Abstract—Delay analysis techniques have been a frequent topic of discussion in construction law literature. Delay analysis guidelines, such as The Society of Construction Law Delay and Disruption Protocol, and forensic schedule analysis guidelines, such as AACE International’s Recommended Practice 29R-03 Forensic Schedule Analysis [1] (“RP 29R-03”), were developed to provide practitioners useful tools for implementation. RP 29R-03 is comprised of numerous method implementation protocols (MIPs), among which is MIP 3.7, commonly known as the Time Impact Analysis (TIA). While MIP 3.7 addresses the retrospective application of a TIA method, Recommended Practice 52R-06 [2] (“RP 52R-06”) addresses the prospective application of the method. The TIA method has been used extensively in the United States and worldwide and can arguably be considered one of the most popular and renowned implemented delay analysis methods. Despite its prevalent use, the TIA method, whether used retrospectively or prospectively, contains numerous technical and legal pitfalls that pose challenges to its users. This paper sheds light on these practical and legal challenges and concludes with recommendations in an attempt to overcome, or at least mitigate, these technical and legal challenges. Case studies from the Middle East North Africa (MENA) region are presented to illustrate the practical challenges highlighted in this paper.
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Introduction

Although the TIA has received notable attention in claims literature and is arguably one of the most popular delay analysis methods used in the industry internationally, it has not received the attention it deserves with respect to legal challenges. RP 29R-03 clearly states in section 1.3.b “the focus of this document is on the technical aspects of forensic scheduling as opposed to the legal aspects.” [1, p. 10] In a comparison between the U.K.-based Society of Construction Law Delay and Disruption Protocol, 2nd Edition (DDP2), and RP 29R-03, it was suggested that, while RP 29R-03 was developed with a recognition of legal precedent, it does not follow construction legal theory [3]. Understanding how courts view the TIA is important, as it can give certainty to delay analysts as to the probable outcome of using a TIA and can therefore be a useful tool for the analyst in terms of how the analysis can be improved to avoid the legal pitfalls. Throughout the years, few attempted to unravel the legal challenges of performing a TIA. In the much renowned book Construction Scheduling: Preparation, Liability and Claims, a chapter is dedicated to the standards of proof for time delay claims, which lists five main points derived from court decisions regarding contractor’s time delay claims [4, p.10-1 to 10-44]. Although the chapter discusses the standards of proof for time delay claims in the general sense, several of these standards are directly applicable to the TIA method as described in AACE RPs, as is elaborated upon in this paper. Livengood discusses whether retrospective TIAs should be put to rest [5] then, nearly 10 years later, if there is a better way than retrospective TIAs [6]. In both papers, Livengood discusses legal and practical problems with using retrospective TIAs. There has been other research which attempted to discuss practical challenges with the implementation of a TIA methodology as set in the AACE RP [7] or a modified version thereof [8]. This paper aims to distill the foregoing discussions into legal (US law perspective) and practical considerations and challenges that should be taken into account when preparing a TIA. Hence, the paper is divided into two main sections – the legal challenges and the practical ones. Case studies from the authors’ experience in the Middle East North Africa (MENA) region are provided in the practical section to illustrate the challenges highlighted.

Legal Considerations for Implementing a TIA

Before delving into the legal considerations for implementing a TIA, it is important to first summarize the TIA process. According to RP 29R-03, a retrospective TIA (MIP 3.7) is a simulation process that entails inserting a network of activities representing delays or changes into a network representing the plan to determine the impact of this network of activities on the plan. The process is performed on multiple networks representing the plan, such as an update schedule, contemporaneous, modified contemporaneous or recreated model. The analysis takes place in periods [1, p.77]. According to RP 52R-06, a prospective TIA process entails adding modeled events into an unimpacted schedule (latest schedule update prior to the delay event) to determine the potential impact of that event(s) on the longest path and therefore the project completion. Hence, in both cases, the key parameters for a TIA method include (a) the as-planned schedule, (b) the updates to this as-planned schedule (c) the fragnets created to simulate delay events that would be inserted on the updated schedule and (d) the analysis undertaken to explain
the results. The literature mentioned above seems to touch on each of these points in different ways. The following is an elaboration on the main legal challenges:

**Accuracy of the As-Planned Schedule and Updates**

The starting point for any TIA method is the as-planned schedule from which updates are created as the base for the insertion of the delay fragnets and on which the first fragnet is inserted. As established in numerous court cases, a delay analysis can be disregarded if the as-planned schedule contains erroneous logic and unrealistic durations.

In *Hensel Phelps Construction Co.* [9], the court concluded the following regarding an early completion claim that relied on the government’s approval of a CPM schedule:

> The fact that the Government approved the early completion schedule does not mean, as appellant suggests, that the schedule is per se reasonable. On the contrary, appellant must present clear proof that it could have and would have finished early but for Government-caused delays... In this case, the evidence concerning the scheduling of PEF duct line work demonstrated that the CPM schedules developed and updated by Hensel Phelps are not reliable and should not be used as evidence supporting the reasonableness of the early completion schedule...

In the *Jones* decision [10], the Board stated:

> 73. JAJ also unilaterally reduced the duration of Activity 26,700, Prepare Project for Acceptance, in the August 1995 CPM Update from 43 workdays (60 calendar days) to 2 workdays (3 calendar days). JAJ contended that the activity included final clean-up type work and that it included another activity in the schedule with a 30-day duration to perform final clean-up off the critical path earlier in the project. Actually, final clean-up and punch list-type work was being performed long after the September 17, 1996 substantial completion date.

> 106. We have found that JAJ’s reduced durations drastically understated the times for performance of the critical railroad-related activities. Both the Appellant’s original claim and its expert’s revised theories are based on an invalid, manipulated August 1995 CPM schedule that unreasonably reduced the durations of critical railroad activities.

Although addressing early completion claims and not a TIA method per se, these cases demonstrate that courts, when presented with a TIA, will not simply accept the as-planned schedule or any of its updates as presented – even if this schedule and updates were approved by the owner. Rather, courts will look into the schedule and updates to see if they are reasonable and do not contain obvious errors and manipulations. This can be detrimental in the case of a TIA, since the method relies heavily on the baseline schedule and updates for presenting the impact of any delay event. Wickwire and Smith opine that authorities have recognized for years
that having a CPM for analysis purposes is not sufficient, as it is always subject to a check for corrections of any significant errors in logic, durations or resources [11].

The Analysis Can Be Considered Hypothetical

Another corollary to the first consideration regarding the reasonableness of the planned and updated schedules so that they are free from logical errors is the TIA can be described by courts as being too hypothetical. Livengood opines that this applies to both prospective and retrospective TIAS and, while drawing support from several cases, concludes that the first criticism of TIAs is that their reliance on the baseline and updated schedules, not on as-built data (even if actual durations are used in the fragnets), can result in the TIA method being dismissed by courts as being hypothetical [6]. He suggests that, since a TIA method “predicts” the impact of an event, and such a prediction may not represent the actual events on the ground, the method can be considered hypothetical. Notably, he refers to the contract appeals board case in *Appeals of Harrison Western Corp* [12], in which the insertion of fragnets in a prospective TIA without knowledge of how the parties arrived at the point in time at which the excusable delays were inserted was made analogous to “saying that a snapshot will suffice where videotapes or movies are required.”

In respect of standard of proof derived from court decisions, and in direct relevance to the TIA method, the book *Construction Scheduling: Preparation, Liability and Claims* [4, p. 10-3] highlights that when schedule updates are used to status the project and analyze the impact of fragnets on delays, the contractor is required to prove that the following measures have been taken with respect to the project updates prior to the update being impacted (after proving that the plan is reasonable and realistic):

- Schedule logic was corrected to reflect actual sequence followed by the contractor on site
- Durations were revised to reflect actual situation on site
- Logic was revised to reflect out-of-sequence work that may have arisen
- Permission for cut logic ties was obtained, and
- Actual start and finish dates were reflected.

The authors cite *Santa Fe Engineers, Inc.*, [13], which clearly sets the required standard as follows:

22. *The CPM schedule must be revised when work is added and deleted, completed and/or changes in logic made. It must also be updated monthly to reflect work completed as well as the contractor’s plan for completing the remaining work including in particular any significant changes in logic or duration….A CPM schedule that does not reflect what work is actually being accomplished in the field does not accurately identify the project’s critical path and activities.*

It is apparent from this court reasoning that fragnets inserted onto an immediately prior update that does not reflect the actual site conditions is considered hypothetical and does not meet the minimum standard of proof. This can therefore result in the entire TIA analysis being dismissed.
The importance of the use of as-built information to prove delays is also summarized in *Continental Consolidated* [14] which stated: “The CPM schedule must reflect actual performance to be a reliable basis for evaluating delay.”

*Use of Prospective TIA After-the-Fact*

Livengood highlights that the prospective use of TIAs to prove delays when the analysis is presented in court at a later stage has been rejected by recent US courts [6]. He cites several cases, among which is the *Appeals of Harrison Western Corp.* [12] in which a prospective TIA was used. The court’s reasoning for the rejection was as follows:

…the insertion of allegedly excusable delays in a CPM contemporaneously with the delay event proves nothing that is critical to this case. An extension of the critical path, by itself, says nothing regarding the assignment of responsibility for delay of the final project date, if any. This is because it says nothing about how the parties arrived at the point in time at which the excusable delays were inserted. More importantly, it says nothing regarding succeeding events including subsequent delays.

It is apparent that the main justification for rejection of the prospective TIA in this case is that it ignored “succeeding events including subsequent delays” when this as-built information was available. A similar conclusion was reached in the case of *Blackhawk Heating & Plumbing Co.* [15] in which the court stated:

The real point...is that time extensions must be based on the best evidence available...we had before us evidence as to how the project was actually built, evidence which did not exist at the time Appellant filed its claims. The evidence compelled us to find that the sixth-floor ductwork delays was noncritical.

Building on the reasoning in *Blackhawk*, the court in *Santa Fe* [16] relied on the “ultimate critical path” in its decision as to whether liquidated damages should be assessed against the contractor. The court explained “By their nature, the delayed activities involved must necessarily lie on the critical path of the project as it was completed.” Although the case did not address a TIA method, the relevance is that the court considered only the as-built conditions to assess delay. In other words, if projected onto the use of prospective or retrospective TIA, the *Santa Fe* court would have most likely supported the *Blackhawk* decision and considered only a retrospective TIA analysis.

It is reported, however, that there is a tension in US court decisions over whether “hindsight” or “blind-sight” is the proper approach to critical path delay analysis [17]. RP 29R-03 explains that “hindsight” is when the analysis uses all the facts, regardless of the contemporaneous knowledge, to determine what happened in the past. However, in “blindsight”, the analyst evaluates events as if standing at the contemporaneous point in time, with no knowledge of subsequent events. The RP summarizes the tension as follows:
There is no prevailing practice, let alone agreement, on which practice ought to be used in the reconstruction of schedule updates. On one hand, the hindsight supporters maintain that it serves no purpose to ignore best available evidence and recreate updates, pretending that the as-built information does not exist. On the other hand, the blindsight supporters argue that the very purpose of reconstructing schedule updates is to replicate the state of mind of the project participants at the time of the update, because project decisions were made based on best available information at the time.

It is recommended that both approaches be evaluated in cases where difference in approach results in a significance variance. [1, p. 112]

It is apparent that US courts are also struggling with this when deciding on delay analyses utilizing TIA. The issue is further complicated when considering the point in time a TIA enters into a retrospective mode. So, for example, if a contractor prepares a TIA for delay events that were apparent at the time of first preparing the analysis, but the analysis takes a month or two to submit for any reason, have the events (that took place two months ago) now become retrospective? This is a common occurrence in construction projects, and it begs the question as to what point in time can an analysis truly be considered prospective or retrospective. The significance of the Blackhawk decision is that this point might not even matter to courts, as consideration may eventually be made only to the as-built critical path, where a seemingly critical activity at the time of delay may eventually turn out to be non-critical.

RP 52R-06 touches on this point as follows:

Under truly prospective circumstances, actual independent delays caused by the contractor cannot be identified and analyzed because they have not yet occurred. An after-the-fact implementation of the prospective TIA that includes the analysis of actual independent delays may produce inaccurate results due to the mixed use of prospective and retrospective viewpoints. It is therefore recommended that analysis for concurrent delays be performed using a retrospective TIA method [2, p.9].

This point has also been addressed in British literature as one of the drawbacks of a prospective TIA method. In the words of one commentator:

In the post-contract dispute, it is perhaps incongruous to establish the likely impact of something that has already occurred. The delay events complained of have happened in the past. The impact of these delays should be a matter of fact, and provided the information is available, capable of analysis and determination. I once heard a leading arbitrator QC put it more eloquently; ‘Why look in the crystal ball when you can read the book?’ [18]
Susceptibility of a TIA to Manipulation

RP 29-R03 highlights that a caveat in using retrospective TIA under MIP 3.7 is that the method “is susceptible to unintended or intended manipulation due to modeling if only one party’s delays are considered, since the method cannot account for the impact of delays not explicitly inserted.” [1, p. 83]. To avoid being accused of manipulation, a delay analyst should comply with the minimum recommended implementation protocols and the enhanced implementation protocols set out in RP 29R-03. Specifically, as demonstrated by the references below, the analyst should be cognizant of the following:

- Accurately prepare fragnet activities that are inserted in a baseline or an update, while taking into account the inclusion of all fragnets in the analysis.
- The impacted schedule should not be subject to adjustments so as to serve a particular outcome.
- The selection of windows for a TIA should be justified, not selectively chosen to produce a desired outcome.

The susceptibility of a TIA to manipulation by the analyst is, along with the necessity of using as-built data, one of the most commonly referenced drawbacks of utilizing a TIA. Livengood mentions three ways that an analyst can manipulate the effect of fragnets into a TIA: the first is the analyst’s decision as to whether to include or exclude a fragnet; the second is the number and type of logic connections employed by the analyst in the fragnet; and the third is the duration used by the analyst for the fragnet activities in a retrospective TIA – the estimated at the time of the delay or the actual [5].

Employing the TIA method to prospectively identify and measure delay for government agencies, Ryan and Van Lenten describe an incident where a fragnet in a TIA presented by a contractor apparently caused a 27-day delay to the substantial completion date. The unimpacted and impacted schedules were analyzed using a Digger Report, which revealed 105 changes implemented by the analyst to the impacted schedule, many of which were not even related to the delay event in question. These changes included 22 activity name changes, 11 constraint changes, 6 actual start and 6 actual finish date changes, one original duration change, 11 added activities, 4 deleted activities, 29 added relationships and 15 deleted relationships [19].

Manipulation in delay analysis to mask contractor delays is firmly rejected by US courts and leads to disqualification of the analysis presented. In Hensel Phelps Construction Co. [9], for example, the Board held:

A claim for delay damages was denied because the contractor failed to prove that the government’s defective specifications delayed any activities.... Additionally, evidence in the record indicated that the contractor’s CPM schedule had been manipulated to conceal work that could not be completed in the time allowed.
Wickwire et al [4] dedicate in their book a section titled “use of total time ‘windows’ or ‘selected windows’ to force results” to highlight a manipulative technique that was rejected by the courts. This technique entails the selective picking of windows for a TIA. One example given is that an analyst can, in an attempt to avoid the fact that the critical path may change from month to month, select a large window of time to analyze delays then assert that one of the delays during the window was a supervening delay that negated the effect of earlier critical path delays.

**Practical Considerations for Implementing a TIA**

In addition to the legal challenges of implementing a TIA, there are practical challenges that should be taken into consideration. The remainder of this paper delves into detail regarding practical challenges that have been encountered in practice during the authors’ experience in the MENA region.

**Utilizing the Incorrect Baseline in a Project with Multiple Baseline Revisions**

By definition, a TIA entails the insertion of activities representing delays into a network analysis model representing a plan to determine the impact of these inserted activities on the network [1, p. 77]. This plan can be the baseline schedule, any revision thereto, or a contemporaneous update. A practical challenge is faced in projects where there are multiple revisions to a baseline schedule and the contractor does not utilize the correct baseline at the time of the delay event(s) or does not use the baseline at all. This can be clarified through the following projects:

1. In a multi-million-dollar university project in Riyadh, Saudi Arabia, there were eight baselines revision. On several occasions, the contractor did not utilize the appropriate baseline which resulted in the project manager’s repeated instruction to the contractor to use the applicable baseline that correlates to the window interval in the extension of time (EOT) claim submitted.
2. In an international bank headquarters project in Cairo, Egypt, the contractor had submitted three EOT claims, where each claim was built on the other (the second based on the first and the third a revision on the second). One of the main comments that led to the project manager’s rejection of the third EOT submission is that the contractor utilized a progress update to an incorrect schedule revision.
3. In an airport terminal project in Cairo, Egypt, the contractor submitted an EOT claim that did not even use the approved baseline or any revision thereto, which on a project level was used as the base for measuring progress. The analysis was undertaken by a consultant who was employed remotely and who preferred to use a recreated baseline in lieu of the one used by the site team. This constituted one of the reasons for the project manager’s
rejection of the contractor’s EOT submission (which was subject to the project manager’s assessment).

On the third example, it is noteworthy to refer to Item 3.7.E.3 of RP 29R-03, which states the following as the third step for implementing the TIA:

*Select the as-planned network to be utilized as the “un-impacted schedule”. If not using the baseline, select the contemporaneous update that existed just prior to the initial delay that is to be evaluated* [1, p. 78] (emphasis added).

The phrase “if not using the baseline” suggests that it is not mandatory that the baseline is used for the purpose of a TIA analysis. Hence, the recreated schedule on the airport terminal project may be, in principle, compliant with the procedures under RP 29R-03.

**The “Approved” Baseline**

Another challenge that is often encountered is the requirement by owners and project managers that any baseline used in a TIA must be “approved” by the owner. Owners and project managers are at times reluctant to approve schedules because of the notion that such approval or acceptance can be used against them by the contractor due to the responsibilities and obligations in the schedule. This reluctance often results in multiple schedule submissions that can last months and, in some extreme situations, a year after the commencement date. This, in turn, results in the EOT submissions of the contractor being rejected due to the utilization of an unapproved baseline schedule. The result is an accumulation of rejected EOT claims well into the duration of the project.

In a multi-million-dollar university campus project in Cairo, Egypt, the baseline schedule was approved nearly six months after the commencement date. This resulted in as-built information being incorporated into this baseline which was, in turn, another reason for the project manager’s reluctance to accept the schedule. The approved baseline ultimately did not reflect the contractor’s initial intent to complete the work.

In the university project in Riyadh mentioned earlier, where eight revisions to the baseline schedule were made, the project manager requested that the contractor identify in his EOT claim the applicable baseline revision in respect of the window interval used in the claim. The project manager also required that the revised baseline in question be approved in order to enable assessment of the associated window in the analysis. This latter requirement resulted in protracted debate between the project manager and contractor which, in turn, delayed the review and determination of the Contractor’s EOT to a stage in the project where the contractor and owner’s teams were demobilized. This resulted in increased difficulty and inaccuracy to the review process.

Wickwire *et al* clarify that this phenomenon of owners’ reluctance to approve a schedule has proven to not be successful in US courts, as an implied obligation is deemed to be imposed on an
owner with regard to the schedule despite the owner’s silence [4]. They further clarify that, although with any approval of a schedule there is a rebuttable presumption of correctness or reasonableness of that schedule, a schedule that contains unrealistic logic and/or durations will be dismissed in court.

This is especially critical in the case of a TIA since the role of a baseline schedule is essential for the correctness of the analysis.

**Correction of Erroneous or Missing Logic Relationships**

Since any TIA method depends on the accuracy of the baseline schedule and its contemporaneous updates, any errors in this schedule and/or updates (whether in durations, activity relationship logic, etc.) may directly impact the accuracy of the analysis. It is therefore not surprising that RP 29R-03 dedicates a section (2.3.D.3) to the adjustment of contemporaneous project schedule for an analysis [1, p. 30-31]. AACE International cautions, however, that the analyst should disclose any corrections made to the contemporaneous schedules and that any correction should be made using balance and reason (i.e., should not be made across the board). Examples given of schedule anomalies include an incorrect logic relationship, a missing logic relationship, an incorrect activity based on described scope of activity and a missing activity.

A practical challenge arises during the preparation of a TIA when a contractor discovers the anomaly as fragnets are being inserted. At that point in time, the baseline schedule would have been approved and subsequent updates had been submitted. Unless the contractor provides a compelling justification for the correction of anomaly as well as for not being able to detect it earlier, any correction in the logic at that later point in time when the TIA is being prepared, even if warranted, could considered by an owner suspicious and can be regarded as an act of manipulation. This situation happened in a major residential project in the United Arab Emirates while the contractor was preparing the fragnet for the impact of the façades modification on the completion of testing and balancing activities. The contractor detected a missing logic relationship between the façade closure activities and the commencement of the testing and balancing activities. This missing logic relationship was present in the baseline schedule as well as in all the schedule updates but was missed by the contractor and the project manager’s team who reviewed the schedule. Creating this link in the TIA resulted in a major direct impact to the critical path. Not surprisingly, the owner rejected the contractor’s correction of the logic during preparation of the TIA claim and the contractor responded that, according to RP 29R-03, a recreated update can be used as a base for the fragnet insertion.

**Inadequate Schedule Level of Details**

Contrary to the “approved” schedule dilemma mentioned above, there may be pressure to approve a schedule early. This situation may arise when, for example, in the construction contract the approval of the schedule is a prerequisite to the contractor’s receipt of the advance payment. In such cases, it has been the authors’ experience that workshops would be held between the
contractor’s planners and the project manager so that the comments on the schedule are addressed as soon as possible. This pressure mounts especially if the owner needs to see physical progress fast for the purpose of satisfying authorities’ requirements in relation to permits or otherwise. Although the prompt approval of the schedule would address the second challenge highlighted in respect of the prolonged “approval” of the schedule, it can pose a challenge if quality of review and approval is compromised resulting in an approved baseline with inadequate details.

In an international sustainable city project worth USD 10 billion in the United Arab Emirates, the contractor submitted a Level 6 baseline schedule, which was approved and upon which the contractor based the contemporaneous updates. The schedule included an activity for the “building sector works”, which did not address the various buildings within this activity. Hence, from a scheduling standpoint, in order to reflect the update the progress of a certain building within the buildings comprising this activity, the contractor had to use progress override (as opposed to retained logic) in order to allow out-of-sequence activities when updating the schedule and CPM calculation. The contract required a TIA method to substantiate an EOT claim and the contractor applied a retrospective TIA method using MIP 3.7 from RP 29R-03. The project manager challenged the methodology employed by the contractor on the grounds that it altered the approved logic of activities and resulted in fragnets being inserted out of the approved sequence. This led to the project team’s realization that the progress updates are insufficient to allow an adequate analysis of delays using a TIA and, in turn, agreed that recreated updates would be prepared (i.e., contemporaneous updates would not be used) for the delay events accepted in principle by the project manager.

Method of Progress Measurement v Fragnet Update

The main types of percentage complete used in schedule updates are:

- **Duration percentage complete**: Records progress based on the number of workdays remaining (i.e., Remaining Duration). Activity is duration-driven.
- **Unit percentage complete**: Records progress based on actual work effort accomplished and remaining work effort needed to complete (i.e., Remaining Units). Activity is work-effort driven.
- **Physical percentage complete**: Records progress based on personal judgment. Activity is work-product driven [20].

In situations where a fragnet requires an update of its progress within a certain window, a challenge arises where the updating percentage complete type applied on the fragnet is different than the that applied on the activities of the schedule updates. In case the contractor uses physical percentage complete, the contractor will have to manually insert the remaining durations with every update. Consequently, when inserting the fragnet using the same percentage complete type, the contractor will have to follow the same methodology to record the progress of the fragnet(s) activities. In case of large-size schedules with complicated sequences, this process can be extensive. Similarly, in case the contractor uses the duration
percentage complete for the fragnet progress, while using a different percent complete type for the other activities, the method of calculating the impact for each window based on the status of progress for each delay event must be carefully monitored. This tends to be very difficult in case of large-size schedules.

In an international bank headquarters project in Cairo, the contractor used physical percentage complete for the project updates. The contractor manually inserted the remaining duration and the actual resources record. When implementing the TIA for the first EOT submission the contractor inserted the fragnets using duration percentage complete to record the fragnet progress for the six windows of the analysis. This impacted the CPM calculation and the accuracy of the completion date for each window analysis. The different method of calculating the remaining duration and the manual changes in the field “Planning Dates” in Primavera P6 resulted in irrelevant and invalid measurements for the resource assignment and the completion date in respect of the window data date. For example, some actual dates were recorded after the data date, some resources indicated level of effort after the project completion and some project constraints were falsely impacted. The project manager had to conduct several workshops with the contractor to revise the submission while addressing the problems encountered using the multiple percentage complete types. The time spent to revise the submission was so time-consuming that a second revision of the EOT claim had to be submitted incorporating additional delay events.

**Missing Updates**

One of the common challenges encountered when conducting a TIA is missing schedule updates. Updates may have been maintained regularly for a certain period of time then dropped for another period then resumed, and so on. One way of overcoming this challenge is to recreate updates from project records. However, another way that has been implemented is to adjust the fixed periods concept into variable periods, depending on the availability of updates.

In the international bank headquarters project in Cairo, the university project in Riyadh and a major city project in Abu Dhabi, there were several missing updates, which resulted in the contractors’ use of a hybrid of fixed and variable periods during the implementation of a retrospective TIA claim. Some windows were extended beyond the fixed period chosen for the analysis period which impacted the accuracy of the analysis results.

**Poor Records of Delay Events (Fragnets)**

Poor record of the delay event activities comprising the fragnet(s) in a TIA can greatly affect the accuracy and credibility of the analysis. As point out by Livengood, fragnets in particular can be subject to manipulation by an analyst by means of inclusion/exclusion, logic connections and

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2 Section 1.4.D.3 (page 15 of 136) of RP 29R-03 refers to the recreation of updates where no contemporaneous updates exist. MIP 3.7 (section 3.7.E.4) refers to recreated updates that can be used in a TIA.

3 The concepts of “fixed” and “variable” periods are addressed in RP 29R-03, Section 1.4.E.1.
durations to produce a desired effect [5]. It is therefore essential that each developed fragnet is identified and adequately supported with backup documentation at an early stage of the project. While the common practice is that an owner or a project manager waits until a contractor submits an EOT claim to review the fragnets (and the entire analysis), it is rare that this project manager is ahead of the game and proactively develops fragnets before a claim is submitted. In a terminal container port project in Morocco, this proactive approach was implemented by the project manager and a “database of fragnets” was developed by the planner as a reference to any delays that can be submitted by the contractor. This method also enabled the project manager to periodically evaluate the potential impacts of any initiated delay attributed to either owner or contractor.

Conclusion

AACE International RP 29R-03 and 53R-06 provide guidance on retrospective and prospective TIAs respectively but do not address, nor are they intended to address, any legal aspects of a TIA. From the limited sources referred to in this paper regarding how US courts dealt with TIAs, or with matters that are relevant to the TIA method, it is apparent that there is emphasis on the use of as-built information so that the time analysis method chosen reflects the actual progress on site. It would also appear from the cases presented that a retrospective TIA that heavily relies on as-built information would be more convincing than a prospective TIA due to the fact that the latter can most effectively be applied contemporaneously throughout the project as delays are being experienced. However, retrospective TIAs have suffered certain challenges in US courts, which takes the discussion a full circle back to whether there is a better way than the TIA method in a US court setting [5, 6].

The account of practical challenges encountered in the MENA region builds on previous research by highlighting additional challenges while implementing a TIA. The concept of the “approved” baseline schedule and updates continues to be a point of concern and an easy owner defense to contractor’s EOT claims. It is suggested that the remaining factors can be addressed by proper application of the steps advocated by AACE International in RPs 29R-03 and 52R-06, although this paper presents at least two topics that can be considered as worthy of further research and of possibly being addressed in further revisions of the RPs. The first is the point in time at which a prospective TIA analysis turns into a retrospective TIA analysis. The second and more notable point is the situation where different progress update measures are used in the progress schedule and the fragnets impacting these updates.
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