

REALLY UNDERSTANDING MICROSOFT PROJECT

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Abstract

Love it or hate it, Microsoft Project (MSP) CPM scheduling software is here to stay. It has long been the ‘darling’ of IT industries but now even many construction contracts are mandating its use. Most people using MSP on construction projects find that MSP is fine for planning the work but very difficult to use when maintaining the status and accurately forecasting project completion.

The good news is that you can ‘make’ MSP properly reflect complicated status including out-of-sequence progress resembling Retained Logic. The Great News is that in this fourth-generation presentation, understanding MSP is easy. This advanced presentation will explain how to best use MSP in place of other status-oriented scheduling software. This is an updated research paper that was presented in 2011 at the AACE Annual Conference.

1. Introduction

Over the last two decades Oracle/Primavera CPM scheduling products became the predominant scheduling software of the construction industry worldwide. Nothing lasts forever and many contracts have recently started to specify MS Project (hereinafter referred to as, "MSP") as the required scheduling software.[1] MS Project is a billion-dollar-a-year business for Microsoft, with over 40,000,000 copies in circulation.[7]

MSP has its advantages; it costs less than many of its competitors and it is 'user-friendly'. It is easy to start scheduling activities immediately. MSP easily produces decent default graphics and reports. Another reason for MSP's popularity is that a majority of US Federal Government desktop computers come equipped with MSP. It is difficult to justify requesting the authority to purchase other scheduling software packages when you already have one installed on your computer 'for free' and thus MSP is used.

Most contracts for construction projects require periodic schedule updates. A schedule update is an assessment of the project status and prediction of how and when the project will be completed. Proper updating of the work schedule is an integral part of project management and a critical communication tool between the parties. The schedule update should reflect the current plan to reach project completion and an accurate record of the past performance. The major steps in updating a schedule involve:

1. Setting a baseline
2. Updating the schedule
3. Comparing schedule updates

These steps are commonly performed by most software packages and considered a regular course of business for construction schedulers. MSP has many unique features specifically designed to make using the software simple. However, when it comes to updating a schedule using MSP, construction schedulers used to other packages often find MSP extremely confusing. This is mainly due to the MSP's 'ease of use features' getting in the way of reflecting the consequences of the current status. It gets even more complicated if you ever have to do a forensic delay analysis on a MSP schedule. Cheer up, as all is not lost. A clear understanding of how MSP calculates a schedule will make it possible to properly use MS Project in place of an Oracle/Primavera scheduling software product, if needed.

This paper documents the complete process of tracking a schedule in MSP as well as the details of how to 'make' MSP properly handle a typical status update involving out-of-sequence status. For brevity, this paper assumes that the reader is familiar with MSP user interface as well as its basic functionality and deals mainly with general steps that an experienced construction scheduler would understand or expect.

2. MS Project History

Microsoft Project has a long, vigorous history of releases and upgrades. Most people are unaware of the extent of the variance of features available to the 'average' MS Project user. Some of the

features that we talk about here may not be available to you on the version that you own. For example, in the 1980's MS Project was only available in the DOS-based versions,

- Version 1 (1984),
- Version 2 (1985),
- Version 3 (1986),
- Version 4 (1986).

Microsoft then 'took off' some years to produce Windows-based versions including

- Version 1 (1990),
- Version 2 (1991),
- Version 3 (1993),
- Version 4 (1993),
- Version 4.1 (1995),
- Version 5 (1995?),
- Version 6 (1996?),
- Version 7 (1997?),
- Version 8 (1997?).

Finally, the Microsoft Project team decided to start naming the product after the date it was released and (starting with MS Project Version 9 in 1998) released the following Windows updates,

- Project 98,
- Project 2000,
- Project 2002,
- Project 2003,
- Project 2007,
- Project 2010,
- Project 2013
- Project 2016,
- Project 2019.

Multi-user versions of MS Project using schedule files located on a common server began with,

- Project Central (2000),
- Project Server (2002),
- Office Project Server 2003,
- Office Project Server 2007,
- Project Server 2010,
- Project Server 2013,
- Project Server 2016,
- Project Server 2019.

The extreme range of MS Project versions makes discussing 'current' features difficult and we ask for your tolerance with the following discussion.

3. MS Project Differences

There are a few operational differences between MSP and the Oracle/Primavera software products such as P6, P6 Professional, or Enterprise Project Portfolio Manager (collectively labeled as "P6" in this paper.) Like most Microsoft products, all work using MSP is performed in computer memory and you only save any changes made if you tell the program to perform this operation. With P6, all changes are registered as soon as you press the Enter key. Because of the computer memory-centric scheme only one person using MSP can view a particular schedule at a time, even in a multi-tasking environment of Microsoft Project Server.

MSP does not have an activity Original Duration field. The default "Duration" field used is actually Remaining Duration plus Actual Duration (or what P6 labels, "At Completion.") When the activity is unstarted, then Duration would be equal to Original Duration, if it existed. This means that the only way to track an activity's Original Duration is to save the unstatused data as a baseline value (discussed later.) The Duration value may easily change without direct, manual modification as the activity's status changes.

MSP calls float values with the term, "Slack" and lists 0 as the value of slack for completed activities whereas P6 calls this term, "Total Float" and blanks out the column for completed activities. Finally, MSP only allows for one relationship between any two activities. This prevents using the Start-to-Start and Finish-to-Finish relationship pairs found in P6 schedules.

MSP has unique concepts like Deadlines, and Recurring Tasks. In some cases, familiar scheduling terms work different in MSP. For example, "Multiple Critical Paths" in MSP means basically to make open ends critical. P6 uses this term for its feature to identify sub-critical paths. In some areas MSP lacks CPM functionality; for example, the designation of a longest path does not exist in MSP. For detailed explanation of MSP features and functionality, a book such as Planning and Scheduling Using Microsoft Office Project 2007 [3] by Paul E. Harris can be consulted.

The differences in the internal computational factors between MSP and P6 are even more significant. It is crucial to understand how MSP calculates the schedule before delving into the mechanics of statusing a schedule. Since most construction schedulers are familiar with the P6 products, it is easier to compare MSP to P6 to point out the major differences.

P6 considers and computes the early and late dates for every activity in the schedule when computing a CPM, even those that are statused as complete [2]. Unless overridden by a constraint, all activities without a predecessor are scheduled (with consideration to their calendars) to begin (early start) on the current data date and their remaining durations and logical relationships are used to compute their early finish. This rule even applies to completed activities with a remaining duration of zero. After all CPM calculations are complete, P6 then goes back to the completed and in-progress activities and overrides the calculated dates with the actual dates.

This process allows P6 to consider the delaying effects of uncompleted work due to out-of-sequence progress under the Retained Logic calculation rule. Even under the other possible P6

calculation rules, all remaining work is always scheduled to occur on or after the data date. Consequently, the P6 Data Date is the starting point and a fundamental piece of information for CPM calculation.

In contrast to P6, the default method of calculation for MSP does not require the scheduler to set a Status Date (P6 uses the term, “Data Date” which is one day later than the date the status was taken). MSP does not need a Status Date to calculate the dates in the schedule. Instead, MSP starts with the Project Start Date and calculates the schedule using CPM rules even for the activities with actual dates. If an activity has actual dates, the calculated CPM dates are ignored and the actual dates are used instead for calculating the next planned activities’ start or finish dates. This is similar (but still different) to the P6 CPM calculation mode, “Actual Dates.”

As shown in Figure 1 below, this process creates a potential for inherently flawed schedules with remaining durations in the past or actual dates in the future. Both P6 and MSP suffer from allowing actual dates in the future. P6 and MSP differ from how they handle incomplete work in the past.

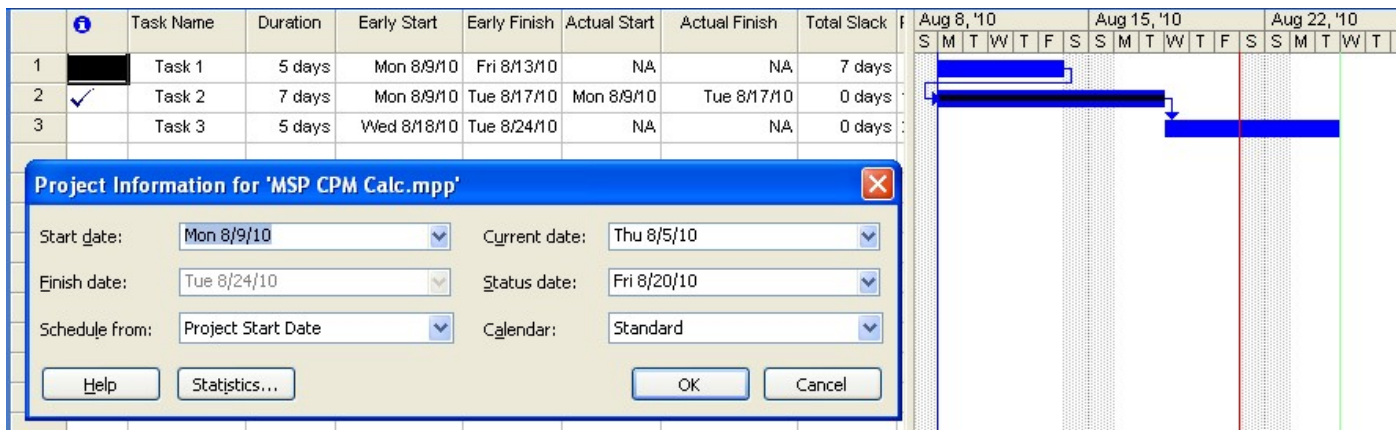


Figure 1 – Remaining Duration in the Past

Common sense and CPM rules require that activities with remaining duration scheduled in the past must be ‘moved’ into the future. It defies logic to say “We will complete this work last month”.

Even though MSP is not designed to calculate the schedule from the Status Date, there are option settings available in MSP to simulate CPM calculations based upon a Data Date. This somewhat complicated process involves the use of built-in routines that automatically add activity constraints and adjusts some internal dates.

For MSP to simulate the effects of a Data Date, all unstarted tasks are given a ‘Start No Earlier Than’ constraint date equal to the status date and all started but incomplete tasks have their Resume Date set to the Status Date. This method delays the incomplete and unstarted tasks to the Status Date. During this process, tasks with constraints lose their previously set constraints and tasks that never had a constraint other than the default As Soon As Possible now get a constraint. This is not desirable, but unfortunately it is the only way that MSP observes the Data Date. Figure 2 below displays, the constraints assigned by MSP to observe the Data Date.

There are other types of date lines that can be displayed on the barchart screen besides the Status date. Current Date looks like a Status Date line but is actually today's date as determined by the computer, unless the Status Date is set. If you do not set a Status Date, the Current Date line automatically moves each day to the date that you are reviewing your schedule. This can be confusing as this clearly does not reflect the currency date of the last time status was taken.

If there is no Status Date set then the Current Date is used for calculating earned value. Neither Current Date nor the Status Date is used for calculating schedule dates and neither has any scheduling significance. Neither of these dates is shown on the Gantt chart by default unless the user adds them to the view. To reduce confusion, it is recommended that the Status Date line be displayed in the Gantt views and Current date should not be displayed. Figure 3 shows the recommended selection setting.

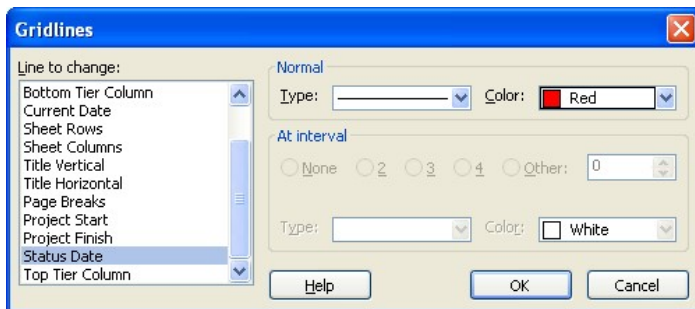


Figure 3 – Recommended Status Date Selection Setting

It is difficult and confusing to implement changes to the CPM calculation modes after an activity is added. To prevent errors and confusion, you should configure your MSP schedule before adding the first activity. The recommended set-up steps are as follows,

1. Schedule Options

Schedule options are found under the Tools / Options / Schedule Tab. Figure 4 shows this tab.

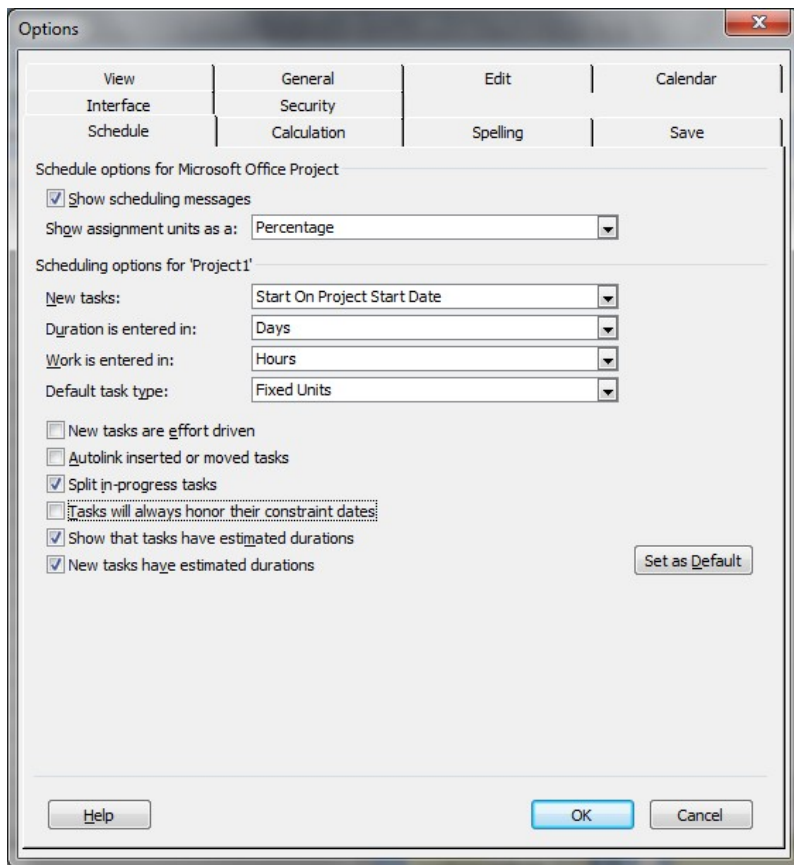


Figure 4 – Schedule Options Tab

Default task type [anything but Fixed Duration] P6 users gravitate to setting the task type of every added activity as Fixed Duration. If this is done, then you will not be able to later show the effects of out-of-sequence activities where the length of the activity ‘stretches’ in response of delaying remaining work until the predecessor work is complete.

New tasks are effort driven [unchecked] Effort-driven activities let the resource availability and needs drive the computation of activity duration, even for unstarted activities. Unless activity duration is supposed to be a function of resources, then this option should be left unchecked.

Autolink inserted or moved tasks [unchecked] This is another of the ‘user help’ functions that automatically modifies your schedule without your knowledge. In this case, when you insert an activity or when you drag and drop an activity between two other activities that were previously logically linked with a Finish to Start relationship, this feature will cause MSP to automatically add successor and predecessor relationships to logically insert the new activity between the other two activities. This feature has caused more trouble and messed-up schedules than practically any other feature in MSP. If consistency of logic is a priority, this setting should always be left unchecked.

Split in-progress tasks: [Checked] This option allows rescheduling of remaining duration and work when an in-progress task is running longer than originally planned and will be used later to properly reflect out-of-sequence progress.

Tasks will always honor their constraint dates: [Unchecked] This option tells MSP to schedule tasks according to their constraint dates, regardless of logic. Clear the check box to specify that task constraint dates with negative slack (float) move according to their relationships with other tasks rather than be strictly scheduled according to their constraint dates. Otherwise, the MSP 'Start No Later Than' and 'Finish No Later Than' constraints will be observed even if the CPM calculated dates do not allow this. P6 will only enforce these constraints if the dates are logically possible.

New tasks have estimated durations [either setting] This setting is the source of the 'mysterious' question mark (?) placed after activity durations. When an activity is added, the duration will automatically be set to the default duration. With this option checked, MSP will help you to remember that this was a default duration setting by adding the question mark. You can remove the question mark by manually entering any duration after creating the activity. Many MSP users have spent long hours trying to find and correct the source of this user help feature. As long as you understand the source and reason for this function, then either setting is useable.

2. Schedule Calculation Options

Schedule calculation options are found under the Tools / Options / Calculation Tab. Figure 5 shows this tab.

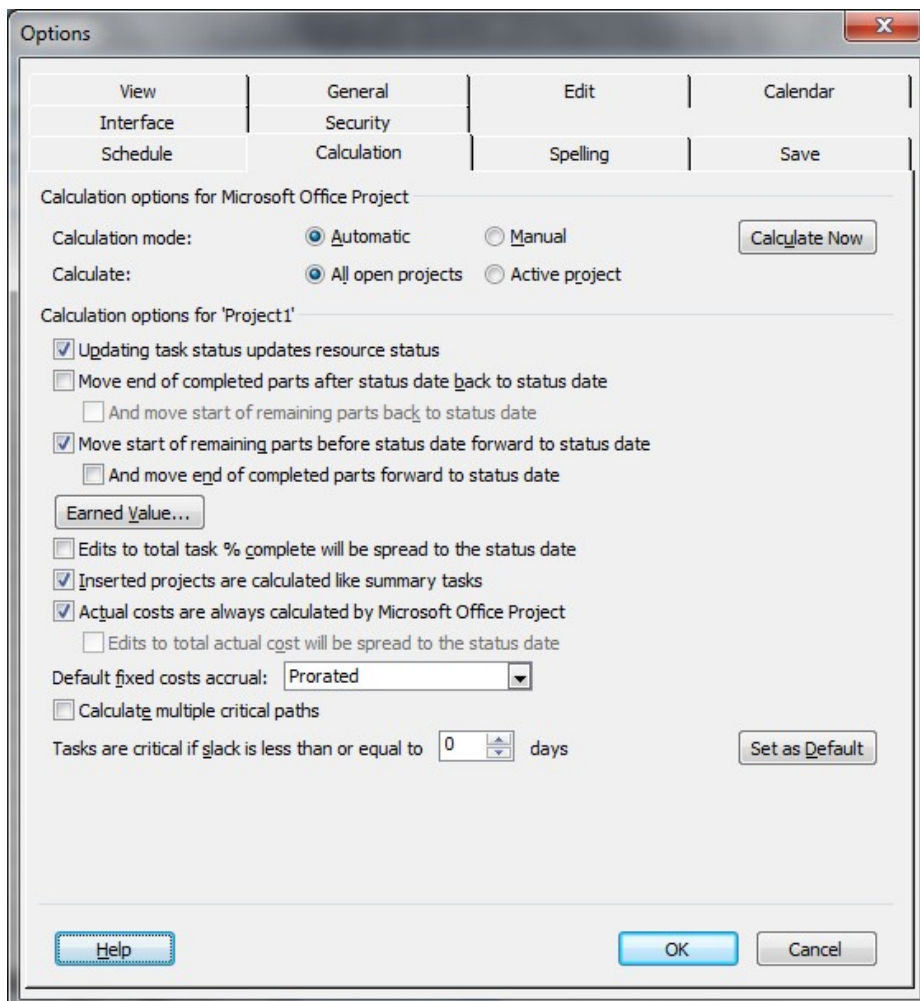


Figure 5 – Calculation Options Tab

Updating task status updates resource status: [Checked] This option insures that task resource status does not override update status.

Move the end of completed parts back to status date: [Unchecked] This option prevents actual dates later than the Status Date (in the future.) It also changes Actual Dates without user input, which is dangerous to do. 'Bad' Actual dates should be flagged, but not automatically changed. P6 allows actual dates in the future as well but does note these as warnings in the Schedule Log produced.

and move start of remaining parts before the status date forward to status date: [Unchecked] This option 'recovers' dangling work left over after moving completed parts back to the status date. This step is unnecessary, as the remaining work will be scheduled after the Status Date.

Move the start of remaining parts before the status date forward to the status date: [Checked] This option prevents uncompleted work from being scheduled before the Status Date (in the past.)

and move end of completed parts forward to status date: [Unchecked] This option will move complete parts of split tasks to the status date and will assign new actual dates. At first glance, this sounds like a good option until you realize that existing actual start dates will automatically be changed to other dates.

3. Activity Type

Because the correct technique involves splitting of tasks, any tasks created must not be assigned Task Duration Type of, "Fixed Duration." The settings, Fixed Rate and Fixed Units are available.

These options may NOT be turned on and off to recalculate all tasks. The options only work on new tasks when they are added to a schedule or when a task is updated by changing the % Complete or Remaining Duration. This is why it is essential to address these settings before adding activities.

4.2. Setting a Baseline

Establishing a baseline is the first step in monitoring a schedule. The term, "Baseline" can be confusing here as MSP and P6 each uses this word to mean something slightly different than from its universal use in the construction industry.

The construction industry calls the first approved, complete schedule on the project a, 'Baseline Schedule.' This type of Baseline typically does not have any status recorded against it. MSP and P6 calls a baseline schedule any copy of the schedule that is stored 'internally' in another schedule. This type of baseline is used for comparison purposes. This paper calls the initial schedule a Baseline Schedule (using capitol letters) and the MSP schedule copy, a baseline schedule (with lower case letters.)

When a baseline schedule is made, MSP copies each activity's Early Start and Early Finish dates to the baseline Start and Finish Date fields. The Duration field gets copied to baseline duration. Each

Task's Costs and Work is copied to baseline Costs and Work fields. Nothing else is saved in a baseline schedule. See Figure 6, Set Baseline Screen.

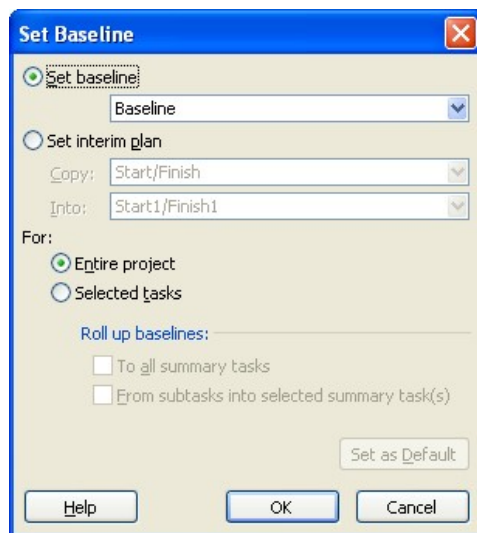


Figure 6 – Set Baseline Screen

MSP treats the baseline as a snapshot of your schedule at the time that you created the baseline. MSP does not store logic, float or constraints for the baseline and as a result, cannot recalculate any of the stored information. P6 users familiar with baselines will assume that they can convert (or 'un-attach') a baseline schedule back into a fully functional schedule. This is not the case with MSP. Due to the fact that MSP baseline schedules do not store complete activity and logic information, creating a MSP baseline is a 'one-way' process.

Because the Duration value is actually the At Completion duration, the baseline Duration value will only be equal to 'Original Duration' if the activity has not started. The Earned Value computations use the Baseline 'Duration' field as the planned duration to measure against. For correct Earned Value computations, a Baseline must be saved before any status is entered.

Baseline information can also be edited manually. Since baseline fields are easily editable by Users and will not be recalculated by MSP, users should be cautious if they decide to manually change any of the baseline information. The fact that it is all together too easy to accidentally change this information makes relying on the variance information riskier than with the typical Target/Update procedure used with Oracle/Primavera's P3 scheduling software.

MSP allows for a maximum of 11 baselines. This is barely enough baseline storage for a 12-month project without any Change Orders or Time Impact Analyses baselines. Users are strongly encouraged to keep separate monthly file backups in order to maintain and be able to prove past status integrity.

There is also another MSP feature called, "Interim Plan" which has similar functionality as the creation of baselines. This feature stores less information than a baseline. The Interim Plan function only stores the Early Start and Early Finish dates of tasks and not durations, costs, or work.

An interim plan can be compared against a baseline plan or current plan to monitor project progress or slippage. MSP allows up to 10 Interim Plans.

It is important to note that the Late Start and Late Finish dates are not stored in baselines. All variance measurements can only be assessed from the early dates. Available float considerations are not taken into account and are not part of the baseline history.

Summary Tasks and Baselines

MSP allows Summary Tasks to be added, deleted, and moved around. Summary Tasks automatically calculate their dates and durations. If a task is added, deleted, or moved after the baseline is set, the baseline dates for Summary Tasks become invalid. MSP has a feature called Roll Up baselines that will reset the baseline dates for Summary Tasks.

4.3. Updating the schedule

Updating the schedule consists of two steps; updating the individual tasks and then observing the Status Date.

Updating Tasks

The first step in updating the MSP schedule is to understand how durations are calculated. Every duration input causes other durations to automatically be re-computed. Pre-defined task durations are comprised of four important pieces of information:

1. Duration (which is equal to Actual + Remaining Duration)
2. Actual Duration
3. Remaining Duration
4. % Complete (which is equal to Actual Duration / Duration)

The calculation of MSP Actual and Remaining Durations is confusing to many schedulers, especially for those who are used to P6. First in P6, actual duration is calculated based the activity's actual date and the Data Date (or Actual Finish date if it exists) whereas in MSP, the Status Date is not used in calculating actual durations. Also as mentioned earlier, there is no Original Duration field to maintain the target duration.

Another reason for confusion is because MSP automatically links Duration, Actual Duration, Remaining Duration and % Complete without an option to remove the link. Only any two of these are independent depending upon what was changed, and the rest are calculated using the formulas listed above.

The scheduler needs to understand how these four pieces of information are calculated in MSP. Table 1 below summarizes the interaction between these four duration-related task properties.

		MS PROJECT WILL			
		Duration	% Complete	Actual Duration	Remaining Duration
IF CHANGED	Duration		Recalculate	Leave As-Is	Recalculate
	% Complete	Leave As-Is		Recalculate	Recalculate
	Actual Duration	Leave As-Is	Recalculate		Recalculate
	Remaining Duration	Recalculate	Recalculate	Leave As-Is	

Table 1 – MSP Calculation Rules

Notice in the table that % Complete and Remaining Duration always gets recalculated, regardless of which value is modified. The value that stays the same is the key to remembering the formulas. A simple activity with 10-day duration as shown in Figure 7 will illustrate how each of these fields is calculated.

Task Name	Duration	Actual Duration	Rem. Dur.	Act. Start	Act. Finish	% Comp.	Aug 22, '10	Aug 29, '10	Se
							S M T W T F S	S M T W T F S	S
Task 1	10 days	0 days	10 days	NA	NA	0%	[Gantt bar]		

Figure 7 – Sample 10-Day Activity

Entering 20% complete will automatically assign an Actual Start date (if not already set) and calculate the Actual Duration and Remaining Duration as a percent of Duration. For unstarted tasks, Actual Start will be set equal to the previous Start date (which reflects the task’s early start date) as shown in Figure 8. Actual duration will be 2 days, which is 20% of the Duration. Remaining Duration will be 8 days which is Duration minus Actual Duration.

Task Name	Duration	Actual Duration	Rem. Dur.	Act. Start	Act. Finish	% Comp.	Aug 22, '10	Aug 29, '10	Se
							S M T W T F S	S M T W T F S	S
Task 1	10 days	2 days	8 days	Mon 8/23/10	NA	20%	[Gantt bar]		

Figure 8 – Result of Entering % Complete

If one further adjusts Remaining Duration to equal 10 days, the Duration will become 12 days as shown in Figure 9. This is 10 days remaining plus 2 Days actual. % Complete will automatically be reset to 17%, which is Actual Duration divided by Duration.

Task Name	Duration	Actual Duration	Rem. Dur.	Act. Start	Act. Finish	% Comp.	Aug 22, '10	Aug 29, '10	Sep 5, '10
							S M T W T F S	S M T W T F S	S M T W T
Task 1	12 days	2 days	10 days	Mon 8/23/10	NA	17%	[Gantt bar]		

Figure 9 – Result of Adjusting Remaining Duration

As can be seen from the above examples, MSP practically demands the scheduler to update progress by entering % Complete. It is the only way one can maintain the Duration figure as if it were Original Duration. In addition, it is the only method to recalculate Actual Duration.

The MSP Statusing Problem

The weakness of this process is that it assumes that everything is going as planned and that At Completion (actual plus remaining duration) is still accurate. As long as the task is tracking properly, MSP allows the single, simple entry of % Complete to keep the Actual Duration and Remaining Duration accurate.

When progress not as planned, then a process akin to 'pushing on a balloon' occurs. We adjust the Remaining Duration to match our status report only to have Duration change and Actual Duration remain constant. We then change the Actual Duration to reflect the difference between the Actual Start date and the Status date and Remaining Duration changes. We complete the process by correcting the Remaining Duration once again. This is why many say that updating schedules in MSP is time consuming. The automatic help features (along with the absence of a Data Date) keeps adjusting values that do not need to be adjusted.

Status Input

MSP provides four different ways to enter actual data for each Task. Not all methods work equally well.

1) One can use the 'Update Tasks' form as shown in Figure 10 to enter actual data for each task. This method is the least preferred method because the form has to be closed after updating each task and opened again after selecting the next Task. This makes it very cumbersome to update large numbers of tasks.

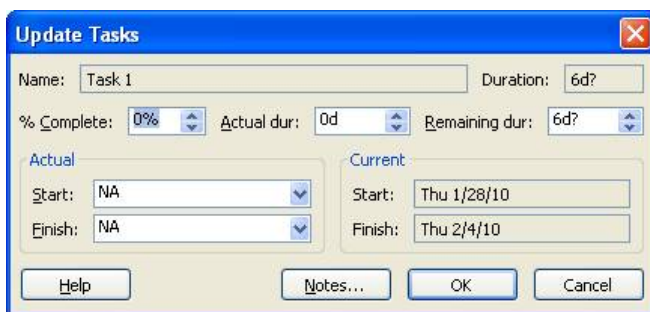


Figure 10 – Update Tasks Form

MSP allows you to use this function to update multiple tasks at once but the problem is that MSP assigns the same value to all selected tasks. Therefore, unless all Tasks have the exact same update information, this function is not useful.

2) Another available update method is the Task Information form as shown in Figure 11. This is also a cumbersome way of updating because the form has to be closed after each update and opened again after selecting the next Task.

Task Information

General | Predecessors | Resources | Advanced | Notes | Custom Fields

Name: Task 1 Duration: 6d? Estimated

Percent complete: 0% Priority: 500

Dates: Start: Thu 1/28/10 Finish: Thu 2/4/10

Hide task bar
 Roll up Gantt bar to summary

Help OK Cancel

Figure 11 – Task Information Form

3) Using the Task Details Form to update the schedule is a less cumbersome method compared the previous 2 methods listed above. Task Details (as shown in Figure 12) can be opened by dragging the divider line and selecting Task Details Form from View, More Views. The scheduler is cautioned that if a Finish date is entered without task being 100% complete, MSP will automatically add a Finish Constraint to the Task. This is one reason that this third option is also not recommended.

Task Details Form

Name: Task 1 Duration: 6d? Effort driven Previous Next

Dates: Start: Thu 1/28/10 Finish: Thu 2/4/10

Constraint: As Soon As Possible Date: NA Task type: Fixed Units WBS code: 1.1

Priority: 500 % Complete: 0%

ID	Resource Name	Units	Work	ID	Predecessor Name	Type	Lag

Figure 12 – Task Details Form

4) The easiest and most efficient method to enter activity actual date status is by using the Tracking Table in the Gantt Chart or creating your own table as shown in Figure 13.

Task Name	Duration	Actual Duration	Remaining Duration	% Complete	Actual Start	Actual Finish	Start	Finish
Summary	13 days?	0 days	13 days?	0%	NA	NA	Thu 1/28/10	Mon 2/15/10
Task 1	6 days?	0 days	6 days?	0%	NA	NA	Thu 1/28/10	Thu 2/4/10
Task 2	7 days?	0 days	7 days?	0%	NA	NA	Fri 2/5/10	Mon 2/15/10

Figure 13 – Tracking Table

It is recommended that the following fields are shown on this custom table.

- Task Name

- Duration
- Actual Duration
- Remaining Duration
- % Complete
- Actual Start
- Actual Finish
- Start
- Finish

This method of entry allows the scheduler to observe all calculated and auto-definable fields so that any unintended consequences may be observed as they occur. Hopefully, this will reduce the number of unintended entry errors.

Regardless of the method of update chosen, certain procedures should be followed,

1. Always assign the actual dates first. Any other action will normally cause MSP to automatically assign the Actual Start or Actual Finish date for you, which may be incorrect.
2. Assign % Complete next. If you only have the Remaining Duration, a quick calculation of Remaining Duration divided by Duration will give you the figure. This will allow you to observe if you agree with the computed Remaining Duration and Actual Durations.
3. The adjust Actual Duration and Remaining Duration as required. Of the four interconnected values, these two are the only ones that really are important for accurate status.

MSP also has a feature called Update Progress which will automatically update the activity as if it progressed as planned. This is found in the Update Project dialog box under Tools / Tracking / Update Project. This feature automatically sets the Actual Start, Actual Finish, % Complete and Remaining Durations. There are 2 options available under this feature as shown in Figure 14.

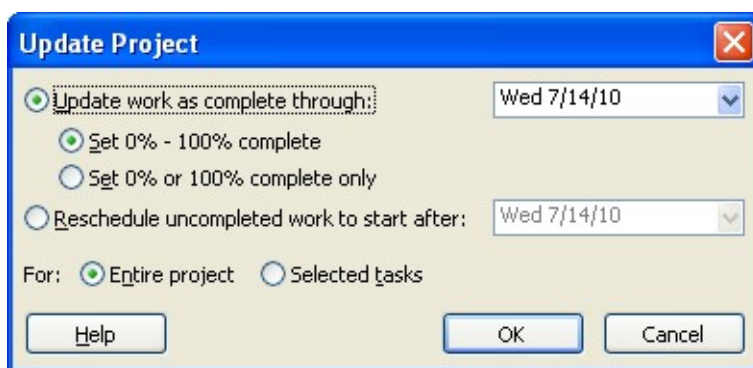


Figure 14 – Update Progress Screen

Set 0% -100% Complete - Selecting this option will set Actual date to Early Start. Actual Duration and % Complete will be calculated based on the date entered in “Update Work As Complete Through”.

Set 0% or 100% Complete - Selecting this option will set the Actual date to that show as Early Start. Duration and % Complete will be zero unless the “Update Work As Complete Through” date is later

than Finish date of the Task. Selecting this option will not reset the Status Date as these are two different dates.

The scheduler must be careful using this feature for various reasons. First, if Set 0% or 100% Complete option is selected, the “Update Work As Complete Through” date and the Status Date might must match if you want the update to perform properly. To make things worse, remaining durations will not move to any of these two dates, resulting in remaining durations scheduled to be complete in the past. Similarly, if this feature is applied only to ‘Selected Tasks’ then there is a possibility that there will be unstarted activities in the past. Set 0% -100% Complete would produce reliable results only if everything is going per plan, therefore this feature is very limited in its use and not recommended.

Updating Summary Tasks

Once the detail tasks are updated, the summary tasks inherit status data from their detail tasks. Actual start is assigned to the Summary task when a detail task has been given an actual start and similarly Actual Finish is automatically assigned when all detail tasks have been assigned actual dates. A Summary Task’s % Complete is calculated by dividing the sum of all detail tasks’ Actual Durations by the sum of all detail tasks’ Durations.

MSP has a somewhat unusual feature that allows the scheduler to directly manually update Summary Tasks. A manual update of a Summary Task works as a ‘push-down’ feature that affects all the detail tasks below it. If a % Complete is entered at the Summary level, MSP assigns values for Actual Duration, % Complete, Actual Start and Actual Finish all the children tasks (Summary or Detail). It is unlikely that this feature will be used by schedulers concerned with accurate statusing.

Calculation of these summary values differs based on the “Updating Task Status Updates Resource Status” setting. If “Updating Task Status Updates Resource Status” is checked, the tasks are statused as if they were completed per plan with actual dates automatically supplied. If not checked, then all of the children tasks get the same % Complete value of the Summary task. This is obviously a dangerous procedure to employ if the accuracy of individual activity status is desired.

Observing the Status Date

As explained earlier, MSP was not designed to calculate schedule CPM dates using the Status Date. Forcing MSP to observe the Status Date is very complicated process that requires understanding the calculation options in conjunction with using the “Reschedule Uncompleted Work” on the Update Project form.

Reschedule Uncompleted Work to Start After

To properly update a schedule, you first need to understand the “Reschedule Uncompleted Work to Start After” feature available on the Project Update form shown in Figure 15. This is found in the Update Project dialog box under Tools / Tracking / Update Project.

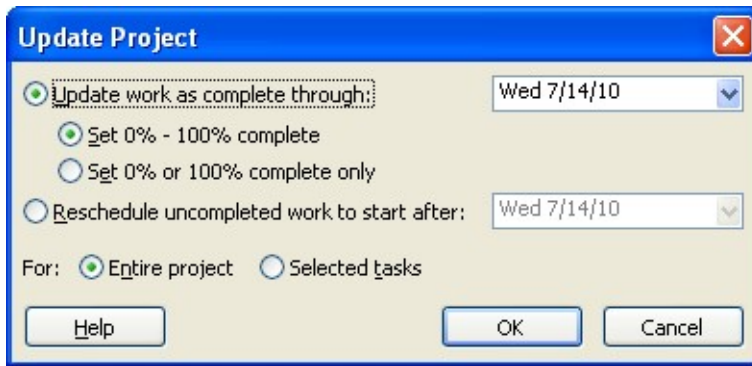


Figure 15 – Update Date Screen

Please note that for this feature to work properly, the ‘Split in Progress Tasks’ option must be selected under the Tools, Options Schedule tab.

When this feature is used, MSP will go through the list of each activity with an early start date earlier than the reschedule after date and will assign a Start-No-Earlier-than-Constraint equal to the Update Project Status date. This process does not assign a new constraint to every activity, just the ones that were scheduled to start ‘early’. Because MSP only allows one constraint per task, if any of those unstarted tasks had a different constraint, the existing constraint will be deleted in favor of adding the new CPM constraint. Tasks that are in progress will have their Resume Date set to the Update Project date.

This assignment of an automatic constraint remains even after the activity is statused complete. This proves to be a problem if one is required to later destatus the project. To do so, the scheduler has to review each activity and remove the unwanted constraints and adjust the task splits manually. This makes it very difficult and time-consuming for analysts to perform schedule what-if analyses.

In addition, MSP does not change the Status Date to the date specified in the Update Project feature (Figure 15.) These can be two different dates. This often results in confusion as the date specified in Update Project screen (Figure 16) is not displayed on the Gantt chart and might end up being a different date than the one that is displayed. To avoid confusion and to display a correct Status Date on Gantt view, the Scheduler should set the Status Date to the same date as specified in the Project Update function as shown in Figure 16.

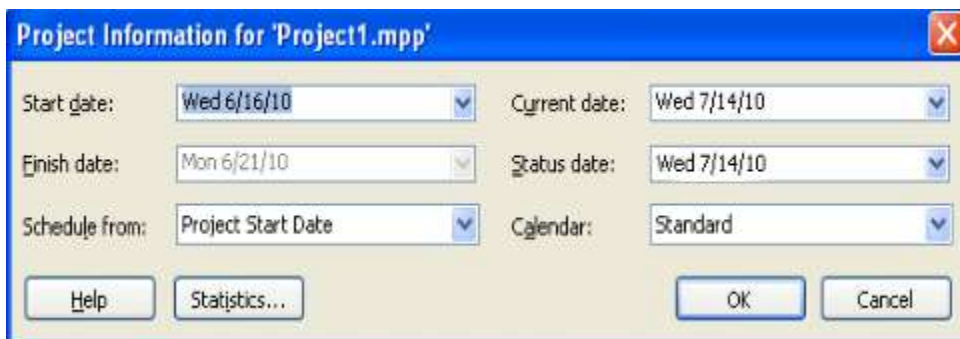


Figure 16 - Status Date Screen

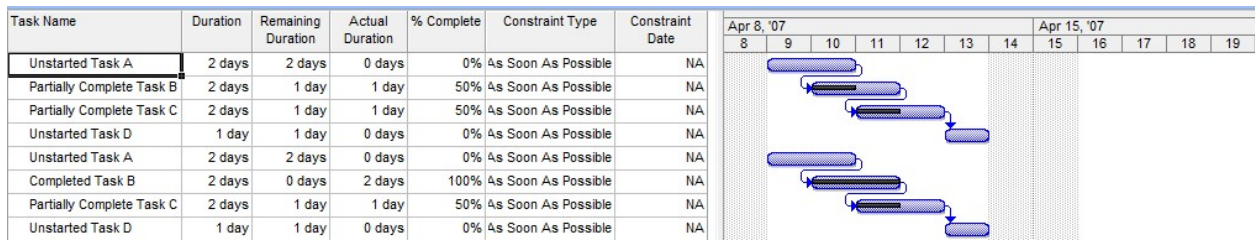


Figure 27- Sample Out of Sequence Progress

The top four activities represent out-of-sequence with remaining duration (i.e. the first activity is not complete.) The second four activities are identical except that Activity B is now complete.

When the out-of-sequence activity (in this case, Activity B) has some remaining duration, then the CPM Calculation Options forces the schedule to resemble Retained Logic. When the same out-of-sequence activity has no remaining duration, then the CPM Calculation Options forces the schedule to resemble Progress Override as demonstrated in Figure 28

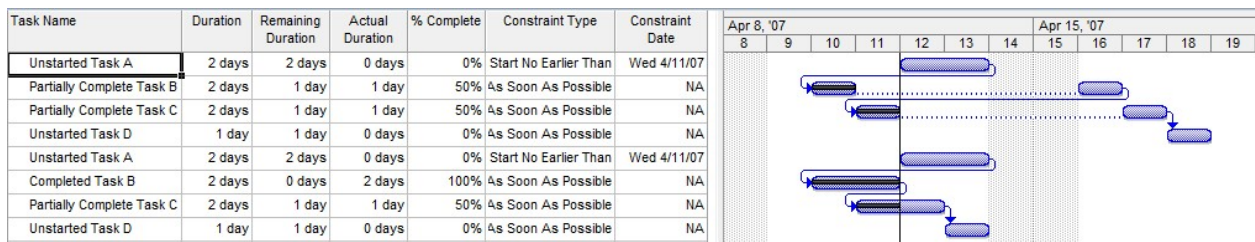


Figure 28 – Results of Reschedule After

This ‘hybrid’ behavior is similar to that displayed with the P6 Actual Dates CPM calculation option. Figure 29 clearly shows that MSP will use the Actual Finish date of Act 2 as the Early Start of Act 3 instead of the calculated date.

Activities with progress that are in the future can be identified by running a filter and then can be manually corrected. This is no different than using P6 products since none of them have a built-in feature to prevent assigning actual dates in the future.

Eventually, the Status Date will advance and our test example will be complete. Supposing that everything now progressed as planned, then Figure 29 would represent the completed schedule.

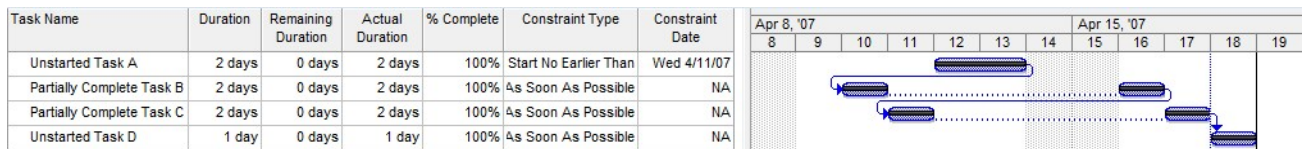


Figure 29 – Completed Test Schedule

Notice that MSP does not consider the time period during the activity splits as actual duration time. Unfortunately, our method for properly statusing a schedule does not include accurate actual durations. The price of accurate forecasting of project completion appears to be the loss of automatic actual duration calculations.

4.4. Comparing Schedules

It is important to remember that a typical project experiences changes to the schedule logic as well as differences between the planned progress and actual progress. Changes to the schedule logic and planned durations are revisions to the schedule and they will be calculated to take place in future to the right of the status date. Other variances due to the performance will be in the past to the left of the data date. Variances in the performance should be handled separately from the logic revisions and planned duration changes.

Identifying Variances

To identify variances in performance, Start Variance and Finish Variance columns can be used. In addition, schedulers can create custom bar styles to display baseline and schedule update information in the same view. MSP has a Gantt chart wizard (Figure 30) that allows users to create these views easily and quickly however schedulers should be aware that using this wizard will overwrite any existing custom formatting.

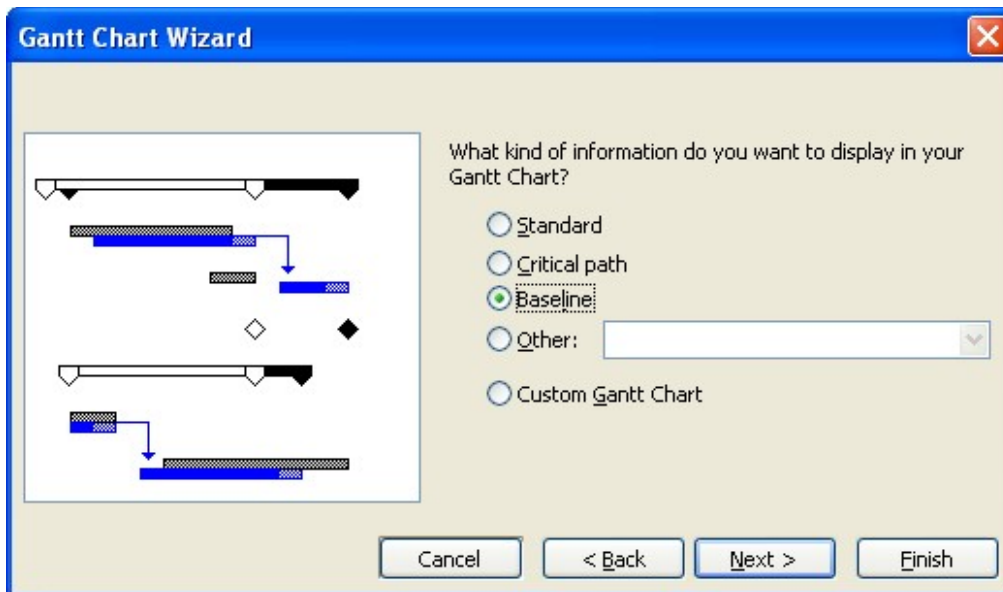


Figure 30 – Gantt Chart Wizard

For a more detailed analysis, the actual dates and planned dates can easily be extracted from MSP and moved to an Excel spreadsheet or to MS Access database to perform a Daily Delay Measure analysis (MIP 3.2) [6] This can be further automated using Excel or Access formulas and macros.

Remember, that MSP users can only note variances to the early dates and not the late dates. Because of the limited baseline fields, variance analysis cannot take activity float into consideration.

Identifying Revisions

MSP 2007 and later versions have a Compare Project Versions utility to review differences between two similar MSP schedules. The Compare Project Versions utility compares tasks and resources only

and does not compare resource assignments. This utility produces a graphic comparison report which looks like a project schedule. Although this report displays color coding and indicators that provide information about tasks and resources, it is extremely hard to understand, especially for schedulers who have been using text-based programs such as Claim Digger or P6 Schedule Comparison.

On the other hand, MSP has a powerful Visual Basic for Applications (VBA) programming language which allows a quick development for custom comparison software. For example, this author has released a public domain MS Project VBA program for reporting on out-of-sequence progress [see Mastering Out-of-Sequence Progress]. MSP users can create their own comparison routines and easily create their own variance reports. Exporting schedules to MS Access and using it to compare the two similar schedules is another option open to the scheduler.

Finally, MSP allows you to create custom fields that can even include user-defined formulas. One can define variances and other comparison issues in these custom fields.

A quick survey noted third-party software providers who specialize in MSP comparison tools to include the following,

- Acumen Fuse
- Project Analyzer
- Schedule Cracker

These software products also review many other CPM software products other than MSP and may not fully understand or properly label the data produced in an effort to standardize the output for all products. For example, a change in the Duration figure is not a change in Original Duration.

5. Conclusion

MSP is inexpensive, very user friendly (especially for beginners) and provides decent default reports and graphs. A casual user of MS Office with no scheduling experience can pick MSP up and quickly create schedules. However, a seasoned scheduler working on a construction contract is likely to struggle with updating and maintaining the same MSP schedule. Some of the “ease of use” features function at the expense of the CPM theory and data accountability, which can become sources of confusion for a seasoned scheduler. The main problematic issues of using MSP are:

- 1) MSP Baseline management is cumbersome and incomplete for the average scheduler.
- 2) MSP updating method of using % Complete is not optimum for construction schedules.
- 3) MSP Data Date issues which in effect complicate the schedule update process are confusing.
- 4) Due to the difficulty of using MSP to note uncompleted work before the Data Date, the difficulties in removing status for what-ifs, and the difficulty in identifying variances between a series of MSP schedules, it can be difficult to perform most types of delay analysis.
- 5) Due to all of the built-in update help routines that automatically insert made-up actual dates and remaining durations, it is difficult to assume that most MSP schedules contain accurate enough status data to support a detailed analysis.

Of course, this does not mean that MSP cannot be used for construction scheduling. MSP is here to stay as many contracts are now mandating its use. This only means that construction schedulers must be proficient in MSP in addition to the P6 products.

References

[1] The Oregon Department of Transportation (ODOT) 2008 Specifications list Microsoft Project as an acceptable scheduling software for scheduling purposes. In addition, many NAVFAC and US Dept of Homeland Security RFPs include references requiring MS Project. Indian Health Service has required that the “electronic version [of the schedule] shall be compatible with Microsoft Office Project”. Catholic Healthcare West also uses MS Project Enterprise system on their projects.

[2] Ron Winter, PSP and F. Burak Evrenosoglu, CCE PSP, 2009 AACE International Transactions PS.15 “Much Ado About Dates” Understanding P6 Date Information

[3] Planning and Scheduling Using Microsoft Office Project 2007, Paul E. Harris, published by Eastwood Harris Pty Ltd

[4] Microsoft Project Standard 2002, Microsoft Corporation, copyright 2002

[5] AACE Recommended Practice 53R-06, “Schedule Update Review”

[6] AACE RP 29R-03, “Forensic Schedule Analysis”

[7] in <http://www.visualizetheplan.com/2013/12/19/adoption-of-microsoft-project-in-it-versus-construction-different-animals-same-cage/> on [December 19th, 2013](#) by [Timothy Deane Mather](#), “Adoption of Microsoft Project in IT Versus Construction: Different Animals, Same Cage?”