UNDERSTANDING CONSTRUCTION SCHEDULING—A *CRITICAL PATH* TO SUCCESSFUL CLAIMS HANDLING

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INTRODUCTION

Insurance and surety claim handlers are often tasked with evaluating and responding to claims involving complex issues, despite not being present to observe the issues in question. Usually, the complexity for handling claims increases when delays and attendant costs come into play. For insurance carriers, a covered event under a Builder's Risk policy may result in a delay in start-up and a claim for the associated interruption costs. For surety claims handlers, a contractor's default may trigger a surety's performance obligation under its bond. Commonly, that default involves an allegation by the obligee that the bond principal has delayed completion of the project. In a contested default scenario, the principal often alleges that the obligee (or a third party) has delayed the project, causing damage to the principal. In each of these instances, understanding who is responsible for the delays and whether the delays are compensable, excusable, or non-excusable is a critical skill for successful claims handling. Fortunately, insurance companies and sureties have access to in-house engineers and an outside stable of construction consultants who are well-versed in analyzing project schedules. However, a fundamental understanding of the accepted methods of forensic schedule analysis, as well as the pros and cons of each, benefits all claims professionals, because scheduling issues may materially impact the insurance carrier's analysis of what costs are reimbursable, the surety's analysis of whether the principal is in default, the negotiation related to contract funds, the time available for the surety to complete remaining work, and/or the evaluation of competing delay claims.

I. SCHEDULING: MANAGING TIME-RELATED CHAOS

Planning of a construction project requires considerations for material and equipment procurement and delivery, sequencing of tasks, and trade coordination. Multiple trades are expected to perform concurrently and efficiently to meet project milestones and avoid cost overruns. As a result, modern construction projects are often fraught with disputes. Owners, construction managers, designers, and general contractors generate and rely on critical path method (CPM) construction schedules to map out the planned construction effort and evaluate performance.

As discussed in this article, forensic schedule analysis comes in different shapes, forms, and methodologies. The common thread among the methodologies is that they are implemented on schedules developed to manage a complicated series of activities that require constant review, analysis, and revision. The best laid plans of owners, contractors, and subcontractors often go awry and often result in potential disputes between parties. Forensic analysis provides a framework for evaluating the disputes and allocating responsibility for a party's failure to meet its obligations and expectations. Much as the process of planning and coordinating a construction project is chaotic, courts occasionally have found the task of adjudicating to be as complicated:

> [E]xcept in the middle of a battlefield, nowhere must men coordinate the movement of other men and all materials in the midst of such chaos and with such limited certainty of present facts and future occurrences as in a huge construction project . . . . Even the most painstaking planning frequently turns out to be mere conjecture and accommodation to changes must necessarily be of the rough, quick and ad hoc sort, analogous to ever-changing commands on the battlefield. Further, it is a difficult task for a court to be able to examine testimony and evidence in the quiet of a courtroom several years later concerning such confusion and then extract from them a determination of precisely when the disorder and constant readjustment, which is to be expected by any subcontractor on the job site, became so extreme, so debilitating and so unreasonable as to constitute a breach of contract.[1]

Forensic schedule analysis "is about allocating responsibility for the chaos and helping the parties to price the source and impact of that chaos."[2] Having a general understanding of the methodologies discussed below is a critical skill for successful claims handling and ensuring a less chaotic outcome for claims resolution.

1. Blake Constr. Co., Inc. v. C.J. Coakley Co., Inc., 431 A.2d 569, 575 (D.C. Cir. 1981).
2. W. Stephen Dale & Robert M. D'onofrio, Construction Schedule Delays § 1:1 (2016).

II. AN OVERVIEW OF COMMON SCHEDULING METHODOLOGIES

Various methods of forensic schedule analysis are detailed in technical references published by industry bodies and have been accepted and rejected by triers or fact based on their use and application. The two primary reference documents for delay analysis are the Association for the Advancement of Cost Engineering International (AACE) Recommended Practice 29R-03 and the Society of Construction Law (SCL) Delay and Disruption Protocol. Generally, the AACE is commonly applied to U.S.-based projects, while SCL is used internationally. This paper provides a high-level review and examples of four commonly used methods that are recognized by both AACE and SCL to prove or rebut construction delay claims: (1) as-planned vs. as-built analysis; (2) windows analysis; (3) time impact analysis; and (4) collapsed as-built analysis.

A. *Background Information*

To explain the four noted methods, the reader is to assume that hypothetical disputes exist between a contractor and an owner that have entered into an agreement for the construction of a project.[3] The disputes involve allegations regarding project delays. Any "delay" referred to is assumed to be critical—meaning that it impacts the critical path of a project and thus delays the overall completion of the project. The critical path is the sequence of work activities that add up to the longest overall duration to achieve completion of a project.[4] An important concept in construction scheduling is "float," which is the amount of time that an activity can be delayed before it impacts completion of the project.[5] Activities on the critical path have no available float.[6] Therefore, impacts that delay critical path activities result in a corresponding delay to the completion date of a project.

B. *Types of Delays*

There are three categories for delays: (1) excusable-compensable delays; (2) excusable-non-compensable delays; and (3) non-excusable delays.[7]

3. Delay claim disputes often exist between general contractors (or construction managers/owners) and subcontractors, and the four noted forensic schedule analyses are often used to prove or rebut delay claim issues between such parties.

4. Elden F. Jones, Scheduling 101—The Basic Of Best Practices (2009) (unpublished paper submitted at Project Management Institute Global Conference).

5. Float, Builder Questions, https://www.builder-questions.com/construction-glossary/float (last visited Apr. 9, 2019).

6. Float may also appear negative if a project completion milestone is constrained to a particular date and the project experiences a delay. In this case, the forecast completion overruns the constrained date, generating a negative float that reflects the number of days of overrun with respect to the constraint.

7. *See, e.g.*, Appeal of Kirk Bros. Mechanical Contractors, Inc. ASBA No. 43738, 93-1 BCA ¶ 2532 , 1992 WL 197581 (Aug. 6, 1992) ("Where the delay is caused solely by the Government, it is compensable; where the delay is caused solely by the [contractor], [the contractor]

Contract agreements typically define specific types of delays that fall into each of these three categories of excusable-compensable, excusable non-compensable, or non-excusable delays. Of the delay categories, excusable-compensable delays entitle the contractor to both an extension of time and associated costs, or damages, for the delay. Typical excusable-compensable delays involve differing site conditions, lack of access, interference, and added work. Excusable-non-compensable delays entitle the contractor to only an extension of time as a remedy, but no compensatory damages. Typically, these delays are those that are out of the control of both the contractor and the owner. Examples of excusable-non-compensable delays may include force majeure events, adverse weather, public utility delays, or instances where the contractor and owner have overlapping or concurrent delays.[8] Non-excusable delays do not entitle the contractor to either time or damages, as these delays arise from the actions (or inactions) of the contractor. One example of a non-excusable delay would be a contractor's failure to submit shop drawings in a timely manner. Accordingly, non-excusable delays entitle the owner to actual damages or liquidated damages, depending on the contract agreement.

C. *Review of Forensic Scheduling Methodologies*

Once entitlement for an impact issue is established, the next step in the claims process is to evaluate whether the impact caused a delay to the completion date of the project through a forensic schedule analysis. It is important for the claimant to review the contract requirements related to delay claims to determine what type of delay analysis is required, if any. While variants of the methodologies discussed below exist, the most common forensic scheduling techniques are

1. As-Planned vs. As-Built Analysis;
2. Windows Analysis;
3. Time Impact Analysis; and
4. Collapsed As-Built Analysis.

Depending on the nature of the dispute and the information available, certain methodologies may be more appropriate or more reliable than others.

is responsible. Where the delay is prompted by inextricably intertwined concurrent Government and contractor causes, the delay is not compensable."); Andrew D. Ness, Federal Government Construction Contracts, American Bar Association 413, 424–27 (Adrian L. Bastianelli et al. eds., 2d. ed. 2003).

8. Depending on the specific language of the contract, certain traditionally excusable-non-compensable delays such as weather may be considered compensable. To make matters even more interesting, delays that shift a project into an unanticipated weather period—for example, paving work that was planned for summer is delayed by owner-impacts and then cannot be performed due to temperature requirements—may result in compensability for these extended impacts.

1. As-Planned vs. As-Built Analysis

The as-planned vs. as-built methodology is a retrospective delay analysis that compares a given schedule, oftentimes the baseline schedule or the contemporaneous schedule update, prior to delay event(s) (the "as-planned") against the "as-built" schedule, a subsequent update or generated schedule that reflects actual progress through a particular point in time. As-planned vs. as-built is a static logic observational method, as it relies on the examination of one set of as-planned network logic, without any changes to the schedule to model or simulate any impacts. An as-planned vs. as-built analysis is typically implemented when a reliable baseline and as-built activity data exist, but interim schedule updates were either not produced or are not reliable for use.

The as-planned vs. as-built method compares what happened to what was supposed to happen. It measures the activities of the "planned" schedule against that of the as-built schedule to identify and quantify encountered delays. When using this method, evaluation of delays should be based on the measurement between as-built actual dates and the late dates in the as-planned schedule as opposed to the early dates. The late dates reflect when available float for the activity is exhausted and thus when the activity becomes critical.

The analysis can be a simple graphical comparison or a more complex analysis that considers start and finish dates and the sequencing of the schedule activities. As an example, linear construction projects, such as road or pipeline construction projects with discrete delay issues, may utilize a simpler implementation of the as-planned vs. as-built schedule analysis. A more sophisticated implementation of the as-planned vs. as-built schedule analysis methodology compares the start and finish dates, durations, and relative sequences of the activities and seeks to determine the root causes of each variance. The complexity of the implementation depends on the nature and complexity of both the project and the issues under evaluation.

The as-planned vs. as-built methodology faces criticism when other, more comprehensive methods are available. Because as-planned vs. as-built does not explicitly use Critical Path Method (CPM) logic, this methodology does not directly allow for evaluation of concurrent delays. Analysis of legal tribunals by Dale and D'Onofrio in 2014 determined that the as-planned vs. as-built methodology had a significantly lower acceptance rate than all other methods.[9]

The following table details the key characteristics of the as-planned vs. as-built methodology:

9. W.S. Dale & R.M. D'Onofrio, Construction Schedule Delays, Thomson Reuters West (2014).

As-Planned vs. As-Built	
Primary Application: Contemporaneous schedule updates are unavailable or unreliable Simple schedules and clear impacts causing delays	
Pros: • Can be visually persuasive. • Presents simply and is often straightforward to explain. • Can be used when data is limited. • Can be performed relatively easily and thus may also be cost effective.	*Cons:* • Does not involve explicit use of CPM logic. • Causation is not demonstrated by analysis and must be substantiated and narrated effectively. • Subjectivity in selection / presentation of data. • Can fail to recognize changes in logic, and thus is not suitable for complex projects or projects constructed differently than planned. • Accuracy / reliability diminishes over larger duration spans. • Does not evaluate concurrent delays.

The following presents an example of an as-planned vs. as-built analysis:

As-Planned vs. As-Built Example:

The contractor's agreement with the owner requires the construction of a small, one-story addition project within 120 days, or 4 months:

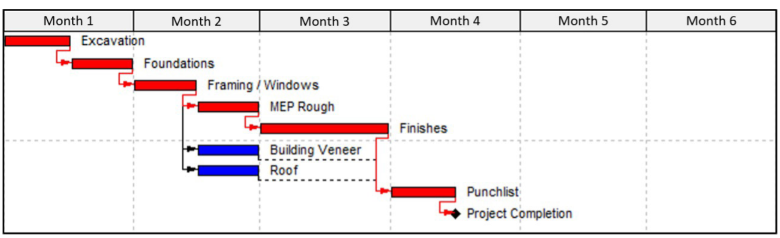

Figure 1. AP vs. AB Example—Baseline Schedule

The contractor completes their work within 150 days, or 30 days later than planned. The contractor argues that the late completion was the result of adverse weather that occurred during foundation installation. The agreement stipulates that the contractor is entitled to additional time, but no compensation, in the event of adverse weather that impacts performance. The contractor performs an as-planned vs. as-built analysis, as shown below, which compares the project baseline schedule to the as-built schedule. This comparison illustrates the contractor's argument that the extended duration of the foundation work extended the overall completion of the project by 30 days, thus entitling the contractor to a 30-day excusable-non-compensable time extension for the weather impacts.

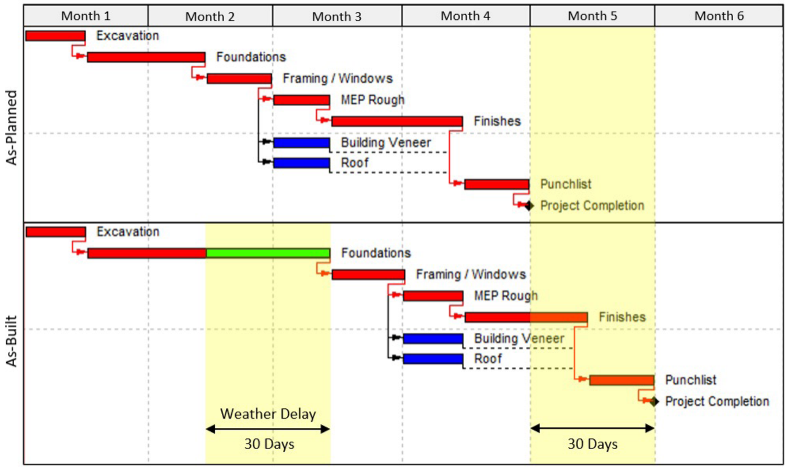

Figure 2. AP vs. AB Example—AP vs. AB

2. Windows Analysis

A Windows Analysis, also referred to as a Contemporaneous Period Analysis, is another retrospective technique that addresses some of the shortfalls of the as-planned vs. as-built methodology. A Windows Analysis considers the interim assessment of delays on updated schedules over specific intervals or "windows." A Windows Analysis is effectively a series of as-planned vs. as-built analyses performed using contemporaneous updates along the desired analysis period. Mechanically, a Windows Analysis is identical to the as-planned vs. as-built analysis in that it compares activity start and finish dates, compares durations and relationships between the updates, and evaluates the effect of any change on the project's completion date or interim milestones. The key differentiator between the two methods is the segmentation of the analysis periods. Fundamentally, a Windows Analysis is simply a study of the development of the project's critical path over time.

By segmenting the study across discrete intervals, explicit causes of delay to the critical path (or near-critical activities) can be identified. Like the as-planned vs. as-built methodology, a Windows Analysis is observational; however, it differs in that it uses dynamic logic observation. Nearly all but the simplest construction projects have changes in logic that are incorporated during the project, usually because of additional work, re-sequencing, and mitigation of impacts. The Windows Analysis method considers the variations in logic between updates and allows for examination of a dynamic critical path from period to period, as the project unfolds. In an as-planned vs. as-built analysis, the evaluation of delays is performed over one window—typically from the baseline to the as-built schedule. Unlike the as-planned vs. as-built methodology, which is criticized for its reliance on baseline logic that may differ from the actual project conditions, the Windows Analysis addresses this issue by performing the analysis over shorter intervals based on the available contemporaneous schedule updates that reflect revisions or changes to the project plan. By relying on interim updates, the as-planned schedule for each window resets to reflect the contemporaneous critical path and therefore considers the dynamic nature of construction and changes to the project's critical path over time.

In applying this methodology, the overall performance period being analyzed is partitioned using available contemporaneous progress updates with the start and finish dates for each window typically determined by the data dates of two consecutive updates, although a window may span multiple available updates. The analysis typically begins with the baseline construction schedule or earliest schedule preceding the project delays being analyzed and proceeds chronologically through the available updates. For each window, the as-built schedule for the previous window becomes the as-planned schedule for the evaluation of delays over the window. Thus, while this method looks forward from the previous update, since it uses past updates it is considered a retrospective analysis. Once the analysis has been performed along the entire review period, the impacts for all window periods are summarized to determine the overall impacts and associated responsibilities. Since this methodology most closely meets the criteria for forensic schedule analysis set forth in the AACE Recommended Practice 29R-03, it is a preferred methodology from a technical application perspective.[10]

The successful execution of a windows analysis depends on the availability of reliable baseline schedule information, contemporaneous progress updates, and verifiable as-built data. Successful implementation may require validation of this data. Given the significant amount of data or updates that may need to be reviewed, this type of analysis is often the most time-intensive to perform and thus the most expensive to prepare. While a windows analysis may overcome shortcomings of an as-planned vs. as-built analysis, it may not be feasible to perform if reliable schedule updates are not available, or if schedules drastically change between updates (i.e., overhaul of activities and major changes to logic/sequencing).

The following table details the key characteristics of the Windows Analysis methodology:

10. R.M. D'Onofrio, Ranking AACE International's Forensic Schedule Analysis Methodologies, Aace International Technical Paper Cdr. 1526 (2014).

<table>
<tr><td colspan="2">Windows Analysis</td></tr>
<tr><td colspan="2">Primary Application:
Reliable, contemporaneous schedule updates available</td></tr>
<tr><td>Pros:
• Considers contemporaneous schedules that are generally familiar to the parties in dispute and were used to manage the project.
• Accounts for dynamic nature of construction.
• Identifies shifts in critical path between schedule updates.
• Allows for analysis of critical and near-critical paths to identify concurrent delays.
• Less means of manipulation by analyst.
• Generally accepted by many courts and agencies.</td><td>Cons:
• Requires reliable and accurate schedule updates.
• May be time-consuming and expensive to prepare.</td></tr>
</table>

The following presents an example of a Windows Analysis:

Windows Analysis Example:

A contractor was required to complete a project within 105 calendar days, as represented by the baseline schedule in Figure 3 below. In Figure 3, red activity bars represent critical activities and blue activities are non-critical.

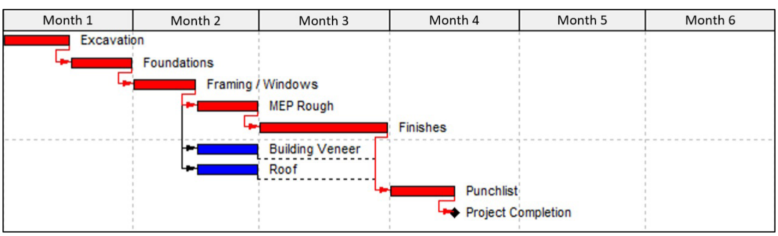

Figure 3. Windows Analysis Example—Baseline Schedule

For any non-excusable delays beyond the completion date, the contract contemplates a liquidated damages provision, wherein the owner assesses the contractor a daily damages amount. The contract also allows for the contractor to recover delay damages in the event that the owner causes delay to the contractor.

The project experienced four critical delays during construction that ultimately resulted in the project completing thirty-five days late, on Day 140: (1) a differing site condition that required unanticipated dewatering,

(2) impacts resulting from adverse weather, (3) an MEP rough-in progress delay, and (4) additional work resulting from a final inspection by the architect. Schedule updates were prepared by the contractor monthly; and to evaluate and allocate delays, a windows analysis was performed using each successive schedule update for each window.

Window 1: Baseline Schedule to Update 1 (Month 1)

When comparing the baseline schedule to the first schedule update, the Month 1 update shows that the completion date has slipped from Day 105 to Day 120, a delay of fifteen days.

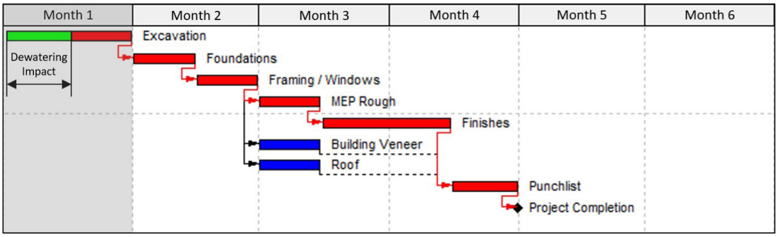

Figure 4. Windows Analysis Example—Month 1 Schedule Update

By analyzing the actual progress of the as-planned critical path activities, it was observed that the late start of the critical excavation activity was responsible for the observed fifteen-day delay over the window period. Based on a review of Requests for Information and a change order for dewatering, which reserved the contractor's rights for additional time, it is determined that the late start to the excavation was the result of a differing site condition that resulted in unanticipated dewatering that required the contractor to mobilize pumps—an excusable-compensable delay event. As such, the contractor would be entitled to a time extension and delay damages for the fifteen days of delay.

Window	Data Date	Schedule	Project Completion	Delay Pd.	Delay Tot.	Differing Site Condition	Ex.-C	Ex.	Non-Ex.
1	Day 0	Baseline Schedule	Day 105						
	Day 30	Update 1	Day 120	15	15	15	15		

Figure 5. Windows Analysis —Window 1 Summary

Window 2: Update 1 (Month 1) to Update 2 (Month 2)

The second window of the analysis uses Update 1 as the "baseline" and the subsequent Update 2 as the comparison schedule to determine whether the project experienced any delay over the update period. Over the window, the project completion slipped from Day 120 in Update 1 to Day 125 in Update 2, a five-day delay. As shown in the figure below, the critical framing activity was not completed as planned on Day 60 and was now forecast to complete on Day 65.

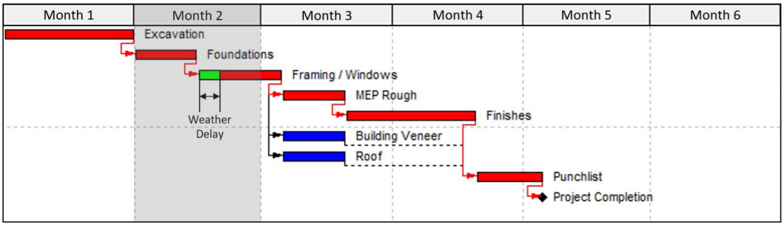

Figure 6. Windows Analysis Example—Month 2 Schedule Update

In reviewing the contemporaneous project records, it was determined that there were five additional days of adverse weather than planned during the second month of the project that prevented the contractor from working. While these weather delays caused a critical impact to the project, the contract specifically notes that adverse weather is an excusable, but non-compensable delay; as such, the contractor would be entitled to a time extension, but no delay damages.

Window	Data Date	Schedule	Project Completion	Delay Pd.	Delay Tot.	Weather Impact	Ex.-C	Ex.	Non-Ex.
2	Day 30	Update 1	Day 120						
	Day 60	Update 2	Day 125	5	20	5		5	

Figure 7. Windows Analysis Example—Window 3 Summary

Window 3: Update 2 (Month 2) to Update 3 (Month 3)

Update 3, the progress schedule updated through the end of Month 3, shows a forecasted completion date of Day 125—the same completion date as the previous update, Update 2. As such, there was no delays reported over this period.

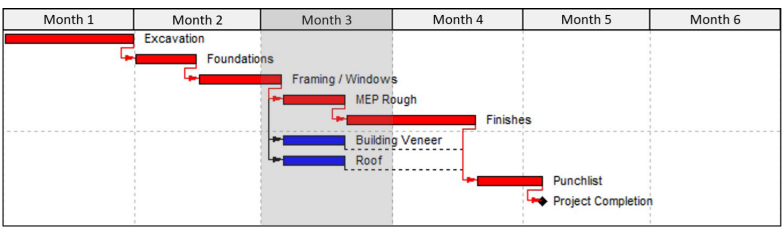

Figure 8. Windows Analysis Example—Month 3 Schedule Update

Window	Data Date	Schedule	Project Completion	Delay Pd.	Delay Tot.	Ex.-C	Ex.	Non-Ex.
3	Day 60	Update 2	Day 125					
	Day 90	Update 3	Day 125	0	20			

Figure 9. Windows Analysis Example—Window 3 Summary

Window 4: Update 3 (Month 3) to Update 4 (Month 4)

For Window 4, the contractor's updated schedule through Month 4 is compared to the prior update, Month 3, to determine whether the project experienced any delays over the update period. The Month 4 update shows that the project completion date slipped to Day 135, a delay of ten days relative to the previous update. By comparing the actual progress achieved during Window 4 against the planned performance in the Month 3 update, the delay to the critical path was determined to be a result of the actual duration exceeding the planned duration for Finishes work:

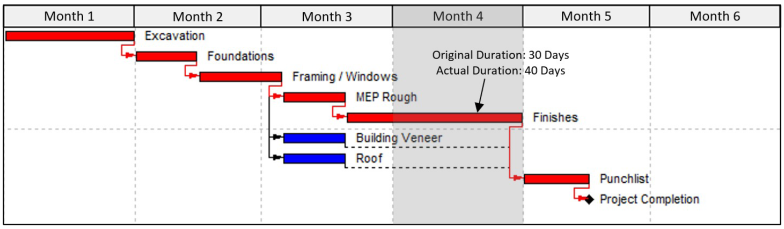

Figure 10. Windows Analysis Example—Month 4 Schedule Update

In reviewing the contemporaneous project records, it was determined that the drywall subcontractor had issues mobilizing and maintaining manpower, resulting in a progress delay. As the observed delay to the project completion date was the result of a subcontractor issue, which the owner was not responsible for, the contractor is not entitled to an excusable-delay from the owner for the ten-day delay.

Window	Data Date	Schedule	Project Completion	Delay Pd.	Delay Tot.	Drywall Progress Delay	Ex.-C	Ex.	Non-Ex.
4	Day 90	Update 3	Day 125						
	Day 120	Update 4	Day 135	10	30	10			10

Figure 11. Windows Analysis Example—Window 4 Summary

Window 5: Update 4 (Month 4) to As-Built Schedule (Month 5)

For the final window of the windows analysis, Update 4 was compared to the as-built data. The preceding update, Update 4, forecasted project completion on Day 135; however, completion was certified on Day 140.

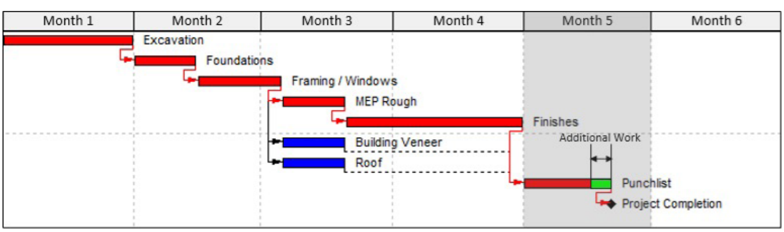

Figure 12. Windows Analysis Example—Month 5 Schedule Update (As-Built)

In reviewing the contemporaneous project records, it was determined that the contractor had completed its punch list work to allow for completion, but during a final inspection by the architect, the architect directed the contractor to add additional illuminated exit signs that were not shown in the contract drawings. Completing this work required an additional five days. As the extension of the project was the result of additional work requested by the owner (through the architect) after all other work had been completed, the contractor would be entitled to an excusable, compensable time extension for the additional five days.

Window	Data Date	Schedule	Project Completion	Delay Pd.	Delay Tot.	Additional Work	Ex.-C	Ex.	Non-Ex.
5	Day 120	Update 4	Day 135						
	Day 150	Update 5 - As-Built	Day 140	5	35	5	5		

Figure 13. Windows Analysis Example—Window 5 Summary

Summary

The windows analysis example observed the project over five windows, starting with the baseline schedule and spanning the successive available schedule updates through the as-built schedule. By observing each update, the activity driving the delays could be identified, and through a causation analysis, the cause and responsibility for the delays could be determined and allocated. In the first window, Month 1, the contractor is entitled to a fifteen-day excusable and compensable delay due to a differing site condition. In the second window, Month 2, the contractor is entitled to a five-day excusable time extension for adverse weather. In the fourth window, Month 4, the contractor incurred a ten-day non-excusable subcontractor delay. In the fifth window, Month 5, the contractor is entitled to a five-day excusable and compensable delay due to additional work being added to the contract. In sum, the project finished thirty-five days late. However, the contractor is entitled to a twenty-five-day time extension, for which twenty days of delay damages are compensable. The owner, on the other hand, is entitled to assess ten days of liquidated damages against the contractor for the non-excusable portion of the delay.

Window	As-Planned Schedule	As-Planned Data Date	As-Built Schedule	As-Built Data Date	Net Period Delay (CD)	Allocation: Differing Site Condition	Allocation: Weather Impact	Allocation: Drywall Progress Delay	Allocation: Additional Work
1	Baseline	Day 0	Update 1	Day 30	15	15			
2	Update 1	Day 30	Update 2	Day 60	5		5		
3	Update 2	Day 60	Update 3	Day 90	0				
4	Update 3	Day 90	Update 4	Day 120	10			10	
5	Update 4	Day 120	**Completion***	**Day 140**	5				5
					35	**15** Ex.-C	**5** Ex.	**10** Non-Ex.	**5** Ex.-C

Figure 14. Windows Analysis Example—Windows Analysis Summary

3. Time Impact Analysis

The Time Impact Analysis (TIA) method can be used as either a prospective or retrospective technique to forecast a delay's effect on the project completion date. Unlike an As-Planned vs. As-Built and Windows Analyses, which are observational methods, a Time Impact Analysis is a modeled method, meaning that changes are made by the analyst to the schedule(s) to simulate the effect of delays. In performing a TIA, activities representing a delay or change event, such as a scope modification or discovery of a differing site condition, are inserted by representative activities into the CPM schedule network. The impact results are modeled and compared to the "before," or as-is schedule update, to determine the effect of the delay on the project's completion date. Because it is a forward-looking approach, the TIA is ideal for prospective analyses performed contemporaneously when a delay impact occurs. In fact, many construction specifications require the use of the TIA method for prospective delay analysis.[11] The TIA is also viable as a forward-looking retrospective analysis. Whether a time impact analysis is appropriate in a retrospective scenario depends on the availability of contemporaneous schedule data and the impact(s) in question.

A TIA is performed by inserting the impact into the available project schedule in the form of a fragmentary network or "fragnet" and comparing the changes in the critical path. If enough float exists on the activities affected by the change, the project completion date will remain unchanged after insertion of the fragnet. If there is no float, or the float is absorbed, resulting in the fragnet activities driving the critical path, then the project will experience a delay and show a later completion date. The quantified delay attributable to the impact is the variance in completion date from the unimpacted schedule to the schedule after insertion of the fragnet.

When performing a TIA, the schedule immediately preceding the impact event is typically the appropriate schedule for analysis. However, other considerations, such as schedule reliability, approval status of the schedule, and other factors may make another update appropriate for use. Using the most recent update prior to the delay event allows for the status of the overall project at the time of the impact to be considered. For instance, if an alleged delay event starts in June and the contractor updated its project schedule in late May, the late May update can be utilized as the control for the delay analysis. The resultant impacted schedule demonstrates the effect of the delay event on the overall project completion date. Oftentimes, however, contemporaneous schedule updates are not available and only a baseline schedule exists to serve as the unimpacted schedule

11. *See, e.g.*, U.S. Army Corps Of Engineers et al., United Facility Guide Specification § 01 31 01.00 10, pt. 3.8.2 (2015), https://www.wbdg.org/FFC/DOD/UFGS/UFGS%2001%2032%2001.00%2010.pdf.

for the analysis. This type of TIA may be referred to as an "Impacted As-Planned" analysis. The mechanics of an Impacted As-Planned are identical to a TIA—the only difference being that the chosen unimpacted schedule serves as the baseline.

The following table details the key characteristics of the Time Impact Analysis methodology:

Time Impact Analysis	
Primary Application: • Prospective analysis for modeling forward-looking delays and impacts. • Retrospective analysis when as-built information may be limited. • Schedule updates exist in close proximity to timing of impact.	
Pros: • Allows each delay to be measured independently. • Clear link between causation and delay. • Can be performed before project is complete and model ongoing delay. • Generally accepted by many courts and agencies.	*Cons:* • Subject to analyst discretion and decisions, which can allow for manipulation or differing viewpoints. • Ignores potential means of mitigation of/for delays. • In its simplest application, does not allow for evaluation of concurrent delays.

The following is an example of a time impact analysis:

Time Impact Analysis Example:

After completing the superstructure, building enclosure, and rough-in, a contractor is progressing through critical finishes work to complete the project. At the start of Month 4, while interior finish work is underway, the owner elects to substitute the commercially available wood flooring with a custom ceramic tile flooring. The remaining work as planned prior to the owner's change is represented in the schedule excerpt below:

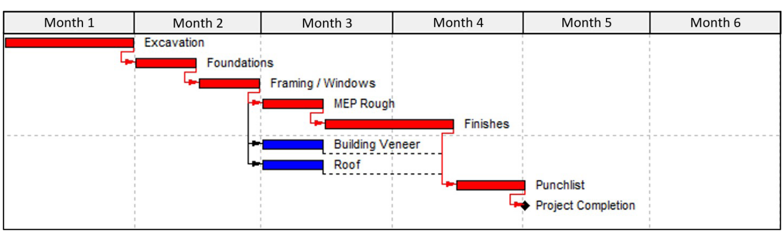

Figure 15. Time Impact Analysis Example—Baseline Schedule

To evaluate the potential time impact of the change, the contractor develops a fragnet modeling the procurement, delivery, and installation of the custom ceramic tile flooring, shown below:

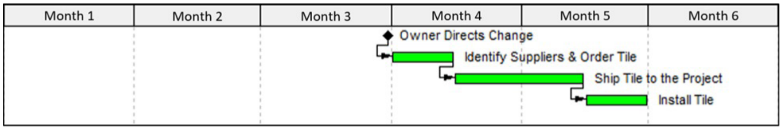

Figure 16. Time Impact Analysis Example—Fragnet

Prior to the substitution, substantial completion was forecasted to be achieved at the end of Month 4 (see Figure 15). However, when the fragnet is inserted into the schedule, the new material delivery becomes critical and delays the completion of the work to the middle of Month 6. As such, the owner's decision to implement a late change to flooring material is forecasted to cause a 1.5-month delay to the project. A comparison of the schedule prior to and after the insertion of the fragnet modeling the flooring change is shown in the figure below:

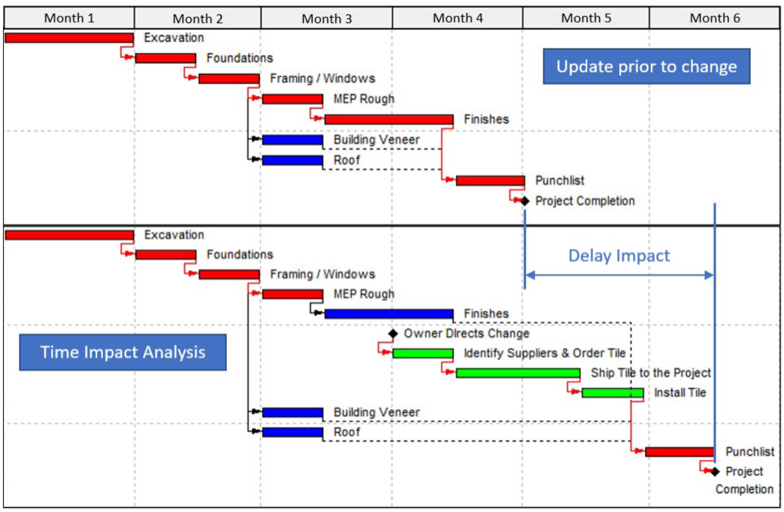

Figure 17. Time Impact Analysis Example—Impacted Schedule

Because this change was owner-directed, resulting in an extended period of performance, the contractor would be entitled to an excusable-compensable delay for the resultant extension of the project.

4. Collapsed As-Built Analysis

The Collapsed As-Built Analysis—also known as a but-for analysis—is a backward-looking retrospective technique that begins with the as-built schedule and then subtracts known delays to demonstrate the hypothetical project completion date but for the delays. The collapsed as-built method is another modeled methodology and is effectively the inverse of the TIA. In the TIA, the analyst estimates project delays by taking an unimpacted as-planned schedule and adding known delay impacts. The impacted schedule then is compared with the unimpacted schedule to quantify project delays. In the Collapsed As-Built method, the reverse is performed. The analyst takes the as-built schedule—which is effectively an "impacted" schedule, as it reflects all project impacts, and subtracts known delay events to create the "unimpacted" schedule. This unimpacted schedule is compared with the as-built schedule to quantify project delays.

Performing a Collapsed As-Built schedule analysis starts with selection, development, or refinement of the project's as-built schedule. Next, actual delay events caused by parties on the project are identified. The delays attributable to one of the parties are removed from the as-built schedule, thereby "collapsing" the schedule and leaving the delays caused solely by the other party. The resulting collapsed as-built schedule illustrates how the project would have progressed but for the delays of the other party. The key principle of the collapsed as-built analysis is that, without the other party's delays, the project would have been completed earlier, thus demonstrating entitlement to a time extension for the difference between the but-for date and the actual completion date.

Generally, a Collapsed As-Built method is used when reliable as-built schedule information exists, but baseline schedule and/or contemporaneous schedule updates either do not exist or are not reliable to support a delay analysis. The resulting "Collapsed As-Built" schedule demonstrates when a project would have been completed but for the delays or changes thereby demonstrating the effect of the delays or changes on a project's completion date. Since other methodologies typically have a strong reliance on contemporaneous schedule updates, the collapsed as-built method provides an approach for analysis when such data is not available.

The following table details the key characteristics of the Collapsed As-Built methodology:

<table>
<tr><th colspan="2">Collapsed As-Built</th></tr>
<tr><td colspan="2">Primary Application:
Used when reliable as-built information is available but baseline schedule and/ or contemporaneous schedules are not available or not reliable.
Straightforward presentation of concurrency as it relates to delay impacts.</td></tr>
<tr><td>Pros:
• Allows each delay to be measured independently.
• Clear link between causation and delay.
• Allows for evaluation of concurrent delays.
• Understandable and simple to present.</td><td>Cons:
• Reconstructing as-built data can be time-consuming and costly if this data does not exist.
• Subject to analyst discretion and decisions, which can allow for manipulation or differing viewpoints.</td></tr>
</table>

The following presents an example of a Collapsed As-Built analysis:

Collapsed As-Built Example:

The contractor was under contract with the owner to construct a building project within 135 days, or 4.5 months. During the finishes portion of the work, the owner added an extensive millwork package to the contractor's scope of work. The contractor's as-built schedule is shown below. All contractor-responsible delays are inherently reflected in the as-built durations of the construction activities. The activity in green is the additional millwork directed by the owner. The contractor was able to complete the work within 165 days, or 5.5 months.

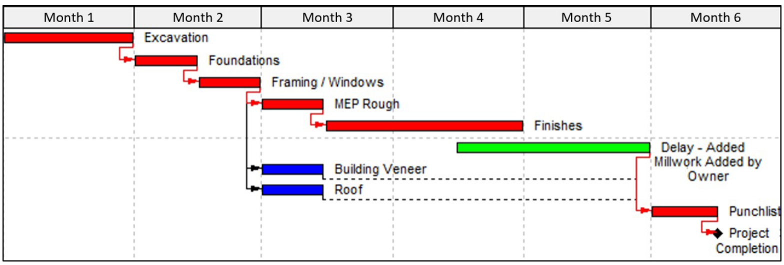

Figure 18. Collapsed As-Built Example—As-Built Schedule

When the as-built schedule is collapsed by removing the millwork delay caused by the owner, the forecasted project completion date is pulled back to 135 days, or 4.5 months; therefore, the calculated delay attributable to the added millwork is 30 days, or 1 month. Because the owner is responsible for the change to the millwork causing the delay, the contractor would be entitled to an excusable, compensable time extension for the resultant impact to its overall performance.

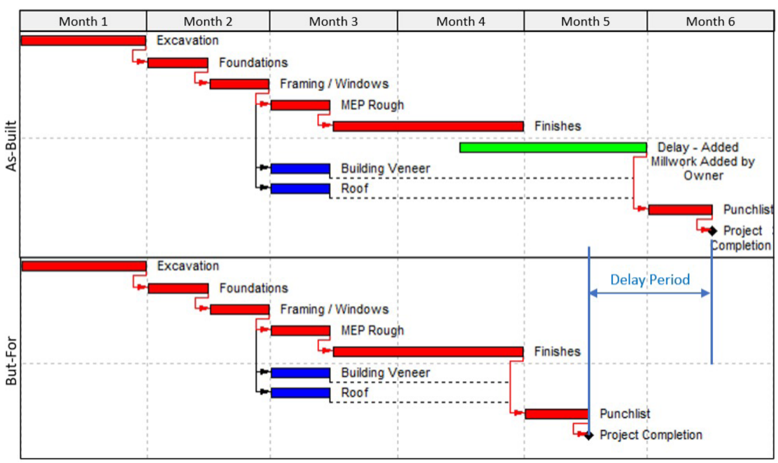

Figure 19. Collapsed As-Built Example—Collapsed Schedule Comparison

III. THE LAW OF CONSTRUCTION DELAY CLAIMS

A. *Elements of a Delay Claim: The Basics*

In federal construction projects, the Federal Circuit has established three elements that a contractor must prove to succeed on a claim for an equitable adjustment to the contract for federal government-caused delays: "liability, causation, and resultant injury."[12] The contractor has the burden to prove "the extent of the delay, that the delay was proximately caused by government action, and that the delay harmed the contractor."[13] More specifically, the contractor has the burden of proving that the federal government's actions "affected activities on the critical path of the contractor's performance of the contract."[14]

B. *Contractual Terms Regarding the Delay Claims*

1. Federal Construction Contracts

In federal government construction contracts, Sections 48 C.F.R. 52.233-1 and 48 C.F.R. 52.243-1 *et seq*. of the Federal Acquisition Regulations (FAR) prescribe contract requirements that must be incorporated into federal government contracts. Those regulations govern the resolution of disputes between contractors and the federal government.[15] Under Sections 52.233-1 and 52.243-1 *et seq*., a contractor must initiate a request for a time extension or delay damages by making either a Request for Equitable Adjustment (REA) to the federal government's contracting officer or a "Claim" under the Contract Disputes Act.[16] A Claim is a more formal procedure, establishing a deadline for the contracting officer's formal response, while there is no set date for the federal government's response to an REA.[17] An REA seeks an informal negotiation with the federal government's contracting officer in an effort to reach a mutually agreeable settlement while better maintaining the working relationship between the contractor and the federal government.[18] In either case, the contractor may seek monetary compensation and an extension of time before liquidated damages begin to accrue.

Contractors will often submit an REA before filing a formal Claim under the Contract Disputes Act. A contractor must notify the federal government's contracting officer of a Claim before receiving final payment, as a

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12. Servidone Constr. Corp. v. United States, 931 F.2d 860, 861 (Fed. Cir. 1991); *see also* George Sollitt Constr. Co. v. United States, 64 Fed. Cl. 229, 237 (2005); CEMS, Inc. v. United States, 59 Fed. Cl. 168, 226 (2003).
13. Wilner v. United States, 24 F.3d 1397, 1401 (Fed. Cir. 1994).
14. Kinetic Builder's Inc. v. Peters, 226 F.3d 1307, 1317 (Fed. Cir. 2000); *see also Wilner*, 24 F.3d at 1399 n.5; *George Sollitt Constr.*, 64 Fed. Cl. at 240.
15. *See* 48 C.F.R. §§ 52.233-1, 52.243-1 to -7.
16. *Id.*
17. *Id.* § 52.233-1.
18. *Id.* § 52.243-1.

release of all claims is required except for those Claims the contractor has specifically excepted from the release.[19] If the contractor does not reach an agreement with the federal government and is not satisfied with the contracting officer's decision on a Claim, the contractor has a right to appeal or to ask the Board of Contract Appeals or Court of Federal Claims to issue a final decision in the contractor's favor.[20] Detailed requirements apply to these procedures. The contractor (or its attorney) will need to review the contract and the applicable regulations to ensure that these procedures are followed.

Only the contractor may pursue these Claims. Federal anti-assignment statutes prevent a surety, assignee, or subrogee from asserting Claims for changes to the contract against the federal government except where the federal government consents to the assignment.[21] Only when the surety is itself the "contractor" under a takeover agreement may the surety assert an REA or Claim, and then only for delays occurring during performance of the takeover agreement.[22]

Accordingly, for the surety to recover on the contractor's Claim for delay damages from the federal government, the surety will need to first have the contractor pursue its Claim to settlement or judgment.[23] Once the delay damages have been added to the construction contract in response to the contractor's own Claim or REA, the surety can step in and assert its right to those funds under the Tucker Act. The Court of Federal Claims has jurisdiction under the Tucker Act over a surety's claim based on equitable subrogation "when the surety takes over contract performance or when it finances completion of the defaulted contractor."[24] A payment bond surety may also sue in equitable subrogation under a federal contract.[25] This option requires caution and is most likely to succeed if the surety has an agreement with the bond principal while the Claim is in process because the surety must both (1) wait until the delay damages have been added to the contract price based on the bond principal's successful Claim or REA, and (2) then assert its right to those funds before the federal government disburses them to that successful bond principal. Such arrange-

19. *Id.* § 52.232-5(h)(3).

20. *Id.* § 52.233-1(f); 41 U.S.C. § 7104.

21. *See* 31 U.S.C. §§ 3727(a)(1), (b); 41 U.S.C. § 6305; United Pac. Ins. Co. v. Roche, 380 F.3d 1352, 1356 (Fed. Cir. 2004); Fireman's Fund Ins. Co. v. Eng., 313 F.3d 1344, 1352 (Fed. Cir. 2002); *see also* Appeal of Thorington Elec. & Constr. Co., ASBCA No. 56895, 10-2 BCA ¶ 34,511, 2010 ASBCA Lexis 51 (July 16, 2010).

22. *See Fireman's Fund*, 313 F.3d at 1351–52; *see also Roche*, 380 F.3d at 1357.

23. *See Fireman's Fund*, 313 F.3d at 1351–52*; see also Roche*, 380 F.3d at 1356; Thorington Elec. & Constr. Co., 2010 ASBCA Lexis 51.

24. *See* 28 U.S.C. § 1491; *see also* Ins. Co. of the W. v. United States, 243 F.3d 1367, 1370–75 (Fed. Cir. 2001); Aviation & Gen. Ins. Co. v. United States, 882 F.3d 1088, 1104 n.8 (Fed. Cir. 2018).

25. Nat'l Am. Ins. Co. v. United States, 498 F.3d 1301, 1304 (Fed. Cir. 2007).

ments may involve, for example, a financing agreement or settlement of the bond principal's indemnity obligation by which repayment to the surety will depend in part on the outcome of the Claim or REA. If the Claim or REA appears to be well founded, the surety may agree to pay the bond principal's attorney fees to pursue the Claim.

2. State and Local Public Works Contracts

State and local public works contracts may also be governed by state statutory procedures, local ordinances, and contract terms. These requirements may include written notice to the project owner within a specified number of days after a delay occurs, submission of a formal claim before suit is filed, mediation, or non-binding arbitration if the claim is below a specified dollar amount. The contract's dispute resolution procedures and state law will need to be reviewed. In some cases, these procedural requirements may simply be contract terms that are waived if neither party requests them (e.g., a contract requirement for mediation). In other cases, they may be conditions precedent to the contractor's right to recovery, which will defeat the contractor's entire claim if not effected in a timely manner.

State and local projects occasionally contain more than one set of contract provisions governing remedies for delays. State public works projects may be funded by one or more federal government agencies. When that occurs, the contract may include the federal agency's required contract terms and conditions in the form of special conditions. Where a project is funded by more than one federal agency, it may contain multiple sets of special conditions that are not entirely consistent with each other. A project architect, design engineer, or construction manager may also add their own standard contract terms to the state or local public entity's contract form. When that occurs, it is important to review the various components of the contract for applicable requirements, rather than assume that the first relevant provision found is the only one that applies.

In addition, the surety's right to pursue the bond principal's claims varies by state law. Generally, the surety's claim may be based on equitable subrogation to the bond principal's rights, a security interest in contract funds under the indemnity agreement's assignment provisions, and/or provisions of the indemnity agreement requiring the contract funds to be held in trust for payments to subcontractors.[26] If only the surety's equitable subrogation rights entitle the surety to assert the contractor's claims for extras, including delay damages, the surety will need to follow all applicable requirements of state law to pursue its subrogation rights, including

26. *See* E.A. "Seth" Mills, Jr. & Brett D. Divers, *The Surety's Recourse Against Its Principal and Indemnitors*, *in* Managing And Litigating The Complex Surety Case 425, 455 (Tracey L. Haley & Christopher R. Ward, eds., 3d ed. 2018).

notice requirements, government claim requirements, and contractual claim requirements.

While public entities usually have their own contract form, ConsensusDocs 210 provides a standard agreement and general conditions form between owner and constructor for a public works project for use by public entities.[27] ConsensusDocs 210, Section 6.3 through 6.5, govern delays, time extensions, and liquidated damages.[28] No particular type of schedule analysis is required.[29] Section 2.4.22 provides: "The 'Schedule of the Work' is the document prepared by Constructor that specifies the dates on which Constructor plans to begin and complete various parts of the Work, including dates on which information and approvals are required from Owner."[30] Section 6.2.1 requires the contractor to submit a Schedule of the Work before the first payment application.[31] The schedule must be updated monthly "or at appropriate intervals as required by the conditions of the Work and the Project."[32]

Additionally, Section 6.4 requires the contractor to provide "prompt" written notice if the contractor "requests an equitable extension of the Contract Time or an equitable adjustment in the Contract Price as a result of a delay."[33] Notice must be provided under Section 8.4.[34] If the contractor causes delay in completion, Section 6.4 provides that the owner "shall be entitled to recover its additional costs subject to Section 6.6."[35] Section 6.6 mutually waives consequential damages.[36] Section 8.4 requires notice of a claim "within fourteen (14) Days after the occurrence giving rise to the claim or within fourteen (14) Days after Constructor first recognizes the condition giving rise to the claim, whichever is later."[37] Thereafter, the contractor "shall submit written documentation of its claim, including appropriate supporting documentation, within twenty-one (21) Days after giving notice, unless the Parties mutually agree upon a longer period of time."[38]

Section 3.13.5 allows the contractor to recover an equitable adjustment in both contract price and time if the contractor "incurs additional costs or is delayed due to the presence or remediation of Hazardous Material."[39]

27. ConsensusDocs 210 (2017), https://www.consensusdocs.org/contract/210-2.
28. *Id.* §§ 6.3–6.5.
29. *Id.*
30. *Id.* § 2.4.22.
31. *Id.* § 6.2.1.
32. *Id.*
33. *Id.* § 6.4.
34. *Id.* § 8.4.
35. *Id.* § 6.4.
36. *Id.* § 6.6.
37. *Id.* § 8.4.
38. *Id.*
39. *Id.*

3. Private Construction Contracts

In private construction projects, the contractor's rights may be governed by detailed contract provisions in a standard form, or they may be governed by unique terms and conditions of a contract form drafted by the project owner. This section provides a survey of well-known standard form private contract provisions related to delay claims.

a. *American Institute of Architects (AIA) Document A201*

Section 3.10 of AIA Document A201-2017 General Conditions governs the contractor's construction schedules for the project.[40] Subsection 3.10.1 provides that the contractor "promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work."[41] No particular type of schedule or software is specified.[42] Article 8 of the AIA Document A201-2017, *General Conditions*, governs delays and time extensions.[43] It does not prescribe a specific type of schedule analysis for time extension requests.

Section 8.3.2 provides that "Claims related to time shall be made in accordance with applicable provisions of Article 15," the "Claims and Disputes" provision.[44] Section 8.3.3 provides that Section 8.3 "does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents."[45]

Article 15 of the AIA A201-2017 applies to delay claims. Section 15.1.3.1 requires written notice to the owner and initial decision maker "within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later."[46] This notice provision may be difficult to apply in that it turns on when the contractor "recognizes" the condition causing the delay. Different personnel may "recognize" a problem at different points in time, making it difficult to pinpoint when the contractor recognized it would have a delay claim.

Section 15.1.6.1 provides that claims for additional time require written notice and shall include "an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary."[47] Section 15.1.6.2 provides that claims for "adverse weather conditions" must be "documented by data substantiating that weather conditions were abnormal for the period of time, could not have

40. AIA A201-2017, § 3.10 (2017).
41. *Id.* § 3.10.1.
42. *Id.*
43. *Id.* § 8.
44. *Id.* § 8.3.2.
45. *Id.* § 8.3.3.
46. *Id.* § 15.1.3.1.
47. *Id.* § 15.1.6.1.

been reasonably anticipated and had an adverse effect on the scheduled construction."[48] Section 15.1.7 waives claims for consequential damages including "loss of management or employee productivity" among other damages for both the Owner and the Contractor.[49]

Section 15.2 provides for the architect to be the initial decision maker unless otherwise indicated in the agreement and shall decide in writing following specified procedures. Mediation, arbitration, or (if the parties choose not to arbitrate) court action can proceed thereafter.[50]

Standard forms still require scrutiny. Any contract may include special or supplementary conditions that alter the contractor's right to delay damages or time extensions. Supplementary conditions may be unique to the individual contract. Parties also may modify portions of the standard form provisions by inserting additional terms or conditions or by striking out portions of the standard provisions.

b. *EJCDC Documents C-700 and C-800*

The Engineers Joint Contract Documents Committee (EJCDC) revised its Construction Series Documents in 2018. The revised Section 4.05 of its EJCDC C-700 Standard General Conditions of the Construction Contract clarifies the contractor's right to relief for delays.[51] While no particular type of schedule analysis is required, the new provisions specifically refer to the requirement of showing the delay's effect on the critical path.[52] New Section 4.05.E provides that the project owner or engineer may require "a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work."[53]

Section 2.03 requires the contractor to provide, within ten days after the effective date of the contract, a "preliminary progress schedule" indicating times for starting and completing various stages of the work.[54] Section 2.05.A.1 provides: "The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times."[55] Thus, while the contract does not require a CPM schedule, in the event of a delay claim, the contractor must be prepared to

48. *Id.* § 15.1.6.2.
49. *Id.* § 15.1.7.
50. *Id.* § 15.2.
51. *See* Eng'rs Joint Contract Document Comm., Ejcdc C-700 General Conditions, § 4.05 (2018) [hereinafter EJCDC C-700]. The authors acknowledge assistance provided by the Engineers Joint Contract Document Committee in the preparation of this portion of our discussion.
52. EJCDC C-700 § 4.05.
53. *Id.* § 4.05.E.
54. *Id.* § 2.03.
55. *Id.* § 2.05.A.1.

provide a revised schedule with an explanation of the effect of the delay on all affected activities.

Under Section 4.05.A, "If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times."[56] The 2018 revision omits a sentence in the 2013 document that conditioned the adjustment "on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times."[57]

Section 4.05.C contains detailed provisions regarding equitable adjustments in contract times, but not monetary awards, for specified unanticipated causes not attributable to either the contractor or the owner (force majeure), such as "abnormal weather conditions" and certain natural catastrophes.[58] EJCDC Document C-800 includes a proposed Supplemental Condition that allows the parties to further detail which weather conditions will be "abnormal" by objective factors, such as a specific amount of precipitation and specific temperatures measured and recorded at a designated weather station.[59]

Newly revised Section 4.05.D and new Section 4.05.E condition the adjustment on the delay, disruption or interference "adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference" and contain requirements for change proposals based on delay, disruption, or interference.[60] Such change proposals must be "supplemented by supporting data," including specific categories of information listed in the contract.[61] The new Section 4.05.E concludes:

> Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.[62]

c. *ConsensusDocs Documents 200 and 230*

Unlike ConsensusDocs 210, *Public Works Projects*, discussed above, ConsensusDocs 200, *Lump Sum*, and 230, *Cost Plus*, expressly require a critical

56. *Id.* § 4.05.A.
57. *Id.*
58. *Id.* § 4.05.C.
59. ENG'RS JOINT CONTRACT DOCUMENT COMM., Ejcdc C-800 Supplemental Conditions (2018).
60. Ejcdc C-700 §§ 4.05.D–E.
61. *Id.*
62. Ejcdc C-700 § 4.05E.

path project schedule.[63] Both contract forms include Section 6.2.1, which provides:

> Except as otherwise agreed, the Schedule of the Work shall be formatted in a detailed precedence-style critical path method that (a) provides a graphic representation of all activities and events, including float values that will affect the critical path of the Work, and (b) identifies dates that are critical to ensure timely and orderly completion of the Work. Constructor shall update the Schedule of the Work on a monthly basis or as mutually agreed by the Parties.[64]

The ConsensusDocs' change order provisions do not require any particular type of schedule analysis to support a request for an equitable adjustment of contract time or price. However, since the contract requires the contractor to perform monthly CPM schedule updates, a CPM analysis will undoubtedly be required under the provisions requiring "appropriate supporting documentation" for the claim.[65]

Section 6.3 of both forms contains a detailed provision for an equitable extension of contract time for "causes beyond the control of Constructor" including "acts or omissions of Owner, Design Professional, or Others" and "changes in the Work or the sequencing of the Work ordered by Owner, or arising from decisions of Owner that impact the time of performance of the Work," as well as "adverse weather conditions" and other items on a detailed list of possible causes of delays.[66] For only four of the thirteen causes of delays, Section 6.3.2 also allows the contractor to request an equitable adjustment in the contract price.[67] For delays caused by the owner, design professional, or others, hazardous materials, unknown conditions, and other items among those four causes, the contractor's claim for delay damages and time extension is made under the contract's changes provision.[68]

Section 6.4 provides that if the contractor seeks an equitable time extension or an equitable adjustment to contract price for delay, "Constructor shall give Owner written notice of the claim in accordance with" the provision requiring notice of changes.[69]

Section 8.4 of Document 200 provides for notice "within fourteen days after the occurrence giving rise to the claim or within fourteen days after Constructor first recognizes the condition giving rise to the claim,

63. ConsensusDocs 200 ¶ 6.2.1; ConsensusDocs 230 § 6.2.1 (2017), https://www.consensusdocs.org/contract/230-2.
64. *Id.*
65. ConsensusDocs 200 § 8.4; ConsensusDocs 230 § 9.4.
66. ConsensusDocs 200 § 6.3; ConsensusDocs 230 § 6.3.
67. ConsensusDocs 200 § 6.3.2; ConsensusDocs 230 § 6.3.2.
68. ConsensusDocs 200 § 8; ConsensusDocs 230 § 9.
69. ConsensusDocs 200 §§ 6.4, 8.4; ConsensusDocs 230 §§ 6.4, 9.4.

whichever is later."[70] Thereafter, "Constructor shall submit written documentation of its claim, including appropriate supporting documentation, within twenty-one days after giving notice, unless the Parties mutually agree upon a longer period of time."[71] Paragraph 9.4 of Document 230 requires notice of the claim within twenty-one days, rather than within fourteen days.[72] As for Document 200, the contractor must provide "written documentation of its claim, including appropriate supporting documentation" within twenty-one days after giving notice.[73]

C. *Cases Concerning the General Requirements for a CPM Schedule Analysis*

While CPM schedules (usually through Primavera P6 software) are not always legally necessary, they may be required by contract or regulation, and they are widely recognized by courts as an established way of proving the cause and amount of time associated with a delay. This section canvases how various courts have treated delay claims brought with or without the aid CPM schedules.

In *PCL Construction Services, Inc. v. United States*, the court stated: "One established way to document delay is through the use of CPM schedules and an analysis of the effects, if any, of government-caused events upon the critical path of the project."[74] The Civilian Board of Contract Appeals quoted *PCL* in *Yates-Desbuild Joint Venture v. Department of State*, adding: "In fact, in situations, as here, where the contractor utilized Primavera scheduling software to create schedules throughout the life of the project, it would be folly to utilize some other method of critical path analysis."[75]

Similarly, in *Morrison Knudsen Corp. v. Fireman's Fund Ins. Co.*, the court stated:

> Courts often use CPM to resolve disputes over excusable-delay claims. *See* Cibinic Nash, *supra*, at 584. CPM provides a useful, well-developed nomenclature and analytic framework for expert testimony. While CPM has generated a technical terminology, the legal requirement that it is used to analyze is general and commonsensical: a contractor must prove that a delay affected not just an isolated part of a project, but its overall completion.[76]

Though not legally required, failing to use a systemic schedule analysis tool like a CPM schedule may prove fatal to a delay claim. In *1-A Construction & Fire, LLP v. Department of Agriculture*, the board found that a defaulted contractor had failed to meet its burden of proving excusable

70. ConsensusDocs 200 § 8.4.
71. *Id.*
72. ConsensusDocs 230 § 9.4.
73. ConsensusDocs 200 § 8.4.
74. 47 Fed. Cl. 745, 801 (2000).
75. CBCA 3350, 17-1 BCA ¶ 36,870, CIVBCA LEXIS 272 (Sept. 19, 2017).
76. 175 F.3d 1221, 1233 (Fed. Civ. 1999).

delays under the contract's default provision by failing to "demonstrate how the delay, or delays, affected activities on the contract's critical path and impacted the contractor's ability to finish the contract on time."[77] Specifically, the board held:

> To show how the critical path of contract performance evolved over the life of the contract and how excusable delays impacted that path, a contractor, at a minimum, needs a reasonable "as planned" schedule and an "as built" schedule, which it can incorporate into an analysis to show "the interdependence of any one or more of the work items with any other work items" as the project progressed.[78]

The contractor never used an "as planned" schedule on the project, and, therefore, the Board concluded that the contractor "[could not] show that any excusable delay actually impacted its ultimate contract completion."[79] The board thus sustained the contract termination and dismissed the contractor's request for damages.[80]

In *CEMS, Inc. v. United States*, the court denied recovery to the contractor, finding that while the contractor argued that its schedules were CPM schedules, they did not "provide the court with the ability to determine whether the alleged delays claimed by the plaintiff were on the critical path" and had not shown its claims to have been based on much more than its superintendent's own "estimates and speculation."[81]

The Second Circuit Court of Appeals has held that while the contractor must show a delay on the critical path, it may satisfy that burden through evidence and testimony that accomplish the same objective as a CPM schedule.[82]

State law is generally to the same effect. For example, California courts have held that a contractor may recover its extended overhead loss due to delay "especially when . . . the contractor has prepared a critical path schedule, for any delay along the critical path results in the delay of the overall project."[83] However, in *Howard Contracting, Inc. v. G.A. MacDonald Construction Co.*, a California appellate court held that a contractor is not

77. CBCA 2693, 15-1 BCA ¶ 35,913, 2015 CIVBCA LEXIS 89 (Mar. 17, 2015).

78. *1-A Construction*, 2015 CIVBCA LEXIS 89, at *65-66 (Mega Constr. Co. v. United States, 29 Fed. Cl. 396, 428 (1993)).

79. *Id.*

80. *Id.*

81. 59 Fed. Cl. 168, 232-33 (2003).

82. Thalle Constr. Co. v. The Whiting-Turner Contracting Co., 39 F.3d 412, 413 (2d Cir. 1994); Helena Assocs., LLC v. EFCO Corp., No. Civ. 0861 (PKL), 2008 WL 2117621, at *11 (S.D.N.Y. May 15, 2008).

83. Altmayer v. Johnson, 79 F.3d 1129, 1132 (Fed. Cir. 1996); JMR Constr. Corp. v. Envtl. Assessment & Remediation Mgmt., Inc., 198 Cal. Rptr. 3d 47, 58 (Ct. App. 2015).

required to use a CPM schedule to establish critical path delays where a bar chart schedule is based on a critical path method analysis.[84]

Applying Texas law in *United States ex rel. CMC Steel Fabricators v. Harrop Construction Co.*, the court carefully considered the opinions of two scheduling experts and then modified the one it thought best, based on the testimony of a percipient witness:

> The Court weighs heavily McCullough's estimate. Using the critical path methodology, Mr. McCullough provided a tighter analysis and did a better job tying and analyzing relationships between job occurrences and job events, providing a tighter and more conservative approach to the flow of events and therefore delays. The CPM is an accepted and even favored methodology for such analysis . . . . Of the experts, the Court credits McCullough and Popescu but believes following their model too closely disregards the testimony of the contractor's supervising employees such as Jack Mount and Judy Jones. The Court's own review convinces it that Mr. McCullough's total project costs are low by approximately $300,000.[85]

As with federal law, though not legally required under state law, failure to systemically track schedule impacts through a method such as CPM may present issues when seeking delay damages. In *Sheraton Operating Corp. v. Castillo Grand, LLC*, a New York trial court held, applying Florida law: "One way, but not necessarily the exclusive way, to demonstrate that the defendant delayed the project is by use of 'critical path' analysis . . . . Thus, in assessing the issue of responsibility for delay in completion of an entire project, the focus is on delays along the critical path."[86]

In *Plato General Construction Corp. v. Dormitory Authority of the State of New York*, a New York trial court declined to dismiss affirmative defenses related to change orders, noting a lack of proof of causation of delays.[87] The defendant public entity was responsible for creating and maintaining a CPM with the input from each of the trades in a multi-prime construction project. Having delayed in awarding an HVAC contract, the public entity was unable to provide a valid CPM. Nonetheless, the plaintiff-general contractor had the burden of proof on the causation of delays.[88] The court concluded that "[i]f there is no connection between the damages and whatever [the particular reason for the delay], including the failure to provide a critical path method schedule, . . . there will still be no recovery . . . . [Y]ou have that burden."[89] Because the public entity's actions left the contractor

84. 83 Cal. Rptr. 2d 590, 602 (Ct. App. 1998).
85. 131 F. Supp. 2d 882, 891–92 (S.D. Tex. 2000).
86. 943 N.Y.S.2d 794 (App. Div. 2011).
87. 911 N.Y.S.2d 695 (App. Div. 2010).
88. *Id.*
89. *Id.*

without a valid CPM schedule, the contractor's ability to prove its damages was hampered; yet the court would not allow the contractor to prevail without finding some other way to prove the cause of the delay.[90] At trial, the lack of a CPM schedule left the plaintiff "unable to provide the proof of plaintiff's degree of responsibility for any particular failing."[91] Nonetheless, the court found clearly delays associated with specific scopes of work, noting that "[d]efendant's attempt to attribute to plaintiff delay in the excavation and erection of the superstructure of the new addition is unavailing. It is clear, even by Turner's own admissions, that substantial delay at the beginning of the Project was attributable to defendant."[92] Ultimately, the court found sufficient evidence to allocate fault and awarded judgment to the plaintiff for its delay damages in a net amount of $10,106,698.00.[93]

Courts often evaluate the need for CPM evidence and the importance given to it on a case-by-case basis, considering how persuasive the presentation is in the context of the facts of a particular case. The cases discussed above are examples of how trial court judges and appellate court judges view that evidence; what they do when they find the underlying facts insufficient to support the conclusions; and what they do when the evidence they wish they had simply is not there due to no fault of the contractor who suffered a loss. In preparing a delay claim for trial, whether in the Claims Court or a state, or federal trial court, it is essential to consider how persuasive the evidence will be taken together in the context of the facts of the case as a whole.

The availability of a sophisticated and accurate CPM analysis will usually be an important and persuasive part of that evidence in a delay damages case.

D. *Demonstrating the Schedule's Reliability*

For the schedule analysis to be persuasive, the initial data must be accurate and supported by the evidence. A scheduling expert's analysis cannot compensate for insufficient admissible evidence of the underlying facts. The following are examples of cases that have addressed schedule reliability issues.

In *Mega Construction Co. v. United States*, the Court of Federal Claims found that the contractor's expert's bar chart analysis was "unsubstantiated and incomplete," drawing from documents that were not identified in the record or were successfully refuted by the defendant.[94] The analysis drew

90. *Id.*
91. *Id.*
92. *Id.*
93. *Id.*
94. 29 Fed. Cl. 396, 433 (1993).

from the plaintiff's construction logs, which the court considered "highly suspect."[95]

In *1-A Construction*, relying on *Mega Construction Co.*, the Board of Contract Appeals held that the contractor, at a minimum, needed a reasonable "as planned" schedule and an "as built" schedule to show whether delays were on the critical path, which the contractor did not have.[96] The lack of a complete schedule at the beginning of the project was also discussed in *Edwin J. Dobson Jr., Inc. v. Rutgers, State University*, where the contractor did not have a complete "as planned" schedule until the third update, and only then had sufficient information to measure a delay.[97]

The board in *Yates-Desbuild* provided an insightful comment concerning the issue of schedule reliability:

> Nevertheless, the existence of contemporaneous schedules does not permit a tribunal to ignore, or fail to consider, logic errors in those schedules. A CPM schedule, even if maintained contemporaneously with events occurring during contract performance, is only as good as the logic and information upon which it is based. CPM is not a 'magic wand,' and not every schedule presented will or should be automatically accepted merely because CPM technique is employed.[98]

In *Hoffman Construction Co. v. United States*, the court found that the plaintiff "has not presented any specific, persuasive evidence or analysis demonstrating how any government action . . . caused [the contractor's] overruns. A contractor must present more than general, unsubstantiated pronouncements from its own witnesses that various acts of the government caused labor overruns."[99]

In *Transtechnology Corp., Space Ordinance Division. v. United States*, an inefficiency claim failed where the court found:

> There is no testimony of a single specific interruption or slowdown, and therefore nothing concrete in terms of length of interruption, what happened on the production line, who made decisions about whether to keep workers in place, whether other tasks could be performed, or how often interruptions occurred.[100]

Additionally, in *Appeal of Santa Fe, Inc.*, the Veterans Administration Board of Contract Appeals discussed the importance of updates to the CPM

95. *Id.*
96. 2015 CIVBCA LEXIS 89, at *65-66, 2015-1 B.C.A. (CCH) P35, 913 (Mar. 17, 2015).
97. 384 A.2d 1121, 1136 (N.J. Super. Ct. Law. Div. 1978); *see also* Broadway Maint. Corp. v. Rutgers State Univ., 434 A.2d 1125 (N.J. 1981), *aff'd*, 447 A.2d 906 (1982).
98. 2017 CIVBCA LEXIS 272, a t *116 (quoting J. Richard Marguilies, *Delays, Suspension of Work, and Acceleration*, *in* Construction Contracting 617, 664 (1991)).
99. 40 Fed. Cl. 184, 201 (1999).
100. 22 Cl. Ct. 349, 398 (1990).

where the contractor was responsible for the accurate and timely submission of all CPM data necessary to produce monthly computer reports while the project was ongoing.[101] The board rejected the contractor's proposed revisions to a November CPM offered in the course of litigating the claim: "We give little weight here to the Contractor's proposed revisions to the November CPM. That is not to say that we would never allow such revisions. We are simply not persuaded that suggested revisions are correct and that the CPM was wrong at the time it was created."[102] However, the board would not totally disregard the October CPM as the federal government suggested: "There is a rebuttable presumption of correctness attached to CPM's upon which the parties have previously mutually agreed. [I]n the absence of compelling evidence of actual errors in the CPM's, we will let the parties 'live or die' by the CPM applicable to the relevant time frames."

It is important to both consider available technology and expertise, as well as to ensure that the expert has available as much supporting evidence as possible, and preferably accurate CPM schedule information prepared in the course of the project.

E. *Acceleration Claims*

"Acceleration" refers to a contractor's losses due to increasing the amount of labor provided to a project to make up for a delay and comply with the project owner's insistence that the contractor work faster. The owner's directive may be either (1) a directive due to the contractor's own delays, which plainly are not compensable; (2) an express directive due to the owner's desire to complete construction in a shorter amount of time than provided by contract; or (3) an implied directive to complete construction in a shorter time than provided by contract, such as where the project owner refuses to grant a time extension to which the contractor is legally entitled.

The court in *Fraser Construction Co. v. United States*, provided an excellent explanation of acceleration claims:

> A claim of acceleration is a claim for the increased costs that result when the government requires the contractor to complete its performance in less time than was permitted under the contract. The claim arises under the changes clause of a contract; the basis for the claim is that the government has modified the contract by shortening the time for performance, either expressly (in the case of actual acceleration) or implicitly through its conduct (in the case of constructive acceleration), and that under the changes clause the government is required to compensate the contractor for the additional costs incurred in effecting the change.[103]

101. VABCA No. 2168, 87-3 BCA ¶ 20104, 1987 VA BCA LEXIS 68 (Aug. 25, 1987).
102. *Id.*
103. 384 F.3d 1354, 1360-61 (Fed Cir. 2004).

The elements of a claim for constructive acceleration are the following:

> (1) that the contractor encountered a delay that is excusable under the contract; (2) that the contractor made a timely and sufficient request for an extension of the contract schedule; (3) that the government denied the contractor's request for an extension or failed to act on it within a reasonable time; (4) that the government insisted on completion of the contract within a period shorter than the period to which the contractor would be entitled by taking into account the period of excusable delay, after which the contractor notified the government that it regarded the alleged order to accelerate as a constructive change in the contract; and (5) that the contractor was required to expend extra resources to compensate for the lost time and remain on schedule.[104]

Acceleration claims often occur together with claims for other forms of delay damages. When the owner disputes the cause of a delay, it is common for the owner to expressly or impliedly demand that the contractor work faster to finish the project more quickly. Counsel, parties, and schedule consultants should keep the concept of acceleration in mind as they consider the facts, the analysis, and the resulting loss.

F. *Concurrent Delays*

The court in *George Sollitt Construction*, explained the analysis of concurrent delays as follows:

> The exact definition of concurrent delay is not readily apparent from its use in contract law, although it is a term which has both temporal and causation aspects. Concurrent delays affect the same "delay period." *See Tyger Constr. Co. v. United States*, 31 Fed. Cl. 177, 259 (1994) ("In cases of concurrent delay, where both parties contributed significantly to the delay period by separate and distinct actions, justice requires that the cost of the delay be allocated between the two parties proportionally."). A concurrent delay is also independently sufficient to cause the delay days attributed to that source of delay. *See Beauchamp Constr. Co. v. United States*, 14 Cl. Ct. 430, 437 (1988) (noting that a concurrent action "would have independently generated the delay during the same time period even if it does not predominate over the government's action as the cause of the delay" (citations omitted)).[105]

The court provided for an apportionment of delays and, thus, a proportionate recovery of damages only where "clear apportionment" of the delay attributable to each party has been established.[106] Unless the claimant contractor can meet its burden of proof of "clear apportionment," the general rule bars recovery for government-caused delays where a concurrent delay

104. *Id.*
105. 64 Fed. Cl. at 238 n.8.
106. *Id.*

is caused by the contractor.[107] Except where clear apportionment can be shown, the general rule prevents recovery of delay damages in the event of concurrent delays. Accordingly, in *Weaver-Bailey Contractors, Inc. v. United States* the court held: "Only if the delay was caused solely by the government will the contractor be entitled to both an extension of time within which to perform, and recovery of excess costs associated with the delay."[108]

Several cases likewise have allowed apportionment of liquidated damages where clear apportionment can be shown.[109] In courts that follow the traditional rule against apportionment, where the federal government has caused part of the delay to project completion, the rule against apportionment prevents government recovery of liquidated damages, thus allowing the contractor a time extension but no delay damages.[110] In courts that allow apportionment, the federal government's liquidated damages claim is barred if the causes are intertwined, and apportioned where the government can show a clear apportionment of the delay attributable to the contractor.[111]

Outside of the context of federal construction contracts, the provisions of the contract and state law may provide for (1) the traditional rule of no recovery to either party in the event of concurrent delays or (2) apportionment of damages. The EJCDC C-700 Standard General Conditions of the Construction Contract §4.05(D)(2), for example, provides:

> Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.[112]

Where the contract establishes the contractor's right (or lack of right) to delay damages, or the owner's right (or lack of right) to recover liquidated damages in the event of concurrent delays, most courts will enforce the parties' agreement.

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107. *Id.*; *see also PCL Constr. Servs., Inc.*, 47 Fed. Cl. at 801 ("If both parties contribute to a delay, neither can recover damages from the other, 'unless there is in the proof a clear apportionment of the delay and expense attributable to each party.'"); William F. Klingensmith v. United States, 731 F.2d 805, 809 (Fed. Cir. 1984) ("Courts will deny recovery where the delays are concurrent and the contractor has not established its delay apart from that attributable to the government.").

108. 19 Cl. Ct. 474, 476 (1990).

109. *See, e.g.*, Neal & Co. v. United States, 36 Fed. Cl. 600, 647, 649 (1996).

110. *George Sollitt Constr.*, 64 Fed. Cl. at 243–44.

111. *Id.*

112. EJCDC C-700 General Conditions § 4.05.D.2.

CONCLUSION

The four forensic scheduling methodologies discussed in this paper are commonly deployed to claim both excusable and compensable delays on construction projects by contractors, while owners use these same methodologies to rebut affirmative claims and to establish that asserted delay claims are non-excusable or non-compensable. Depending on the quality and availability of scheduling information, project participants should make an informed decision about which scheduling method to use. In addition, understanding the project schedule is a critical skill for successful claims handling. The schedule is often the source of conflict and later the source of relief. Working with owners and claimants to understand their scheduling concerns goes a long way towards reaching a favorable result. When this is not possible, the construction professional needs to have a keen understanding of the basic principles of delay claims, any contractual requirements regarding notice and presentation of same, and how the courts have ruled when confronted with varying schedule analysis methodologies.