WHY OWNERS AND CONTRACTORS SHOULD SHARE THE FLOAT

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I. INTRODUCTION

The subject of float on the schedule for a construction project, and specifically its ownership and use, is an important and controversial aspect of risk allocation for the construction industry. For many years, owners and contractors have exchanged their respective perceptions as to why the other party should not be able to use float that would otherwise be available for various work activities. These perceptions have led some parties to believe that a better way to allocate schedule risk would be for the contract to convey the right of float usage to one party, usually themselves. Such contract provisions have come to be known as "float-ownership" provisions.[1]

Viewed from a technical standpoint, that is, from the context of Critical Path Method (CPM) scheduling, it is a mistake to believe that "float ownership," if assigned to one party prior to the project's commencement, will be a fair or efficient way to resolve potential time-related issues arising from float usage during a project. Float is not something that can easily or accurately be "built into" a schedule, much less easily or accurately manipulated, allocated, or

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[1] For instance, the Winter 2010 edition of the *Journal of the American College of Construction Lawyers* contains an article entitled *Who Should Own the Float?,* by Stephen A. Hess. 4 No.1 Journal of the American College of Construction Lawyers 109. In the article, Mr. Hess posits that construction activity float is developed by the contractor, and that the contractor alone should be entitled to the use of the float.

sequestered. Float is a dynamic arithmetic calculation that is different at different points in time during a project. The assignment of "float ownership" as a static resource is illusory, especially at the time of contracting, prior to the project's commencement.

Those that advance the idea of "float-ownership" tend to define float as an intangible static resource, *e.g.,* "slack or extra time in a schedule that is allotted to complete a task as a cushion against unforeseen delays."[2] If float is a created resource, goes the argument, then it can be assigned or allocated to one party over others. But this underlying premise, that float is a resource that the creator of the CPM schedule (typically the contractor) "builds into the schedule," is contravened by an understanding of the technical aspects of the CPM process. This article will demonstrate that float is a resource that has no creator other than the CPM process itself, is dynamic, and should have no "owner" other than the project.

A. *A Balanced Approach to the Question: Who Should Own the Float?*

We will address three main points in detail. The first point is to explain float in the context of CPM scheduling, and how it comes to exist and to change during the project. With a firm grasp on the determination of float, we will then explore the reasons why float is not created as a resource and should not be set aside for a particular party.

After demonstrating that float is not a resource that the contractor or scheduler builds into the schedule, the second point this article will address is what float means to those using the schedule as a management tool, and how float may be used by the contractor or the owner during

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[2] See, e.g., 4 No.1 Journal of the American College of Construction Lawyers 109.

the planning and building phases of the project. An understanding of the meaning and usage of float is essential to the discussion of why float should be shared by both the owner and the contractor.

With an understanding of what float means to the parties and how it may be used to manage the project, we then address our third and main point in which we explore the likely results assuming various float-ownership possibilities. It is this exploration that leads to the conclusion that the "shared resource rule" is the most appropriate and fair way to treat the consumption of float.

II. FLOAT IS NOT "BUILT INTO THE SCHEDULE" BY THE CONTRACTOR OR SCHEDULER

A. *Definition of Float*

Float is a term of art. It is a term that was conceived when the Critical Path Method was first developed. That is not to say that float does not exist if there is no CPM schedule, it does. But, the term was conceived with the advent of CPM to represent a concept that is important to the understanding of CPM scheduling.

Conceptually, float is the amount of time that a particular work activity can be postponed or delayed before it begins to delay the Project. Float is dynamic; it changes as activities in the schedule make progress or when activities fail to make progress. When an activity's float is consumed, in theory, it becomes critical and may then delay the project. In a CPM schedule, float is the mathematical difference between the activity's early and late dates. This can be the difference between the early start and the late start, or the early finish and the late finish, either of which will yield the same value of float.

B. *Types of Float*

The term "float" can relate to different aspects of the CPM scheduling process. The CPM identifies two types of float, total-float and free-float. In the simpler days of CPM software—or even before we had software and did it by hand—total-float was defined as the difference between when an activity could start (or finish) and when it must start (or finish) so as not to delay the scheduled finish date of the project. Free-float was defined as the difference between when an activity could start and when it must start so as not to delay the early start of a succeeding activity. We have focused this discussion on the ownership of total-float.[3] While free-float is relevant when considering the effect of float consumption, if the consumption of float is limited to only the free-float available, the effects of such consumption are limited to one activity and are less controversial. For the purposes of this discussion, we use the term "float" to refer to total-float.

In the context of a CPM schedule, float is calculated against the completion date determined by the forward pass through the project network of activities. We will explain this calculation further in a moment. Float is therefore technically unrelated to the project's contract provisions. For example, suppose the schedule reflects a planned end date of November 1, but the contract specifies a completion date of December 1. The CPM forward pass stops at

[3] Some authors refer to total-float as "activity float."

November 1. The period that follows November 1 is a period that exists only in the context of the contract.[4]

The innovative contractor will often attempt to schedule a project to finish as early as possible in order to reduce project overhead costs. This may be done through an iterative process that begins with the normally-anticipated relationships and durations of the work activities. Then, with a calculated end date, the contractor will look for ways to improve upon the end date either to meet the contract required completion date, or to beat it if doing so is economically prudent. A schedule that shows the project completing before the contract completion date takes advantage of the contractor's right to complete the project early.[5] Such a schedule is commonly referred to as an early completion schedule.

Because we will be focusing on float ownership throughout this article, it is instructive to consider who "owns" the 30-day period between the planned completion date and the contract completion date in our hypothetical. As in any discussion of float ownership, one must first establish the definition of delay. Delays are a measure of actual progress against the contractor's plan to complete the project. Change the plan, and the delay may be mitigated. The same

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[4] We acknowledge that some authors and the 2007 Association for the Advancement of Cost Engineers International (AACE) (http://www.aacei.org/resources/rp/) Recommended Practice No. 29R-03 describe this condition as "project-float," referring to the period between the planned completion and the contract completion. The authors believe that technically, this period is not "float." The term "float" is more properly confined to the context of the schedule created for a specific project, without reference to possibly-conflicting contract provisions.

[5] An exception to this would be for a contract that requires the contractor to finish the project no later than and no earlier than December 1. In the authors' experience, seldom, if ever, do contracts specify a "no-earlier-than" completion date.

analysis is used whether the schedule's completion is consistent with the contract completion date or an earlier date.

In our hypothetical, the contract requires the project to be completed by December 1, but the contractor plans an early completion of the project on November 1. It is against November 1 that delays are measured. If the contractor delays the project into this 30-day period, the contractor must absorb its extended overhead costs but will not be subject to contract damages to the owner until the delay goes beyond December 1. If the owner delays the contractor into the period between November 1 and December 1, the owner may be liable for the contractor's extended overhead costs. So, in effect, no one "owns" the time period between the scheduled project completion date and the contract completion date, and the contract determines entitlement to the recovery of damages based on the party responsible for the delay.[6]

Float is really a function of several factors, these being what is being built, how much time is allotted in the contract to build it, and the intended means, methods, and sequence of construction. Float is simply a result of the relationships of the various activities in a schedule. These interrelationships are a function of activity durations, logic, and constraints. In its purest sense, float is only a mathematical calculation. It is not subjective, as the phrase "built into" implies, and it is not a function of the contractor's desire to allocate float to certain activities as a "cushion" against unforeseen delays.

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[6] Thus, the authors believe the use of the term "project-float" is incorrect and only confuses and compounds the technical language used concerning scheduling. Similarly, the authors believe that AACE's assertion that "*project float is owned solely by the contractor*" is also incorrect. There are certainly examples where an owner's actions could improve the project completion date to a date earlier than the required contract completion date. In such a case, we do not believe that the benefits of such owner actions would be "*owned solely by the contractor*," as stated by AACE.

C. *Float is a Function of How the Schedule is Calculated*

The early start and finish dates represent the earliest that an activity can start or finish based on the activity durations and logic relationships in the network. An activity's early start and finish dates are determined during the arithmetical process of the forward pass. The forward pass is a basic step in the algorithm used to analyze a CPM schedule. The forward pass begins from the schedule's data date and the early dates are calculated by adding the durations of each of the successive activities according to the logic relationships in the network diagram. The completion of the forward pass through all paths determines the earliest date that the project can finish. This calculated project completion date is driven by the longest path of activities through the project network. This longest path is also referred to as the critical path. The term "critical" is applied because if anything on this path was to take longer than planned, the project would necessarily take longer to complete.

Similarly, an activity's late start and finish dates represent the latest date that the activity can start or finish before it will delay the project. An activity's late dates are identified during the backward pass. The backward pass is also a basic step in the CPM algorithm. The backward pass begins from the arithmetically calculated project completion date and works backward through each path of the network, subtracting the durations of each preceding activity.

As explained earlier, the term "float" refers to the difference in workdays between the early and late dates of an activity. Non-critical activities have float or slack time between their early and late dates. As mentioned earlier, when non-critical activities experience delay, their float is consumed and they may ultimately become critical.

D. *Allocating Float for a Particular Purpose*

A major theme that drives the arguments and conclusions of "float-ownership" advocates is the idea that float is inserted into the schedule for a particular purpose.[7] These advocates assert that the allocation of float to particular activities results from subjective judgments and assumptions made when the schedule was prepared. But, practically speaking, float is not allotted and is not a pre-assigned cushion. Float is a calculation based on the forward and backward pass of the CPM algorithm. Seldom, if ever, does a scheduler allot or assign float to specific activities. In practice, the converse is what occurs. The scheduler determines the sequence and durations of activities, develops the logic for the efficient construction of the project, and then calculates the schedule. The schedule logic and durations dictate what float exists for a specific activity.

While it is true that the creation of a schedule is often an iterative process by which further judgments and assumptions are factored in, the idea that float can be manipulated to influence particular activities is simply not practical. If a scheduler attempted to alter the schedule logic for the purpose of controlling the float values on specific activities, this would necessarily change the float in many, if not all, of the remaining activities. There really is no physical way to alter the float values on isolated paths without changing durations or utilizing constraints or alternate calendars. Even so, the process of doing so would be by trial and error on an iterative basis and would likely take tremendous amounts of time. And each time the scheduler adjusted durations, constraints, or calendars to alter float on one activity, it would be necessary to check how this affects the float on every other activity—a daunting, frustrating, and

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[7] For instance, "…float is included in the schedules precisely to accommodate the uncertainty with respect to where a contractor delay might arise…" 4 No.1 Journal of the American College of Construction Lawyers 109.

essentially useless exercise, which would likely backfire as the actual progress of the work unfolded.

One approach to controlling or manipulating the float in a particular path of activities would be to utilize a zero-total-float constraint, a feature incorporated in Oracle/Primavera's P3 software. Constraints are used in a schedule to represent or model preferences or contract restrictions, such as limited access to areas of the work. For example, in a project where a ferry dock needs to be closed to facilitate the construction of a bridge pier, the contract might allow for a limited time to take the ferry dock out of service. The contractor may schedule this work with a zero-total-float constraint to indicate that every work activity on this path must be performed to its early dates; in essence this path of work would be critical to meeting this contract constraint or milestone. But, these types of constraints only allow the scheduler to limit float, not to build in larger amounts of float.

E. *Sequestering Float for a Particular Use*

As discussed above, the advocates for float-ownership see total-float as an allocable and created resource, and therefore often describe the consumption of float as a contractual matter, as if it were akin to a breach of the contract.[8] But, just as float cannot be "built into" the schedule, it cannot reasonably be reserved or sequestered for a particular use.

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[8] See, e.g., "[A]n owner's consumption of all the float in a side activity potentially deprives the contractor of the opportunity to absorb and overcome its own subsequent delays, which was the essential reason for building float into the schedule in the first place." 4 No.1 Journal of the American College of Construction Lawyers 109.

The idea of "sequestering float" is a corollary to the idea of float allocation. It refers to the assertion that the contractor is trying to "hide" or "squirrel away" float in the schedule so the owner can't see it, find it, or know it exists. This can only be done by expanding durations beyond those that the contractor reasonably believes are required or by adding constraints to the schedule logic. But this game has a large downside for the contractor; it essentially masks potential delays caused by the owner. In such cases, where the reasonable duration would have demonstrated delay from the owner's actions, the expanded duration will appear to absorb the additional time and the contractor will be unable to demonstrate the impact caused by the owner. The bottom line is that there are few games that can be played with float. More importantly, knowledgeable contractors understand that, without a crystal ball, such games may as easily be detrimental as helpful.

III. THE MEANING AND USE OF FLOAT

A. *The Real Meaning of Float*

Having established that float is not built into the schedule by the contractor as a "cushion against unforeseen delays," it is logical to next determine what meaning it does have in the schedule, if any. When CPM was originally developed, the concept of float had a much stronger relationship to the critical path than it does today. This was because CPM was initially developed by the arrow diagramming method (ADM) in which every activity was related to another in a head-to-tail or finish-to-start relationship and all activities were on the same calendar. With the advent of the precedence diagramming method (PDM), activities could now be related in four ways (finish-to-start, start-to-start, finish-to-finish, and start-to-finish), these relationships could be quantified with leads and lags, and each activity could be assigned a

different calendar. In addition, the logic could be constrained in numerous ways. These features dramatically improve the modeling capability of the schedule. They also affect the calculation of float and, thus, change the traditional meaning of float. As a result, many of the old rules have been turned on their heads.

B. *The Historical Significance of Float*

In the early days of CPM, float was understood as the value that determined the critical path of the project. With an unconstrained end date, the zero-float-path was understood to be the critical path; with a constrained end date, the critical path was the path with the least (or most negative) float value. This was due to the simplicity of the network relationships and the use of one calendar. Even with today's high-powered software, if we have a schedule with a single calendar and no constraints, the total float values will indicate the critical path of the project. Because of this historical and well-learned concept of float, the industry has come to rely upon the adage that the path of activities with the lowest float (zero, positive, or negative) defines the critical path and when the project will finish. While this still may be true only in the cases of single-calendar, unconstrained schedules, these kinds of schedule are not as common today and, thus, float cannot be relied upon as an absolute as it was in the past.

C. *The Modern Insignificance of Float*

To those of us who have used CPM for many years, the advancements in CPM scheduling software create a problem with respect to float. While in the past, most project managers were conditioned to look at the float values and draw conclusions based solely on those, now such conclusions may be meaningless in relation to the critical path. In fact, float may have no relationship at all to what is critical or to what may cause a delay to the project.

This is because of the way the various relationship types, leads and lags, multiple calendars, and constraints factor into the forward and backward passes and the effect these have on the determination of float. The result is that, with these enhanced scheduling features, the critical path may consist of activities with many different float values. As a consequence, the impact of the owner's consumption of float on a contractor is even more speculative.

Along with the evolution of the characteristics of float is the basic fact that, as a schedule is updated with progress, modified by the addition or deletion of activities, or altered in reaction to the progress or lack of progress of activities, the float throughout the schedule will change. Thus, float is really applicable only to particular activities or paths of activities at a given time when the float is calculated. It is not necessarily applicable to a network path or the entire schedule for the entire period of performance. From this, we can see that float is ever-changing, and any gamesmanship up front, if even possible, will likely yield unintended consequences.

D. *The Appropriate Uses of Float*

Any discussion of float ownership should be preceded by a thorough understanding of how float may be used by the parties to a construction project. The use of float can occur at various times throughout the preconstruction and construction phases of a project. As described above, float is the amount of time that a scheduled activity can be delayed before it begins to delay the project. Therefore, the float associated with an activity can be consumed without affecting the project's critical path. Because the consumption of float may not result in an activity becoming critical, a discussion of float usage should not be limited to potential critical path delays. Float usage on paths of non-critical activities can also have an effect on resources, stacking of trades, and other productivity issues. In the planning phases of a project, float can be

used to improve efficiency and productivity. But, in the project execution, the consumption of float can negatively influence these factors.

1. Use of Float During The Pre-Construction Phase

The prudent contractor will start preparing the project schedule during the estimate or bid phase. A contractor's projected costs are determined by its understanding of the physical nature of the project, the desired characteristics of the project, and its preferences for how the work and resources will flow throughout construction. While we acknowledge that projected costs could be separated from the creation of the initial project schedule, it is wise to develop these concurrently, as projected costs are determined by the means, methods, and resources planned to complete the work.

When preparing a schedule for a project, the contractor first establishes the schedule network of activities based on three considerations:

a. The physical requirements of construction.
b. Contract requirements for completion of project milestones.
c. The preferred means and methods of the construction process.

After calculating the initial network, the contractor will often look for ways to reduce costs by adjusting planned resources and the plan to construct the work.

As a simple example of pre-construction use of float, presume the contractor completed its pre-construction schedule and noticed that the installation of 36-inch RCP was scheduled to occur concurrently at four different locations during a specific time period. After this time period, the remainder of the project required a minimum of one and a maximum of two drainage

crews in order to meet the current plan. The contractor has the option of: (1) mobilizing two additional crews to meet the increased demands during the four-crew time period, or (2) shift some of that work to a later time when fewer crews are required to meet the project demands. In this case, it may make sense to shift some of the four-crew work to a time when the current demands required only one crew. One of the main questions to ask before deciding to change the schedule network is, "Do the activities during the four-crew time period have enough float so they can be delayed without delaying the project or any interim milestones?" If the answer to the question is "yes," then the contractor may use the available float for these drainage activities, presuming this adjustment will not result in higher costs in another area of the project.

Many of today's software packages allow users to utilize the float in this manner automatically using resource leveling and smoothing features in the software. There are a multitude of options that allow the scheduler to choose the method, filter, and priority of activities to level. Resource information inserted in the schedule can be limited to high-dollar resources (e.g. tower cranes) or contain detailed information (e.g. drainage crew labor).

This practical use of float by the contractor is encouraged to maximize potential cost savings over the duration of the project. An innovative contractor can derive significant cost reductions in construction costs using float in this manner. And these costs reductions are generally passed along to the owner through the competitive bid process that uses price as at least one selection factor.

2. Use of Float During The Construction Phase

Typically, the earlier changes are made in the construction process, the more flexibility the parties have to mitigate the potential consequences, if there are any. However, whether the

change is made during the preconstruction or construction phase, the process of evaluating the consumption of float, its effects, and the subsequent additional costs, remains the same.

Like contractors, owners can use float. Owners often use float during the construction phase. Let's presume the contract has been finalized between the owner and contractor, and the notice to proceed was awarded a month ago. The project specifications required that the contractor use granite tile for the three-story lobby entrance of a building. The contractor planned to procure the material in the United States and the initial schedule identified that tile installation in the lobby had 64 days of float. In concept, this means that the installation of tile could be delayed 64 days before it would affect the critical path of the project, assuming the rest of the project progresses as expected. The owner, an Italian-owned company moving its corporate headquarters to the new building, preferred to use tile directly from an Italian quarry. This was a change to the contract. The owner specified the quarry and type of granite it wanted, and the contractor determined that it would take 45 days longer to procure the Italian tile instead of the tile from the United States. As a result of the change, the owner used 45 of the 64 days of available float and, thus, did not delay the project completion date.

As can be seen from the examples in the pre-construction and construction phases, the determination of whether or not the change caused a critical path delay is linked to the amount of float that is available at the time of the change. Both examples demonstrated that float was available at the time of the change, and that the use of float did not delay the project completion date as a result of the change. In practice, this conclusion would have to be verified by evaluating the longest path, rather than relying solely on the float values.

But what happens when more than the available float is needed to absorb the change? Let's presume that the tile situation remained the same, except that the contractor determined that it would take 70 days longer to procure the tile from Italy than from the United States. In concept, this means that our current plan for completing the project would now be controlled by the tile procurement and the project would be delayed by six days (70 - 64 = 6) as a result of this change. Again, this assumes that the other activities in the schedule are progressing as expected. In this case, the owner and contractor have several choices with respect to time:

a. The owner may choose to execute the change and provide the contractor a six-day time extension. Let's presume this also results in additional time-related costs for the contractor at $5,000 per day for a total time-related damage of $30,000.
b. The contractor, in its duty to help mitigate the delay, notifies the owner that the quarry is willing to accelerate its work to shorten its procurement time by 10 days at an extra cost of $10,000. This will give the tile four days of float.

This example demonstrates several key points. First, the owner's suggested change would use up the available float and delay the project by six days. Second, the contractor notified the owner of an alternative plan, and fulfilled its obligation to explore alternative methods to mitigate the delay from the owner's tile change. While this alternative plan still resulted in an additional cost to the owner, it reduced the time-related cost of the change by $20,000 ($30,000 - $10,000 = $20,000) and prevented the delay to the project completion date. The contractor's action also may have prevented any further acceleration issues on the project site or any loss of productivity, while preserving the contractor's intended means and methods for construction.

The timing of the owner's change, along with the contractor's assistance with mitigating the delay, allowed the owner to change the tile without delaying the critical path of the project. However, the change may have also reduced the available float to the activities on the lobby-finishes path of work. Further, a subsequent contractor-delay to the tile installation could consume the remaining float and cause a delay to the project completion date. The change may also cause a loss of efficiency to other work as a result of trade-stacking. Would this mean the owner is responsible for these later impacts because of the owner's float usage at an earlier time in the project? An accurate determination of whether or not the owner has responsibility for the contractor's subsequent impacts would depend on the terms of the contract, an understanding of what was known at the time of the change, and the effect of other work progress on the impacted work.

IV. FLOAT IS PROPERLY A SHARED RESOURCE

A. *Should Any Party "Own" The Float?*

The Winter 2010 *Journal* article posited that the current practice of sharing float gives the owner preferential treatment to consume float. Several points are set forth in support. The most credible (and which is commonly asserted within the industry) of these is the idea that the owner's consumption of float takes away the contractor's ability to use it later, should the need arise. This circumstance, when it arises, is a legitimate cause of frustration for contractors. But, at the time the owner is consuming float, the contractor's need for this float is purely speculative. And, provided that the owner is consuming the float for a legitimate purpose, and at no additional cost to the contractor, it is the project that is benefiting. Key in this statement is the idea that the consumption of float by the owner does not increase the contractor's cost of the

work. Most contracts that do address float ownership fail to address what float ownership means in terms of the consequences of its use by the "non-owning" party. In the absence of specific language that addresses the damages associated with float consumption, what does "float-ownership" really mean?

B. *Float "Owned" By The Owner*

Some owners believe that the solution to the float "problem" is to write provisions that define float as being the property of the owner. Because the owner typically writes the contract, the owner simply declares in the contract that the owner owns the float! Owners may include this provision because they want to shift some of the risk for their own performance to the contractor, gaining protection from delays and providing additional flexibility for making changes to the project. However, such clauses are typically ambiguous; they leave open to interpretation the consequences of the contractor's use of float, if any.

To determine the value of such a provision, it is necessary to explore several key questions. First, what advantages or protections has the owner gained by owning the float? For example, does float ownership mean that the owner has procured the contractual right to delay any activity with float up to the point where the float is consumed and the activity becomes critical? Perhaps, yes. But, what if the consumption of float causes the contractor to incur additional costs, such as those associated with trade-stacking and the need to mobilize additional resources to accomplish more work concurrently? The answer to this question will be fact-specific and is not likely to be resolved by the float ownership provision of the contract on its own. To jump from the concept that the owner has procured the contractual right to delay work to the more onerous concept that the owner is not responsible for any damages that result from

its non-critical delays, is quite a leap. Thus, the advantages and protections gained from the owner-owns-the-float provision can be illusory, and potentially no greater than that which the owner enjoys from a float-sharing provision.

However, a second question needs to be asked. What damages does the owner incur if the owner-owns-the-float provision is violated and the contractor uses the float? The answer to this question is most likely—"none!" For example, let's presume that the path of activities containing the owner's acquisition of a permit and the work that follows that permit has float. If the contractor intends to start the work by a certain date following permit acquisition, the contractor's commencement of that work later than the early start date will not adversely impact the owner as long as float is being consumed and no delay to the project completion results. There may be rare exceptions to such an example, such as the owner being able to provide certain access for a limited period, but such a restriction must be stated in the contract. When such restrictions are stated in the contract, the contractor can model these and is responsible for meeting these elements of the contract.

Consider another example where the contractor has used the float that precedes an owner activity, such as the review and approval of a contractor submission. Because the contractor used the float, the submittal review is now critical. If the owner takes longer to approve the submittal and causes a delay to the project, can the owner argue that the contractor must accelerate the project to restore the float and recover the owner's delay? Two issues complicate this answer. The first is the dynamic nature of CPM schedules that result in the float values changing with each update. Because float is not static, it is not clear which float value the owner would or could argue should be restored. The second is the unintended consequence of such a

provision which may encourage the contractor to ensure that there is no float on owner activities. We'll talk more about that in a moment.

Having determined that the owner obtains no real benefit from such a provision, we must consider if it is nonetheless harmless to include. We know from experience that there are several unintended consequences from these owner-owns-the-float provisions. In some cases, these provisions have encouraged contractors to run two schedules, one in which the work durations have been expanded such that there is no appreciable float when the schedule is run and another "internal" schedule that reflects the contractor's actual plan. Of course, the schedule with "no float" is the one given to the owner. While the goal of such a schedule is to show little or no float, the float values may still have no relevance to the determination of the critical path. In addition, these schedules have pitfalls for both the owner and the contractor.

The pitfalls to the owner are obvious: there is no float available to absorb unavoidable activity delays. Instead, most, if not all, activities will appear to be critical. Thus, the owner cannot delay any activity without, in theory, delaying the project. The pitfalls to the contractor are more insidious. For example, the "zero-float" schedule the owner has been given will inform the owner when it is required to perform its obligations. When the contractor completes work activities within the realistic durations shown on its internal schedule, the owner-controlled activities will need to be accomplished earlier than reflected in the schedule given to the owner. If the owner cannot perform to the earlier dates shown in the contractor's internal schedule, the owner may have an argument that the contractor did not properly inform it of the actual progress and the true timing of the owner's actions needed to allow the contractor to progress its work as expected. Another example may be when the owner causes the contractor to work more slowly than it intended, perhaps by its rate of inspections or other factors. If this slow progress is

consistent with the expanded durations included in the "zero-float" schedule the owner was given, the contractor may be unable to demonstrate that the activity took longer than expected as a result of the owner's actions or lack of action.

The bottom line is that contract provisions that state "the owner owns the float" do not provide real advantages or protections for the owner beyond those protections that come to the parties through a float-sharing provision. To the extent that an owner desires certain protections for certain circumstances, such protections must be stated in the contract with specificity and are not guaranteed by the simple conveyance of float ownership to the owner.

C. *Float "Owned" By The Contractor*

The other possible alternative would be a contractor-owns-the-float provision. While provisions that provide for the contractor to own the float are rare, there are good reasons for these not to be used, as well.

To understand this position, let's explore the same questions that we discussed for the owner-owns-the-float provisions. First, what advantages or protections has the contractor gained by owning the float? For example, does float ownership mean that the contractor has procured the contractual right to delay any activity with float up to the point where the float is consumed and the activity becomes critical? In this case, the answer is more clearly, yes. But is this an advantage gained by the contractor-owns-the-float provision? Not really! Because most construction contracts convey to the contractor the right to control the means and methods of construction, the contractor is inherently free to adjust its means and methods throughout the course of construction. This means that the contractor is inherently free to use the float for such adjustments.

In this regard, the contractor's obligation to the owner is simply to deliver the various elements of the project by the milestone dates specified in the contract. The freedom to use float to affect adjustments in the contractor's means and methods as the contract work progresses applies in the context of a float-sharing theory, as well. Thus, the advantages and protections gained from the contractor-owns-the-float provision are no greater than that which the contractor enjoys from a float-sharing provision.

However, again, a second question needs to be asked. Does the contractor incur any additional costs if the contractor-owns-the-float provision is violated and the owner uses float? In this case, the answer is a firm—"maybe!" While the owner's use of the float will not directly result in delay damages to the contractor, there are other types of cost impacts that may directly flow from the owner's use of float. For the most part, these could be productivity and extra work costs that flow from trade-stacking and the need to mobilize more resources to accomplish work concurrently. In this case, we're not speaking of speculative impacts—the impacts that *may* occur. Rather, if the contractor can establish a causal link between the owner's non-critical delay and the additional costs incurred, the contractor may be entitled to recover these costs.

But, such an argument does not rely on a contractor-owns-the-float provision to have merit. To the extent that additional costs can be shown to be the direct result of the owner's actions, equity and most standard-form contracts allow for the contractor to recover such costs. So, again, the contractor-owns-the-float provision offers the contractor no more protection against damages caused by the owner than contracts governed by a float-sharing provision.

But, what of the damages that are not those that directly flow from the owner's actions, but those that may occur later because float that was once available is no longer available? The

idea is that when the owner uses the float, the contractor no longer has the opportunity to have potential delays that occur later on the same path of work absorbed by the float. Such damages are speculative—they may or may not occur in the future. Moreover, the causal connection between the loss of float otherwise available to the contractor and the earlier, non-critical owner delay is also speculative. As discussed earlier in this article, float in a schedule is dynamic. The float values of the various activity paths in the schedule change throughout the duration of the project. So, float that once existed but is later unavailable to the contractor may or may not be as a result of the owner's actions. For this reason, the idea that the owner should be prohibited from using float as a way of preserving it for the contractor's later use is an oversimplification of the float concept and is simply not practical.

While the use of float by the owner may appear to increase the contractor's risk, the schedule is dynamic and, because float is relative to the longest path, the situation cannot be viewed in a vacuum where all else is static. The determination of what is critical is not solely based on the progress, or lack of progress, of activities related to the owner's consumption of float; it is based on the progress, or lack of progress, of *all* activities in the schedule. The owner's use of float on a path may affect the start dates of succeeding activities, but next week other events may affect the same activities in other ways.

To the extent that the contractor intended to use the float for economic gain or as a bid advantage, such as resource leveling or other preferential relationships, these logic relationships would generally be incorporated into the project schedule. If they are, the float on these paths will already have been used by the contractor and, as such, not be available to the owner for its use. However, modeling preferential logic ties in a schedule can be a time-consuming and tedious process. It becomes increasingly difficult on projects where multiple crews of the same

work type are expected to complete work in different areas, and not concurrently. As a result, it may not be reasonable to expect all such logic to be incorporated into the schedule at the beginning of the project. Thus, during the project, it may be reasonable for the contractor to add logic ties or to otherwise be able to demonstrate how this crew flow was envisioned in the original plan.

Also, most construction contracts require the contractor to mitigate owner delay in the most economical way possible. If fulfilling this duty to mitigate an owner-caused delay comes at a cost, the owner is typically responsible for those costs. However, if the mitigation can be done at no cost, the contractor is expected to affect such mitigation. This may mean that the contractor performs work in a different sequence to meet its duty to mitigate delay. This is no different than the adjustments a contractor has to make when the owner absorbs float. In other words, the contractor is expected to adjust its means, methods, and sequence in such a way as to minimize delays caused by the owner and this is also true with respect to non-critical, owner-caused delays that consume float.

Thus, a contractor-owns-the-float provision does not provide advantages or protections not already inherent in the context of a float-sharing provision. In either case, if the contractor incurs additional costs as a result of the owner's actions or inaction, then the owner is liable for those damages, presuming the necessary factual support is demonstrable.

Finally, if the contractor really obtains no definitive benefit from a contractor-owns-the-float provision, we must consider if it is nonetheless harmless to include. Again, similar to the owner-owns-the-float provisions, it is easy to envision the unintended consequences from a contractor-owns-the-float provision. For example, let's assume that the enforcement of this

provision requires that the contractor be protected from causing delay on a path of work once the owner had consumed float on that path. In essence, that would mean that the contractor was guaranteed to receive a compensable time extension for any contractor-caused delay that occurs on a path from which float had previously been consumed by the owner. If this were the case, the contractor's incentive to timely complete the work would be reduced or eliminated. But, more problematic would be the level and complexity of analysis that would be necessary to manage such a provision. In fact, because a CPM schedule is a dynamic tool that adjusts for all of the actual progress on the project, such analysis is not practicable.

In summary, there may be a perceived benefit of a contractor-owns-the-float provision in that it appears to enforce the contractor's right to maintain schedule flexibility for activities with float. But, this right exists with or without such a provision. Ultimately, the owner's consumption of the contractor's "owned" float does not harm the contractor unless it results in additional cost. If it does, the contractor has the same argument to recover these costs, with or without a contractor-owns-the-float provision.

D. *Float as a Shared Resource*

Most float-sharing provisions in the authors' experience recognize that float is a shared resource of the construction project and that it is a resource that must not be squandered. This means that float must be consumed for legitimate purposes. We believe these legitimate purposes fall primarily into two categories. The first is for reasons that are beyond or outside the control of the party responsible to perform the work activity. The second is for reasons that allow one party to economize project costs or time.

To understand why sharing this resource makes sense, it is important to understand its source. As discussed above, float is not a resource created by the contractor as part of its plan to construct the project. Float is a by-product of three factors: what is being built, how long the contractor has to build it, and how the contractor intends to build it, commonly referred to as the contractor's means and methods. The first two are defined by the owner; the last by the contractor. As such, both parties have a hand in the determination of how much float will be available on a particular activity. Thus, float is a resource that is created by both parties, to be shared by both parties.

More importantly, sharing the float immediately resolves potential time-related issues arising from float usage. Many owners and contractors resist this "best practice" of construction management, putting off the determination of delay impacts until the end of the project under the theory that things in the future may change in their favor. They prefer to speculate about what the future might hold and fear that, by settling time impacts as they occur, they may miss out on a turn of events that could shift their fortunes, hoping that a future misfortune of the other party will overshadow the impact of the event they caused. In the authors' experience, these parties do so at their peril.

Successful owners and contractors understand the benefits of timely resolving delay impacts as close to their occurrence as possible. They know that estimating the cost and time impact of a change and resolving it allows both parties to get back to what they do best. Conversely, putting off resolution of changes removes the contract incentives that drive owners and contractors to work as efficiently as possible to complete a project. For this reason alone, the sharing of the float resource makes perfect sense. It immediately resolves the entitlement questions regarding the use of float.

V. SUMMARY AND CONCLUSIONS

Float is not a scheduler's tool that can easily or accurately be built in, manipulated, allocated, or sequestered. Rather, it is the result of an arithmetic calculation of the forward and backward passes of the CPM algorithm. The calculation of float is controlled by the logic or sequence in the schedule, the durations assigned, and the constraints and calendars that are used. The owner and contractor each have a hand in the formation of float, as it is purely a function of what is being built, the time allotted to build it, and the means, methods, and sequence of construction to be utilized to build it.

There are little or no advantages to either party "owning the float." While the perception of benefit may exist, when we analytically evaluate the specific benefits to either the owner or contractor, the conclusion is that, for the most part, these same benefits exist when the parties share the float for the benefit of the project.