



A COMBINED METHOD OF COLLAPSED AS - BUILT AND IMPACT AS PLANNED DELAY ANALYSIS METHODS FOR CONSTRUCTION PROJECTS.

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Abstract: Construction projects frequently have delays, hence many delay analysis methods have been developed to assess these delays. However, each approach has advantages, disadvantages, and requirements. Finding a single approach that works for all project participants in all situations is challenging. The nature, size, and complexity of the project determine the accuracy and time requirements of each approach. Collapsed as - built (CAB) delay analysis method is an analytical method with high accuracy. However, it is time-consuming, which is the major disadvantage influencing decision of time extension's evaluation, and thus adversely affects the disbursement of payments and the progress of work eventually. This research introduces an efficient, combined method, aimed at streamlining the delay analysis process by minimizing both effort and time investments. This approach mandates a synthesis of as-planned and as-built schedules, along with any modifications, and pertinent liability documents that enumerate critical delay incidents. Application of this combined method within a case study substantiates its efficacy for expeditious delay analysis. Findings generated through this combined method are precise, methodical, and offer a dynamic analysis. They afford a lucid, traceable analysis process that aligns seamlessly with the as-built schedule.

Keywords: (EOT) Extension of Time, (IAP) Impact as Planned, (DAMs) Delay analysis methods, Revised Schedule, (CAB) Collapsed as - built

1. Introduction

Construction conflicts can be both costly and adversarial, negatively impacting project performance if not promptly and effectively addressed. Given the multitude of stakeholders involved in construction projects, each with their own interests and benefits, the potential for conflicts is high [1–2]. Particularly, complex projects, typically executed over an extended period in an uncertain and multifaceted environment [3], tend to involve intricate activities with complicated conflicts.

Consequently, conflict becomes an inescapable aspect in the Architecture, Engineering, Construction and Operation industry. It not only tarnishes professional relationships and damages businesses [4] but also exhausts project resources, thereby posing significant challenges. This is further complicated as changes have cascading effects across multiple tasks [5]. Conflict, hence, also incurs high transaction costs, escalating the total project expenditure. Therefore, the environment of the project is best described as competitive, intricate and unpredictable, making a non-adversarial environment a rather elusive and impractical goal.

Construction conflicts have been investigated due to the paramount importance as well as the urgent need to discuss factors, and determined the factors affecting the delay analysis methods and compared common delay analysis methods [6]. Swift and provisional resolution of payment disputes, in complete compliance with the statutory adjudication regime, is crucial for maintaining cash flow for the project. [7–8] and maintains the regular delivery of payments to the contractor on time [9]. Delay in deciding on time claims need conflict settlement mechanisms for construction project [10] such as incorporating conflict management in relation to BIM to develop a conceptual framework for conflict management before escalating [11].

The objective of this paper is to introduce a proposed method of delay evaluation. This proposed method is a combination of the impact as planned delay analysis method and Collapsed As - Built delay analysis method. The literature review section presents the types of delay from views of liability, occurrences and effect – impact in section I, II and III respectively as well as general overview on the delay analysis methods along with advantages / disadvantages of Collapsed As - Built / impact as planned delay analysis methods in section IV.

Types of delays in construction projects have been studied in many researches as indicated in Figure 1. Types of delays were classified according to liability, occurrence, and effect-Impact.

2. Literature Review

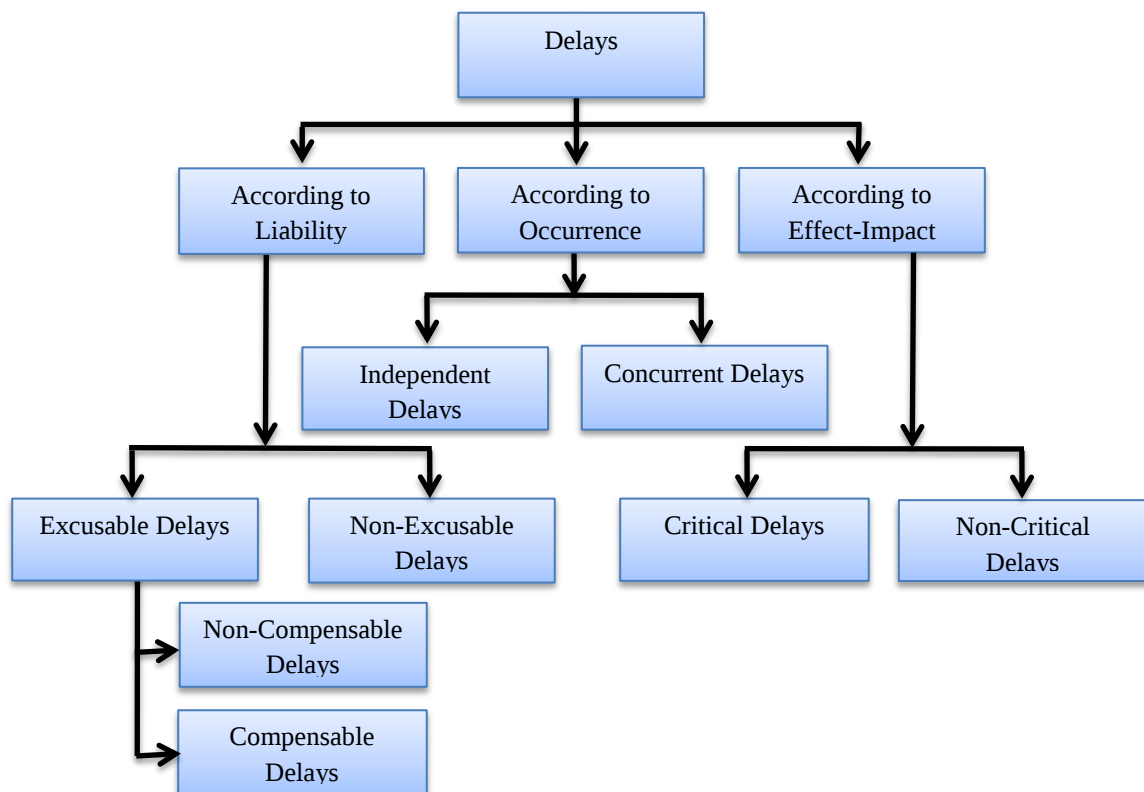


Fig 1. Types of Delays.

I. Critical and non-critical delays.

Critical delays, often resulting from external factors beyond the contractor's control (e.g. amendments to design material specifications during construction), extend the project completion date. Non-critical delays, on the other hand, do not affect the project's completion date [12]. Prior research has pinpointed construction delays as

crucial elements impacting construction projects [13]. Generally, the magnitude of delays and cost impact escalates with the residential projects' budget. Delays may result in loss and expense claims due to resultant delays and fluctuation claims, significantly influencing cost overruns.

II. Excusable and non-excusable delays.

Excusable delays, similar to critical delays, are prompted by factors beyond the contractor's control, such as force majeure events. Non-

excusable delays, however, solely fall within the contractor's liability [14]. The primary objective in construction projects is their time and budget completion. Delays often lead to cost overruns, instigating legal disputes among the contracting parties and affecting the project completion date. Thus, identifying the type of delay is a challenging yet vital component of claims analysis and evaluate the impact of delays [15]. The contractor is solely responsible for non-excusable overrun, which can neither be compensated nor excused. The causes of such delays include lack of appropriate project documentation, unavailable or limited mobilisation area, procurement delay issues, limited project coordination, delays in material fabrication, delays in the submission of design/shop drawings, poor planning estimation, issues in clearing customs, limited availability of rental equipment, poor labour productivity and limited availability of spare parts/tools [16].

III. Concurrent and non-concurrent delays

Many studies have examined concurrent and non-concurrent delays because of their effects on evaluating the excusable time and the amount of compensation for the contractor. Concurrent delays are caused at the same time two contracting parties. By contrast, non-concurring are caused separately by each contracting party [17]. A precise and comprehensive definition of concurrent delays is crucial for understanding delay concurrency, one of the most critical problems. The definition of concurrent delays has sparked considerable debate among researchers and analysts, with varying definitions reflecting differing perspectives on concurrency's occurrence.

Researchers studied delays from occurrence's perspective as indicated in Figure 2. According to Occurrence and categorised into independent, serial and concurrent delays [18], which are defined as follows:

- Independent delays occur in isolation and are not dependent on previous delays. The resulting delays in project duration can be calculated from the effect of independent delays.
- Serial delays result from the occurrence of many independent delays, the majority of which have occurred before the affected scope. For instance, the installation of Heating, ventilation, and air conditioning (HV/AC) ducts may be delayed due to the holding design or labour strikes.

- Main causes of concurrency caused when many unrelated delays happen in critical paths. For instance, the client may incur delays in approving shop drawings of steel structures, whereas the contractor may incur delays due to the errors of unrelated subcontractors. Both these events can delay the project completion.

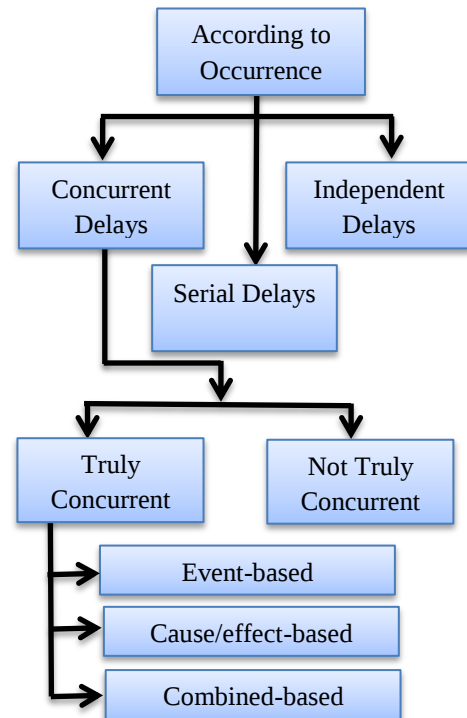


Fig 2. Types of Delays According to Occurrence

The concurrent delays may be categorised into the following:

- Truly concurrent: Two unrelated delay events are deemed truly concurrent when they occur within the same time frame, are partially overlapping and fall on critical paths.
- Not truly concurrent: Two unrelated events are deemed not truly concurrent when they are overlapping, with one critical delay.
- Non-concurrent: A delay is deemed non-concurrent when the effects of unrelated events do not affect the completion of project. The resultant delays are absorbed by the available float within the incurred network paths.

IV. Delay Analysis Methods (DAMs).

Numerous delay analysis methods (DAMs) exist, yielding reasonable outcomes in some instances and unsatisfactory results in others. However, irrespective of the chosen DAM, if the quality of project schedules or delay analysis is

substandard, the derived results will be unreliable. The selection of a suitable DAM is dependent on several factors, including the availability of a reliable baseline program, contemporaneous as-built records, value of disputes, time constraints, analysis timing, and the budget allocated for conducting the evaluation. The evaluation of overrun may be for the occurred events or expected events.

Prospective evaluation, undertaken during a delay within the project lifespan, anticipates events in the future as the delay's effects are yet to be fully realised. Conversely, retrospective analysis, performed after the manifestation of a delay event(s), examines past events during or after project completion. The terms 'prospective' or 'retrospective' relate to the timing of the analysis and whether delay impacts are known or not. Therefore, any expected delays that are known (e.g. updated as-planned vs. as-built) is deemed retrospective.

The frequent methodologies used for determining the extension of time include the s-curve, as-planned versus as-built which was described as the most popular method in construction industry [19] and time impact analysis which was recommended by [20] (TIA; including the contractors and the clients delays) methods. The results of many researches imply that both the contractors and clients prefer to use methods that are easy track the occurred delays and do not need complete records of the project [21]. The daily delay analysis as a flexible method that can allow for improvements, clearly illustrate the project progress and delays and improve the accuracy of the results [22] however, the risk events of the contractor should be considered, and a baseline should be set [23]. CAB method is a deductive method that is the exact opposite of the impacted as-built and TIA methods, which are traditionally performed on a single-base schedule. CAB depends on the simulation of a 'what if' scenario considering the actual start, finish and duration of activities [24].

DAMs have been investigated by researchers, the accuracy of 10 DAMs as presented in table1, including global impact, as-planned, as-built, impacted as-planned, TIA, but-for, isolated delay time window, window/snapshot, window/but and total float management, in measuring time delay,

concurrent delay and acceleration and found that the results of the window/but-for method are fairly accurate [25]. Many studies have highlighted the pros and cons of each analysis method, but none of these methods can offer a definitive solution to delay disputes in all project circumstances [26–27].

Table 1: Comparison Delay Analysis Methods

Delay Analysis Method	RT	CD	AC	PD
Global impact	N	N	N	A
As-Planned	N	N	A	N
As Built	N	N	A	N
Impacted As-Planned	A	N	A	N
Time impact	A	N	A	N
But-for	N	A	N	N
Window-IDT	N	N	N	N
Window-snapshot	A*	A	N	N
Window-But For	A	A	N	N
TF management	A	A	A	A

N :Not Acceptant CD :Concurrent delay
 A :Acceptant AC :Acceleration credit
 A* :Not accurate PD :Pacing delay
 RT :Real time delay IDT :Isolated Delay Type

The Association for the Advancement of Cost Engineering (AACE) protocol for forensic schedule analysis further divides retrospective delay analysis into 'observational' and 'modelled'. Observational methods scrutinise and compare the project schedule with others, like as-built schedules, without adapting them to simulate any scenario or delay events' impact. On the other hand, modelled methods involve inserting or removing delay events from the project programme or as-built schedule to simulate their impacts hypothetically, thereby allowing for a comparison between project and simulated schedules.

According to AACE's hierarchal nomenclature, analysis conducted during or after the project works is classified as prospective or retrospective, respectively. Although 'timing' may not necessarily be considered a layer, it provides a useful division regarding the analysis's timing or context. In the 'observational or modelled delay analysis' layer, 'observational' refers to the analysis or comparison of one programme with another, whereas 'modelled' implies that changes

are introduced into the programme to simulate specific scenarios, such as the insertion of a delay event to exhibit the event's effects before and after [28].

3. Methodology

The main objective of this research is to develop a combined method that combines more than one delay analysis methods.

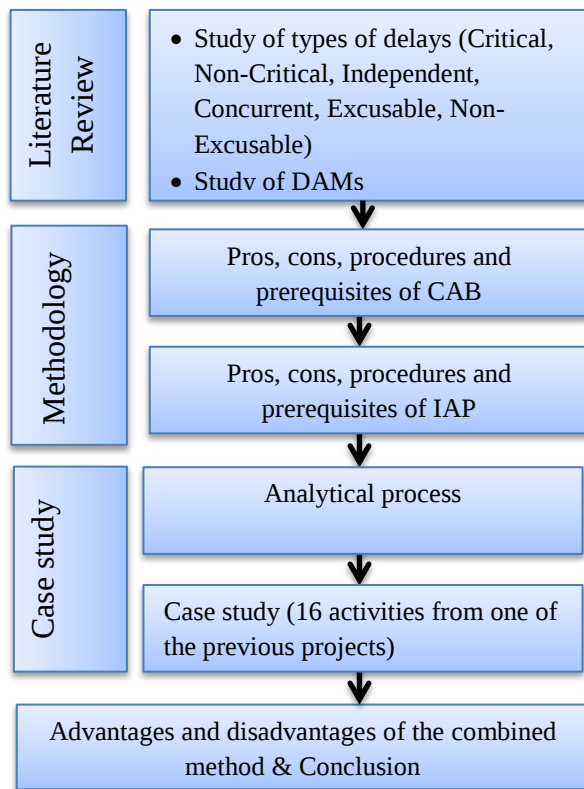


Fig 3. Research Methodology

The combined method allows the possibility of obtaining accurate and faster results. Therefore, the search steps are as shown in the figure. 3 Researchers proposed four points that can help delay analysts clarify delay-related problems: (a) the actions supposed to happen. (b) the actions happened (c) the differences between the actions supposed to happen and actions happened (d) the change of project's schedule [29]. The appropriate data collection method ought to be quick to respond to diverse conditions of the contract, acknowledge current case law, be applicable to projects of varying sizes and types, be adopted by both the contractor and employer. Many studies have attempted to improve and computerise DAMs given that several construction projects involve many complex activities. Some studies argued that no method for construction project delay analysis

is acceptable to all contracting parties (i.e., contractor, consultant, and client) because each DAM has its own advantages and disadvantages [30].

Therefore, a DAM should be selected on the basis of the project circumstances. Researchers also proposed an improved delay analysis method for construction projects based on Collapsed As - Built.

Cause and effect-based analysis method (CAB) is centred on the impact of a delay event on the project as actually executed. Similar to the as-planned versus as-built method, CAB is limited by its powerlessness to recognise concurrency or resource redistribution. This limitation becomes particularly evident when dealing with complex as-built logic, which demands a reconstruction of said logic. Some studies posit that CAB can generate accurate results, but this method overlooks changes in the critical path and the substantial effort needed to identify the as-built critical path [31]. CAB is often deemed the 'method of choice' when a project does not have an acceptable programme [32]. Notwithstanding acceptability of this method, the conventional CAB method (commonly referred to as the 'but for' method) has substantial disadvantages, including its unilateral focus on a single party's perspective and its powerlessness to precisely account for concurrency [33]. The contractor can frequently manipulate to conceal the impact of its own delay [34].

DAMs should consider the instabilities of activities' criticality whilst event(s) occur at the site. These methods may also produce inaccurate results if they are unable to correctly identify the changes in the critical path. Therefore, the CAB technique, although submerged in actual data, produces a theoretical result.

In Impact as Planned delay analysis method (IAP), one party's delays are inserted into new activities. In other words, this method is considered an additive methodology that mainly depends on adding a new activity / activities to the baseline schedule; these activities show the delay caused by the contract parties (i.e. contractor, consultant or client). The underlying principle of this methodology is that delayed activities are inserted into the baseline schedule [35]. Given its subjectivity and hypothetical (i.e. the actual on-site

progress is not reflected) nature, the IAP method is generally rejected by the courts. Some others studies for DAMs concluded that the IAP method is the least favoured of all these methodologies because of its theoretical basis of calculation. Moreover, all experts who participated in his survey did not recommend the IAP method and criticised its incapability of proving the delay impact. This methodology has also been rejected by many courts since the 1990s given its dependence on an as-planned plan to conclude the impact.

The IAP method is seen as the simplest DAM due to its minimal variable use to demonstrate a ‘what if’ theoretical scenario, it has also been criticised by many commentators whereby delay inserts as a sub-network and linked to other relevant activities [36], the SCL-Protocol, and courts, and its use is limited. This method is recommended only if no as-built programme or data are available and both parties agree to its use. However, to ensure more reliable results, it’s important that any known anomalies or errors in the baseline programme are corrected, preferably by mutual agreement between parties, before initiating any delay analysis.

The effect of excusable delays on the contractor’s work is thus demonstrated by contrasting the original as-planned completion date with the simulated IAP completion date. Despite ignoring the project progress, the IAP method also excludes the acceleration or delays during work when calculating the completion date. Instead, it calculates the forecasted extent of extension of time (EOT) due to excusable delays.

The resulting IAP is essentially a projection of the initial (or baseline) program, accounting for known excusable events. IAP can also form the foundation for calculating the contract duration at the project’s commencement.

Commonly used in the construction industry, the IAP analysis is a critical path method (CPM)-based approach to illustrate the impact of excusable delays on project completion. Recognised as the simplest form of CPM-based DAM due to its use of a minimal number of variables, it’s been widely adopted by contractors to demonstrate delay effects (Society of Construction Law).

A proposed method drawn from the but-for/collapsed as-planned method was an attempt to

improve the construction delay analysis. However, this method imposes many requirements for achieving an accurate delay analysis, including the baseline schedule, updated schedule/as-built programme, clear liability classification for each activity in the combined schedule and chronological order of delay events. To achieve an accurate delay analysis, researchers have recommended the development of a solid DAM that can meet the expectations of contracting parties [37].

4. The combined method of (CAB) Collapsed As Built and (IAP) Impact As Planned delay analysis method

A prominent theme in construction delay research is the development of a new model for delay analysis. The proposed method leverages the principles of the IAP method but commences with an as-built schedule since it reflects actual start and finish dates and actual duration. Hence, the proposed method retains the advantages of both CAB and IAP methods while mitigating their drawbacks. It can be regarded as a blend of the CAB and IAP methods. The proposed method adheres to the following concepts:

If no delay transpires for each analysis period, the project completion date is adjusted to a plausible date (CAB). This adjusted date establishes the new baseline for defining the delay impact, taking into account the liability of the client or contractor. Consequently, the difference between an impacted completion date of the project and the original dates caused by an analysed delay determines the delay responsibility for the analysed contract party. To improve clarity around liability associated with analysed activities, this enhanced method calculates the delay value under an extracting window, which can comprise several activities.

5. Analytical Process

Figure 4 illustrates the analytical procedures of the proposed method, which employs an as-built schedule as a reference point. This method conducts delay analysis to explicitly interpret the liabilities of the contract parties.

The proposed method segments the as-built schedule into manageable periods. At the commencement of each analysis period, it requires the modification of durations and logical relationships for activities before and after the time-point using the mechanisms delineated in the

following subsection. This adjusted schedule becomes the new basis for delay comparison. Like the CAB method, the proposed method conducts delay analysis from two distinct perspectives: those of the client and the contractor.

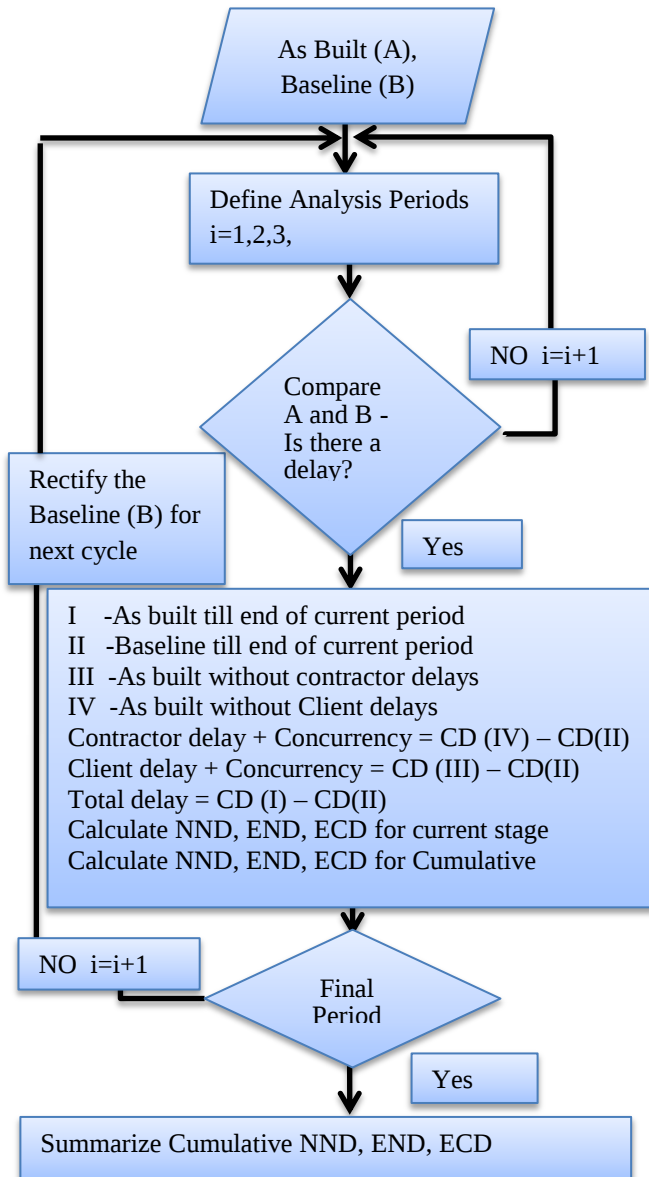


Fig 4. The analytical processes for the proposed method.

This method ensures the incorporation of excusable and non-excusable delays into the as-built programme to imitate the delay impacts from the perspectives of the contractor and the client, respectively. Consequently, from one viewpoint of analysis, delays caused by the other party are imposed on the adjusted as-built schedule.

Upon comparing the adjusted as-built schedule with a modified planned schedule, the time variance between the project completion date

on the adjusted as-built schedule and the date post-delay insertion is considered as the actual delay.

Ultimately, the proposed method assigns liability to each one by summarizing the delay values attributed to each party from each study period. For each analysis window, the proposed method calculates the expected project completion duration for the window baseline and contrasts it with the actual duration prior to the analysis of the time-point plus the as-planned duration. Excusable Non-Compensable Delay (END), Non-Excusable Non-Compensable Delay (NND), and Excusable Compensable Delay (ECD) are considered within each analysis window, after which the baseline is adjusted for the subsequent window analysis.

At the commencement date of each analysis scenario, the proposed method modifies start and finish dates, and durations, to analyse activities prior to the time-point by assuming their actual start dates, finish dates, and durations in the condition where no delay occurs from the previous period.

The proposed method utilises the same documents as the CAB method, including daily/weekly reports and the as-planned, as-built, and any revised schedules implemented during project execution. At a minimum, the as-planned and as-built schedules are required.

6. Case Study

I. Case Description

The case study consists of 16 activities, 4 activities related to client in one group and 12 activities related to contractor in two groups. These activities were excerpted from one of the previous projects which handled by an expert engineer in the construction industry. The project was (DB project) design and build project, in this type of projects, client allocate both design and construction to only one company (Riveros, C., et al, 2022). The actual dates for these activities and the rectified baseline / updated schedules are presented in figures 4,5 and 6.

II. Window 01 Analysis

The period for this window is from 01 Jan 2022 until 10 Jan 2022, and the activities 002, 003 and 004 were in progress in this period. Three paths were allocated in this window, two paths were critical and one path was non critical. The occurred delay in this window is 15 days (the

variance between the forecast completion date and the baseline completion date), this postponement allocated in the critical path related to contractor and 6 days delays allocated in the critical path

related to client as presented in figure 04. Amongst the delayed 15 days, 6 days have excusable and non-compensable delay (END) and 9 days have non-excusable and non-compensable delay (NND).

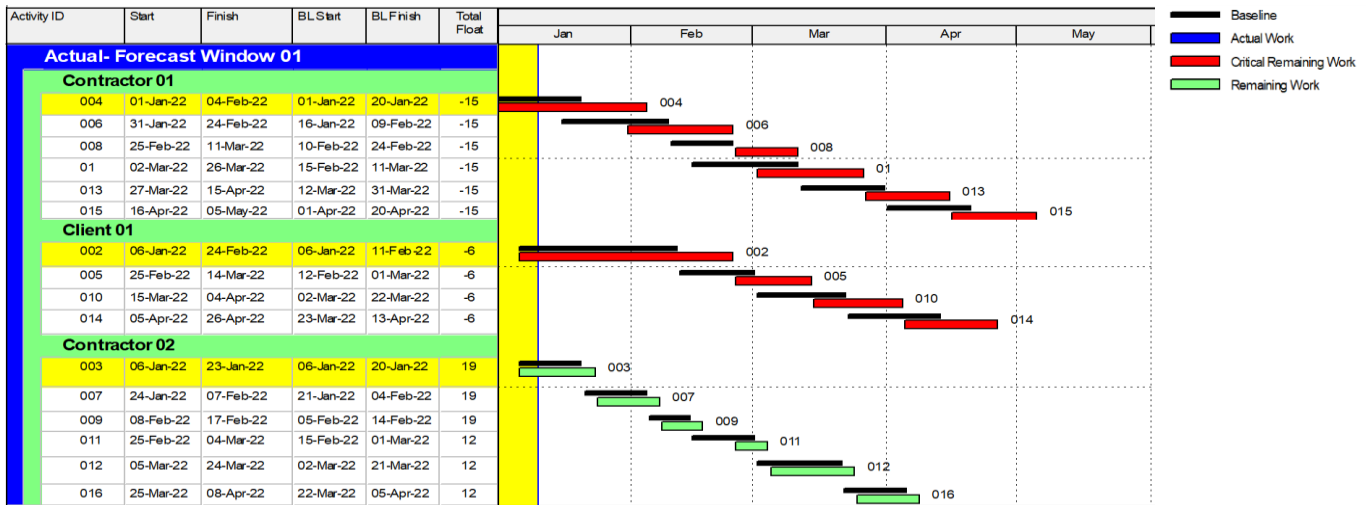


Fig 5. Actual and planned dates related to window 01

III. Window 02 Analysis

The period for this window is from 20 Feb 2022 until 01 Mar 2022, and the activities 002, 008 and 011 were in progress in this period. Three paths were allocated in this window, one path was critical and two paths were non critical. The occurred delay in this window is 2 days (variance between the forecast completion date for this

period and the forecast completion date of prior period), this delay allocated in the critical path related to contractor as presented in figure 05. The occurred delay in this window is 2 days, which have non-excusable and non-compensable delay as presented in table 2: Delay Analysis for Window 01, 02 and 03.

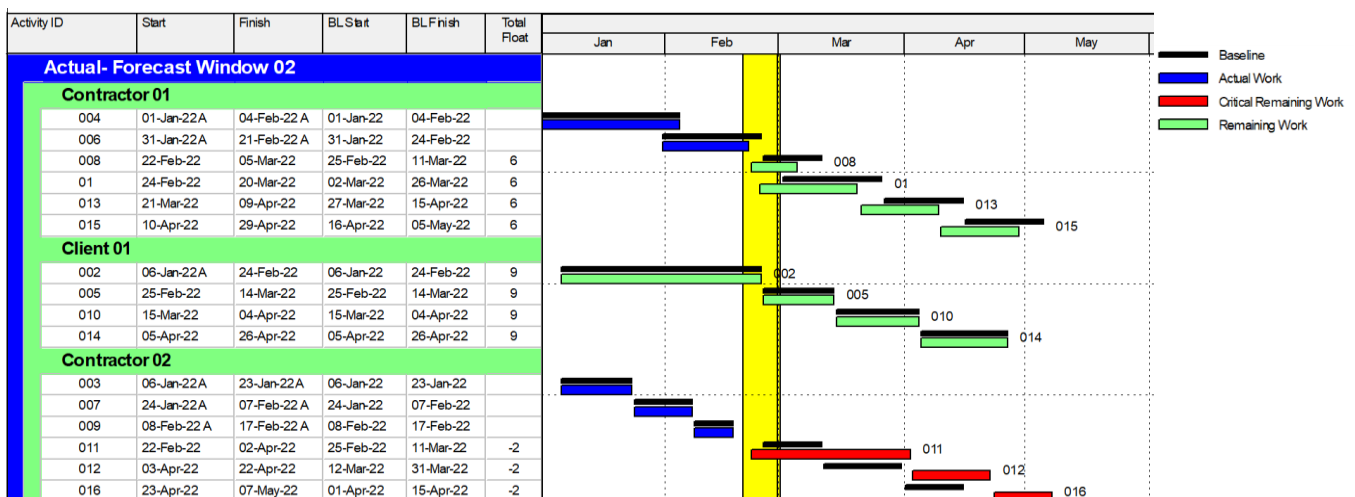


Fig 6. Actual and planned dates related to window 02

IV. Window 03 Analysis

The period for this window is from 11 Apr 2022 until 20 Apr 2022, and the activities 012, 014 and 015 were in progress in this period. Three paths

were allocated in this window, all paths were critical and the occurred delay in this window is 25 days (variance between the forecast completion

date for this period and the forecast completion date of prior period), this delay allocated in the critical path related to client. Amongst the delayed 25 days, 12 days have excusable and compensable

delay (ECD) and 13 days have excusable and non-compensable delay as presented in table 2: Delay Analysis for Window 01, Window 02 and Window 03.

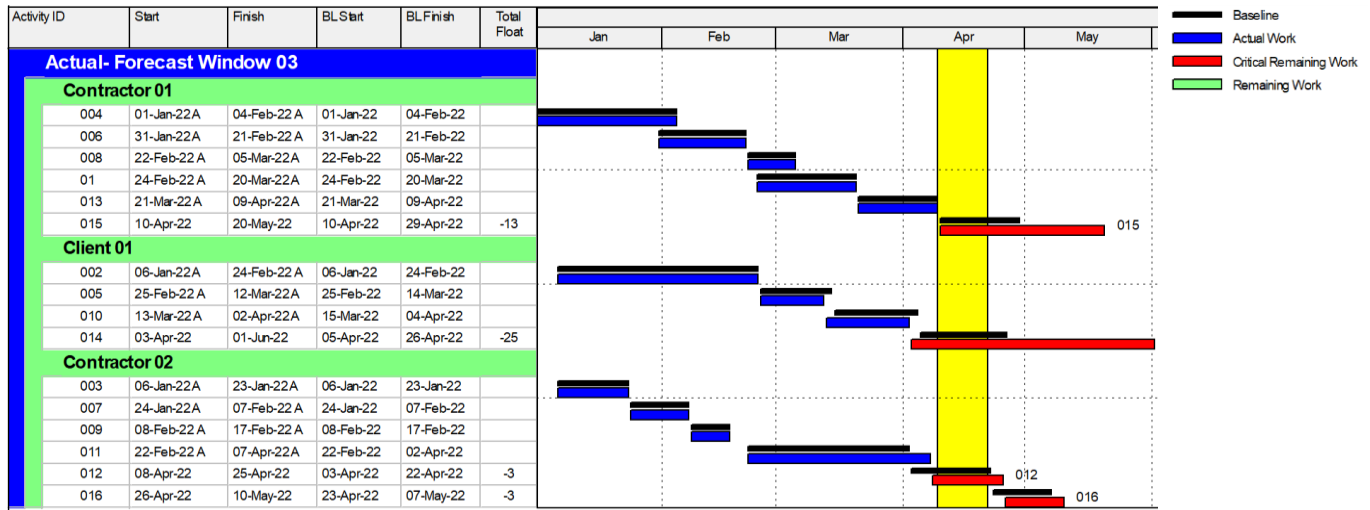


Fig 7. Actual and planned dates related to window 03

Table 2: Delay Analysis for Windows 01, 02 and 03

Window	Start	Finish	ID	Criticality	Responsibility	TD *	NND **	END **	ECD **
W1	1-Jan-22	10-Jan-22	004	Critical	Contractor	15	9	6	0
			002	Critical	Client	6			
			003	Non Critical	Contractor	-			
W2	20-Feb-22	1-Mar-22	008	Non Critical	Contractor	0	2	0	0
			002	Non Critical	Client	0			
			011	Critical	Contractor	2			
W3	11-Apr-22	20-Apr-22	015	Critical	Contractor	13	0	13	12
			014	Non Critical	Client	25			
			016	Critical	Contractor	0			

* TD: Total Delay

**NND: Non- excusable non-compensable delay, END: Excusable non-compensable delay and ECD: Excusable compensable delay.

7. Advantages and Disadvantages of the Proposed method

There is no definitive rule determining which method will yield the most accurate results. Nonetheless, the proposed method derives its methodology with the considerations of computerization suitability and computation consistency. Given that most construction projects are complex, often consisting of hundreds or thousands of activities, the proposed method offers

precise procedures to deliver perfect results for simple delay situations. For more complex delay circumstances, manual delay analysis may not be feasible, thus computerization becomes essential. This paper has constructed a procedural structure that can be applied within a computer system, thereby aiding delay analysis. Therefore, the proposed method has easier implementation than the CAB method given that its analytical windows are less. The proposed method has attempted to provide an alternative for helping delay analysis.

The proposed method has the following advantages similar to those of the IAP and CAB delay analysis methods:

- Analysis method, and it resolves concurrent delays.
- It is simple, quick and low cost and is easy to produce because it does not require analysing the same number of windows in the CAB.
- It is easy to understand and verify.
- The method offers a detailed, descriptive analysis with a definitive baseline schedule development algorithm. This is crucial for consistent delay analysis and forms the basis for the development of a computer-based delay analysis system.
- The delay analysis is grounded on the as-built schedule, which a contractor typically substantiates with daily construction reports or similar evidence. This enables tracking of delay

8. Conclusion

The prevalent problem with construction projects is delays. Therefore, it is critical to clearly define each contract's parties' obligations. To analyze and assess delays, several different techniques have been developed and are in use today. However, it is difficult to identify a delay analysis technique that is suitable for all delay situations and delivers the necessary accuracy with reasonable personnel effort. This study presents the combined delay analysis method. This process-based analysis method provides an accurate analysis using reasonable effort. It

9. Nomenclature

AACI	The Association for the advancement of cost engineering protocol for forensic schedule analysis
CAB	Collapsed As-Built Delay Analysis Method
CPM	Critical Path Method
DAM	Delay analysis methods
ECD	Excusable compensable delay

- It is a systematic and dynamic types, start and finish dates of actual activity and delay events.

- Its analysis results would provide a convincing outcome same as CAB delay analysis methods.

The proposed method still has the following limitations:

- It cannot resolve complicated delay situations, such as project acceleration
- Acceptance of each window delay analysis has to be obtained from parties (i.e. Contractor, Client, etc.) prior to continue analysing the next window.
- On the downside, the method necessitates as-planned and as-built schedules, and it classifies delay information with evidence of delays, which may not always be available.

offers a systematic analysis and easily traces delayed events using an as-built schedule.

The proposed method keeps the advantages of the CAB and IAP methods. Schedule delays in the construction industry typically arise from complex delay situations, result in various delay phenomena, and involve many project participants. Thus, a systematic and accurate delay analysis method is essential to resolve delay issues. The suggested approach cuts down on analysis time while keeping the same degree of accuracy as the CAB delay analysis approach.

END	Excusable non-compensable delay
EOT	Extension of Time
IAP	Impact as Planned Delay Analysis Method
NND	Non-excusable non-compensable delay
SCL	The Society of Construction Law
TIA	Time Impact Delay Analysis Method

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المخلص: التأخيرات شائعة في مشاريع البناء ، لذلك تم تطوير عدة طرق لتحليل التأخير لتقييم وحساب التأخيرات لمشاريع البناء. ومع ذلك ، فإن كل طريقة لها حدود وإيجابيات وسلبيات ومتطلبات مسبقة لكي يتم استعمالها. من الصعب إيجاد طريقة واحدة مناسبة لجميع أطراف المشروع تحت جميع الظروف. تختلف كل طريقة من حيث الدقة والوقت المطلوب لانتهاء التحليل بناء على خصائص المشروع (أي النوع والحجم والتعقيد). CAB هي طريقة تحليلية عالية الدقة والقبول. ومع ذلك ، فهي تتطلب وقت كبير للتحليل ، وهو العيب الرئيسي الذي يؤثر على قرار تقييم تمديد الوقت ، وبالتالي يؤثر سلباً على صرف المدفوعات وتقدم العمل في نهاية المطاف.

تقدم هذه الدراسة الطريقة المبسطة لـ Collapsed As - Built. الهدف الرئيسي من هذه الطريقة المبسطة هو تقليل الجهود والوقت المستهلك لإجراء تحليل التأخير. أثناء التحليل ، تتطلب الطريقة المبسطة مزيجاً من الجداول الزمنية المخططة والمعدلة (إن وجدت) والجداول الزمنية المحددة ووثائق المسؤولية المحددة مع أحداث التأخير الرئيسية لإجراء التحليل. وتطبيق الطريقة المبسطة لـ Collapsed As - Built وجد أنها فعالة لتحليل التأخير. النتائج التي توفرها الطريقة المقترحة للتحليل دقيقة ومنهجية وديناميكية ، وبالإضافة الي وصف تفصيلي يمكننا من متابعة المتغيرات الحادثة.

الكلمات المرجعية: (EOT) تمديد الوقت ، (CAB) مطوي حسب طريقة تحليل التأخير المبني ، (IAP) التأثير كما هو مخطط ،
(DAMs) طرق تحليل التأخير ، الجدول المعدلة

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