUCTION

According to Pickavance (2000), a delay in progress is not the same as a delay in completion. A delay in progress is a significant shift in the planned timing of a specific activity, or the activities that could occur at any time. Although the start and/or finish of the activity might differ from the original intent, it is irrelevant unless it ultimately impacts on the completion date. On the other hand, a delay in the completion date occurs only when the completion date has passed; and this can only be caused by a delay to the progress of an activity, which is on the critical path to completion.

2.5.2 DEFINITION – CRITICAL AND NON-CRITICAL DELAYS

The criticality of a delay can be defined as follows in terms of the ultimate impact on completion:

1) Critical delay – a delay on the critical path of the project, and as a result the final completion date of the project would be delayed; and
2) Non-critical delay – a delay that is not on the critical path, and would therefore, not impact the overall completion date. (Figure 2 depicts the relationship between critical delays and non-critical delays)
(Ndekugri *et al.*, 2008)

2.5.3 DETERMINING CRITICALITY

The effect of delays in projects can be analysed, in order to incorporate the impact of delays on the overall project-execution period. There is no single solution; and therefore, the most suitable methodology must be selected to perform a comprehensive analysis of the delay with accurate outcomes (Bordoli & Baldwin, 1998).

Braimah (2008) states that various methodologies have been developed over the years as aids to evaluate any delay claims. These methods would test delays in terms of the criticality, and also attempt to quantify the extent of the delay. These methodologies can be divided into different categories (non-critical path-method based techniques and critical-path method-based techniques), and different types, as are encountered in projects.

The methodologies for analysing delay can be summarised and categorised in Table 2.

Table 2 – Existing methodologies (adapted from Braimah, 2008)

	Common name	Literature	Alternative names used by different authors
Non-CPM based techniques	S-Curve	Rubin et al. (1999)	Dollar-to-Time Relationship (Trauner, 1990)
	Global Impact technique	Leary and Bramble (1988); Alkass et al., (1995; 1996); Pinnell, (1998)	
	Net Impact	Leary and Bramble (1988); Alkass et al. (1995, 1996)	Bar chart analysis (Zack, 2001) and (Lucas, 2002) As-built bar chart (Bordoli and Baldwin, 1998)
CPM Based technique	As-planned vs. As-built	Stumpf (2000); Lucas (2002); Lovejoy (2004); Pickavance (2005)	Adjusted as-built CPM (Leary and Bramble, 1988) and (Alkass et al., 1996) Total time (Zack, 2001) and (Wickwire and Groff, 2004) Impacted as-built CPM (Pinnell, 1998)
	As-Planned but for	Alkass et al. (1996); Pinnell, (1998)	
	Impacted As-planned	Trauner, (1990); Pinnell (1998); Lucas (2002); Lovejoy (2004) Pickavance (2005)	What if (Schumacher, 1995) Baseline adding impacts (Bordoli and Baldwin, 1998) As-planned-plus delay analysis (Zack, 2001) and (Chehayeb et al, 1995) As-planned CPM (Pinnell, 1998)
	Collapsed As-built	Pinnell (1998); Stumpf (2000); Wickwire and Groff (2004); Lovejoy (2004)	But-for (Schumacher, 1995), (Zack, 2001) and (Lucas, 2002) As-built but-for (Pickavance, 2005) As-built subtracting impacts (Bordoli and Baldwin, 1998) As-built-minus analysis (Chehayeb et al, 1995)

	Window Analysis	Galloway and Nielsen (1990); Bordoli and Baldwin (1998); Finke (1999); Lovejoy (2004); Pickavance (2005)	Contemporaneous Period Analysis (Schumacher, 1995) and (Lucas, 2002) Snapshot (Alkass et al., 1996) Periodic update analysis (Chehayeb et al., 1995) Watershed (Pickavance, 2005)
	Time Impact Analysis	Leary and Bramble (1988); Alkass et al. (1996); Pickavance (2005).	End of every delay analysis (Chehayeb et al, 1995) Chronological and cumulative approach (Wickwire and Groff, 2004)

Bordoli and Baldwin (1998) found that **basic methods** are simple unsophisticated ways of assessing responsibility.

Critical path methods all incorporate the method of scheduling that was developed during the mid-1950s (Lockyer, 1969); and these are now used by some 88% of contractors in the UK and USA (Aouad & Price, 1994). The critical-path method, according to Aouad and Price (1994), includes the following techniques:

- The as-built network;
- The as-built subtracting impacts;
- The baseline adding impacts;
- Window analysis; and
- Isolated delay type.

The production of an as-built network demands considerable time and effort, in order to produce a model where both the logic and the durations re-create what actually occurred, as well as the final overall project duration. Having achieved this, however, the network may be used for allocating the possible reasons for delays, and for assessing their impacts. In allocating the responsibility for delay, attention is focused on the critical path (Scott, 1987) and (Antill & Woodhead, 1982).

Two other variations of network-based techniques were identified. The `as-built subtracting impacts' method uses the as-built network as a basis, and then subtracts the delaying events to provide a `no disruptions' programme (Cree & Barnes, 1989). This produces a programme, showing what would have transpired if no delays had occurred. The impact of disruptions may then be evaluated. An alternative to deducing impacts from an as-built network is to add them to an as-planned or baseline network. This is known as the `baseline-adding impacts' method.

The baseline network is the programme produced at the start of the project; and it indicates the contractor's intentions. A schedule of delaying events is then produced; and each of these is added to the network in turn. The impact of all these delays may then be assessed and apportioned.

2.5.3.1 PROSPECTIVE AND RETROSPECTIVE DELAY ANALYSIS

Both prospective and retrospective delay analysis techniques are used during the construction process. Prospective analysis regards the analysis of future delays, which means that the analysis is done based on the likely impact the delay might have on the progress and completion of the project. Retrospective analysis can be linked to analysis of delays that occurred in the past and therefore analysis is done based on the actual impact the delay had on the progress and completion of the project (Barry, 2009).

The Society of Construction Law Delay and Disruption Protocol (2002) propose that parties should address delays prospectively where possible. The aim with prospective delay analysis is to keep the programme of the project on track, as well as to provide a useful management tool for project managers (Gorse, Ellis, & Hudson-Tyreman, 2004). Prospective delay analysis can be done by the contract administrator during the contract at the earliest stage of an employer-delay. This will, according to the SCL Protocol (2002), require that claims for EOT should be accompanied with an updated programme which shows the effect of the employer-delay. This method of delay analysis is referred to as the updated programme tool. It firstly requires that the construction programme should be fully updated before the employer risk event is to take place, where after it should be modified to show how the contractor plan to recover from the delay. This will consist of a "sub-network" which refers to the activities, duration of those activities that are to follow and the linkage thereof to the construction programme. Lastly the impact of the delay on the completion date should be expressed. This analysis is mainly based on the theoretical or likely impact that the delay may pose to the construction programme and can be seen as an idealistic approach to delay analysis that might end up in various claim disputes (Gorse *et al.,* 2004).

Retrospective analysis on the other hand provides the contract administer with more reliable information regarding the claim for EOT or additional compensation, as the employer-delay already took place. This type of analysis can be implemented either directly after the delay took place or after the completion of the project (Braimah, 2008). The SCL Protocol (2002) also considers retrospective delay analysis where EOT issues are dealt with after the completion of the project.

The timing of when the delay analysis can take place is greatly determined by the proof necessary for the analysis of the claim. Braimah (2008) states that the reason for the claim can also determine whether the analysis is done prospective to or retrospective to the delay occurrence. If the claim is done with the intention to extent the project, prospective delay analysis may be implemented because it is possible to determine the effects of the disruption or the delay with the use of CPM methods. The use of retrospective delay analysis is however proposed to be utilised during the analysis of claims for reimbursement, as the claimant should be able to provide proof of the actual expenses that had occurred. This statement is reinforced by the SCL Protocol (2002) which states the following: *"…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…"*

Once it is determined when the delay analysis would take place, prospective of retrospective to the completion date, the method of analysis could be determined. Barry (2009) and Braimah (2008) advise on the DAMs (refer to Table 3) most suitable in the case of prospective and retrospective delay analysis.

Table 3 – Prospective and retrospective DAMs

	Prospective	**Retrospective**
Impacted as-planned	✓	
Time impact analysis	✓	
Collapsed as-built		✓
Window analysis		✓
As-planned vs as-built		✓

2.5.3.2 NON-CPM-BASED TECHNIQUES

a. S-Curve

Chao and Chien (2010) stated that the S-curve is usually utilised in the planning and control of a project. However, due to the inaccuracy of the original methods for estimating the S-curves, a number of alternative models have been adopted to cater for the shortcomings of the original methods.

The S-curve is a graphical representation of the cumulative progress of a construction project over the life-cycle of the project. It may be concluded from the shape of the S-curve that initially, progress on a construction project is slow at the start and end of the project. However, it is rapid in the middle of the project cycle, where the work load intensifies (Chao & Chien, 2010).

Employers and contractors normally utilise the S-curve to plan and control the activities in a project; because it offers a basis for estimating the cash flows that are used to make financial arrangements prior to construction; and it also sets an objective for evaluating the progress during the construction period of the construction cycle (Chao & Chien, 2010).

It is therefore crucial for the project manager to establish a reasonable S-curve. Because the actual progress can significantly differ from the original or planned progress; it is, therefore, necessary to update the S-curve on a regular basis (Chao & Chien, 2010).

b. Global-impact technique

This approach displays the delays on a bar chart; and it establishes the global effect of a delay by adding up the total overall periods of the delays. The global impact technique is an easy way to evaluate delays when comprehensive calculations cannot be executed (Arditi & Pattanakitchamroon, 2006).

However, the courts and the arbitration panels are not in favour of the utilisation of this technique because it incorrectly assumes that all the delays have an equal effect on the project period (Arditi & Pattanakitchamroon, 2006).

The outcomes of delay analysis may be subject to the approach chosen; hence the most suitable approach must be chosen by the affected parties (Arditi & Pattanakitchamroon, 2006).

c. Net impact

The net impact technique displays only the overall impact of all the delays claimed in a bar chart. Disturbances, variation orders and deferrals are projected on the as-built schedule when utilising this method (Alkass, Mazerolle & Harris, 1996).

Only the overall impact of all the delays is determined; and the difference in the completion dates of the as-planned and the as-built times defines the amount of EOT required. The as-planned and as-built schedules are projected as summary bars on a bar chart; but they only show the overall effect of all the delays. The mutual overwhelming impact of these delays largely affects the overall project, compared to the period of each separate delay (Alkass et al., 1996).

This method does not evaluate the type of delay; although it attempts to address any concurrent delays. This thus results in the exaggeration of the amount of delays and the effect they have on the dates of completion. It is difficult to determine the overall delay on completion of the project; because this method does not utilise the networks (Alkass et al., 1996).

2.5.3.3 CPM-BASED TECHNIQUES

a. As planned vs as built

The as-planned vs as-built method is basically the result of the difference between the as-planned and the as-built schedule. The as-built critical activities are determined by comparing the activities of the as-planned schedule with those of the as built schedule; thereby the effect of the delay on the project is evaluated; and the order, which defines the length of the project cycle, is determined. Furthermore, the reason and the accountability for the delay are established, together with the effect on the date of completion. This method is the most comprehensive form of analysing the delay when compared with the other methods (Fruchtman, 2000).

The as-planned vs the as-built method is recommended to be used as a starting point in collaboration with the other advanced analytical methods (Fruchtman, 2000). However, McCullough (1999), Zack (2000), Stumpf (2000) and Gothand (2003) are against the use of this method; because it basically defines the overall effect of all the delay occasions, rather than addressing each occasion independently. The as-planned vs the as-built method assumes that the as-planned and the as-built schedules are accurate in terms of both activity periods and logical arrangement; even though the progressive updates are unavailable (Harris & Scott, 2001).

In terms of this method, extra activities in relation to the original activities are addressed independently to ensure that the judgement is valid (Harris & Scott 2001).

Where modifications have been effected to the as-built schedule, it is difficult to do a comprehensive comparison with an as-planned schedule that has not been updated.

Zafar (1996) and Fruchtman (2000), however, promoted the use of the method. Their motivation was that this method or approach considers both the as-planned and the as-built schedules, in order to estimate the effect of the delay; and it also indicates and takes into account both the employer and the contractor delays. Courts of law also presume that this method is the most commendable way of analysing delays.

It is believed that the as-planned vs the as-built analytical method is able simultaneously to address both the compensability and the concurrency (Sgarlata & Brasco, 2004).

This method basically relates the activities of the original CPM standard programme to those of the as-built programme for a comprehensive evaluation of the delays that have occurred. It is preferred because it is relatively cheap, simple and easy to understand and implement (Lovejoy, 2004).

However, it fails to take into account the deviations in the critical path at different stages of the project. It is also unable to address the concurrent delays, including any complicated delay situations (Braimah & Ndekugri, 2008).

Zafar (1996) states that the method needs only the available materials related to the general organisational procedures: for example, the as-planned and the as-built schedules. In the case of a project, where the CPM schedules may not even exist, a bar chart illustration with an as-built schedule or records that are up-to-date is considered to be enough to undertake the analysis.

With this method, it is not required to adjust or formulate a new network compared to the additive or subtractive methods. This, therefore, limits the chance of the analyst to be biased in the process of analysing (Zafar, 1996).

b. As-planned but for

According to Palaneeswaran and Kumaraswamy (2008), when using this technique, a scheduled reference programme is utilised to determine the effect that a party to the agreement’s actions would have on the progress.

The affected completion date is then paralleled with the ‘As-Built’ completion date. A contractor using this method would identify and add all the non-excusable delays to the as-planned schedule whereas the owner would add all the excusable delays to the as-planned delays (Braimah, 2013).

The `but for’ method appears to be a sound technique for analysing the delay as it addresses the problem of concurrent delays; and it examines the different types of delay. However, it does not consider any variations in the CPM schedule during the lifecycle of the project, which is a major problem. *Delays are applied in a `one-shot deal' to the as-planned schedule*. Because of this problem, this method offers inaccurate results; since the critical path would in most cases change during the project's lifecycle. *The potential error lies in the fact that delays may be on the as-planned critical path; but when the delay actually occurred, it was not a critical delay* (Alkass *et al.*, 1996).

The "as-planned-but-for" technique rejects the idea of the critical-path method scheduling completely. Using this technique entails a full comparison of the as-planned schedule with the as-built schedule. The analyst conducting the analysis concludes that numerous undertakings had experienced delays. The analyst then classifies and claims that a delay caused by the employer is offset by a delay caused by the contractor. *This analysis fails to recognise the fact that the original owner-caused delay provided the contractor with a float on other activities, which, therefore, no longer had to be accomplished in the originally scheduled time-frame* (Trauner, 1990).

c. Impacted as-planned

According to Wickwire (2003), the impact as-planned procedure only uses the as-planned or baseline schedule for analysing the delays. Basically, it is formed from the theory that the earliest completion date of a project can be determined by adding the total delays to the as-planned schedule.

However, a project completed later than "as-planned" is justified by the reasons derived from the addition of new activities that represent delays, suspension and disruptions to the as-planned schedule. Claims submitted by contractors involving time extensions only add delays caused by the owner to the as-planned schedule. And these are added in an appropriate sequence; in order to document the delays caused by the owner (Wickwire, 2003).

According to Trauner (1990) and Pickavance (2000), this procedure involves taking into consideration the delays experienced as activities into the as-planned CPM schedule – to show how the completion date of the project is being delayed by the delaying events.

Each delaying event impacts on the amount of project delay, which is the difference between the schedule's date of completion before and after the addition (Pickavance, 2000; Trauner, 1990).

According to Braimah (2013), this procedure does not require as-built information in order to operate. However, it has huge drawbacks, like the failure to take into consideration the changes in the critical path, as well as the assumption that the construction sequence planned remains valid.

d. Collapsed as-built

This technique's popularity in claim representation is enhanced by the fact that it is fairly easy to understand by anyone attempting to use it (Zack, 2001).

This approach can be utilised where a proper schedule is not available during the execution of the project, and also where the as-planned schedule is essential to the agreement (Fruchtman, 2000).

An as-built CPM schedule is established firstly, comprising all the delays that are met. Delays are then eliminated from the schedule to establish a 'collapsed' as-built schedule, which outlines the progress of the project in the absence of the delays (Sgarlata & Brasco, 2004).

Similar to the effect of the as-planned analysis, this approach is also based on the idea of a 'what-if' method; but it is an improved version to address the effect of the shortfalls on the as-planned analysis (Sgarlata & Brasco, 2004). Relevant information about the work that has been executed is displayed by the as-built schedule. The collapsed as-built approach is convenient; because the activities runs parallel with the real occurrences during the lifecycle of the project; hence, its consideration as useful by the courts in the United States (Sgarlata & Brasco, 2004).

Harris and Scott (2001) add that a number of professionals in the United Kingdom also find this method very handy. Where there is no as-planned schedule, or it is out of date, the as-built schedule can be generated from the existing information, like the progress reports of the project.

The collapsed as-built approach is usually chosen, where there are no authentic schedules available at the time of analysis, or no scheduling information exists with regard to that project (Lovejoy, 2004). According to Lovejoy (2004), the collapsed as-built approach is the most practical method; because it provides a good integration of all the benefits.

However, Zafar (1996), Finke (1997), Finke (1999), Fruchtman (2000), Stumpf (2000), Zack (2001), Gothand (2003), and Sandlin, Sapple and Gautreaux (2004) are against the above proposition that the collapsed as-built analysis is the best analytical method to utilise. Firstly, when a contractor undertakes a collapsed as-built analysis, the results of the analysis are bound to take into account only the effects of the delays caused by the employer at the end of the project cycle. The analysis excludes the delay caused by the contractor, thus resulting in biased results.

It does not include contractor-caused delays in the analysis. Therefore, the method does not identify any existing delays; and this acts to the disadvantage of this employer; and overall it serves as a disadvantage of the analytical method. Secondly, this method ignores the effective nature of the critical-path method. In some cases this may result in delays during the life cycle of the project; and consequently, these may not be determined by this approach (Zack, 2001).

Thirdly, the chances of the manipulation of the results of the analysis are considerable. The parties involved are required to evaluate the records and reach consensus with regard to the outcomes of the particular event to the as-built network prior to the analysis being performed (Arditi & Pattanakitchamroon, 2006).

e. Window analysis

Window analysis is a procedure that deviates from the time-impact analysis. The analysis is executed by utilising weekly or monthly updates. The delaying events and their accrued effects are incorporated each time into the schedule, when the schedule is revised (Wickwire & Groff, 2004).

This procedure uses the total construction project duration, as provided by the as-build CPM schedule. The duration is firstly divided into a number of time periods. The time periods are chronologically updated, using the as-built information, together with all the delays experienced. The difference that exists between the project-completion dates, which result from any time period that is under review, give the project delay encountered during that period.

The main advantage of this procedure is its ability to look after the dynamic nature of the project's critical path. However, this procedure is normally more expensive than the other procedures, due to the large amount of time and effort required to perform it (Zack, 2001).

f. Time-impact analysis

The time-impact method is dependent on the assumption that the impact of delays to a project can be evaluated by running a series of analyses on the scheduled updates. Time-impact analysis is an approach that uses CPM principles. It evaluates the effects of delays on the project schedule by evaluating the schedule periodically, basically on a day-by-day basis (Wickwire, 2003).

Arditi and Pattanakitchamroon (2006) observed that the time-impact analysis, amongst the other four methods, is the most credible delay-evaluation method. Furthermore, it does not display the shortcomings displayed by the other methods. It uses fragments to evaluate the delay of the individual events.

The relationships and the durations of delays to activities of projects are reviewed simultaneously in detail, together with the information. Thereafter, the delay is inserted into the project. This procedure provides both parties with an opportunity to carefully examine the delay and to reduce disputes (Arditi & Pattanakitchamroon, 2006).

Baram (1994), Finke (1997), Zack (2001), and Stumpf (2000) addressed the significance of the dynamic nature of a project's critical paths. Time-impact analysis performs a series of evaluations throughout the period of a project, differing from the major disadvantage of the other methods that consider a single schedule at a time. The analysis is able to systematically discover the causes and effects of delays. Then, the impact of a delaying event is evaluated individually in detail. The time-impact analysis uses the CPM algorithm to follow on the project on a day-by-day basis from the start to the completion date, including any concurrent delays, consumption of the float, re-sequencing accurately, or acceleration and recovery times. A time-impact analysis differs from the collapsed as-built analysis and the impact as-planned analyses; since it integrates the delays of both parties into the analysis, providing for the separate identification of the excusable compensable, non-excusable and excusable non-compensable delays.

In addition, this method defines the benefits generated indirectly, by using the time-impact analysis, which assists in keeping a project schedule up to date and properly adjusted for the contractual parties (Baram, 1994).

The first disadvantage of the time-impact analysis is that it requires a large scope of information for the performance of the analysis. Some actual construction projects contain limitations that weaken the power of this procedure, such as the limited amounts of information available. This necessitates an as-planned schedule in CPM format that needs to be updated periodically.

According to (Baram, 1994), the use of time-impact analysis is the most advantageous approach to handle a claim for delay; but it is efficient only when the documents and information are available on time in the required format. Construction projects that lack strict management procedures and/or schedules that are updated would not effectively benefit from using this procedure; as the required information would not be available.

Secondly, the analytical procedure may not be suitable when resources and/or information, or the time allowed are restricted. Time-impact analysis uses more time than the other methods because of its detailed methodology (Finke, 1999).

Lastly, time-impact analysis is intricate; because it determines the cumulative results from a number of simultaneous data; therefore, the result of the analysis may be influenced by a variety of factors (Finke, 1999).

2.5.3.4 THE BENEFITS OF NON-CPM TECHNIQUES

Table 4 below provides a brief overview of the benefits identified in the literature for the non-CPM techniques.

Table 4 – Benefits of non-CPM techniques

Non-CPM Techniques	Benefits
S-curve	• Graphically represents the progress of the project (Chao & Chien, 2010).
Global impact technique	• Easy way to evaluate delay when comprehensive calculations cannot be done (Arditi & Pattanakitchamroon, 2006). • Quick and simple (Farrow, 2007).
Net impact technique	• Considers concurrent delays in its evaluation (Kumaraswamy & Yogeswaran, 2003).

2.5.3.5 SHORTCOMINGS OF NON-CPM TECHNIQUES

Table 5 below provides a brief overview of the shortcomings identified in the literature for the Non-CPM techniques.

Table 5 – Shortcomings of Non-CPM techniques

Non-CPM Techniques	Shortcomings
S-curve	• Inaccuracy of the original approaches for assessing s-curves (Chao & Chien, 2010). • Does not determine and evaluate the activities in the critical path (Braimah, 2008). • Payments for stored materials and equipment could result in misleading progress of an updated S-curve (Braimah, 2008).

Global-impact technique	• No contractual support and offers no "cause and effect." (Farrow, 2007). • Lack support of courts and arbitration panels for its use because it incorrectly accepts that all delays have an equal influence on the project life cycle (Arditi & Pattanakitchamroon, 2006). • No allowance for concurrent delays in parallel undertakings (Kumaraswamy & Yogeswaran, 2003).
Net-impact technique	• There is limited information to recommend its use (Farrow, 2007). • Does not use network programmes and thus one may misjudge the true overall impact of a delayed activity on the date of completion (Kumaraswamy & Yogeswaran, 2003).

2.5.3.6 THE BENEFITS OF CPM TECHNIQUES

Table 6 below provides a brief overview of the benefits identified in the literature for Non-CPM techniques.

Table 6 – Benefits of CPM techniques

CPM Techniques	Benefits
As-planned vs. as-built	• Considers both the as-planned and as-built schedules to estimate the effect of delay (Zafar, 1996) and (Fruchtman, 2000). • It determines, identifies and computes both employer and contractor delays (Zafar, 1996) and (Fruchtman, 2000). • Depicts the net impact of the overall claims for delays (Braimah, 2013).
As-planned, but for	• It can be executed quickly because it ignores the real progress of the works (Braimah 2013). • Firstly implemented to the sample project to consider the contractor's point of view and then repeated for owner's point of view (Braimah, 2013).
Impacted as-planned	• As-built data is not required for this method to function (Braimah). • This method can be utilised to analyse delays during and after project date of completion (Braimah, 2013).
Collapsed as-built	• Outcomes are good and accurate (Sgarlata & Brasco, 2004). • Sustain little time and cost compared to the impact analysis (Harris & Scott, 2001).

Window analysis	• Capability to look after the dynamic nature of the project's critical path (Zack, 2001).
Time impact analysis	• Offers distinct identification of the excusable compensable, non-excusable and excusable non-compensable delays. • Maintains up-to-date project schedule and adjusted properly for the contractual parties (Wickwire, 2003).

2.5.3.7 SHORTCOMINGS OF CPM TECHNIQUES

Table 7 below provides a brief overview of the shortcomings identified in the literature for the CPM techniques.

Table 7 – Shortcomings of CPM techniques

CPM techniques	Shortcomings
As-planned vs as-built	• It does not "scrutinise" delay types and therefore the results can easily be manipulated. • Depicts either the situation of the plaintiff or the respondent. • It ignores the dynamic nature of the critical path and any variations in the logic of the schedule (Lucas, 2002), (Stumpf, 2000) and (Zack, 2001). • Does not attempt to establish the individual effect for each delay at the date of the project completion. All delays, including delays on non-critical path items, are summed up and their net effect calculated (Braimah, 2013).
As-planned but for	• Ignores all the variations in the critical path schedule during the lifecycle of the project (Alkass et al., 1996). • It undertakes that the intended construction logic remains valid throughout the life cycle of the project (Lovejoy, 2004). • Owner's opinion and contractor's opinion may result in different outcomes therefore initiating disputes (Braimah, 2013) .
Impacted as-planned	• Fixed as-planned schedule is used to evaluate delays out of framework and time (Lucas, 2002) and (Stumpf, 2000). • The original reference programme may not be a realistic model on which to base the whole analysis. • It has the potential of failing to consider the delays of all parties. • Potential disputes over the adequacy of the as-planned schedule. • Possible, but does it makes sense, to schedule the entire project in detail at its inception (Cher, 1995) and (Schumacher, 1995).

Collapsed as-built	• Fixed as-planned schedule is used to perform analysis of delays out of framework and time (Lucas, 2002). • Avoiding any deviations in the critical path and the initiative needed in identifying the as-built critical path (Braimah, 2013) and (McCullough, 1999). • The analyst is normally obliged to incorporate after-the-fact logic, therefore the perception of the executor of the schedule may not be outlined (Lovejoy, 2004). • The exclusion of the delays from the schedule can cause an unrealistic as-built but-for schedule, especially if the schedule structure is affected by the delays. • Experience and sound decision is needed when modifying the collapsed schedule to accommodate the structure that the contractor is most likely to follow, most analyst lack that capability (Wickwire & Groff, 2004). • It ignores the conditions at the time of delay and the dynamic nature of the critical path. • The determination of the as-built critical path needs a huge amount of effort (Zack, 2001). • The utilisation of as-built information to formulate the as-built schedule is subject to and highly responsive to manipulation (Trauner, 1990).
Window analysis	• It is time consuming and costly to run and also requires complete project records, which are not always available. • Alterations in the time periods (or “windows”) can result to different outcomes (Hegazy & Zhang, 2005). • Maintained regular updates may not be obtainable or available, therefore the analyst may be required to do a highly difficult analysis of project data to formulate the updates (Braimah, 2013). • “More expensive” in relation to the other techniques because more time and energy is needed to undertake its process (Zack, 2001).
Time impact analysis	• It may not be practical or realistic to utilise this method if there is a vast number of delays triggering events (Pickavance, 2000). • Regular updates may not be available then the analyst will be obliged to undertake difficult and time consuming analysis of the project records to formulate updates. • Intensive energy is required by the analysis and needs a lot of time (Braimah, 2013). • The outcomes of the evaluation may be determined by a number of factors (Finke, 1999). • Large amount of information is needed for the presentation of the evaluation (Baram, 1994).

2.5.4 GENERAL DEFICIENCIES OF DELAY-CLAIM ANALYSIS METHODOLOGY

In general, the existing methods of evaluating delays and formulating claims are "inaccurate, time-consuming and costly". Preparing the claims involves scrupulous digging up information through piles of project documents to arrange and ascertain the relevant delays encountered throughout the project lifecycle (Alkass *et al.*, 1996).

The overall view among practitioners regarding the use of these methodologies is that no particular method is appropriate for all delay-claims circumstances; and that the most suitable one for any circumstance is dictated by numerous factors or criteria. The requirement to determine and utilise an appropriate method is progressively becoming a fundamental issue (Braimah, 2013).

In addition to the diverse outcomes that existing methods produce, when applied to the same set of delay claims data, other significant matters that have the possibility of influencing the outcomes are frequently not even considered when applying these techniques. These matters comprise: the functionality of the programming software employed; resource loading and levelling requirements; resolving concurrent delays; and delays in pacing the strategies (Braimah, 2013).

2.5.5 CRITERIA TO DETERMINE THE APPROPRIATENESS OF THE METHODOLOGIES

Most standard contracts contain provisions that list the relevant events that would enable the contractor to apply for an EOT. Unfortunately, there is no specific explanation with regard to the assessment of the claim; and this is often left to the professionals involved in the project. One of the contributing factors to the late submission of claims is the absence of clear guidelines. This can also be a source of disputes (Yusuwan & Adnan, 2013).

Pickavance (2000) commented, in reference to the methods of analysis that UK courts have not pronounced on the appropriateness of the different methodologies. Courts in the USA also have failed to impose a strict requirement for the use of any particular scheduling method. However, in order to be effectively used in court to support or refute a delay claim, a schedule analysis must accurately reflect the actual events on the project – both before and after the delay (Sgarlata & Brasco, 2004).

Similarly, South African courts also have not expressed any explicit views in terms of the specific methodologies for the analysis of delay claims.

A small number of studies have attempted to identify specific criteria to be utilised to identify the most appropriate methodology to utilise. The Society of Construction Law (SCL) (2002) as in Braimah (2008) provides for the following criteria to be considered, when choosing the most appropriate analytical methodology:

- The relevant conditions of the contract;
- The nature of the causative events;
- The value of the dispute;
- The time available;
- The records available;
- The programme information available; and
- The programmer's skill level and his/her familiarity with the project.

Arditi and Pattanakitchamroon (2006) identified the following criteria to be utilised in selecting a delay-analysis methodology:

- Availability of information;
- Time of analysis;
- Capability of methodology; and
- Time and funds available for the analysis.

In a survey of 63 contractors and 67 consultants conducted in the UK by Braimah and Ndekugri (2008), the criteria to be considered in the identification of the most appropriate delay analysis methodology were established. The criteria were grouped together in terms of the following main factors:

- Project characteristics;
- Requirements of the contract;
- Characteristics of the baseline programme;
- Cost proportionality;
- Timing of the analysis; and
- Record availability.

Braimah (2008) developed a framework to assist in identifying the most appropriate Delay-Analysis Methodology (DAM) by utilising the above criteria as inputs in a multi-attribute decision-making model.

2.5.6 CONTRACT CLAUSES DEALING WITH CRITICALITY

Most standard contracts contain provisions that list the relevant events that would enable the contractor to apply for an EOT. The JBCC, GCC and FIDIC allow for the EOT to be considered for any circumstance delaying the completion of the project.

2.5.6.1 JBCC EDITION 6.1

The JBCC provides for the revision of the date for practical completion in three main claim clauses: 23.1, 23.2 and 23,3:

23.1. The contractor is entitled to the revision of the date for practical completion without the adjustment of the contract value where a ***delay to practical completion*** *has been caused by one or more of the following events:*

23.2. The contractor is entitled to the revision of the date for practical completion and an adjustment of the contract value [26] where a ***delay to practical completion*** *has been caused by one or more of the following events:*

23.3. Further circumstances for which the contract may be entitled to a revision of the date of practical completion and an adjustment of the contract value are ***delays*** *due to any other cause beyond the contractor's reasonable control that could not have been reasonable anticipated and provided for.*

Clause 23.1 and 23.2 make specific reference to a delay to practical completion. It is therefore very clear that both these clauses refer to critical delays. Clause 23.3 does not specifically refer to a delay to practical completion. The clause provides for circumstances causing a delay further to those mentioned in clauses 23.1 and 23.2. As a result, it may be assumed that the intention here is that the circumstances should cause a delay to practical completion; therefore such as delay can be seen as a critical delay.

2.5.6.2 GCC 2015

EOT is dealt with mainly in clause 5.12 of the GCC.

5.12. Extension of time for practical completion

5.12.1. If the contractor considers himself entitled to an extension of time for circumstances of any kind whatsoever which may occur that will, in fact, delay practical completion of the works, the contractor shall claim in accordance with clause 10.1 such extension of time as is appropriate. Such extension of time shall take into account any special non-

working days and all relevant circumstances, including concurrent delays or saving of time which might apply in respect of such claim.

The clause allows for the contractor to submit an EOT claim for any circumstance that would delay practical completion. The essence of a critical delay is that it should delay practical completion. Therefore it is clear that reference is made here to critical delays.

2.5.6.3 FIDIC 2010

FIDIC 2010 deal with the types of delay, which would entitle the contractor to an EOT mainly in clause 8.4:

8.4. The contractor shall be entitled subject to clause 20.1 [contractor's claims] to an extension of the time for completion if and to the extent that ***completion*** *for the purposes of clause 10.1 [taking-over of the works and sections] is or* ***will be delayed*** *by any of the following causes:*

- *(a) a variation (unless an adjustment to the time for completion has been agreed under clause 13.3 [variation procedure]) or other substantial change in the quantity of an item of work included in the contract,*
- *(b) a cause of delay giving an entitlement to extension of time under a clause of these Conditions,*
- *(c) exceptionally adverse climatic conditions,*
- *(d) unforeseeable shortages in the availability of personnel or goods caused by epidemic or governmental actions, or*
- *(e) any delay, impediment or prevention caused by or attributable to the employer, the employer's personnel, or the employer's other contractors.*

The following clauses make provision for an EOT if a delay caused by the event mentioned in the clause cause a delay:

1.9 Delayed drawings and instructions

2.1 Right of access

4.7 Setting out

4.12 Unforeseeable physical conditions

4.24 Fossils

7.4 Testing

8.5 Delays caused by authorities

8.9 Consequences of suspension

10.3 Interference with tests on completion

13. Adjustment for changes in legislation

16.1 Contractor's entitlement to suspend work

17.4 Employer's risk

19. Force Majeure

It is clear that the contractor will only be entitled to claim for EOT for events which will result in a delay to completion or in other words critical delays.

2.6 CONCURRENT DELAYS

Concurrent delays can be defined as a situation where there is a simultaneous occurrence of different types of delays. According to Rubin *et al*. (1983) this does not necessarily mean that delays should take place at the exact same time or impact the same critical path. The term concurrent delay is however restricted by the requirement that each delay must affect a critical path of the project independently (Braimah, 2008).

Trauner *et al.* (2009) elaborate on this definition by classifying concurrent delays into two groups: concurrent delays to separate critical paths and concurrent delays to the same critical path. Concurrent delays to separate critical paths can be described by looking at three different situations.

- The first situation involves concurrent delays which are concurrent for the same duration. The occurrence of concurrent excusable and non-excusable delays may justify the granting of EOT, according to some jurisdictions. However, no additional adjustment to compensation will normally be made. If it happens that the concurrent delays are both excusable and one of the delays is classified as compensable, the delay that is non-compensable will take preference. This means that the contractor will not receive compensation and will only be issued with an EOT.
- The second situation involves delays that are not concurrent for the full extent of time that they take place. In this case it may happen that one of the delays ends before the other. The contractor will then only be compensated by means of EOT for the excusable delay that took place as the concept known as primacy of delay is applied.

- The third situation involves a delay to one critical path starting before another delay on another critical path. This might cause that the delay that starts at a later date, will never reach a critical stage, and therefore influence the contractors' entitlement to an EOT. The concept of primacy of delay is also applied here and therefore it might be seen that the critical delay that took place first created a float on other critical paths.

Concurrent delays to the same critical path can rather be defined as concurrent causes for the same delay to the critical path of a project and can be classified according to the duration of the causes for delay. If the causes for the delays are of the same duration the analysis of the delay is simple, but the question of who is at fault becomes a much debated subject. When the causes for the delay of the critical path are not of the same duration, it will be easier to identify who is at fault and entitlement to EOT will be analysed accordingly.

The Society of Construction Law Delay and Disruption Protocol (2002) states that issues regarding concurrent delays may occur due to the various different views on the analysing of EOT claims and on the meaning of concurrent delays itself. The following guideline on dealing with concurrent delays is provided:

- When an employer-delay and a contractor-delay occur simultaneously and produces concurrent effects, it is known as a true concurrent delay. In this instance, the contractor is entitled to claim for EOT, but only for the employer-delay to the completion date, further it is required that each delay should be analysed separately, starting with the employer-delay.
- Where delays occur sequentially, but have effects that take place at the same time, delays should be analysed according to their sequence and only thereafter can it be determined if additional compensation will be issued. In this case, as with the previous one, the contractor-delay does not have an effect on the EOT claim for the employer-delay.
- On the other hand, when a contractor-delay takes place before a non-compensable employer-delay, no compensation or EOT for the specific employer-delay will be due.

2.7 CONTRACTUAL COMPLIANCE IN TERMS OF DELAY CLAIMS

In order to assist contracting parties in dealing with claims that might arise during the execution of the construction contract, most standard form construction contracts contain provisions, under which the contractor can recover compensation from the employer for various losses suffered – where the project is prolonged or disrupted by certain specified causes (Croeser, 2010).

Most contractual regimes, and even general conditions of contract, do not provide details of the principles governing the assessment of claims for EOT; and this is left to the professionals involved in each project (Yogeswaran, Kumaraswamy & Miller, 1998)

Contractors are responsible for establishing and substantiating the claims, and the principal agent/project manager/engineer is responsible for assessing the claims. These gaps in the perceptions have led to disputes (Kumaraswamy, 1997a).

The Building Law Encyclopaedia by Chappell *et al.* (2009) states that contractual claims are those made, in accordance with the specific provisions of the contract, e.g. ‘ direct loss and/or expense’. This type of claim is also, though rarely, described as being *ex contractu*, i.e. arising from the contract. The authority of the contract administrator, and the scope of that authority to address such claims, would depend on the precise wording in the contract.

The onus for substantiating a claim rests with the claimant (contractor). During construction, claims are frequently submitted without adequate details; but frequently, the engineer is asked to assess the claim expeditiously (Yogeswaran *et al.*, 1998).

According to Yogeswaran *et al.* (1998), the principal agent/project manager/engineer would request further details. This back-and-forth process takes up valuable resource-time; and the time for settlement also takes longer, during which time, further delays may occur.

The spirit of most of the forms of contract is to ensure that both the employer and the contractor are aware of the effect of delaying events on the project completion, as soon as the event occurs and not after completion of the project. It is therefore necessary to specify what documents/details are required to substantiate a claim, so that an assessment can be made within a specified period from the date of the event that caused the delay. Yogeswaran *et al.* (1998) state that these delays should ideally be incorporated into the contract documents in unequivocal terms.

In the study done by Yogeswaran *et al.* (1998), he found that the general specifications and/or any particular specification and the conditions of contract should incorporate clearly the procedures and the details that are required to substantiate a claim for EOT.

In a study conducted by Vidogah and Ndekugri (1998), 8 reasons for rejecting contractors’ claims were identified. Figure 3 highlights the reasons for rejection in order of significance.

Non-compliance with contractual procedures was ranked 5th and inadequate information was ranked 2nd.

Reason	Mean rank	Rank order
Non-entitlement in principle	6.20	1
Non-compliance with contractual procedures	4.20	5
Inadequate information	6.00	2
Lack of breakdown of claim by causes	4.57	4
Inadequate effort at mitigation	3.93	6
Validity of architect/ engineer's instructions	2.43	7
Quantification of claim	5.50	3
Other grounds	3.17	8
W	Significance	
0.38	0.001	

Figure 3 – Reasons for rejection of part or all of contractors' claims (Vidogah & Ndekugri, 1998)

One of the things that make standard form contracts appealing to its users is the fact that it offers specific provisions or procedures that should be followed by users, when executing works under the contract, specifically with regard to communication, and claim notification procedures, which facilitate the testing and evaluation of disputes, which may arise from the contract. If parties thus fail to comply with such provisions and procedures, especially the stipulated time limits, it could give rise to grounds, on which claims may be rejected by the Employer (Croeser, 2010).

Most standard form contracts also make use of a "Time-bar provision"; and according to The Building Law Encyclopaedia by Chappell *et al.* (2009), this provision can be defined as a clause which requires a party to undertake certain specific steps, e.g. carry out an act, or provide a notice, or information, or the like, within a specified period. Should the steps not be undertaken within the period; then the party is deprived of a right or benefit, e.g. an EOT or payment.

Pickavance (2000) states that some contracts contain provisions, which require not only the contractor to advise the employer or his agents of a delay with regard to the progress, but also to advise them of any circumstance that might cause a delay, as soon as the contractor has become aware – or ought to have become aware – of such a delay. According to Pickavance (2000), research carried out by the Chartered Institute of Building (CIOB) in 2008 revealed that when asked in which occasions a delay to progress is notified, the following responses were received:

- 50% admitted that they were generally unaware of a delay to progress for some time after it has occurred;
- 38% declared that a delay in progress was only notified if it were perceived to be the probable cause of a delay in completion;
- 20% said that they were familiar with a delay in progress being notified to the employer or his agents when the contract requires it; and
- 5% stated that a delay in progress would be declared, irrespective of the predicted consequences.

Pickavance (2000) states that the benefits of notifications in the current contracts are not fully appreciated. He further refers to an article published by the SCL written by Prof. D. Jones, which states:

"Notices are not simply provided for the benefit of the employer. Such provision, properly and fairly applied, enables the contractor to claim in an orderly, timely and disciplined manner. The contractor can be confident that the claims process once begun, in the event of a failure to agree, may lead to invoking the dispute-provisions contract. Much of the uncertainty and confusion, which can arise when claims are postponed to the end of the works, can be reduced" (Pickavance, 2000).

In the South African construction industry, projects are usually procured by using the following standard form for construction contracts:

- The Joint Building Contract Committee, Principal Building Agreement (JBCC);
- Conditions of Contract for Construction for building and engineering works designed by the employer (FIDIC); and
- General Conditions of Contract for Construction (GCC).

These contracts have been designed to specifically cater for the special circumstances relating to construction. The JBCC is predominantly utilised for building projects and the GCC for civil engineering projects. The roots of these standard form contracts can be traced back to contract law; but they do not always manage to specifically cover all kinds of possible delays and disruptions, which can arise during the construction process.

The EOT claim procedure is structured differently in each of the standard contracts; but the principal procedure remains the same (refer to table 8 below). The contractor would issue the employer's representative (principal agent, engineer, etc.) with some form of communication/notification of a delay in writing within a certain period of time, after becoming aware of such a delay. The notification would then be followed by a claim, which should also be issued to the employer's representative within a stipulated number of days after the delay has terminated.

Table 8 – Summary of claim procedures [adapted from (Croeser, 2010)]

	JBCC PBA 2014	GCC 2015	FIDIC 2010
Time Period to notify of possible delay	**20 working days:** Notify of possible delay.	**28 Calendar days:** Notify claim for additional time and/or money	**28 Calendar days:** Notify of claim for additional time and/or money
Duty to inform	Notify for entitlement to additional time and or money.	Notify for entitlement to additional time and/or money.	Notify for entitlement to additional time and/or money
Extent of awareness	Notify when contractor becomes aware or ought reasonably to have become aware of event/ circumstance	Notify when contractor should have become so aware of event/ circumstance	Notify when contractor becomes aware or should have become aware of event/ circumstance
Consequences of failure to comply with notice period	Contractor's right to claim lapses	• Due date for completion not extended • No entitlement to additional payment • Employer is discharged of all liability in connection of claim	• Time for completion not extended • No entitlement to additional payment • Employer is discharged of all liability in connection of claim
Possible Possible Contractual remedy available for contractor	No remedy available in contract	No remedy available in contract	No remedy available in contract

2.7.1 CONTRACT CLAUSES DEALING WITH DELAY CLAIMS

Delay-claim clauses in most of the standard construction contracts can be separated into the following two main categories:

- Clauses dealing with the notification of a possible delay; and
- Clauses dealing with the claim itself.

Compliance with all contract provisions in regard to claims is a prerequisite for the claim to be considered for approval.

2.7.1.1 JBCC EDITION 6.1

The JBCC describes a claim as a formal request for compensation by the contracting party, evaluated by the principal agent. (Provided that a notice of a potential claim is given and the substantiated claim is submitted within the prescribed time periods) (JBCC, 2014).

2.7.1.2 NOTIFICATION CLAUSES

The JBCC relies mainly on clause 23.4 for claim notification. This clause refers to the occurrence of circumstances, listed in clause 23.1.3 as a prerequisite for the notification.

23.4. Should a listed circumstance occur [23.1-3], which could cause a delay in the date for practical completion, the contractor shall:

23.4.1. Take reasonable steps to avoid or reduce such a delay;

23.4.2. Within twenty (20) working days of becoming aware, or should reasonably to have become aware of such delay, given notice to the principal agent of the intention to submit a claim for a revision of the date of practical completion, failing which the contractor shall forfeit such a claim

In terms of this clause, the contractor has the obligation to mitigate or reduce the delay by taking reasonable steps. According to the SCL (2002), the contractor has a general duty to mitigate the effect of employer risk events. Subject to express contract wording or agreement, the duty to mitigate does not extend to requiring the contractor to add extra resources, or to work outside the planned hours. The contractor's duty to mitigate this loss has two aspects – firstly, the contractor must take reasonable steps to minimise the loss; and secondly, the contractor must not take unreasonable steps that might increase this loss (SCL, 2002).

Secondly, the contractor must notify the principal agent within 20 working days after becoming aware of the delay of the intention to submit a claim for a revision to the date of practical completion. If the contractor does not comply with the time bar applicable, the contractor will thereby forfeit the right to claim.

2.7.2 CLAIM CLAUSES

The JBCC addresses delay claims in clauses 23.5 – 23.8. The process, governed by specific time bars, is described, in addition to the information to be provided as part of the claim.

23.5. The contractor shall submit a claim for the revision of the date of practical completion to the principal agent within forty (40) working days, or such an extended period that the principal agent may allow, from when the contractor is able to quantify the delay in terms of the programme.

23.6. Where the contractor requests a revision of the date for practical completion, the claim shall in respect of each circumstance separately state:

23.6.1. The relevant clause [23.1-3], on which the contractor relies;

23.6.2. The cause and effect of the delay on the current date for practical completion, where appropriate, illustrated by a change to the critical path on the current programme;

23.6.3. The extension period claimed in working days and the calculation thereof;

23.7. The principal agent shall, within twenty (20) working days of receipt of the claim, grant in full, reduce or refuse, the working days claimed; and:

23.7.1. Determine the revised date for practical completion, as a result of the working days granted, where applicable;

23.7.2. Identify each event and the reference clause for each revision granted or amended;

23.7.3. Give reasons, where such a claim is refused or reduced;

23.8. Where the principal agent fails to act within the period [23.7], such a claim shall be deemed to be refused. The contractor may give notice of a disagreement [30.1], where the principal agent refuses a claim, or alternatively reduces a claim, or fails to act.

According to the JBCC's Guide to Completion, a Valuation, Certification and Payment (JBCC Guide, 2014), the contractor should motivate the claim using site records, if applicable – stating briefly:

- The 'problem' (refer to "records");
- The root cause – identify events / entities responsible for act / omission;
- Single / multiple events > identify dominant cause (isolate and quantify the effect of each cause);
- Separate events due to the sub-contractor's inefficiency from employer obligations;

- The effect – on the (revised) date for practical completion (events that impact directly on the scheduled completion date);
- The effect – adjustment of the contract value;
- Options explored – preventive measures;
- Effect on (original) critical path on revised programme; and
- Other consequences.

2.7.3 GCC 2015

The communication procedure is of importance as it would give guidance how contractual notices and claim submission documents, which are key components of the EOT process, should be dealt with. Clause 1.2.1 of the GCC states that the following communication procedures should be followed under this contract:

1.2. Interpretation

1.2.1. Any written communication between the parties shall have been duly delivered if:

1.2.1.1. Handed to the addressee, or to his duly authorized agent, or

1.2.1.2. Delivered at the address of the addressee, as stated in the Contract Data;

Provided that the employer, engineer and contractor shall be entitled, by written notice to each other, to change their said addresses.

In addition to the communication procedure the GCC also provides for claim notification procedures in clause 10.1. A careful consideration of the clause is required to distil issues that will impact on compliance with the contract. This clause states the following:

10. 1. Contractors' claim

10.1.1. The following provisions shall apply to any claim by the contractor for an extension of time for the practical completion of the permanent works in terms of clause 5.12, or in terms of any clause that refers to clause 10.1 for additional payment or compensation:

10.1.1.1. The contractor shall, within 28 days after the circumstance, event, act or omission giving rise to such claim has arisen or occurred, deliver to the engineer a written claim, referring to the clause and setting out:

10.1.1.1.1 The particulars of the circumstance, event, act or omission, giving rise to the claim concerned;

10.1.1.1.2. The provision of the contract on which he bases the claim;

10.1.1.1.3. The length of the extension of time, if any, claimed and the basis of the calculation thereof; and

10.1.1.1.4. The amount of money claimed, and the basis of the calculation thereof.

10.1.1.2. If, by reason of the nature and circumstances of the claim, the contractor cannot reasonably comply with all, or with any of the provisions of clause 10.1.1.1 within the said period of 28 days, he shall:

10.1.1.2.1. Within the said period of 28 days notify the engineer, in writing, of his intension to make the claim and comply with such requirements of clause 10.1.1.1, as he reasonably can; and

10.1.1.2.2. As soon as practicable, comply with such requirements of clause 10.1.1.1, as have not yet been complied with.

10.1.1.3. If the event or circumstances relating to the claim are of an ongoing nature, the contractor shall, in addition to delivering the said notice within 28 days, each month deliver to the engineer, in writing, any updated particulars required in terms of clause 10.1.1.1 and, within 28 days after the end of the events or circumstances, deliver his final claim.

10.1.2. If, in respect of any claim, the contractor did not comply with the provision of clause 10.1.1 because he was not, and could not reasonably have been aware of the implications of the facts or circumstances concerned, the period of 28 days referred to in clause 10.1.1, shall commence to run from the date when he should reasonably have become so aware. The cost and time of all works done in this regard by the contractor prior to giving such notice shall be deemed to be covered by the rates and/or prices set out in the pricing data, and the time stated in the contract data relating to clause 5.1.1.

10.1.3. To properly assess the extent and validity of the claims submitted in terms of this clause, the following provisions shall apply:

10.1.3.1. All facts and circumstances related to the claims shall be investigated, as and when they occur or arise. For this purpose, the contractor shall deliver to the engineer, records in a form approved by the engineer, of all the facts and circumstances, which the contractor considers relevant, and wishes to rely upon in support of his claim, including details of all construction equipment, labour and *materials relevant to each claim. Such records shall be submitted promptly after the occurrence of the event giving rise to the claim.*

10.1.3.2. The engineer may record the facts and circumstances, additional to those recorded by the contractor, that he considers relevant and the contractor shall, for this purpose, supply the engineer with all the information he may require.

10.1.3.3. The engineer and the contractor shall, at the time of recording in terms of cause 10.1.3.1 and 10.1.3.2, set out, in writing, signed by each party and delivered to each other their respective agreement or disagreement with regard to the correctness of the matter recorded.

10.1.3.4. Each record of an agreed fact in terms of clause 10.1.3.3 shall in any dispute be conclusive evidence of the fact concerned.

10.1.3.5. For the purpose of this clause, information arising from a technical investigation or analysis undertaken after the events that gave rise to the claim, have occurred, shall not be regarded as facts or circumstances required to be recorded in terms of this clause.

10.1.3.6. The employer, the engineer and the contractor shall not in any proceedings, in accordance with clauses 10.3 to 10.11 be entitled to give or lead evidence of or rely on any fact or circumstance not recorded in terms of this clause, if the other party to the dispute is prejudiced by such non-recording of the facts.

10.1.4. If, in respect of any claim to which this clause refers, the contractor fails to comply with the 28 day notice period in clause 10.1.1, as read in clause 10.1.2, or does not deliver his final claim within 28 days after the end of the events or circumstances, the due completion date shall not be extended; and the contractor shall not be entitled to additional payment, and the employer shall be discharged of all liability in connection with the claim.

10.1.5. Unless otherwise provided in the contract, the engineer shall, within 28 days after the contractor has delivered his claim in terms of clause 10.1.1 as read with clause 10.1.3, give effect to clause 3.1.2 and deliver to the contractor and the employer his written and adequately reasoned ruling on the claim (referring specifically to this clause). The amount thereof, if any, allowed by the engineer shall be included to the credit of the contractor in the next payment certificate;

Provided that:

10.1.5.1. The said period of the 28 days may be extended, if so agreed between the contractor and the engineer, and

10.1.5.2. Any amount that has been established to the satisfaction of the engineer, before his ruling on the whole claim, shall be included to the credit of the contractor in the next payment certificate.

Both the notification procedure and claim procedure are dealt with in clause 10.1. Contrary to some other forms of contract the GCC calls for the immediate submission of the EOT claim and not only a notification. Only when it is not possible to comply with the submission requirements within in the prescribed period of 28 days the contractor is allowed to only submit a notification of delay. An important determination from a contract compliance point of view will be to determine whether it was possible to submit the claim within the 28 days.

Specific requirements in terms of information to be provided with the claim are set out in clause 10.1.1. The compliance to these requirements is also an important consideration from a contract compliance point of view and will be dealt with in depth in chapter 4 as part of the discussion of contract compliance in context of the decision trees.

2.7.4 FIDIC 2010

2.7.4.1 NOTIFICATION CLAUSES

It is important to understand how FIDIC addresses communication as it would impact on the contractual compliance during the EOT process. Clause 1.3 of FIDIC states that the following communication procedures should be followed under this contract:

1.3. Communications

Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests and discharges, these communications shall be:

(a) In writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission, as stated in the Contract Data; and

(b) Delivered, sent or transmitted to the address for the recipient's communications, as stated in the Contract Data. However:

i. If the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and

ii. *If the recipient has not stated otherwise when requesting an approval or consent, it may be sent to the address from which the request was issued.*

Approvals, certificates, consents and determinations shall not be unreasonably withheld or delayed. When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Engineer, a copy shall be sent to the Engineer, or the other Party, as the case may be.

Clause 20.1 also stipulates the procedure to be followed in terms of the notification process to be followed when the contractor becomes aware of the delay. A time bar requirement of 28 days in terms of notifications is explicitly stated. Non-compliance to this time bar would result in the claim not being considered.

20.1 Contractor's Claims

If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give notice to the Engineer, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance. If the Contractor fails to give notice of a claim within such a period of 28 days; the Time for Completion shall not be extended; the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim.

2.7.4.2 CLAIM CLAUSES

FIDIC stipulates the claim procedure in 20.1, the clause applicable to the actual claim (if the contractor has complied with the provisions subject to the issue of the notification) state the following:

20.1 Contractors' claims

The contractor shall also submit any other notices, which are required by the contract, and supporting particulars for the claim, all as being relevant to such an event or circumstance.

The contractor shall keep such contemporary records, as may be necessary to substantiate any claim, either on the site, or at another location acceptable to the engineer. Without admitting the employer's liability, the Engineer may, after receiving any notice under this clause, monitor the record-keeping and/or instruct the contractor to keep further contemporary records. The *contractor shall permit the engineer to inspect all these records, and shall (if instructed) submit copies to the engineer.*

Within 42 days after the contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the contractor and approved by the engineer, the contractor shall send to the engineer a fully detailed claim, which includes full supporting particulars of the basis of the claim and of the EOT and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

(a) This fully detailed claim shall be considered as interim;

(b) The contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the engineer may reasonably require; and

(c) The contractor shall send a final claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period, as may be proposed by the contractor and approved by the engineer.

Within 42 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the engineer and approved by the contractor, the engineer shall respond with approval, or with disapproval, and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within the above defined time period.

Within the above defined period of 42 days, the Engineer shall proceed, in accordance with Clause 3.5 [Determinations] to agree or determine: (i) the extension (if any) of the Time for Completion (before or after its expiry), in accordance with clause 8.4 [EOT for Completion], and/or (ii) the additional payment (if any) to which the Contractor is entitled under the contract.

Each payment certificate shall include such additional payment for any claim, as has been reasonably substantiated, as due under the relevant provision of the contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

If the engineer does not respond within the timeframe defined in this clause, either party may consider that the claim as rejected by the engineer and any of the parties may refer to the dispute board, in accordance with clause 20.4 [Obtaining Dispute Board's Decision].

The requirements of this clause are in addition to those of any other clause, which may apply to a claim. if the contractor fails to comply with this or another sub- clause in relation to any claim, any EOT and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim; unless the claim is excluded under the second paragraph of this clause.

2.8 COMPENSABLE DELAYS

2.8.1 INTRODUCTION

Sometimes, there will be no link at all between the EOT clauses of a contract and provisions for additional payments; but just as the contractor looks for something tangible on which to base his claims, so the contract supervisor looks for something tangible to justify his certification of extra payments. Tacitly, if not expressly then, there is a link between the extensions and the claims; and there is a general recognition that there are two types of extension: (i) 'Reimbursable' extensions, which are based on the employer's fault; and (ii) 'non-reimbursable' extensions, which are based on neutral events. In the SCL Protocol these are referred to as 'compensable' and 'non-compensable' events (Eggleston, 2009).

2.8.2 DEFINITION – COMPENSABLE AND NON-COMPENSABLE DELAYS

Compensation will have to be considered if a delay is found to be excusable; and it should be established whether the delay can be defined as follows:

- Non-compensable delay – an excusable delay caused by factors beyond the control of the client and the contractor. Although most forms of contract make provision for the extension of the contract-completion date, the contractor will not receive compensation from the client; and
- Compensable delay – an excusable delay caused by the client or the client's agents. The contractual completion date will be extended; and the contractor will receive compensation from the client (Tumi *et al.*, 2009).

2.8.3 CONTRACT CLAUSES DEALING WITH COMPENSABLE DELAYS

Some modern contracts provide for a list of events; and should any of these events result in a delay to completion, the contractor will be entitled to compensation. According to McKenzie *et al.* (2009), some contracts in addition provide single clauses, which by reference and cross-reference give circumstances, which give rise to changes in parties' rights. Should these circumstances be as a result of the conduct of the client and the client's agents, the delay will be compensable.

2.8.3.1 JBCC EDITION 6.1

The JBCC clearly differentiates between delays, which would attract compensation and delays which are not compensable. Clause 23.1 provides a list of delay-causing events, which would not result in an adjustment of the contract value (compensation). On the other hand, clause 23.2 makes provision for delaying events, which would attract compensation. Clause 23.3 also makes provision for circumstances, not specifically mentioned in clause 23.1; while clause 23.2 makes provision for circumstances, which are beyond the contractor's reasonable control.

23.1 The contractor is entitled to the revision of the date for practical completion without the adjustment of the contract value, where a delay to practical completion has been caused by one or more of the following events:

23.2 The contractor is entitled to the revision of the date for practical completion and an adjustment of the contract value [26] where a delay to practical completion has been caused by one or more of the following events:

23.3 further circumstances, for which the contractor may be entitled to a revision of the practical completion, and an adjustment of the contract value are delays due to any other cause beyond the contractor's reasonable control that could not have reasonably been anticipated and provided for. The principal agent shall adjust the contract value where such a delay is due to the employer and/or the agents.

Clause 26 explains how compensation should be determined. This clause also provides a procedure to be followed, if the contractor becomes aware of expense and/or loss, for which provision was not required in the contract sum.

2.8.3.2 GCC 2015

Unlike the JBCC, the GCC does not distinguish between delaying events, for which the contract value would be adjusted (compensable delays) and delaying events, for which the contract value would not be adjusted (non-compensable). Clause 5.12.3 mainly deals with compensation:

5.12.3 If an extension of time is granted, the contractor shall be paid such additional time-related general items, including for special non-working days, if applicable, as are *appropriate regarding any other compensation, which may already have been granted in respect of the circumstances concerned.*

According to this clause, if the contractor is granted an EOT, the delay is compensable.

2.8.3.3 FIDIC 2010

Other than some forms of contract, FIDIC does not require a delay to be critical as a condition for a delay to be compensable. Specific provisions which entitle the contractor to claim for the cost associated with a delay or disruption are contained in a number of clauses and clauses in the contract. The following clauses summarised in Table 9 make provision for the contractor to claim for additional cost, and in some cases cost and profit:

Table 9 – FIDIC clauses where the contractor can claim for additional cost

Clause number	Clause Title	Type of compensation
1.9	Delayed drawings or instructions	Cost & profit
2.1	Right of access to site	Cost & profit
4.7	Setting-out	Cost & profit
4.12	Unforeseeable physical conditions	Cost
4.24	Fossils	Cost
7.4	Testing	Cost & profit
8.9	Consequences of suspension	Cost
10.2	Taking over parts of the work	Cost & profit
10.3	Interference with tests on completion	Cost & profit
11.2	Cost of remedying defects	Compensation determined in terms of clause 13.3 variation orders
11.8	Contractor to search	Cost & profit
12.4	Omissions	Cost
13.2	Value engineering	50% of saving
13.3	Variation order	Compensation determined in terms of clause 12.3 evaluations
13.7	Adjustment or changes in legislation	Cost
15.5	Employer’s entitlement to terminate	Cost & damages
16.1	Contractor’s entitlement to suspend work	Cost & profit
16.4	Payment on termination	Cost, profit & damages
17.4	Consequences of employer’s risk	Cost & profit in some instances
19.4	Consequences of force majeure	Cost
19.6	Optional termination, payment and release	Cost
19.7	Release from performance under the law	Cost

Clause 20.1, the clause dealing with the administrative and general procedures relating to contractor's claims also makes mention of additional payment to which the contractor is entitled under the contract.

20.1 Within the above defined period of 42 days, the engineer shall proceed in accordance with clause 3.5 [determinations] to agree or determine (i) the extension (if any) of the time for completion (before or after its expiry) in accordance with clause 8.4 [extension of time for completion], and/or (ii) the additional payment (if any) to which the contractor is entitled under the contract.

Each payment certificate shall include such additional payment for any claim as has been reasonably substantiated as due under the relevant provision of the contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

According to clause 20.1, the contractor will be entitled to additional payment, but the procedure set out in the different clauses allowing for the entitlement of additional cost in the case of delays, should be followed. In addition, the clause makes it clear that the additional payment should be sufficiently substantiated.

2.9 CAUSES OF DELAY

Although it is not one of the main objectives of this study to identify the causes of delays, it would be beneficial to provide an overview of the predominant causes, as an introduction to the claim-evaluation process. Over the years, a number of studies have been conducted to identify the causes of delays in the construction industry. These studies have been conducted in different countries. This section aims to identify the international causes of delay by reviewing the relevant literature.

2.9.1 SAUDI ARABIA

Assaf, Al-Khalil and Al-Hazmi (1995) used randomly selected samples in Saudi Arabia to identify the causes of delay in large building projects. Surveys comprising the causes of delays were presented to the respondents requesting a ranking, according to the degree of importance. These surveys provided data that were analysed in terms of frequency, severity and importance of the delays. The study identified 73 causes of delays. The owners who participated in the survey alleged that the delays were as a result of the fault on the part of the contractor and the labourers. However, the final results of the survey contradicted this opinion; as it was the found that the majority of the causes of delay resulted from the actions of the employer/owner and his agents/consultants.

2.9.2 HONG KONG

Chan and Kumaraswamy (1997) conducted a survey that was aimed at determining and evaluating the significant factors that cause delays in Hong Kong construction projects. From the survey, it was concluded that poor site management and supervision, unforeseen ground conditions, low speed of decision-making involving all project teams, client-initiated variations and necessary variations of works are the five most significant sources of construction time overrun. Differing perceptions of the major causes of delays observed between Hong Kong, Saudi Arabia and Nigeria, which indicate the specific differences between construction industries in the different countries were further identified by Chan and Kumaraswamy (1997).

A follow-up study by Kumaraswamy and Chan (1998) analysed the contributors to construction delays – in order to determine the causes of delays in Hong Kong. The study utilised a questionnaire that was formulated from 83 factors identified in previous phases of the investigations. The responses also highlighted the differences in the opinions on the relative implications of the delays between clients, consultants and contractors. The findings of the study identified the following causes of delay:

- Delays in design information;
- Long waiting time for the approval of drawings;
- Poor site management and supervision;
- Unrealistic contract durations imposed by client;
- Mistakes and discrepancies in the design documents;
- Long waiting time for approval of test samples of materials;
- Inappropriate overall organizational structure linking all the project teams;
- Inadequate design teams;
- Lack of communication between the consultant and the contractor;
- Low speed of decision-making involving all the project teams;
- Delays in subcontractors' work;
- Inadequate contractor experience;
- Necessary variations;
- Disputes/conflicts;

- Low speed of decision-making within each project team;
- Lack of communication between the client and the consultant;
- Shortage of materials in the markets;
- Client-initiated variations;
- Unforeseen ground conditions; and
- Slow information flow between the project team members.

2.9.3 EGYPT

Amer (1994) discussed the causes that contribute to construction delays in Egypt. The study involved a comparison of delays in projects from areas close to or within Egypt. The study identified 32 causes of project delays. The causes included: Financing by the contractor during construction; delays in contractor's payment by owners; design changes by owner, or his agent during the construction process; partial payments during the construction process; and non-utilization of professional construction management during the construction process.

2.9.4 MALAYSIA

Abdullah, Rahman and Azis (2010) conducted a survey to determine the delays experienced by a government agency in Malaysia, known as Majlis Amanah Rakyat (MARA). The results of the analysis revealed that the most significant delay causes were financial difficulties faced by contractors, contractors' poor site management and ineffective planning, and poor scheduling by contractors.

2.9.5 INDONESIA

Factors influencing construction time and cost overruns on high-rise projects in Indonesia were discussed by Kaming, Olomolaiye, Holt and Harris (1997). In this study, project managers were surveyed. It seems that cost overruns occur more frequently; and they are more severe than time overruns. The main factors that influence time delays are: design changes, poor labour productivity, inadequate planning and resource shortages.

2.9.6 TURKEY

The Turkish construction industry was studied by Kazaz, Ulubeyli and Tuncbilekli (2012) and the causes of time extensions and their level of importance in Turkey were identified. According to the results obtained, design and material changes were determined as the most important factors, followed by the delay in payments, cash-flow problems, contractors' financial problems and poor labour productivity.

2.9.7 THAILAND

Ogunlana, Promkuntong and Jearkjirm (1996) conducted a survey to investigate the delays experienced in high-rise building projects in Bangkok, Thailand. The findings of this study were then compared with other global studies of construction delays, to determine whether there were special problems resulting in construction delays in developing economies. The findings from the study indicated that the principal problems were mostly related to designers, clients, contractors and finance. However, globally construction projects face a number of factors that cause delays; and these include: Shortage of human resources; machinery and equipment; and construction materials. Furthermore, additional factors causing delays in developing countries, such as a lack of finance, technical incompetence, and less-experienced local companies, underdeveloped business environment, complexities in legal and regulatory systems and distinct socio-cultural issues were identified. The findings of this study indicated that the factors causing delays in construction projects across developing countries are, to a large extent, similar. The procurement of construction projects in developing countries encompasses of a high amount of bureaucracy, approval checks, several administrative levels, high levels of corruption, fragmentation of laws on procurement, lack of coherence between procurement systems and local culture, administrative systems and authority structures. These factors constitutes inefficiencies, high cost and delays in construction projects (Ogunlana *et al.*, 1996). The study identified the following reasons for delay:

- Slow decision-making;
- Incomplete drawings;
- Slow response;
- Deficiencies in organisations;
- Deficiencies in co-ordination;
- Uncompromising attitudes;
- Delays in work approval;
- Material-management problems;
- Deficiencies in organisations;
- Co-ordination deficiencies;
- Planning and scheduling problems;
- Equipment-allocation problems;

- Financial difficulties;
- Inadequacy of site inspection;
- Shortage of construction materials;
- Late delivery;
- Price escalation;
- Low quality of materials;
- Shortage of site workers;
- Shortage of technical personnel;
- Insufficient numbers of equipment;
- Frequent equipment breakdown;
- Confined site;
- Problems with neighbours; and
- Slow permits by Government agencies.

2.9.8 INDIA

According to Iyer *et al.* (2008), the increase in size and complexity of the construction projects in India has resulted in a higher number of claims and disputes. The following reasons for delay were identified:

- Delay due to handing over of site;
- Delay due to the release of mobilisation advance;
- Delay due to late receipt/checking of drawing;
- Delay due to accidents;
- Delay due to temporary stoppage;
- Delay due to reworks; and
- Delay due to extra work.

2.9.9 JORDAN

Al-Momani (2000) undertook a study to determine the causes of delays in 130 public projects in Jordan. Residential, administration buildings, school buildings, medical centres and commotion facilities were among the projects evaluated. The findings of the study identified the following reasons for delays:

- Delay due to designers;
- Delay due to user changes;

- Delay due to weather;
- Delay due to site conditions;
- Delay due to late deliveries;
- Delay due to economic conditions; and
- Delay due to increases in quantities.

2.9.10 NIGERIA

Aibinu and Odeyinka (2006) conducted a study in Nigeria to determine the causes of construction delays. The study evaluated the reasons for delays with the emphasis on the actions and the inactions of the parties involved in the project. Quantitative information from completed building projects was analysed to determine the extent of these delays, and also to make use of information from a postal questionnaire survey of construction managers. The results of the study identified the following reasons for delays:

- Variation orders;
- Slow decision-making;
- Clients' cash flow;
- Clients' late contract award;
- Late preparation of interim valuation;
- Late valuation of variation works;
- Incomplete drawings;
- Late instructions;
- Inadequate supervision;
- Poor information dissemination;
- Architects' delay in work approval;
- Contractors' financial difficulties;
- Contractors' planning and scheduling problems;
- Contractors' inadequate site inspection;
- Shortage of manpower;
- Material shortages;
- Unforeseen material damages;
- Equipment breakdowns and maintenance problems;
- Equipment shortage, and equipment-delivery problems;
- Slow mobilisation;

- Interference with other trades;
- Late delivery of ordered materials;
- Non-compliance of material with the specifications;
- Price escalation;
- Government regulations;
- Inclement weather;
- Acts of God;
- Labour disputes and strikes; and
- Civil disturbances and slow provision of permits by government.

Mansfield, Ugwu and Doran (1994) conducted a study in Nigeria to determine the causes of delays and cost overruns that greatly affected the highway construction projects in the country. From the investigation, it is evident that most of the delays in the construction industry are related to human and management conduct. Furthermore, the study identified financing, payment for completed works, poor contract management, shortages of materials, price fluctuations and inaccurate estimates as being the significant factors causing delays.

A study was conducted by (Aiyetan, 2014) in the South Western part of Nigeria to determine the causes of rework and consequential delays in construction projects. Descriptive and quantitative research methodologies were utilised. To collect the comprehensive data for analysis, a survey and the historical data were utilised. The results of the study identified the following causes of delay: Rework, which results in subsequent delays in the construction schedule; inferior quality of concrete; poor plastering and construction errors during excavation (Aiyetan, 2014).

2.9.11 SOUTHERN AFRICA

Baloyi and Bekker (2011) investigated the causes of cost overruns and time delays during the construction and upgrading of the ten 2010 world cup stadia in South Africa. A questionnaire was formulated and circulated amongst the participants involved in the various aspects of the construction of the various stadia projects. Design-related factors were found to cause the most delays in the construction of the stadia. When comparing results for global delays and delays implicated by the construction of the stadia, it was found that the increase in material cost was the largest single contributor for both the global and the local stadia-construction delays. Furthermore, the factors identified were grouped into three groups: External factor-related, client-related and contractor-related delays (Baloyi & Bekker, 2011).

A system-thinking approach was utilised by Aiyetan *et al.* (2011) in their study to determine how to eliminate delays in building-construction projects in South Africa. The study investigated 7 different phases in the construction project cycle and the activities in these phases that could decrease the negative impact of delays during of the project. The results of the study concluded that 8 out of the 12 groups of delays were experienced during the construction stage. Interventions to prevent such delays were found to be more effective during the construction phase compared to interventions during the briefing/design stage.

Musuya (2012) undertook a study in Botswana to determine the impact of delays and the inexcusable reasons for delays in construction projects by either citizens or non-citizen construction firms. Furthermore, the study evaluated the impact of inexcusable delays, in order to outline the reasons for the high occurrence of delays in construction projects undertaken by local firms. The results of the study showed that a large portion of the public sector in Botswana encounter delays. Performance of citizen/local construction firms was inferior to those rendered by non-citizen firms. The results of the analysis/study, identified the management style as the main factor of delay in the construction industry of Botswana (Musuya, 2012).

Klopper and Brümmer (2000) conducted a study to determine the impact of delays on building projects in South Africa. In this study, 211 public sector construction projects were reviewed. The identified possible factors were investigated independently, in order to determine the impact on the building projects. Insufficient work-rate was determined to be main factor that had influenced the late completion of building projects in South Africa (Klopper & Brümmer, 2000).

2.9.12 SUMMARY OF REASONS FOR DELAY

In general terms, the reasons for delay can be summarised in three main categories: Contractor delays; client delays; and external factors – where neither the contractor nor the client could be held directly responsible for the delay. In section 2.9.1. to section 2.9.11 various studies dealing with delays were discussed, in order to identify the predominant causes of these delays the studies were analysed and the results are summarised in Table 10.

It was evident from the review of local and international studies that delays remain very prevalent in construction projects. Variation orders were the predominant cause of client delays. Late payment of the contractor, long waiting times for the approval of drawings, slow decision-making and incomplete or poor quality drawings were also significant causes of delay.

The review of the external causes of delay revealed that the shortage of construction material was the predominant cause of delay. In addition, price fluctuations, unforeseen site conditions and slow approvals by government organisations, also contributed to the prevalence of delays.

The identification of common causes would be of assistance to ultimately address the universal problem of the late completion of construction projects.

Table 10 – Summary of reasons for delay

Reasons for delay	Saudi Arabia	Nigeria	Hong Kong	Egypt	Indonesia	Turkey	Thailand	South Africa	Botswana	Malaysia	India	Jordan	Occurrence (%)
	(Assaf *et al.*, 1995)	(Aibinu & Odeyinka, 2006), (Mansfield *et al.*, 1994),(Aiyetan, 2014)	(Chan & Kumaraswamy, 1997), (Kumaraswamy & Chan, 1998)	(Amer, 1994)	(Kaming *et al.*, 1997)	(Kazaz *et al.*, 2012)	(Ogunlana *et al.*, 1996),	(Baloyi & Bekker, 2011), (Aiyetan *et al.*, 2011), (Klopper & Brümmer, 2000)	(Musuya, 2012)	(Abdullah *et al.*, 2010)	(Iyer *et al.*, 2008)	(Al-Momani, 2000)	
Contractor:													
Labour (shortage of skilled and unskilled)	✓	✓	x	x	x	x	✓	x	x	x	x	x	25%
Site management and supervisions	x	✓	✓	✓	x	x	x	x	✓	x	✓	x	42%
Accidents	x	x	x	x	x	x	x	x	x	x	✓	x	8%
Reworks	x	x	x	x	x	x	x	x	x	x	✓	x	8%
Materials management problems	x	✓	x	x	x	x	✓	x	x	x	x	✓	25%
Planning and scheduling problems	x	✓	x	x	x	x	✓	x	x	✓	x	x	25%
Equipment allocation problems	x	x	x	x	x	x	✓	x	x	x	x	x	8%
Material (low quality and damage)	x	✓	x	x	x	x	✓	x	x	x	x	x	17%
Equipment (availability, breakdowns)	x	✓	x	x	✓	x	✓	x	x	x	x	x	25%

Reasons for delay	Saudi Arabia	Nigeria	Hong Kong	Egypt	Indonesia	Turkey	Thailand	South Africa	Botswana	Mozambique	India	Jordan	Occurrence (%)
	(Assaf et al., 1995)	(Aibinu & Odeyinka, 2006), (Mansfield et al., 1994),(Aiyetan, 2014)	(Chan & Kumaraswamy, 1997), (Kumaraswamy & Chan, 1998)	(Amer, 1994)	(Kaming et al., 1997)	(Kazaz et al., 2012)	(Ogunlana et al., 1996),	(Baloyi & Bekker, 2011), (Aiyetan et al., 2011), (Klopper & Brümmer, 2000)	(Musuya, 2012)	(Abdullah et al., 2010)	(Iyer et al., 2008)	(Al-Momani, 2000)	
Contractor:													
Contractors' financial difficulties	x	✓	x	✓	x	✓	x	x	x	✓	x	x	33%
Contractors' inadequate site inspection	x	✓	x	x	x	x	x	x	x	x	x	x	8%
Slow mobilization	x	✓	x	x	x	x	x	x	x	x	x	x	8%
Productivity / work-rate	x	x	x	x	✓	✓	x	✓	x	x	x	x	25%
Interference with other trades	x	✓	x	x	x	x	x	x	x	x	x	x	8%
Delays in subcontractors' work	x	x	✓	x	x	x	x	x	x	x	x	x	8%
Inadequate contractor experience	x	x	✓	x	x	x	x	x	x	x	x	x	8%

Reasons for delay	Saudi Arabia	Nigeria	Hong Kong	Egypt	Indonesia	Turkey	Thailand	South Africa	Botswana	Malaysia	India	Jordan	Occurrence (%)
	(Assaf *et al.*, 1995)	(Aibinu & Odeyinka, 2006), (Mansfield *et al.*, 1994),(Aiyetan, 2014)	(Chan & Kumaraswamy, 1997), (Kumaraswamy & Chan, 1998)	(Amer, 1994)	(Kaming *et al.*, 1997)	(Kazaz *et al.*, 2012)	(Ogunlana *et al.*, 1996),	(Baloyi & Bekker, 2011), (Aiyetan *et al.*, 2011), (Klopper & Brümmer, 2000)	(Musuya, 2012)	(Abdullah *et al.*, 2010)	(Iyer *et al.*, 2008)	(Al-Momani, 2000)	
Client:													
Financial (late payment of contractor, cash flow)	x	✓	x	✓	x	✓	x	x	x	x	✓	x	33%
Inaccurate estimates	x	✓	x	x	x	x	x	x	x	x	x	x	8%
Variation orders	x	✓	✓	✓	✓	✓	x	x	x	x	✓	✓	58%
Delays in design information	x	✓	✓	x	x	x	x	x	x	x	x	x	17%
Long waiting time for approval of drawings/samples	x	✓	✓	x	x	x	✓	x	x	x	✓	x	33%
Inadequate design team	x	✓	✓	x	x	x	x	x	x	x	x	x	17%
Slow information flow between project team members	x	✓	✓	x	x		x	x	x	x	x	x	17%
Delay due to handing over of site	x	x	x	x	x	x	x	x	x	x	✓	x	8%
Design quality/incomplete drawings	x	✓	✓	x	x	x	✓	✓	x	x	x	x	33%
Deficiencies in coordination	x	x	x	x	x	x	✓	x	x	x	x	x	8%

Reasons for delay	Saudi Arabia	Nigeria	Hong Kong	Egypt	Indonesia	Turkey	Thailand	South Africa	Botswana	Mozambique	India	Jordan	Occurrence (%)
	(Assaf et al., 1995)	(Aibinu & Odeyinka, 2006), (Mansfield et al., 1994),(Aiyetan, 2014)	(Chan & Kumaraswamy, 1997), (Kumaraswamy & Chan, 1998)	(Amer, 1994)	(Kaming et al., 1997)	(Kazaz et al., 2012)	(Ogunlana et al., 1996),	(Baloyi & Bekker, 2011), (Aiyetan et al., 2011), (Klopper & Brümmer, 2000)	(Musuya, 2012)	(Abdullah et al., 2010)	(Iyer et al., 2008)	(Al-Momani, 2000)	
Client:													
Design team inadequate supervision	x	✓	x	x	x	x	x	x	x	x	x	x	8%
Lack of communication between client and consultant	x	x	✓	x	x	x	x	x	x	x	x	x	8%
Slow decision-making	x	x	✓	x	x	x	✓	x	x	x	x	x	17%
Unrealistic contract durations imposed by client	x	x	✓	x	x		x	x	x	x	x	x	8%
Inappropriate overall organizational structure linking all project teams	x	x	✓	x	x	x	✓	x	x	x	x	x	17%

Reasons for delay	Saudi Arabia	Nigeria	Hong Kong	Egypt	Indonesia	Turkey	Thailand	South Africa	Botswana	Mozambique	India	Jordan	Occurrence (%)
	(Assaf *et al.*, 1995)	(Aibinu & Odeyinka, 2006), (Mansfield *et al.*, 1994),(Aiyetan, 2014)	(Chan & Kumaraswamy, 1997), (Kumaraswamy & Chan, 1998)	(Amer, 1994)	(Kaming *et al.*, 1997)	(Kazaz *et al.*, 2012)	(Ogunlana *et al.*, 1996),	(Baloyi & Bekker, 2011), (Aiyetan *et al.*, 2011), (Klopper & Brümmer, 2000)	(Musuya, 2012)	(Abdullah *et al.*, 2010)	(Iyer *et al.*, 2008)	(Al-Momani, 2000)	
External													
Shortage of construction materials	x	✓	✓	x	✓	x	✓	x	x	x	x	x	25%
Price fluctuations	x	✓	x	x	x	x	✓	x	x	x	x	x	17%
Unforeseen site conditions	x	x	✓	x	x	x	x	x	x	x	x	✓	17%
Disputes/conflicts	x	x	✓	x	x	x	x	x	x	x	x	x	8%
Economic conditions	x	x	x	x	x	x	x	x	x	x	x	✓	8%
Confined site	x	x	x	x	x	x	✓	x	x	x	x	x	8%
Problems with neighbours	x	x	x	x	x	x	✓	x	x	x	x	x	8%
Slow permits by govt. Agencies	x	✓	x	x	x	x	✓	x	x	x	x	x	17%
Government regulations	x	✓	x	x	x	x	x	x	x	x	x	x	8%
Inclement weather	x	✓	x	x	x	x	x	x	x	x	x	✓	17%
Acts of God	x	✓	x	x	x	x	x	x	x	x	x	x	8%
Labour disputes and strikes	x	✓	x	x	x	x	x	x	x	x	x	x	8%
Civil disturbances	x	✓	x	x	x	x	x	x	x	x	x	x	8%
Increase in material cost	x	x	x	x	x	x	x	✓	x	x	x	x	8%
External factor-related	x	x	x	x	x	x	x	✓	x	x	x	x	8%

2.10 FLOAT

The concept of float in construction projects refers to the excess time assigned to specific activities. It is therefore seen as a valuable resource that can be utilised by both the contractor and the employer during planning and control processes. The excess time for activities provides contractors with some flexibility to manage time and costs connected to activities, whereas employers often see it as a provision that was made to accommodate changes to the project (Braimah, 2008).

Arditi and Pattanakitchamroon (2008) states that when one party, either the contractor or the employer, uses the majority of the float for their delay, it may lead to disputes during the claim for EOT. The contract conditions, therefore, typically states where the ownership of the float lies – it will either be implemented on a "first-come first-serve basis" or it will belong to the contractor.

A "first-come first-serve basis" will in other words enable either the employer or the contractor to exhaust the float with their delay and ultimately cause that any other occurring contractor-delay could affect the critical path of the project. In such instance, the contractor will not be entitled to claim for an EOT and will be subsequently liable to liquidate damages. Contractors, in turn, would typically argue that had the employer's delay not exhausted the float, their delay would not have influenced the date of completion. The validity of the contractors' argument is determined by the ownership of the float (Braimah, 2008).

Float ownership is highly debated due to the financial and time implications it might have on different parties. McDonald and Baldwin (1989) proposed that float ownership can be categorised into three main types: float belonging to the contractor, float belonging to the project, and float belonging to either the contractor or the employer so long as the use thereof is reasonable.

The Society of Construction Law Delay and Disruption Protocol (2002) provide the following guidelines with regard to the ownership of the float:

It firstly encourages parties to address this issue in their contract. The term "float" is rarely used in the conditions of contracts, but it is usually implied within the EOT clause. Where the wording of the clause states that EOT will only be granted when there is an employer delay that results in a direct delay of the completion date, it implies that the float should first be exhausted before a contractor is entitled to claim for EOT. Under these circumstances the float belongs to the project or to either party who makes reasonable use thereof.

Where the EOT clause provides for a contractor to be entitled to claim for EOT whenever an employer-delay will affect the planned completion date, it implies that the employer is not at liberty to benefit from the float in the event of an employer-delay. It can therefore be interpreted that the float belongs to the contractor.

Secondly it states that when the float does not belong to the contractor and the contractor-delay causes a delay in the completion date, regardless of who made use of the float, the contractor will be liable. However, if it is an employer-delay that extends over the completion date, the employer is liable.

Where the float belongs to the contractor the contractor is potentially entitled to claim for EOT every time the employer is responsible for a delay to the Contractor's planned completion date.

2.10.1 JBCC FLOAT OWNERSHIP

The JBCC does not directly address float or the ownership of float in any of the contract clauses. The SCL Protocol (2002) suggests that the wording of the main EOT clause would provide some guidance in this regard. Clause 23.4 makes provision for EOT for circumstances, which could cause a delay in the date for practical completion. The reference to practical completion, the formal contractual completion date, implies that the float should first be exhausted before an EOT can be considered. It is fair to assume that the float belongs to the project on a "first-come first-serve basis".

2.10.2 GCC FLOAT OWNERSHIP

The GCC also does not directly refer to float or how it should be dealt with. The contractual clause providing for the contractor's right to claim for EOT is contained in clause 5.12.1. This clause allows for the contractor to submit a claim for EOT for circumstances, which may occur that would delay the practical completion of the works. It is important to note that the clause refers to the practical completion date, in other words the contractual completion date of the project. As a result it implies that the float should first be utilised before an EOT can be considered. Therefore, the float belongs to the project.

2.10.3 FIDIC FLOAT OWNERSHIP

Float or the concept of ownership of floats is not explicitly addressed in the FIDIC. Clause 8.4 (extension of time for completion) states that: "*the contractor shall be entitled, subject to* *clause 20.1 [contractor's claims], to an extension of the time for completion if and to the extent that completion for the purposes of clause 10.1 [taking-over of the works and sections], is or will be delayed…."*

This clause makes reference to clause 10.1 (taking-over of the works and sections). Clause 10.1 refers to clause 8.2 (time for completion). Like the other two forms of contract reference is also made to the contractual completion date. Therefore, this reference to the contractual completion date implies that the float should first be used up before an EOT can be considered.

2.11 THE PREVENTION PRINCIPLE AND TIME AT LARGE

Where there is a contractually binding date for completion but, for reasons within the employer's control the contractor is prevented from completing by the contract completion date, the employer can no longer insist upon completion by the due date, the contractor is then left without a firm date by which to complete and must then complete within a reasonable period as a result of the effect of what is known as the "prevention principle". This is a well established common law principle and should be taken into account when contractual provisions are applied in dealing with EOT claims (Pickavance, 2000).

The application of the prevention principle is evident in the approach taken in Australia by the Supreme Court of Victoria in *SMK Cabinets v Hili*. In that case, where the ordering of variations for which time could not be extended, but which had contributed to the delay to the date for completion, the court found that, notwithstanding that the contractor could not have completed on time as a result of effects of its own culpable delay to progress, because the employer did not allow the contractor to extend time for the effects of variation it had ordered, the employer could not enforce the completion date. However, whilst acknowledging that the prevention principle was grounded upon "considerations of fairness and reasonableness", Brooking J. concluded that the ordering of variations after the completion date had passed (where there was no power in the contract to extend time for that reason) only served to prevent the employer from taking liquidated damages which accrued after the date of instruction of the variation, but did not upset the parties contractual rights and obligations occurring prior to the date upon which the instruction was given.

Where no date has been given for the completion of the works, time is at large and the contractor has the duty to complete the works within a reasonable time depending on the nature of the work and the surrounding circumstances. In order for the employer to claim damages from a contractor who does not complete the works within a reasonable time the Employer must first place the contractor in mora before he can claim damages (McKenzie *et al.*, 2009)

Mora requires that the employer place a specific demand on the contractor that performance be made by a certain date. Trengove J pointed out in the South African case *Alfred McAlpine & Son (Pty) Ltd v Transvaal Provincial Administration 1977 (4) SA 310 (T)* that the concept of time at large relates to the consequences of a breach and not the breach itself, so if no time is fixed there can be no breach by non-performance, whether or not time is of the essence, until the client has informed the client when he has to perform.

To reduce the risk of time being at large the three contracts under consideration all contain unilateral EOT clauses where the possible reasons for delay are not restricted. Should a restrictive list of possible causes of delay be provided in the contract and the completion date is delayed by an event not provided in the contract, time would be at large. The result would be that the contractor would have to complete the project within a reasonable time.

CHAPTER 3 - RESEARCH METHODOLOGY

3.1 INTRODUCTION

The main objective of this chapter is to outline the research methodology followed, in order to achieve the objectives of the research. The chapter firstly provides an explanation of the research design chosen, and the factors considered to make an informed decision in this regard. Information on the overall approach to test the thesis statement is also provided. The strengths and weaknesses of the design, and the reasons why the specific research design is best placed to address the objectives of the study, are duly highlighted.

Secondly, the methodology is discussed by addressing a number of significant considerations in the implementation process. The implementation of the research design is dealt with in detail. The motivation for choosing specific research instruments is explained. The relevance of the data is highlighted; and the process of the data analysis is also clarified.

Thirdly, any limitations of the research method are explored; and lastly, the ethical considerations of the study and the ethical approval process are explained.

3.2 RESEARCH DESIGN

3.2.1 INTRODUCTION

A clear understanding of the term research design is essential to avoid any confusion when compared with the chosen research methodology of the study. According to Creswell (2013), the research design can be seen as the object of this study; and this refers to the overall plan for conducting the research. Hofstee (2006) adds that the research design of a study deals with the overall approach utilised to test the thesis statement.

Blaikie (2007) describes research methodology as the analysis of how research should, or does proceed. It includes discussions of how theories are generated and tested – what kind of logic is used; and what criteria they have to satisfy. Research methodology, therefore, involves the study of research designs and methods.

Hofstee (2006) further advises that the details on how research techniques/research designs will be implemented should not be explained as part of the research design; but they should rather be addressed as part of the research methodology. Therefore, this section will focus in general terms on the research design and the details on the particular use. The implementation of the research design will be discussed later in the section dealing with the research methodology.

In essence, two main approaches to conducting research are traditionally being followed: a qualitative approach and a quantitative approach. In some instances, a combination of both approaches can also be followed (Creswell, 2013).

Quantitative research can be defined as an inquiry into a social or human problem, based on testing a theory composed of variables, measured with numbers, and analysed with statistical procedures, in order to determine whether the predictive generalisations of the theory hold true. A quantitative study usually concludes with confirmation of – or disconfirmation – of the hypotheses tested. On the other hand, qualitative research can be defined as an inquiry process of understanding social or human problems, based on building a complex, holistic picture, formed with words, reporting detailed views of the informants, and conducted in a natural setting. A qualitative study concludes with tentative answers or hypotheses regarding what was observed (Creswell, 2013) and (Glesne & Peshkin, 1992).

Care should be taken to choose the most suitable research approach. The decision is normally informed by a number of aspects – perhaps the most significant of these being the consideration of whether the approach would be able to successfully address the research problem.

The context of the research taking place within the built environment should be considered when the type of research design is being contemplated. The notion of research design is less pronounced in the built environment field, at least in comparison with the social sciences. Among the authors of 19 chapters in a text entitled *Advanced research methods in the built environment* (Knight & Ruddock, 2009), only Dainty and Hughes address the notion of "research design". Although these are only two examples, an overview of methodological literature and the research articles in the built environment field reveals very much of the same (Du Toit and Mouton, 2013).

When deciding on a specific research design, one of the predominant factors to contemplate is whether the specific research design would ensure that the objectives of the study are achieved. The ultimate purpose of the study is to simplify the complicated and involved process of the assessment of construction-delay claims. Currently, there is a lack of guidance available for the assessment of delay claims. Construction contracts mostly refrain from providing specifics in terms of the assessment of delay claims. Analysis and assessment are left to the judgement of the practitioners tasked to make a ruling on the outcome of the delay claim. Without a guiding structure, it can be problematic to justify the fairness of the ruling, if the contract period should be extended. The study will attempt to provide a tool to be utilised as a guiding framework for the assessment of construction-delay claims.

Decision-tree analysis will be utilised as the underlying method to streamline and standardise the assessment of EOT claims. Various decision-support systems were considered; but decision trees are viewed as the most appropriate for this study – mainly because of the fact that decision trees provide decision support in a fairly simple manner. This is in line with the main objective of the study: to simplify the delay-claim assessment process. The decision tree framework would guide practitioners through the various steps in the process – to determine whether an EOT claim is valid, or not. It would have the added benefit of providing a more transparent system of analysis, which would hopefully reduce the number of disputes associated with EOT claims.

The study provides a universal decision-tree framework and in addition it also provides specific decision-tree frameworks for the three different types of construction contracts.

3.2.2 ACTION RESEARCH

In considering the choice of the research design, one should keep in mind that the research is undertaken in the built environment. Built-environment disciplines are primarily applied sciences, focusing on the application more than on the mere generation of knowledge (Klosterman, 1983), (Knight & Ruddock, 2009). Given this background, the research design should be able to deliver results that can be applied in practice.

Several possible research designs were considered, keeping in mind that the research is taking place within an applied-science environment – with the main objective of providing a guideline tool for practitioners. A qualitative approach would be more likely to deliver the required results. Upon further investigation, it became evident that action research, a very specific qualitative approach, would be the most appropriate choice for the research design.

Action research can be defined as a participatory, democratic process, concerned with developing practical knowledge in the pursuit of worthwhile human purposes, grounded in a participatory worldview. It seeks to bring together actions and reflection, theory and practice, in participation with others, in the pursuit of practical solutions, in order to address issues of pressing concern to people. Reason and Bradbury (2001) and Huang (2010) simplified it further by stating that action research is an approach to knowledge creation that results from a context of practice; and it requires researchers to work with practitioners.

Action research is similar to – and frequently draws from the methods of – qualitative research; since both are richly contextualised in the local knowledge of practitioners. However, qualitative research is research about practice rather than with practitioners. This crucial difference often leaves the work 'inactionable', that is, not something that practitioners can, or even wish, to utilise (Huang, 2010).

Given that the principal objective of the research is to develop a decision-support tool that can be utilised by practitioners in the built environment to assess construction-delay claims, it is evident that action research would be an appropriate choice for the research design. This can be further substantiated by the primary purpose of action research; as it is defined by Reason and Bradbury (2001), "as the ability to produce practical knowledge that is useful to people in [the] everyday conduct of their lives".

To ensure the decision-support system for construction-delay claims is an issue that would be of benefit to practitioners in the industry; it would be crucial to involve specialist practitioners in the research process. An action research approach will be followed, whereby a group of specialists will be requested to review proposed decision trees, to comment and to propose any amendments. The proposed amendments would then be incorporated, if deemed to be appropriate, to improve the decision trees. This interactive approach should contribute to a decision-support framework that would transcend the boundaries of the theoretical to become a tool that can truly benefit the practitioner.

Action research has a complex history; because it is not a single academic discipline, but an approach to research that has emerged over time from a broad range of fields (Nelson, 2013). There are strong elements of action research in the work of John Dewey, both in his philosophical work and in his studies and experiments in education. Kurt Lewin brought an action-research perspective to the United States in the 1940s; and he succeeded for a time in making the notion of collaborative research with stakeholders with a liberating intent the central interest of a broad range of social scientists.

Action research is currently receiving resurgent interest – especially in the fields of education, social work, international development, healthcare, etc. (Reason & Bradbury, 2001) and (Huang, 2010).

According to Reason and Bradbury (2001), action research has the following benefits; when it is used as a research design for a study:

- Action research goes beyond the notion that theory can inform practice, to a recognition that theory can and should be generated through practice; and that theory is really only useful, insofar as it is useful in the service of a practice focused on achieving positive change; and

- Action research is emancipatory; since it leads not just to new practical knowledge, but to new abilities to create knowledge.

However, Hofstee (2006) warns that when making use of action research as a research design, one should be careful of subjectivity and generalisation of the results. This concern is addressed by ensuring that industry specialists, with different sets of expertise, are consulted during the research process.

3.2.3 LITERATURE REVIEW

While the main approach is an action-research process, a review of the relevant literature was instrumental in the development of the decision-support frameworks as decision trees, which were utilised as discussion material for the interaction with industry specialists.

According to Leedy and Ormrod (2013) and Hofstee (2006), the literature review serves several purposes:

- It assists in addressing the research problem;
- When information is available on what others have done, the chosen problem can be investigated with deeper insight and more complete knowledge;
- It shows that the researchers are aware of what is going on in the field;
- It indicates that there is a theoretical basis for the research;
- It demonstrates how the research fits in with the work that has already been done;
- It shows that the research has significance; and
- It demonstrates that the work should lead to the production of new knowledge.

In addressing the significance of literature reviews, Lather (1999) argued that a literature review should be instrumental in gatekeeping, controlling, and leading to new productive work, rather than merely reflecting the research conducted in a particular field.

The review of the literature played a major role in the research design, for two main reasons. Firstly, an assessment of the literature was required, to establish what level of guidance is available to practitioners when assessing construction-delay claims. The literature revealed that a very limited amount of decision-support guidance is available for the assessment of construction-delay claims. Secondly, because the assessment of construction-delay claims is, to a large extent, influenced by the construction contract utilised, a thorough review of three construction contracts was required. This review process guided the initial development of the decision trees. The decision-tree decision-support frameworks were an essential input for the action-research process to be executed successfully.

3.3 METHODOLOGY

3.3.1 INTRODUCTION

The action research process required to develop a decision tree support framework for the assessment of EOT claims will be executed as depicted in figure 4:

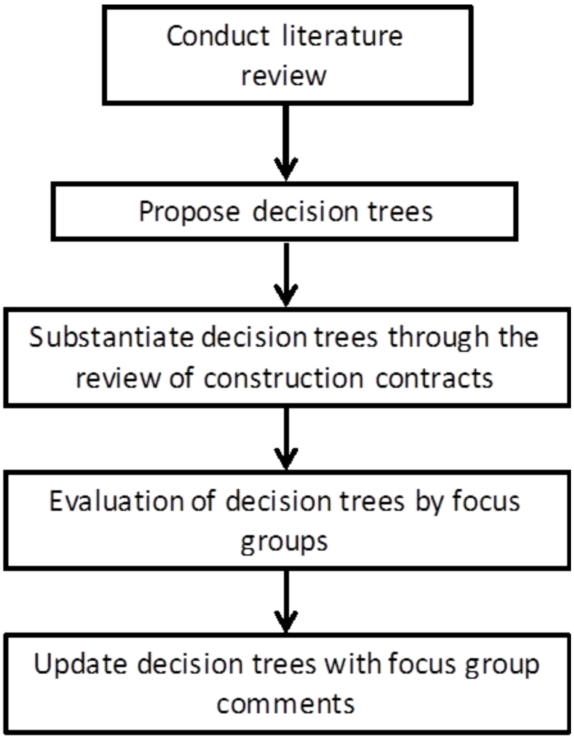


Figure 4 – Action research process to develop a decision tree support framework

The first step in the action-research process was to conduct a literature review. The main objective of the literature review was to identify the key decisions required in the assessment of construction-delay claims. The core component of decisions trees is, as the name indicates: decisions. For a decision tree to be functional, the decisions to be considered, in order to reach a conclusion should be known. Therefore, key decisions are an essential requirement when developing a decision tree.

The literature was of great assistance, not only when identifying critical decisions in the assessment of EOT claims, but also to further investigate important considerations associated with the key decisions.

The information, in terms of critical decisions identified during the literature-review process, was utilised as the input to develop a decision-tree for the assessment of EOT claims. The first decision-tree attempted to provide a high-level universal-decision tree that could be utilised as an overall framework for decision-making. The decision tree was informed and supported by the literature discussed in the literature review.

The specific construction contract utilised for a project has a major influence on the process of assessing EOT claims. For a decision-tree to be effective as a decision-support tool, it should adhere to all the requirements, as set out in the construction contract relating to EOT claims. After some consideration, it was decided to review three different commonly utilised construction contracts:

- JBCC;
- GCC; and
- FIDIC.

The JBCC is predominately being used in South Africa for those projects, which involve the construction of buildings. The GCC, also a South African construction contract, is mostly utilised for civil infrastructural projects. The FIDIC is a versatile construction contract utilised internationally. The FIDIC has French origins, created by an organisation similar to that responsible for the GCC and JBCC in South Africa – the International Federation of Consulting Engineers. The literature review focused to a large extent on a review of the relevant contract clauses dealing with EOT claims. The review was utilised to inform the development of decision trees for each form of contract. The decision trees were substantiated by both drawing from the relevant-contract clauses, as well as the relevant literature – especially when the contract provided no guidance on a specific matter.

With the overall objective of the study of developing a decision-support tool that could be used in practice in mind, it was considered essential to involve practitioners in the process of substantiating the decision trees. It was decided that focus groups and interviews would be utilised, as industry specialists would provide valuable input to further streamline the decision trees. The decision trees were updated with the comments and suggestions from the focus groups.

The end-result is a decision-tree framework informed by the literature, substantiated by the chosen standard form of construction contracts, and ultimately reviewed and validated by industry specialists.

3.3.2 RESEARCH INSTRUMENT

A research instrument is a tool utilised to gather the data for analysis (Hofstee, 2006). The research tool should be considered in the context of the action-research design followed in the study. The data gathered, as part of the action-research process, should be able to contribute to the objective of providing a decision-support tool that can be effectively utilised in practice. Therefore, the participation of practitioners regularly involved in the assessment of construction-delay claims was important. The research instrument should be effective in gathering the data from the industry practitioners.

Two options were considered: Questionnaires or focus groups with limited interviews. Questionnaires would have the advantage that more practitioners could be reached. However, several disadvantages in the utilisation of questionnaires were identified:

- It would be very difficult to explain the decision trees in a questionnaire;
- To convey the decision-tree concept in written form would necessitate a very long and involved description. This would seriously impact on the response rate; as it is unlikely that prospective participants would be willing to spend a couple of hours responding to a questionnaire; and
- The most significant shortcoming is that the interactive approach central in the action-research design would not be possible. The decision-tree framework would only be successful in practice, if it were thoroughly reviewed; and input was provided by industry specialists.

The identified disadvantages were of such significance that it became evident that questionnaires could not be utilised as an effective research instrument.

Kitzinger (1995) indicated that *"focus groups are a form of group interviews that capitalise on communication between the research participants, in order to generate data. Although group interviews are often used simply as a quick and convenient way to collect the data from several people simultaneously, focus groups explicitly use group interaction as a part of the method."* Morgan (1996) definition of focus groups also places the emphasis on the fact that the main intention of this research technique is to collect the data through group interaction. He continued by highlighting three essential components of the definition. Firstly, the focus-group process is a research method devoted to the data collection. Secondly, it locates the interaction in a group discussion, as the source of the data. Thirdly, it acknowledges the researcher's active role in creating the group discussion for data-collection purposes.

The focus-groups process was viewed as a more appropriate approach, due to the following benefits:

- Sufficient time would be available to explain the decision trees to the participants;
- The participants would be able to make concrete suggestions with the benefits of immediate feedback and discussion;
- Collective recommendations, in lieu of individual views, would be possible; and
- An interactive approach to develop and substantiate the decisions trees would be possible.

To further supplement the focus-group process, selected interviews with industry specialists were also undertaken. The benefits of interviews are similar to those mentioned for focus groups. However, although immediate feedback in terms of recommendation and suggestions are possible, the discussion and debate with other industry specialists are not possible during a one-on-one interview process. This process of deliberation is essential in producing a decision-tree framework that can be successfully utilised in practice. For this reason, the number of interviews was limited. Interviews were only utilised as tools, where industry specialists could not attend focus-group meetings for logistical and other reasons.

3.3.3 DATA

The absence of a specific grouping structure of construction industry specialists knowledgeable and experienced in EOT claims has necessitated the use of non-probability sampling. Purposive sampling, one of the most common non-probability sampling strategies, was deemed to be the most appropriate approach. Purposive sampling calls for the participants to be selected on the merits of their specific involvement and the experiences central to the phenomenon being studied (Greig, Taylor & MacKay, 2012).

Another important consideration was the number of focus groups and the composition of the focus groups. The decision trees are mainly informed by the form of contract utilised. Focus-group participants were required to have an in-depth knowledge of a specific form of contract. The decision trees would differ, depending on the form of the contract utilised. For this reason, it was decided to arrange different focus groups for the different forms of contract considered.

The level of knowledge required excluded some possible participants, who would only have a basic knowledge of contract clauses – as a result of the utilisation of the specific contract in a project. As a result, it was decided to target those members serving on the technical committees of organisations responsible for the compilation of the construction contract. The only exception was the FIDIC form of contract. The FIDIC form of contract was not compiled in South Africa; and it does not have a local technical committee. Participants for the FIDIC focus group were chosen on the basis of their level of knowledge of the specific form of contract. To ensure that meaningful participation of all the group members was possible, it was decided to keep the number of participants as low as possible. Each focus group consisted of between five and seven members. Refer to Table 11 and 12.

Table 11 – Focus group 1 – Universal decision tree framework & JBCC

	Designation	**Years of experience**
1.	Architect; CEO JBCC technical committee	More than 40 years
2.	Contractor; Construction contract specialist	More than 30 years
3.	Contractor, Construction contract specialist	More than 30 years
4.	Construction contract consultant	More than 30 years
5.	Quantity Surveyor; Construction Contract specialist	More than 40 years
6.	Architect; attorney; Construction Contract specialist	More than 40 years

Table 12 – Focus group 2 – Universal decision tree framework, FIDIC & GCC

	Designation	**Years of experience**
1.	Engineer; Construction contract specialist	More than 40 years
2.	Quantity surveyor; Senior government project manager	More than 40 years
3.	Quantity Surveyor; Construction contract specialist	More than 20 years
4.	Attorney; Claims consultant	More than 30 years
5.	Quantity Surveyor; Construction Contract specialist	More than 40 years

As a result of the action-research design, the data gathered comprised the experts' input and those opinions substantiating and informing the EOT-decision trees. The data gathered through the focus group and interview process were extremely valuable, and led to a number of amendments to the original proposed decision trees developed. The focus groups were not the only source of data; as the original decision trees were developed via an assessment of the literature and the construction contracts provided.

3.3.4 ANALYSIS

Analysis effectively commenced with the interpretation of the original data gathered by means of the general literature review and the specific construction-contract review. This information was utilised to develop the initial EOT-decision trees for the different forms of contract.

The next step in the process was to analyse the data from the focus groups and interviews. Analysing the focus groups is basically the same as analysing any other qualitative data. At the very least, the researcher draws together and compares the discussions of similar themes, and examines how these relate to the variables. In general, it is not appropriate to give percentages in reports of focus-group data. As in all qualitative analysis, deviant case analysis is important. Attention must be given to minority opinions and examples that do not fit in with the researcher's overall theory (Kitzinger, 1995).

The process followed during the focus groups basically started with an explanation of the different decisions trees. In line with the action-research design, the participants were allowed to make suggestions in terms of improvements to the decision trees. The impact of the proposed changes was analysed with the group – to reach a point of group consensus in terms of any proposed changes. Minority opinions were also recorded for further analysis.

3.4 LIMITATIONS

Decision-support tools for EOT claims were mainly developed for two South African construction contracts and one international construction contract. The interaction with industry specialists via the focus groups targeted the South African practitioners. It would have been beneficial to perhaps consider focus groups in other countries, and to also allow industry specialists outside South Africa to participate. Unfortunately, this was not possible due to restricted funding and time limitations.

During the process of assessing the EOT claims, a large number of decisions are required. Each decision would normally involve a number of factors to be considered. Because the purpose of the study is to provide an overall framework for decision support in EOT claims, the specific criteria to support all possible decisions required were not addressed. As a result of the large number of decisions required in the assessment of EOT claims, the development of the criteria for decision-making would be a mammoth undertaking. Given the fact that all projects are to some extent unique it would perhaps be impossible to provide specific criteria for decision-making for all possible conditions and scenarios. However, the overall framework would be of assistance in terms of decision support even though it would not provide specific criteria for decision-making for all possible scenarios.

3.5 ETHICAL CONSIDERATIONS

Great care was taken to ensure that the research adhered to the University of Pretoria's ethical guidelines. The University of Pretoria requires that all research undertaken should comply with the code of ethics for research (the Code). The Code identifies key values characterising the ethos, which the University pursues. In doing so, it highlights the rights and the responsibilities of researchers that should apply in the various relationships they would encounter in the research environment. It also highlights the endeavours to eliminate unacceptable practices within the research milieu.

The following responsibilities of researchers are provided in the Code:

- "Social responsibility, in terms of which researchers accept the responsibility to address, where possible, by research and technology development, the pressing problems in the broader South African communities;
- Justice, in terms of which, researchers accept the responsibility for the equitable treatment of all individuals and organisations involved in the research process;
- Benevolence, in terms of which researchers should be inspired – not only to protect others from harm, but also to ensure and promote the wellbeing of all those affected by research;
- Respect for the individual, where the focus is on the interaction between the researcher and all people he/she may encounter during the research process. The researcher is required to recognise the dignity and autonomy of all individuals. and to maintain their humanity, as well as their freedom of choice in all situations; and
- Professionalism, in terms of which it is recognised that researchers form part of a specific profession; and therefore, they should exhibit professional responsibilities, such as integrity, quality and accountability."

  (University of Pretoria, 2009)

  (University of Pretoria, 2009. *Code of Ethics for Research*. [Online] Available from http://www.library.up.ac.za/research/docs/code_ethics.pdf [accessed: 2016-03-08])

The research does not have a high potential for harm in terms of ethical consideration. The tool produced by the research should assist practitioners in the construction industry. All the participants were willing to contribute to this worthwhile cause. A formal ethical application was lodged and approved by the University of Pretoria's ethical committee.

CHAPTER 4 - THE DECISION TREE FRAMEWORK FOR THE EXTENSION OF TIME CLAIMS

4.1 INTRODUCTION

One of the predominant causes of disputes in construction projects is delays to the contractor's progress, thereby resulting in time and cost overruns. It is critical for a contractor, when faced with delays caused by the client or other factors, to ensure that the claim for an EOT is suitable - for adjusting the contractual completion date, as well as to address any financial losses suffered in the process. Problems are encountered in practice in the application, preparation and assessment of EOT claims. In many cases, these problems might result in disputes. The lack of clear guidance on how to assess EOT claims can be seen as a major contributing factor to disputes (Williams, 2003), (Danuri *et al.*, 2006), (Kumaraswamy, 1997b) and (Cheung & Yeung, 1998).

Although there is an abundance of studies dealing with various issues to be considered during the EOT claims process, little information is available in terms of an overall framework or procedure to follow when assisting practitioners to assess EOT claims. Previous research, in terms of the various issues to be considered, is fragmented in nature; and such research would typically investigate one of the aspects in isolation. Moselhi and El-Rayes (2002) and Bubbers and Christian (1992) attempted to provide guidance in the process of assessing EOT claims by making use of computer-based systems.

Moselhi and El-Rayes (2002) developed a computer-based system, named WEATHER, to quantify the impact of weather conditions on construction productivity, project schedule and associated delays. Although this system will be helpful in the assessment of weather-related claims, it cannot be utilised as an overall decision-support system for claim evaluation because of its narrow focus on only one cause of delay.

Bubbers and Christian (1992) made use of a hypertext-information system to assist in the analysis of claims by informing contractors, owners, and their representatives of the contract provisions. The system presents the users with the information they need, in order for them to reach an informed decision on the validity of a claim. The main purpose of the utilisation of hypertext in this study was to organise the data; and thereby to enable users to focus quickly on only the relevant material. The hypertext-based system indeed acts as a decision-support system; but it does not provide a framework to guide practitioners through the claim-evaluation process.

Braimah (2008) developed a model for the selection of an appropriate EOT claim-assessment method. The aim of the model was to serve as a tool for assisting practitioners in justifying their choice of delay-analysis method. Scoring multi-attribute analysis, a multi-criteria decision-making method was utilised as the basis for the model. Although this model is a helpful tool in deciding on which of the many delay analytical methods should be utilised for a specific delay, it does not provide guidance on each step in the claim-assessment process.

The UK's SCL is a body comprising highly experienced engineers, architects, quantity surveyors and lawyers. It has developed a Delay-and-Disruption Protocol. The purpose of the protocol is to provide good practice guidance for construction delays and disruptions. Section 3 of the protocol offers guidelines on dealing with EOT during the course of the project (SCL, 2002). The guidelines include a high-level procedure for EOT, proposing the following steps:

Step 1 – Follow the contract conditions;

Step 2 – Contractor to submit a sub-network to be inserted in the updated programme;

Step 3 – Determine whether the employer is at risk; and

Step 4 – Use the time-impact analysis method to determine the amount of EOT.

The main advantage of the protocol is that other than the previous studies mentioned, it takes a holistic view of the steps involved in the EOT claim-assessment process. The protocol can be utilised as a guide for practitioners. However, the main deficiency of the protocol is the lack of detail provided for each step. In addition, some practitioners might also find it difficult to correctly apply the narrative-based description to a specific EOT claim.

It is evident from the literature that there is a need for guidance to simplify the many complexities associated with the EOT claim-assessment process. However, a very limited number of guidance tools are available at this stage for practitioners. The current guidance tools available to practitioners are fragmented, contract-specific or delay-event specific; and they do not provide guidance from inception to conclusion. Most significantly, current guidance tools are lacking in the sense that a holistic process-oriented approach is not followed.

The process of assessing delay claims consists of a series of decisions taken in regard to a number of different matters – ranging from compliance to contractual clauses to risk allocation between contractor and client. In essence, the evaluation of EOT claims is a sequential decision-making process, in which each decision would impact on the outcome of the claim. A guidance tool should therefore support this sequential process of decision-making.

4.2 DECISION TREES

A decision tree is defined as a powerful method for classification and prediction, and for facilitating decision-making in sequential decision problems (Kattan & Cowen, 2009).

A decision tree is a flowchart-like structure that shows the various outcomes from a series of decisions. It can be used as a decision-making tool, for research analysis, or for planning a strategy. A primary advantage of using a decision tree is that it is easy to follow and understand.

Work on constructing decision trees from the data exists in multiple disciplines, such as statistics, pattern recognition, decision theory, signal processing, machine learning and artificial neural networks. Researchers in these disciplines, sometimes working on quite different problems, have identified similar issues and heuristics for decision-tree construction (Murthy, 1998).

Decision trees are currently one of the most popular methods used for data modelling. Decision trees have many uses, such as, for example, predicting a probable outcome, assisting in the analysis of problems, and aiding in making decisions. When formulating and configuring decision trees, the results of real-world factors are analysed and compiled, so that the specifics of the previous factors and the related results are used to predict the results of future factors (Smith & Tansley, 2003).

There are several types of decision trees; but of these, just two types are probably the most significant:

Classification tree – As the name implies, decision trees are used to separate a dataset into classes belonging to the response variable. Usually, the response variable has two classes: Yes or No (1 or 0). If the response variable has more than two categories, then a variant of the algorithm, called C4.5, is used. C4.5 is an algorithm used to generate a decision tree developed by Ross Quinlan C4.5 is an extension of Quinlan's earlier ID3 algorithm. The decision trees generated by C4.5 can be used for classification, and for this reason, C4.5 is often referred to as a statistical classifier. For binary splits, however, the standard Classification and Regression trees (CART) procedure is used. Thus, classification trees are used when the response or target variable is categorical in nature.

Regression trees – These are needed when the response variable is numeric or continuous, for example, when you need to predict the price of a consumer good, based on several input factors. Thus, regression trees are applicable for the prediction-type problems, as opposed to classification (Deshpande,2011).

Decision trees consist of the following components:

- A *root node:* no incoming edges and zero or more outgoing edges;
- *Branches:* arrows connecting nodes, showing the flow from question to answer;
- *Decision node:* Often represented by squares showing decisions that can be made. Lines emanating from a square show all the distinct options available at a node;
- *Chance node:* Often represented by circles showing chance outcomes. Chance outcomes are events that can occur, but are beyond the ability of the decision-maker to control;
- *Internal nodes*, each of which has exactly one incoming edge and two or more outgoing edges; and
- *Leaf* or *terminal nodes*, each of which has exactly one incoming edge and no outgoing edges. Often represented by triangles or by lines having no further decision nodes or chance nodes. Terminal nodes depict the final outcomes of the decision-making process (Tan, Steinbach & Kumar, 2006) and (Kattan & Cowen, 2009).

Decision trees have a number of advantages:

- They have the advantage of being conceptually simple; and they have been shown to perform well on a variety of problems (Smith & Tansley, 2003);
- Decision trees have the ability to handle data measured on different scales;
- They have the ability to handle non-linear relationships between features and classes (Brodley & Utgoff, 1995);
- The tests in a decision tree are performed sequentially by following the branches of the tree. Thus, only those features that are required to reach a decision need to be evaluated (Brodley & Utgoff, 1995);
- A decision tree provides a clear statement of a sequential-decision procedure for determining the classification of an instance (Brodley & Utgoff, 1995);

- Clarity and Conciseness – The classification knowledge is presented in a form that human decision-makers can understand and scrutinize; (Quinlan, 1990)
- Context Sensitivity – Decision trees allow the relevance of different attributes to be conditional on the outcomes of earlier tests; and
- Flexibility – These methods cope successfully with both the continuous and the discrete attributes. (Quinlan, 1990)

Given the above, it appears that decision trees would be of great assistance as a guidance tool for the evaluation of EOT claims. Decision trees can guide decision-making during the EOT process by providing a simplistic tool to assess claims; since decision trees are simplistic in nature.

When an EOT claim is being considered, sequential decision-making is required to ultimately decide if the claim should be awarded. Decision trees are conceptually structured in such a way as to allow for sequential decision-making.

The diverse nature of delaying events would necessitate a high degree of flexibility in the assessment of EOT claims. One of the benefits of decision trees is that they provide for a high degree of flexibility. Another benefit of decision trees is that they provide for clarity and conciseness in decision-making – a critical requirement in the process of the assessment of EOT claims.

4.3 A UNIVERSAL DECISION TREE FRAMEWORK

Information gathered by means of the literature review, focus group meetings and interviews will be utilised in this section, to propose a universal decision tree framework for the assessment of extension of time claims. It will then be followed by detailed decision trees for the various steps within the universal decision tree framework with a specific focus on the different forms of construction contracts.

To be able to apply decision tree principles to EOT analysis it is necessary to identify the decisions taken as part of the evaluation process. The literature, focus groups and interviews identified the following essential decisions required when an EOT claim is to be analysed:

- Was the delay critical? (refer to Chapter 2, 2.5);
- Was the delay excusable? (refer to Chapter 2, 2.4);
- Were the contractual provisions complied with? (refer Chapter 2, 2.7); and
- Was the delay compensable? (Refer to Chapter 2, 2.8).

Many of the construction contracts do not specifically mention the term 'critical delay', but rather a delay to the practical completion date. For a delay to impact on the practical completion date, it would necessarily have to be critical. An important decision in the EOT assessment process would be to determine if the claim event delayed the practical completion date; and therefore, it can be categorised as critical. An important consideration in the decision tree would therefore be whether the delay is critical.

Excusable delays are fairly well-defined concepts in the literature. However, although the notion of excusable delays is captured in some of the clauses of the construction contracts under consideration, the term 'excusable delay' is not explicitly mentioned. Perhaps for this reason most of the focus-group participants found the term foreign. After highlighting the fact that, in essence, the term alludes to the process of determining whether the contractor is responsible for the delay, consensus was reached that it should be considered during the EOT assessment process.

One of the main considerations in the EOT-assessment process is to determine whether the contractual provisions were complied with. There are instances where contractual compliance to specific clauses does not lead to an outright rejection of the claim. These instances were highlighted in the focus groups and were considered in the decision trees for the different forms of contract.

If it was established that an EOT should be awarded, an important consideration at that stage would be whether a compensation was payable to the contractor.

Decision trees address decisions in a sequential manner. As a result, it is necessary to determine the sequence in which the above decisions should be made.

The decision on whether the delay is compensable can only be made once all the other decisions have had a positive outcome and it is established that and EOT should be awarded. Therefore, this decision should be considered last. A logical approach would be to sequence decisions in terms of the consequence of the outcome of the decision. If a specific decision would lead to the rejection of the EOT, it would make sense to consider this decision first. However, it is not possible to decide which of the three remaining decisions should be addressed first, by merely looking at the outcome of the decision; because a negative response to any of the first three decisions would result in the EOT not being awarded. The degree of effort required in making a decision in each of the three questions differs. In practical terms, it would make sense to consider the decision that would require the least amount of effort first. Should this first decision result in the claim not being awarded, time would not unnecessarily be spent on decisions that require more effort to consider.

To determine whether a delay is critical is normally the most complex and time-consuming part of an EOT claim analysis. A practitioner would not want to embark on this cumbersome process without knowing the contract provisions were complied with and the delay is indeed excusable. For this reason it is proposed that criticality should only be considered after contractual compliance was assessed and the question if the delay is excusable has been addressed. To determine whether a delay is excusable (beyond the contractor's reasonable control) can sometimes be complex. It is reliant on evidence presented by the contractor and the verification by the person responsible for the EOT claim analysis. This can become a time consuming process.

To determine whether the general contract clauses were complied with would normally not be a very involved process; as the facts presented in the EOT claim submission would be evaluated in terms of the relevant contract clauses. It is therefore proposed that the compliance with contract clauses should be considered before a determination is made on whether the delay is excusable. The following sequence of decision making is therefore proposed:

- Decision 1 – Were the contractual provisions complied with?
- Decision 2 – Was the delay excusable?
- Decision 3 – Was the delay critical?
- Decision 4 – Was the delay compensable?

If the decisions required in the EOT claim analysis process are translated into a decision tree, the decision tree can be formulated as follows (refer to Figure 5):

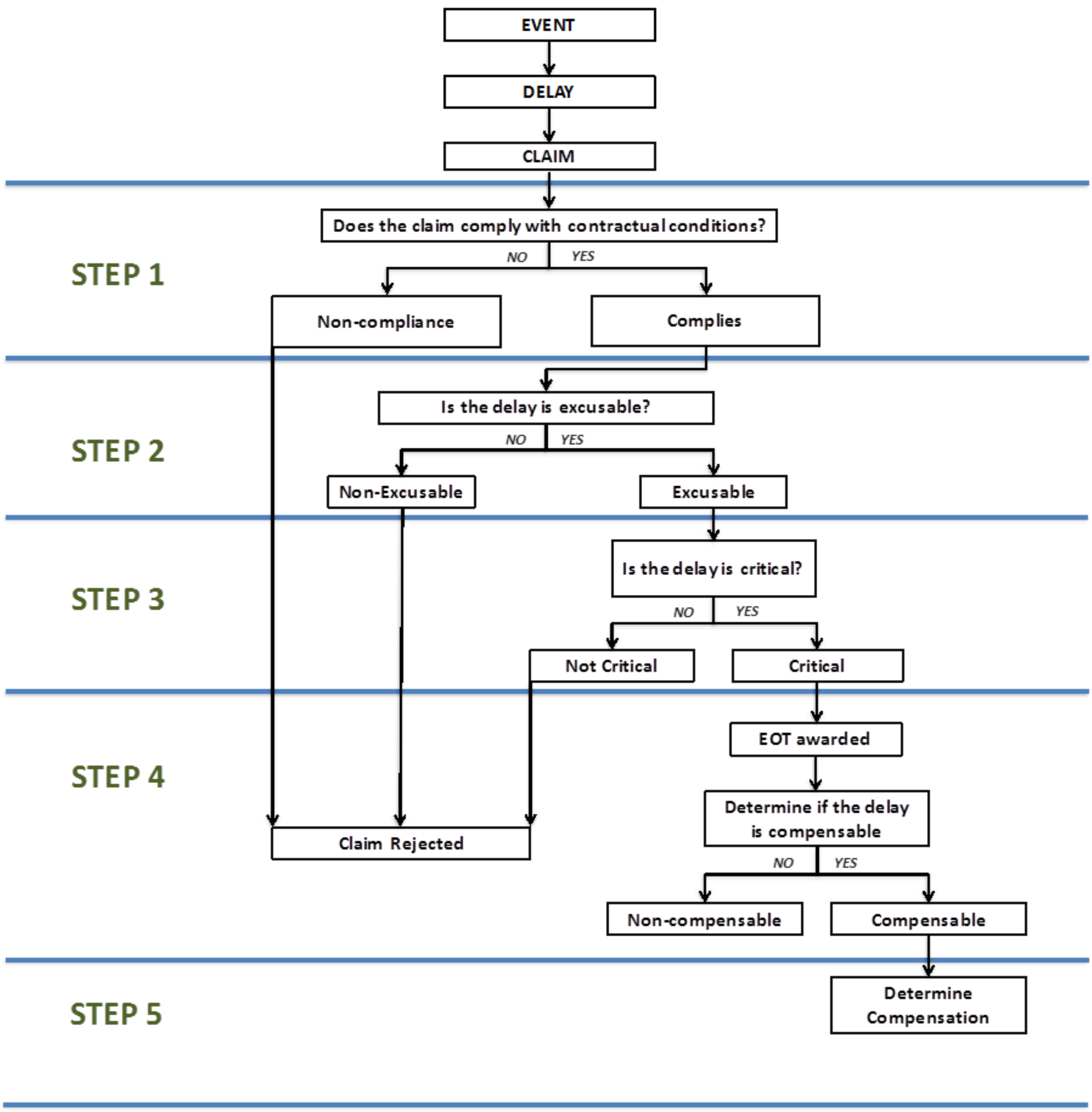


Figure 5 – Universal decision tree framework

The purpose of the universal decision tree framework is to provide a holistic guidance framework for EOT claims. The universal decision tree framework provides a guiding structure; but does not attempt to provide a high level of detail. The detail required in each of the steps would be to a large extent be influenced by the form of contract utilised. The detail required to properly assess each of the steps will be unpacked in terms of the different forms of contract under consideration in the sections to follow.

4.4 JBCC DECISION TREE FRAMEWORK

4.4.1 ASSESS CONTRACTUAL COMPLIANCE (STEP 1)

As explained in chapter 2 (2.7.1) the test for contractual compliance in the JBCC is twofold. Firstly, criteria in terms of the notification of delay should be complied with and secondly certain requirements in terms of the claim should be met.

The main focus of the notification clause is to determine if the contractor complied with the time bar requirements set in clause 23.4.2. According to the clause the contractor should provide a notice within 20 working days of becoming aware of the delay. The clause is clear that should this time bar not being adhered to the claim will be forfeited. Therefore, the first decision as part of the decision tree framework should be to test compliance with the time bar requirements.

If the provision in clause 23.4.2 is strictly applied to a situation where the 20 working-day notification requirement has not been met by the contractor; then the claim can be rejected. However, from a common-law and a case-law perspective, the decision to reject the claim is perhaps not so simplistic. In case-law, it is clear that if a client, by his own act, delays performance, he is not entitled to take advantage of his own wrong. One example can be found in *Kelly and Hingle's Trustees vs Union Government (Minister of Public Works) 1928 TPD 272,* a case dealing specifically with delay and the right of the employer to impose liquidated damages on the contractor, as a result of delayed completion of the work. Feetham J. quoted the English case of Holme vs Guppy (3M. & W. 387, 150English Rep 1195), in which case it was held that "*if a man by his own act prevents the performance of what another has been stipulated to perform, he cannot take advantage of his own wrong.*" And further that "*…., and there are clear authorities that if the party be prevented, by the refusal of the other contracting party, from completing the contract within the time limited, he (the contractor) is not liable in law for the default. It is clear, therefore, that the plaintiffs (the contractor) were excused from performing the agreement contained in the original contract. ……The plaintiffs were, therefore, left at large, and they are not to forfeit anything for the delay.*

If this principle is applied to the time-bar provision in clause 23.4.2, it is perhaps not advisable to immediately reject a claim if the 20 working-day notification provision was not adhered to. It should first be considered whether the delay was not as a result of the actions of the client. If, indeed, this was the case, then the contractor might have a remedy in law if the claim is outright rejected – due to non-compliance with the time bar.

Should it be found that the time bar required was adhered to; the next step would be to assess compliance in terms of the claim-admission requirements.

According to clause 23.5, the submission of the claim is also governed by a requirement to submit the claim within a stipulated period of time. The contractor should submit the claim within 40 working days from when the contractor is able to quantify the delay in terms of the programme. Provision is also made for the principal agent to allow an extended period for claim submission.

The second decision, as part of the decision-tree framework, would therefore be to establish if the claim was submitted within the stipulated period of time. It should be kept in mind that the principal agent would only be in a position to verify adherence to the deadline once the claim is submitted as the relevant information to determine when the contractor was able to quantify the delay in terms of the programme (in accordance with clause 23.5) will only be submitted with the claim. In contrast to the notification clause (clause 23.4.2), the clause dealing with the submission of the claim is silent on the consequence of non-adherence to the 40 working-day submission requirement. Without a specific provision in the clause that the claim will be forfeited if the 40 working-day submission requirement was not adhered to, it is not advisable to reject the claim on this basis.

The first consideration would be to determine if the principal agent granted an extended period for the claim to be submitted. If an extended period was agreed to, it should then be determined whether the contractor complied with the deadline in terms of the extended period. Late submission in both scenarios, non-adherence to the original 40 working-day submission requirement, or to the extended deadline, would not lead to the rejection of the claim. It is in the contractor’s interest to submit the claim as soon as possible; because without an approved EOT claim, the practical completion date would not be adjusted. In a case where the claim was submitted late, the contractual remedy for the client is damages. It should be determined whether the client suffered any damages as a result of the late submission of the claim. The JBCC does not provide specific guidance on how damages, as a result of the late submission of an EOT claim should be dealt with. It is assumed that if damages can be proven, it would be possible for the client to recover the cost in terms of clause 27 (recovery of expense and/or loss).

If the claim was submitted within the 40 working day deadline, or it was submitted late, the next decision required will be to establish if the claim complies with the content requirements stipulated in clause 23.6:

23.6.1 State the relevant clause on which the contractor relies;

23.6.2 Show the cause and effect of the delay (impact of critical path); and

23.6.3 State the extension period in working days and the calculation thereof.

No specific consequence is mentioned if the claim does not comply with the content requirements. In practice, the principal agent would normally request the contractor to submit additional information if sufficient information to comply with the content requirements was not provided; even though the JBCC does not specifically deal with a request for additional information. If no information is forthcoming after a request for additional information by the principal agent, the claim would be evaluated on the basis of the original information provided. It is possible that the lack of information would influence the outcome of the claim. At this stage, the principal agent would have to review the information submitted, and make a decision on whether the information was sufficient to confirm the delay. If the information is not sufficient – even after a request for additional information – it is probable that the claim would be rejected.

Should the content be acceptable; there still remain one requirement to consider – if all reasonable steps to avoid or reduce the delay were taken according to clause 23.4.1. The JBCC is silent on the issue of non-compliance with this clause. The question that the principal agent should consider is if any reasonable action from the contractor could have reduced the delay or even resulted in the avoidance of the delay. If it is clear that the action – or it may very well be the lack of action – by the contractor resulted in the delay persisting longer than necessary, the remedy might be to reduce the number of days awarded. It would only be possible to effect this reduction in step 3 of the universal decision tree, when it is being considered whether the delay is critical. The number of days awarded would only be determined in this step.

If it is found that reasonable steps could have been taken by the contractor to avoid the delay, and the steps were not taken, this may lead to the rejection of the claim. The difficulty in this scenario is perhaps to determine what can be considered as reasonable steps. The outright rejection of the claim should be dealt with cautiously, and should only proceed if clear evidence is available that reasonable steps by the contractor would have led to the avoidance of the delay.

If the contractor did take all the reasonable steps to reduce or avoid the delay, the next step in the decision-tree process would be to determine whether the delay is excusable.

According to clause 23.7, the principal agent is required to make a ruling within 20 working days after receipt of the claim. Some of the focus group participants were of the opinion that this should also be included in the decision tree. However, the purpose of the decision tree is to be a decision-making tool for the assessment of EOT claims and a provision for the principal agent to respond within 20 working days is not part of the assessment process. The inclusion of the clause 23.7 goes beyond the scope of any decision tree to determine contract compliance by the contractor during the process of assessing EOT claims. For this reason, it was decided not to include clause 23.7 in the decision tree.

If the contractor does not agree with the decision of the principal agent in terms of an extension of time claim, clause 30 of the JBCC can be utilised to give notice of disagreement. The clause provides for a dispute-resolution procedure to be followed. Although it is possible to include the dispute-resolution procedure in the contract-compliance decision tree, as with clause 23.7, it also goes beyond the scope of the purpose of the decision tree to provide guidance in terms of an EOT claim assessment. Please refer to the JBCC: Contract compliance decision tree, Figure 6 on the next page.

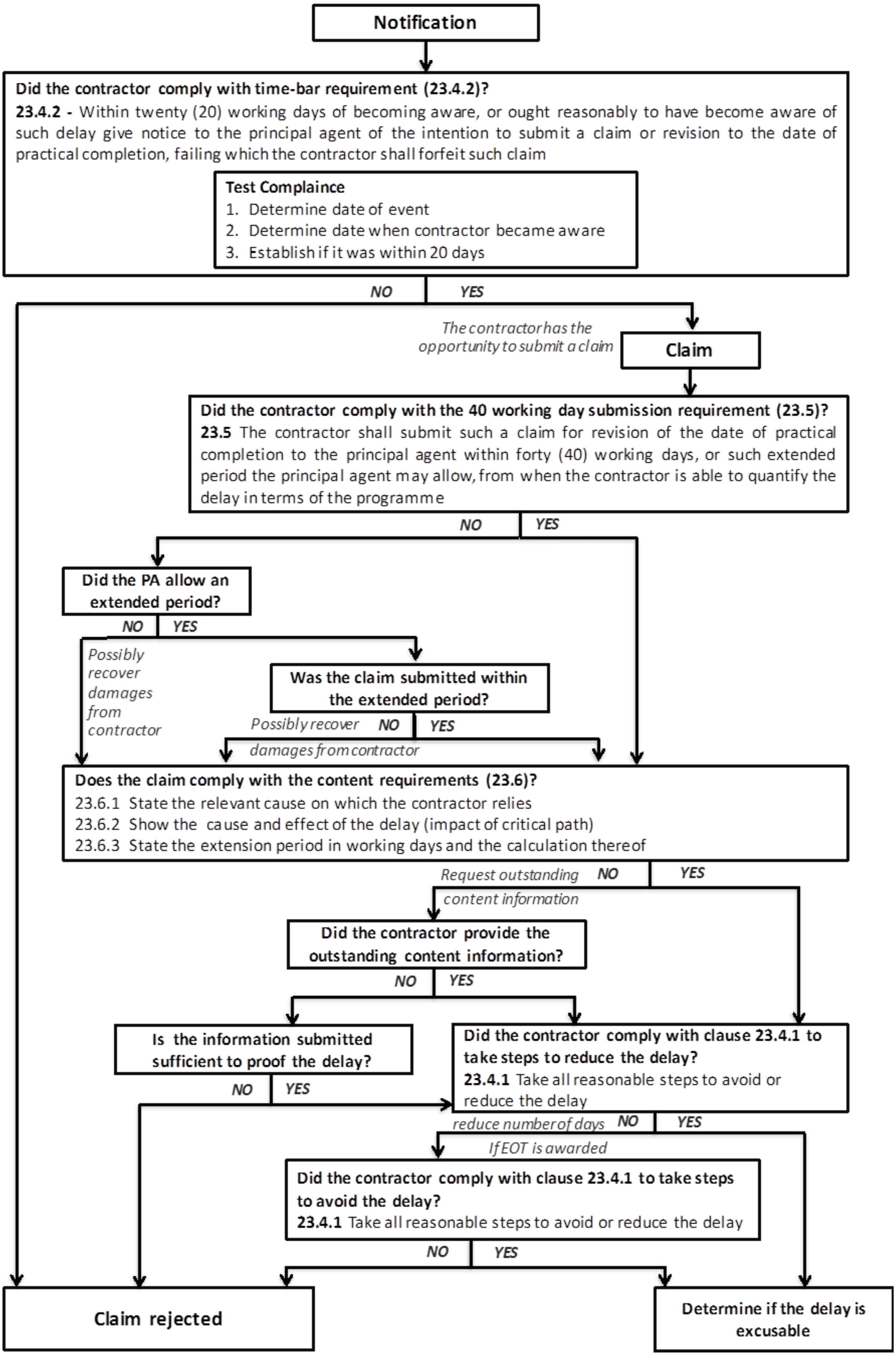


Figure 6 – Decision tree: JBCC contract compliance

4.4.2 DETERMINE WHETHER THE DELAY IS EXCUSABLE (STEP 2)

The JBCC edition 6.1 addresses excusable delays in three main clauses (refer to Chapter 2, item 2.4.3.1). In clause 23.1, several causes of delay are provided that would provide a valid basis for an extension of the contract period – without any increase in the contract value. Clause 23.2, in turn, provides a list of events caused by the client or those for whom the client is responsible. These events listed fall outside the sphere of the contractor's control; and as a result, this would lead to an extension of the contract period and an increase in the contract value. Clause 23.3 does not provide a list of possible causes; but rather it provides the opportunity for the contractor to claim for any other cause (not mentioned in clauses 23.1 and 23.2), which, given the cause of the delay, is beyond the contractor's reasonable control. It is therefore clear that if the cause of delay is not specifically listed in clauses 23.1 and 23.2, or it does not comply with the test provision in clause 23.3, that the cause of the delay then is not excusable.

The first decision required would be to assess whether the cause of the delay is specifically mentioned in the lists of possible delays provided in clause 23.1 and clause 23.2. Should this be the case, the delay would then be viewed as excusable. If the delay is not specifically mentioned in any of the two clauses, it should then be considered in terms of clause 23.3. Clause 23.3 provides for the following criteria to test the cause of the delay:

- Is the cause of the delay beyond the contractor's reasonable control?
- Could the cause of the delay not have been reasonably anticipated and provided for?

To establish whether the delay is beyond the contractor's reasonable control; and whether the cause of delay could have been anticipated or provided for; it would be necessary to consult the tender documents. By assessing the tender documents, one should be able to establish the information available to the contractor in terms of the delay in question. This information would assist one to answer the question on whether the cause of the delay could have been anticipated or reasonably provided for. If the delay could not have been anticipated and provided for, this would qualify as an excusable delay. If the contrary is evident, the claim would be rejected on the basis that the contractor was responsible for the risk associated with the cause of the delay.

It is possible that the tender document might be silent on the cause of the delay in question. In such a case, it is proposed that the definition of an excusable delay be utilised to determine the outcome of the decision.

An excusable delay, on the other hand, can be described as a delay caused by either of the following two factors:

- Third parties or incidents beyond the control of the client and the contractor; and
- The client or the client's agents.

(Alaghbari *et al.*, 2007), (Hamzah *et al.*, 2011) and (Tumi *et al.*, 2009)

A final decision can now be made to determine if the cause of the delay was excusable. Should the assessment show that the delay is indeed excusable, and therefore not as contractor's risk the next consideration in the decision tree framework is to determine whether the delay is critical. (Refer to Figure 7)

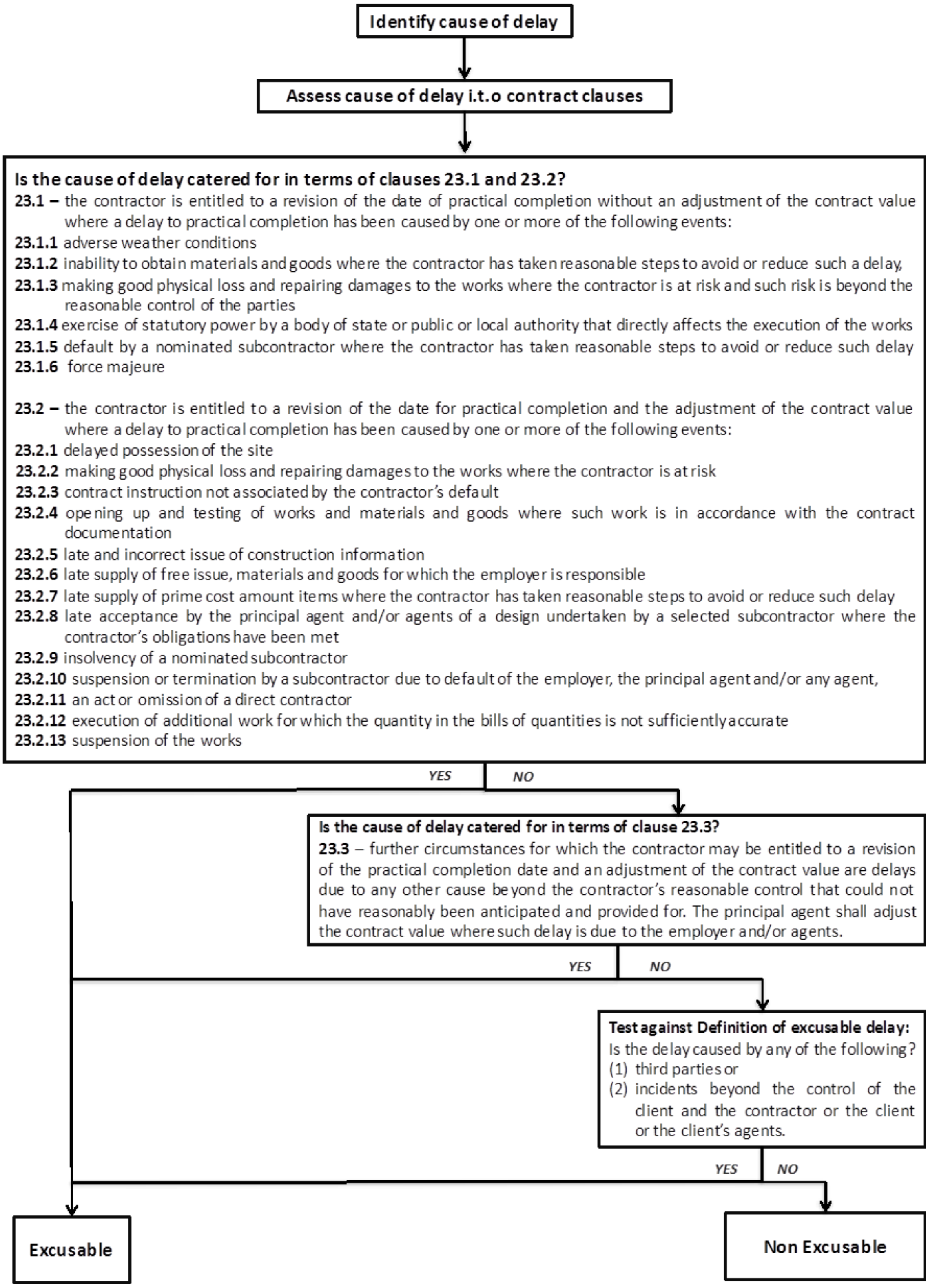
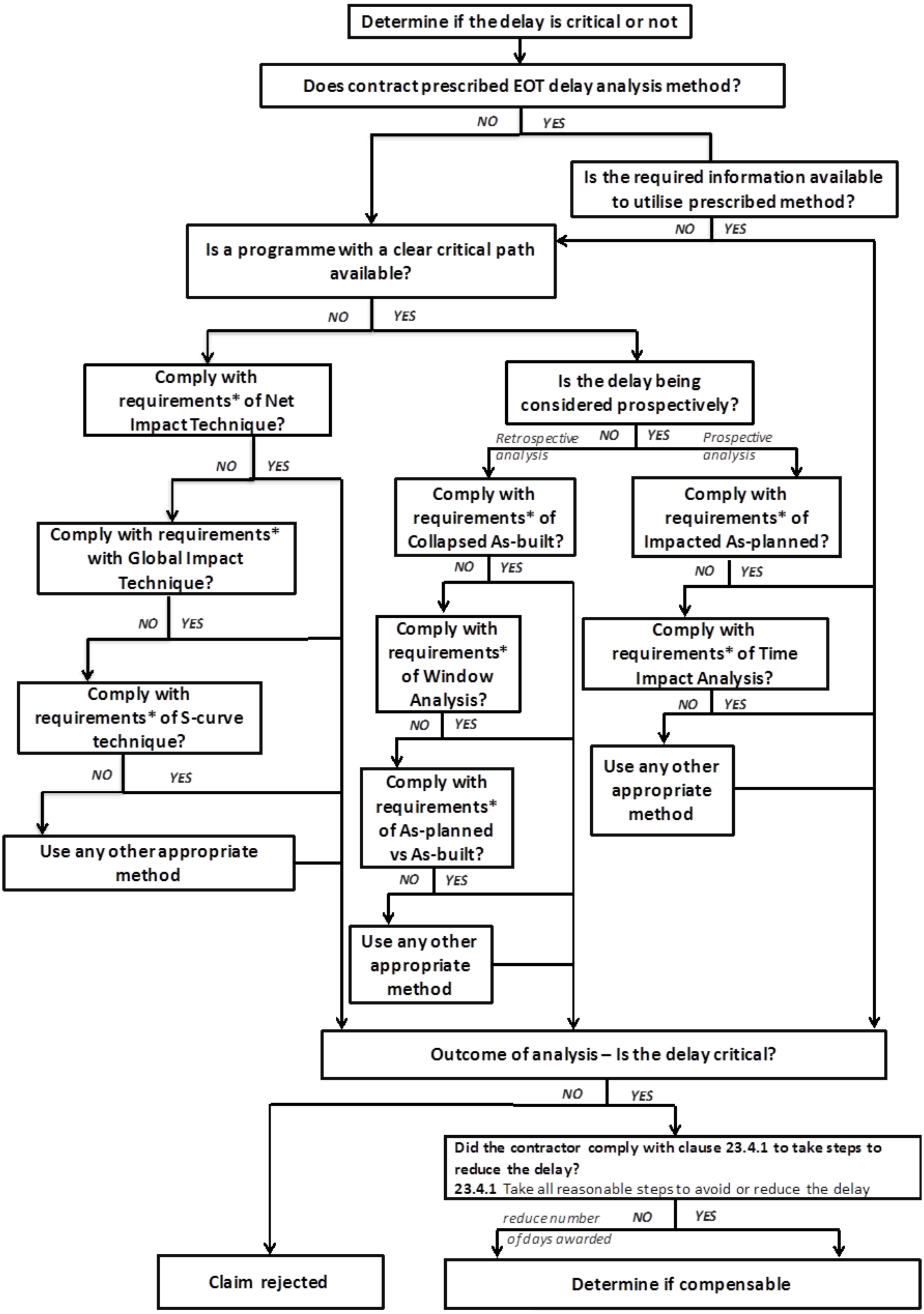


Figure 7 – Decision tree: JBCC excusable delay or not

4.4.3 DETERMINE WHETHER THE DELAY IS CRITICAL (STEP 3)

Although the term critical delay is not used in the JBCC, clauses 23.1 and 23.2 make specific reference to a delay to practical completion. It is therefore clear that both these clauses refer to critical delays. Clause 23.3 does not specifically refer to a delay to practical completion. The clause provides for circumstances causing a delay further to those mentioned in clauses 23.1 and 23.2, as a result it can be assumed that the intention here is that the circumstances should cause a delay to practical completion, therefore a critical delay. The following decision tree can be utilised to determine if the delay is critical. (Refer to Figure 8)



Utilise supplementary decision tree to test compliance

Figure 8 – JBCC: Decision tree to determine if delay is critical

To determine whether the delay is critical the first decision required as part of the decision tree would be to establish which of the EOT delay analysis methods (DAM) should be utilised.

Refer to Chapter 2, section 2.5.3.2 and 2.5.3.3 for an explanation of the different methods available. The information available in terms of the construction programme and the cause and effect of the delay will to a large extent influence the choice of the DAM. The JBCC form of contract does not prescribe the type of DAM to be utilised therefore leaving the choice open to the principal agent.

Should a DAM be prescribed in the contract, it should be determined if the required information is available to utilise the prescribed method. If not, the decision tree can be utilised to decide on an alternative method.

EOT delay analysis methods can be divided into two main categories: non-critical path methods and critical path methods. It would be preferable to utilise a critical path method; as this outcome would be conclusive whether the delay was critical or not. Unfortunately it is possible, in some instances that a programme with a clear critical path is not available; and a decision would have to be made with the limited information available. In such cases; the only alternative would be to utilise one of the non-critical path methods. The second consideration in the decision tree would be to determine whether a programme with a clear critical path is available. If the response is positive the next consideration would be to decide on the most appropriate critical path method to utilise.

The timing of when the analysis is taking place would have an impact on the choice of DAM. Prospective analyses are forward looking, and seek to determine the likely impact of the delay on the project completion date. Retrospective analyses look to the past, and seek to determine the actual impact of the delay on the completion date. Table 3 in Chapter 2 provides information on DAMs suitable for prospective and retrospective delay analysis respectively. Therefore, before the decision tree considers the choice of DAM it requires that it should first be determined whether the delay is being considered prospectively or retrospectively.

An overview of studies conducted to identify the criteria for the selection of the most appropriate DAM is provided in Chapter 2, section 2.5.5. Braimah and Ndekugri (2008) did a study on the factors that influence analysts' selection from these methodologies. Eighteen factors were identified through the literature review and pilot surveys; and then ranked on their relative importance, based on data collected in a nation-wide survey of UK construction organisations. The literature review identified the following factors summarised in Table 13:

Table 13 – Factors influencing the selection of DAM [adapted from (Braimah & Ndekugri, 2008)]

Factor	Source literature						
	Bramble (1988)	**Colin & Retik (1997)**	**Finke (1997)**	**Bubshait & Cunningham (1998)**	**Bramble & Callahan (2000)**	**SCL (2002)**	**Pickavance (2005)**
Records availability	✓	✓	✓	✓	✓	✓	✓
Baseline Programme availability	✓			✓		✓	✓
Nature of baseline programme				✓	✓	✓	✓
Updated programme availability				✓	✓	✓	✓
Reason for the delay analysis	✓	✓				✓	✓
Applicable legislation		✓					
The form of contract		✓	✓			✓	✓
Cost of using the technique	✓			✓		✓	✓
Nature of the delaying events	✓				✓	✓	
Skills of the analyst	✓				✓	✓	
The amount in dispute	✓				✓	✓	
The number of delaying events			✓		✓		

The construction industry wide survey yielded the following results (summarised in Table 14) in terms of the relevant importance of the factors influencing the selection of the DAM:

Table 14 – Relevant importance of DAM selection factors [adapted from (Braimah & Ndekugri, 2008)]

Selection factor	Overall	
	Importance index	Rank
Records availability	97.5	1
Baseline Programme availability	84.1	2
The amount in dispute	73.1	3
Nature of baseline programme	71.5	4
Updated programme availability	69.8	5
The number of delaying events	66.1	6
Complexity of the project	65.8	7
Skills of the analyst	65.3	8
Nature of the delaying events	64.6	9
Reason for the delay analysis	61.8	10
Type of contract	59.2	11
Cost of using the technique	58.0	12
Dispute resolution forum	54.4	13
Time of the delay	62.0	14
Size of project	50.9	15
Duration of the project	45.1	16
The other party to the claim	44.7	17
Applicable legislation	36.5	18

The industry wide survey also determined the extent of use of different DAMs. The survey ranked the DAMs in terms of the extent of use for both critical path methods and non-critical path methods. Table 15 provides information on the overall ranking of different methods.

Table 15 – Extent of use of DAMs [adapted from (Braimah & Ndekugri, 2008)]

DAM	Usage Index	Rank
As-planned vs As-built	65.7	1
Impacted as-planned	59.4	2
Collapsed as-built	54.8	3
Time impact analysis	48.2	4
Net impact	45.7	5
Global	45.5	6
Window analysis	40.2	7
S-Curve	33.8	8

In the absence of any guidance from the contract, a decision on the most appropriate DAM should be made. In order to make this decision, it is proposed that the five most significant factors influencing the selection of DAMs should be utilised in the decision tree, in order to identify the most appropriate method: (refer to Table 14)

1. Records availability;
2. Baseline programme availability;
3. The amount in dispute;
4. Nature of baseline programme; and
5. Updated programme availability.

Table 16 below highlights the information required for the following criteria for selection:

- Records availability;
- Baseline programme availability;
- Nature of baseline programme; and
- Updated programme availability.

Table 16 can be utilised as a tool to support decision making when considering the selection of the appropriate DAM as part of the decision tree.

Table 16 – Requirements to utilise DAMs [adapted from (Braimah, 2008)]

Record	As Planned vs As Built	Impacted As Planned	Collapsed As Built	Window analysis	Time Impact Analysis
Important project information required for the application of DAMs					
Outline of delay events	✓	✓	✓	✓	✓
Start dates of delay events	✓	✓	✓	✓	✓
Finish dates of delay events	✓	✓	✓	✓	✓
Activities affected by delays			✓	✓	✓
Duration of delay events	✓	✓	✓	✓	✓
Original planned completion date (or as extended)	✓	✓		✓	✓
Actual completion date	✓		✓	✓	✓
As-planned critical path(s)	✓	✓		✓	✓
As-built critical path	✓		✓		
Updates critical or near critical path(s)				✓	✓
Update or schedule revision dates				✓	✓
Activity list with logic and lag	✓	✓	✓	✓	✓
Main programming requirements of DAMs					
Baseline programme available	✓	✓		✓	✓
Nature of baseline programme					
Available in CPM	✓	✓		✓	✓
Includes all relevant activities	✓	✓		✓	✓
Reasonable activity durations	✓	✓		✓	✓
Reasonable activity relationships	✓	✓		✓	✓
Activities defined in appropriate detail	✓	✓		✓	✓

Relevant programmes updates for DAMs application					
Intermediate regular programme updates available				✓	✓
Final updated programme available (as-built programme)	✓		✓	✓	✓
TOTAL	**16**	**13**	**9**	**19**	**19**

A specific DAM can only be utilised if it was established that the required information to execute the particular DAM is available. The supplementary decision trees provided below (refer to Figure 9 to 16) in conjunction with Table 16 would be of assistance in this regard. The contract administrator should verify whether the information required to successfully utilise the DAM provided in Table 16 is available. This would be the first decision required in the decision trees. Should the information be available the decision trees would then consider the adherence to the other important selection criteria. Should the decisions required in terms of the other selection criteria yield positive responses the specific DAM can be utilised. Should any of the decisions required in terms of the selection criteria be negative an alternative DAM should be considered by repeating the process.

The following important aspects were taken into account when the sequences for the testing in the decision tree of the different DAMs were determined:

- Various studies identified the advantages and shortcomings of each of the different DAMs. Section 2.5.3.4 and 2.5.3.5 summarises the advantages and shortcomings of non-critical path DAMs. Section 2.5.3.6 and 2.5.3.7 provide information on the advantages and shortcomings of critical path DAMs.
- The SCL organised a series of debates to assist in identifying the most effective DAMs. It was first presented to an audience of over 300 in London and subsequently in Scotland, USA and Dubai. These debates involved participants speaking in favour of each of the common methodologies with reference to a hypothetical construction scenario. Voting was subsequently carried out to establish the most appropriate methodology that should be applied to the hypothetical construction scenario. In the London debate, for example, no consensus was reached as to the correct method, with votes splitting into four significant minorities (SCL, 2006).
- According to Braimah (2008) there is currently no industry-wide agreement on which is the most appropriate methodology to use for delay claims analysis. This is evident by the diverse views among researchers and practitioners.

It would be preferable to test the DAM which would be the most likely to be utilised first. It was considered to utilise the advantages and disadvantages of the DAMs as guide to assist in the determining the sequence of testing. However, given the challenge that there seems not to be any consensus amongst the specialists of which of the DAMs would be the most appropriate under certain circumstances, it is unlikely that an assessment of the advantages and shortcomings would be of assistance.

The extent of the use of different DAMs was viewed as a better alternative in determining the sequence of testing. It can be assumed that trends in terms of the extent of use of different DAMs would not likely change significantly in the future. The studies conducted to determine the extent of the use of DAMs would therefore be helpful to establish a ranking in terms of the most likely DAM to utilise. The information provided in Table 15 in terms of the extent of use of DAMs was utilised to determine a ranking of DAMs to inform the sequence of testing of the DAMs in the decision tree:

Non-critical path methods:

1) Net impact
2) Global impact
3) S-curve

Critical path methods – retrospective analysis:

1) As-planned vs As-built
2) Collapsed as-built
3) Window analysis

Critical path methods – prospective analysis:

1) Impacted as-planned
2) Time impact analysis

The DAM with the history of the highest extent of use would be considered first. Should this DAM not comply with the requirements considered in the supplementary decision trees provided in Figures 9 to 16 the DAM with the second highest extent of use would be considered. The process would be repeated until a DAM is identified that is responsive to the requirements.

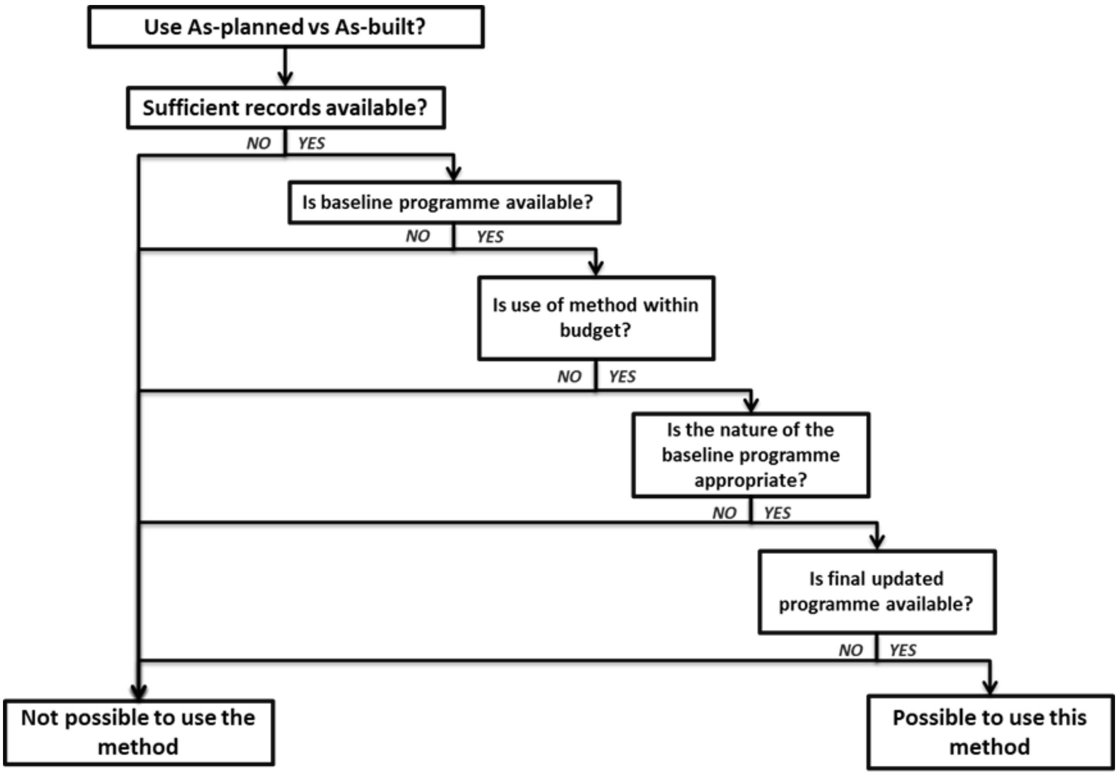


Figure 9 – Decision tree: Use As-planned vs As-built?

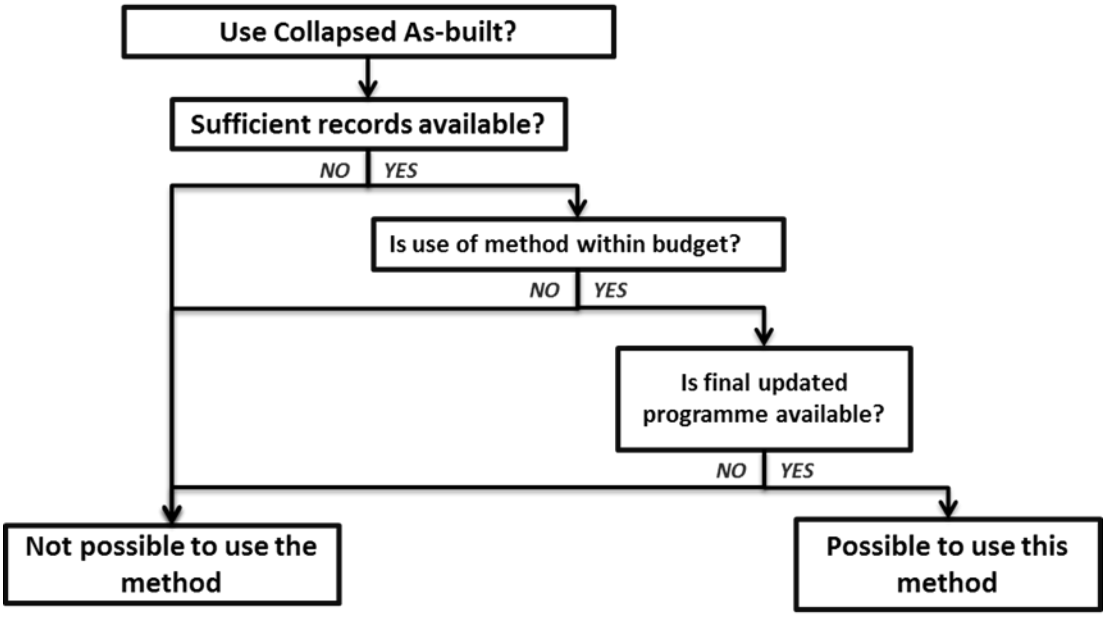


Figure 10 – Decision tree: Use Collapsed As-built?

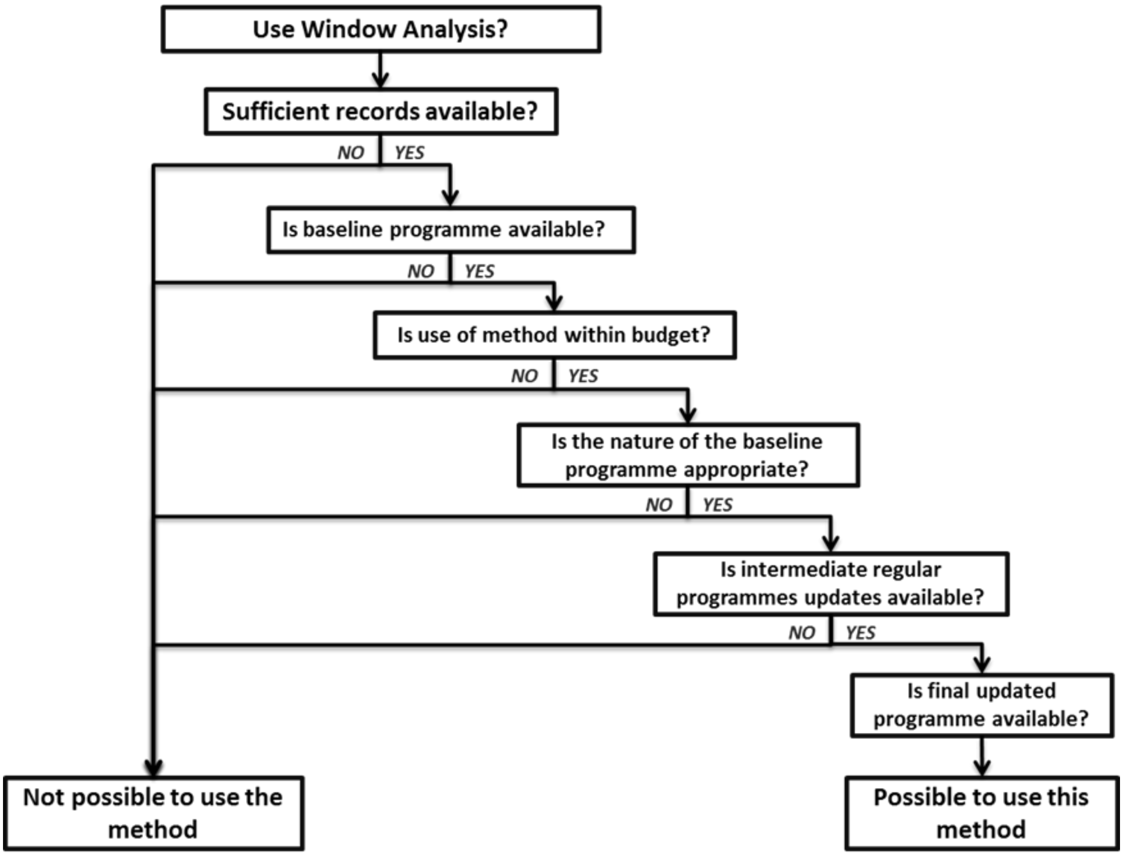


Figure 11 – Decision tree: Use Window Analysis?

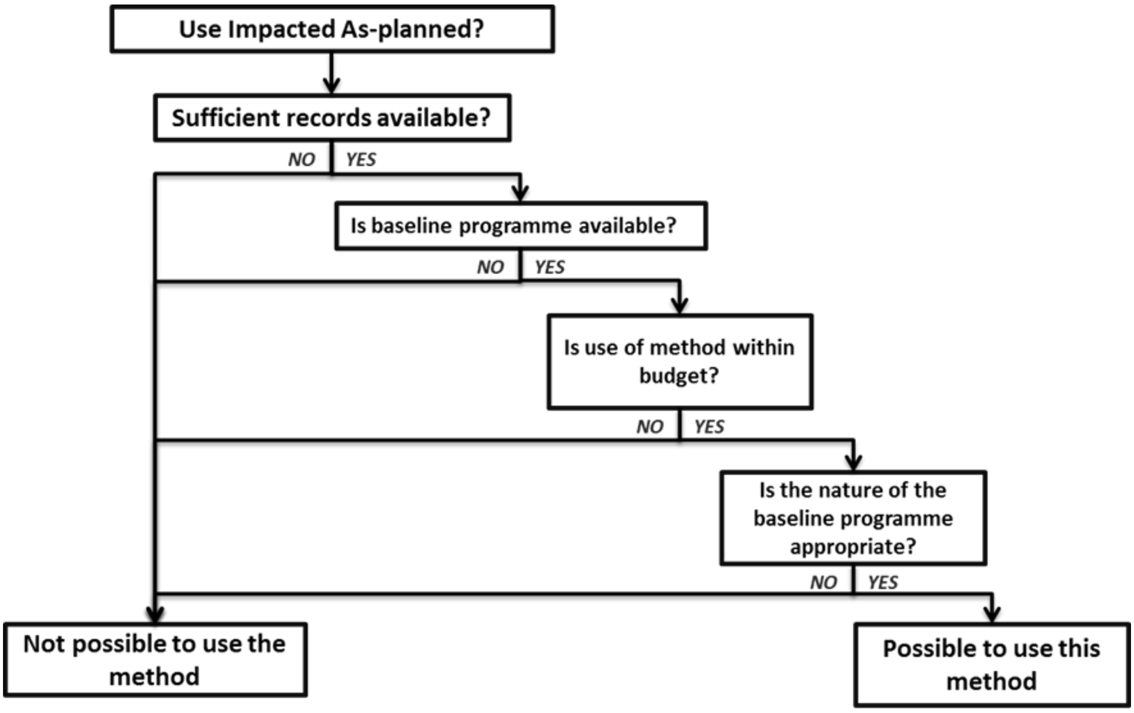


Figure 12 – Decision tree: Use Impacted As-planned?

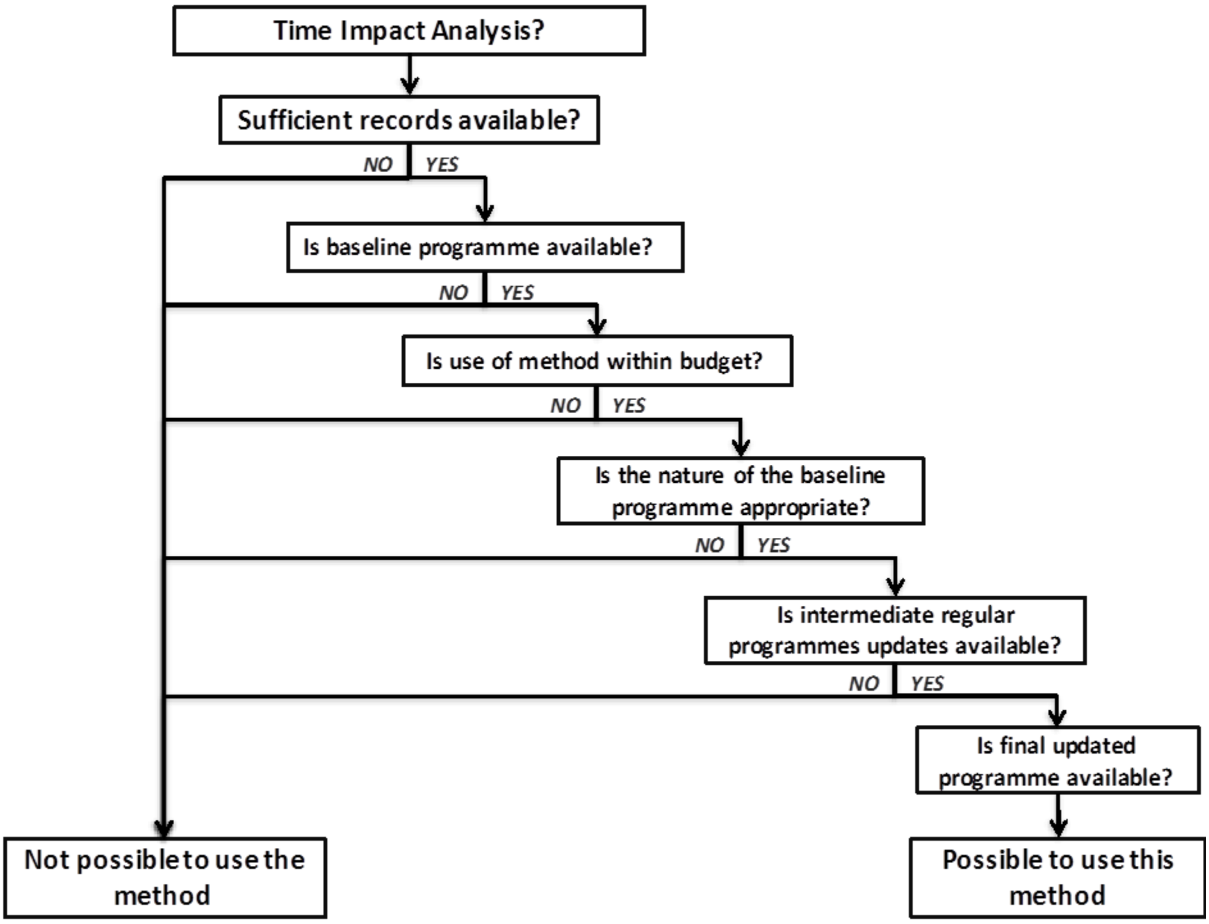


Figure 13 – Decision tree: Use Time Impact Analysis?

If a programme with a clear critical path is not available, one of the non-critical path methods should be considered. The project related information available would be the most significant deciding factor utilised in the decision tree to choose the most appropriate non-critical path DAM. One of the following decision trees can be utilised to decide on the most appropriate non-critical path method. (Refer to Figure 14, 15 & 16)

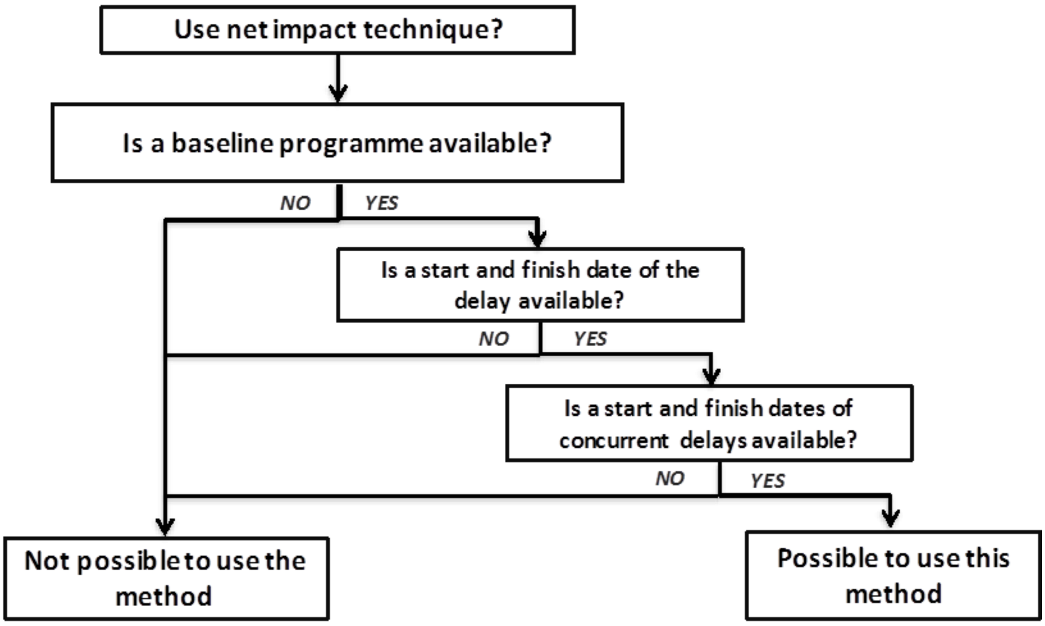


Figure 14 – Decision tree: Net impact technique?

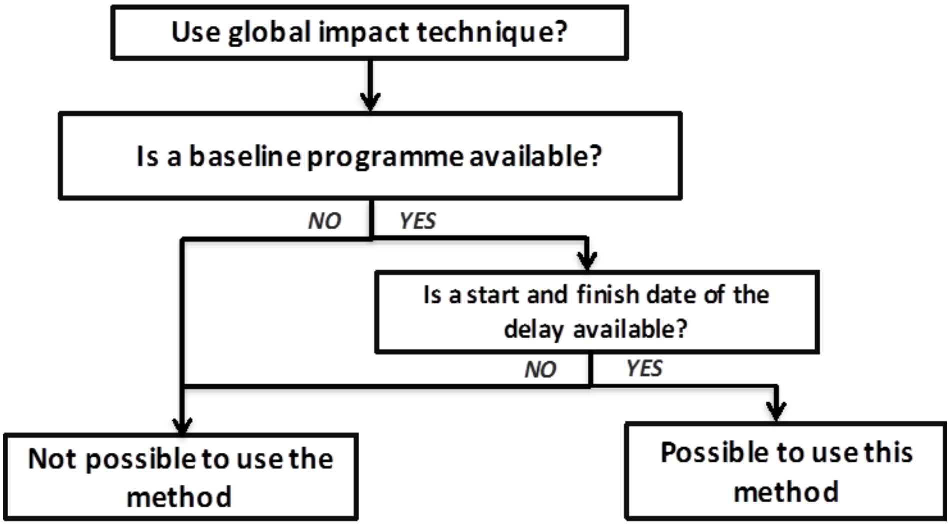


Figure 15 – Decision tree: Use Global impact technique?

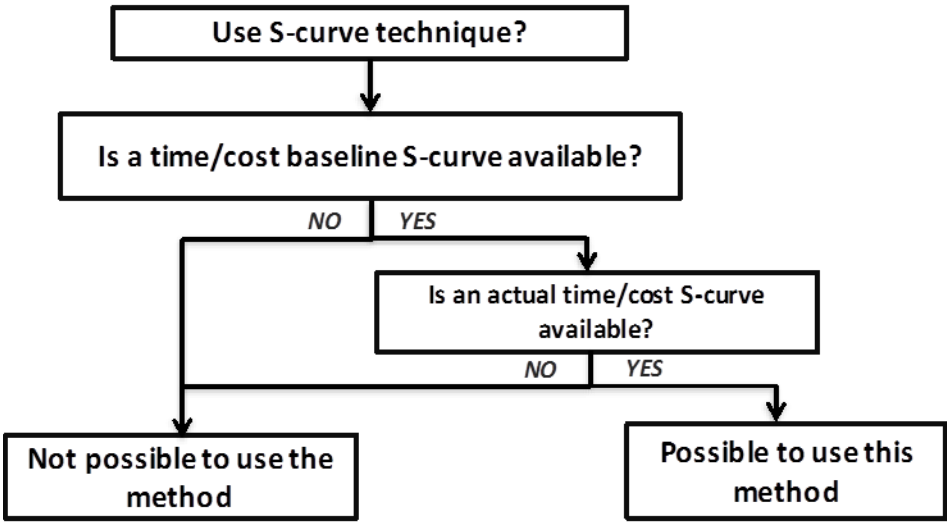


Figure 16 – Decision tree: Use S-curve technique?

It is also possible that, under some circumstances, it would not be necessary to utilise one of the recognised critical path methods, or even one of the non-critical path methods. For example, if possession of the site is given later than the agreed date, one of the more sophisticated DAMs would not be required to determine the delay. A simple calculation to determine the number of days the possession of the site was given after the agreed date would suffice.

Once the DAM has been decided upon, the delay would be analysed. The main outcome of the delay-analytical process would be to determine whether the delay is critical or not. The DAM should also give an indication of the number of days that the event delayed practical completion. At this stage, the decision tree would consider the impact of clause 23.4.1. Clause 23.4.1 calls for the contractor to take reasonable steps to avoid or reduce the delay. Should it be established that the contractor did not take reasonable steps to address the delay, the impact should be considered. If, as a result of the contractor not taking action, the delay persisted for a prolonged period of time, the number of days awarded may be reduced, in order to take this into account. If the delay could have been avoided by the contractor taking reasonable steps to address the delay, the outcome of the assessment process may very well be that no EOT is awarded to the contractor.

If the delay is not critical, the delay would be rejected; but if the delay is critical, the next step in the decision tree process would be investigate whether the delay is compensable.

4.4.4 DETERMINE WHETHER THE DELAY IS COMPENSABLE (STEP 4)

The JBCC clearly differentiates between delays, which would attract compensation and delays which are not compensable. Clause 23.1 provides a list of the delay-causing events, which would not result in an adjustment of the contract value (compensation). On the other hand, clause 23.2 makes provision for delay events, which would attract compensation. Clause 23.3 makes provision for circumstances not specifically mentioned in clause 23.1 and clause 23.2, but which are beyond the contractor's reasonable control.

In this case, the decision tree is fairly simplistic. The first consideration would be whether the cause of the delay is specifically mentioned in clause 23.1 or clause 23.2. If the cause of the delay can be identified in clause 23.1, then the claim would not be compensable, but if clause 23.2 makes provision for the cause; the delay would be compensable. It is possible that the cause of the delay is not catered for in either clause 23.1 or clause 23.2. Under these circumstances, clause 23.3 can be utilised to determine whether the delay is compensable.

It is possible that the cause of the delay is not catered for either in clause 23.1 or in clause 23.2. Under these circumstances, clause 23.3 can be utilised to determine whether the delay is compensable. According to clause 23.3, the contractor may be entitled to a revision of the contract value (compensation) for delays due to any other cause beyond the contractor's reasonable control that could not have reasonably been anticipated and provided for. The consideration of the decision tree at this point would be to determine whether the cause of the delay was beyond the reasonable control of the contractor and could not have been reasonably anticipated. The clause further states that the contract value should be adjusted where such a delay is due to the employer and/or his agents. The next consideration in the decision tree would be to determine whether the delay was caused by the employer or his agents. If this was found to be the case, compensation would be due. If the delay was not due to the employer or his agents, the principal agent should decide whether the circumstances justify any adjustment of the contract value. (Refer to Figure 17)

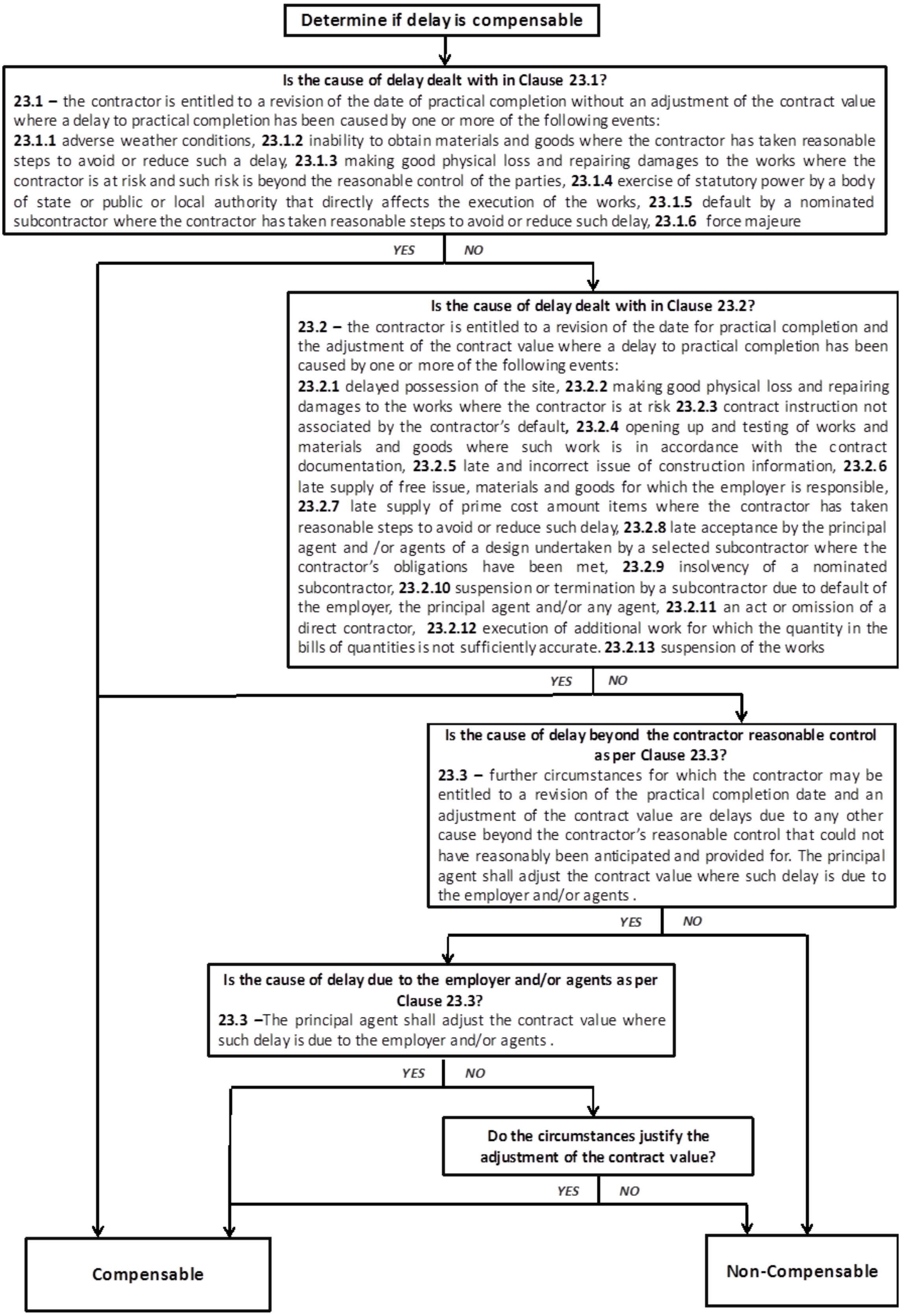


Figure 17 – Decision tree JBCC: to determine if delay is compensable

4.5 GCC DECISION TREE FRAMEWORK

4.5.1 ASSESS CONTRACTUAL COMPLIANCE (STEP 1)

A number of clauses (refer to Chapter 2, item 2.4.3.2) in the GCC refers to the right of the contractor to claim for EOT; but clause 10.1 deals specifically with the process to follow and compliance related matters.

According to clause 10.1.1, the contractor shall, within 28 days after the circumstance, event, act or omission – giving rise to such claim that has occurred, deliver to the employer's agent a written claim addressing a number of requirements. Should the contractor not be able to reasonably comply with the requirements within the 28 days; then clause 10.1.1.2.1 allows for a notification of the intention to make a claim to be submitted in writing.

The first decision in the decision tree would be to determine whether the contractor has complied with the 28 day provision to submit the claim. If the contractor did not submit a claim within the 28 day time bar; then second consideration would be to determine whether the contractor submitted a notification within the 28 days. If no claim or notification was provided within this time period; the claim would be rejected, as provided for in clause 10.1.4.

If a notification was submitted, the next decision would be to determine whether the contractor submitted the monthly updates, according to clause 10.1.1.3; while the circumstances are of an ongoing nature. Once the claim is submitted, it would also be required to verify whether the claim was submitted within 28 days after the delaying event.

Clause 10.1.4 dealing with the contractor's failure to comply with the notice period only provides for the claim to be rejected if the notice period of 28 days are not complied with or if the claim is not submitted within the required 28 days. Therefore non-compliance to the provision of clause 10.1.1.3 to provide updated particulars will not necessarily lead to the rejection of the claim. It is assumed that the impact of the failure to provide monthly updates would be taken into account when the impact of the delay is considered.

The decision tree will then consider whether the claim complied with the content requirements highlighted in clauses 10.1.1.1 – 10.1.1.4:

- Were the particulars giving rise to the claim provided? (10.1.1.1.1);
- Was the provision of the contract, on which the claim is based, stated? (10.1.1.1.2);
- Was the time related information and the calculations provided? (10.1.1.1.3); and
- Was the amount of money claimed and the calculation provided? (10.1.1.1.4).

If the required content information has not been provided it is likely to impact on the assessment of the claim. It is in the contractor's interest to provide sufficient information to substantiate the claim. The GCC does not make provision for the claim to be rejected outright if the required information is not submitted. However, the lack of information is likely to impact on the outcome of the assessment to determine whether the delay is excusable and critical. (Refer to Figure 18)

The next step in the decision tree process would be to investigate if the delay was excusable.

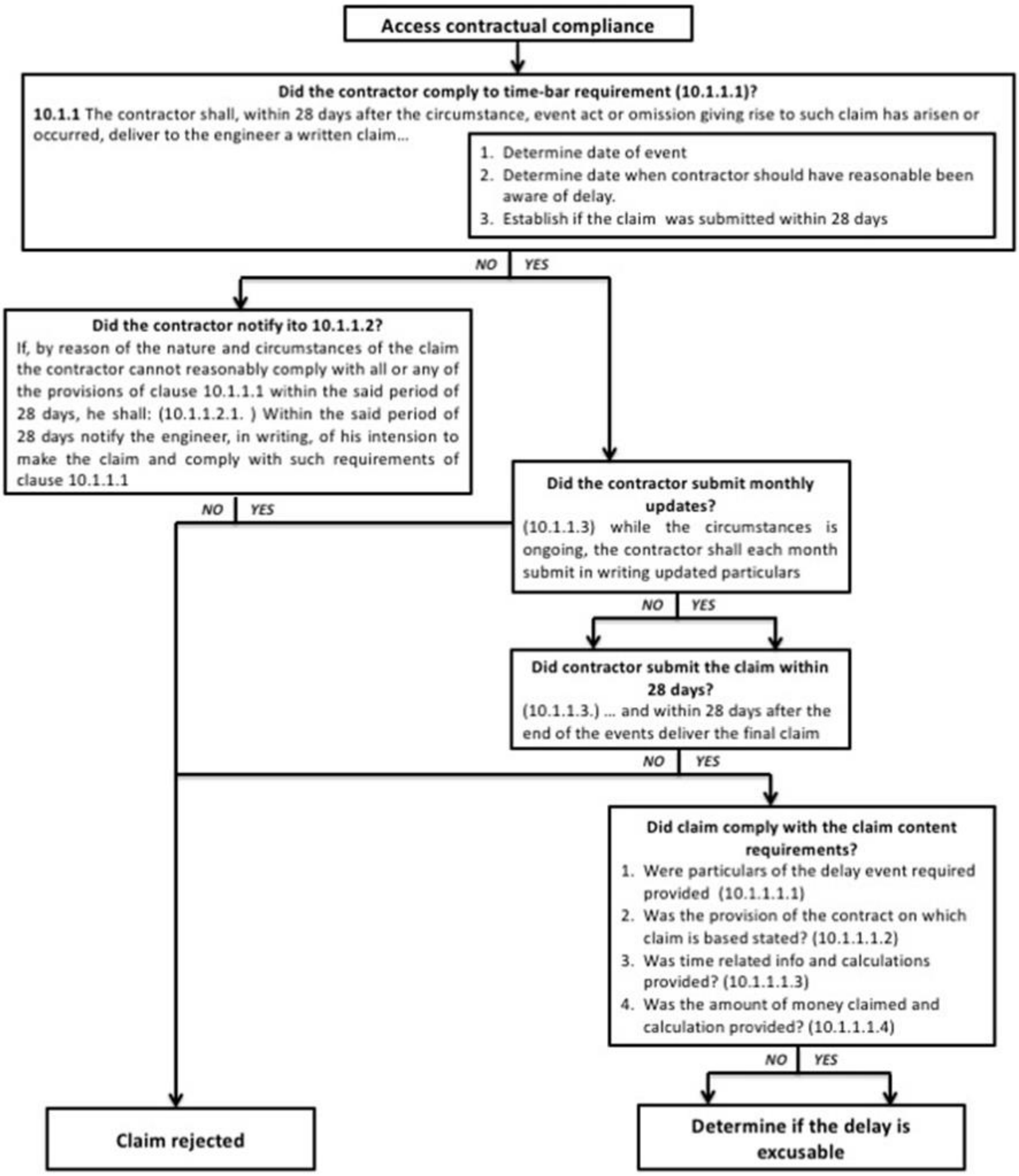


Figure 18 – Decision tree: GCC contract compliance

4.5.2 DETERMINE WHETHER THE DELAY IS EXCUSABLE (STEP 2)

The GCC makes provision, according to clause 5.12.1, for circumstances of any kind whatsoever, which may occur, which would, in fact, delay practical completion of the works. The circumstances referred to in clause 5.12.1 are to some extent governed by clause 5.12.2:

5.12.2. Without limiting the generality of clause 5.12.1, the circumstances referred to in that clause include:

5.12.2.1. The amount and nature of any additional work

5.12.2.2. Abnormal climatic conditions

5.12.2.3. Any provision of these conditions which allows for an EOT

5.12.2.4. Any disruption, which is entirely beyond the contractor's control

The overall objective of this part of the decision tree is to test whether the cause of the delay is excusable in terms of the conditions of the contract. The first question in the decision tree is to determine whether the delay is as a result of additional work, as provided for by clause 5.12.2.1. If this is the case, the delay would be deemed excusable. The second consideration in the tree is to determine whether the delay is as a result of abnormal climatic conditions. If this is indeed the case, the delay would be viewed as excusable. Thirdly, if the delay is not as a result of these two causes, the decision tree would then consider whether the delay is as a result of any provision of these conditions which allows for an EOT, in accordance with clause 5.12.2.3. The following clauses make provision for an EOT if the contractor is delayed as a result of the matter being addressed in the clause:

Table 17 – GCC2015 – Clauses making provision for EOT

Clause number	Clause title
2.2.4	Adverse physical conditions
2.3.1	Technical data differing
2.4.2	Ambiguity in documents
4.7.1	Encountering fossils, etc.
4.8.2.2	Providing facilities to others
5.4.3	Delays in possession of site
5.9.6	Employer's agent's late instructions
5.10.1	Employer's delays
5.11.2	Suspensions of the works
6.4.3	Delays in valuing variations
7.5.3	Employer's agent's late attendance
7.5.4	Late delivery of plant
7.5.5	Uncovering and openings
8.3.2	Excepted risk

If the claim relies on one of these clauses, the decision tree would then test whether the provisions in the clause were met. If this was the case, the delay can be considered as excusable. If the provisions of the clause were not complied with, the claim would not be considered as excusable; and it could then be rejected on this basis.

If the cause of delay is not attributable to any of the possible causes of delay previously considered, the decision tree would then test the cause of the delay in terms of clause 5.12.2.4. This clause makes provision for an EOT for any disruption beyond the contractor's control. The cause of the delay should be assessed to determine whether it was entirely beyond the contractor's control. In the assessment it would be necessary to consider what information was available to the contractor at the tender stage; and if provision could have been made to address the disruption. If the cause of the delay is viewed as something that was under the control of the contractor, the delay would not be considered excusable. However, if it is found that the cause of the delay was beyond the contractor's control, the delay would be viewed as excusable. The next step will be to determine if the delay was critical. (Refer to Figure 19)

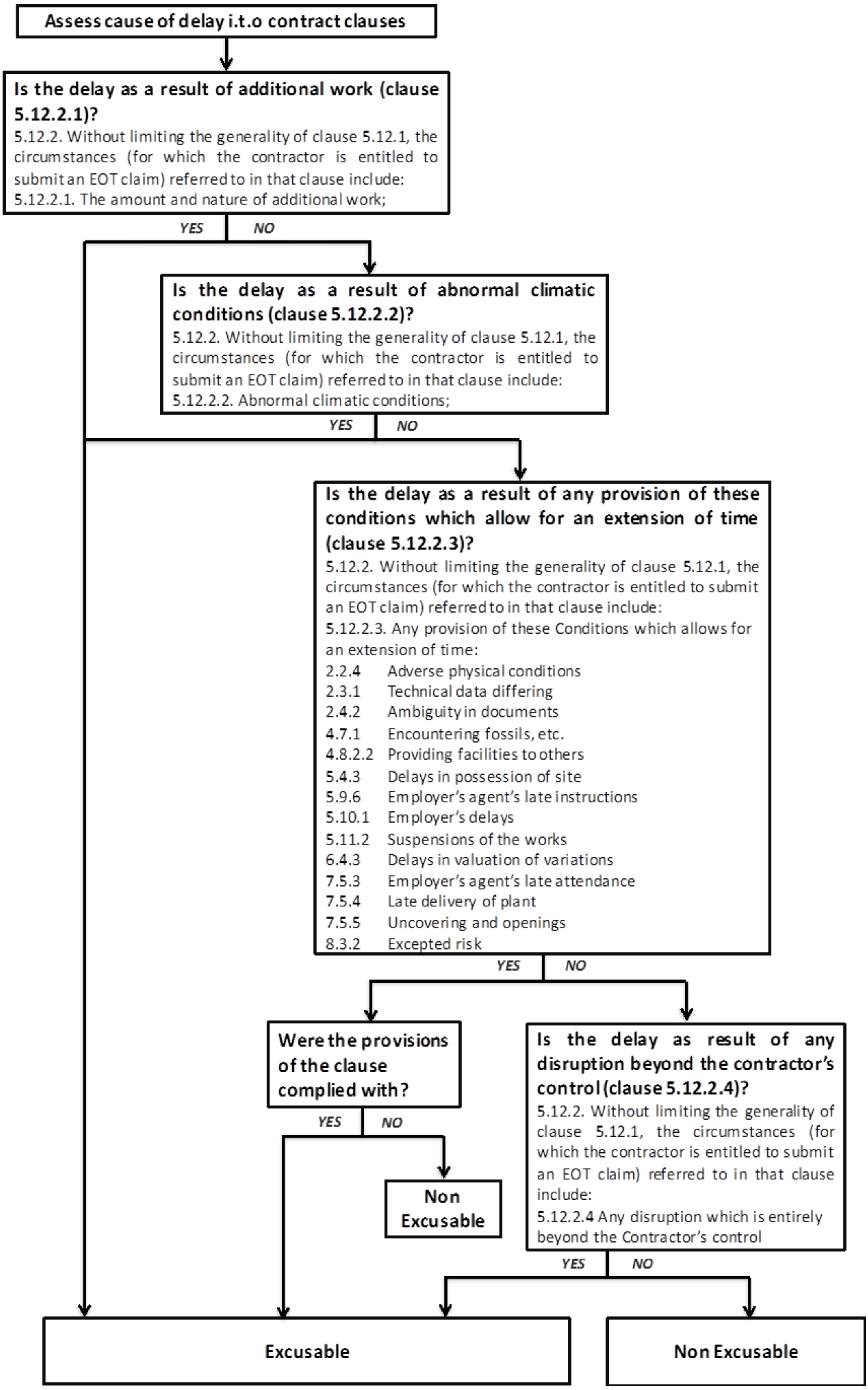


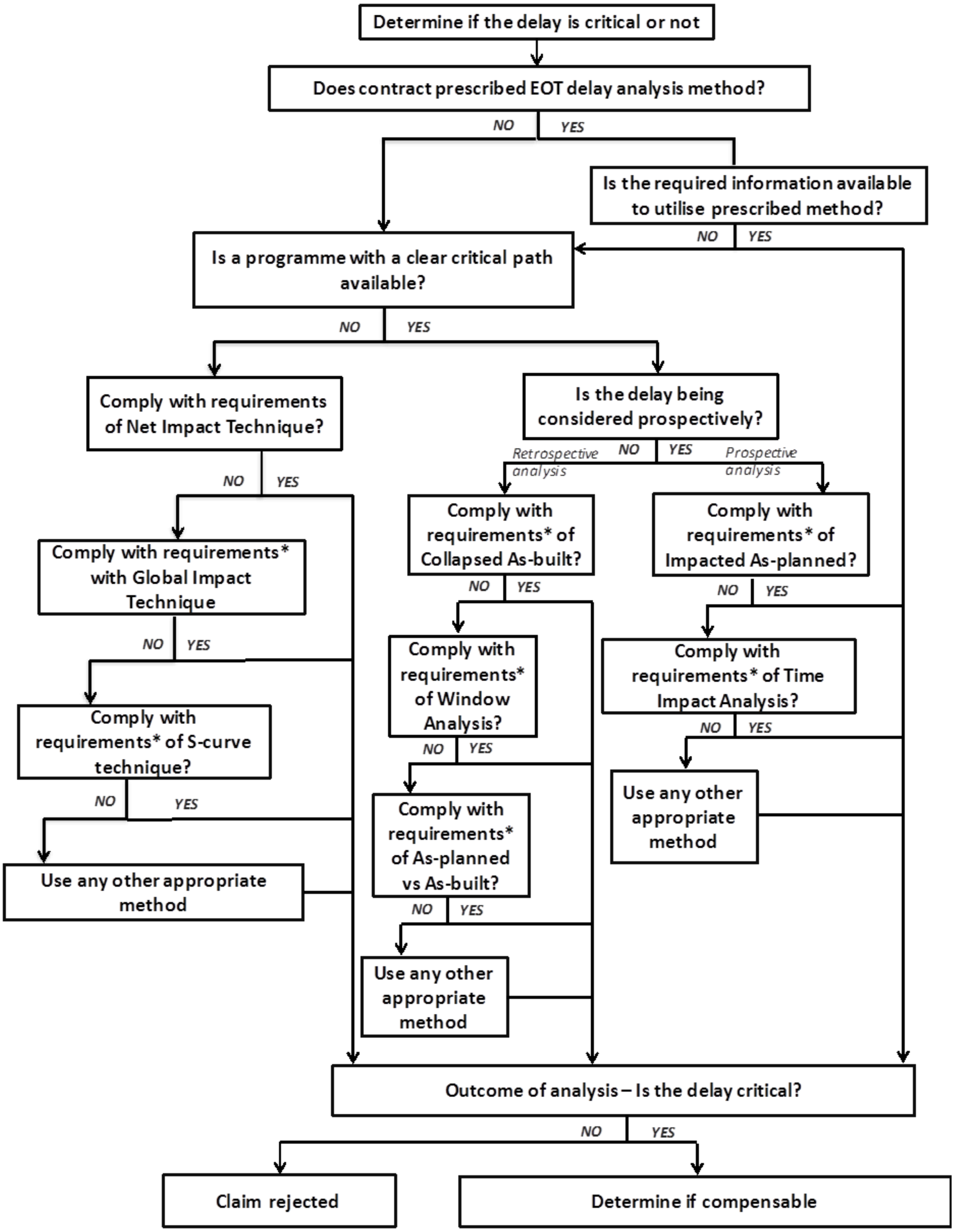
Figure 19 – Decision tree: GCC excusable delay

4.5.3 DETERMINE WHETHER THE DELAY IS CRITICAL (STEP 3)

The GCC deals with the issue of criticality and the extension of the contract period in terms of clause 5.12. Clause 5.12.1 allows the contractor to claim for an EOT for any circumstances that would actually extend the practical completion of the works beyond the due completion date. The clause makes reference to a delay in the practical completion, in other words a critical delay. It is clear from the provision in this clause that the contractor is only entitled to an EOT if the delay is critical.

The main objective of this part of the decision tree is to determine if the delay is critical. To determine if the delay is critical one of the DAMs will have to be utilised. The GCC does not prescribe a specific DAM to be utilised for the assessment of EOT claims. The decision of the most appropriate DAM will be left to the employer's agent's discretion.

A decision tree can be utilised to choose the most appropriate DAM for the specific delay. Section 4.4.3 above provided a detailed description of how a decision tree methodology can be followed to identify the most appropriate DAM. The same decision tree process can be utilised in the selection of a DAM for the GCC: (refer to Figure 20)



**Utilise supplementary decision tree to test compliance*

Figure 20 – Decision tree: GCC determine whether the delay is critical

Once the DAM is selected and applied to the delay it will be possible to determine if the delay is critical or not. If the delay is not critical and therefore will not delay practical completion, the EOT claim can be rejected based on the requirements of clause 5.12.1. However, if the delay is critical the next issue to be assessed in the decision tree will be to determine if the delay is compensable.

4.5.4 DETERMINE WHETHER THE DELAY IS COMPENSABLE (STEP 4)

The GCC does not distinguish between delaying events, for which the contract value could be adjusted (compensable) and delaying events, for which the contract value would not be adjusted (non-compensable). Compensation related to EOT for practical completion is addressed in clause 5.12.3; and a relevant adjustment is made to general items:

5.12.3 If an EOT is granted, the contractor shall be paid such additional time-related general items, including for special non-working days, if applicable, as are appropriate regarding any other compensation, which may already have been granted in respect of the circumstances concerned.

According to this clause, if the contractor is granted an EOT, the delay is compensable. The decision tree to determine whether the delay is compensable is simplistic; as the only requirement would be to determine whether an EOT was granted. If an EOT was granted, the delay is compensable. (Refer to Figure 21)

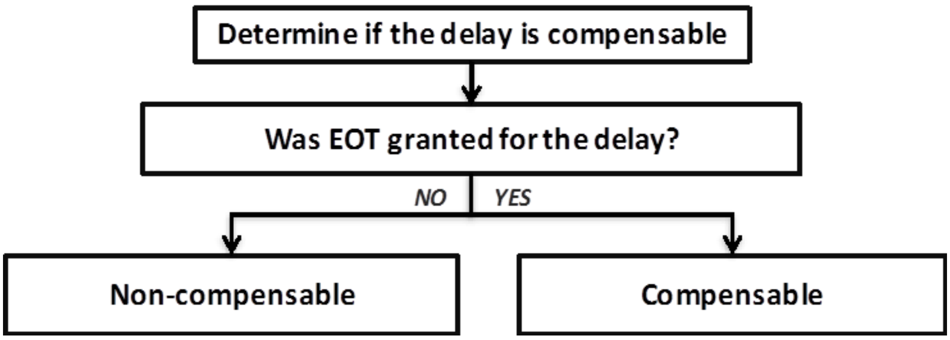


Figure 21 – Decision tree: GCC determine whether the delay is compensable

4.6 FIDIC DECISION TREE FRAMEWORK

4.6.1 ASSESS CONTRACTUAL COMPLIANCE (STEP 1)

The EOT-claim process in the FIDIC contract is mainly governed by clause 20.1. Clause 20.1 is comprehensive and deals with a number of different aspects relating to the notification and the claim. The first requirement is that if the contractor considers himself to be entitled to any EOT for completion and/or any additional payment, then notice should be given as soon as practicable, and not later than 28 days after the contractor became aware, or should have become aware, of the event or circumstance. The starting point of this part of the decision tree will be to determine whether the notification was submitted within the 28 days. If this was not the case, then clause 20.1 makes it very clear that the contract period will not be extended. If the notification complies with this time-bar requirement; then the next decision would be to determine whether the contractor submitted a detailed claim with full supporting particulars of the basis of the claim and of the EOT and/or additional payment claimed. This should happen within 42 days after the contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the contractor and approved by the engineer. If the claim was submitted within the 42 days – or within another period approved by the engineer – the claim will be deemed to be in compliance; and the next step in the decision-tree process would be to determine whether the delay is excusable.

It is possible that the claim was not submitted within the 42 days, particularly if the event causing the delay was of an ongoing nature. The next decision, as part of the decision tree, would be to establish whether the event causing the delay is of an ongoing nature. If it is not, and the claim was not submitted within the 42 days, then the claim would be rejected. However, if the event is of an ongoing nature, the contractor will have to comply with the following interim requirement:

20.1 (b) The Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Engineer may reasonably require;

If the contractor adhered to these interim requirements he will be obligated to send a final claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the contractor and approved by the engineer.

The 28 day-notice period when the contractor becomes aware of the delay is the only time-related requirement where it is explicitly mentioned that the claim would not be considered if this requirement is not met. If the following time-related requirements:

- a claim should be submitted within 42 days
- interim claims to be submitted monthly if the delay is ongoing
- a final claim to be submitted within 28 days after the event causing the delay has ceased.

Are not complied with, the claim would still be considered; but the following provision in clause 20.1. should then be applied:

20.1 If the Contractor fails to comply with this or another Clause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Clause.

If any of these time-related requirements are not met, the claim would still be considered. However, during the assessment, the extent to which the failure has prevented or negatively impacted the investigation of the claim, should be considered. It is possible that the late submission of information might have prevented steps from being taken to reduce the delay. The impact on the delay would be considered; and it is possible that the number of days awarded might be reduced, or that no additional time might be awarded. The exercise to consider the impact of the non-adherence to the time-related requirements would only take place as part of the decision tree to determine whether the delay is critical. The next step will be to consider if the delay is excusable. (Refer to Figure 22)

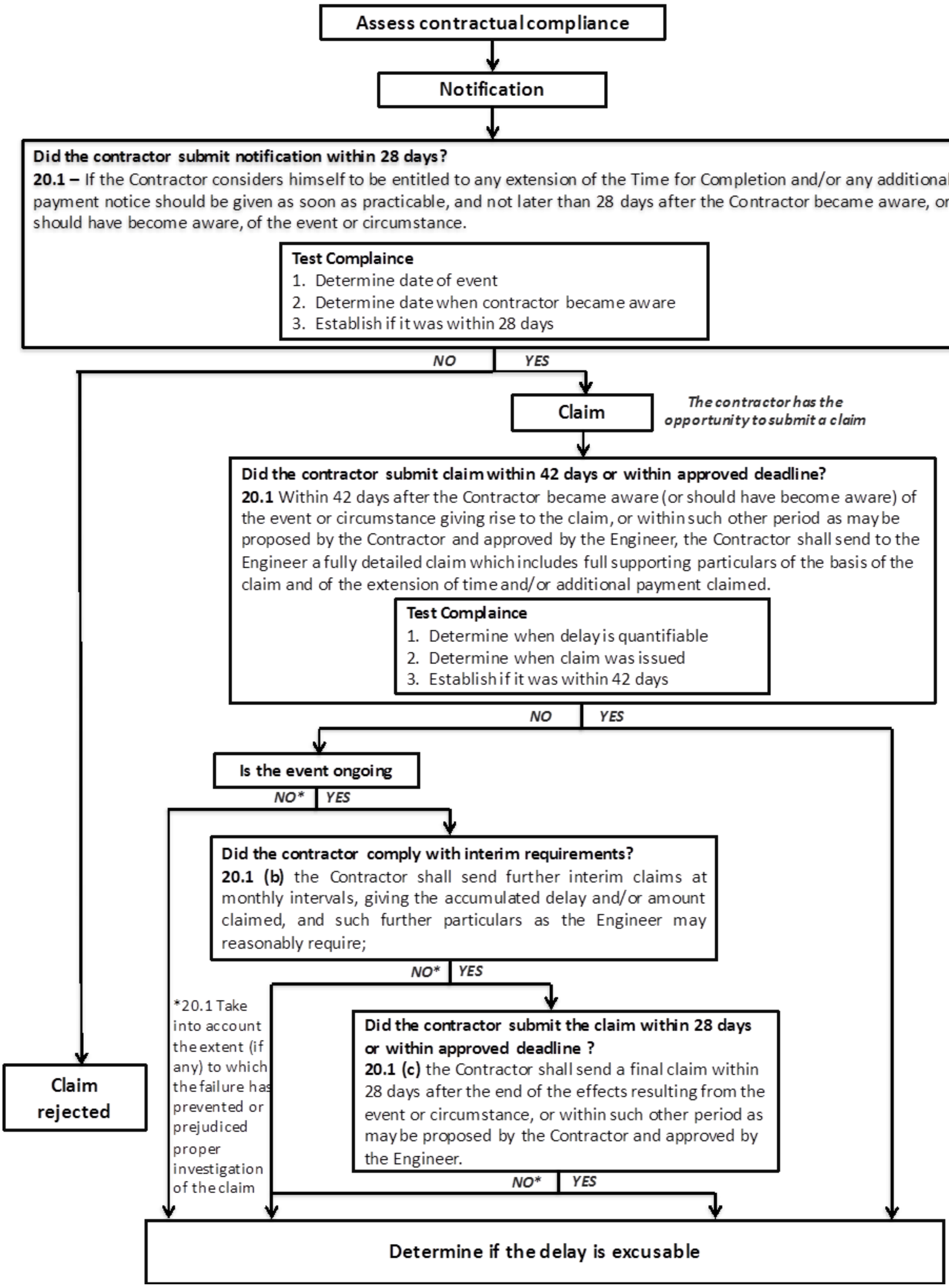


Figure 22 – Decision tree: FIDIC assess contract compliance

4.6.2 DETERMINE WHETHER THE DELAY IS EXCUSABLE (STEP 2)

Clause 8.4 provides a list of circumstances, for which the contractor would be entitled to an extension of the completion date:

The Contractor shall be entitled subject to Clause 20.1 [Contractor's Claims] to an extension of time for completion if and to the extent that completion for the purposes of Clause 10.1 [Taking-Over of the Works and Sections] is or will be delayed by any of the following causes:

(a) *a variation (unless an adjustment to the Time for Completion has been agreed under Clause 13.3 [Variation Procedure]) or other substantial change in the quantity of an item of work included in the Contract;*

(b) *a cause of delay giving an entitlement to EOT under a Clause of these Conditions,*

(c) *exceptionally adverse climatic conditions;*

(d) *unforeseeable shortages in the availability of personnel or goods caused by epidemic or governmental actions; or*

(e) *any delay, impediment or prevention caused by or attributable to the Employer, the Employer's Personnel, or the Employer's other Contractors.*

The first consideration in the decision tree would be to determine whether the cause of the delay can be attributed to any of the circumstances listed in clauses 8.4 (a) to (e).

Clause 8.4 (a) provides for variations or substantial changes in the quantity of an item of work. The first question in the decision tree would be to determine if the EOT was dealt with in the variation order sub-clause (13.3). If this is the case, it would not be necessary to further consider the EOT as it would have been considered as part of the variation order procedure. If the EOT was not considered as part of the variation order procedure, it would be deemed an excusable delay; and it would be further assessed.

In terms of clause 8.4 (b) an EOT can be claimed making use of any clause of the contract providing for such an entitlement. A large number of clauses explicitly state that the contractor is entitled to an EOT for a delay related to the event mentioned in the clause. Should a claim rely on any of these clauses, it should be considered in the decision tree if the provisions of the clauses were complied with. The clauses were assessed to determine whether generic conditions are included in the different clauses, refer to Table 18:

Table 18 – FIDIC – similar conditions in clauses making provision for EOT

Clause number	Clause	Additional notification	As a result of contractor's failure	Specific requirements
1.9	Delayed drawings	✓	✓	✓
2.1	Right of access		✓	✓
4.7	Setting out		✓	
4.12	Unforeseeable conditions	✓		✓
4.24	Fossils	✓		
7.4	Testing		✓	
8.5	Delays by authorities		✓	
8.9	Suspension of work		✓	
10.3	Interference with tests for completion			✓
13.7	Adjustments for changes in legislation			✓
16.1	Contractor's entitlement to suspend work	✓		✓
17.3	Employer's risk	✓		✓
19	Force majeure	✓		✓

The assessment found that conditions included in these clauses can be categorised under the following generic requirements:

- Additional notification over and above the notification required according to clause 20.1;
- Any failure on the part of the contractor; and
- Clause specific requirements.

The requirements of these clauses will later be discussed in more detail. In testing the requirements stated above the decision tree will firstly consider if there is a requirement in the clause for an additional notification. If the response is affirmative it will be established if an additional notification was provided in line with the specific requirements associated with the notification. If the additional notification provision was not complied with it is advisable not to immediately reject the claim but rather to apply the provision in clause 20.1 to take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this clause.

The next decision will be to determine if there was any failure on the part of the contractor. The failure may include and error, action or inaction. Failure on the part of the contractor will result in the EOT not being considered.

If there was no failure or error on the part of the contractor the decision tree will consider whether the clause provides for any specific requirement to be complied with. If no specific requirements need to be met the delay will be accepted as an excusable delay. However, if the clause provides for any specific requirements relating to the cause of the delay the decision tree will establish if these requirements were adhered to. The specific clause will have to be consulted to determine the consequence. If the contractor complied with the specific requirement the delay will be accepted as excusable.

If a delay was experienced as a result of exceptional adverse climatic conditions, clause 8.4 (c) allows for the contractor to submit an EOT claim. With the specific reference to exceptional adverse climatic conditions, it is clear that normal adverse climatic conditions that can be foreseen by assessing annual weather records would not be viewed as an excusable delay. However, should the contractor be able to prove that the climatic conditions were exceptionally adverse; the delay would be viewed as excusable.

Clause 8.4 (d) provides for an EOT in the case of unforeseeable shortages in the availability of personnel or goods caused by an epidemic or governmental actions. If the delay were a result of these causes, it would be accepted as an excusable delay.

The final consideration would be to establish whether the cause of the delay is as a result of clause 8.4 (e) – any delay, impediment or prevention caused by or attributable to the employer, the employer's personnel, or the employer's other contractors. Should this be the case, the delay would be deemed excusable; and the next step in the decision-tree framework would be to determine whether the delay is critical. (Refer to Figure 23)

If the cause of the delay is not catered for in clauses 8.4 (a) to (e), the claim could be rejected.

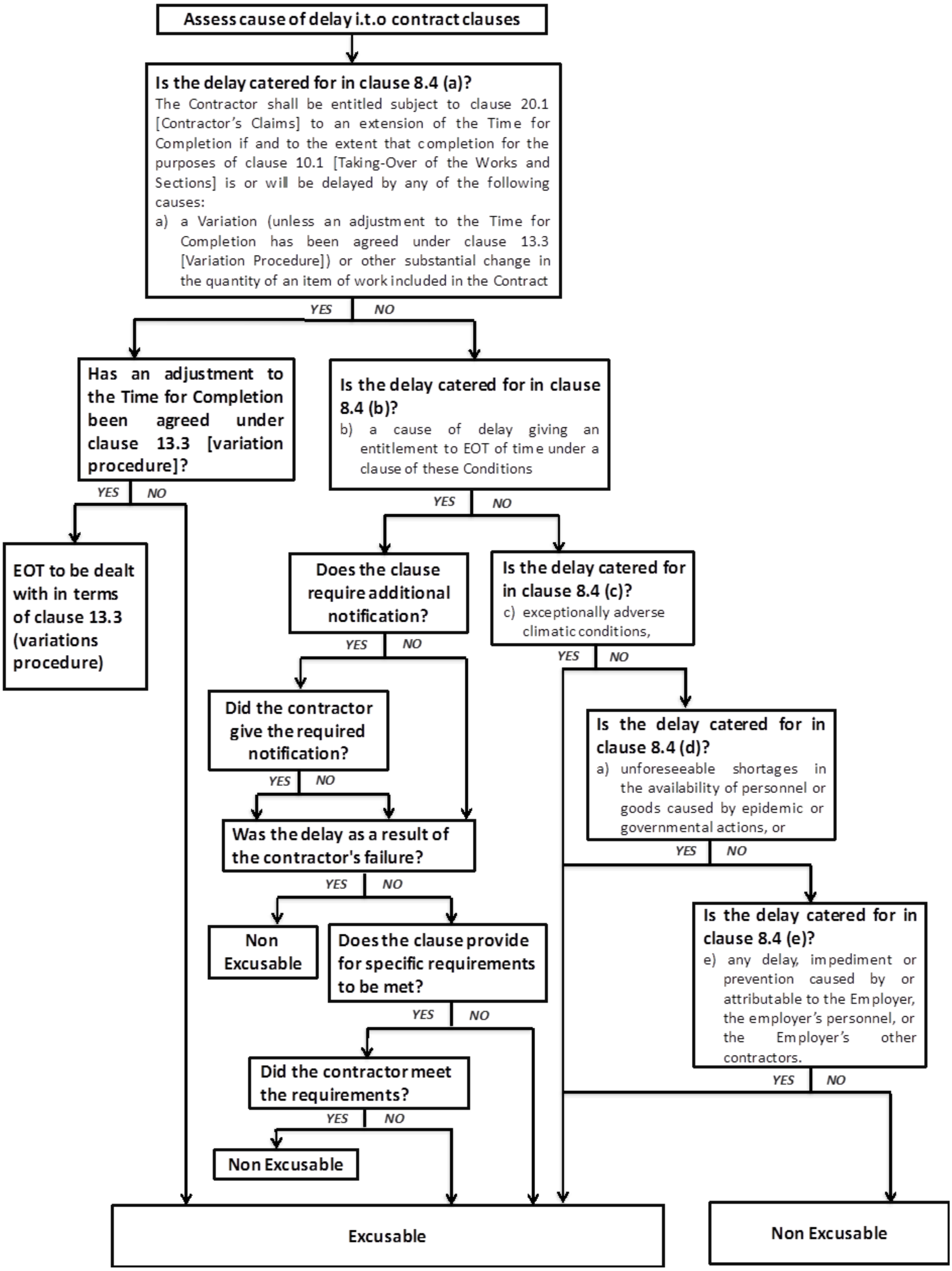


Figure 23 – Decision tree: FIDIC Determine whether the delay is excusable

4.6.2.1 DELAYED DRAWINGS AND INSTRUCTIONS

Clause 1.9 is the first of several clauses that allows for an EOT, as a result of a delay pertaining to the provisions of the specific clause. If the contractor was delayed due to late drawings and instructions, a claim for EOT can be submitted in terms of clause 1.9. It would firstly be determined whether the contractor gave notice of a possible delay if the required information was not issued within a reasonable time. If notice was not given the impact will be considered in terms of clause 20.1, which provides for the engineer to take into account the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim. If it is found that by providing timeous notice of the information required the delay could have been prevented it is likely that no EOT will be awarded.

The second step will be to determine whether the content requirements of the notice were complied with. Clause 1.9 states that the notice should include the following:

- Details of the necessary drawing or instruction,
- Details of why and by when it should be issued, and
- The nature and amount of the delay or disruption likely to be suffered if it is late.

If the notification did not include the above mentioned content requirements the impact of the non-adherence would again have to be considered in terms of clause 20.1.

The final consideration would be to establish whether the engineer's failure to provide the drawing or instruction late was caused by an error or delay by the contractor. If this was the case, the contractor would not be entitled to an EOT.

4.6.2.2 RIGHT OF ACCESS TO SITE

Clause 2.1 provides for the contractor to claim for an EOT if access to the site was provided later than the time stated in the contract data. If it can be established that the right of access was delayed, it would be necessary to determine whether the delay was not caused by the late submission of the performance security by the contractor. If this was the case an EOT would not be considered; as the employer may, according to clause 2.1 withhold possession of the site until the performance security has been received

If the employer's failure was as a result of an error or delay by the contractor the EOT would not be awarded.

4.6.2.3 SETTING OUT

According to clause 4.7, the contractor is entitled to an EOT if a delay is suffered as a result of an error on a specified setting out reference provided by the employer. However, the clause provides for a further condition that an experienced contractor should not have been able to discover such an error and avoided the delay. It should be considered whether the contractor used reasonable effort to verify the accuracy.

4.6.2.4 UNFORESEEABLE PHYSICAL CONDITIONS

If the contractor is delayed by unforeseeable physical conditions, clause 4.12 provides for a means to claim for EOT. The clause requires the contractor to give notice of the unforeseeable physical condition, as soon as is practicable. The purpose of the notice is for the engineer to be informed that he can inspect the conditions to determine whether it was unforeseeable. If the notice was not given, the provisions of this clause were not met.

The second decision required would be to determine whether the content requirements of the notice were complied with. Clause 4.7 states that the notice should include the following:

- A description of the physical conditions, so that they can be inspected by the Engineer; and
- The reasons must be set out why the contractor considers them to have been unforeseeable.

If the notification did not include the above mentioned content requirements, the impact of the non-adherence would have to be considered in terms of clause 20.1, which provides for the engineer to take into account the extent (if any) to which the failure has prevented or prejudiced a proper investigation of the claim.

The next consideration would be to establish if the physical conditions were unforeseeable. The information available to the contractor at the time of tender should be taken into account, in order to determine if the physical conditions were unforeseeable.

4.6.2.5 FOSSILS

Clause 4.24 makes provision for an EOT if the contractor was delayed by the discovery of fossils, coins, articles of value or antiquity, and structures and other remains, or items of geological or archaeological interest. The contractor shall, upon discovery of any such finding, promptly give notice to the engineer, who shall issue instructions for dealing therewith it. It should be considered whether the contractor gave notice of the discovery. If notice was not given the impact would be considered in terms of clause 20.1 which provides for the engineer to take into account the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim. Should timeous notification by the contractor have resulted in the delay being reduced or eliminated, this would be considered when assessing the EOT.

The next consideration would be to determine whether the contractor was delayed by the discovery. If the contractor was delayed and the notification was provided the provisions of the clause were complied with.

4.6.2.6 TESTING

According to clause 7.4, the contractor can ask for an EOT if a delay was suffered, as a result of testing required, or as a result of a delay for which the employer is responsible. As a starting point, it should be considered whether a delay was suffered as a direct result of the instruction for testing. However, if the tests show that the tested plant, material or workmanship was not according to the contract, the EOT will not be considered; as this would not be classified as an employer's responsibility, as required by the clause.

4.6.2.7 DELAYS CAUSED BY AUTHORITIES

Delays caused by authorities would be considered according to clause 8.5 as a cause of delay, provided the following conditions are met:

- The contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities in the country;
- The authorities delayed or disrupted the contractor's work; and
- The delay or disruption was unforeseeable.

Compliance to these conditions should be considered. The first would be to determine whether the contractor followed the procedure of the relevant authorities. If the procedure were not followed, an EOT would not be considered; as the delay was not caused by the authorities, but rather as a result of the inaction of the contractor. If the contractor had followed the procedures the next consideration would be to determine whether the delay was foreseeable. If the delay was not foreseeable, the provisions of the clause were complied with.

4.6.2.8 CONSEQUENCES OF SUSPENSION

Clause 8.9 provides for the contractor to request for an EOT, if a delay was suffered as a result of the suspension and/or from the resumption of the work. However, the clause would not allow for an EOT to be considered if the delay was as a result of the following:

- Making good of the consequences of the contractor's faulty design, workmanship or material; or
- The contractor's failure to protect, store or secure in accordance with clause 8.8 (suspension of the work).

It should be considered whether a delay was suffered as a result of the suspension and/or from the resumption of the work after suspension. In addition, it should be established whether the suspension was not as a result of any wrong doing on the part of the contractor. If the contractor was not responsible for the suspension, then the delay is excusable.

4.6.2.9 INTERFERENCE WITH TESTS ON COMPLETION

According to clause 10.3, if the contractor is prevented, for more than 14 days, from carrying out the tests on completion, by a cause for which the employer is responsible, and the contractor suffers delay, the contractor is entitled to an EOT.

The first consideration, would be to determine whether interference with the tests delayed the contractor for more than 14 days. If this was indeed the case, the next decision would be to determine whether the delay was as a result of a cause that the employer was responsible for. If this answer is in the affirmative, the delay can be accepted as being an excusable delay.

4.6.2.10 ADJUSTMENT FOR CHANGES IN LEGISLATION

If there are changes in the laws of the country, or in the judicial or official governmental interpretation of such laws, after the base date of the contact, that delay the contractor clause 13.7 provides for an EOT to be considered in this regard.

It should firstly be determined whether the contractor suffered a delay as a result of a change in legislation. If the contractor was delayed, the next consideration would be to determine whether the change in legislation took place after the base date of the contract. If the change in legislation took place before the commencement of the project the contractor should have been aware of the impact; and the EOT is unlikely to be awarded. If the change in legislation took place after the base date the next decision will be to determine whether the relevant delay had not already been taken into account in the determination of a previous EOT. If the delay had not been previously taken into account the delay can be considered as excusable.

4.6.2.11 CONTRACTOR'S ENTITLEMENT TO SUSPEND WORK

Clause 16.1 allows the contractor to suspend the work after giving at least 21 days notice in the event of a failure in terms of the following clauses:

- If the engineer fails to certify, in accordance with clause 14.6 [Issue of Interim Payment Certificates]; or
- The employer fails to comply with clause 2.4 [employer's financial arrangements] or clause 14.7 [payment]

The clause also gives the contractor the entitlement to claim for an EOT if the suspension of the works caused a delay. It should first be determined whether the contractor suffered a delay as a result of the suspension. The second consideration would be to determine if the contractor was entitled to suspend the work in terms of clause 14.6, clause 2.4 or clause 14.7. If the contractor was entitled to suspend the work, the third consideration would be to determine if the contractor provided at least 21 days notice of the planned suspension. If all these conditions were met the provisions of the clause were complied with; and the delay would be deemed excusable.

4.6.2.12 EMPLOYER'S RISK

Clause 17.3 stipulates 8 different risk events for which the employer is responsible for. Clause 17.4 provides for an EOT if the contractor suffers a delay as a result of any of the employer's risks. If any of the risk events occur, the clause requires the contractor to promptly give notice to the engineer.

As a starting point is should be determined whether the contractor suffered a delay as a result of any of the employer's risks provided for in clause 17.3. If this is not the case, the cause of the delay would not be excusable in terms of the provisions of this clause. If the delay is attributable to one of the employer's risks the next decision would be to determine whether the contractor promptly gave notice to the engineer as required by clause 17.4. If notice was not given, the impact will be considered in terms of clause 20.1, which provides for the engineer to take into account the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim.

If the contractor complied with the provision to promptly notify the sub-contractor, the provisions of the clauses were complied with; and the cause of the delay can be viewed as excusable.

4.6.2.13 FORCE MAJEURE

Clause 19 allows the contractor to submit a claim for an EOT for the following force majeure events:

- War, hostilities (whether war be declared or not), invasion, act of foreign enemies;
- Rebellion, terrorism, sabotage by persons other than the contractor's personnel, revolution, insurrection, military or usurped power, or civil war;
- Riot, commotion, disorder, strike or lockout by persons other than the contractor's personnel;
- Munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the contractor's use of such munitions, explosives, radiation or radio-activity; and
- Natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

According to clause 19.1, the force majeure is not limited to these events, as long as the exceptional events or circumstances comply with the following criteria:

- They should be beyond a party's control;
- Which such party could not reasonably have provided against before entering into the contract;
- Which, having arisen, such party could not reasonably have avoided or overcome, and
- Which is not substantially attributable to the other party.

It should be considered whether the event causing the delay is listed as part of the force majeure event in clause 19.1. If the event was not explicitly mentioned, it should then be established whether the criteria for exceptional events and circumstances had been met. If this was not the case, the provisions of the clause were not met.

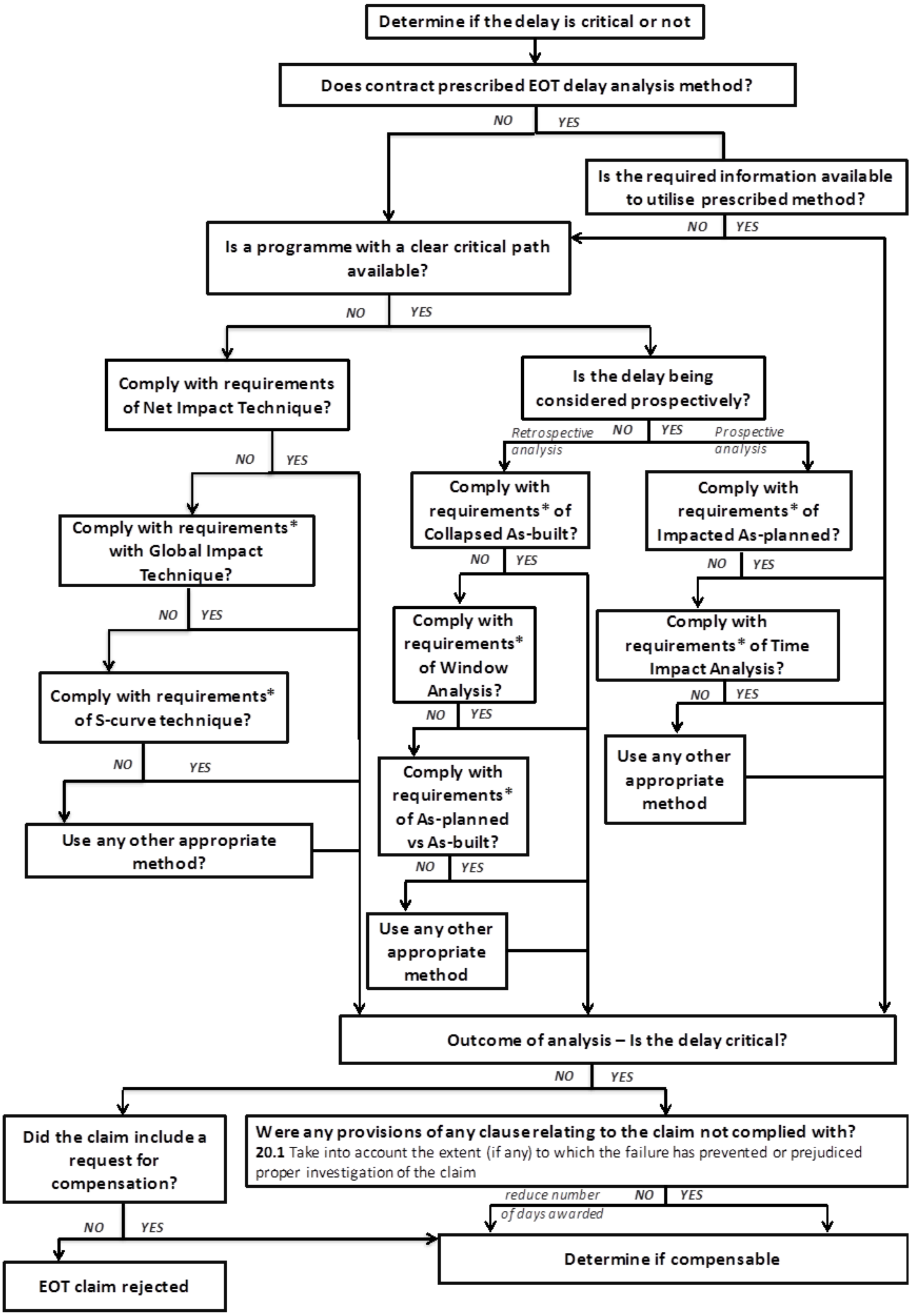
If the event is a force majeure event, the question should be asked whether notice was given within 14 days of becoming aware of the event as prescribed by clause 19.2. If notice was not given, the impact would be considered in terms of clause 20.1, which allows the engineer to take into account the extent (if any) to which the failure has prevented or prejudiced any proper investigation of the claim.

Clause 19.3 requires that reasonable steps should be taken to minimise the delay. The next consideration would be to determine whether steps were taken to minimise the delay. If no steps were taken, the above stated provision of clause 20.1 would again be applicable.

If the various requirements in terms of force majeure events were met the delay can be considered as an excusable delay.

4.6.3 DETERMINE WHETHER THE DELAY IS CRITICAL (STEP 3)

Criticality is indirectly discussed in clauses 8.4 and 17.4. of FIDIC. Both these clauses make reference to circumstances, which would delay completion. The contractor would only be entitled to claim for an EOT for events, which would result in a delay of completion, or in other words for critical delays. According to clause 20.1, the engineer shall respond to the claim, indicating whether the claim is approved or disapproved, and must provide detailed comments. No mention is made of the DAM to be utilised to come to a conclusion in terms of approval or disapproval. The choice of the specific DAM is left to the discretion of the engineer. A decision tree can be utilised to assist the engineer to choose the most appropriate DAM for the specific delay. Section 4.4.3 provides a detailed description of how a decision-tree methodology can be followed to identify the most appropriate DAM. The same decision tree can be utilised in the selection of a DAM in this instance: (refer to Figure 24)



**Utilise supplementary decision tree to test compliance*

Figure 24 – Decision tree: FIDIC determine whether delay is critical

The selected DAM will be applied; and it will firstly determine whether the delay was critical; and secondly, it would also provide an indication of the number of days on the critical path.

The decision tree would also take into account whether any provisions of any of the clauses relating to the claim were not complied with. If this were the case, the extent (if any) to which the failure has prevented or prejudiced the proper investigation of the claim should be taken into account, in accordance with clause 20.1. This assessment might lead to the reduction in the number of days awarded, or if non-compliance made it impossible to properly investigate the claim; it could result in the claim being rejected.

If the delay is not critical; and would therefore not delay the practical completion, the EOT claim can be rejected. However, if the delay is critical, the next step would be to use a decision tree to determine whether the delay is compensable.

4.6.4 DETERMINE WHETHER THE DELAY IS COMPENSABLE (STEP 4)

Contrary to some of the other construction contracts, the award of an EOT claim in FIDIC does not automatically include the payment of compensation under certain circumstances. The contractor should, in accordance with clause 20.1, give notice within 28 days of becoming aware of an event that might result in additional costs. In practice, it is likely that a claim for EOT in terms of clause 20.1 would also include a claim for compensation. It is possible, but unlikely, that separate claims for compensation and EOT would be submitted for the same event. A number of clauses make provision for the contractor to claim for additional costs. Section 2.8.3.3 provides a summary of the clauses with this specific provision.

The FIDIC does not require the delay to be critical for compensation to be claimable. Even though the delay might not be critical, it would be required to assess whether compensation is payable. The decision tree determining whether the delay is critical allows for an assessment to determine whether the compensation is payable, when the delay was found to be critical and when the delay was not found to be critical.

The decision tree determining the need for compensation would firstly consider whether the provisions of the clause providing for compensation were complied with. If the provisions were complied with, then compensation is payable. The specific clause would provide guidance on how the compensation should be determined.

If the provisions of the clause were not complied with, the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim should be taken into account, as stipulated by clause 20.1. The outcome of the assessment might result in the compensation being reduced or not awarded. (Refer to Figure 25)

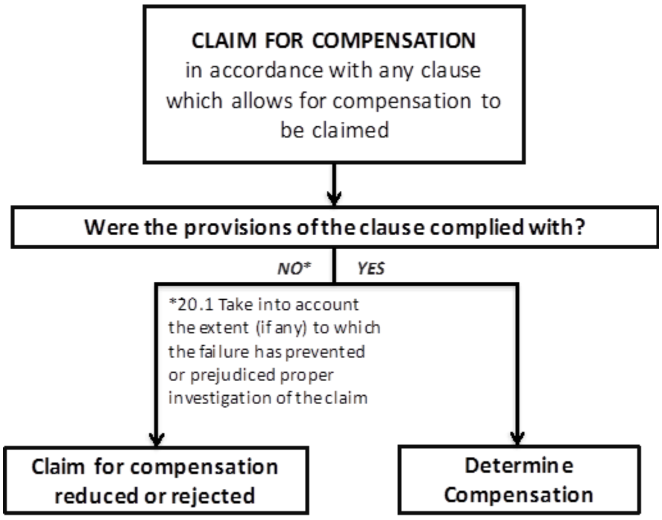


Figure 25 – Decision tree: FIDIC determine whether delay is compensable

CHAPTER 5 - **FINDINGS**

5.1 INTRODUCTION

The aim of this chapter is to present the evidence of the findings of the focus groups and of the interviews, which were conducted as part of the research process. The purpose of the chapter is not to summarise all aspect of the findings, but rather to focus on the contributions received during the focus-group and interview processes. It is important that this chapter should be read in conjunction with Chapter 4, where it was explained how the findings, together with the relevant literature, culminated in the final decision trees. The input received by means of the focus groups and interviews was instrumental in the development of the final decision trees. To avoid the unnecessary duplication of the decision trees, as discussed in Chapter 4, the findings are presented on the basis of summarising the responses to questions that were raised during the focus groups and the interviews.

The focus groups were structured in such a manner so as to group together specialists on each of the three construction contracts independently. In each of these sessions, the universal decision-tree framework and the decision trees of the specific contract, the participants – who were specialising therein – were discussed. Please refer to section 3.3.3 for more detailed information on the focus groups and the interviews.

Both the interviews and focus-group sessions started with a short presentation on the following:

- The purpose of the research;
- The purpose of focus groups/interviews in the research process;
- A basic explanation of the research method; and
- A basic explanation of decision trees.

The participants were invited to raise questions in terms of clarity, relating to the agenda items presented. (Refer to Appendix B for a copy of the agenda.) The interaction continued by posing specific questions to the participants relating to the elements that were influential in the initial development of the decision trees. The initial decision trees that were developed, by means of the literature review, were then presented. The participants were allowed to comment and deliberate on the decision trees. In most cases, consensus was reached among the participants in terms of the possible changes.

The proposed changes were recorded and reviewed after the focus group or interview. The decision trees were then amended to incorporate the proposed changes.

5.2 UNIVERSAL DECISION-TREE FRAMEWORK

The following questions were posed in discussing the universal decision-tree framework:

a) What should be considered in general if (EOT) claims are assessed?

According to the responses received, the most significant consideration would be general compliance with the contract. A suggestion was made that one of the starting points in the assessment process would be to identify all the clauses in the contract pertaining to the claims process. Compliance with these clauses should be confirmed.

In addition, some of the participants remarked that it is important to determine if the delay was on the critical path. In response, other participants explained that in the case of disruption claims, a delay in the critical path is not necessarily a requirement.

b) Do you agree that the following will be the main decisions in the assessment of EOT claims?

i. Assess the contractual compliance
ii. Determine whether the delay is excusable
iii. Determine whether the delay is critical
iv. Determine whether the delay is compensable

All the participants agreed that the assessment of the contractual compliance, and to determine whether the delay is critical, are some of the main decisions that would be required. In general, consensus was also reached that a decision on criticality is necessary if a delay is required for an EOT claim, which does not merely rely on a disruption as the main cause of delay. However, the term 'excusable delay' was not understood by the majority of the participants. After an explanation of the term, the participants agreed that it is important to consider the ownership of risk (whether the delay is excusable) during the EOT-assessment process.

c) In what sequence would the decisions be made?

The participants were of the opinion that the sequence of the decisions would not impact on the ultimate outcome. No specific views were expressed by the focus-group participants, or during the interviews, on the sequence of decision-making during the assessment process. It may be assumed that the proposed sequence discussed was acceptable.

d) Please comment on the proposed universal-decision tree.

The participants of the focus groups and of the interview process largely agreed with the decisions included in the decision tree. Some views were again expressed in terms of the use of the word “excusable delay”. A suggestion was made to rather refer to contractor’s risk. This suggestion was considered; but it was decided not to include it in the final decision tree; as the term “excusable delay” is widely accepted.

The general layout and flow of decision-making in the decision tree were accepted – except for a suggestion to add confirmation within step 4 of the awarding of the EOT. The final decision tree was amended to include this suggestion.

5.3 JBCC CONTRACT COMPLIANCE DECISION-TREE FRAMEWORK

a) Would non-compliance to the contractual conditions result in the rejection of the claim?

The consensus view expressed was that it is difficult to generalise; and the compliance should be reviewed on a clause-by-clause basis.

b) Should the claim be rejected if it is not submitted within the 40-day time limit in terms of clause 23.6?

The participants were in agreement that the outright rejection of the claim due to non-compliance should be viewed with caution. Even though the JBCC provides for the rejection of the claim under certain circumstances relating to the time bar, the common law provisions in this regard should be considered. It is an accepted principle supported by case law that in a scenario where the client is responsible for the delay; and the contractor does not adhere to the time bar, that the claim should not be rejected; as the client would then benefit from his own failure to comply.

c) Should the claim be rejected if the content requirements in terms of clause 23.6 are not adhered to?

It was noted that the principal agent has a duty to request additional information; if it was not supplied with the original claim submission. It would be problematic to reject the claim on the basis that the requirements mentioned in clause 23.6 were not adhered to. Should the required information, after a request by the principal not be provided, the claim would be assessed on the basis of the original information provided. It might be that the delay cannot be sufficiently substantiated, due to the lack of information; and this would then lead to the rejection of the claim.

d) Should the claim be rejected if the contactor did not provide proof that reasonable steps had been taken to avoid the delay in terms of clause 23.4.1?

The participants concluded that the specific circumstances causing the delay should be considered. In most cases, if it is found that the contractor did not take reasonable steps to reduce the delay, the number of days awarded would be reduced accordingly.

e) Should a comment be provided on the JBCC contract compliance-decision tree?

The following amendments to the decision tree were proposed by the participants in the interviews and the focus groups:

- The decision tree should provide for the provision in clause 23.6 that the principal agent can allow for the claim-submission period of 40 days to be extended.
- Non-compliance with the 40 day-claim submission requirements, or any extended period, would not lead to the rejection of the claim.
- Non-compliance with the claim content requirements stipulated in clause 23.6 would not lead to an outright rejection of the claim.
- Provision needs to be made in the decision tree for the duty of the principal agent to ask for additional information if this was not provided in the original claim submission.
- Should this information not be provided, the decision tree should provide for the reduction of the number of days awarded – and not the outright rejection of the claim.

The proposed amendments were incorporated in the final decision tree.

5.4 JBCC EXCUSABLE DELAY DECISION-TREE FRAMEWORK

a) Can the definition of excusable delay be utilised as the final test to determine whether the delay is excusable?

Most of the participants were in agreement that the definition of excusable delay can be utilised as an additional test, if clauses 23.1, 23.2 or 23.3 are not of assistance in making a final decision.

b) Please comment on the JBCC excusable-delay decision tree.

No significant suggestions for specific amendments to the decision tree were made. Some of the participants questioned the inclusion of the provision in the decision tree to test the validity of the delay against the definition of excusable delays. However, no opinion was expressed on whether this should be removed from the decision tree.

5.5 JBCC CRITICAL DELAY DECISION-TREE FRAMEWORK

a) Please comment on the JBCC critical-delay decision tree.

The general layout and flow of the decision tree was accepted by all the participants. Only one amendment to the decision tree was suggested:

- The provision contained in clause 23.4.1 that the contractor should take reasonable steps to avoid or reduce the delay, should be incorporated at the end of the decision tree.
- Non-compliance with this provision would not necessarily lead to the rejection of the claim; but in most cases to the reduction of the number of days awarded.

The proposed change was incorporated in the final decision tree.

5.6 JBCC COMPENSABLE DELAY DECISION-TREE FRAMEWORK:

a) Comment on the JBCC compensable-delay decision tree.

The general layout and flow of the decision tree was accepted by all the participants; but the following additions were proposed:

- The decision tree should test whether the cause of the delay was due to the employer and/or the agents.

- If the delay was caused by the employer and/or the agents, the delay would be compensable.
- Provision should also be made to determine whether the delay circumstances justify the adjustment of the contract value in terms of clause 23.3.

The suggested changes were incorporated in the final decision trees.

5.7 GCC CONTRACT COMPLIANCE DECISION-TREE FRAMEWORK

a) Would non-compliance with the contractual conditions result in the rejection of the claim?

The participants were of the opinion that non-compliance with the contract conditions could not be universally addressed. The circumstances and the relevant contractual clause would impact on the decision.

b) Should the claim be rejected if it is not submitted within the 28-day time bar in terms of clause 10.1.1?

Some of the participants were of the opinion that clause 10.1.1 is very clear in this regard and the non-compliance with the 28-day time bar is sufficient reason for a claim to be rejected. The participants with a legal background differed. They were of the opinion that the principal in law that a person should not benefit from his own wrongdoing would be applicable provided the delay was caused by the client only.

c) Should the claim be rejected if the contractor did not submit monthly updates in terms of clause 10.1.3; and these are not adhered to?

The consensus opinion was that the lack of monthly updates would not necessarily lead to the rejection of a claim.

d) Should the claim be rejected if the contactor did not comply with the claim content requirements, in terms of sub clauses 10.1.1.1.1 – 10.1.1.1.4?

Most of the participants were of the opinion that the claim content requirements might impact on the outcome of the claim; but an immediate rejection, as a result of the non-compliance with the content requirements by the contractor, would not be valid.

e) Should comments be provided on the GCC contract compliance with the decision tree?

Comments on the decision tree centred on the issue of non-compliance with the contract conditions. The following changes were proposed:

- The flow of the decision tree would be improved if a decision were added to establish whether the delay is of an ongoing nature, or not.
- Non-compliance in terms of the provision of monthly updates should not result in a rejection of the claim.
- If a contractor did not comply with the claim content requirements, the claim should not be rejected for this reason only.

The suggested recommendations were incorporated in the final decision tree.

5.8 GCC EXCUSABLE DELAY DECISION-TREE FRAMEWORK

a) Can the definition of excusable delay be utilised as the final test to determine whether the delay is excusable?

The participants expressed the view that the definition is very similar to the content of sub clause 5.12.2.4; and as a result, it would not serve a purpose to utilise the definition to determine whether a delay is excusable, or not.

b) Comment on the GCC excusable-delay decision tree.

The following recommendations were made to improve the decision tree:

- The first consideration in the decision tree in terms of clause 5.10.1 (employer's delay) should not be independently considered as the first decision.
- The second consideration in the decision clause 5.12.2 (additional work) should rather be utilised as the starting point.
- A decision should be introduced to consider sub clause 5.12.2.3 (any provision of these conditions, which allows for an extension of time).
- Finally, the resulting consideration should be whether the delay is as a result of any disruption beyond the contractor's control (sub clause 5.12.2.4).

The final decision tree was updated to reflect the proposed changes.

5.9 GCC CRITICAL DELAY DECISION-TREE FRAMEWORK

a) Please comment on the GCC critical-delay decision tree.

It was noted by one of the focus-group participants that when assessing EOT claims, a programme with a clear critical path would not necessarily be available. The critical path methods included in the decision tree would not be of any assistance if the required programme information is not available. As a result, the following addition to the decision tree was suggested:

- The decision should make provision for the non-critical path methods for instances where a programme with a clear critical path is not available.

The suggested addition was incorporated in the decision tree.

5.10 GCC COMPENSABLE DELAY DECISION-TREE FRAMEWORK

a) Please comment on the GCC compensable- delay decision tree.

The GCC deals with compensation in a simplistic manner; and no significant comments were made by the participants. The proposed decision tree was accepted without any changes.

5.11 FIDIC CONTRACT COMPLIANCE DECISION-TREE FRAMEWORK

a) Would non-compliance with the contractual conditions result in the rejection of the claim?

The participants pointed out that in general terms, non-compliance with the contractual conditions relating to EOT claims should be dealt with in terms of clause 20.1. This clause provides for the extent to which the failure by the contractor has prejudiced the proper investigation from being considered.

b) Should the claim be rejected if a notification is not submitted within the 28-day time bar in terms of clause 20.1?

The majority view was that the provision in clause 20.1 is sufficiently clear, so that a claim would not be considered if the notification was not submitted within the 28-day period. However, it was also mentioned that the reference in the clause that the 28-day period would commence, once the contractor becomes aware of the delay, allows for some flexibility in the application of the time bar.

c) Should the claim be rejected if the contractor did not submit within the 42-day time bar in terms of clause 20.1?

The participants remarked that the 42 days were not a time bar. The claim cannot be rejected if the 42-day period was not complied with. In such a case, the impact of the contractor's failure for not complying with the 42-day requirement should be considered in terms of clause 20.1.

d) Should the claim be rejected if the contactor did not comply with the interim requirements in terms of clause 20.1 (b)?

The participants again made reference to the provision in clause 20.1; and they noted that the claim should not be rejected if the interim requirements were not complied with.

e) Provide comment on the FIDIC contract compliance-decision tree.

The following proposals were made to improve the decision tree:

- Non-compliance with the 42-day deadline for the submission of the claims should not result in the rejection of the claim.
- The decision tree should not indicate that the claim would be rejected if the contractor did not comply with the interim requirements.
- The decision tree should not indicate that the claim would be rejected if the contractor did not submit the claim within 28 days of the approved deadline.

The recommendations were taken into account; and the decision tree was updated accordingly.

5.12 FIDIC EXCUSABLE DELAY DECISION-TREE FRAMEWORK

a) Can the definition of excusable delay be utilised as the final test to determine whether the delay is excusable?

Most of the participants were not against the use of the definition. However, views were expressed that the relevant contract clauses would be sufficient to determine whether a delay is excusable, or not.

b) Please comment on the FIDIC excusable-delay decision tree.

Several changes to the decision tree were suggested. The structure and flow of the decision tree had to be changed significantly, in order to make provision for these changes. The proposed changes included the following recommendations:

- Thirteen different clauses make provision for the entitlement to EOT. These clauses should be incorporated in the decision tree.

- Clause 17.3 (Force majeure) is one of these clauses; and it should not be shown separately in the decision tree; but it should rather be incorporated into the decision tree together with the other clauses.
- Clauses 8.4 (a) to (d) would all require a different decision path; and these should therefore be dealt with as separate branches in the decision tree.
- Clause 13.3 (variation procedure) should also be dealt with as an independent branch of the decision tree.

5.13 FIDIC CRITICAL DELAY DECISION-TREE FRAMEWORK

a) Please comment on the FIDIC critical-delay decision tree.

Some very valuable comments were received that necessitated changes to the final decision tree. The following comments were taken into account in the formulation of the final decision tree:

- One of the participants in the interview process remarked that in some cases, it is not necessary to do a critical-path analysis. For example, the late handover of the site to the contractor could easily be substantiated without the need for a critical-path analysis. As a result, the decision tree was amended to cater for non-critical path DAMs.
- Non-compliance with any provision of any clause relating to the claim in terms of clause 20.1, would not necessarily lead to the rejection of the claim; but in most cases, it would lead to a reduction in the number of days awarded. This should be considered as part of the decision tree.

5.14 FIDIC COMPENSABLE DELAY DECISION-TREE FRAMEWORK

a) Please comment on the FIDIC compensable delay-decision tree.

The general layout and flow of the decision tree was accepted by the participants. The following recommendation was made that impacted on the final decision tree:

- The section of clause 20.1 allows for the impact – to which the failure of the contractor has prejudiced the proper investigation of the claim – to be taken into account. This provision could possibly impact on the compensation; and it should be considered as part the decision tree.

5.15 CONCLUSION

The contributions received during the focus groups and the interview processes were essential in shaping and refining the final decision trees. The participants consulted in the course of the process possessed a very high level of knowledge on the forms of contract considered. Some of the participants were involved in the drafting and updating of these forms of contract. A common view was shared that the decision trees would be of great value to assist practitioners with the assessment of EOT claims.

CHAPTER 6 - **CONCLUSION**

6.1 INTRODUCTION

The assessment of an EOT claims as part of a construction project can have far-reaching consequences. For the contractor, the rejection of EOT claims might have a significant impact on the financial success of a project and the profitability of his business. Late completion of the project might lead to reputational damage for the contractor; and it might also impact on future business opportunities. If an EOT claim is not accepted, it might result in the contractor being forced to accelerate the work, which would lead to constraints on resources and a higher risk of safety-related incidents occurring.

On the other hand, for the employer, the awarding of an EOT claim may increase the cost of the project and possibly impact on the financial success of the project. In commercial projects, the employer is likely to suffer further financial losses in the form of rental income. Reputational damage can also be a result; since the occupation by prospective tenants would have to be delayed. This, in turn, could influence the success of future developments of the employer. The financial success of the employer's business might also be influenced.

In major projects time-related preliminary and general costs can very significantly aggregate the negative impact for the contractor and the employer. With so much at stake, it is understandable that EOT claims were found to be a major source of disputes in the construction industry. The proper and transparent assessment of EOT claims is therefore an essential component in the success of any project.

The assessment of EOT claims can be a daunting task – not only because of the severe impact the outcome of the claim would have on the parties involved, but also as a result of the many complexities faced in the assessment process. Although construction contracts feature in the curriculum of many built-environment qualifications, the assessment of EOT claims is seldom adequately addressed. For a number of reasons, common construction contracts do not venture into the realm of prescribing the process to be followed in the assessment of EOT claims. As a result, practitioners would normally be faced with a significant challenge when assessing EOT claims.

The main purpose of the research was to provide a user-friendly guideline to assist practitioners to navigate this potential minefield of complexities in the process of the assessment of EOT claims.

In concluding the research, this chapter will start by providing a summary of the findings. The main thesis statement will be addressed by summarising the conclusions of the study. The outcome of the research has practical implications; and for this reason, suggestions for the application of the decision-support framework will be discussed. A brief summary of the contributions of the research is provided; and the chapter concludes with some recommendations for further research.

6.2 SUMMARY OF FINDINGS AND CONCLUSIONS

An action-research approach was followed to achieve the main objectives of the study. This approach yielded a number of conclusions, which assisted in shaping the decision-tree analysis frameworks for EOT claims. The iterative process assisted in streamlining the decision trees – to produce a tool that can be used in practice.

The starting point was to conduct a comprehensive literature review, in order to produce the relevant decision-support frameworks for EOT claim analysis in the form of decision trees. The data gathered as part of the action research process contributed to the objective of providing a decision-support tool that could be effectively utilised in practice. The participation of practitioners regularly involved in the assessment of construction-delay claims was of much value. Focus groups, consisting of industry practitioners with specialist knowledge in construction contracts contributed to the development of the decision-support framework, and ultimately to the findings.

The primary data collected and the in-depth literature review yielded the following findings:

6.2.1 MAIN CAUSES OF DELAYS

In general terms, reasons for delays impacting on the completion date of construction contracts can be summarised in three main categories: contractor delays, client delays and external factors – where neither the contractor, nor the client are directly responsible for the delay. EOT claims would only be considered for two of the three categories: client delays and external factors – where neither party is responsible.

It was evident from the review of local and international studies that delays remain very prevalent in construction projects. Variation orders were the predominant cause of client delays – with an occurrence level of approximately 58%. Late payment of the contractor, long waiting times for the approval of drawings, slow decision-making and incomplete or poor quality drawings were also significant causes of delay with an occurrence level of approximately 17%. Inaccurate estimates, late site handover, poor co-ordination and inadequate supervision by the design team impacted on progress to a lesser extent, with an occurrence level of approximately 8%.

The review of the external causes of delay revealed that the shortage of construction material was the predominant cause of delay – with an occurrence level of approximately 25%. In addition, price fluctuations, unforeseen site conditions and slow approvals by government organisations, also contributed to the prevalence of delays, with an occurrence level of approximately 17%. Force majeure, labour disputes, inclement weather, confined site conditions and general disputes had a lesser impact, with an occurrence level of approximately 8%.

6.2.2 LEVEL OF GUIDANCE FOR THE ASSESSMENT OF EOT CLAIMS

Guidance available to practitioners involved in the assessment of EOT claims tends to be fragmented in nature and would typically investigate one of the aspects in isolation. Although there is an abundance of studies dealing with the various issues to be considered during the EOT claims process, little information is available in terms of an overall guidance framework or procedure to follow to assist practitioners to assess EOT claims. The following studies conducted would provide limited guidance:

- Moselhi and El-Rayes (2002) and Bubbers and Christian (1992) attempted to provide guidance in the process of assessing EOT claims by making use of computer-based systems.
- Moselhi and El-Rayes (2002) developed a computer-based system, named WEATHER, to quantify the impact of weather conditions on construction productivity, project schedule and associated delays.
- Bubbers and Christian (1992) made use of a hypertext-information system to assist in the analysis of claims by informing contractors, owners, and their representatives of the contract provisions.
- Braimah (2008) developed a model for the selection of an appropriate EOT claim-assessment method.
- The UK's SCL It has developed a Delay-and-Disruption Protocol. The purpose of the protocol is to provide good practice guidance for construction delays and disruptions.

6.2.3 EOT CLAIM-ASSESSMENT REQUIREMENTS

One of the important considerations of the main decision-support framework was to determine the specific assessment requirements in the process of evaluating EOT claims. The views expressed in the literature on the requirements were substantiated and supported by the different focus groups. The literature, the focus groups and the interviews identified the following essential requirements that an EOT claim should meet, in order to be successful.

- The delay should be critical;
- The delay should be excusable; and
- The contractual provisions should be complied with.

6.2.4 COMPONENTS OF THE UNIVERSAL DECISION-TREE FRAMEWORK

One of the major conclusions was the development of universal decision-tree analysis frameworks for EOT claims. The universal nature of the decision tree framework allows it to be utilised as a holistic framework for any of the three different construction contracts reviewed. It was ascertained that the four main requirements for the assessment of EOT claims should be utilised as the main decisions in the decision tree.

In essence, a decision tree is a flowchart-like structure that shows the various outcomes from a series of decisions. The process of assessing EOT claims also requires a number of decisions to be considered. The following decisions were identified as the essential decisions required during the EOT claim-analysis process:

- Was the delay critical? (refer to Chapter 2, item 2.5);
- Was the delay excusable? (refer to Chapter 2, item 2.4);
- Were the contractual provisions complied with? (refer to Chapter 2, item 2.7); and
- Was the delay compensable? (Refer to Chapter 2, item 2.8).

These decisions were informed by the main requirements when assessing EOT claims.

6.2.5 SEQUENCE OF DECISION-MAKING

Decision trees are conceptually structured in such a way as to allow for sequential decision-making. It was, therefore, important to determine the sequence in which decisions should be taken in the universal decision-tree framework. After the consideration of several options in the focus groups, it was agreed that the level of effort required to come to an informed decision would be the most appropriate factor to determine the sequence of decision-making. The following sequence of decision-making steps was therefore recommended:

- Decision 1 – Were the contractual provisions complied with?
- Decision 2 – Was the delay excusable?
- Decision 3 – Was the delay critical?
- Decision 4 – Was the delay compensable?

6.2.6 CONTRACT COMPLIANCE

The first decision required in the universal decision-tree framework is to assess compliance with the conditions of the contract. The construction contracts reviewed all required compliance with specific contractual conditions relating to EOT claims. The contractual conditions focus in broad terms, firstly on the specific requirements relating to the delay notification, and secondly on the requirements in terms of the EOT claims.

The requirement for the contractor to notify, as soon as he becomes aware of a delay, is strongly enforced in FIDIC, GCC and JBCC. Non-compliance with the explicit requirements would probably lead to the rejection of the EOT claim. However, focus-group participants pointed out that, according to case law, the immediate rejection of the EOT due to the non-compliance with the notification time-bar is not advisable in cases where the delay can be contributed to the client or his agents action or inaction. In law, the client is not allowed to take advantage of his own wrong.

Other provisions in terms of the content requirements for claims are interim-delayed reporting and submission deadlines for claims that are not as strongly enforced by the different forms of contract. The GCC and JBCC are silent on the contractual remedy if the contractor does not comply with these requirements. FIDIC, on the other hand, allows the engineer to take into account the extent (if any) to which the failure of compliance with any claim-related provision in the contract has prevented or prejudiced the proper investigation of the claim.

6.2.7 EXCUSABLE DELAYS

The term excusable delay, although commonplace in the literature, was not recognised by all the participants in the focus groups. After an explanation of the term, consensus was reached that a delay needs to be excusable, in order to be considered in terms of an EOT claim. The FIDIC, GCC and JBCC deal with excusable delays in a similar fashion.

The JBCC provides a brief list of the excusable delays, which is further divided into compensable and non-compensable delays. In addition, a specific clause of the JBCC provides the opportunity to the contractor to claim for any other cause given when the delay is beyond the contractor's reasonable control, and could not have been reasonably anticipated and provided for.

The GCC provides a short list of three main excusable delays: abnormal climatic conditions, any clause of the contract allowing for EOT, and any disruption that is entirely beyond the contractor's control. A further 14 different clauses provide for an EOT when a delay is caused by the subject matter dealt with in the claim.

The FIDIC provides a list of five general causes of delay in the main EOT clause which can be classified as excusable. In addition 13 different clauses also provide for the entitlement to EOT in the case of certain circumstances.

The decision trees to determine whether the delay is excusable for the FIDIC, GCC and JBCC use the same main principle to determine whether a cause of delay is excusable; since the decision trees establish sequentially compliance with the lists of excusable delays.

6.2.8 CRITICAL DELAYS

None of the three forms of contract reviewed directly refer to the term 'critical delay'. FIDIC makes reference to circumstances, which would delay completion. The contractor would only be entitled to claim EOT for events, which would result in a delay to completion, or in other words, for critical delays.

GCC allows the contractor to claim for EOT for any circumstances that would actually extend practical completion of the works beyond the due completion date. The clause makes reference to a delay to practical completion, in other words a critical delay. Although the term 'critical delay' is not used in the JBCC, reference is made to a delay in the practical completion. It is, therefore, clear that critical delays are referred to.

Neither the FIDIC, GCC or the JBCC prescribed a specific DAM to be utilised to determine whether a delay is critical, or not. One of the main considerations in the decision trees dealing with critical delays is to identify the most appropriate DAM. The following factors were identified by means of the literature, as being the most significant in terms of identifying the most appropriate DAM:

1) Records' availability;

2) Baseline-programme availability;

3) The amount in dispute;

4) Nature of the baseline programme; and

5) Updated programme availability.

These factors were utilised in the decision trees to ultimately determine the most appropriate DAM.

It was found – through the focus-group consultations – that a programme with a clear critical path is not always available when EOT claims are being assessed. The decision tree was adapted to make provision for a non-critical path method to be chosen to assess the EOT claim, (refer to section 4.4.3).

6.2.9 COMPENSABLE DELAYS

According to the literature, compensation would have to be considered if a delay is found to be excusable. However, if an excusable delay is caused by factors beyond the control of the client and the contractor, compensation would not necessarily be due.

The three contracts under consideration differed in their approach to the application of compensable delays. The JBCC clearly differentiates between those delays which would attract compensation and those delays which are not compensable. In addition, a separate clause makes provision for circumstances, which are beyond the contractor’s reasonable control. In line with the literature, compensation would be payable if the delay is caused by the employer or his agents. If the delay was not as a result of the employer or his agents, the discretion is left to the principal agent to decide whether the circumstances justify the adjustment of the contract value.

Unlike the JBCC, the GCC does not distinguish between delay events for which the contract value would be adjusted (compensable delays) and delay events for which the contract value would not be adjusted (non-compensable). The GCC allows compensation to be paid in the event of any EOT.

Other than some forms of contract, FIDIC does not require a delay to be critical as a condition for a delay to be compensable. Specific provisions, which entitle the contractor to claim for the cost associated with a delay or a disruption, are contained in a number of clauses and clauses in the contract.

6.2.10 JBCC DECISION-TREE FRAMEWORK

A further outcome of the research was the development of an EOT decision-tree framework for the edition 6.1 of the JBCC. The decision tree followed the steps outlined in the universal decision-tree framework. The first decision tree considered compliance with the relevant notification and claim-related clauses. It was found that non-compliance with the contract clauses by the contractor do not necessarily lead to the rejection of claims. The only provision for outright rejection of an EOT claim was found to be non-compliance with the notification of delay requirement. However, even this provision should be dealt with carefully if the employer caused the delay.

The JBCC second decision tree verifies whether the cause of the delay is excusable. Three main clauses provide guidance in terms of excusable delays. It was found that if the cause of the delay was not mentioned in the first two clauses, the third clause provides delays to be excusable for any cause beyond the reasonable control of the contractor.

The third JBCC decision tree that was developed determines whether the delay is critical. In addition it was found that if the contractor did not take reasonable steps to reduce or avoid the delay, the principal agent can take this into account in the award. Finally, a decision tree to determine whether the delay is compensable was developed.

6.2.11 GCC DECISION-TREE FRAMEWORK

Decision trees for the assessment of EOT claims when making use of the GCC 2015 were also produced. Again the main steps prescribed by the universal decision tree framework was utilised as the basis for the different decision trees. The contract compliance decision tree assessed compliance in terms of the claim related clauses. As for the JBCC the only explicit provision for which the EOT claim can be rejected on the basis of non-compliance to contractual provisions was found to be the requirement to notify within a stipulated time period.

The next GCC decision tree considered if the delay can be categorised as excusable. Except for the main clause providing for the contractor to claim for EOT in the event of delays 13 other clauses scattered in the conditions of contract also make reference to this remedy if delayed. It was found that the decision tree should test the cause of the delay against all the clauses providing for excusable delays.

A decision tree to establish if the delay is critical was also developed for the GCC. As for the other forms of contract, the main consideration in this decision tree is to identify the most appropriate DAM.

The final GCC decision tree considered if the delay is compensable. This decision tree is very simple as the GCC provides compensation for all EOT claims.

6.2.12 FIDIC DECISION-TREE FRAMEWORKS

As for the other forms of contract, the main decision tree for FIDIC was in line with the major decisions taken as part of the universal decision-tree framework.

A decision tree was developed to test contractual compliance of the EOT claims. The procedural aspects, in terms of claims, are dealt with in one main clause in FIDIC. The decision tree considered both the contractual requirements in terms of the notification of delay and the EOT claim. It was found that non-compliance with the notification provision would result in the rejection of the EOT; but non-compliance with any of the claim-related provisions would not necessarily lead to the rejection of the claim.

In addition to the general clause allowing for the contractor to submit a claim for EOT 13 other clauses scattered in FIDIC also provide for EOT if the delay is as a result of the event described in the specific clause. It was found that these individual clauses also had a number of requirements to be addressed before the delay can be accepted as excusable.

The next main FIDIC decision tree considered whether the delay was critical. As for the other forms of contract, this decision tree's main focus was to assist in the process of choosing the most appropriate DAM. The final outcome of this decision-tree process was to establish whether the delay was critical.

It was found that, according to FIDIC, the entitlement to compensation is not automatically linked to the award of an EOT. The contractor should also follow the contractual procedures to notify whether the possibility of additional cost became evident.

6.3 SUGGESTIONS FOR APPLICATION OF RESEARCH

One of the main objectives was to produce a decision-support tool for the assessment of EOT claims. An action-research process was intentionally chosen to ensure that the decision-support framework developed would be applicable in practise. The following can be considered when the decision-support framework is applied for assessing EOT claims:

- Agreement should be reached between the contractor and the employer, or his agent that the decision tree framework would be utilised as the basis for the evaluation of EOT claims.
- The decision trees for the different steps in the evaluation process should be reviewed by the contractor and the employer, or his agent, before the commencement of the project to agree on the final decision trees to be utilised during the course of the project.
- Care should be taken that the decision trees utilised address the requirements of the specific form of contract for the project.
- The contractor should motivate EOT claims, using the decision trees as guiding templates for the claim submission.
- The employer's agent should assess the EOT claim by reviewing the decision trees provided by the contractor as part of the claim submission.
- Should the employer agent's interpretation of any of the decision trees provided differ from the contractor's submission, the employer's agent should produce an alternative decision tree.
- In response to the EOT, the employer's agent should provide feedback in the form of comments on the decision trees provided by the contractor.

Alternatively, the process can be applied as follows:

- Agreement should be reached between the contractor and the employer, or his agent, that the decision-tree framework would be utilised as the basis for the evaluation of EOT claims.
- Information required from the contractor to enable the employer's agent to develop the decision trees should be agreed upon.
- The EOT claim submission by the contractor should include the required information, as agreed.
- The decision trees for the different steps in the evaluation process should be developed by the employer's agent, in order to determine the validity of the EOT claim.

6.4 SUMMARY OF CONTRIBUTIONS

According to the literature, one of the common causes of disputes in construction projects is the assessment of EOT claims and that very limited guidance is available for the assessment thereof. Information, in terms of the different considerations relating to EOT claims, is available to some extent; but is insufficient to act as a guideline of what steps are required in the assessment EOT claims.

One of the main benefits of decision trees is that they are simple and easy to understand. The main objective of the study is to provide a user-friendly tool to guide practitioners in the assessment of EOT claims. It was important to provide a tool that can assist in the decision making with the added objective not to be over complicated which would negatively impact the potential use by practitioners. Classification trees, a type of decision tree, were identified as the most appropriate tool. Decision trees differ from flow charts mainly because flow charts are process driven. Decision trees on the other hand, provide guidance in terms of process flow and more importantly, also provide decision support. The decision trees make use of a sequential process, in order to consider different decisions. This is very much in line with the process normally followed in the assessment of EOT claims.

One of the main contributions of the study to original knowledge was the development of a universal decision tree framework for the assessment of EOT. The decision tree framework is unique in that it would assist practitioners holistically in terms of all considerations in the assessment process. Other forms of guidance produce to date are mostly focussed on assessment of the criticality of the delay.

Decision trees have been developed for the three different forms of contract, namely FIDIC, GCC and JBCC. For each of the different forms of contract, a number of decision trees is utilised to investigate the issues relating to contract compliance, in order to determine whether the delay is excusable, and to establish whether the delay was critical, as well as to address the issue of compensation.

The decision trees would hopefully assist in eliminating uncertainty in the assessment process of EOT claims by providing clear guidelines.

It is possible that the decision trees could, to some extent, assist in the standardisation of the assessment of EOT claims. Standardisation would have a number of benefits. One of the significant benefits would be that this could possibly reduce the number of disputes in EOT claims.

The main benefit of the decision-support framework is that it would provide a guideline with clear and easy to follow steps to assess any EOT claims. This could be of assistance to practitioners that are responsible for the assessment of EOT claims on projects.

The decision-support framework would also provide insight for contractors into the process of the assessment of EOT claims. This would hopefully lead to a better understanding of what is required to substantiate EOT claims, and to better quality claims being submitted.

6.5 SUGGESTIONS FOR FURTHER RESEARCH

The main objective was to provide a holistic guideline to assist in the assessment of EOT claims. The EOT assessment process addresses a large number of different aspects. It was not possible to do an in-depth analysis of each of the different aspects, partly because of time and practical constraints, and partly because too much detail would detract from the aim to provide an overall guideline with an emphasis on ease-of-use. As a result, several recommendations for further research can now be made:

- The decision trees for EOT claims can be developed for other forms of contract not dealt with in this study.
- The decision trees can be developed to simplify other contractual processes, for example, dispute resolution processes in different forms of contract.
- It can be investigated how decision trees could be utilised as a tool to assist in the analysis of disruption claims.
- It could be investigated how regression decision trees could be utilised to predict the outcome of EOT claims.
- Decision trees can be developed for the FIDIC form of contract specifically dealing with the clauses providing for an entitlement of additional costs.
- It can be investigated how decision trees could be of assistance to address the contentious issue of concurrent delays.
- It can be investigated how regression-decision trees could be utilised to predict the possible occurrence of different types of delay in projects.
- The comparison of projects, where the decision-tree support framework has been implemented with other projects, without making use of such a framework to determine the benefits of the decision-support framework.

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LIST OF APPENDICES

APPENDIX A

FOCUS GROUP AND INTERVIEW QUESTIONS

FOCUS GROUP AND INTERVIEW QUESTIONS

UNIVERSAL DECISION TREE FRAMEWORK:

1. What should in general be considered if construction extension of time (EOT) claims are assessed?
2. Do you agree that the following will be the main decisions in the assessment of EOT claims?
    a. Assess contractual compliance
    b. Determine if the delay is excusable
    c. Determine if the delay is critical
    d. Determine if the delay is compensable
3. In what sequence would the decision be made?
4. Provide comment on the proposed universal decision tree.

JBCC DECISION TREE FRAMEWORK:

5. What should be considered if construction extension of time (EOT) claims are assessed?
6. Do you agree that the following will be the main decisions in the assessment of EOT claims:
    a. Assess contractual compliance?
    b. Determine if the delay is excusable?
    c. Determine if the delay is critical?
    d. Determine if the delay is compensable?
7. In what sequence would the decision be made?

JBCC CONTRACT COMPLIANCE DECISION TREE FRAMEWORK:

8. Would non-compliance to the contractual conditions result in the rejection of the claim?
9. Should the claim be rejected if it is not submitted within the 40-day time bar in terms of clause 23.6?
10. Should the claim be rejected if the content requirements in terms of clause 23.6 are not adhered to?
11. Should the claim be rejected if the contactor did not provide proof that reasonable steps were taken to avoid the delay in terms of clause 23.4.1?
12. Provide comment on the JBCC contract compliance decision tree.

JBCC EXCUSABLE DELAY DECISION TREE FRAMEWORK:

13. Can the definition of excusable delay be utilised as final test to determine if the delay is excusable?
14. Comment on the JBCC excusable delay decision tree.

JBCC CRITICAL DELAY DECISION TREE FRAMEWORK:

15. Comment on the JBCC critical delay decision tree.

JBCC COMPENSABLE DELAY DECISION TREE FRAMEWORK:

16. Comment on the JBCC compensable delay decision tree.

GCC DECISION TREE FRAMEWORK:

17. What should be considered in if construction extension of time (EOT) claims are assessed?
18. Do you agree that the following will be the main decisions in the assessment of EOT claims:
    a. Assess contractual compliance
    b. Determine if the delay is excusable
    c. Determine if the delay is critical
    d. Determine if the delay is compensable
19. In what sequence would the decision be made?

GCC CONTRACT COMPLIANCE DECISION TREE FRAMEWORK:

20. Would non-compliance to the contractual conditions result in the rejection of the claim?
21. Should the claim be rejected if it is not submitted within the 28-day time bar in terms of clause 10.1.1?
22. Should the claim be rejected if the contractor did not submit monthly updates in terms of clause 10.1.3 are not adhered to?
23. Should the claim be rejected if the contactor did not comply with the claim content requirements in terms of clause 10.1.1.1.1 – 10.1.1.1.4?
24. Provide comment on the GCC contract compliance decision tree.

GCC EXCUSABLE DELAY DECISION TREE FRAMEWORK:

25. Can the definition of excusable delay be utilised as final test to determine if the delay is excusable?
26. Comment on the GCC excusable delay decision tree.

GCC CRITICAL DELAY DECISION TREE FRAMEWORK:

27. Comment on the GCC critical delay decision tree.

GCC COMPENSABLE DELAY DECISION TREE FRAMEWORK:

28. Comment on the GCC compensable delay decision tree.

FIDIC DECISION TREE FRAMEWORK:

29. What should be considered in if construction extension of time (EOT) claims are assessed?
30. Do you agree that the following will be the main decisions in the assessment of EOT claims:
    e. Assess contractual compliance
    f. Determine if the delay is excusable
    g. Determine if the delay is critical
    h. Determine if the delay is compensable
31. In what sequence would the decision be made

FIDIC CONTRACT COMPLIANCE DECISION TREE FRAMEWORK:

32. Would non-compliance to the contractual conditions result in the rejection of the claim?
33. Should the claim be rejected if a notification it is not submitted within the 28-day time bar in terms of clause 20.1?
34. Should the claim be rejected if the contractor did not submit within the 42-day time bar in terms of clause 20.1?

35. Should the claim be rejected if the contactor did not comply with the interim requirements in terms of clause 20.1 (b)?
36. Provide comment on the FIDIC contract compliance decision tree.

FIDIC EXCUSABLE DELAY DECISION TREE FRAMEWORK:

37. Can the definition of excusable delay be utilised as final test to determine if the delay is excusable?
38. Comment on the FIDIC excusable delay decision tree.

FIDIC CRITICAL DELAY DECISION TREE FRAMEWORK:

39. Comment on the FIDIC critical delay decision tree.

FIDIC COMPENSABLE DELAY DECISION TREE FRAMEWORK:

40. Comment on the FIDIC compensable delay decision tree.

APPENDIX B

AGENDA FOCUS GROUP MEETINGS

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DEPARTEMENT KONSTRUKSIE-EKONOMIE/
DEPARTMENT OF CONSTRUCTION ECONOMICS

AGENDA

Towards a decision framework for the analysis of construction delay claims

Focus Group Meeting 01

18 April 2016, 13:00

University of Pretoria, South Campus, Building 5

1	**Opening and Welcome**	
2	**Finalisation of agenda**	
3	**Purpose of Research/Focus Group**	Hendrik Prinsloo
4	**Research Method**	Hendrik Prinsloo
5	**Universal decision tree framework for EOT claims** **5.1 Presentation of decision tree framework** **5.2 Comments and discussion**	Hendrik Prinsloo
6	**FIDIC decision tree framework for EOT claims** **6.1 Presentation of decision tree framework** **6.2 Comments and discussion**	Hendrik Prinsloo
7	**GCC decision tree framework for EOT claims** **7.1 Presentation of decision tree framework** **7.2 Comments and discussion**	Hendrik Prinsloo
8	**Closure**	

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DEPARTEMENT KONSTRUKSIE-EKONOMIE/
DEPARTMENT OF CONSTRUCTION ECONOMICS

AGENDA

Towards a decision framework for the analysis of construction delay claims

Focus Group Meeting 02

21 April 2016, 09:30

University of Pretoria, South Campus, Building 5

1	**Opening and Welcome**	
2	**Finalisation of agenda**	
3	**Purpose of Research/Focus Group**	Hendrik Prinsloo
4	**Universal decision tree framework for EOT claims** **4.1 Presentation of decision tree framework** **4.2 Comments and discussion**	Hendrik Prinsloo
5	**JBCC decision tree framework for EOT claims** **5.1 Presentation of decision tree framework** **5.2 Comments and discussion**	Hendrik Prinsloo
6	**Closure**	

APPENDIX C

ETHICAL APPROVAL CONFIRMATION LETTER

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology

1956 – 2016
60
years of
Engineering Education

Reference number: EBIT/08/2016 18 April 2016

Mr HF Prinsloo
Department Construction Economics
School for the Built Environment
University of Pretoria
Pretoria
0028

Dear Mr Prinsloo,

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Ethics Committee refers.

1. I hereby wish to inform you that the research project titled "Towards a decision framework for the analysis of construction delay claims" has been approved provisionally by the Committee. If video/voice recording is to be used during interview, consent needs to be obtained from the participants. If this is the case, please update the informed consent form accordingly.

   This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Codes of Research Ethics of the University of Pretoria, if action is taken beyond the approved proposal.

2. According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of any member of the Faculty Committee who will deal with the matter.

3. The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof JJ Hanekom
Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

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Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie
Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo