Percent Complete in Microsoft Project Pro and Primavera P6 Pro

Understanding "Units" in P6 and "Work" in MS Project

P6 Pro uses the term "Units" and MS Project uses the term "Work" to measure "work". But what do these programs mean by "work"? The answer is this:

"Units" = "Work" = effort (i.e., manhours) spent by resources on an activity.

"Units" (in P6) and "Work" (in MS Project) are measures of "input" (effort). They do not measure "output" (accomplishment). They do not measure physical work. Thus, it is possible for an activity to have spent a large number of "Units" or "Work", i.e., manhours spent, but to have little actual physical work performed (cubic meters excavated).

Earned Value and Percent Complete

Both MS Project and P6 Pro calculate "Earned Value" (BCWP) for an activity using the same formula:

Earned Value = (Baseline Cost) * (% Complete)

All three quantities in the above formula refer to the same activity. Clearly, the key question is how to determine "% Complete" for an activity that is currently "in progress".

The preferred method for measuring "% Complete" for most production activities is by "output", e.g., by "cubic meters of soil actually excavated", or by "square meters of porcelain tile actually installed", relative to the total.

However, neither MS Project nor P6 Pro have built-in facilities for entering or tracking the physical quantities of work performed by activities and thus cannot calculate "% Complete" based on "output". I.e., they cannot calculate "Physical % Complete". To overcome this limitation, both MS Project and P6 Pro allow the user to enter a value for "Physical % Complete" directly. This value can be estimated subjectively or can be taken from a different system (e.g., a cost accounting system).

The default method for calculating % Complete in both MS Project and P6 Pro is based on "input" or "effort" and compares the "remaining duration" for an activity to its estimated total duration. P6 can also compare the "remaining units (i.e., manhours)" for an activity relative to its total estimated units. Thus, the default method for calculating "% Complete" for both programs is "LOE" = "level of effort".

However, the default formulas that MS Project and P6 Pro use to calculate "% Complete" for an activity in progress based on its duration are not the same. As a result, MS Project and P6 Pro can produce different results for % Complete, Earned Value, and BCWP. To produce the same results, the user must change the default behavior of P6 Pro as explained below.

Moreover, even the "% Complete" produced by P6 Pro alone can have different values, depending on whether P6 calculates "% Complete" "based on duration" or "based on units" (i.e., work). The formulas that P6 uses to calculate "% Complete" based on "duration" and based on "units" are also described below.

MS Project Pro — Percent Complete

The method used to determine "% Complete" for each activity in MS Project is chosen by selecting the "Earned Value Method" in the "Advanced" tab of the "Task Information" dialog box for that activity. Each activity can have one of two types of "% Complete" (both of which are described below):

- % Complete (the default)
- Physical % Complete

It should be noted that this field affects BCWP (Earned Value) but does not affect BCWS because BCWS is calculated using the baseline schedule, the Data-Date (Status-Date) and baseline cost values.

The default "Earned Value Method" for all new tasks can be set to "% Complete", or "Physical % Complete", in the "Project Options" dialog box. The same "Project Options" dialog box also allows choosing which of the 11 available baselines should be used for Earned Value calculations.

% Complete: This type is the default and indicates that the activity's % Complete (and Earned Value) will be calculated by MS Project based on durations. The formula used is the following:

"Activity % Complete" = "% Complete" = 1 - ["Remaining Dur" / ("Actual Dur" + "Remaining Dur")]

Notice that the denominator in this formula does not use the "Original Duration" of the activity (which is stored in the baseline and which is used by P6 Pro). Instead it uses the latest estimate for the activity's "Total Duration", which is given by "Actual Duration" + "Remaining Duration".

Physical % Complete: This type indicates that the activity's % Complete will be "determined outside of MS Project" and will be entered manually by the user. In this case,

Activity % Complete = Physical % Complete.

"Physical % Complete" is not the default and should be chosen when a task's earned value should be based on real accomplished work in place (i.e., by output or accomplishment) rather than just by the time spent on the work (i.e., by input or effort).

The "Physical % Complete" field should be used to enter values manually when the % Complete (which is calculated based on durations) would not be an accurate measure of the real work in place. Unlike the "% Complete" field (which is tied to duration), the "Physical % Complete" field is independent of the total duration or actual duration values, and thus can provide a more accurate value for "Earned Value".

Example: Consider building a stone wall that consists of 100 stones stacked five high. The first row of 20 stones can be laid in 20 minutes, but the second row takes 25 minutes because now you have to lift the stones up one row higher, so it takes a little longer. The third row would take 30 minutes, the fourth 35 minutes, and the last row takes 40 minutes to lay—150 minutes total. After laying the first three rows, the project could be said to be 60 percent physically complete (you laid 60 of 100 stones). However, you only spent 75 of 150 minutes, so in terms of duration, the job is only 50 percent complete. For such a task, you can add the Physical % Complete field to the Gantt Chart view to enter and track progress.

Depending on how value is "earned" (by the stone, or by the hour), a contractor should choose the appropriate percentage type, "Physical % Complete" or "% Complete" (based on duration), to properly reflect this in the earned value analysis.

P6 Pro — Percent Complete Types

Each activity in P6 can be assigned to one of three "types" of "percent complete" by making a choice in the "General" tab of the "Activity Details" pane. The three types of "percent complete" available are:

- Physical % Complete
- Duration % Complete
- Unit % Complete

Physical % Complete: This type is identical to "Physical % Complete" in MS Project and indicates that the activity's % Complete will be determined outside of P6 and will be entered manually by the user. Thus:

Activity % Complete = Physical % Complete.

Duration % Complete: This type indicates that the activity's % Complete will be calculated by P6 using the Original Duration and Remaining Duration. In this case,

"Activity % Complete" = "Duration % Complete" = 1 - ["Remaining Duration" / "Original Duration"]

It is important to notice that the denominator is the "Original Duration", which could be the same as the "Baseline Duration", which is a value that was estimated with much less information at the start of the project and was used in the target schedule.

The relationship between "Original Duration" and "Remaining Duration" (for an activity that has not started) depends on whether the user has set P6 to use "Method 1" or "Method 2" for this project:

Method 1: Does NOT Update/Change "Original" Activity Durations (this is the default in P6)

- Do NOT place a checkmark next to "**Link *Budget* and *At Completion* for not started activities**".
- Method 1 treats "Original Duration" and "Remaining Duration" as unlinked—changing one does not change the other.

Method 2: Updates/Changes the "Original" Activity Durations (like MS Project)

- Place a checkmark next to "**Link *Budget* and *At Completion* for not started activities**"
- Select "**Reset *Original Duration* and *Units* to *Remaining***".
- Method 2 links "Original Duration" and "Remaining Duration" (but only for non-started activities) so that changing one changes the other.

Thus, when using Method 1 (and, sometimes, when using Method 2), the "Original Duration" used by the P6 formula to calculate "% Complete", does not equal "Actual Duration" + "Remaining Duration".

The difference between Method 1 and Method 2 is best illustrated by example: Consider an activity with "Original (Baseline) Duration" = 10d, "Actual Duration" = 2d and "Remaining Duration" = 3d:

Method 1: "Duration % Complete" = 1 - 3d/10d = 70%

Method 2 (and MS Project): "Duration % Complete" = 1 - 3d / (2d+3d) = 3d/5d = 40%

Notice that Method 1 uses the old and clearly inaccurate estimate "Original Duration" = 10d to calculate "Duration % Complete" = 70%. Clearly, Method 1 completely ignores the known fact that the "Actual Duration" of the activity up to the Data-Date is 2d which implies that the latest estimate for the total duration of the activity is "Actual Duration" + "Remaining Duration" = 5d.

For Method 2 to produce the above "Duration % Complete" = 40% automatically (to match that calculated by MS Project) it is necessary to first change its "Remaining Duration" from 10d to 5d before the activity is marked as started. Changing the "Remaining Duration" from 10d to 5d, before the activity is marked as started, will also change the linked "Original Duration" from 10d to 5d. Notice that this change in "Original Duration" from 10d to 5d does not change the saved "Baseline Duration" = 10d (assuming, of course, that a Baseline was saved and has been assigned to the project). After the "Original Duration" is changed from 10d to 5d, the activity should be marked as "started" and its "Remaining Duration" should be changed to 3d. Notice that because the activity has been marked as "started", changing the "Remaining Duration" to 3d does not change the "Original Duration" = 5d. The end result is that P6 will calculate "Duration % Complete" = 40% as shown above.

It should also be noted that P6 allows the user to manually change the value for the field "Original Duration" for any activity. If the activity has not started, then this changes the "Remaining Duration" as well. If the activity has been marked as started, then P6 allows changing its "Remaining Duration" manually. Thus, by manually changing both the "Original Duration" and the "Remaining Duration", a user can have P6 calculate any desired value for "% Complete".

In most cases, the "% Complete" produced by Method 2 and MS Project is the preferred metric because it measures progress relative to the "currently estimated total duration of the activity".

Units % Complete: This type indicates that the activity's "% Complete" will be calculated based on the actual and remaining labor and nonlabor "Units" (in P6, "Units" = "manhours"):

"Activity % Complete" = "Units % Complete" = "Actual Units" / ["Actual Units" + "Remaining Units"]

where:

"Actual Units" = "Actual Labor Units" + "Actual Nonlabor Units"

"Remaining Units" = "Remaining Labor Units" + "Remaining Nonlabor Units"

Notice that "Units % Complete" is only depended on labor and nonlabor units. Material units and expense units are not used in calculating "Units % Complete".

Moreover, notice that the denominator does not use "Budgeted (Baseline) Units". Instead, it uses the latest estimate for "Total Labor and Nonlabor Units". Thus the P6 formula based on Units is similar "in spirit" to the formula used by MS Project based on activity durations.

Clearly, for an ongoing activity, each of the "percent complete types" supported by P6 can produce a different Earned Value and BCWP. It is up to the user to make an appropriate choice based on how value for the particular activity is earned.

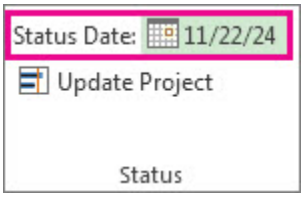
The following is from Microsoft online help with additional comments from P.G. Ioannou

MS Project - Set the status date for project reporting

Usually, you report your project's progress on a day you set— the status date, to use project management-speak. For example, if you want sales report figures for last month, you set the status date to the last day of that month. Or, if progress reports are due Friday, but were sent in late, you might set the status date back to Friday before reporting on progress information.

The status date is almost never the current date, so you need to set it:

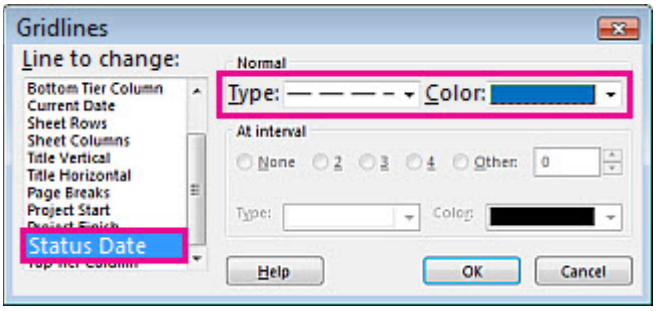
1. Choose **Project** > **Status Date**.



2. Select the new status date.
   To set the status date back to the current date, either enter the current date, or enter **NA** in the date field.

View the status date on the Gantt Chart

1. On the Gantt Chart, choose **Format** > **Gridlines**.
2. Under **Line to change**, pick **Status Date**, and then select a line style and color.



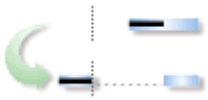
How does the status date affect progress updates?

When you enter progress as percent complete or actual work to date, Project uses the status date to determine where to place actual work and where to schedule remaining work. You can modify the default settings for how the status date is used for placing actual work and remaining work where you want, particularly when assignments are completed earlier or later than scheduled.

To modify the default settings, choose **File** > **Options** > **Advanced**, and scroll to the **Calculation options for this project** section.

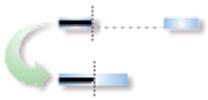
- **Move end of completed parts after status date back to status date**

Consider tasks that are scheduled after the status date, and have actuals entered against them. If the **Move end of completed parts after status date back to status date** check box is selected, then if a task is scheduled after the status date and you enter actuals against it, Project moves the actual, completed portion of the task so that the completed work ends on the status date and any remaining work remains scheduled to begin in the future. Therefore, if the status date is set to today, and you enter actuals, the work is assumed to finish today, not in the future. But the remaining work is not expected to start until the future:



- **And move start of remaining parts back to status date**

If the **Move start of remaining parts before status data forward to status date** check box is selected, you can also select the **And move start of remaining parts back to status date** check box. With both check boxes selected, Project moves the entire task around the status date to show that work was done on the task and completed as of the status date and remaining work is continuing as of the status date:



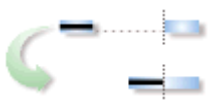
- **Move start of remaining parts before status data forward to status date**

Consider tasks that are scheduled before the status date and that have actuals entered against them. If the **Move start of remaining parts before status data forward to status date** check box is selected, then if a task is scheduled before the status date and you enter actuals against it, Project leaves the actual portion of the task as scheduled, but moves any remaining work to the status date. Therefore, if the status date is set to today and you enter actuals, the work is assumed to have been completed when it was scheduled, but it is assumed that the remaining work will begin immediately instead of in the past (before the status date):



- **And move end of completed parts forward to status date**

If the **Move start of remaining parts before status date forward to status date** check box is selected, you can also select the **And move end of completed parts forward to status date** check box. With both check boxes selected, Project moves the entire task around the status date, to show that work was done on the task and completed as of the status date and that remaining work is continuing as of the status date:



These settings are particularly useful when you want to see "ahead of schedule" progress lines. They're also useful for changing how earned value is accrued.

If you change these settings, Project does not move the actual or remaining work at all; work remains where it was originally scheduled, even if you report that the work was completed several weeks earlier than scheduled.

Note: These settings do not control the placement of actual and remaining work when you track progress by entering actual work by time period.

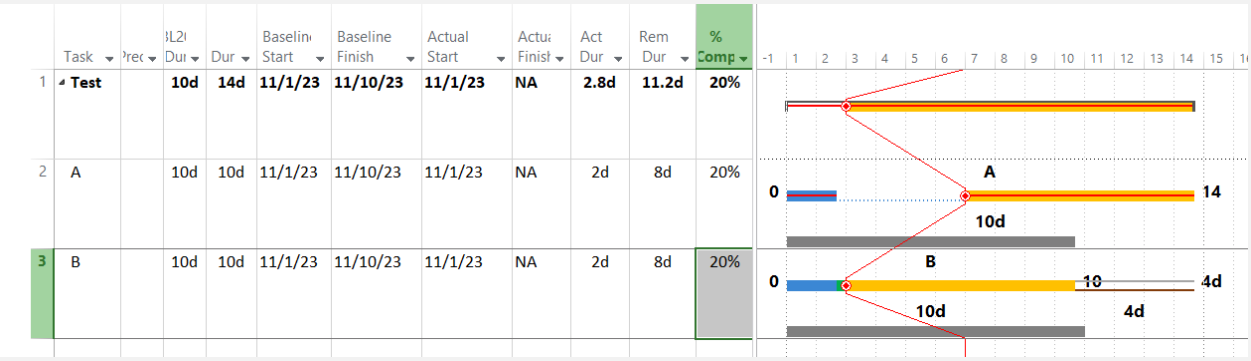
Important (PGI): Microsoft does not make it clear that the above four settings for "**Calculation options for this project**" apply **only** to those activities that were defined (i.e., entered into the schedule)

(a) **After** these calculation options were selected
(b) **Before** any actual progress activity information was entered for any activity.

These options **do not apply** to those activities that were defined (i.e., entered into the schedule) after any actual progress activity information was entered for any other activity.

I.e., for the "**Calculation options for this project**" to **apply to all activities** in a project, these options must be set **before** any activities are defined (i.e., before activities are entered into the schedule).

Example (PGI): The figure below shows two identical activities A and B that have:
T=10d, no predecessors, "Start as Soon as Possible", 20% complete as of data date = 6 days.
Activity A was defined before, and activity B was defined after actual progress information was entered for activity A.
For activity A, the remaining duration of 8 days is scheduled based on the "Calculation options for this project" and its remaining 8 days are scheduled to start at the Status Date and take place in the future. Because activity B, however, was defined after actual progress was entered for activity A, it is NOT scheduled based on the "Calculation options for this project", and its remaining 8 days start in the past, before the Status Date. Thus, 4 days of its remaining duration of 8 days take place in the past.
Thus, the two activities A and B are scheduled to have two different finish dates.



How does the status date affect earned value?

Certain earned value costs are calculated as of the status date. For example, the budgeted cost of work scheduled (BCWS) is the portion of the cost that is planned to be spent on a task between the task's start date and the status date. For example, the total planned budget for a four-day task is $100, and it starts on a Monday. If the status date is set to the following Wednesday, the BCWS is $75. When you change the status date, the earned value calculations reflect costs up to and including the status date.

How does the status date affect calculations for progress lines?

If you use progress lines to display progress information, you can display progress lines for the status date, current date, or regular intervals. To be sure that progress lines are shown correctly, choose **File** > **Options** > **Advanced**, and scroll to the **Calculation options for this project** section. (In Project 2007, choose **Tools** > **Options** > **Calculation**.) Select the **Edits to total task % complete will be spread to the status date** check box. This setting ensures that Project evenly spreads the work reported through percentage complete up to the status date. Then, when you display progress lines, the progress lines reflect the likely progress of work on any given date.