The Construction Lawyer

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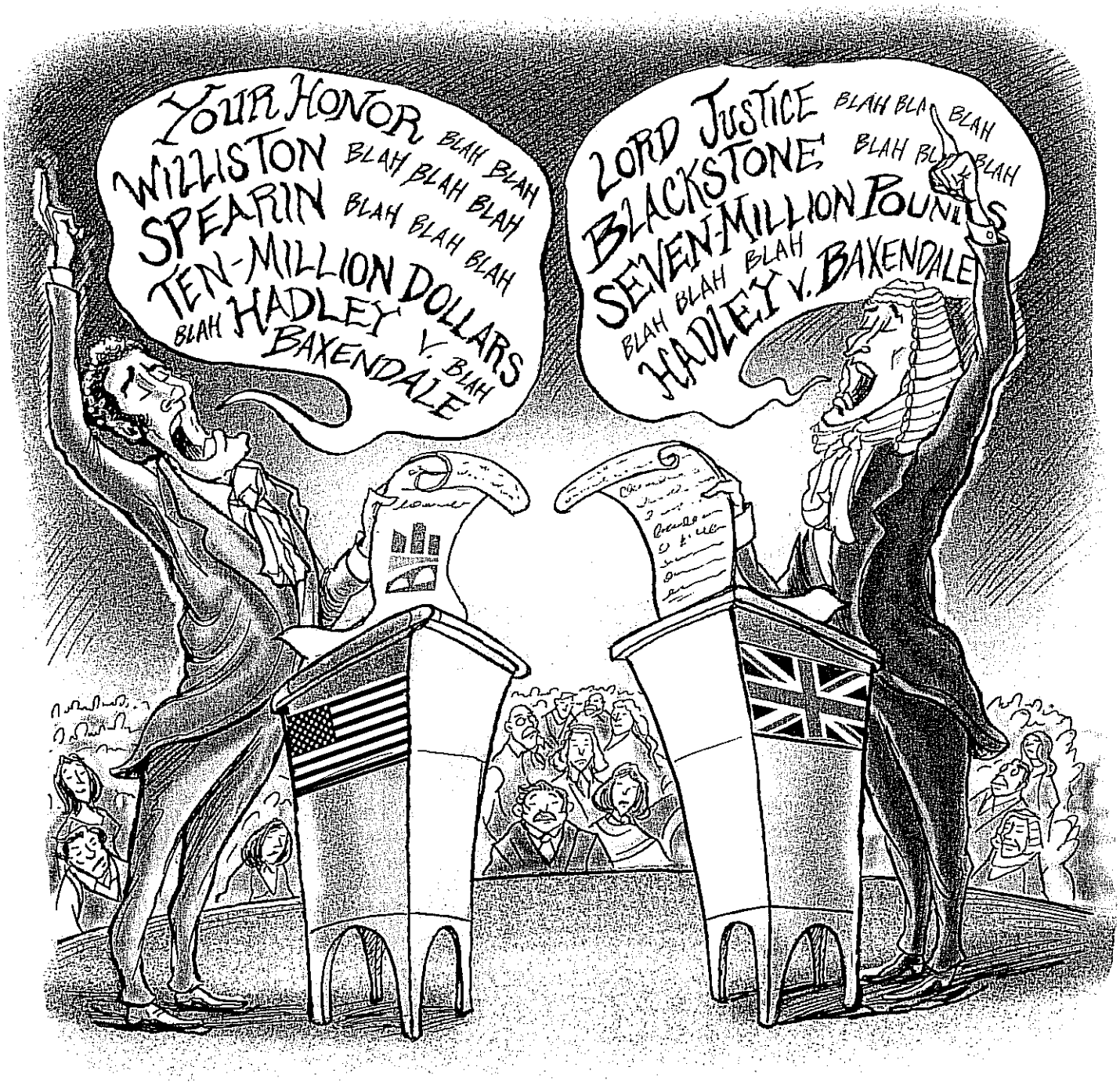

English Vines, American Grapes

Illustration: Chad Crowe

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Volume 35, Number 3, Summer 2015

FORUM ON CONSTRUCTION LAW
Building the Best Construction Lawyers

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The Construction Lawyer

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Notes from the Editor

By Stephen A. Hess

Stephen A. Hess

The well-regarded Italian epistemologist Lawrence Peters Berra once explained, "In theory there is no difference between theory and practice. In practice there is." Hmmm. Anyway, this issue encompasses both theory and practice.

With regard to theory, in "Delay Damages and Site Conditions: Contrasts in US and English Law," Julian Bailey and I discuss the differing treatment the titular topics receive here and in England. The material was presented at a meeting of the Society of Construction Law (the English equivalent of the Forum) in London in March. Julian is Chairman of the SCL and wrote a three-volume treatise on English construction law, so you would do well to start with Julian when investigating English law. Of course, because Julian is a scholar, and England has such a rich legal history, you might well get an answer that finds it roots (like this article) in such hoary authorities as Blackstone's *Commentaries on the Laws of England*, *Hadley v. Baxendale*, and Joseph Chitty's *Treatise on Pleading*.

John Livengood provides our second article concerning English and American law: "Comparison of English and US Law on Concurrent Delay." With respect to site conditions and delay damages, we had the benefit of relatively clear lines between the two jurisdictions. John tackles a more difficult task with respect to concurrent delay, as the United States and England:

> have seemingly different approaches, each of which is poorly explained or inconsistently applied by the jurists or other triers-of-fact. Despite numerous judicial decisions, neither the English nor the US law has a coherent or comprehensive approach to the consideration of concurrent events. Further, the two countries approach the issues with different concepts and different vocabulary.

Indeed, John's discussion and overview of the problem in comparing the two jurisdictions prove as interesting as the actual comparison that he undertakes.

Once you have nourished yourself on the theoretical discussions about comparative law, there are two articles that will satiate your appetite for more practical topics. Fredric Plotnick provides advice to owners in his piece "Rewriting the CPM Scheduling Specification to Better Support the Project Owner." We reached out to Fred as one of the preeminent authorities in this field as a service to our readers. Although scheduling is of vital importance both to construction projects and to subsequent claims, form contracts pay little attention to creating scheduling clauses with ramifications that are predictable, much less effective in protecting either party. That is not to say that *The Construction Lawyer* favors owners. Rather, we think it is important to start investigating practical solutions to common problems, and Fred (without any constraints from us on his approach) elected to treat the subject from the owner's perspective. Naturally, the discerning reader can use the lessons Fred teaches for the benefit of other parties, and contrary views are always a lively topic for further discussion.

Finally, Lauren McLaughlin and Shoshana Rothman discuss "When *Spearin* Won't Work: How Contractual Risk Allocation Often Undermines This Landmark Ruling." The *Spearin* doctrine has received substantial attention in the literature, but there is still no uniform restatement possible that fits all jurisdictions as to the extent or application of *Spearin*. One possible way to deal with that uncertainty is simply to excise *Spearin* from the applicable law by fiat—that is, to exclude its operation through express or implied contract clauses. But can the parties do so effectively? The authors canvas rulings from numerous jurisdictions and present their conclusions in our fourth article. At this juncture, I note that one of the ugly tasks I have borne as editor is a page budget, which limits what we can print. A truly unfortunate casualty of this issue of *The Construction Lawyer* is Lauren's and Shoshana's 50-state matrix of decisions concerning the enforceability of contractual limitations of the *Spearin* doctrine, as we could not squeeze into this issue in any readable font. Interested readers are heartily encouraged to contact the authors for a copy.

This brings me to a final note about changes at *The Construction Lawyer* and the Forum's other journal, *Under Construction*. Michael Branca takes over next issue as Editor, and John Foust steps into Michael's shoes as Associate Editor. R. Thomas Dunn has been installed as the new Associate Editor of *Under Construction*, where Jayne Czik remains as Editor for the near future. Both of these publications offer you a wonderful opportunity to contribute your knowledge to the construction bar generally, and to get your name in print in a form suitable for framing. Indeed, these skilled editors will all make your words sparkle. If you are not sure which publication better suits your needs, talk to any of these four people. And when thinking about your Forum career path, bear in mind the profound counsel of Mr. Berra: "When you reach a fork in the road, take it."

Stephen A. Hess is Editor of The Construction Lawyer *and practices in the Denver and Colorado Springs offices of Sherman & Howard, LLC.*

Rewriting the CPM Scheduling Specification to Better Support the Project Owner

By Fredric L. Plotnick

Fredric L. Plotnick

One of the most contentious and misunderstood sections of construction contract specifications relates to the schedule. We all understand that *time equals money*, but while concepts of expenses and payments are generally simple and understood, those of measurement of time, delays (concurrent, pacing, serial), and disruptions are often considered fuzzy.

A typical contract specification is all about allocation of risk. However, *risk*, as a mathematical concept, is handled differently for cost than for time. Estimated costs (in the architect's initial proposal or contractor's bid) of performance of the scope of work are summed to a total (with perhaps a few alternates for options chosen). Estimated durations of activities are selectively summed along a "critical path" of a logic plan sequencing the work as the basis for the project schedule. (See Figure 1.) The sum of costs for four items of 10 each is 40. If each item of cost is subject to some risk or variation of say 20 percent, then the total may be as low as 32 or as high as 48. However, if we "roll the dice" for each item, plus or minus, then add to the total, then do this again 10,000 times, the average total cost will still be 40.

Now consider the schedule on the right of Figure 1. Four activities, each of 10 days' duration, sum to 30 days for this project. In the world of schedulers, we would say that activities B and C are concurrently critical; if either is late, then the project will now take 31 or more days to complete. But the estimated durations for these four activities are also subject to variation, even if we leave out external aspects of risk. So if each activity is subject to some variation or risk of say 20 percent, then the total duration of the project may be as low as 24 or as high as 36 days. But if we "roll the dice" for each item, plus or minus, then add to the total, and do this again 10,000 times, the average total project duration will not still be 30 but will be 32, or a 6.7 percent overrun. For a one-year project, this represents about an additional month. Why?

With the list of costs, if one cost is high and another low, they cancel. After 10,000 iterations we expect variations to cancel. With the logic network of durations, if B is high and C is low, we only count B in our calculation; if C is high and B is low, we only count C. After 10,000 iterations we find 75 percent of the time either B or C is high, and only 25 percent both are low. Add to this that the lowest variation for cost is the penny, rounded down or up, while in the world of CPM for construction the lowest variation is a full day, rounded up only. Even for a string of critical activities, we schedule the next crew for the next working day after a prior partial day activity.

So a specification requesting the contractor to submit a schedule showing completion by the contract deadline is much like telling a hunter to aim at a flying duck, rather than somewhere in front of the duck. This concept was known by engineers specializing in this field from the inception of CPM in 1956 but has not yet been embraced by most architects, engineers, or project managers, nor by our legal community. In his seminal text (and still industry bible) *CPM in Construction Management*, Jim O'Brien indicated a 12-month schedule to meet a 12-month deadline was unacceptable; try demanding an 11-month schedule, "and so forth."[1] Computers of that era could not readily calculate the necessary contingency; a plethora of software products now exist and run on more robust hardware that can perform this calculation.[2]

The degree of how far to aim in front of where the duck is flying is a combination of the number of merges of logic (both B and C merge to D) and relative durations of activities. A trained and experienced practitioner can "see" this on a pure logic diagram or in various other graphics depictions. Whereas our example has only one merge of two activities, a typical construction project has much more complexity and therefore has but a 22 percent chance of completing by the date calculated by the static CPM algorithm. Some projects with one clearly defined critical path may have a higher likelihood; many I have worked on are upward of 80 percent; it is possible for a very linear network to approach 100 percent. Exacerbating the issue is that the industry "standard" is to assume each duration estimate to be within a -15 percent and

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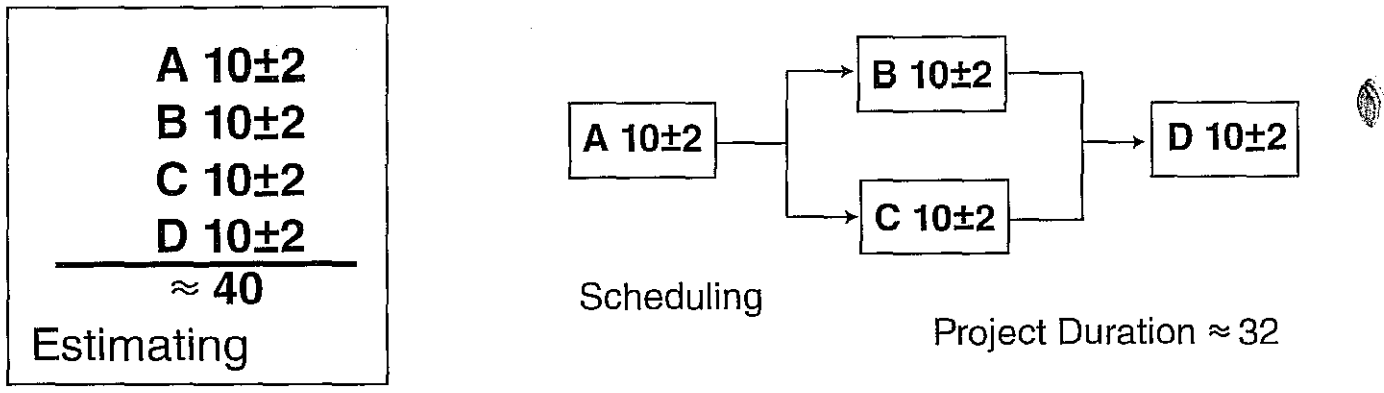


Figure 1. Compariston of Risk for Estimating and Scheduling

+20 percent envelope, thus engendering a normal degree of overrun even for a single strand of activities without merges. While a specification copied or amended from 1970 could not "calculate" the necessary degree of contingency, they could follow Jim's advice, assuming use of an experienced engineer (in this field) to set that necessary "factor of safety."

This relation back to mathematics is the backbone of this article on writing a better specification for CPM scheduling.

Another cause for the contentious and misunderstood nature of this section of the specification is that it has been cobbled together over the years with little concern to its purpose but rather to hopefully correct some (bad) court decisions relating to these less-than-fully-grasped concepts. Most sections of the specification detail either what the contractor is to provide or perform, or what to submit to permit proper administration of the project, but not both. The section on excavation rarely will discuss details of contractor equipment maintenance. The all-important payment section does not direct the contractor to perform scopes of work not covered elsewhere.

Section 013200 (or 01310 or other designations) for CPM schedules and reports is essentially a shop drawing. It requires the contractor to submit its planned sequence of execution, which is then subject to a mathematical analysis for review by the owner. Why does the owner desire this submittal? So that it may decorate the walls of its field office with the bar charts? So that it may fill all those empty filing cabinets with printouts and reports? Because everyone else demands it, so we want one too?

The primary purpose for specifying submission of a project plan and schedule (prepared and calculated using concepts of CPM) is to provide the owner additional assurance that the contractor *can* complete on time. The primary purpose of requiring periodic updates of the CPM schedule is to provide the owner additional assurance, as the project progresses, that the contractor *can* complete on time. The primary purpose of requiring an analysis of the impact of changes and possible revisions to the initial logic is provide the owner additional assurance, whatever changes may come, that the contractor *can* complete on time.

Other goals—such as to encourage that the contractor will complete on time, or to help facilitate progress payments funding but not allow the contractor to get ahead, or even the all-important need to determine entitlement to extensions of time as a result of changes or other factors—do not belong in this section. More importantly, such concerns should not detract from this primary purpose of this section of the specification. The section on painting should not include a subsection on safety issues for scaffolding. The section on payment procedures and necessary submittals should not include a subsection on negotiating, mediating, or litigating modification of contract value; neither should the section on preparation and submittal of the CPM schedule.

And so, the issues of time must be addressed within the 013200 section of the specification, but also in other sections including:

003113 Preliminary Schedule
012600 Contract Modification Procedures
012900 Payment Procedures
013100 Project Management and Coordination
013300 Submittal Procedures

Our 013200 section must be clear as to purpose—both to the contractor and to the engineer writing and enforcing the specification:

1.3.2 Purpose of the Schedule

1.3.2.1 Provide additional assurance by the Contractor of its adequate planning, scheduling, and reporting during the execution of the construction and related activities so they may be prosecuted in an orderly and expeditious manner, within the Contract time and the milestones stipulated herein.

Note specification of dates or days of Contract commencement and completion of work, including but

not limited to access (complete or partial), final and substantial, and intermediate milestones are typically provided in the primary Contract and not within Specifications.

1.3.2.2 Provide additional assurance by the Contractor of the coordination of the work of the Contractor and the various Subcontractors and suppliers at all tiers.

1.3.2.3 Assist the Program Manager in monitoring the progress of the work.

Users of this Guide Specification may choose to globally replace "Program Manager" with "Contracting Officer," "Resident Engineer," or other named person.

1.3.2.4 Assist the Program Manager in evaluating the Contractor's monthly progress payments requests.

1.3.2.5 Assist the Program Manager in evaluating the potential impact of proposed changes to the Contract.

1.3.2.6 Assist and be utilized by the Contractor in the coordination of its forces, subcontractors, and vendors.

1.3.2.7 Assist both Program Manager and Contractor in detecting problems for the purpose of taking timely corrective action and to provide a mechanism or tool for determining and monitoring such corrective actions.

Inclusion of use by the Contractor for its own benefit may be more hoped for than mandated, but does inform and set limits to the Program Manager on demands that may reduce the usefulness of the Schedule for such purposes.[3]

Now that we have specified the purpose, we must follow through to effectuate that purpose. Other benefits may be mined from the exercise, such as assisting payment facilitation and preventing or resolving claims, but these must be sublimated to the primary purpose of this section even if alternate schemas are to be used in sections devoted to those purposes. A key question to be asked in this (or any other section of a specification or provision of a contract) is "Does this added language detract from the primary purpose?"

Our second issue is not to allow a specific vendor to dictate our specification to its own end, and especially where such is antithetical to our primary purpose.[4] As author of the initial NAVFAC Guideline Specification for CPM in 1986 (now morphed to the Unified Facilities Guide Specification 01321N), I saw that great effort was expended to make the specification product neutral despite a close working relationship with Primavera. Despite marketing materials of Oracle (current owner of the Primavera product line), the purpose of the schedule is not primarily for mining of "big data" at an enterprise level of *one* of the project participants. Should an owner desire to accumulate "big data" from this and other projects, there are better and less intrusive means to do so.

Moreover, most software products use a mathematical algorithm designed for a different purpose from assurance of timely completion. The primary purpose supported by most products is best productivity for individual activities within such schedules, even if such will lead to delay of completion of the subject project. Although this is a worthy goal for a scheduling throughput for a shop of machines (thus the algorithm is named "job shop scheduling") or computer coders, it does not address our primary purpose. Worse yet, when set for "enterprise" considerations, work on this project may be suspended to improve productivity on another. The settings within the software that control are largely not fully understood by most writers of specifications, casual users (such as the field scheduler-of-record), nor even most of the salesforce of the product vendor.

Imagine a payment specification that requires use of a proprietary accounting package that arbitrarily will round all cost items up to next increment of five, and then after five such instances reduce another cost item by ten to help round out the error. In general, this practice does not impact the usefulness of the CPM schedule; miscalculation by a few days on a multiyear project is far less than the variation based on our estimated durations. However, in the short term, misuse of output by a resident engineer following the printout and not the contractor's notice of when an inspector is needed can create problems. And now imagine explaining this algorithm to a court.[5]

Our first issue where we confront that the software vendors should not dictate the specification is the form of submittal. We are primarily looking for submission of a project plan (prepared from inputs of the contractor) and schedule (calculated from that plan). For the typical shop drawing submission—we are looking for a drawing! We want to see the *input* used by contractor or fabricator and not merely a printout saying "correct result." Most specifications of the 1960s, '70s, and '80s all required a hand-drafted, pure logic drawing showing all of the activities, estimates of durations, basis for such estimates (resources), and, most importantly, the logic between the activities. Data were then to be "taken off" of the pure logic diagrams and entered into the software, which calculated the result. But even after a quick check of the printout to see if the end date was achieved, the hand-drafted diagrams required tedious review to winnow out missing or improper logic.

As software entered the 1990s and beyond, focus morphed from the time-centric algorithms of construction

(and related fields) to that of human productivity (as driven by software code development). Here a depiction of the initial plan (a static bar chart) and not a means to measure progress and automate the schedule was more important. Activities may be placed where stakeholders deem proper and not merely by the impersonal logic of a network diagram and resultant calculations. Software "wizards" preferred key strokes on-the-fly to the team building of a full logic network and only then entering into the software. Software vendors even dropped graphical depiction of the logic network while focusing upon productivity tools such as pie-charts of resource utilization. The 90 percent of nonconstruction users, not using or desiring improved logic network graphics, drove the development of software. And the software that then favored one format over another then drove changes to the specification.

Compare the 1986 Guideline Specification[6] by this author to the current iteration[7] [note *emphasis added*]:

1986 GUIDELINE SPECIFICATION

PART 2—PRODUCTS AND EXECUTION

2.1 NETWORK SYSTEM FORMAT: The system *shall consist of network diagrams* and accompanying mathematical analyses. [Facilities with discrete completion dates shall be identified by separate subnetworks interconnected with the basic diagram or specially coded.]

2.1.1 Diagrams: Shall show the order and interdependence of activities and the sequence in which the work is to be accomplished as planned by the Contractor. The basic concept of a network analysis diagram shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and how its completion restricts the start of following activities. PDM networks also permit relationships showing:

how the start of an activity is dependent upon the start of preceding activities plus a time delay other than the duration of such preceding activities and

how the finish of an activity is dependent upon the finish of preceding activities plus a time delay other than the duration of such preceding activities.

2.2.6 Submission Requirements: *Sheet size of network diagrams shall be a minimum of 24 by 36 inches* and a maximum of 30 by 60 inches. Contractor shall show on all diagrams the name of the contract, contract number, start date of the project, contractual finish date of the project, data date of information depicted on the diagram, date diagram was prepared, *designation of "Logic Network Diagram"* . . . . Network diagrams and complete revisions shall be submitted in three copies (one reproducible and two prints). Monthly reports shall be submitted in three copies. Contractor shall supply an additional copy (print) of the network diagrams and complete revisions and of all printed reports to each major subcontractor.

2.2.7 Summary Network: After the completed network is accepted, the Contractor *shall prepare and submit a time-scaled summary network.* This network shall be in PDM format with approximately 10% of the number of activities in the Completed Network. Starting, completing and milestone events shall be the same as those on the Detailed Network. Network may be drafted on standard sheet size or computer generated. The summary network shall show (in summary): all major portions of the Construction work; critical (and near-critical) procurement items; critical (and near critical) Government activities; milestones; all work on the critical (and near critical) path and interface events.[8]

2002 GUIDELINE SPECIFICATION

1.6 NETWORK SYSTEM FORMAT

The system *shall consist of time scaled logic diagrams* accompanying mathematical analyses and specified reports.

1.6.1 Diagrams

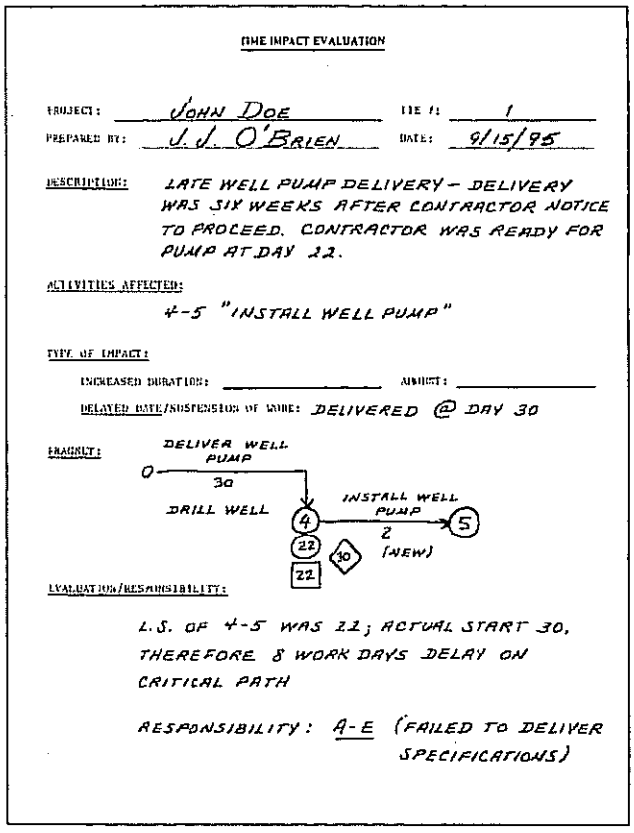
Show the order and interdependence of activities and the sequence in which the work is to be accomplished as planned. The basic concept of a network analysis diagram will be followed to show how the start of a given activity is dependent on the completion of preceding activities and how its completion restricts or restrains the start of following activities.

1.7.8 Summary Network

. . . [optional] . . .

A summary network shall have the same network form as the Accepted Network Analysis Schedule. The summary network will contain a minimal number of activities that represent the general approach of work sequence. The *Summary will be a time-scaled logical sequence* . . . .[9]

To a typical construction attorney the significance of the change from requiring a network diagram and optionally a time-scaled summary network to a time-scaled logic diagram and optionally a second time-scaled but summary network may be lost, but this is a major issue to



TIME IMPACT EVALUATION

PROJECT: JOHN DOE TIE #: 1

PREPARED BY: J. J. O'BRIEN DATE: 9/15/95

DESCRIPTION: LATE WELL PUMP DELIVERY – DELIVERY WAS SIX WEEKS AFTER CONTRACTOR NOTICE TO PROCEED. CONTRACTOR WAS READY FOR PUMP AT DAY 22.

ACTIVITIES AFFECTED:

4-5 "INSTALL WELL PUMP"

TYPE OF IMPACT:

INCREASED DURATION: _____ AMOUNT: _____

DELAYED DATE/SUSPENSION OF WORK: DELIVERED @ DAY 30

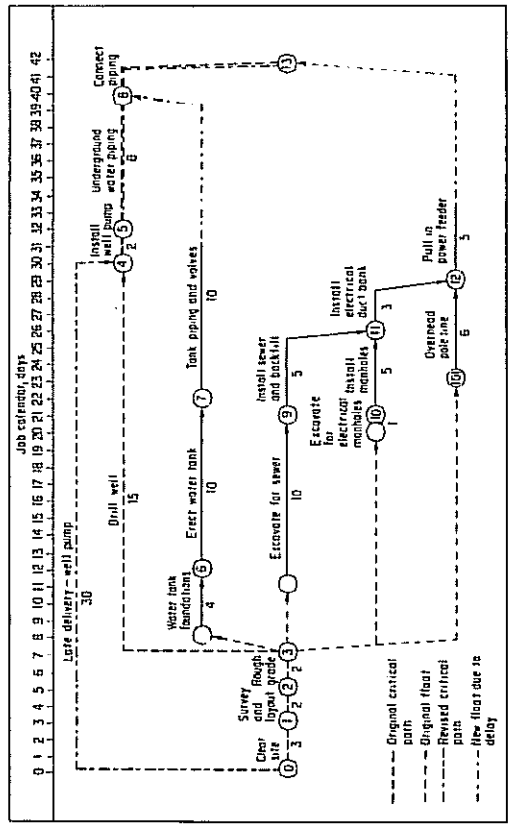
FRAGNET:

EVALUATION/RESPONSIBILITY:

L.S. OF 4-5 WAS 22; ACTUAL START 30, THEREFORE 8 WORK DAYS DELAY ON CRITICAL PATH

RESPONSIBILITY: A-E (FAILED TO DELIVER SPECIFICATIONS)

Time impact evaluation (TIE) describing delay of well pump.



Time scale network showing late delivery of well pump.

Figure 2. Example of a "Fragnet" for a Claim, and as Then Properly Inserted Into the Full Pure Logic Network

serious practitioners. The purposes of the two differ. The pure logic diagram depicts the recorded knowledge of the project team as *input* prior to computer calculation. The time-scaled diagram or summary depicts the *output* of the computer calculations in a graphical format. The reason why a time-scaled logic diagram should be only of a summary of activities is that once more than 50 to 200 activities are depicted, it becomes almost impossible to follow the logic between activities. An article on this topic in *ENR* (*Engineering News Record*) quotes one professor saying, "[w]ith time-scaled PDM, the display can start to look like 'a plate of spaghetti,' and so people often suppress the logic arrows and use the easy-to-read bar chart."[10] Therefore, in practice, the initial complete time-scaled diagram demanded by the specification is rarely actually required or provided, and would be impossible to read other than for the simplest of projects.

Technology again drives the specification. A pure logic diagram is best prepared, displayed, and reviewed on large scale media, typically "D" sized paper, 22" × 34". (Architectural "D" size is 24" × 36".) The predominant software vendors encourage data entry on-the-fly. This favors keeping everything on the computer screen. The majority of their customers in the IT fields are not as concerned with the integrity of the logic network. Their "schedules" are more flavored with intuition and support a bar chart. When actual experience does not match the plan, the preferred correction is to again assemble the team and "rebaseline" while "improving" upon the original (or most recent) plan. Because both the developers and the majority of customers do not want or need a pure logic diagram to be properly viewable on a computer screen, perhaps fewer development dollars have gone toward improvement. The result is to discourage use of a pure logic network, and thus these have been largely eliminated from standard specifications.

The industry reaction? Horror! The same cover story of *ENR* for the May 26, 2003, *Off the Critical Path* features a photograph of James O'Brien holding a pure logic diagram[11] and is subtitled, "Experts debate the state of CPM scheduling." Suffice it to say, industry experts prefer the requirement for a pure logic diagram. However, in fact, most current specifications require only an abbreviated form involving only a "fragnet" surrounding activities upon which a claim of change is to be made.

What is a fragnet? The term is industry shorthand for "a fragment of a pure logic network" or "fragmentary network." The concept is based upon the parties reviewing the (now nonexistent) pure logic network diagram, locating the activity or activities impacted by a change, and inserting additional logic to show how the change will cause an impact. (See Figure 2.)

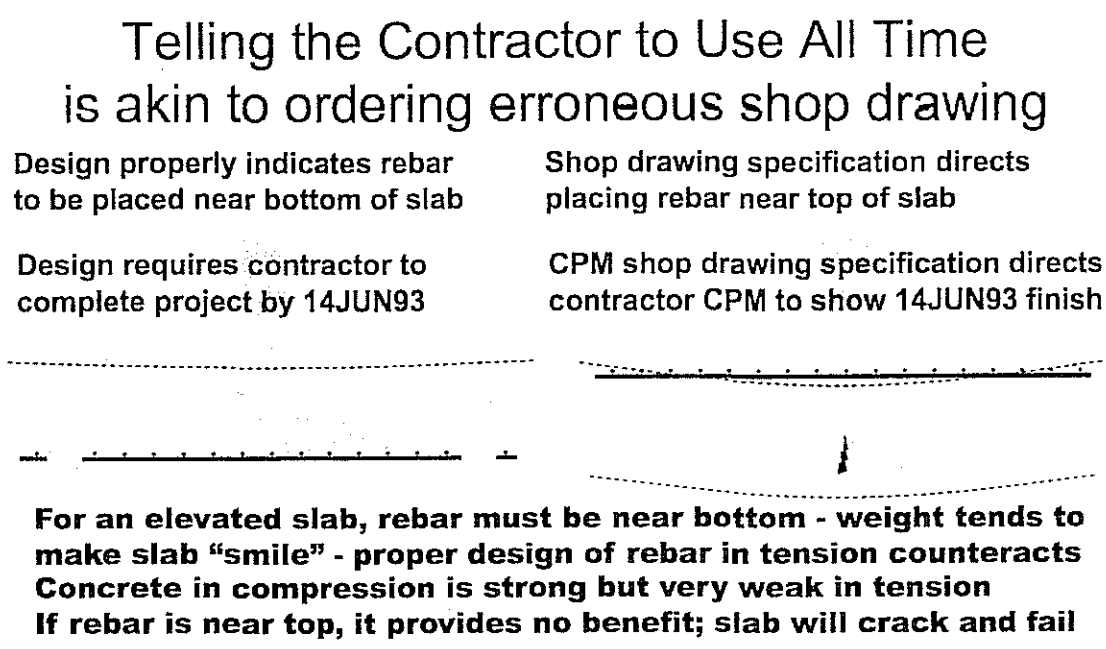


Figure 3. Possible Impact of a Specification Requiring Contractor to Show Rebar at the Top of an Elevated Slab

1.8 CONTRACT MODIFICATION

When a contract modification to the work is required, submit proposed revisions to the network with a fragnet and a cost proposal for each proposed change. All modifications shall be incorporated into the network analysis system as separately identifiable activities broken down and inserted appropriately on the first update following issuance of a directive to proceed with the change. Submit [one copy] [_____ copies] of the Total Float Report, Log Report and a copy of the proposed Time Impact Analysis on disk, with the cost proposal. Unless the Contracting Officer requests otherwise, only conformed contract modification fragnets will be added into the subsequent monthly updates. All revisions to the current baseline schedule activities that are necessary to further refine the schedule so that the changed work activities can be logically tied to the schedule shall be made. Financial data shall not be incorporated into the schedule until the contract modification is signed by the Contracting Officer.[12]

Our third issue relates back to aiming to where the duck is flying and not where it may now appear to be in the sky. In recent years, a number of specifications for CPM have required that the contractor show it is to be using all contract time. The wording is somewhat fuzzy, and the author has not seen a specification requiring the contractor to actually use all such time—purposely delaying work if necessary—nor even requiring the contractor to maintain its field office and all overheads after achieving both substantial and final completion. But it is suggested that the requirement for a shop drawing (or CPM schedule) that "shall use all contract time" is arguably such a demand.

To a professional in CPM planning and scheduling, this is lunacy. The mathematics require the contractor to reserve contingency for the almost certain unexpected events endemic in construction. As Jim O'Brien said, "if you need a 12-month period for completion of the project, set your CPM goal at about 11 months, and so forth."[13] Accepting, much less demanding, a CPM that matches the completion date is akin to accepting a design with a factor of safety of zero. Or perhaps it is worse, once one understands the mathematical basis for the necessary contingency.

An argument that "this is only the CPM and not telling the contractor to delay until the last day" falls short. If a key subcontractor, or a product vendor, or the owner's inspector is told by the CPM that installation may not start before a date calculated by the official CPM, there is a strong likelihood that there will be pushback to the superintendent's request to expedite work. There may be a strong *Spearin*[14] argument that this one clause both forgives the contractor of contract deadlines and entitles the contractor to extended overhead and other damages caused by late completion.

Imagine a specification requiring the contractor shop drawing to show rebar in the top inch of an elevated slab. Notwithstanding that the design drawings may properly show the reinforcing steel correctly, we now have direction to install improperly. See Figure 3 for the impact should the contractor then prepare the shop drawing as demanded, and install as per the shop drawing. A specification requiring the contractor to "use all contract time" is the equivalent to the demand for the improper shop drawing for rebar.

The purpose of the offending demand to "use all contract time" appears to be a misguided effort to prevent a contractor from claiming it may finish early, and then claiming that owner-caused factors prevented such early completion, entitling the contractor to extended overhead and perhaps other damages. So let's look at this issue. First, the specification for a shop drawing of the contractor's "plan of execution" and for the purpose of "providing additional assurance that the contractor can finish on time" is probably not the proper place to address change orders, payment, or adjustment of time issues.

The base contract could provide that part of the scope entails that the contractor provide a fully staffed field trailer and encompasses other overhead for the entire duration from Notice-to-Proceed until the stipulated contract completion date. Why an owner would want the contractor to bid to pay all these expenses while its staff plays pinochle after substantial and final completion is a business decision. There may be financial draw considerations—a 36-month project not needed until month 36 should not be burdened with a drawdown over 30 months. This issue belongs in the base contract and perhaps the specification relating to payment. The owner may desire some insurance should it disrupt or delay the contractor inadvertently, or even perhaps for adding extras so long as there is no impact on that final completion date. Perhaps the owner should also specify that should the contractor's contingency for removal of rock not be required, the owner may order extra excavation elsewhere without cost. Why not simply specify that, should any one line item of the contractors' internal bid be bettered by actual performance, the savings go to the owner. (Of course, for those line items where the bid is under actual cost, that comes out of the contractor's pocket.)

Then, of course, we can go back to the mathematics. If the contractor's CPM calculates an early completion that when risk-adjusted provides for an 80 percent likelihood of completion on time, the likelihood of completion by that earlier date will be less than 80 percent. In general and for a project of average complexity, that likelihood will be around 22 percent. Even so, the contractor is entitled to have the owner support aiming at the earlier target.

Finally on this topic, a specification requiring the contractor to submit a CPM that will "use all contract time" is demanding the contractor to commit fraud. The owner does not desire the contractor to deliberately slow work to fill the contract duration. The specification demands the contractor provide its best estimate of durations for various activities. And then this clause demands the contractor change various durations to get a calculated result without any intent to increase or decrease resources or hours worked or any of the other factors that would support modification of its initial estimate of duration for said activities. Fraud!

Our fourth issue relates to follow through on moving all references in this specification section not required to support the primary purpose to another, more appropriate section relating to performance of any task other than the preparation of this shop drawing. Look through your draft specification. Wherever you see instruction for the contractor to *do something*, move such to the new appropriate section.

Use of Float and Reasonable Limitations Upon Resources

This entire subsection belongs rather in 031000, Project Management and Coordination, or 012600, Contract Modification Procedures, as it directs actions other than the preparation and submittal of a shop drawing. Of utmost importance is the setting of limits for resources of the owner and its architects, engineers, and inspectors. Note with each shop drawing specified the resources required for review. Note a maximum level of owner resources (somewhat below what the owner may actually be able to field) to perform such reviews. Leave to the contractor the task of processing its submittals in a timely fashion to fit within such limits. Suggest that the contractor prioritize submittals and provide notice to the owner as to importance of early review.

Float Time Is Not for the Exclusive Use or Benefit of Either the Contractor or the Owner

This entire subsection belongs rather in 031000, Project Management and Coordination. The concept of "ownership" of float is strange. Who owns float? Float is a calculated number. Float is defined as the day number when an activity must be complete for the project to finish on time, minus the day number when that activity may first be completed, all assuming that each duration is estimated perfectly.[15] So who owns the late finish and who owns the early finish? Subtract one from the other to determine who owns float. Who owns the right to use float may be a better question. Float represents the ability to allocate limited resources among several activities that may concurrently be performed. It is a difficult topic and perhaps the basis for a separate article. However, at its root, the rules of allocation of float follow those of riparian rights:

> From the common stream of resources to be allocated to a logical network of activities, take what one needs to live. Even for critical activities there is usually no need to have a crew standing by to start as soon as the prior work is done. If the string of activities has adequate float and the predecessor completes on a Thursday, there should be no quarrel with putting off starting the successor until Monday.
>
> Once assuring there will continue to be adequate float for follow-on activities, use float to commercial advantage, first-come, first-served. Assuming several weeks of float, there should be no quarrel to defer work until another crew is available rather than hiring an additional crew. Nor should there be an issue to defer work for a week looking to better weather. Assuming adequate float!
>
> Do not waste! Pulling a crew off this project to send to

another, and then placing a follow-on subcontractor in a situation where it must hire additional crews to maintain schedule, is not to be permitted, and should be the basis for a demand for additional compensation.

Contract Completion Times
Typical language addresses issue of both 013100, Project Management and Coordination, and 012600, Contract Modification Procedures:

> The Contractor acknowledges and agrees that actual delays to specific activities that do not exceed available total float time of such activities will not have any effect upon Contract completion times and Contractor will take all actions necessary to maintain the overall schedule.

Requirement for Additional Resources
This subsection belongs in 031000, Project Management and Coordination, as it directs actions other than the preparation and submittal of a shop drawing. For example, that specification may include the following:

> The Contractor shall provide adequate resources, including but not limited to manpower and construction equipment, to perform its obligations in a timely manner. The Contractor shall be required to provide additional resources for additional work or events which may be anticipated on a construction project of this magnitude.

Entitlement to Extension of Time and Acceleration
This subsection belongs rather in 012600, Contract Modification Procedures. We are now discussing the *use* of data provided in the 013200 submittal. Suggested language for 012600 may include the following:

> Entitlement to extensions of time for performance as described in the Contract Documents will be granted only to the extent that time adjustments for the activity or activities affected by any condition or event which entitles the Contractor to a time extension exceed the total float along the current critical path of activities affected.
>
> If the Program Manager does not provide an extension of time at the request of the Contractor, the Contractor shall in a timely manner provide a Recovery Schedule and itemized estimate of costs to effectuate such or shall be deemed to waive its claim for additional compensation therefore.

Preliminary Schedule
This language belongs in a separate subsection titled Preliminary Schedule or perhaps may be incorporated within 013100 Project Management and Coordination, as it addresses an entirely different purpose than Section 013200. The purpose of the Preliminary Schedule is to provide notice to the owner of work anticipated to be performed in the next several weeks and perhaps months such that the owner may then plan and schedule its resources to provide necessary support. Such resources may include inspectors, owner-provided cash flow, access, equipment, and other deliverables. This schedule is not designed nor does it in any manner provide the additional assurances of Section 013200. It is for this reason that some urgency should be demanded for the 013200 submittal and similarly for a process to expedite the review process on this critical item of the Critical Path Method submittal. Until the 013200 product is submitted and reviewed, the owner must act solely upon the initial assurances of the signed contract.

Project Meetings Where Schedule May Be Discussed
These subsections belong in 031000, Project Management and Coordination. Many specifications include these within 013200 because they do relate to schedule. This may be compared to including within the specification for painting the detailed requirements of all equipment that will be painted. The Unified Facilities Guide Specification includes subsections covering Monthly Coordination Meetings (01321N, Part I, 1.12,) a Biweekly Work Schedule (1.13), Weekly Coordination Meetings (1.14), and even instruction on Correspondence and Test Reports (1.15). Once moved to 031000, hopefully these subsections will be coordinated with:

- review of the initial pure logic network,
- the subsequent calculated schedule and other analyses,
- the observation and reporting of work performed as then to be further analyzed as part of an update,
- the observation and reporting of factors that may cause disruption or delay[16] as then to be analyzed for impact and perhaps the basis for a call to revise the initial CPM submittal, and
- other subsections relating to the observation and reporting of project scope.

The list of what to include, what to exclude, suggested language for both the 013200 and other sections, and other general discussion relating to time could go on to fill a book. And indeed it shall, but not here.

We of the legal community must look to the engineers for education on how to perform and how to interpret the analyses of the recording of the contractor's anticipated plan of execution. We of the legal community must also educate the engineers who prepare the specifications of the contract documents as to proper format and separation of direction of what to report via submittal or perform via actions.

Endnotes
1. JAMES J. O'BRIEN, CPM IN CONSTRUCTION MANAGEMENT

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delay, the contractor need *not* show he would have finished on time but-for the government's delays. Utley James, Inc., G.S.B.C.A. No. 5370, 85-1 B.C.A. (CCH) ¶ 17,816 (1984).

98. *T. Brown Constructors*, 132 F.3d 724.

99. Blinderman v. United States, 39 Fed. Cl. 529 (1997).

100. P.J. Dick v. Principi, 324 F.3d 1364 (Fed. Cir. 2003).

101. *PLC Constr. Serv.*, 53 Fed. Cl. at 484 (footnotes omitted).

102. Fink, *supra* note 42.

103. *Arntz Contracting Co., Beacon Constr. Co., K.A. Constr. Co., & Teaco, Inc., A Joint Venture*, E.B.C.A. No. 187-12-81, 84-3 B.C.A. (CCH) ¶ 17,604, at 87704.

104. G.S.B.C.A. No. 5370, 85-1 B.C.A. (CCH) ¶ 17,816 (1984). *Accord* Cline Constr. Co., A.S.B.C.A. No. 28600, 84-3 B.C.A. (CCH) ¶ 17,594; Titan Pac. Constr. Corp., A.S.B.C.A. No. 24148, 87-1 B.C.A. (CCH) ¶ 19,626. *See also* WICKWIRE ET AL., *supra* note 26, § 9.08[G], which states, "Neither the contractor nor the owner must satisfy the same standard for the recovery of damages as the standard required to avoid the application of delay damages through the obtaining of time extensions. . . . With respect to the avoidance of delay damages either the contractor [or owner] need only show that the other party [or some excusable delay] was responsible for a concurrent critical path delay."

105. Stephen Dale & Kathryn Muldoon, *A Government Windfall: ASBCA's Attack on Concurrent Delays as a Basis of Constructive Acceleration*, PROCUREMENT L., Summer 2009, at 4; Stephen Dale & Robert D'Onofrio, *Reconciling Concurrency in Schedule Delay and Constructive Acceleration*, 39 PUB. CONT. L.J. 161 (2010).

106. E.N.G.B.C.A. No. 5698, 94-1 B.C.A. (CCH) ¶ 26,491.

107. *See* R.J. Lanthier Co., A.S.B.C.A. No. 51636, 04-1 B.C.A. (CCH) ¶ 32,481.

108. Mann Chem. Labs., Inc. v. United States, 182 F. Supp. 40 (D. Mass. 1960).

109. *Titan Pac. Constr. Corp.*, 87-1 B.C.A. (CCH) ¶ 19,626.

110. HOSHINO ET AL., *supra* note 12, at 100, fig.12.

111. The phrase seems to have been developed by the military during the 1940s. It has been made popular in the construction field by WICKWIRE ET AL., *supra* note 26.

112. James Bidgood et al., *Cutting the Knot on Concurrent Delay*, CONSTR. BRIEFINGS, Feb. 2008; P. McGeehin & W. Kime, *Concurrent Delay—Cutting the Knot*, Construction SuperConference, San Francisco, CA (Dec. 14, 2007).

REWRITING THE CPM SCHEDULING SPECIFICATION

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142 (McGraw-Hill 1964).

2. Some examples used by the author include Monte Carlo of Primavera Systems (©1991), Open Plan of Deltek (©1994), Pertmaster (©1998) (now renamed as Oracle Primavera Risk Analysis), and Acumen Fuse of Deltek (©2006); others reviewed by the author include Risk+, Full Monte, Polaris, and Risky Project; and there are many more not yet so reviewed.

3. From draft for *Sample CPM Specification* for 8th edition of James J. O'Brien & Fredric L. Plotnick, *CPM in Construction Management*.

4. Another example relates to the "language" or format of the logic network. The original format (now called ADM, for "Arrow Diagramming Method") had stricter logic rules than the more modern (PDM, for "Precedence Diagramming Method") format. Jon Wickwire, a prominent attorney of the construction bar over many years, is widely quoted as stating only a CPM using the ADM format should be accepted in a court. However, in or about 1994, Primavera, the leading software provider, ended support of ADM networks, forcing specification writers to accept PDM. Also see *Construction Scheduling: Preparation, Liability, and Claims*, Jon Wickwire, Aspen Publishers, 2003.

5. *See* Fredric L Plotnick, *Evidence Issues in Forensic Use of CPM Scheduling*, presentation for the NJSBA Section on Construction Law (2008). A PowerPoint slideshow may be viewed at http://www.rdcpm.com/08sLJC-1.pps.

6. FREDRIC L. PLOTNICK, DEP'T OF NAVY, NAVAL FACILITIES ENGINEERING COMMAND GUIDE SPECIFICATION, NAVFAC GS-01013NF (1986) (prepared pursuant to Contract # N62472-87-C-1005).

7. Unified Facilities Guide Specification, as published in JAMES J. O'BRIEN & FREDRIC L. PLOTNICK, CPM IN CONSTRUCTION MANAGEMENT (McGraw-Hill 6th ed. 1999; 7th ed. 2005), app. B.

8. Excerpts of Naval Facilities Engineering Command Guide Specification. *See* PLOTNICK, *supra* note 6.

9. Excerpts of Unified Facilities Guide Specification currently in use. *See* O'BRIEN & PLOTNICK, *supra* note 7.

10. See Off the Critical Path, ENG'G NEWS REC., May 26, 2003, at 32.

11. *See Off the Critical Path*, ENG'G NEWS REC., May 26, 2003. The pure logic drawings shown in the cover photo were prepared by the author for various projects in the 1980s. These were hand drafted to Mylar, then printed using the blueprint technology of that era.

12. Excerpt of Unified Facilities Guide Specification. *See supra* note 7.

13. *See supra* note 1. *See also* O'BRIEN & PLOTNICK, *supra* note 7, at 428 (7th ed. 2005).

14. *United States v. Spearin*, 248 U.S. 132 (1918), provides that should a contractor perform as directed, all adverse consequences will be shifted to the party providing such direction. In common parlance, "If you did not want a fly in your soup, why did you order it?"

15. Other or perhaps expanded definitions may apply. For the original algorithm of 1956, using what is now called the ADM format for the logic network, this calculated number would be equal to the day number when an activity must start for the project to finish on time, minus the day number when that activity may first start. For the majority of algorithms using the currently predominant PDM format, the calculation of "start" float may differ from "finish" float, and software may report "start," "finish," or "most critical" (being the lesser of the two.)

If multiple calendars are supported by the software, the definition of float becomes more complex and problematic. The "day number" is now based upon the calendar of the activity, and perhaps the calendar of the restraint between activities. Monday to Monday on a "workday" calendar is five days, perhaps four days if a holiday intervenes. Monday to Monday on a pure calendar is seven days. If the period for concrete cure ends on a Saturday, but work on the next activity will not begin until Monday, does the activity of "Cure" and all previous activities now have one more day of float? That is what will be calculated. A multiyear project utilizing multiple calendars may calculate its first activities with 10 or more days of float (reducing to zero at the end of the project). Who owns this float?

16. Technically, a professional scheduler speaks of disruptions to specific activities that when analyzed may be the cause of a delay to the project. However, even the most professional of schedulers will often use the verbal shorthand to say an activity has been delayed. Whether the disruption to activity will delay the project (or milestone thereof) is a matter for subsequent analysis.