

Delay analysis Methodology in UAE construction Projects: Delay Claims, Literature Review¹

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Introduction

UAE is one of the pioneers among developing economies in the Middle East and the core for its development depends on the construction industry as an important sector. It is considered one of the largest sectors in the UAE economy; the government is spending billions of dollars every year in major projects; and in such environment, claims appear as an important factor increasing the possibility of project delays (Zaneldin, E.K., 2006). Some studies indicate that more than 50 % of the construction projects in UAE suffer from delays (Faridi, A.S. & El-Sayegh, S.M., 2006). And it is always a point of disagreement between parties about delays and causes of them, client and engineer trying always to mitigate delays to avoid giving the contractor extra money; on the other hand the contractor trying to impose the delays to get the maximum time and money. Claims industry in UAE is approximately 4 billion US dollars; it is really a big problem for projects and the industry, and claims management itself has real problems. (Enshassi, at. al., 2009)

Choosing the delay analysis is an important part of the claims industry. Many techniques are used in the UAE, and with the involvement of many factors the chosen practice became more important to define the delays. Contractors pay a lot to the specialist to prove their right using delay analysis methodologies DAMs and they submit this as extension of time (delay claim), trying to maximize their benefits. Meanwhile the client is trying to use other DAMs to try to neglect certain facts which increase the dispute with the contractor.

In this review we will discuss the delay claims in the construction industry in UAE and the approach for choosing delay analysis methodology.

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1. Literature Review

1.1 General Overview

Delay in construction projects is common, mainly no plan is executed as it had been planned, the construction projects focused to be completed on time, quality and within the cost. When there are project delays, a contractor raises a claim by asking for extension of time. Initiation of such claims is mostly due to its source and the involved parties' attitude (Lyers et/ al., 2008). Claims have direct effect on the projects, as they increase the risk of not completing on time and within the cost. Claims parties always have a dispute regarding many related items, especially the delay analysis methodology, each part trying to use the way which could maximize its benefits. This leads to more disputes and moving to arbitration or courts, which cost the project and the parties.

1.2 Claims

1.2.1 Claims as definitions

(Wood R.D., 2006) stated that the word "claim" comes from the old French word "claime", which is defined in the oxford English dictionary as a demand for something as due; an assertion of right to something. (Mbabazi, A., 2004) defines a claim as a written demand submitted by one of the contracting parties seeking additional money, time and other adjustment to a contract.

(Hughes, G.A., Barber, J.N., 1992) "Mainly the word claim is used to mean simply a request, demand, application for payment or notification of presumed entitlement to which a contractor, rightly or wrongly at that stage, considers himself entitled and in respect of which agreement has been reached.

(Sodhi, 1980) Claims on the Canadian Law Dictionary are defined as an "assertion to the right to remedy, relief, or property "or a "failure to fulfill obligations under the contract".

(Corbett, E.C. 1991) while commenting upon the procedures for claims under the FIDIC 4th edition , states "as the words claim and additional payment are not defined terms, the precise application of the clause is uncertain; it is necessary for a contractor to claim in circumstances where the entitlement is beyond dispute or triggered by, for example an Engineer's opinion'.

Claims could be classified as per (Wood R.D., 2006) to contractual claims and extra contractual claims, or as per (Hughes, G.A., Barber, J.N., 1992) to 3 types - the firstly claims under the contract; secondly claims under the common law, equitable and statutory remedies; and thirdly ex-gratia claims.

So by reading all these definitions they aren't the same but the meaning is almost the same.

1.3 Delays

1.3.1 Delays in construction industry

(Bramble, B.B. & Callahan, M.T., 1987) defines delays as the time during which some part of the construction projects has been extended or not performed due to certain circumstances. The society of construction law in its delay and disruption protocol (SCL, 2002) stated that the expression "delay to completion" should be defined as "either delay to the date when contractor planned to complete its works, or delay to the contractor completion date".

(Davenport,1995) stated that the time frame given to the contracts must be achieved by the contractor to complete the project and describe the importance of applying the law by giving him an extra time to complete it, if the employer caused a delay to the project.

Most published papers on delays in construction show that delays are common and happen in a majority of projects, in different size or degree (Assef, S. & Al-Hejji, S., 2006; Alaghbari et al., 2007; Sweis et al. 2008).

Even the project management discipline has developed techniques for managing delays when they happen (Carmichael, S. & Murray, M., 2006); and the characteristics of delay in construction as per many researchers views could be due to, but not limited to; involvement of many stakeholders, complexity of project, uncertainty of project conditions (Kao & Young, 2009; Arditi & Pattanakitchamroon, 2008; Faridi & El-Sayegh, 2006; Yasser Soliman 2002).

In research for (Koushki et al., 2005) in Kuwait, he found that 56% of the studied samples experienced delay. In another case from Jordon (Al-Momani, A.H., 2000) worked at 130 projects, he found that 106 of them experienced delays. He connected delays with some factors like design mistakes, changes, procurement and more, (Odeh, A.M.& Battaineh,H.T. ,2002) criticized Al-Momani and added some factors to the delays causes like site management, and they executed a survey to recognize the causes of delay in Jordon construction. They grouped them into 8 categories, depending on relationships to client, contractor, consultant, material, labour, contract, contractual and external.

(Sweis et al., 2008) made a study through survey to identify the major causes of claim in Jordon as well. His results were more related to financial issues like the lack of funds and shortage of manpower, also adding poor planning and scheduling by the contractor.

Threes studies from 2000 till 2008 show differences in expert opinions about the causes, which show the importance of research and applying new methods in delay analysis. (Faridi& El-Sayegh, 2006) advised in their study that owners should incorporate scheduling & control requirement in the contract documents.

Delays according to (Turner,1990) may be caused by the contractor, employer or some external events, and the contractor is only entitled for extension of time (EOT) when the delay affects the critical path

1.3.2 IN UAE

In the construction industry in UAE as we noticed, the management of claims and delays is not compliant with international standards and best practices. This may be because the professionals have a limited knowledge in this area, and many contracts have been modified to omit the parts which could help in solving the delays and disputes, especially the delay analysis techniques and acting like delays do not exist.

Employers try to minimize the cost of extra claims by contractors by avoiding the right analysis of the claims, and claims become a negotiation paper more than actually applied. Most contractors are submitting claims to avoid penalties from the Employer, and the same employer puts penalties to avoid the claims.

The study of this field becomes more important, especially in the absence of sufficient research volumes for UAE construction industry.

2 Types of Delays

Different types of delays could be classified according to figure 1

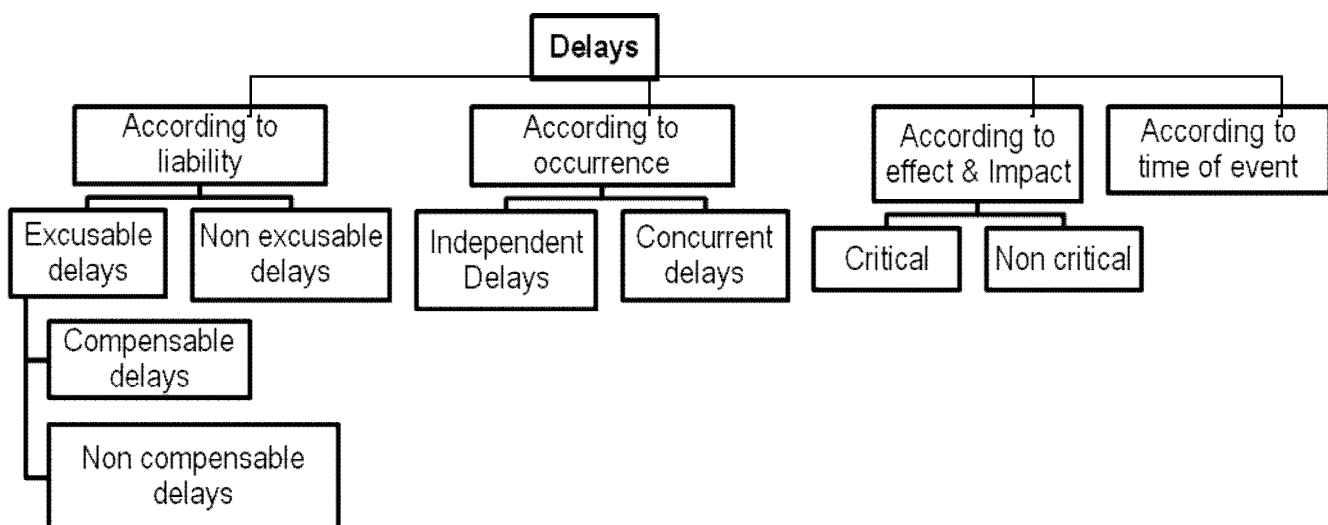


Figure 1, the delay categories (Saad Hegazy, 2011)

2.1 According to liability

Excusable delay is “a delay to completion which is caused by matters deemed to be outside the control of the contractor” (Pickavance,K, 2005). Such delays excuse the contractor from performing the contract on time and give him the right to have extra time, whatever delays was depends on an act of god like weather or contract provision, and owner changes of scope. There are 2 types of excusable delays:

- **Compensable** delays caused by the owner or the owner’s representative “in some special circumstances, a compensable delay does not always mean that additional time is due. Sometimes only additional costs will be compensable” (Callahan et al, 1992), (Williams, 2003) specified them as the client’s fault and automatically gives the right for extension of time to the contractor and to recover his damages as well; in such delays the client can’t force the contractor to recover this delay as such recovery may need acceleration plans which cost money. These types of delays are common in the UAE.
- **Non compensable** delays caused by a third party, like the weather problems, and each party should carry its share; in this case “the contractor is entitled to a time extension without the recovery of associated cost of damages” (Leon 1987). Or as (Pickavance, 2005) explained that each party is to absorb its own losses, these delays are usually the force majeure like bad weather or fires (Iyer, et.al., 2008) and also this type is applicable in the UAE.

Non excusable delays result from contractor risk and the client compensates his losses according to liquidated damages. As they are purely the contractor’s fault, like the delays in execution, design, lack of labour, or project management problems (Iyer, et.al., 2008); in such case the contractor won’t get either extra time or money .

2.2 According to occurrence

Independent Delays occur as the result of another delay (Leon, 1987), like the delay of owner because of contractor bad management. **Concurrent** delays consist of two or more independent delays that occur at the same time as a result of different causes (Leon, 1987); generally the contractor receives an extension without cost and the owner doesn’t receive liquidated damages, however with (Rubin,1983) explanation for the three cases.

2.3 According to effect & Impact

Some delays affect the whole project and some not, and they can be classified as per (Brimah, 2008) as critical and noncritical. Critical are the delays which extended the project duration (Callahan et al, 1992), while noncritical affect the activities with float on the time schedule and not pushing the dates forward. We should note the dynamic of

the activities on the schedule as while time running some noncritical changes become critical as (Cushman et al., 1996) (cited in Williams et al 2003).

2.4 According to time of event

It is usual in construction projects to witness more than one delay, and some of them occur at the same time. (Brimah, 2008) identified 3 types of delays according to time independent, serial and concurrent while there was a difference in recoding between (Kartam, S. 1999) and (Araditi D. & Pattanakitchamroon, T., 2008) that the last referred the concurrency to the events regardless of the causable party.

3 Delay analysis Methodologies

“The task of investigating the event that led to a project delay for the purpose of determining the financial responsibilities of the contracting parties arising from the delays” (Ndekurghi et al. , 2008) (Hegazy T. & Zhang K. , 2005 (Araditi D. & Pattanakitchamroon, T., 2006) categorized the accepted professional delay analysis to 4 categories:

- A. The as-planned vs. as-built schedule analysis method.
- B. The impact as-planned schedule analysis method
- C. The collapsed as-built schedule analysis method
- D. The time impact analysis method (Windows Analysis)

While (Farrow, 2001) Grouped them to 2 main groups

- I. Theatrical based methods which include
 - Global impact method
 - net impact method
 - as-planned impacted method
 - planned but for method
 - as-built but for method

These methods depending as shown on the theoretical impact of delay at the project

- II. Actual based methods which include
 - Actual based method
 - Windows/snap-shot or update methods
 - Impact/update method

These methods seek to show what already happened and push the analyst to investigate the real causes of project delay.

(Bordoli D.W. & Boldwin A.A., 1998) categorized the delays analysis method in relation to use of critical path method, to basic method and critical path methods.

Recently the AACE updated its international recommended practice No. 29R-03 under the name of Forensic schedule analysis (AACE, 2010) to deeply describe the analysis methods as shown in figure 2.

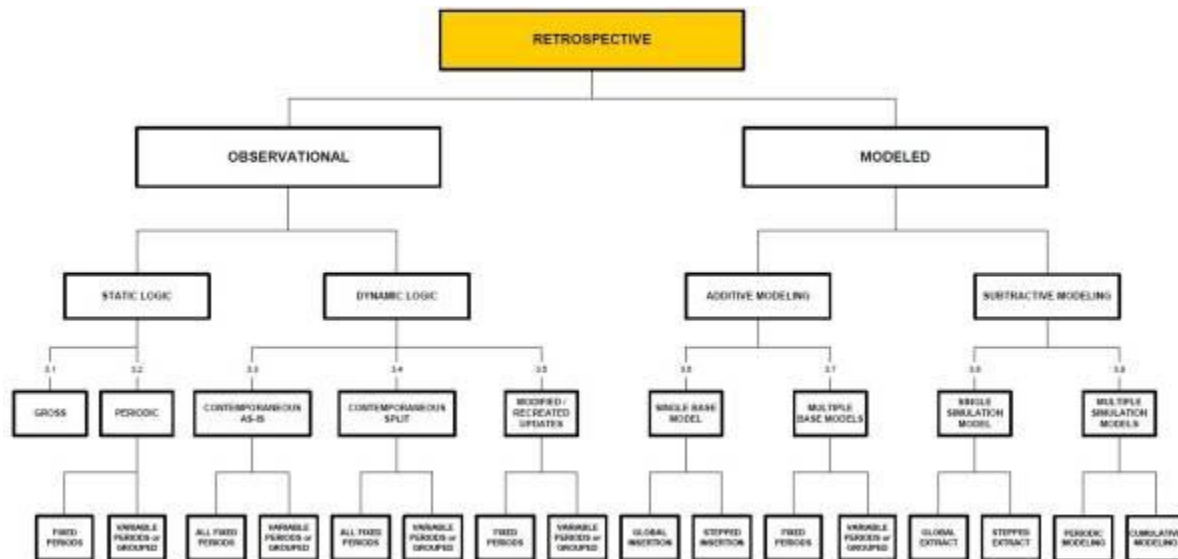


Figure 2, Delay techniques (AACE, 2011)

The guide neglected the prospective view and clarified the retrospective analysis which is performed after the delay event.

1. Observational method based on analyzing the schedule with itself or another one without changes and this gives two main choices
 - **Static logic** to compare the plan which is static and not changed to the as-built, and further there are two ways to implement that gross mode which is known as as-built VS as planned (Fruchtman E., 2000). This considers the whole project period as one period, and periodic known as windows analysis which segments and breaks the whole to whatever fixed periods or variable.
 - **Dynamic logic** is using the schedule updates and incorporated with logic changes, divided to two main applications, contemporaneous updates and known as-is or Time Impact Analysis (TIA), mainly to isolate the slippage /recovery of the schedule and this applies to all periods or grouped periods. Modified / reconstructed updates also involve the observation of updates, however the implementation recreates the entire updates where no contemporaneous updates exist; this is called recreation application.
2. **Modeled** method, unlike the observation method, gives the analyst the freedom to extract or insert activates in the schedule from CPM network or before-after

results, and it includes the famous application “collapsed as-built” (Zack Jr J., 2001) and the “impacted as planned”. As an observational method the model has two main choices

- **Additive** modeling where the analyst compares the recreated schedule in which he inserted the delay events with the original one, and it includes the impacted as planned method (Wickwire J, Driscoll T, Hurlbut S., 1991). In this method the analysis could go through single base or multi bases; the single is when the analyst uses one source for extracting or adding the delays, while the multi base uses many delay sources like many scenarios as built simulations, could extracted to be add to the CPM network. The single known as “impacted as planned”, while the multi is known as “windows analysis.” In the additive single base modeling, the insertion or extracting could be global or stepped, as the global inserting/extracting all at once while the stepped is performing sequentially. In the additive multi-base modeling, the periods could be fixed or variable as explained in the observational dynamic logic.
- **Subtractive** modeling is a way to compare the CPM schedule with a newly created one by the analyst and subtracted the delays from the first. Collapsed as-built schedule is an example for subtractive modeling. As it is based on simulation, there are two main ways to execute this method single or multi simulation as the same in additive modeling.

So we could consider the main delay analysis methods are as stated by (Araditi D. & Pattanakitchamroon, T., 2006) as follows:

1. The as-planned vs. as-built schedule analysis method.
2. The impact as-planned schedule analysis method
3. The collapsed as-built schedule analysis method
4. The time impact analysis method (Windows Analysis)

3.1 AS-Planned VS As-Built

This method is simple, which is why it is very common, and it is conducted by comparing the as-built program with the planned one in order to assess the delay and in which period in the project time. The method is more useful on small projects; after comparing the delays we need to identify which event caused the delay and was it on critical path or not. The final difference is the entitlement for the contractor for extension of time.

The comparison could be conduct through the whole project as per Fig 3

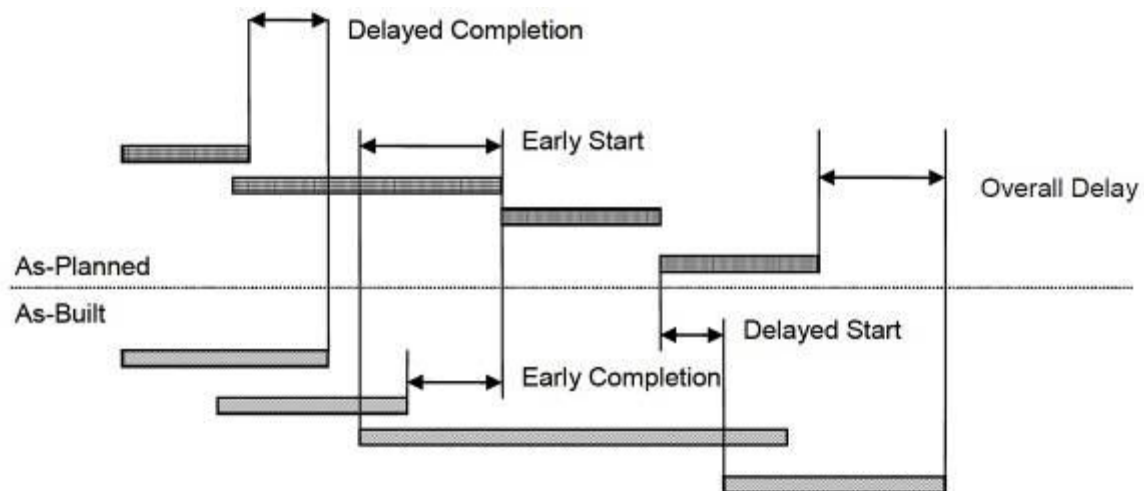


Figure 3 AS-Planned VS As-Built DAMs (AACE, 2011)

AACE suggested the implantation to be as follows, as we compare the planned start and finish against actual start and finish for activities. It is better to compare the late planned dates as it has the zero float and exists on the critical path; also it is not reasonable to measure delays that do not exist.

1. Identify the baseline program (original plan) and consider it as planned plan; it should be agreed from the beginning as most of the construction projects had approved one, mainly it is CPM logic .
2. Identify the critical and near critical paths on the planned program
3. Compare between both programs based on (delayed starts, extended durations and delayed finishes)
4. Make the calculations and judgment of delay relativity.
5. Check the delays on the critical path and who was responsible for extending the duration for delayed activities and shortening durations for those early finished.

The resulting difference should be considered as the extension of time only if all delays were concurrent delays. On the other hand the same analysis could be conducted periodically as per Figure 4

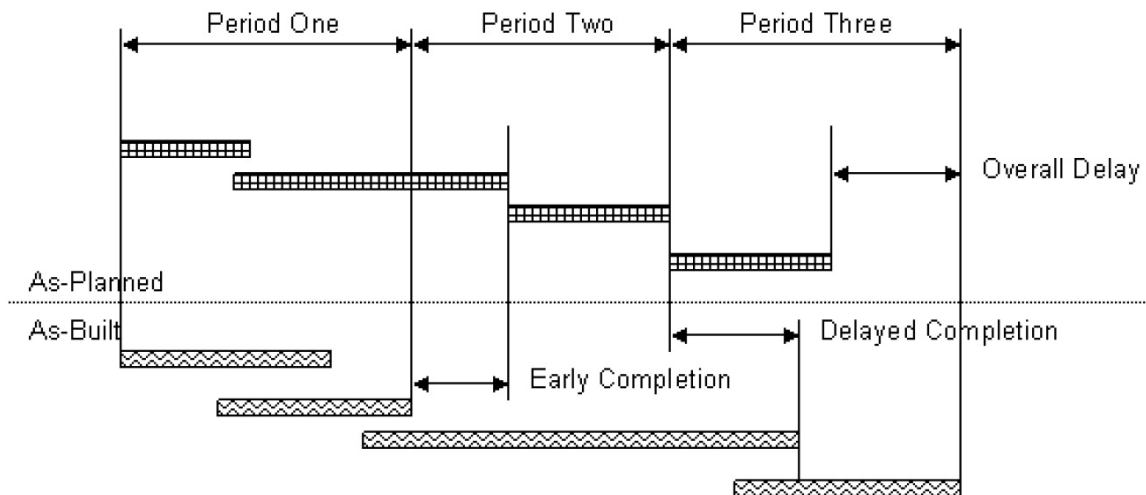


Figure 4 AS-Planned VS As-Built DAMs – Periodically (AACE, 2011)

Which is allowing us to investigate more and enhance the analysis by doing it in stages; the same steps should be applied at this type.

This method has been found in many literature in common names like traditional method (Bramble & Callahan, 1987) adjusted as built (Al Kass et al, 1996) and program of possible entitlement POPE (Farrow, 2001) (Bordoli & Baldwin, 1998) referred to the as built program building process and the availability of accurate date like the daily reports and correspondences (Bramble & Callahan, 1987) (AlKass et al, 1996) agree that this method is misleading as the contractor have intentions to tying the delays of the employer with the critical path, (Bubshait & Cunningham, 1998) comments also at the accuracy of the date and the relation between it and the as built program, (Farrow, 2001) spoke about the weakness of that method as it isn't rigorous enough for the complex projects.

3.2 Impacted AS-Planned

This method is depend on the as-planned program, and using the original baseline, the delays which accorded by the client inserted in the baseline line schedule as new activities or durations and should be linked to the affected activities and we rescheduling again, the new finish date should be compared with the original one to know the variance, the variance is taken as the entitlement for extension of time for the contractor. (SCL, 2001).

The method have a several names as well (Bubshait & Cunningham, 1998) call it as planned method, (AlKass et al, 1996) name it as collapsing method, (Bordoli & Baldwin, 1998) are calling the new program with the adding events POPA or program of possible achievement.

As per (AACE, 2011) this way consider additive way as it is consider the addition of activities representing delays into as-planned CPM as shown in figure

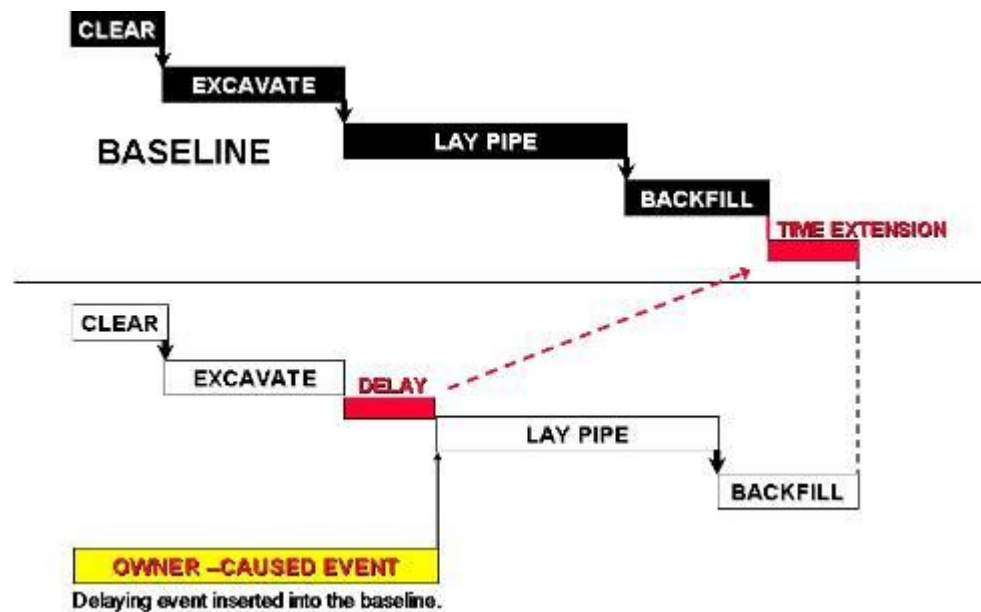


Figure 5 Impacted AS-Planned DAMs (AACE, 2011)

The implementation procedures (AACE, 2011)

1. Identify the baseline program (original plan) and consider it as planned plan, it should be agreed from the beginning as most of the construction projects had approved one, mainly it is CPM logic .
2. Identify the critical and near critical paths on the planned program
3. Identify all the approved extension of times, and quantify the delays and evaluate it and what is the documents you have and which bases
4. Insert activities to the as-planned schedule, and reschedule to see the impact of the new activities.
5. Make the calculations and judgment of delay relativity. Compare the as-planned schedule with the impacted one, the variance should be the extension of time granted to the contractor.
6. Check if the delays on the critical path and ensure that the schedule have continuous critical path.

This way is a fast way to analysis the delay, because there is no need to depend on the actual schedule which need many events, reports and documents, and illustrate the areas where contractor has taken the acceleration measures, researches shown that this illogical/theoretical way because the using of as-planned schedule isn't really what happened in the project, as many projects hadn't been executed as planned. Also

because the delays applied only once and may we will got more delays or there was no delays at the time of occurrence.

That is way isn't widely accepted especially from the clients, if the analysis shown that new completion date is after the as-built completion date , this may shown that the contractor already put extra measures to accelerate the project end., (Bordoli & Baldwin, 1998; Bubshait & Cunningham, 1998; AlKass et al, 1996; Farrow, 2001; Kumaraswamy, Yogeswaran, 2003

3.3 Collapsed As-Built

This scenario based on the extracting the owner delays events from the as-built program to determine the impact of these delays on the network (AACE, 2011), it is try to compare between what would have happened but for excusable delays, and what actually happened (Bordoli & Baldwin, 1998) this simulation is running on one network analysis model representing the as-built program (AACE, 2011), this known also as but for technique , starting by furnishing the CPM as-built program , then we prepared detail delays events record , removing the delays one by one and rescheduling again to find the impact of each delay on the project completion date , after removing all delays we have Collapsed as-built program, reschedule the collapsed as-built program and compare it with the as-built, the result will be the contractor extension of time (Farrow,2001) as figure 6.

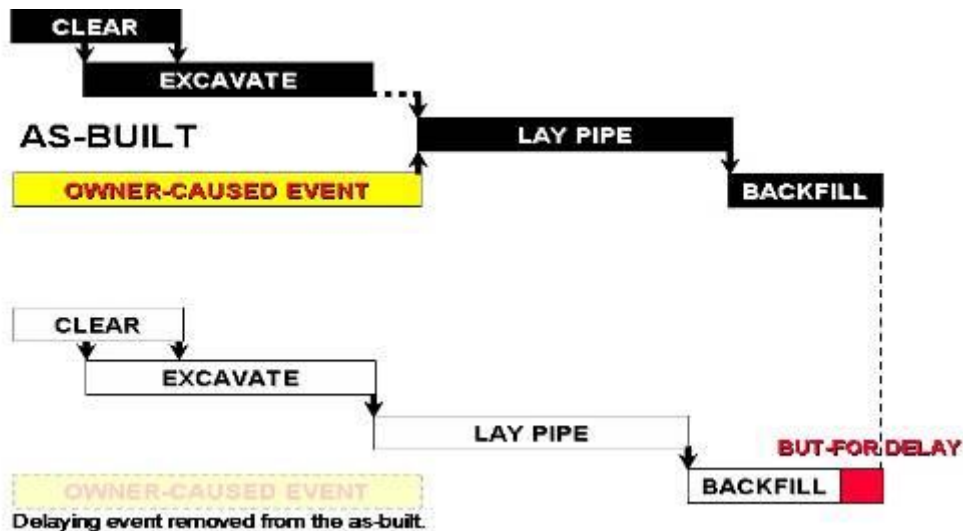


Figure 6 Collapsed As-Built DAMs (AACE, 2011)

The implementation procedures (AACE, 2011)

1. Identify the as-built program/plan, it should reflect the actual status of the project during the execution, and it is coming through updating the Baseline program after inserting to it the excusable/concurrent delays, baseline should be agreed from the beginning as most of the construction projects had approved one, mainly it is CPM logic.
2. Identify the critical and near critical paths on the planned program
3. Identify all the approved extension of times, and quantify the delays and evaluate it and what is the documents you have and which bases
4. Prepare the collapsed as built by removing event by event and rescheduling again to identify the impact of the each delay, and after removing all the delays rescheduling again and the final should be called Collapsed as-built. No adjustment to the logic should be done to the collapsed program
5. The collapsed as-built should contain mainly
 - As-built critical path activities including the critical and near critical longest paths
 - Baseline critical path and longest path
 - All contractual milestones and chains procedures
6. Make the calculations and judgment of delay relativity. Compare the as-built schedule with the collapsed one, the variance should be the extension of time granted to the contractor.

(Farrow, 2001) see that this technique is theoretical as it depends mainly on assumptions and expectations, for example the program logic after each removing of delay isn't agreed on , it is assumption of what could have happened if the delay wasn't there , many contracts reject this practice as well .

3.4 Time Impact Analysis (TIA)

There are two ways in this technique, TIA and Windows analysis which consider subcategory or variant of the TIA.

First the Window analysis also known as Snapshot analysis considered one of the most accredited and logical analysis in comparison with the other techniques (KAO & Young 2009; Farrow, 2001; Alkass 1996). This method consider depending on both as-planned program and the as-built one , it is built on what really happened on the project not what could have happened that is why it is actual method (Farrow,2001).

This way dividing both the as-built and as-planned to windows periodically “snapshots” then obtaining the information from the as-built schedule like durations, actual dates, major changes (relationships) and all related information to the period in the as-planned schedule, imposing these information to the as-planned schedule to produce impacted as-planned program , run the program , the difference between the original period of as-

planned and the impacted program should be recorded as the first amount of the delays occurred, repeat the process on the other windows and consider the first window baseline for the second one till the end of the project to obtain the entitlement of extension of time for the contractor in case of all delays were related to the client , and we should divided the liability among the two parties based on their responsibility.

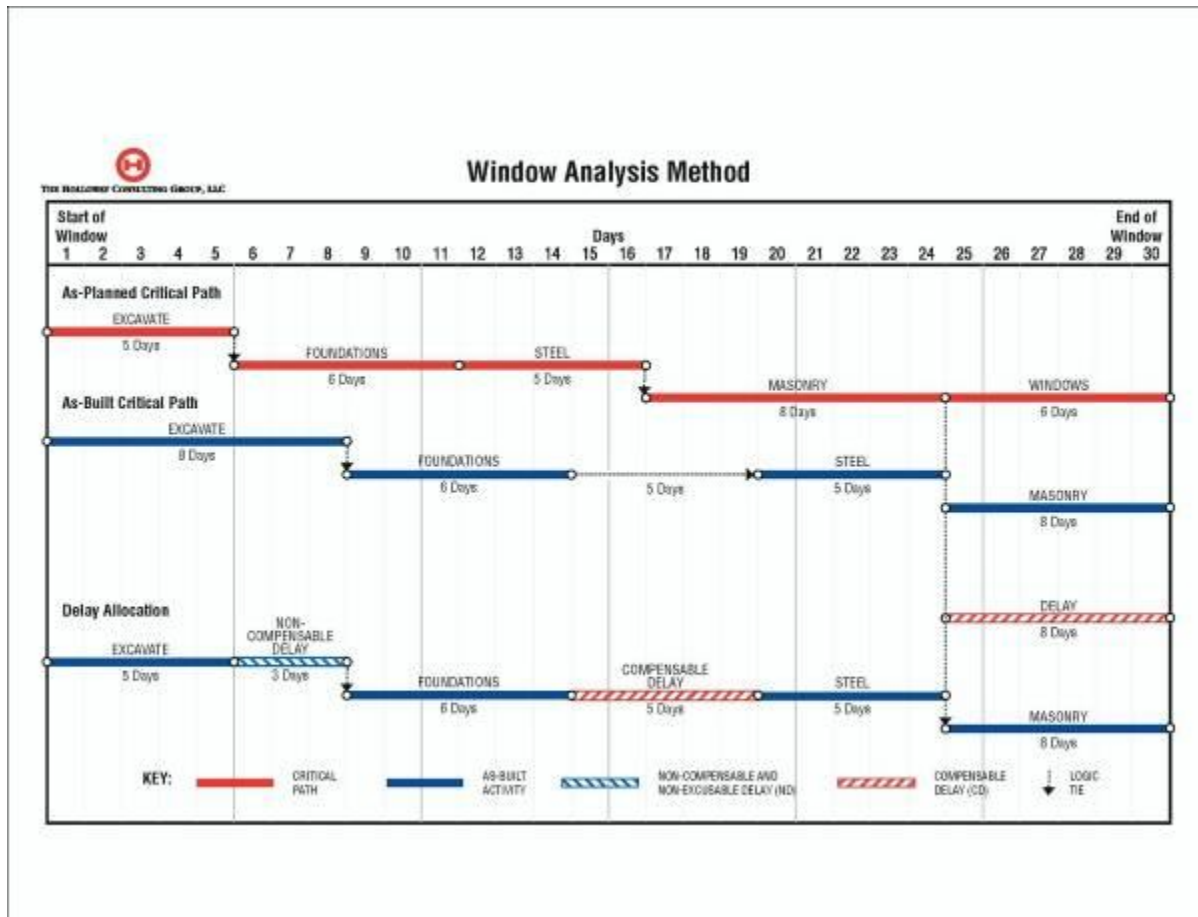


Figure 7 Windows Analysis DAMs (Hollway, 2012)

One of the important factors which affect on the accuracy of this method is the size of the window (Alkass, 1996; Hegazy & Zhang, 2005), also in the case of absences of regular updates to the schedule, the retrospective as-built program may contain errors and wrong assumptions (Hegazy & Zhang, 2005) and stated more that this way doesn't consider the fluctuations in the critical path as in the window depends on the critical path till the end of the window only especially in short periods.

(Hegazy & Menesi, 2008) had an opinion that this method incapable of dealing with the multiple baseline updates (Ibbs & Nguyen, 2007) highlighted that the method neglect the recourse allocation all over the project.

To solve these debates (Hegazy & Zhang, 2005) suggested to use the one day window analysis, which creating a monitoring updated system depends on daily reports filled by both parties daily on the site, and attached to the main schedule which allow only update based on this schedule, but that could be only for the small and medium projects still hard to be applied in the large projects.

While Time Impact Analysis TIA focuses on the effect of the delays on the updated as-planned program, by imposing the delays one by one on the updated as-planned schedule and compare it with the updated as-planned to see the event effect on the schedule, then imposing the next and repeat the whole process again till we finalize imposing all delays, the difference will be the entitlement for extension of time, (Brimah, 2008) stated that this method is the most credible method and that is why SCL recommend it .

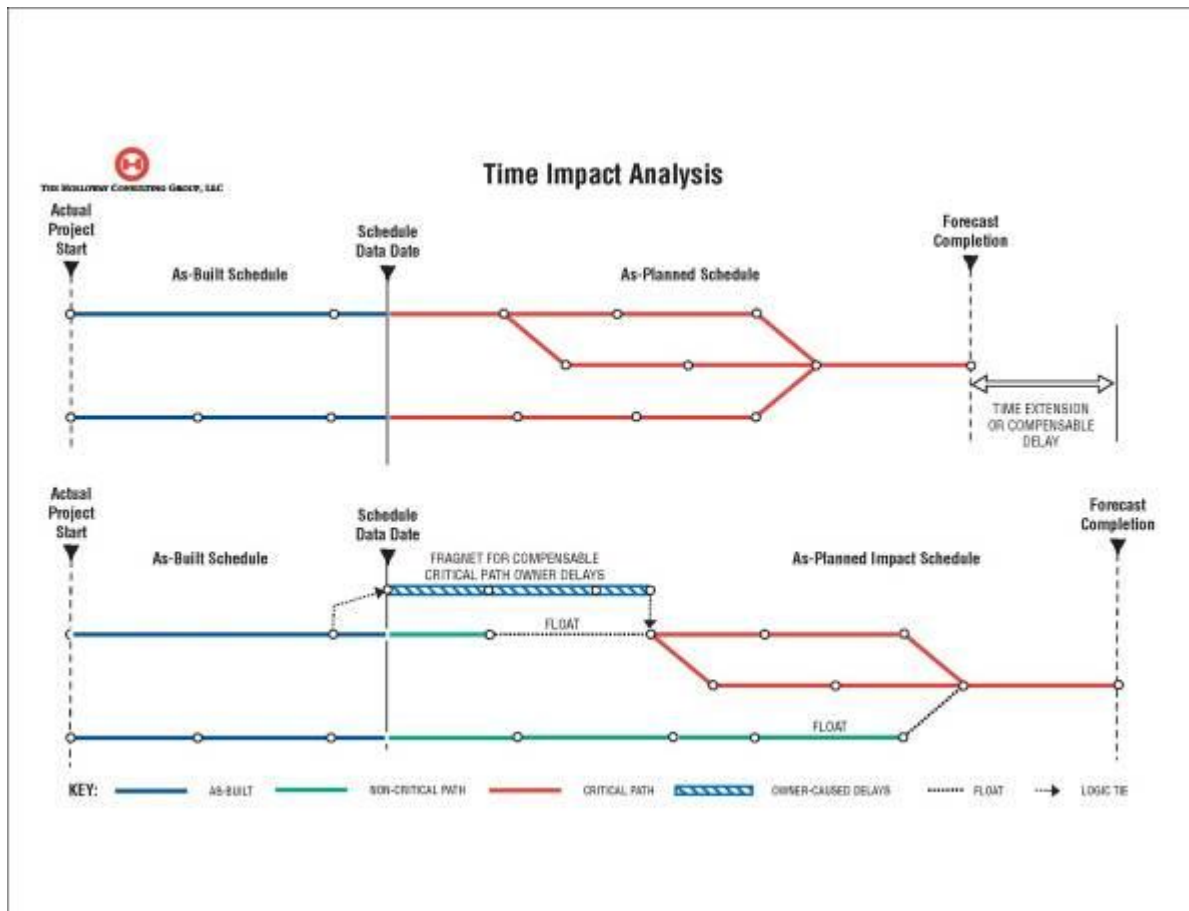


Figure 8 Time Impacted Analysis DAMs (Hollway, 2012)

This method could be difficult when dealing with many delays (Alkass et al,1996; kumaraswamy & Yogeswaran, 2003) as explained in Figure 8

4 Analysis Evaluation

Farrow, 2001) explain because of wide range of factors and issues in construction delays, some delay analysts have a confusion regarding the difference between the methodology and mythology, these debatable factors are subjectivity, concurrency and float ownership specially when we dealing with complex delay analysis case. AACE.2001) categorized these factors as 1.excusability and compensability of delay, 2.identification and quantification of concurrency of delay, 3.critical path and float and 4.delay mitigation & constructive acceleration, Ibbs & Nguyen, 2007) consider the delay analysis is a formidable challenge.

4.1 Subjectivity

When the analysts start establishing the relationship between the impacted activities, try to evaluate the effect of the event or producing a certain scenario, subjectivity is a common feature in most of the methodologies, the subjectivity is different from point of view and the other, case to case and even from method to method (Pivickance, 2005) imagined scenario for delay analysis in theoretical debate for 300 UK from 4 points of views

1. Contractor who used the impacted as planned delay analysis method to debate his entitlement for extension of time and how he is free from any penalties but more he have the right for extra costs
2. Owner who used the as-planned VS as-built method to prove how the contractor was responsible for delays and entitled to penalties
3. Consultant who tried to solve the matter by using the collapsed as-built method which had been refused by contractor and Owner
4. Adjudicator who used Time Impacted analysis TIA to solve the matter but no one agreed and the matter hadn't been solved

This is show how subjectivity different and affected factor specially when the analyst trying to establish and new baseline, although if the baseline was logical and updated regularly the level of subjectivity will be reduced (Farrow, 2001; Bolodi & Baldwin, 1998).

4.2 Changes in CPM

The projects have a dynamic nature; usually the plan at the beginning express optimum plan to execute the project, many projects faces every day challenges and problems, when the project team faces such thing they trying to solve it by modifying or changing the plan, also in the construction industry the contractor obligated to submit to the client or the consultant the mitigation response to such delay or sometimes revised plan (FIDIC 1987),and here we shouldn't use the methods which depends on the original plan (Yogeswaran & kumaraswamy, 1998), experts around the world using different types of plans like in UK they using the as-planned and in US they using the as-built,

that is why exist of the four types of plans should be necessary which is as-planned, as-built, impacted (as-planned with the delays) as-adjusted (the updates) which expressing the dynamicity of the CPM (Williams, 2003).

4.3 Concurrency

Factors affecting the concurrent delays are time of occurrence of delays, duration of the delays, critical or not, what the maximum effect, project delay and the relation between it and the event allocation impact, the remedies should be extension of time or time and extra delays costs, these factors make the decision is more difficult to choose the analysis methodology (Brimah, 2008).

(Marrin, 2002) explained the approaches to decide in each situation where

- The first-in-line approach : where the first delay event is responsible for delays and the caused party will hold the responsibility and liability damage regarding this
- The Dominant cause approach : it is a common sense judgment each party try to proof that the other party event is superseding his event
- The American approach & the Mailmasion approach are almost the same as the overlapping of the excusable and non-excusable delays should be consider as contractors' entitlement of extension of time

The main notice in the above that there is no agreeable method had been reached yet between the practitioners or the experts.

4.4 Float ownership

Who owns the float? The oldest argument in the construction dispute history when the plan depends on the critical path method CPM, (Zack,1993 ; De La Gaza et al., 1991) explained that the main dispute core is the float ownership and who really have the right in especially when many contractors doesn't have defined source or clause dealing with this subject.

This is open the door to more conflicts regarding the extension of time specially when many point of views will be presented (SCL, 2002) defined the float as technical term as that it is the difference between the early start and late start for the same activity or between and early finish and late finish for the same activity.

More definitions and explanations had been provided like (De La Gaza et al., 1991) stated that the float is the length of time activity's finish date could delayed without affecting the completion date of the project. As we explained before at the beginning of the delay analysis, we explore the effect of delay to know the impacted activities in order to see if the event changed the completion date or not.

(Householder & Rutland, 1991) stated that they support the idea of client float ownership, they explain that since the client force the contractor to submit a baseline program from the beginning , this is means that the client will plan it role according to that baseline, and the contractor know that there will be float in such activity from the beginning so actually there will be no harm before the float end , that is why they explained that client own the float , the writer argued this approaching as it may cause new problems also the original CPM is almost different to actual as-built CPM, which mean that the activity status may change from no critical to critical and there will be risk at the owner when he delays such activities he will have to pay the damages, also they highlighted two main responses from the contractor side, the first is to submit zero float program by using lags, leads time and long activities durations (De Le Garza et al., 1991) and the second is to use the extra contingency cost in bidding .

In contrast the reasonable way to contractors as they relying on the float to plan for resource smoothing over the project duration or as time contingency in the bidding stage and this will be replacement for traditional cost contingency also selecting the most economic way to start the work or the activities to save the cost (De Le Garza et al., 1991).

So mainly there are three opinions at the float ownership

- Contractor , as per (Finke,1999) who explained that as the contractor is totally responsible for the planning so he have the right to use the flexibility (float) to perform the project
- Client, as the client pay for the project he should use the float so they should control the float and more discussion had been provided in (Householder & Rutland, 1991) between type of contract and risk share
- Project, whoever gets it first uses it for his benefits (De Le Garza et al., 1991), which is the common understandable in UAE construction industry. Even recent studies recommend that the ownership of the float should be to the project.

4.5 Resources

The resource limitation isn't the real excuse to justify the delays; even so most of the Daley Analysis Methodologies DAMs failed to address the issues of resources constrained schedules, (Williams, 2003)

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