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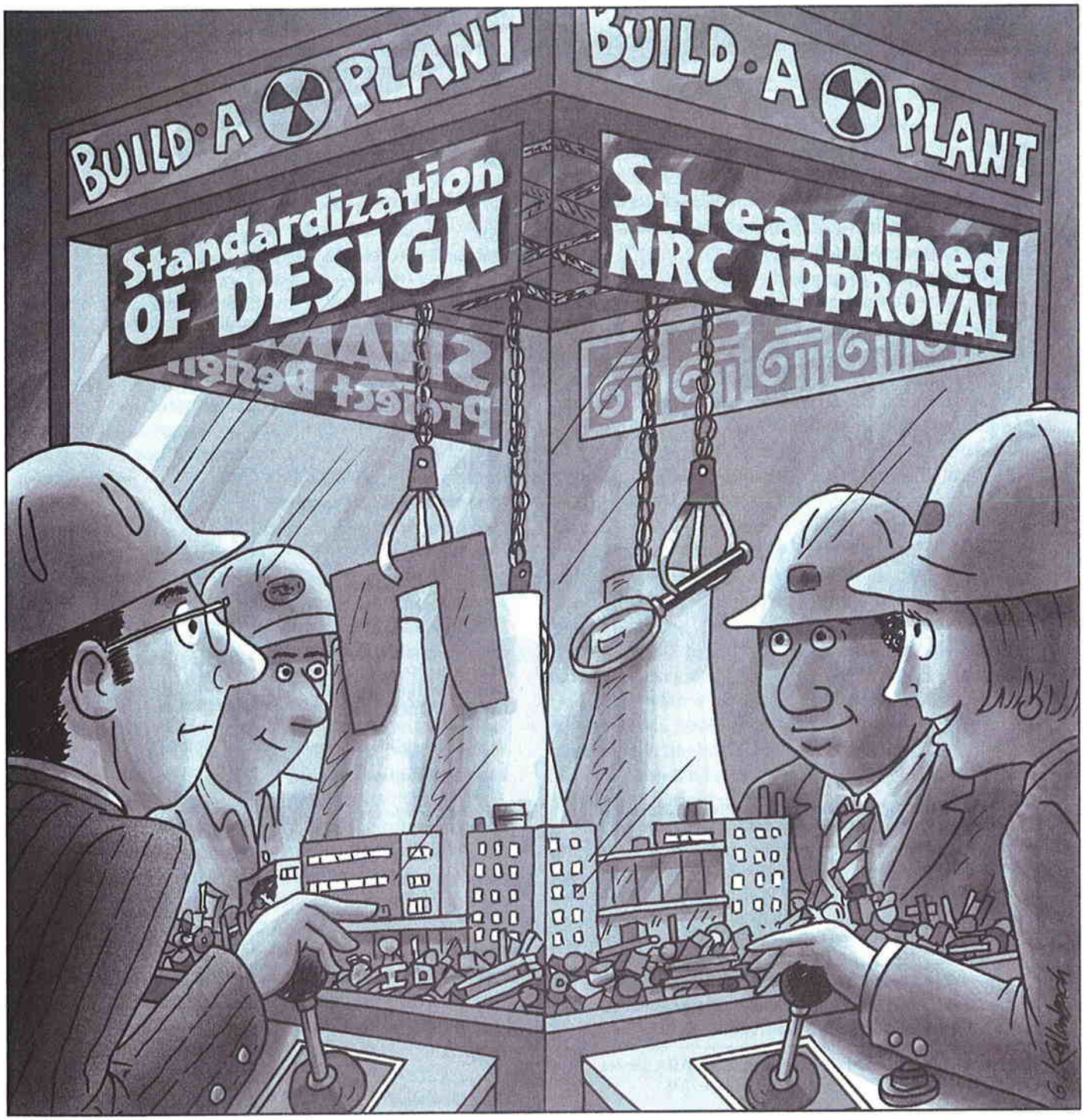

New Approaches to Nuclear Power Project

Illustration: Garrett Kallenbach

A Critical Review of the AACEI Recommended Practice for Forensic Schedule Analysis

By Judah Lifschitz, Evans M. Barba, and Alexis M. Lockshin

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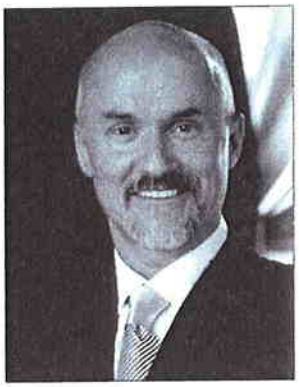

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During the 1950s, in separate programs, the DuPont Company with a team from Remington Rand Company and the U.S. Navy with its Polaris contractor Lockheed Company independently developed project planning techniques based on network analysis for use in scheduling and managing very large projects. DuPont's "Critical Path Planning and Scheduling" (CPSS) and the Navy's "Project Evaluation and Review Technique" (PERT) became the precursors of what is now the standard in the industry for scheduling and project management—critical path method (CPM) scheduling.[1]

Since its development, CPM scheduling has been used by the construction industry for two very different purposes. First, it is used prospectively and contemporaneously to schedule and manage projects. Second, it is used forensically and analytically to prove cause, effect, and liability in delay claim prosecution and dispute resolution. This article addresses this second use of CPM scheduling, as a tool for discerning the proximate cause of project delays, and, in particular, presents a critical review of the *Recommended Practice No. 29R-03 for Forensic Schedule Analysis* (RP) issued by the Association for the Advancement of Cost Engineering International (AACEI) in June 2007.[2]

Any critical assessment of the RP must be done with recognition of the history and development of legal precedent with regard to the forensic use of CPM scheduling. CPM-based delay analysis has evolved in terms of both the techniques employed and the decisional case law commenting upon the different analytical approaches. Various CPM-based delay analysis methods have been proffered over the years by consultants, parties, and counsel to prove and disprove liability in delay claim disputes. If there is a single universal truism, it is that while several methods have been seriously questioned and/or rejected by the courts, no single method has been adopted by the industry, the courts, or the boards of contract appeals as *the* correct or preferred method of analysis.

In June 2007, the AACEI published the RP. The full text is available on the World Wide Web.[3] The stated objective of this publication is to "provide a unifying technical reference for the forensic application of critical path method (CPM) of scheduling" and "to reduce the degree of subjectivity involved in the current state of the art." The introduction to the RP expresses the hope that "the implementation of this Recommended Practice will result in minimizing disagreements over technical implementation of accepted techniques and allow the providers and consumers of these services to concentrate on resolving disputes over substantive issues."[4] Since its publication, the RP has been the subject of much discussion and criticism in the industry. This article offers a critique of the RP, identifies its fundamental flaws, and explains the material concerns that the authors and many in the industry share regarding the RP.

Overview of AACEI's Recommended Practice for Forensic Schedule Analysis (RP No. 29R-03)

In a 100-plus-page document, the AACEI[5] classifies and discusses, from a technical perspective, the methodologies for forensic schedule analysis with a stated desire to minimize disagreements over implementation of the methodologies.[6] The RP defines terminology, identifies and classifies forensic scheduling methodologies, and sets forth procedures and protocols for the use of these methodologies. The RP states that it seeks to "provide a unifying technical reference for the forensic application of critical path method (CPM) scheduling." It also sets out to minimize procedural subjectivity, establish guidelines to increase accountability of analyst opinions, and get away from what it refers to as "black-box" or "voodoo" analyses.

Significantly, the RP states that its focus is on the *technical* aspects of forensic scheduling and not any legal aspects.

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As such, it identifies and describes multiple forensic schedule analysis methods all on an equal footing and without consideration of their legal standing and acceptance.

For a more detailed overview of the RP, see John C. Livengood's two-part article in the Summer/Fall 2008 (Vol. 18 No. 1) and Winter 2009 (Vol. 18 No. 2) issues of the American Bar Association Section of Litigation publication *Construct!*

Significantly, the RP states that its focus is on the *technical* aspects of forensic scheduling and not any legal aspects.

Forensic Methods of CPM Schedule Analysis

Because the RP discusses multiple CPM delay analysis methodologies, as equals, it is useful to review the primary methods of CPM delay analysis and their treatment in the law. Although many an ingenious claimant, litigant, or consultant has developed his or her own case-specific use of CPM scheduling techniques to prove or defend against liability for delay, four basic techniques have been frequently employed and discussed in court and board opinions:

(1) Impacted as-planned;
(2) Collapsed as-built;
(3) As-planned versus as-built; and
(4) Windows analysis.

Impacted As-Planned ("What-if")

Among the very first delay analysis techniques to utilize a CPM schedule was the "impacted as-planned" method (sometimes referred to as the "what-if" method). The technique has been dealt a virtual death knell by the courts and boards of contract appeal that have considered it.[7] In this approach a contractor's original as-planned CPM schedule is utilized and the claimed delays are "inserted" into that schedule to see the effect of these claimed delays on the critical path. The original as-planned schedule is then compared with the impacted version and any resultant additional days are allocated to the claimed delays inserted into the schedule. It is well-settled law that a delay analysis utilizing an impacted as-planned approach will be rejected as invalid.[8] There are several primary reasons for the rejection of this approach. First, this technique ignores the as-built critical path of the project. Second, the technique is predicated on a typically erroneous assumption, i.e., that the project was actually built strictly in accordance with the as-planned sequences, durations, and logic but for the claimed delays. Third, it fails to reflect and consider the entirety of the as-built events and contemporaneous schedule adjustments and logic changes made during the project. Fourth, the method is particularly susceptible to manipulation. As a result, the impacted as-planned technique has been characterized as a "theoretical approach that overlooks actual job history [and thus] is recognized as a legally unacceptable method of proof."[9]

In *Titan Pacific Constr. Corp. v. United States*,[10] the U.S. Claims Court held that the ASBCA had properly rejected an expert's "theoretically adjusted as-planned schedule" that disregarded the facts that actually existed in on-site operations, and, thus, held that "[a]nalyses made after project completion . . . that make adjustments to attain new and revised projected scheduling depend on theoretical contingencies . . . are of limited value." This view was later reaffirmed by the U.S. Claims Court in *Gulf Contracting, Inc. v. United States*,[11] where the court noted that such analyses serve a limited purpose. More recently, in *In re Robust Constr., L.L.C.*,[12] the ASBCA again confirmed that use of an impacted as-planned analysis is inadequate to evaluate project delays, as it fails to take into account and give appropriate credit for all of the impacts to project completion.[13]

Collapsed As-Built ("But For")

The starting point for the collapsed as-built method, also referred to as the "but-for" method, is an as-built CPM schedule (as opposed to the original as-planned schedule) as the basis for the forensic analysis of project delays. To undertake this analysis, one must first develop a complete project as-built schedule, either from a contemporaneously updated CPM schedule or through an after-the-fact review of project records.[14] After developing the as-built CPM schedule, the claimed delaying events and activities are removed from the as-built schedule, thereby "collapsing" the schedule in an attempt to show what would have occurred on an as-built basis "but for" the claimed delays.[15]

Although the collapsed as-built method has on occasion been accepted by courts and boards,[16] its weaknesses are also well known. Indeed, one commentator has noted that "experience with the [but-for method] has led to the conclusion by many in the defense bar that it is impossible for anyone to prepare an unbiased collapsed CPM analysis. [The "but-for" method] is popular because the schedule analysis can be easily manipulated to show the desired outcome."[17] Quite obviously, this technique is only as good as the CPM as-built upon which it relies. Although the use of an as-built schedule provides the benefit of utilizing actual durations and sequences of all construction work activities, it nonetheless remains vulnerable to inadequate or manipulated analysis.[18] The accuracy of the data used to build the as-built, the precision and correctness of the analyst's interpretation of those data, the nature and quality of the subjective determinations of the as-built logic, and the identification and recognition of concurrent causes of delay are all major concerns that arise with the use of a collapsed as-built to determine responsibility for delays.[19]

Further, this method is highly subjective because the analyst creates the as-built schedule, assigns preferential logic, chooses the delay issues to address, creates a fragnet to represent those issues, determines how those fragnets connect and impact the project, and then eliminates the delays in a sequence chosen by the analyst.[20] The subjective choices made by the analyst are often determinative of the results of the analysis and courts frequently note these concerns in questioning the validity of a delay analysis predicated upon a collapsed as-built.[21] The collapsed as-built method also has been criticized for (i) failing to address time extensions on a real-time basis; (ii) failing to look forward, or in a chronological/cumulative sequence; (iii) utilizing after-the-fact logic ties or assumptions that may fail to reflect the contractor's actual views during performance; and (iv) failing to take into account the as-planned schedule. Its deficiencies notwithstanding, it has *on occasion* been accepted as a legitimate method of delay analysis,[22] such as in the case of *Zurn Constructors, Inc. v. Castaic Lake Water Agency*,[23] where the California Court of Appeals upheld an award of delay damages based on the use of a collapsed as-built analysis.

As-Planned Versus As-Built

The as-planned versus as-built method involves a retrospective analysis of the project record to determine the identity, cause, and effect of project delays. To conduct this after-the-fact analysis, one must first identify a sufficiently detailed as-planned schedule to serve as an analytical baseline schedule, typically the contractor's original as-planned schedule or a corrected version thereof. Then an accurate as-built schedule must be developed either from the contemporaneous project schedule updates or forensically from detailed project records such as daily logs, time sheets, and other similar project records. The baseline as-planned schedule is compared with the as-built schedule to identify the differences between the planned and actual progression of the work. These differences are then scrutinized to determine the reasons for the variances from the plan and the effect of the variances on the actual progress of the work.[24] A proper comparison of the contractor's baseline as-planned schedule against a faithfully reconstructed as-built schedule allows for the determination of the project's *as-built* critical path and the identification and quantification of delaying events.

This approach, while very practical, is not scientifically precise. The comparison process can involve subjective determinations about the actual as-built critical path and the extent to which the contractor's as-planned performance was impacted by identifiable time-impacting events.[25] Further, on projects where the contemporaneous record keeping was deficient, there can be difficulty in reconstructing a fully accurate day-by-day historical as-built. Indeed, some commentators have questioned the utility of a reconstructed as-built CPM schedule:

> An as-built CPM can never be a correct document since no one can tell what the restraints that prevailed at the job actually were. No one can totally know the real restraints that took place, why the work is discontinuous (perhaps such simple things like people not showing up for work or preferring to work on something else more attractive on the job site) nor will there be any record of the actual restraint or what made some activity start or not start or stop or not stop on a certain day. Remember, there are both forward past restraints and backward past restraints; and without these for the historical document, all one will have is conjecture. The logic diagramed for as-built CPMs and the dates they produce are only conjecture.[26]

Such concerns notwithstanding, the as-planned versus as-built method of retrospective delay analysis is regularly utilized and accepted as a proper and useful method of delay analysis.[27]

Although the collapsed as-built method has on occasion been accepted by courts and boards, its weaknesses are also well known.

Windows/Time Impact Analysis

Presently, windows/time impact analysis (hereinafter referred to as "windows") is a favored method of establishing project delays. Utilizing a windows approach, the overall as-built project is divided for analytical purposes into separate chronological blocks, or periods of time, referred to as "windows." This enables the sequential analysis of the project and the identification and quantification of the time-related losses and gains as they actually occurred over time. Utilizing each individual window in proper chronological sequence, the contemporaneous schedule as it existed during each window/period of time is updated by the use of either contemporaneous updates or forensically developed updates in order to conduct a detailed, chronological, and cumulative analysis. This results in a window-by-window determination of the events that impacted the time of performance during each individual period and the quantification during each window of the loss or gain in time along the project's as-built critical path. Significantly, the windows approach allows for a period-by-period analysis based upon the actual schedule as it existed during each period. Thus, the contractor's contemporaneous schedule changes are factored into the delay analysis as well as the as-built history of the project, all on a chronological basis.[28]

The analytical advantages of this approach have been described as follows:

> In this approach, a "window" or period of time during which the delay at issue occurred is analyzed, to perform the analysis, a monthly schedule update is utilized immediately prior to the advent of the delay at issue, and the critical path and plan completion date are determined. The actual events and delays encountered during the window of time are introduced into the schedule, and the job is statused at end of the window, typically by using a monthly update immediately after the delay is resolved. This establishes the planned completion at the beginning and end of the window, and the total delay to the project during the window of time. All delays that occurred during the window are analyzed to see which delays impacted the critical path, as well as which delays may represent concurrent delays. The "window analysis" is chronological and cumulative and is a valuable tool for analyzing delay to the job.[29]

The chief criticism of the windows approach is that the selection of the window time periods can be subjective, which can have a material effect on the resulting analysis. As stated in *Old Dominion Electric Cooperative v. Ragnar Benson, Inc.*,

The chief criticism of the windows approach is that the selection of the window time periods can be subjective.

> [i]n a windows analysis, the windows are selected on a subjective basis. One can affect the outcome of the analysis by how one chooses the windows. By selectively choosing the milestones and windows, the results can be controlled. [30]

Another concern arises when a windows approach is used for the purpose of quantifying a specific delay in a specific time period as opposed to analyzing the entirety of the project. Such a partial use of a windows approach may result in a failure to consider and address out-of-sequence progress or the effect of delays occurring in a different time period. Nonetheless, the windows approach remains a widely accepted method of forensic delay analysis.[31]

Industry Reaction to the RP

In December 2008, the RP was the subject of a presentation at the annual Construction SuperConference in San Francisco, California.[32] This presentation identified and discussed the presenter's views relative to numerous flaws and problems in the RP. The noted deficiencies were both global and specific, overarching, and detailed. The presentation generated significant discussion and much criticism of the RP among industry forensic schedule analysis practitioners.

In the months following, industry leaders in forensic schedule analysis communicated with the AACEI expressing similar concerns and dissatisfaction with the RP, including calls for the elimination of the designation "Recommended Practice" and even the outright immediate rescission of the RP.

Primary Global Concerns With the RP

There are several overarching concerns with the RP. First, although the RP purports to be a step forward in establishing a unified technical reference for the forensic application of CPM scheduling, it has not achieved that goal. To the contrary, it has created an uproar in the industry and has not been accepted as a legitimate or authoritative work on the subject.

Second, in its current form, the RP cannot and should not be considered a "Recommended Practice" or "Standard" for the performance of forensic schedule analyses. As stated by a recognized industry leader in a letter to the AACEI regarding the RP:

> As you may be aware, the publication of the RP has generated a significant amount of controversy in the scheduling and expert witness community. Notwithstanding the original intent of the RP, "to minimize disagreements over technical implementation of accepted techniques," it has only served to add further confusion and been a tool for litigators and fact finders who attempt to use the RP as a baseline of acceptable performance. As a result, I must respectfully request that the AACEI remove the designation of Recommended Practice.
>
> I do not make this request lightly. After reviewing the RP in detail, speaking with colleagues and peers, and seeing the manner in which the RP is being used, it is evident that the actual use is inconsistent with the original intent. In the engineering and construction community the term Recommended Practice denotes procedures or processes that are established by authority, custom, or general consent as a model from which a deviation could be the basis for allegations of failure to comply with the standard of care for that industry. The RP does not rise to this level as it is not supported by case law and certainly does not meet the standard of a general consent. [33]

Third, the RP is fundamentally flawed because it fails to consider, and even ignores, the law of delay analysis and relevant and controlling jurisprudence regarding CPM schedule forensic techniques. This is highly problematic because the technical aspects of delay analysis are inextricably intertwined with legal precedent on delay issues. By

describing multiple methods of analysis without indication of their legal standing, the RP erroneously approves of dubious methods long rejected in the law.

Lastly, although the RP is designated a "Recommended Practice," it does not rank the methods of analysis discussed therein in terms of degree of accuracy, reliability, and soundness. Thus, it leaves the erroneous impression that all methods of analysis are of equal quality and merit.

In addition to these global concerns, there exist a number of specific concerns with the RP. Presented below is a sampling of some of the more significant ones, organized according to specific sections of the RP.

Taxonomy and Nomenclature

Section 1.4 of the RP, entitled "Taxonomy and Nomenclature," discusses the RP's approach to "naming" and "classifying" the various methods of analysis. It states, "This taxonomy will allow for the freedom of regional, cultural and temporal differences in the use of common names for these methods." One recognized industry leader has correctly pointed out the confusion created by the RP's attempt to "rename" long-standing methods of analysis:

> The names of all eight methodologies included in the taxonomy are foreign to the construction industry and legal profession and inconsistent with years of case law. Why create new names when you propose to avoid confusion, and when the objective as an expert is to keep it simple, and be convincing and persuasive. The methodologies recognized as plan + impacts, total time analysis, as-plan versus as-built, as-plan versus as-built versus as-adjusted, collapsed as-built, and windows analysis are all recognized and cited in case law whether acceptable or not and for specific reasons. Obviously, there are variations to these. In addition, I believe there are terms that are a poor choice of words such as "hindsight method", "blinder's method", "half step updating", "black box analysis", "voodoo analysis", and others that simply have no place in a RP.[34]

Baseline Schedule Validation

Section 2.1, entitled "Baseline Schedule Selection, Validation, and Rectification," states:

> The baseline schedule is the starting point of most types of forensic schedule analysis. . . . Hence assuring the validity of the baseline schedule is one of the most important steps in the analysis process.
>
> Note that validation for forensic purposes may be fundamentally different from validation for purposes of project controls. What may be adequate for project controls may not be adequate for forensic scheduling, and vice versa. Thus the initial focus here is in assuring the functional utility of the baseline data as opposed to assuring the reasonableness of the information that is represented by the data or optimization of the schedule logic. So for example, the validation of activity durations against quantity estimates is probably not something that would be performed as part of this protocol. The test is, if it is possible to build the project in the manner indicated in the schedule and still be in compliance with the contract, then do not make any subjective changes to improve it or make it more reasonable.
>
> The obvious exception to the above would be where the explicit purpose of the investigation is to evaluate the reasonableness of the baseline schedule for planning, scheduling and project controls purposes. . . . If the baseline schedule is to be used in an observational analysis, the forensic schedule analyst may simply note the baseline's (*sic*) schedule's compliance, or non-compliance, with the various protocols below.

By describing multiple methods of analysis without indication of their legal standing, the RP erroneously approves of dubious methods long rejected in the law.

The authors strongly disagree with the notion that "validation for forensic purposes may be fundamentally different than validation for purposes of project controls. What may be adequate for project controls may not be adequate for forensic scheduling, and vice versa." To the contrary, the validation purposes are and should be fundamentally consistent, i.e., to determine whether the schedule is a reasonable plan to perform the work within the allotted time period. To suggest otherwise is to diminish the importance of contemporaneously *validating* a baseline schedule at the time it is created, which, when done, *validates* the reasonableness of the contractor's baseline schedule for both project controls and forensic analysis purposes. Nor is it correct that the initial focus in validating a baseline schedule is "in assuring the functional utility of the baseline data as opposed to assuring the reasonableness of the information represented by the data" or that "the validation of activity durations against quantity estimates is probably not something that would be performed as part of this protocol" or that "[t]he test is, if it is possible to build the project in the manner indicated in the schedule and still be in compliance with the contract, then do not make any subjective changes to improve it or make it more reasonable."

Although *subjective* changes should not be made to a contractor's baseline schedule, it often is appropriate, if not necessary, to correct a contractor's baseline schedule to

establish a "reasonable baseline" from which to perform a forensic analysis. Such situations include (i) when the contractor's baseline schedule did not comply with contract requirements, (ii) when the schedule contains fundamental logic errors, or (iii) when activity durations are not in accordance with contract requirements. In fact, case law reveals the necessity to establish a "reasonable baseline schedule" when performing a forensic schedule analysis.[35] The RP appears to conflict with this requirement.

Strict adherence to this recommendation could often result in missing the occurrence of a delay in the work that could be critical or concurrent with another delay.

Moreover, the RP contends that making *alterations* to a contractor's baseline schedule for purposes of performing a *modeled* analysis is appropriate, but not appropriate when performing what the RP describes as an *observational type* analysis, in which one should merely "*note the baseline schedule's compliance, or non-compliance*," with the various protocols listed in the RP. Case law, however, provides that a contractor seeking additional time has an affirmative obligation to establish a "reasonable baseline schedule" for purposes of analysis, *irrespective* of the method of forensic schedule analysis used.[36]

As-Built Schedule

Section 2.2.A of the RP, entitled "As-Built Schedule Sources, Reconstruction, and Validation," states:

> Along with the baseline schedule, the as-built schedule is the most important source data for most types of forensic schedule analysis methods.
> ***
> As with the baseline, assuring the validity of the as-built schedule is one of the most important steps in the analysis process.

Thereafter, section 2.2.D.1.f, "Creating an Independent As-Built from Scratch," states:

> Identify the true "start" of an activity. It is usually relatively easy to identify from the as-built data the start of an activity, but not always. It is recommended that the start of an activity be considered the first date associated with a series of substantive work days on the activity.

We question the recommendation that the "start of an activity" should be considered "the first date associated with a series of substantive work days on the activity." Strict adherence to this recommendation could often result in missing the occurrence of a delay in the work that could be critical or concurrent with another delay. To the contrary, rather than simply *ignoring* the first day, or days, associated with the performance of work on an activity, one should exercise professional judgment and inquire *why* the work initially started, stopped, and was resumed at a later time. The inquiry could well disclose an owner-caused or contractor-caused critical and/or concurrent delay event, which would impact the analysis.

Contemporaneous As-IslSchedule Update Approach

Section 3.3, entitled "Observational/Dynamic/Contemporaneous As-Is (MIP 3.3)," states:

> 3.3 is a retrospective technique that uses the project schedule updates to quantify the loss and gain of time along a logic path and identify the causes. Although this method is a retrospective technique, it relies on the forward-looking calculations made at the time the updates were prepared. That is, it primarily uses the information to the right of the updates' data date.
>
> 3.3 is an observational technique since it does not involve the insertion or deletion of delays, but instead is based on observing the behavior of the network from update to update and measuring schedule variances based on unaltered, existing logic models.
>
> Because the method uses schedule updates whose logic may have changed from the previous updates as well as from the baseline, it is considered a dynamic logic method.

As noted under section 3.3.L, the implementation of this method relies upon the *validity* of the contemporaneous schedule updates. The RP, however, fails to address many typical situations when proceeding in accordance with section 3.3 would not be prudent. Examples include the following situations: (i) when a contractor's updates were not approved contemporaneously by the owner because the updates did not comply with the requirements of the contract documents; (ii) where the contractor, in violation of the contract, unilaterally added activities to the schedule, revised schedule logic, or changed activity durations in its updates without providing explanation or justification for the changes; or (iii) where during construction the contractor asserted that the updates did not represent its plan for the work due to the fact that the owner had allegedly failed to timely grant extensions of time for changes and delays. Under the RP, what would one do in these circumstances? *Correct* the projected plan(s) of performance in the updates, or use them *as is*? What if the *corrections* alter the projected critical path or extend the projected date of completion of the work? These are extremely significant issues that go to the heart of being able

to use MIP Nos. 3.3 and 3.4, yet the RP does not discuss these matters at all.

In addition, the RP fails to recognize that while the *projected plan* information in schedule updates may not be *viable* for purposes of analysis, the as-built "progress achieved/percentage of completion" data behind the data date may be of significant value. "Progress achieved" data can be used to perform a *chronological* and *cumulative* forensic delay analysis that progresses through time, measuring the impact of critical delays upon the performance of the work at various "milestones," including commencement or completion of work on given activities, the occurrence of a significant event, or a shift in the as-built critical path. Such an analysis compares what was originally planned with what actually happened. This method facilitates the determination of the status of completion of the work both *prior to* and *after* the occurrence of delays or changes in the work, and thus enables the measurement of the effect of delays or changes in the work on the *as-built critical path* and the *projected date of project completion*. This approach, not even mentioned in the RP, has been accepted by the General Services Board of Contract Appeals and should be included in any *bona fide* RP.[37]

Modeled/Additive Approach

Section 3.6, entitled "Modeled/Additive/Single Base (MIP 3.6)," discusses the "impacted as-planned method." It states:

> 3.6 is a modeled technique since it relies on a simulation of a scenario based on a CPM model. The simulation consists of the insertion or addition of activities representing delays or changes into a network analysis model representing a plan to determine the impact of those inserted activities to the network. Hence it is an additive model.

As previously discussed, the impacted as-planned method is a *theoretical* analysis that purports to establish the duration of delay and number of days of time extension due a contractor for a change or delay in the work, based on inserting a fragnet with *as-built durations* and *logic* into a contractor's as-planned schedule. The result of an impacted as-planned analysis is a purely theoretical projection of the point in time to which a project completion date allegedly *would have been pushed* had the work on the project in question *actually* been performed *as projected* in the as-planned "impacted schedule." The fatal flaws of such an analysis are that it fails to (i) consider what actually happened on a project, (ii) account for contractor-caused delays, and (iii) identify the *as-built critical path* to project completion.

As discussed above, the impacted as-planned method has been widely rejected by courts, and is generally recognized as an improper method of forensic analysis. The following excerpts from *Construction Scheduling: Preparation, Liability, and Claims*, by Wickwire, Driscoll, Hurlbut, and Hillman, are instructive:

Impacted As-Planned Method

This approach, which purports to present a fair picture of responsibility for owner delays on the project by impacting the original CPM on the project solely with owner delays encountered during performance, suffers from one fatal flaw: it ignores what actually happened on the project, including excusable delays and delays by the contractor. Actual performance by all parties must be considered.[38]

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. . . [A]ppellants['] fragnet analyses did not reflect the actual start and finish dates of the impacting and impacted activities (finding 40). Hence those analyses are not sufficiently credible to show the duration of delays. See Youngdale & Sons Construction Co. v. United States, 27 Fed. Cl. 516, 552–53 (1993).[39]

Under the RP what would one do in these circumstances? Correct the projected plan(s) of performance in the updates, or use them *as is*?

The RP, however, presents the impacted as-planned method as an *accepted method* of analysis, to be used *prospectively* or *retrospectively* to establish a contractor's entitlement to an extension of time. RP section 3.6.A states expressly that this method

> can be used *prospectively* and *retrospectively. Prospectively it can be used to forecast future impacts.* Retrospectively, it relies on the forward looking calculations to the right of the data date. (Emphasis added.)

This statement coupled with the introduction, which refers to "accepted techniques," clearly presents the impacted as-planned method as an *accepted method* of retrospective analysis. Further, by stating that this method can be used *prospectively*, the AACEI has equated the terminology "impacted as-planned method" with the term "*prospective* time impact analysis," thereby *confusing* rather than *clarifying* the differences between these two *fundamentally different* methods of analysis.

The RP elevates the impacted as-planned method to a level of apparent credibility, which stands in stark contradiction to the method's wide rejection by the courts. The RP's acceptance of this method is a significant step backward in the forensic application of critical path method scheduling. It is noteworthy that in a recent *Construct!* article,[40] one of the coauthors of the RP characterized

the RP as the "first American effort at a 'how to' manual on Forensic Schedule Analysis." Significantly, this article, which discusses the methods of analysis in the RP, concedes that with regard to the impacted as-planned methodology, that "[t]he biggest problem of the methodology is that it has been widely rejected by courts." This significant fact should have been clearly stated in the RP.

As noted above, the RP has mistakenly equated the terminology "impacted as-planned method" with the term "*prospective* time impact analysis." Although not discussed in the RP, there are fundamental differences between a *prospective* "time impact analysis" and the "impacted as-planned method" of analysis. A prospective "time impact analysis" is used to *estimate* the effect a given change or delay *may* have on the performance of the work on a project, *in advance of performance* of the changed work or occurrence of a delay. This method involves contemporaneously inserting into the schedule updates in effect at the time the change is issued or the delay occurs a fragnet with durations and logic that represent a contractor's *best estimate* of future events related to the performance of the changed or delayed work.[41] The impacted as-planned method, on the other hand, is a theoretical, *after-the-fact* approach that purports to establish the duration of delay and number of days of time extension based on retrospectively inserting a fragnet with *as-built* durations and logic into the schedule update in effect at the time the change was issued or delay occurred.

The RP elevates the impacted as-planned method to a level of apparent credibility, which stands in stark contradiction to the method's wide rejection by the courts.

The "Advantages and Disadvantages" Subsections

The RP subsections entitled "Advantages and Disadvantages" under the discussion of the various "Method Implementation" sections are problematic. The subject headings are cryptic and misleading. For example, section 3.2 discusses the "as-planned versus as-built" method of analysis. Subparagraph L.2, "Weaknesses & Disadvantages," states that the subject method is "[n]ot suitable for projects of extended duration." The basis for the statement is unclear, and, in any event, this statement is incorrect because this method of analysis is equally useful in projects of shorter duration as well as those of longer (extended) duration.

The confusion created by the RP's attempt to identify relative "strengths" and "weaknesses" of the analytical techniques was pointedly noted by a recognized forensic schedule analysis practitioner in a letter to AACEI:[42]

> The RP sets forth that "it is not the intent of the RP to exclude or endorse any method over others." However, the RP goes on to list the purported "Strengths & Advantages" and the purported "Weaknesses & Disadvantages" for the various forensic schedule analysis methods presented. Notwithstanding the fact that these purported advantages and disadvantages are opinions unsupported by fact, case law, or reasoned argument, what was the purpose of listing these advantages and disadvantages if not to exclude or endorse specific forensic methods?

Concurrent Delay

Among the more confusing and troublesome sections of the RP is its discussion of the identification and quantification of concurrent delay under section 4.2. Specifically, the RP's discussion ignores and/or misstates much of the currently recognized concepts and principles applicable to the identification, determination, and adjudication of concurrent delays and, instead, sets off on its own to create its own new concepts and theories. For example, a key starting point of the RP's consideration of the identification and quantification of concurrent delay is its hypothesis that there exist two different and conflicting definitions of concurrent delay, which it labels as "literal concurrency" and "functional concurrency." In fact, these terms are not recognized in the volumes already written on this subject. As correctly noted by one industry authority, the RP's new definitions reflect a basic misunderstanding by the authors of the RP of concurrent delays:

> Various sections of the RP refer to concurrent delay. As noted previously, this raises a serious question about the Committee's understanding of concurrent delay. The RP states that concurrent delay is the most contentious technical subject in forensic analysis. In addition, it states there is no consensus on many factors affecting the identification and quantification of concurrency. I disagree unless the RP is referring to differing opinions among the Committee itself. The RP refers to literal concurrency and functional concurrency. The RP states the difference is whether delays have to be literally concurrent in time, as is happening at the same time, or they need to be functionally concurrent so that only the separate network paths on which the delays reside be concurrently impacting the completion date. The RP further states under the literal approach, an owner delay and a contractor delay of equal duration occurring at different times are calculated as a period of compensable delay for the owner and a separate period of compensable delay of equal length for the contractor. The RP concludes the two periods will cancel each other out in time. Without further clarification of the hypothetical facts, I would suggest this to be an incorrect understanding of concurrent delay.[43]

Second, as is true throughout the RP, the discussion of concurrent delay fails to consider the extensive development in the law of the issues related to the identification and

adjudication of concurrent delays. For example, the RP's discussion of the effect of delay events—see, e.g., table 2, Net Effect Matrix Concurrent Delay—fails to address the well-established legal requirement to allocate delays and fails to appreciate that the requirement for allocation of delays generally results in a careful and relatively precise segregation of delays into separate causes and effects, thereby avoiding a whole cloth assertion of concurrency.

Third, the RP's discussion of concurrent delay fails to adequately address the fact that the challenge in adjudicating claims of concurrency is often less the result of difficulty in developing a credible CPM analysis, but rather discerning the facts—the true cause and effect of events and delays on the project.

Further, the RP's concurrency discussion suggests that concurrent delays can be identified and quantified using the long-rejected impacted as-planned method as an acceptable technique. The authors are not aware of cases involving concurrent delay in which such an approach has been accepted.

Lastly, the RP's discussion of pacing in section 4.2.B suffers from many of the same problems as does its discussion of concurrent delays. Additionally, the RP mistakenly suggests that pacing is an issue that relates solely to concurrent delays. This is incorrect. To the contrary, often the defense of pacing is raised where no concurrency issue exists; for example, to explain why a contractor did not achieve its planned labor efficiency or progress in a particular phase of work at a point in time when no other concurrent delay exists.

Fundamental Concerns

As discussed above, there are many concerns, large and small, technical and philosophical, and analytical and legal, with the RP. But two overarching fundamental concerns are worthy of repetition. First is the AACEI's designation of the RP as a "Recommended Practice," a title that connotes a highly reliable and accepted industry standard. Given the many issues and concerns with the RP, the RP should not be regarded as authoritative on the subject of forensic delay analysis.

Second, as discussed above, forensic schedule analysis is inextricably intertwined with the law of delay and disruption. The RP ignores legal precedent and purports to discuss only the "technical" aspects of delay analysis. In large measure, this simply is a non sequitur, since a delay analysis methodology that does not obtain judicial imprimatur has little value. Nor is it a sufficient justification (as some associated with the RP have argued) that because the AACEI is an organization that spans the globe, with members in over sixty nations, its RP cannot be expected to address the law of over sixty nations. Ignoring the law completely in a document presented as a Recommended Practice is to create, not resolve, confusion, misunderstanding, and error.

Endnotes

1. GLENN L. WHITE, THE USE OF CPM IN CONSTRUCTION: A MANUAL FOR GENERAL CONTRACTORS AND THE CONSTRUCTION INDUSTRY 7 (Associated General Contractors of America 1976).

2. On the eve of submission of this article, the AACE International issued a revision to the RP. A critical review of this revision and any future revisions will be the subject of a future article.

3. AACE INTERNATIONAL RECOMMENDED PRACTICE No. 29R-03, FORENSIC SCHEDULE ANALYSIS, www.aacei.org/technical/rps/29R-03.pdf [hereinafter FORENSIC SCHEDULE ANALYSIS].

4. *Id.*

5. The AACE International is an industry-independent organization and is considered to be the leading professional society for cost estimators, cost engineers, schedulers, project managers, and project control specialists in the United States. It has been in existence since 1956 and has more than 5,500 members in seventy-eight countries worldwide. It is considered to be the largest organization serving the entire spectrum of cost management professionals. Forensic scheduling analysis is "the study and investigation of events using CPM or other recognized schedule calculation methods for use in legal proceedings" and is described as both "a science and art" relying upon professional judgment and expert opinion.

6. *See* FORENSIC SCHEDULE ANALYSIS, *supra* note 3.

7. *See* 5 PHILIP L. BRUNER & PATRICK J. O'CONNOR JR., BRUNER AND O'CONNOR ON CONSTRUCTION LAW § 15:134. *See also* Titan Pacific Constr. Corp. v. United States, 17 Cl. Ct. 630 (Cl. Ct. 1989), *aff'd*, 899 F.2d 1227 (Fed. Cir. 1990); Gulf Contracting, Inc. v. United States, 23 Cl. Ct. 525, 527 (Cl. Ct. 1991); *In re* Robust Constr., L.L.C, A.S.B.C.A. No. 54056, 2005-2 B.C.A. (CCH) ¶ 33,019, 2005 WL 1634771 (2005).

8. *See* Gulf Contracting, Inc., ASBCA Nos. 30195 et al., 89-2 B.C.A. ¶ 21,812, at 91,989 (1989), reconsidered, 90-1 B.C.A. ¶ 22,393 (1990), *aff'd*, Gulf Contracting Co. v. U.S., 23 Cl. Ct. 525 (Cl. Ct. 1991), *aff'd without op.*, 972 F.2d 1353 (Fed. Cir. 1992), *cert. denied*, 113 S. Ct. 598 (1992); *Titan Pacific Constr. Corp.*, 17 Cl. Ct. 630; John T. Jones Constr. Co., A.S.B.C.A. No. 48303 (1997); J.D. Pirrotto, A.S.B.C.A. No. 37939, 94-2 B.C.A. ¶ 26,726 (1994); Ealahan Elec. Co., DOTBCA No. 1959, 90-3 BCA ¶ 23,177 (1990); BRUNER & O'CONNOR, *supra* note 7, § 15:134; JON M. WICKWIRE, THOMAS J. DRISCOLL, STEPHEN B. HURLBUT & SCOTT B. HILLMAN, CONSTRUCTION SCHEDULING: PREPARATION, LIABILITY & CLAIMS § 9.06[D] (Aspen Law & Business, 2005 and Supp. 2009) (1991) (citing *Robust Constr.*, 2005-2 B.C.A. (CCH) ¶ 33,019).

9. *Id.*

10. 17 Cl. Ct. 630.

11. 23 Cl. Ct. at 529.

12. 2005-2 B.C.A. (CCH) ¶ 33,019.

13. *Id. See also* cases cited in note 7, *supra*.

14. Metric Constr. Co., Inc. v. United States, 81 Fed. Cl. 804, 821 (Fed. Cl. 2008); BRUNER & O'CONNOR, *supra* note 7, § 15:135. If using project records, the records are used to reconstruct the day-by-day history of the job, thereby establishing start and finish dates for every activity as well as the as-built sequence and logic actually employed.

15. Fischbach & Moore Int'l Corp., A.S.B.C.A. No. 18,146, 77-1 BCA ¶ 12,300 (1977); John Murphy Constr. Co., AGBCA No. 418, 79-1 B.C.A. ¶ 13,836 (1979).

16. *Id.*

17. BRUNER & O'CONNOR, *supra* note 7, § 15:135 (citing MICHAEL T. CALLAHAN & H. MURRAY HOHNS, CONSTRUCTION SCHEDULES 254 (2d ed. 1998)). *See Metric Constr. Co.*, 81 Fed. Cl. at 821.

18. *Id.*

19. BRUNER & O'CONNOR, *supra* note 7, § 15:135 ("First, the after-the-fact approach fails to address the need to issue time extensions on a real-time basis. Second, the analysis is not forward looking,

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81. Int'l Herald Trib., Nov. 20, 2008.
82. Moody's Investor Services, *supra* note 72, at 8.
83. *Id.* at 10.
84. Nucleonics Wk., Feb. 15, 2007, at 13.
85. *The Nuclear Options*, Power Mag., Jan. 2009.
86. Chicago Trib., June 1, 2008.
87. Nucleonics Wk., *supra* note 84, at 13.
88. *Id.*
89. Fed. Energy Regulatory Comm'n, *supra* note 69.
90. *Id.*
91. *Id.*
92. *Id.*
93. Moody's Investor Services, *supra* note 72, at 9.
94. William Gardner, Standardized Plants, Impact on New Nuclear Build, Nuclear Power Congress, Dec. 2008.
95. *AREVA Filed Application with NRC for Certification of US-EPR Design*, Nucleonics Wk., Dec. 13, 2007, at 5.
96. Gardner, *supra* note 94.
97. *Id.* at 13.
98. James Carter, Effective Planning and Execution Strategies for New Nuclear Building, Nuclear Power Congress, Dec. 2008.
99. *Nuclear Tangled Economics*, Bus.Wk., June 26, 2008.

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chronological, and cumulative. Third, in order to collapse the schedule, the analyst typically is forced to insert after-the-fact logic ties that may not reflect the thinking of the contractor during actual performance. Fourth, adjustments for anomalies in the adjusted schedule require experienced judgment that is beyond the capability of many analysts and may be subject to dispute by experienced experts. Regardless of the disadvantages, 'but for' analyses continue to be accepted as valid methods of measuring delay.") (quoting Jon M. Wickwire & Stuart Ockman, *Use of Critical Path Method on Contract Claims—2000*, 19:4 Constr. Law. 12, 15 (Oct. 1999)).

20. Metric Constr. Co., Inc. v. United States, 81 Fed. Cl. 804, 821 (Fed. Cl. 2008). *See also* Bruner & O'Connor, *supra* note 7, § 15:135.

21. Bruner & O'Connor, *supra* note 7, § 15:135 (citing Callahan & Hohns, *supra* note 17, at 254) (the but-for method "is popular because the schedule analysis can be easily manipulated to show the desired outcome").

22. Fischbach & Moore Int'l Corp., A.S.B.C.A. No. 18,146, 77-1 B.C.A. ¶ 12,300 (1977); John Murphy Constr. Co., A.G.B.C.A. No. 418, 79-1 B.C.A. ¶ 13,836 (1979).

23. 2003 WL 22846350 (Cal. App. 2 Dist. 2003).

24. *See, e.g.*, Wayne Knorr, Inc. v. Dep't of Transp., 2009 WL 1324068 (Pa. Commw. Ct. 2009) (noting expert's use of an as-planned versus as-built schedule to evaluate project delays).

25. *See, e.g.*, Sunshine Constr. & Eng'g, Inc. v. United States, 64 Fed. Cl. 346, 368–69 (2005).

26. Bruner & O'Connor, *supra* note 7, § 15:132 (quoting Callahan & Hohns, *supra* note 17, at 273).

27. *See, e.g.*, *Sunshine Constr. & Eng'g*, 64 Fed. Cl. at 368–69 (describing an approved delay analysis method as a review of "the as-planned schedule, schedule updates, progress payments, and other project documentation in order to construct an as-built schedule").

28. *See* Bell BCI Co. v. United States, 81 Fed. Cl. 617, 640 (Fed. Cl. 2008) (accepting a "time impact analysis" that "inserted fragnets into the CPM update for the applicable month to determine the effect of the extra work"); Hennessey v. U.S. Agency for Int'l Dev., 121 F.3d 698 (4th Cir. 1997) ("The first part included the 'as-built' data, which is an historical record of when the various project construction activities took place. The second part is a methodology, pursuant to which the project was divided into several 'windows,' where time periods and events that affected the project schedule during each window were examined. The third part is the causation analysis, which synthesized the relationships between the various scheduling delays and the ultimate delay in the completion date. This portion also attributed responsibility for specific delays."); *In re* Donohoe Constr. Co., A.S.B.C.A. Nos. 47310 et al., 99-1 B.C.A. ¶ 30,387, 1999 WL 322644 (1999) (CPM time impact analysis, using as a starting point the original approved baseline CPM, was accepted by Board as persuasive); SAE/Americon-Mid Atl., Inc. v. Gen. Servs. Admin., G.S.B.C.A. Nos. 12294 et al., 98-2 B.C.A. ¶ 30,084, 1998 WL 753312 (1998) (scheduling methodology that "marches through the project, [and] measures where the project stood at certain milestones" and then attempts to determine where the project was prior to and after the alleged change or delay, was accepted by the board); Bruner & O'Connor, *supra* note 7, § 15:136.

29. Bruner & O'Connor, *supra* note 7, § 15:136 (citing Wickwire & Ockman, *supra* note 19, at 15).

30. 2006 WL 2854444 (E.D. Va. 2006) (rejecting use of a windows analysis, noting that a windows analysis could be manipulated to obtain a particular result).

31. *See, e.g.*, Donohoe Constr. Co., A.S.B.C.A. Nos. 47310 et al., 98-2 B.C.A. ¶ 30,076, reconsidered, 1994 WL 322644 (1998) (accepting expert's use of window analysis); *SAE/Americon-Mid Atl.*, Inc., 98-2 B.C.A. ¶ 30,084 (accepting time impact analysis that utilized a reasonable adjusted as-planned schedule as the initial baseline, analyzed the schedule before and after each delay, evaluated the interrelationships of the delays, and adjusted the as-planned schedule for the actual status of the project and the remaining work in order to evaluate each successively).

32. Evans Barba, Peer Review of AACE International's Recommended Practice No 29R-03, Forensic Schedule Analysis, Annual Construction SuperConference, San Francisco, California, Dec. 12, 2008. "I wasn't given the chance to review it before it was published, so I thought I'd do it now."

33. Letter from Irvin E. Richter, Chairman and CEO, Hill International, Inc., to AACE (Mar. 6, 2009) (on file with the authors).

34. Letter from Thomas J. Driscoll, Senior Vice President, URS Corp., to AACE International (June 20, 2009) (on file with the authors).

35. *See* Bruner & O'Connor, *supra* note 7, §§ 15:8, 15:128 (noting the importance of a reasonable baseline schedule).

36. *Id.*

37. SAE/Americon-Mid Atl., Inc. v. Gen. Servs. Admin., GS-BCA Nos. 12,294 et al., 98-2 B.C.A. ¶ 30,084, 1998 WL 753312 (1998) (accepting time impact analysis that utilized a reasonable adjusted as-planned schedule as the initial baseline, analyzed the schedule before and after each delay, evaluated the interrelationships of the delays, and adjusted the as-planned schedule for the actual status of the project and the remaining work in order to evaluate each successively).

38. Wickwire et al., *supra* note 8, § 9.06[D], at 274.

39. *Id.* § 9.06[D], at 123.

40. John C. Livengood, *The New AACEI Recommended Practice for Forensic Schedule Analysis (Part 1 of 2)*, 18:1 Construct! 1 (Summer/Fall 2008).

41. Evans M. Barba, *Prospective and Retrospective Time Impact Analysis*, Constr. Briefings, July 2005.

42. Letter from David Halligan, PhD, PE, to AACEI (Jan. 28, 2009) (on file with the authors).

43. Letter from Thomas J. Driscoll, *supra* note 34.

44. *Id.*