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]

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

[1] It should be noted that none of these projects utilized the TIA method. However, in all of these projects, using the baseline schedule as a reference was required in the same manner as the baseline is required for a TIA. Hence, these examples are applicable to illustrate the point.

> 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 œrtain 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.[2] However, another way that has been implemented is to adjust the fixed periods concept into variable periods, depending on the availability of updates.[3]

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

[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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