

# Outlook

McDONOUGH BOLYARD PECK

Achieving Quality Through Teamwork

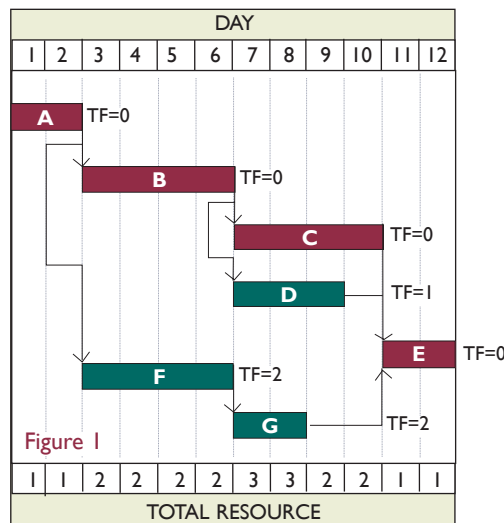
## Phantom Float

Additional information added to a traditional CPM schedule can convey costs, earned value, and resources. During a construction project, any limitation on these factors can impact the on-time completion of the project. For this reason, a prudent scheduler may choose to limit the resources that the schedule can consume each day based on actual market and project conditions, such as the availability of only one tower crane. Placing restrictions on the resources available to a project expands the basic CPM schedule into a resource constrained CPM schedule. However, current construction scheduling software packages do not provide the necessary additional resource relationship ties when performing resource constrained scheduling. This lack of proper resource ties leads to elevated values of total float (TF) available to activities.

When the scheduling software performs the forward and backward pass, TF is determined based on the activity durations and logic for each activity. With resource constrained scheduling, the software performs additional calculations using resource constraints entered by the user. These calculations may affect the available TF for activities depending on the allocation of resources and limits set by the user. However, these new TF values may not represent the actual TF available to the activities due to missing resource logic ties. This ambiguity in actual TF available leads to a concept known as Phantom Float. Phantom Float is the difference between the TF in a resource constrained schedule with original logic ties and the TF in the same schedule with additional logic ties inserted to model the resource constraints. The following example illustrates the effects of resource constrained scheduling and the development of Phantom Float.

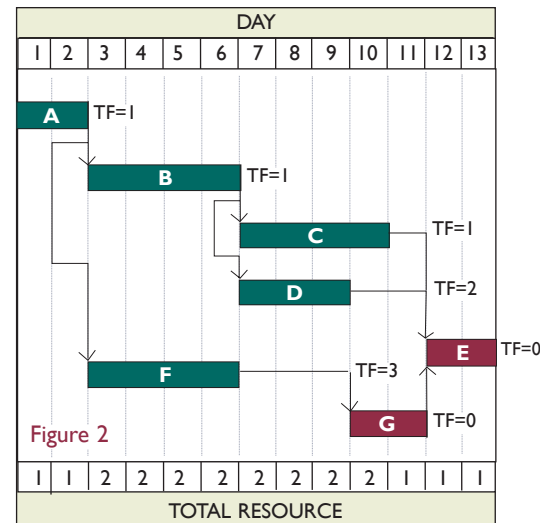
While theoretically it may be possible to

accomplish the following group of activities in twelve days, it may not actually be possible due to limitations on the resources available. Figure 1 represents the output one would expect from scheduling software such as Primavera Project Planner® (P3) when scheduling solely on activity durations and schedule logic.



Activities A, B, C, and E define the critical path of the project that completes in twelve days. However, if each activity consumes one "resource" each day and the limit on that resource is a total of two resources per day, the schedule exceeds the available resources on days 7 and 8. When using resource constrained scheduling, the output from the scheduling software is different.

As a result of the resource limitations, the total project duration is extended and now completes in thirteen days (see Figure 2). The resource constraints do not override the schedule logic of the project, but rather places additional restrictions on the schedule. Activities G and E now define the critical path of the project.



Although the TF for Activity F is 3 according to the CPM calculations, when considering the resource limitations it has only one day of TF available, due to the necessary resource logic tie between Activity F and Activity C. This 2 day difference in available TF for Activity F is Phantom Float. Phantom Float is created when scheduling software moves activities due to resource constraints, but adds no resource logic ties to properly calculate the start and finish dates and the subsequent float.

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Tony Carter

# Phantom Float

In order to force the scheduling software to properly calculate the TF, additional resource constraint logic ties must be inserted into the schedule logic to model the resource constraints. In this example, one resource logic tie must be added from Activity F to Activity C and one from Activity D to Activity G.

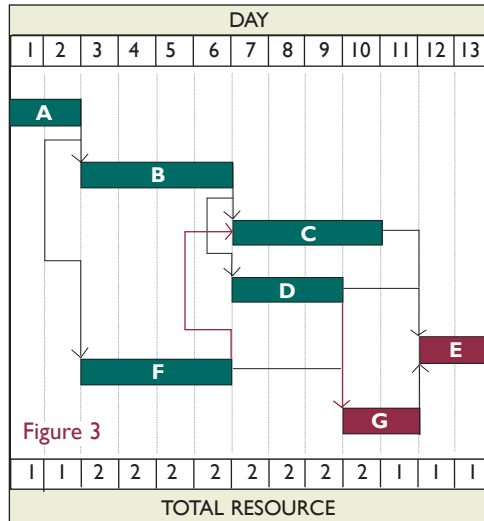


Figure 3

The effect of inserting the additional resource logic ties creates a complete critical path based on the schedule logic in addition to the resource constraints. The critical path is now through Activities A, B, D, G, and E.

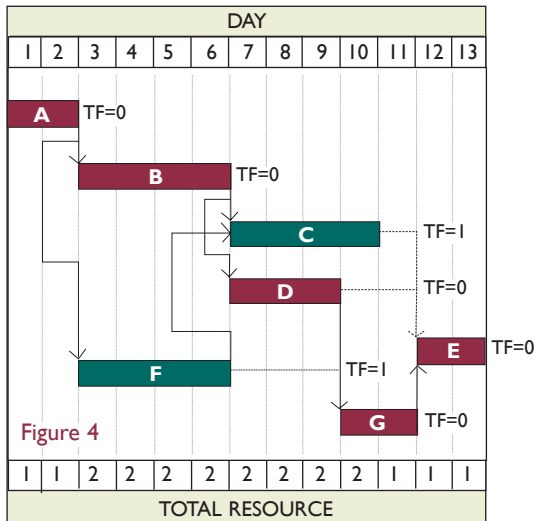


Figure 4

The P3 resource constrained CPM schedule and the properly resource logic tied schedule are significantly different and the TF available to the activities is greatly reduced. The following chart depicts the TF available to the activities in the different schedules as well as the Phantom Float that is created.

When a project is greatly influenced by available resources, not considering resource

limitations can present a false picture of the project and lead to delays not forecasted by a CPM schedule without the additional resource constraint ties. Owners, Contractors, and Construction Managers

should carefully consider and fully investigate the available resources and the impact of those resources on the construction schedule for their projects.

Activity	TF of P3 Resource Constrained Schedule (Figure 2)	TF of Resource Constrained Schedule w/ Additional Resource Ties (Figure 4)	Phantom Float
Project Duration	13	13	
A	1	0	1
B	1	0	1
C	1	1	0
D	2	0	2
E	0	0	0
F	3	1	2
G	0	0	0

## News & Events

### TEAM MEMBER ACHIEVEMENTS

**Lynn DeWolfe has been promoted to Director of Human Resources and Administration**, and to Senior Associate, where she will place increased emphasis on establishing and implementing short-and long-range programs which will facilitate MBP's growth and profitability objectives. Ms. DeWolfe joined the MBP Team in May 1994.

**Cathy Young has been promoted to Vice President of Finance and Administration**, where she will manage and coordinate the administrative functions and actions of the Corporate Team - IT, HR/Admin., Marketing, and Accounting. This is a natural progression as Cathy regularly interfaces with the Corporate and Branch Teams on administrative as well as fiscal activities. Ms. Young joined MBP in May 2000.

MBP is proud to announce that **Robert Carter has earned the designation of Certified Construction Manager (CCM)**. Mr. Carter is a Project Manager in MBP's Columbia, MD office.

**Congratulations to Blake V. Peck, PE, CCM for his selection as a Fellow of CMAA!** The formal presentation/recognition will take place at the CMAA Annual Meeting in September 2005. Blake has been a steadfast participant in CMAA at both the local and national levels, having served as National President, and continues active involvement with the CM Certification Institute.

### MBP IS GROWING!

MBP has opened a new **Chesapeake, VA** office to better serve the Tidewater area.

### UPCOMING SEMINAR

Save the Date! MBP's Atlanta Branch is hosting a seminar "Keeping Your Projects on Time and within Budget" October 5th, 2005 at the Wyndham Atlanta Midtown Hotel, 125 10th St., Atlanta, GA.

### CORRECTION

In the Spring 2005 Outlook, **Creekside Elementary School in Suffolk, VA** was mis-identified as **Cross Creek Elementary School**. We apologize for any confusion.

## Getting Right On Time

In our cover article, we discussed a scheduling phenomenon known as Phantom Float. I first heard the term about 3 years ago, when a team member who was completing his Master's degree in Construction Engineering asked me, "Have you ever heard of Phantom Float?" My initial reaction was something like "You've got to be joking." After it was explained to me, I realized that I had in fact seen this situation before reviewing schedules that were resource loaded. In that case, the contractor's schedules were cost and resource loaded with resource constraints indicated for critical resources. As part of our analysis, MBP reviewed the baseline schedule and progress updates to the schedules and was able to determine that, while the schedule logic made sense, the total float values from the software output was not accurate based on resource limitations. Phantom Float is one example of the errors that can occur when the scheduler does not have a full understanding of how the software works.

While some errors in the project schedule are made with malice, such as deletion of sequence mandated logic ties, for the most part, the mistakes we see either during a claim analysis or when performing a schedule review for an owner during construction are made accidentally. Unfortunately, most of these mistakes are much more difficult to find and can lead to bigger problems that might render the schedule useless. *Here are some of the more common accidental mistakes:*

- **Scheduling in hours rather than days:** For the most part, construction projects should not be scheduled by hours. Primavera Project Planner®, P3, allows the user to select either. Primavera SureTrak Project Manager®, SureTrak, schedules in hours, even if the user elects to display in days. When scheduling in hours, I have seen activities with a 5 calendar day duration schedule to complete in 4 days. This occurs when the Global Calendar for the project is

set to 8 hours and the activity calendar is set to 10 hours. The duration in hours is calculated as 5 days times 8 hours per day (from the Global Calendar), or 40 hours. The start date is Day 1. The finish date is calculated as 4 days later, 40 hours divided by 10 hours per day (from the activity calendar). My suggestion, unless it is absolutely necessary, is to avoid having different hours in your calendars.

- **Linking percent complete to remaining duration:** This is a default setting in most scheduling software, but, unless your project is actually executed in the same manner and at the same production rates as contemplated in the as-planned schedule, it is not proper scheduling technique. Activities rarely complete in the exact same duration as planned - some take less time, some take longer. In a recent claim that MBP was involved in, the contractor had the remaining duration linked to percent complete. The contractor had a 5 day activity for 1st floor drywall, but the contractor continuously worked on that activity for 6 months. In the first update, the contractor updated the activity to 10% and the software scheduled 5 days remaining duration. By the 3rd update, the contractor updated the activity to 75% complete and the software scheduled 1 day remaining duration. This activity, which was on the as-built critical path, was never on the critical path of the schedule updates because the contractor failed to project an accurate remaining duration. Instead, it allowed the software to calculate a remaining duration. Unfortunately, the software is not capable of realizing changes to crew sizes or mistakes in the baseline duration calculation.

These are just a few examples of mistakes that can be made by contractors, owners and construction managers. The moral is that anyone involved in creating or reviewing CPM schedules should fully understand the capabilities and limitations of the software that is being used to create the schedule.

This edition of the Viewpoint was written by John L. MacKay, Jr., PE, Vice President and Branch Manager of the Raleigh Office.

## MBP Projects



CITY OF WILMINGTON  
CONVENTION CENTER

Wilmington, North Carolina

**The City of Wilmington, NC has awarded MBP's Raleigh office the contract to perform Construction Management Services for the new Wilmington Convention Center** to be constructed on the Cape Fear River in Wilmington, NC. MBP will provide Construction Management services on behalf of the City of Wilmington as the project progresses from conception and initial design through the end of construction and the issuance of the certificate of occupancy. The project is anticipated to be completed by September 2007.



CLAREMONT  
ELEMENTARY SCHOOL

Arlington, Virginia

**MBP, in conjunction with DMJM Management, has been selected to provide CM services to Arlington Public Schools.**

This three year contract will allow us to continue to serve one of our largest and longest tenured schools clients in Virginia at a time when their program turns its focus from elementary and middle school upgrades to major renovations in its largest high schools.

APS has been a client of MBP's for more than 8 years, and provided us with the opportunity for our first on-site schools assignment.

