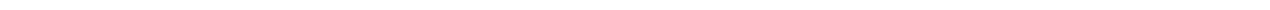




# Earned Value Management with Microsoft Project 2019

A Practical Guide with Examples from the  
Construction Industry

Published by [TacticalProjectManager.com](http://TacticalProjectManager.com)



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# Chapter 1

## Introduction

Efficient planning plays a pivotal role in the success of any project. Projects face various types of risk during the execution phase and timely response to these risks saves projects significant time and cost.

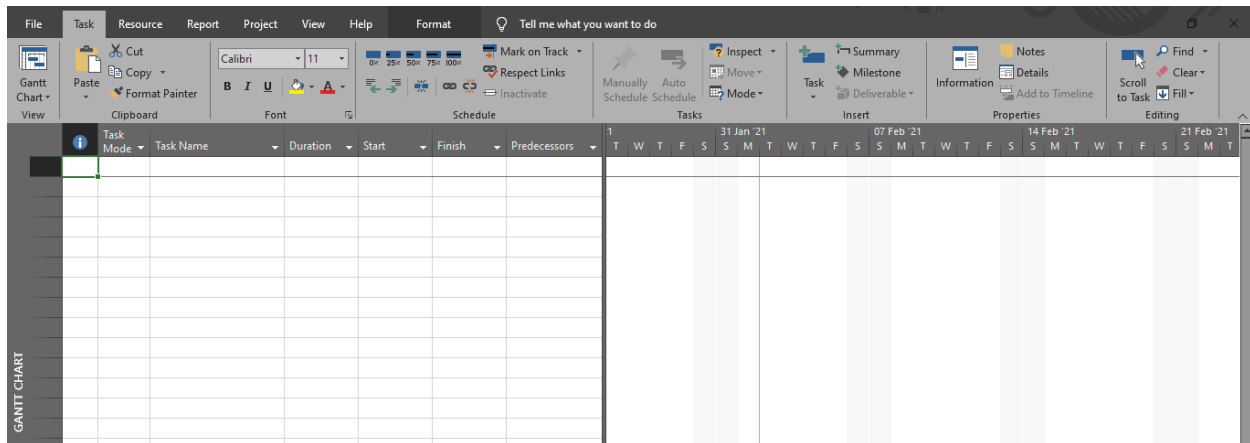
Earned Value Management (EVM) is the technique that helps the project manager with planning, taking timely action against risks and improving the project performance. EVM is known as "management with the lights on" because it helps the project manager see the project's current and forecasted performance by looking at the project metrics, generated by EVM. Another essential feature of EVM is that it integrates the three pillars of project management: schedule, scope, and cost.

Instead of having to use any external software for Earned Value Analysis (EVA), we can use Microsoft Project for EVM analysis. Microsoft Project uses all formulas related to EVM analysis so there is no need to memorize any formula for the computation of any EVM components.

This guide will show you how to use Microsoft Project 2019 to prepare the construction schedule and EVM. Preparing a proper schedule helps in effective project monitoring and controlling. In the guide, we will create a construction schedule from scratch, which will be used later for the EVM report creation. This guide will help provide an understanding to those who not only wish to learn about scheduling, but also EVM. Follow the steps described in the various following sections to create a schedule and perform EVM analysis.



When we open a blank project in Microsoft Project, we can see the screen splits into two parts, as shown in figure 1. The sheet's left side shows the table columns/fields, whereas the sheet's right side shows the blank space for the Gantt Chart.



**Figure 1 Microsoft Project Screen**

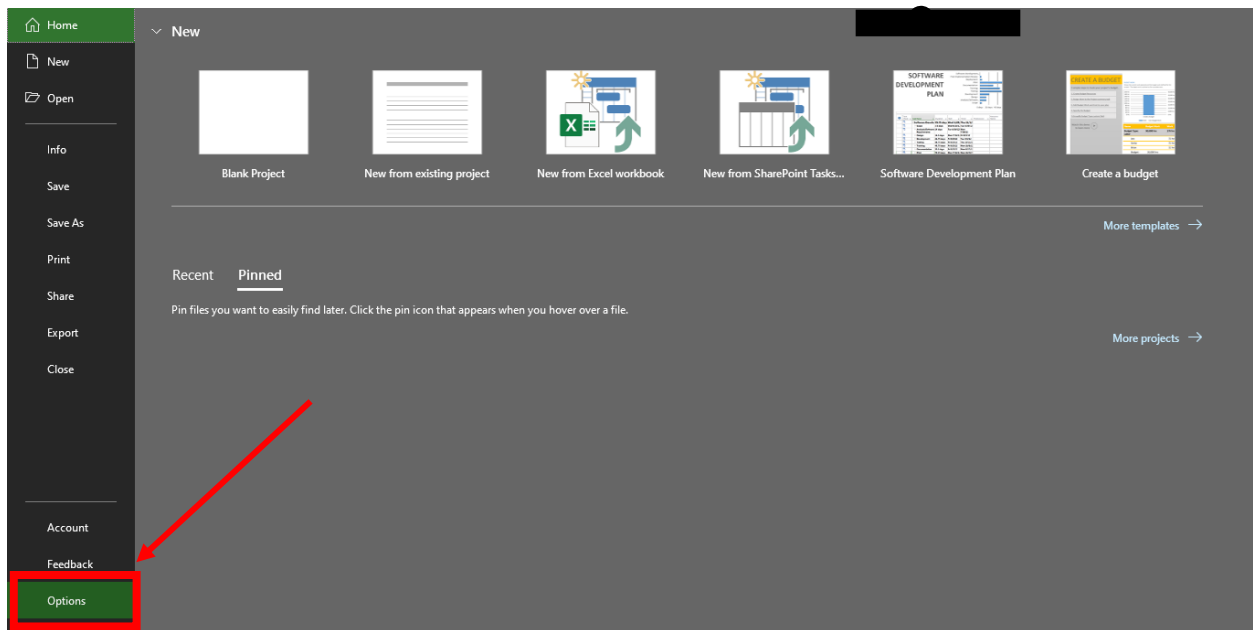
The Microsoft Project professional settings are dependent on the project requirements, and we can tweak the project according to the project requirements. Before preparing this project schedule, we altered the Microsoft Project settings.

### Setting the Project under Options Menu

Before creating the new project schedule, set Microsoft Project's options to meet project requirements, leaving those you do not wish to alter as the default value settings. Within this example, we made significant changes in the project *Schedule* tab of the *Options* dialogue box.

The first thing to do is to set the project calendar. The project calendar must remain consistent for a project; otherwise, we will encounter problems with EVM. Let's start with general calendar settings.

- To do this, we click the *File* tab button on the top left corner of the Microsoft Project screen.
- After clicking on the File tab, open the *Options* tab located at the bottom left side, shown in the green box in figure 2.

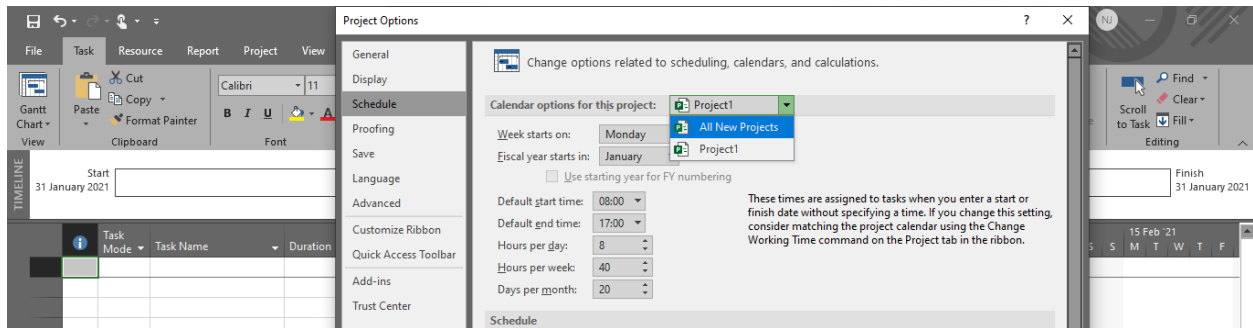


**Figure 2 Options Tab**

- Click on the *Options* button.
- Herein, we can see the Project Option dialogue box.

### **Calendar Option for the projects**

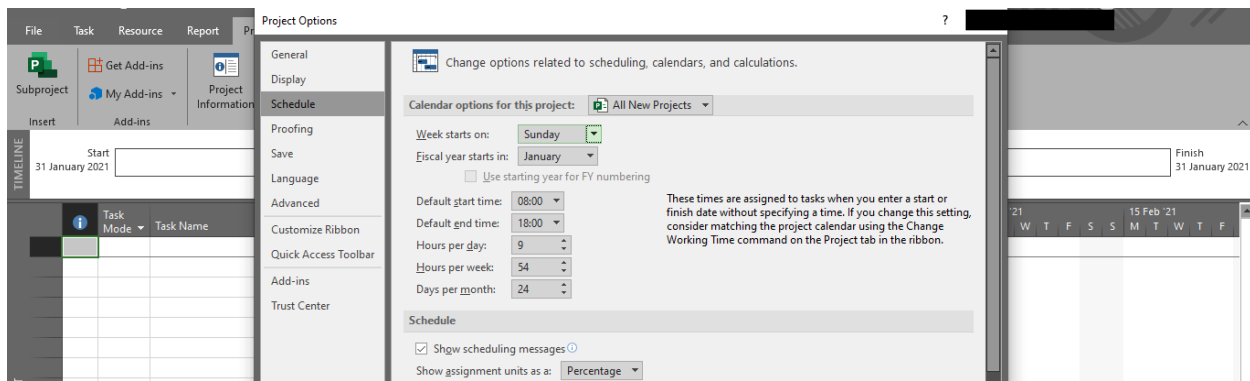
- Click on *Schedule* tab on the left before setting the general calendar settings for a particular project.
- We made the same calendar settings for all of the projects, as shown in figure 3.
- Thus, we select *All New Projects*. This way, all new projects have the same calendar settings.



**Figure 3 Calendar options for All New Projects**

### Default Day and Hour Settings

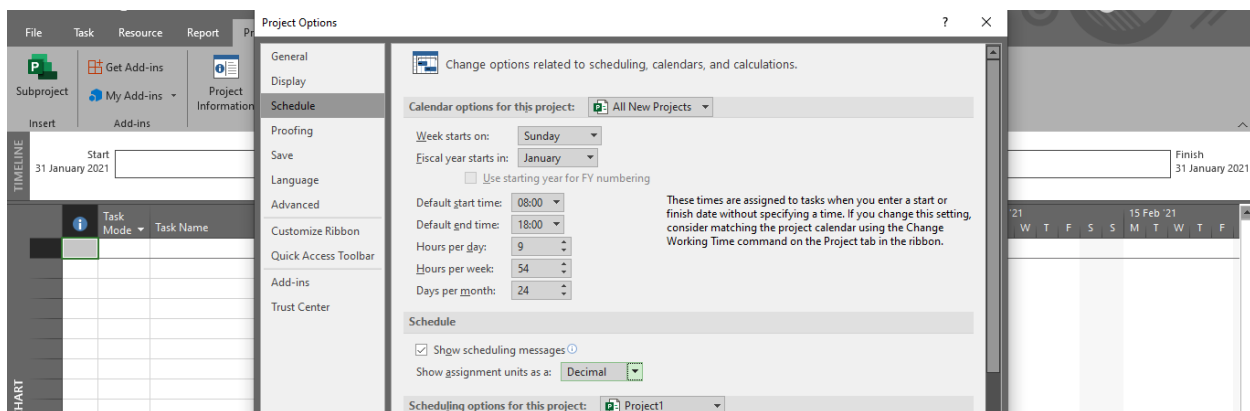
- Now, Let's begin with the working days or hours.
- This project assumes that work will start on Sunday and the fiscal year starts in January.
- We set 9 hours per day as working hours. So, let's assume the work starts at 8:00 and ends at 18:00.
- The default start time matches our scenario, so no change is required here. In contrast, we adjusted the default end time to 18:00 because we are planning to work for 9 hours, starting at 08:00.
- Accordingly, we adjusted the hours per day to 9 hours/day from the default 8 hours/day.
- Each day has 9 hours, and each week has six days. So, our total weekly working hours will be 54 hours.
- Days per month depends upon the month. We entered our estimated value here. We assume that each month will be four weeks and update the working days per month equivalent to 24 days/month (6 days x 4 weeks).



**Figure 4 Setting Days and Hours**

## Schedule

- I ticked the "Show scheduling messages" box as it will help determine any Microsoft Project schedule inconsistencies.
- Below this, we have an option for our resources. We can either select the percentage or decimal option as shown in figure 5. For example, if any task requires three workers and a percentage option is selected, we need to assign 300% of this resource to this task. And if the decimal option is selected, we enter 3 instead of 300%.



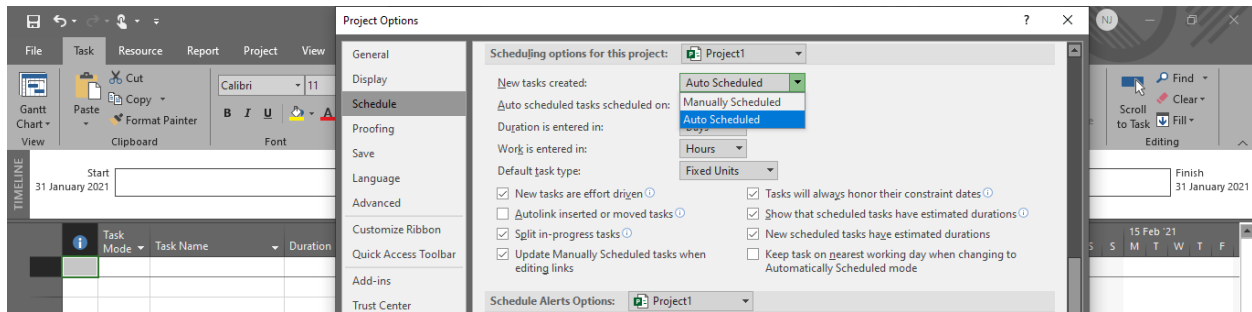
**Figure 5 Schedule Message and Assignment Units**

## Scheduling Option for this Project

- Firstly, changed the "New task created" option from 'Manually Schedule' to 'Auto Schedule', for our schedule to become dynamic.
- We added the duration in days and work in hours. Duration defines the time, in calendar days, required to complete the project work.

- We changed the default task type to 'Fixed Units'.
- We ticked the 'New tasks are effort driven' box as it was unticked.

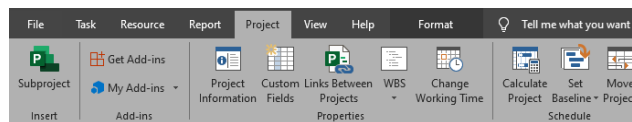
Default task type and new tasks are effort-driven because they affect the calculation of Microsoft Project.



**Figure 6 Scheduling options for this projects**

## Setting the Project under Project Menu

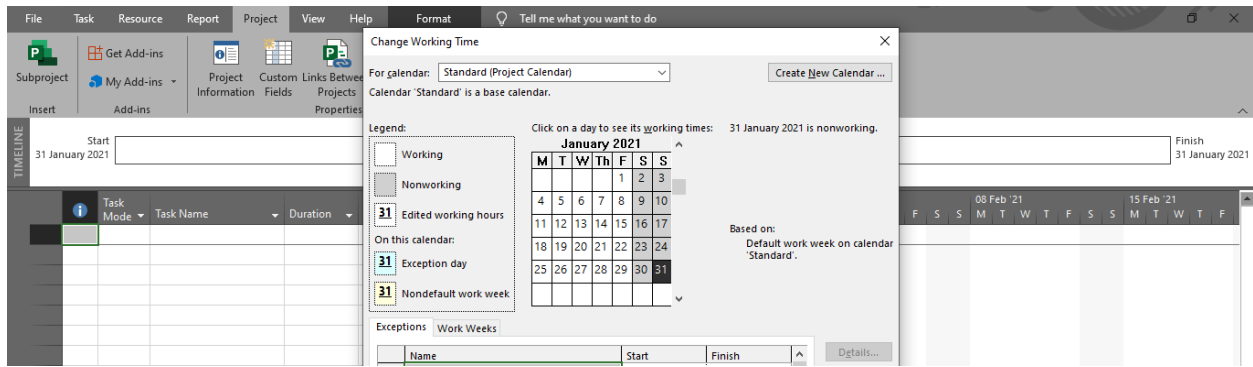
In the project setting, we adjust project settings according to the project requirements. These settings help with calculations. To change these settings, click on the Project tab located on the top ribbon, as shown in figure 7.



**Figure 7 Setting Project Calendar**

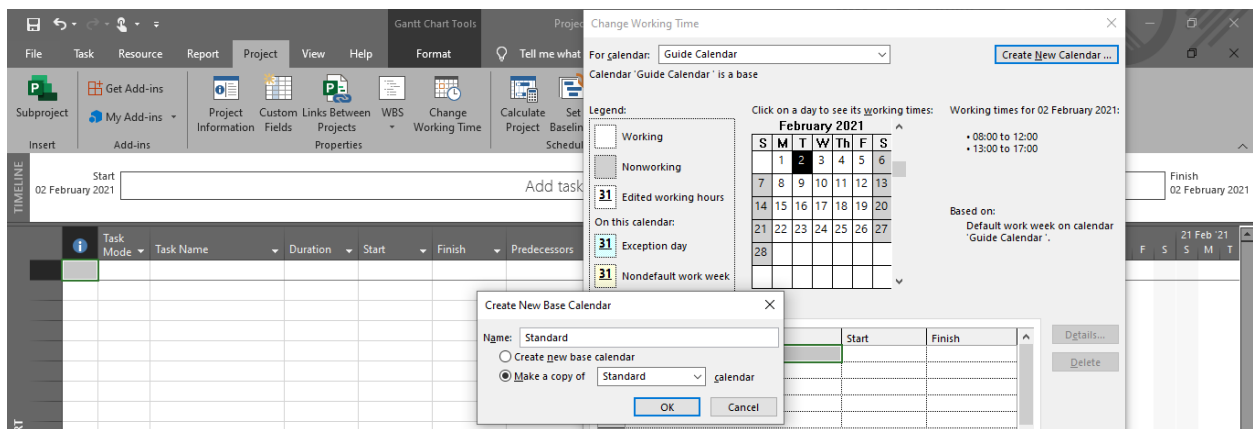
## Change Working Time

- We will select 'Change Working Time' which located inside the Properties group.
- A new window will pop up, as shown in figure 8.
- In this change working time dialogue box, we will set the setting to meet the specific requirements of our project. In this dialogue box, we will put working days in a week, public holidays, and vacations.



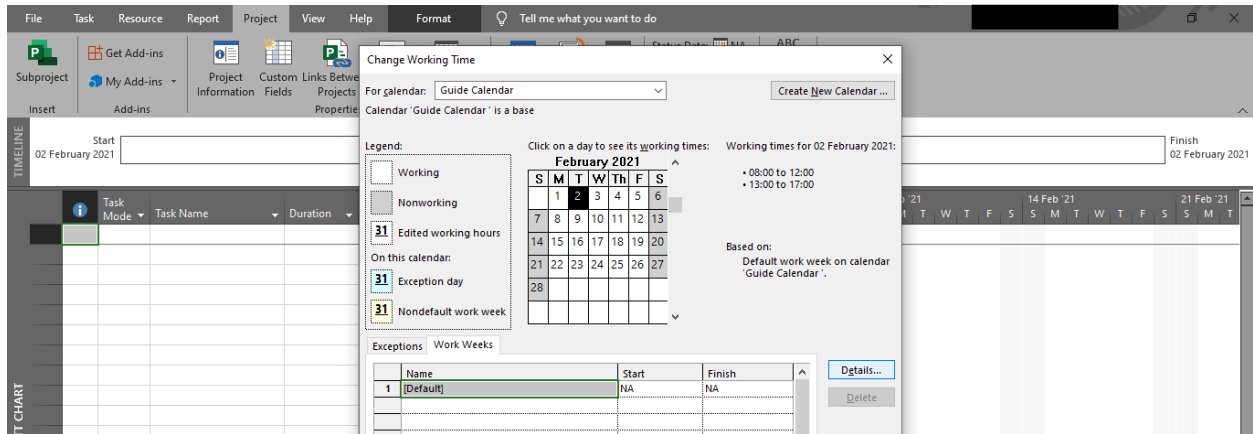
**Figure 8 Change Working Time**

- First, we will set the Calendar specific to our project.
- In the upper right corner, we will click 'Create New Calendar'. Now, let's name the new calendar. For our example, we named it "Guide Calendar".



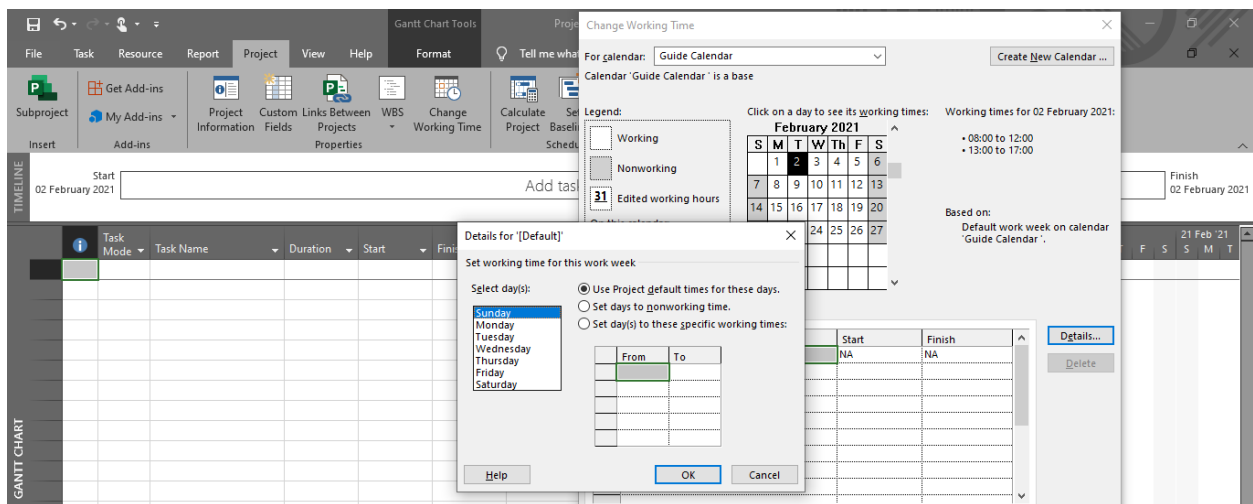
**Figure 9 Create New Base Calendar**

- In the create new base calendar dialogue box, select the "Make a copy of *standard* calendar".
- This will allow us to start creating our calendar using the standard calendar.
- Now, we hit the OK button to create our new calendar.
- Above, we can see the name of our new calendar, Guide Calendar. Now, we can start inputting specific settings for our project.
- Let us set the working days and hours.
- To do so, click on the workweeks tab as shown in figure 10.



**Figure 10 Setting Work Weeks**

- Then, click on the detail button shown on the right side of the work weeks table.
- A new dialogue box for Details for '[Default]' will open.



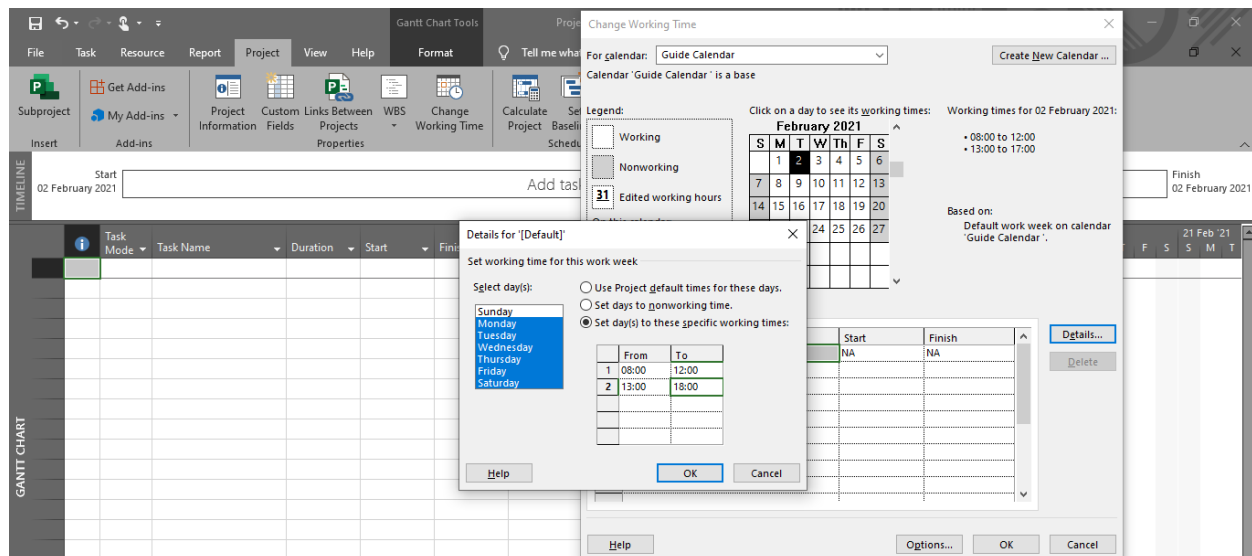
**Figure 11 Default Working Time in a Week**

In the figure above, we can see the default calendar settings. These show that from Monday to Friday the working hours will be from 8:00 to 12:00 and then 13:00 to 17:00. Therefore, the total working hours will be 8 hours. Between Monday and Friday, we observe a working hours pattern however this differs for Saturday and Sunday. Saturday and Sunday represent non-working days because they have no working hours and are therefore days off.

In our example, we adjusted working hours from 8:00 to 18:00, including a 1-hour lunch break between 12:00 and 13:00, which is equivalent to 9 working hours per day. Secondly, we altered the weekend working-hours to state that we would work full time i.e., 9 hours, on Saturdays also. Sunday remains a day of no work. The steps below show how we made these changes.

*Note: values in the table should be the same as the values we entered in the schedule under the options menu. If the values are different, we will not get the correct calculations or will get undesired results.*

- To change the working hours per day, click on the required day(s) within the left hand-side table.
- After selecting the days, check the "Set day(s) to these specific working times" option. Then we can edit daily working hours.



**Figure 12 Adjusted Working Time in a Week**

- We change the working times for Monday. We will start the work from 8:00 to 12:00, followed by an hour break from 12:00 to 13:00. Then we will again perform the work from 13:00 to 18:00. Instead of changing the working hour for the rest of the days one by one, we select all the days from Monday to Saturday, check the

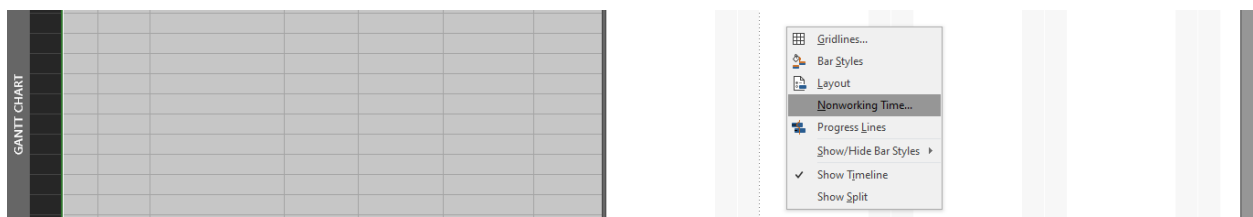


option of "Set day(s) to these specific working times," and change the working timings accordingly.

- Let's click on the OK button below and exit this dialogue box.
  - Again, click the OK button below and exit the "change working time dialogue box."
- Now, we have completed our calendar settings.

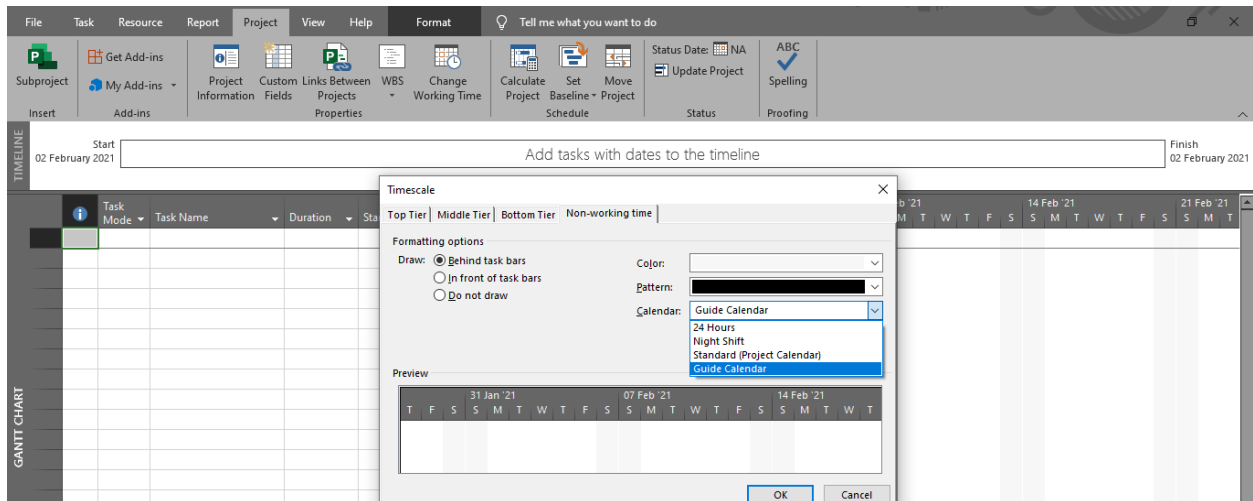
### Assigning Calendar to Gantt Chart

- When we looked at the Gantt chart, we found two vertical grey strips for Saturday and Sunday. These vertical grey strips represent non-working days. So, to set this vertical only for Sunday right click on the Gantt chart area, a dialogue box will pop up.
- Select non-working time from the dialogue box.



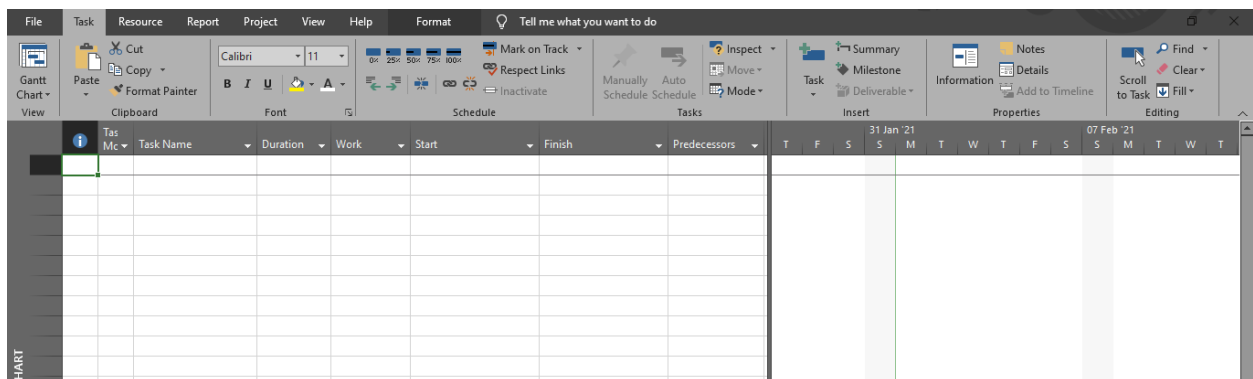
**Figure 13 Assigning calendar to Gantt Chart**

- Select the non-working time tab from the pop-up window and change the calendar from standard to guide galendar (or whatever your personalised calendar has been named).



**Figure 14: Changing Calendar for Gantt Chart**

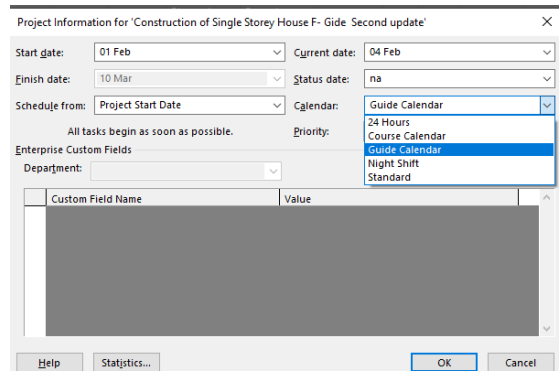
- After clicking the OK button, we will return to the main screen. Now, we can see only one vertical grey strip which represents Sunday.
- Sunday is represented by grey as it is a non-working day.



**Figure 15 After Changing the Calendar for Gantt Chart**

### Assigning Calendar to Project

- Now, let's assign the calendar to the project. To do so, select the project tab from the ribbon.
- Select the "Project Information" button inside the Properties group.
- In the calendar field, we are selecting our Calendar: "Guide Calendar" from the drop-down menu. Now, we have assigned the required calendar to our project. Hit the OK button and return to the main page.



**Figure 16 Assigning Calendar to Project**

## Chapter 2

### Creating Work Breakdown Structure

We have set our project settings. Now, we will work on the project's work breakdown structure (WBS). WBS helps to understand the project efficiently.

- Considering the construction of single storey house as a project for this hypothetical project, we assumed a four-level WBS structure as shown below:
  - Foundation Work,
  - Construction Work,
  - Electrical and Plumbing Work, and
  - Backfilling and Landscape Work.

Let's see how to create WBS of a new project in Microsoft Project.

- To do this, we click on the first row of the Task name Column and start to write the elements of our WBS.
- We start with Excavation Work; after entering the Excavation work, Duration, Start, and Finish values pop up automatically.

- Duration seems to be one day with a question mark at the end. The question mark shows that Microsoft Project has assumed duration by default. Since we are creating our WBS elements, we don't need to do anything with the question mark now. Therefore, we create other WBS items such as construction work and backfilling and landscape work.

Task ID	Task Name	Duration	Start	Finish	Predecessors
1	Foundation Works	1 day?	02 February	03 February	
2	Construction Work	1 day?	02 February	03 February	
3	Electrical and Plumbing Work, and	1 day?	02 February	03 February	
4	Backfilling and Landscape Work.	1 day?	02 February	03 February	

**Figure 17 Creating WBS**

## Setting up Activities

After entering the four-level WBS items, we will add our activities. In this part, we will enter only the name of the activities.

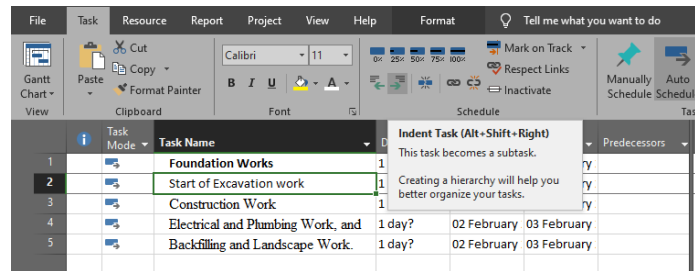
- Let's enter the first activity under the WBS heading of Foundation Works. To do this, right-click on the first row under the Foundation Work, and the drop-down list will pop up.
- Select the Insert Task option from the drop-down menu.

Task ID	Task Name	Duration	Start	Finish	Pred
1	Foundation Works	1 day?	01 February 2021	01 February 2021	

**Figure 18 Insert Task under WBS**

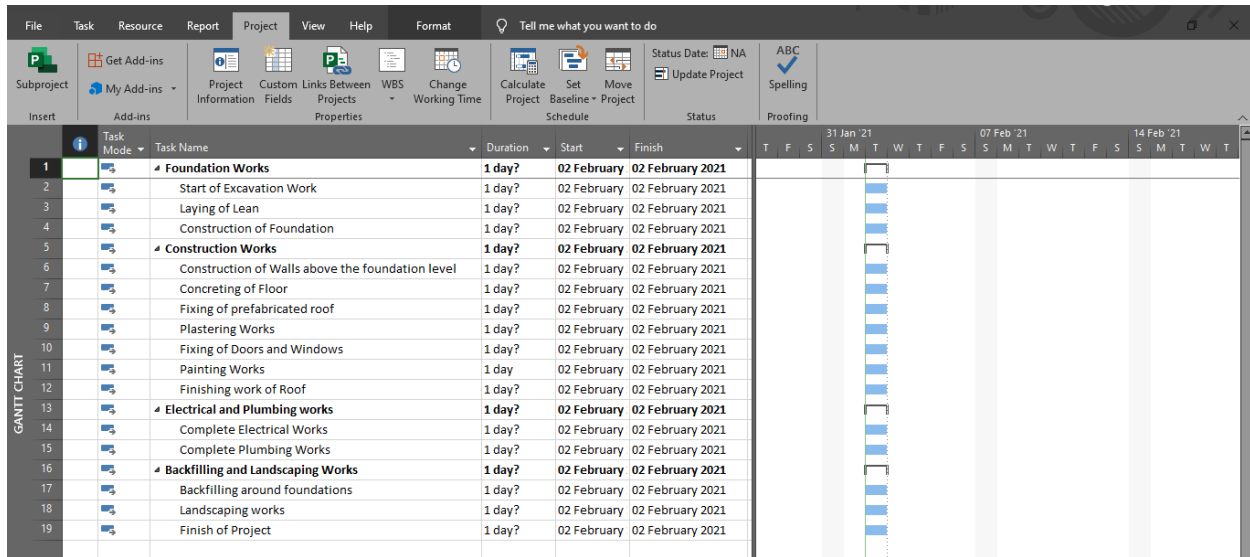
- Change the activity name. To do this, click on the < New Task > under the Task Name column and rename it, we renamed ours Excavation Work. Press Enter after renaming the activity. The other way to add the task is to directly click the Task button shown in the Insert menu under the Task tab.

- As we can see, the WBS heading and task activity are on the same level. Since it is an activity under this group, it can not be on the same level. Instead, it should be at the next level, so we indent the activity.
- To indent the activity, first, select the activity row you wish to be lowered a level before clicking on the indent task button shown under the Schedule group of the Task tab.



**Figure 19 Indent Activity under WBS**

- As we click on the indent task button, the WBS task will become bold, becoming a group rather than an activity. With excavation work becoming the first activity within this group.
- We add wall construction, concreting of floor, plastering, door and window installation, painting and roofing works under the construction works group.

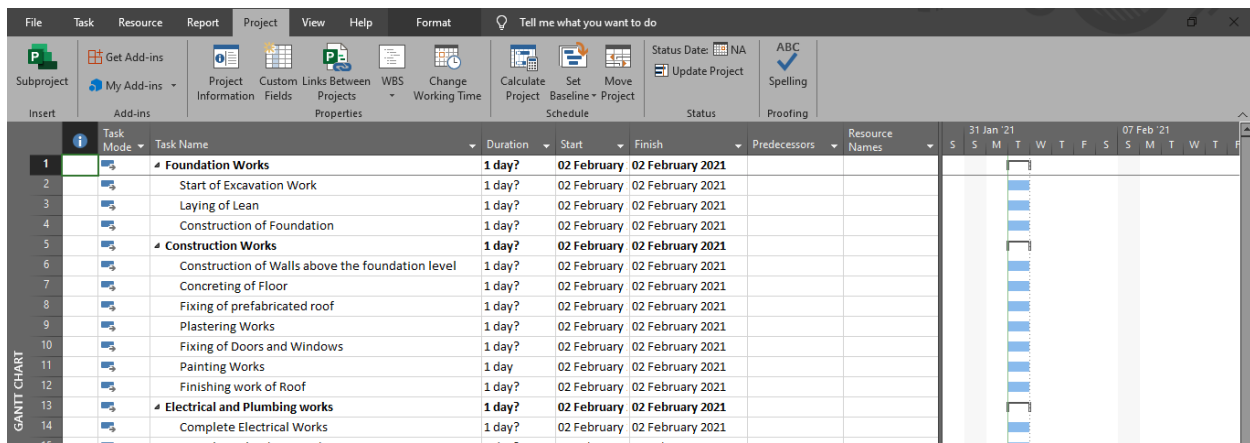


**Figure 20 Inserting all the Activities under WBS**

## Setting up Dependencies in among the Tasks

We have successfully added the project activities in the last section. Now we will develop the relationships between the activities.

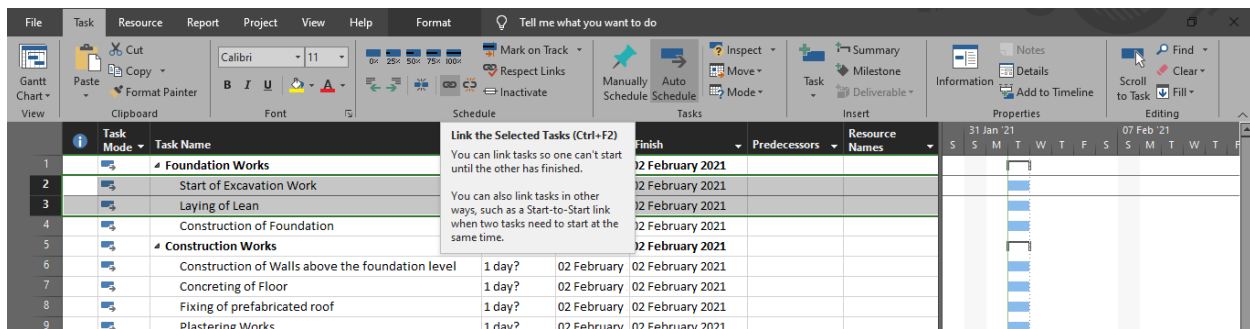
- First, we need to expand the table to see more columns. Directly after the Finish column, we can see the predecessor column.



**Figure 21 Showing Predecessor and Resource Name Column**

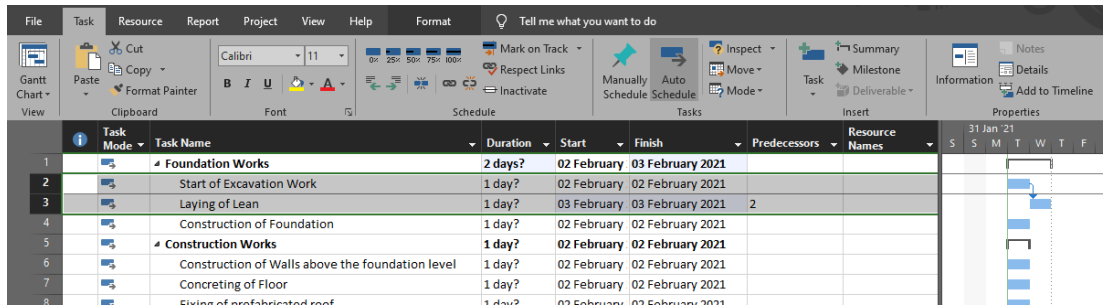
- Linking the activities will depend upon the condition or type of the project. We can have the following types of relationships between the activities.
  - Finish to Start Relationship: Activity X will start when we finish the Activity Y.

- Start to Start Relationship: Activity X and Activity Y will start simultaneously with or without lag.
- Finish to Finish Relationship: Activity X and Activity Y will finish simultaneously with or without lag.
- Start to Finish Relationship: Activity X will complete when the Activity Y begins.
- Now, we will develop the connection between the activities. We will select the activities that need to be linked. To select the two activities simultaneously, we will choose the first activity, and by using the Ctrl button, we choose the second activity. After selecting both activities, we will click on the Link button shown in Schedule properties under the Task menu.



**Figure 22 Linking the Activities**

- Pressing the Link button, we can see '2' will appear in the predecessor column for the Laying of Lean activity. It means that the activities Start of Excavation Work and Laying of Lean are linked together with the FS relationship.
- In the Gantt Chart, we can see a Finish to Start relationship between the activities Start of Excavation Work and Laying of Lean. It means that the Laying of Lean will start after the completion of Excavation Work.
- We can also see that the start and finish dates of these activities are also changed. The first activity will start on 2nd February and end on 2nd February since the second activity will start on 3rd February and end on 3rd February.

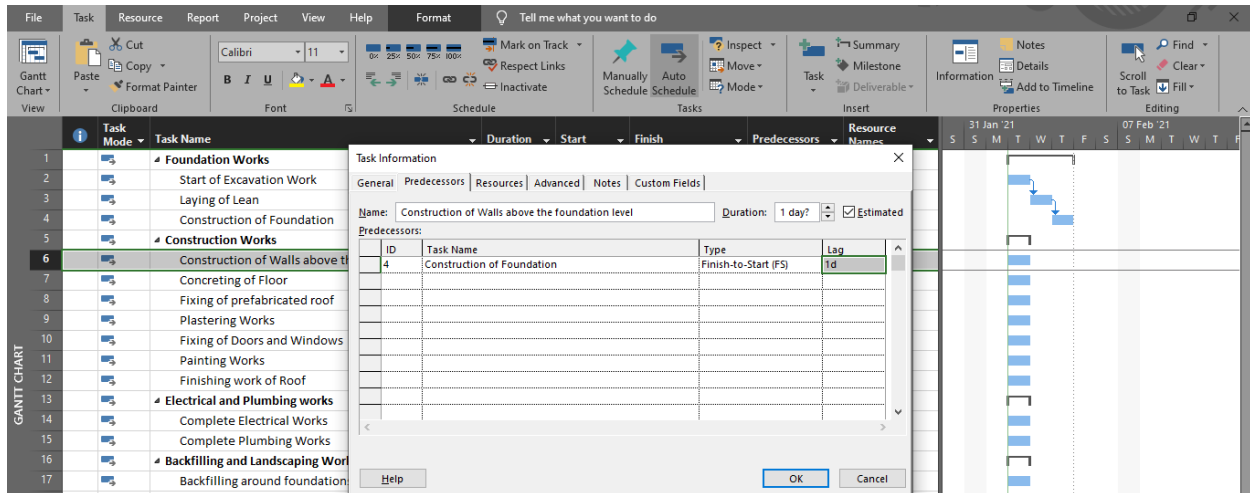


**Figure 23 Finish to Start Relationship between the Activities**

Double-clicking on any activity is another way of linking the activities.

- When we double click on any activity, the Task Information box pop up.
- In this Task Information dialogue box, we will click on the Predecessor tab. We can see the Task Name; moving our cursor to the first row, a small black triangle will appear.
- Click on the small black triangle because it has all the project's activities. When we select the activity, Microsoft Project automatically fills the ID column.
- Task name will be filled automatically. We can also change the type of relationship and the lag period between the activities.





**Figure 24 Inserting activities through Dialogue box and Adding Lag between activities**

- By following the steps mentioned above, we will link all our activities. Again, the type of link between activities depends on the type of resources we have or the project/activity type.

## Entering the Working Hours

In the previous section, we developed the relationship between the activities. Now, in this section, we discuss working hours for the respective activities. There is a difference between the Duration and Work. Duration is the time in calendar days required to complete the task. Work refers to the effort required to complete the job. For example, a task requires two laborers and three days (one day has nine hours) to complete the task. The task's duration is three days, whereas the task's effort requires 54 working hours (3days\*9hours\*2people) or six workdays.

- First, we add the work column right behind the predecessor column. To add the work column, we extend the table by dragging the vertical line to the right. Add a new column field will be seen at the extreme right corner of the table. By clicking on add new column, we select Work from the drop-down list.
- Another way to add the Work column is to right-click on the column next to the duration column. When a drop-down menu pops up, select the Insert Column option from this drop-down menu. Find the Work column and click on it.

- After assigning Work resources to the activities, Microsoft Project calculates the working hours.

	Tas Mc	Task Name	Duration	Work	Start	Finish	Predecessors
0		Construction of Single Storey House	33 days	855 hrs	01 February 2021	10 March 2021	
1		Received approved Drawings from the Architect	0 days	0 hrs	01 February 2021	01 February 2021	
2		Foundation Works	6 days	117 hrs	01 February 2021	06 February 2021	
3		Start of Excavation Work	3 days	27 hrs	01 February 2021	03 February 2021	1
4		Laying of Lean	1 day	36 hrs	04 February 2021	04 February 2021	3
5		Construction of Foundation	1.5 days	54 hrs	05 February 2021	06 February 2021	4
6		Construction Works	23 days	585 hrs	09 February 2021	06 March 2021	
7		Construction of Walls above the foundation level	3 days	108 hrs	09 February 2021	11 February 2021	5FS+1 day
8		Concreting of Floor	1 day	36 hrs	12 February 2021	12 February 2021	7
9		Fixing of prefabricated roof	3 days	81 hrs	17 February 2021	19 February 2021	8FS+3 days
10		Plastering Works	3 days	135 hrs	20 February 2021	23 February 2021	9
11		Fixing of Doors and Windows	4 days	108 hrs	25 February 2021	01 March 2021	10FS+1 day
12		Painting Works	4 days	108 hrs	02 March 2021	05 March 2021	11
13		Finishing work of Roof	1 day	9 hrs	06 March 2021	06 March 2021	12
14		Electrical and Plumbing works	5 days	45 hrs	12 February 2021	17 February 2021	
15		Complete Electrical Works	2 days	18 hrs	12 February 2021	13 February 2021	7
16		Complete Plumbing Works	3 days	27 hrs	15 February 2021	17 February 2021	15
17		Backfilling and Landscaping Works	3 days	108 hrs	08 March 2021	10 March 2021	
18		Backfilling and Landscaping Works	3 days	108 hrs	08 March 2021	10 March 2021	13

**Figure 25 Work Hours for each activity**

## Project Summary Task

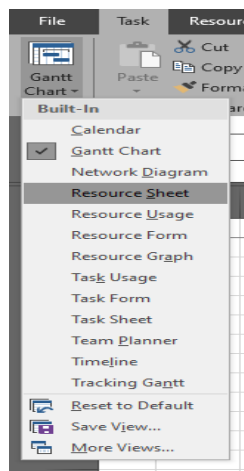
- We can see the work hours required to complete the activities in each activity group, but we don't know the total work hours needed to complete the project. To view the entire works hour required to complete the project, follow the below steps.
- Click on the File tab, select Options.
- Click on Advanced settings
- Scroll down and find the Display option for this project.
- Check the show Project Summary task
- Then Click OK
- Now we can see our Project Summary task at row 0. We can see the total Duration of our Project, Start, Finish, total work hours required to complete this project.
- We can also change the name of the project shown in the table. To do this, double click on the project name displayed in the summary task and a writing cursor will appear. Change the name of the project, we changed ours to Construction of Single Storey House.
- Click enter.

## Chapter 3

### Setting up Resources

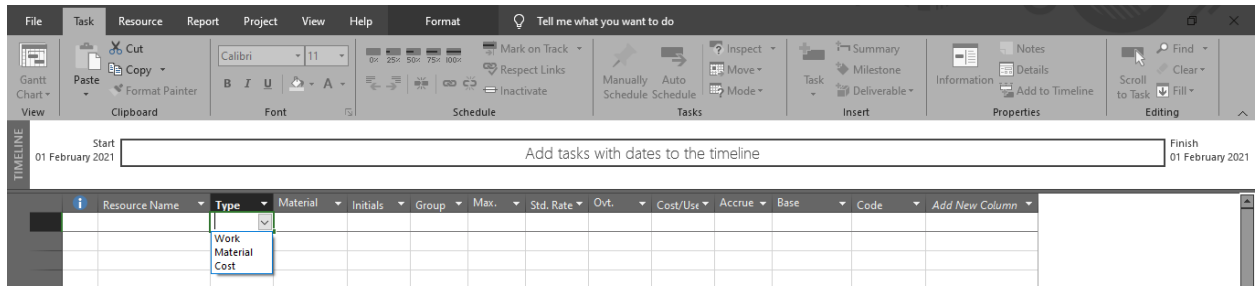
In the previous section, we entered the work hours for each activity and set up our project resources. A resource is something that is required to complete the task/project.

- We can add resources by changing the Gantt Chart view to the Resource Sheet view.
- To do this, click on the Gantt Chart shown at the top left corner of the Task tab.
- We will get a drop-down list of available views. Select the Resource Sheet from the drop-down list.



**Figure 26 Open Resource Sheet**

- In the resource sheet, click on the Type button.
- We can see three types of resources Material, Work and Cost



**Figure 27 Resource Type**

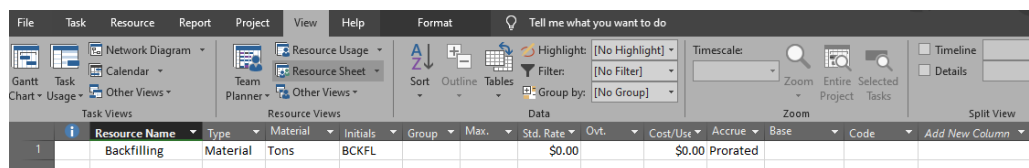
*A work resource is a person, a team, or a piece of machinery or equipment that consumes time while working on a project. Therefore, we define labor, equipment, or machinery resources as a work type.*

*Material Resources are the resources that an activity consumes during its execution, like concrete, steel, etc.*

*Cost is a fixed cost associated with the resources. Costs such as travel expenses or rental of equipment are some examples of cost resources.*

## Material Resource

In the resource sheet, click on the first row Resource Name Field and type your resource name, and press enter. All the remaining columns will be filled automatically by default.



**Figure 28 Change it to Material Item Adding the Resource**

We start entering our resources from Backfilling. Since Backfilling is the material resource, so we change the Type from work to material. We measure backfilling material in Tons, and the initials of backfilling material are BCKFL.

We will continue to do this with all resources, as shown in figure 29. Concrete is the material resource, so we change the Type from Work to Material. In Material,

we will add the units of the material. The concrete is measured in cubic meters, so under the material label, we write M3. In the Initials column, we entered Con as a concrete abbreviation.

Similarly, we add brick as a material resource. We assume a pallet of bricks has 1,000 bricks. The Material Label of Bricks will be in thousands, and the "000s" value represents thousand value. For example, we need 10,000 bricks, so; we will write only 10 of this resource because each pallet has 1000 bricks. In the Initials column, we will write BCK as the abbreviation.

Backfilling	Material	Tons	BCKFL		
Concrete	Material	M3	CON		
Bricks	Material	000s	BCK		
Doors	Material	Single	DR		
Window	Material	Single	WD		
Prefabricated roof	Material	Lumpsum	PrRf		

**Figure 29 Material Resources**

## Work Resource

- Microsoft will not allow filling the Material label field because it is not a material resource.
- Suppose we use an excavator for the excavation work. So, excavator is a work resource. We will use EXC as an initial for excavator.
- We will state the maximum units within the Max. column. We assume only one excavator is required for excavation work as a resource.
- Similarly, we add all other work resources, for example, concrete labour, mason, roof labour, etc.

File

Task

Resource

Report

Project

View

Help

Format

Tell me what you want to do

Network Diagram

Calendar

Other Views

Resource Usage

Resource Sheet

Other Views

Team Planner

Other Views

Task Views

Resource Views

Sort

Outline

Tables

Highlight:

Filter:

Group by:

[No Highlight]

[No Filter]

[No Group]

Timescale:

Zoom

Entire Project

Selected Tasks

Timeline

Details

Split View

Resource Name

Type

Material Label

Initials

Group

Max.

Std. Rate

Ovt.

Cost/Use

Accrue

Base Calendar

Code

Add New Column

1

Excavator

Work

EXC

1

\$50.00/hr

\$70.00/hr

\$0.00

Prorated

Guide Calendar

2

Concrete Labour

Work

CON LB

4

\$20.00/hr

\$30.00/hr

\$0.00

Prorated

Guide Calendar

3

Mason

Work

MAS

4

\$15.00/hr

\$25.00/hr

\$0.00

Prorated

Guide Calendar

4

Roof Labour

Work

RF LB

3

\$30.00/hr

\$45.00/hr

\$0.00

Prorated

Guide Calendar

5

Electrical Subcontractor

Work

ELT

5

\$50.00/hr

\$60.00/hr

\$20.00

Prorated

Guide Calendar

6

Plumbing Subcontractor

Work

PLU

5

\$45.00/hr

\$55.00/hr

\$20.00

Prorated

Guide Calendar

7

DW

Work

DW FX

3

\$20.00/hr

\$30.00/hr

\$0.00

Prorated

Guide Calendar

8

Painting Subcontractor

Work

PNT

3

\$35.00/hr

\$45.00/hr

\$30.00

Prorated

Guide Calendar

9

Plastering Sub Contractor

Work

PLS

4

\$25.00/hr

\$35.00/hr

\$0.00

Prorated

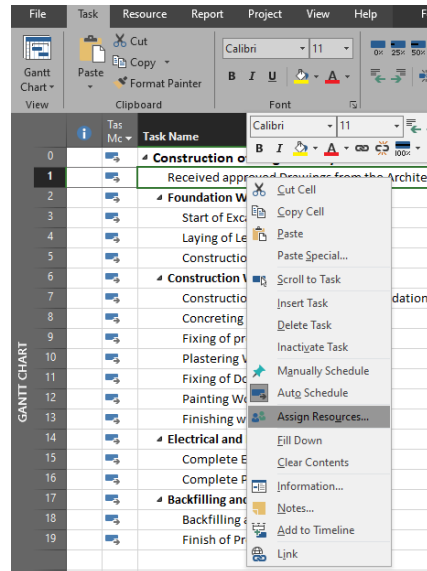
Guide Calendar

**Figure 30 Work Resources**

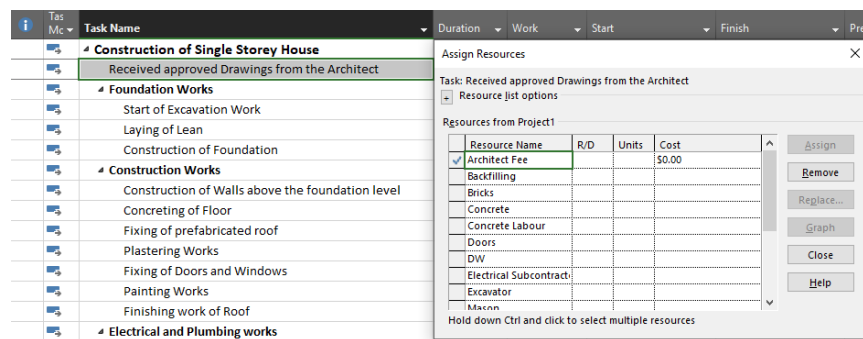
## Assigning Resources

In the last section, we determined the resources of our project. In this section, we will assign resources to our assumed project activities. To do this, first, we follow the following steps.

- Right-click on the activities
- Select the Assign Resource from the drop-down list. A new Assign Resources dialogue box will open having all the resource names.

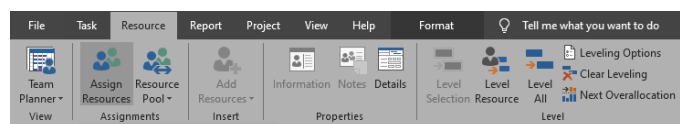


**Figure 31 Assigning Resources through the drop-down list**



**Figure 32 Assigning Resources Dialogue Box**

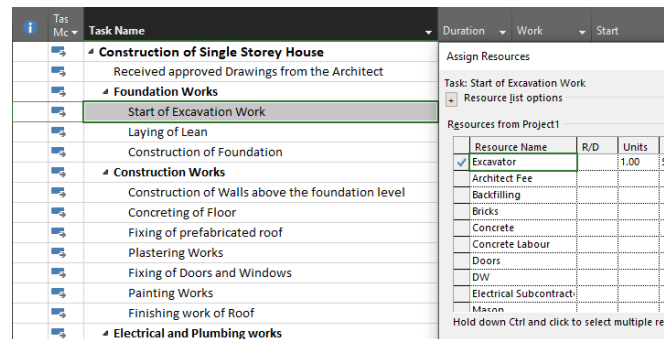
- Or we can directly click on the Resource ribbon shown at the top.
- When the resource tab is open, click on the Assign resources button in the ribbon's Assignment group, and the dialogue box will open.
- We will use this dialogue box while assigning the resources.



**Figure 33 Assigning Resources through Resources ribbon**

- We want to allocate the excavator to the excavation activities. To do that, we will find the Excavator from the Assign Resources dialogue box.

- Select the Excavator and press the assign button.

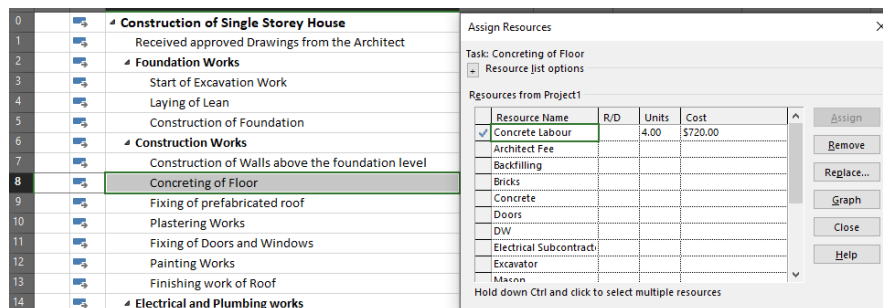


**Figure 34 Resource Assignment Dialogue box**

- As you can see, the Excavator is assigned to the Excavation work.

*Note: We don't need to open and close the assign resources dialogue box while assigning resources to various activities. It will remain open until we close it.*

- Assign resources to Concrete Work
  - Assign the concrete labour shown in the assign resources dialogue box to 'Concreting of Floor'. We will follow the same steps for each task discussed earlier.
  - We assigned two concrete workers for the concreting work. So, we changed the unit's value from 1 to 4.



**Figure 35 Assignment of Concrete Labour Resource**

- When any resource is assigned to the activity, you can notice a small tick mark before the Resource Name.



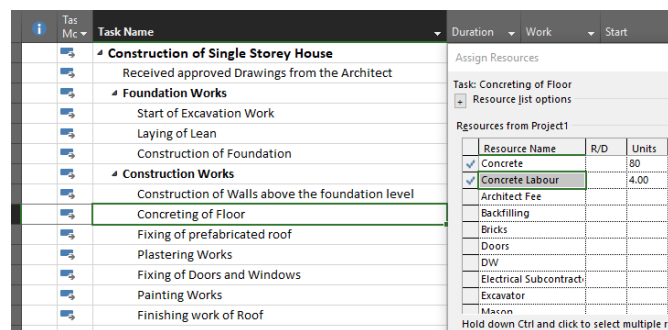
While Assigning resources, we should remember the maximum units for each Work Resource. We should not assign the resources more than its maximum amount mentioned in the resource sheet. If we exceed the maximum number of resources, the Red Human figure will appear before the Task Name as an indicator.

- We will follow the same steps while assigning the resources to the rest of the activities.

## Assign the Material Resource

We have assigned work resources to our activities. Now we will allocate Material Resources to our Activities.

- Right-click on the activities and select assign Resources from the drop-down list.
- The assign resources dialogue box will open.
- To assign concrete to concreting floor task:
  - Select Concreting of Floor from the table and select the concrete from the assign resources dialogue box.
  - Change the concrete units from 1M3 to 100 M3.



**Figure 36 Assignment of Material Resource**

- Assign Bricks for the construction of the wall.
  - Select the construction of wall activity from the table and select the Bricks from the Assign Resources dialogue box.
  - Change the Bricks units from 1 to 50.
- Assign Backfilling material

- Select the Backfilling activity from the table and select the Backfilling Material from the Assign Resources dialogue Box.
- Change the backfilling material from 1 to 1000 Tons.

We will follow the same steps for the remaining resources.

## Costs

We have created the Resources and assigned the resources to our project's activities. Now, we will learn how to assign a cost to resources.

- Open the Resource Sheet.
- Right-click on the Gantt Chart shown below the File Tab and select the drop-down menu's resource sheet.
- Let's assume one cubic meter of concrete costs us \$30/M3. We will use Std. Rate column for entering this value. The overtime rate for all the activities is assumed zero.
- Similarly, we enter costs for all the Resources.

	Resource Name	Type	Material	Initials	Group	Max.	Std. Rate	Ovt.	Cost/Use	Accrue
1	Excavator	Work		EXC			\$50.00/hr	\$70.00/hr	\$0.00	Prorated
2	Concrete Labour	Work		CON LB			\$20.00/hr	\$30.00/hr	\$0.00	Prorated
3	Mason	Work		MAS			\$15.00/hr	\$25.00/hr	\$0.00	Prorated
4	Roof Labour	Work		RF LB			\$30.00/hr	\$45.00/hr	\$0.00	Prorated
5	Electrical Subcontractor	Work		ELT			\$50.00/hr	\$60.00/hr	\$20.00	Prorated
6	Plumbing Subcontractor	Work		PLU			\$45.00/hr	\$55.00/hr	\$20.00	Prorated
7	DW	Work		DW FX			\$20.00/hr	\$30.00/hr	\$0.00	Prorated
8	Painting Subcontractor	Work		PNT			\$35.00/hr	\$45.00/hr	\$30.00	Prorated
9	Plastering Sub Contractor	Work		PLS			\$25.00/hr	\$35.00/hr	\$0.00	Prorated
10	Backfilling	Material		BCKFL			\$5.00		\$0.00	Prorated
11	Concrete	Material		CON			\$30.00		\$0.00	Prorated
12	Bricks	Material		BCK			\$450.00		\$0.00	Prorated
13	Doors	Material		DR			\$200.00		\$50.00	Prorated
14	Window	Material		WD			\$150.00		\$50.00	Prorated
15	Prefabricated roof	Material		PrRf			\$1,000.00		\$0.00	Prorated

**Figure 37 Costing of Resource**

## Adding the Cost Resource

Microsoft project has three types of resources, i.e., material, work, and cost. We have worked on material and work resources. Now, we will discuss the cost Resource. Some type of projects has a particular type of cost. Our project's Architect fee is a cost resource, and we can use this resource as a financial cost

associated with a project plan task. Cost resource doesn't do any work, and they have no effect on the scheduling of a task.

## **Chapter 4**

### **Assigning Baseline to a Project**

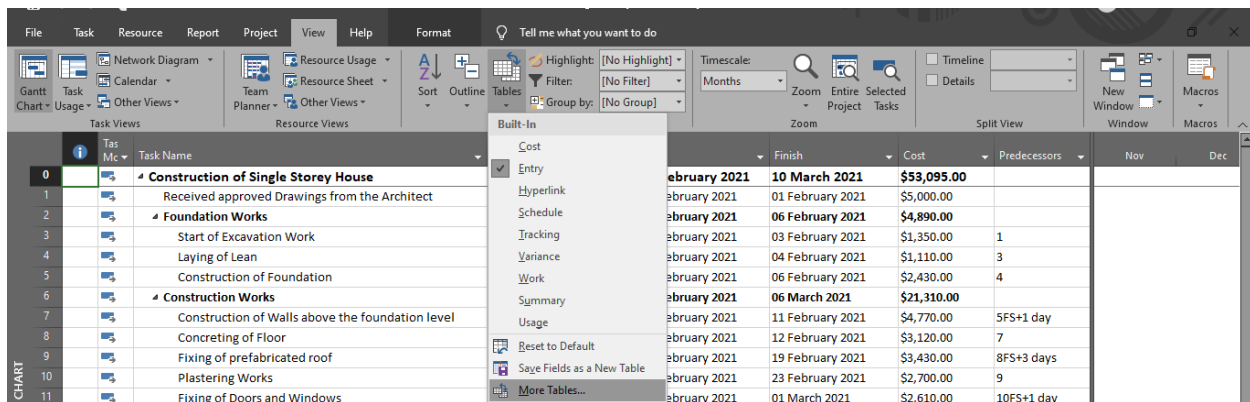
We have created our project schedule, assigned cost to resources, and then linked resources with the tasks. These are the preliminary requirements before effective monitoring of the project as well as for EVM analysis.

Now, we assume our project is just about to start, and we will need to track the activities; that is, we will need to compare the actual values with our planned values.

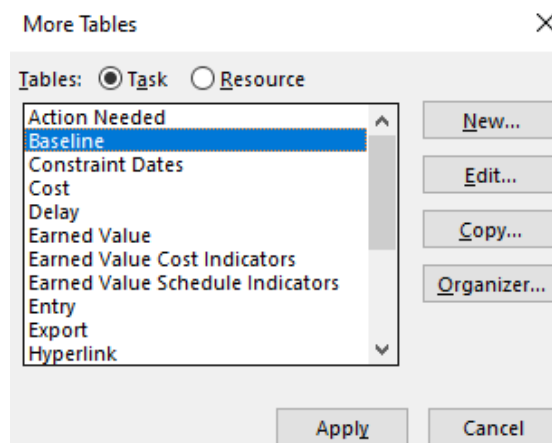
While we enter our actual values into the project schedule, the dates, durations, week hours, and the project's cost may be changed. If we don't reserve a copy of our original plan, we will not have any data for comparing values. Therefore, it is important to have a copy of our project schedule. We will need to copy the dates and the information about the resources as well as the cost of the tasks.

A baseline provides us a copy of our project plan. It copies the schedule, the resources, the work hour information and the original cost information. Therefore, we create the baseline before starting to track our project.

- Let's start and create the project baseline.
- To do that, we will click on the View tab ribbon shown at the top of the screen.
- In the Data group, click on Tables.
- The drop-down list will pop up, select More Tables.



**Figure 38 Assigning Baseline**

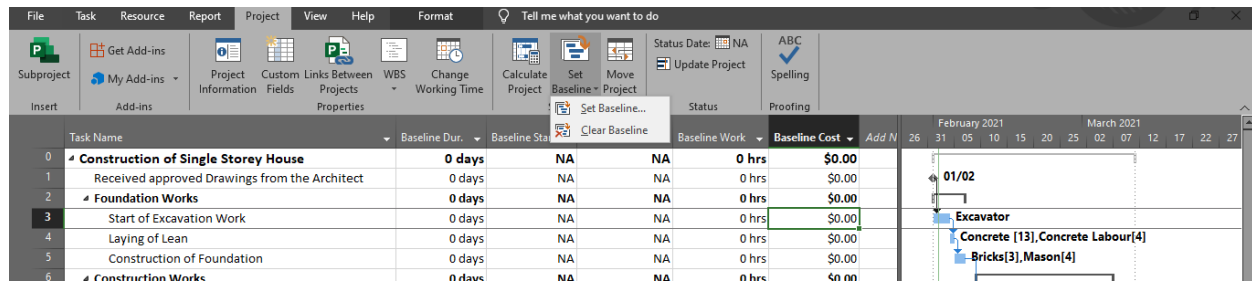


**Figure 39 Baseline Dialogue box**

- Now we will select baseline from the dialogue box then click on the apply button.
- The new Baseline table having baseline start, finish, work, and cost columns respectively will open.
- We haven't created our baseline yet, so we don't have any value inside the fields.
- Let's create the baseline and see what will happen.

## Create Baseline

- To create a Baseline, click on the Project tab.
- In the Schedule group, we will click on the Set Baseline button



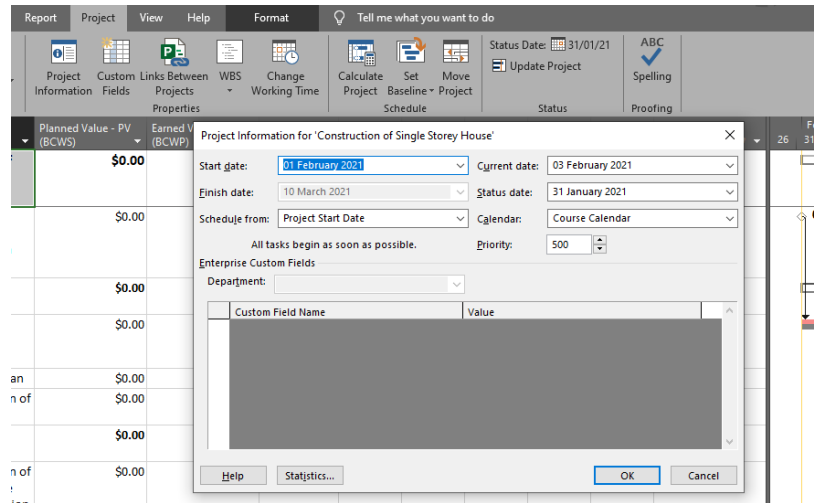
**Figure 40 Create Baseline**

- Now you can see we can not only create the baseline but also, we can clear any previously created baselines.
- To create a baseline, click on Set Baseline, and the dialogue box will open.
- We will select Set Baseline from here. We will choose a baseline.
- We want to create the baseline for the entire project. So, we checked it and clicked OK.

## Tracking the Project

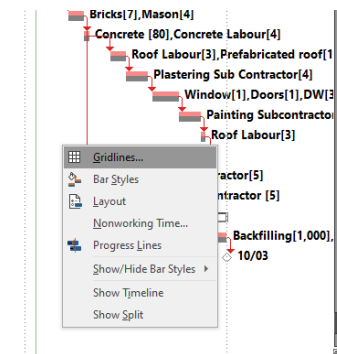
We have created our project plan. After that, we have created the Project Baseline of our Project. Now, we will do tracking of our project. As the project starts, we regularly check if everything is going okay or not. We will review the dates of the activities as well as the work hours and their costs. We will need to report the status of tasks and activities required in achieving the planned results. Tracking the project will be done according to the requirements of the project. For this example project, we will track the project weekly.

- Let's click on the Project ribbon shown above.
- Select the Project Information from within the properties field.
- As before, we use this Project Information dialogue box to determine the project Start Date.
- Now, we will focus on the current date and status date fields. When we track the project using Microsoft Project, we will enter the activities status up to the status date.



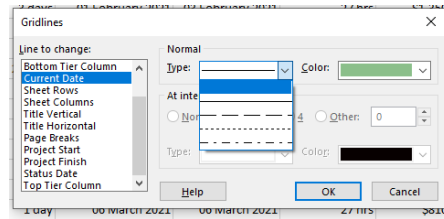
**Figure 41 Current Date and Status Date**

- By default, the green line represents the current date of the project. As discussed earlier, Microsoft Project, by default, shows the current date line, so let's hide this and show the status date line.
- Right-click on the Gantt Chart and then choose Gridlines from the drop-down menu.



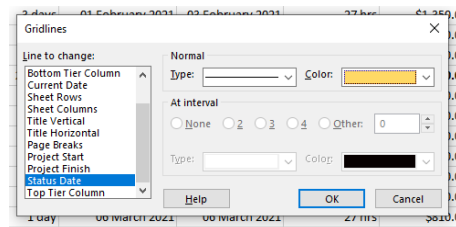
**Figure 42 Show Status Line**

- In the 'line to change' section, select 'current date' before selecting the first blank option from the drop-down Type list under the 'normal' heading. It will hide the current date line.



**Figure 43 Hide Current Date Line**

- Now, from the 'line to the change' section, select the Status Date. Then, under the heading 'Normal', click on the Type drop-down list and select the line as well as the Colour.



**Figure 44 Set Status Date Line**

- Click the OK button. Now we can see the Status Dateline.



**Figure 45 Showing the Status Yellow Line**

## Chapter 5

### Why EVM

There are many various advantages associated with Earned Value Management (EVM) that help the higher management understand the current performance of the project. Using EVM, a project's future performance can be predicted by analyzing the EVM metrics. EVM also helps project managers to take timely action to avoid any risk associated with project delay or cost overrun. Some of the crucial attributes are given below.

- EVM gives overall performance of the project in numerical terms. These numbers help the project manager to take timely action to avoid delay and disruption in project completion.
- Dealing with numbers is more manageable and better than dealing with dates. Earned value view in Microsoft Project uses numbers rather than dates.
- Project plan monitoring at any level (summary/activity) of a project is simple using Earned Value Analysis (EVA).
- Customer satisfaction is improved because progress is provided to a customer and sponsor periodically in a status report.
- Forecasting the effort and time required to complete the remainder of a project gives a clear picture of how a project is likely to end (e.g., with/without schedule/effort overruns).
- Forecasting the efficiency parameters required to complete a project on time and under budget gives a project manager a heads-up about conducting team meetings.
- Trends in effort/schedule parameters indicate to a project manager if serious action needs to be taken or if a subtle discussion of the situation in a team meeting will suffice. Managing trends in variances is another way to monitor a project and keep it on track.



- EVA is produced by plotting three performance measures (earned value, planned value, and actual cost).

## **EVM in Microsoft Project**

EV is a robust feature in Microsoft Project that helps in project tracking and monitoring in terms of numbers. EVM metrics help project managers to analyze the current progress of the project, amount spent and how much time and money we need to complete the project. EVM values provide valuable insight into the actual situation of the project.

Microsoft Project provides the tools to perform EVM and predict the health of the project. Microsoft Project enables us to measure planned and actual project performance and costs by using the EVM tool. In this section, we will briefly discuss EVM terms like PV, AC, EV, SPI that we will use in Microsoft Project.

Before implementing the EVM, we need to complete the following steps

### **Work Breakdown Structure**

WBS is an important aspect of project planning and monitoring. Ensure that you create a deliverable oriented WBS so that tracking is easy, and issues may be resolved quickly. Typically, a deliverable oriented WBS has the project at the top-most level followed by deliverables or activities. Tasks or activities under WBS must be logically scheduled/linked, there are no dangling activities (all the activities have logical predecessor and successors) and the critical path is identifiable. The next step is to assign the duration to the lowest-level tasks.

### **Creating Resources**

The next step in creating a schedule is setting up the resources used in Microsoft Project. Work, material, and cost resources for the project are created in the Resources tab of Microsoft Project.

### **Assigning Cost to Resources**

After creating the resources, the cost is assigned to the various resources created in the resources sheet. After assigning the cost to resources, we will assign the resources to the various activities.

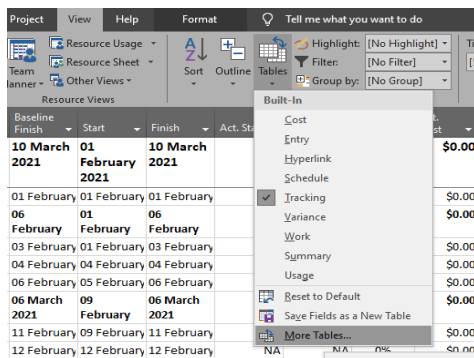
## The Baseline of the Project

When the resources are defined and assigned to tasks, we will make a baseline of the project. This baseline will help to compare the planned and actual/current progress of the project.

## Adjustments in EVM table of Microsoft Project

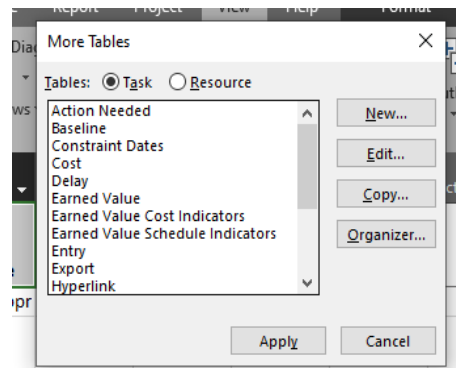
As discussed earlier, we have set up our project in Microsoft Project. We will now adjust the EV table because it will help analyze the project performance at one glance. To do this, we will follow the following steps.

- Before using this table for analysis, we must ensure that we have assigned all our resources and costs to our project. Secondly, we must ensure we have set our Project Baseline. Thirdly, we must ensure we have started our project so that we can add actual data to the project.
- We will adjust our Gantt Chart view for EVM analysis.
- In Microsoft Project, there are some tables dedicated to EVM.
- Click on the View ribbon and select the Tables from the Data menu.
- A drop-down list will appear; select More Tables from the drop-down list.



The screenshot shows the Microsoft Project interface with the 'View' ribbon selected. The 'Tables' dropdown menu is open, displaying a list of built-in tables. The 'More Tables...' option at the bottom of the list is highlighted. In the background, a portion of the project table is visible, showing columns for 'Baseline Finish', 'Start', 'Finish', and 'Act. St.' with dates like '10 March 2021' and '01 February 2021'.

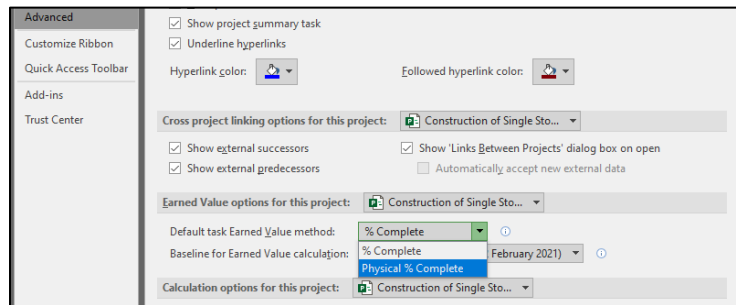
**Figure 47 Show Earned Value Table**



**Figure 46 Earned Value Table**

- Let's select the Earned Value table.
- There are two percentages in Microsoft Project for tracking the project. The first one is % complete, and the other one is physical % complete. % complete is about duration, whereas physical % complete tells how much physical work is done.

- If you are not familiar with PV, EV, and AC values, hover your cursor over the EV field, and the definition of EV will appear.
- Microsoft Project uses the percentage complete method for EVA by default. To change this, click File > Options > Advanced > Earned Value Options and change % complete to physical % complete.



**Figure 48 Setting Physical % Complete**

- Or there is a Shortcut of changing the % complete to Physical % complete.
  - Right-click on the PV field/column, and from the drop-down list, select insert new column.
  - Find Earned Value Method from the drop-down list.
  - Now Change the percentage complete to Physical Percentage complete and drag this down for all the activities shown in the figure.

Task Name	Earned Value Method	Physical % Complete	Planned Value - PV (BCWS)	Earned Value - EV (BCWP)	AC (ACWP)	February 2021	March 2021
0 Construction of Single Storey House	% Complete	0%	\$1,350.00	\$0.00	\$0.00		
1 Received approved Drawings from the Architect	% Complete	0%	\$0.00	\$0.00	\$0.00	01/02	
2 Foundation Works	Physical % Complete	0%	\$1,350.00	\$0.00	\$0.00		
3 Start of Excavation Work	% Complete	0%	\$1,350.00	\$0.00	\$0.00		
4 Laying of Lean	% Complete	0%	\$0.00	\$0.00	\$0.00		
5 Construction of Foundation	% Complete	0%	\$0.00	\$0.00	\$0.00		
6 Construction Works	% Complete	0%	\$0.00	\$0.00	\$0.00		
7 Construction of Walls above the foundation level	% Complete	0%	\$0.00	\$0.00	\$0.00		

**Figure 49 Setting Physical % Complete**

- After setting the physical % complete for all the activities, hide Earned Value Method column.
- We added the columns of physical % complete, baseline start and finish dates, actual Start, and finish dates in the EV Table before starting the EVA.

## Implementation of EVM in MP

In this section, we will discuss two examples (a) Construction of a Wooden Chair and (b) Construction of a single-storey house. Both the projects are created in Microsoft Project (MP). In each example, we have two scenarios.

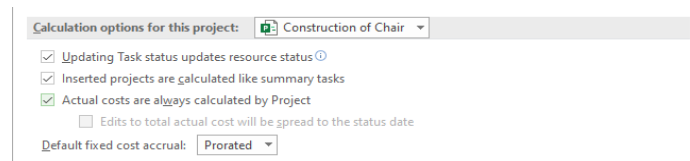
**Scenario 1:** Check - *Actual Cost Calculated by Project*

**Scenario 2:** Uncheck - *Actual Cost Calculated by Project*

### Example (a) - *Actual Cost Calculated by Project*

Let's begin with scenario 1 when the AC is Calculated by the project. In this scenario, we assumed that the project is not affected by ground realities, for example, currency conversion rates and other adjustments that affect the AC.

To allow Microsoft Project to calculate the AC itself, follow these steps, go to File → Options → Schedule and check the box "Actual costs calculated by Project."



**Figure 50 Check the Actual Cost Calculated by the project**

We have assumed the Construction of a Wooden Chair as a generic project. This project will help us to understand the EVM in Microsoft Project better. The total working days for this project are 11 days and the working hours for this project are 117 hrs. We have assumed five resources for this project. The resources are shown under the Resource Names column in front of each activity. Purchase of raw material, cutting of wood, finishing of chair, and dispatching of chair falls on the critical path, whereas task making of chair falls on the non-critical path. If the activities that fall on the critical path are delayed, then the project will be delayed.

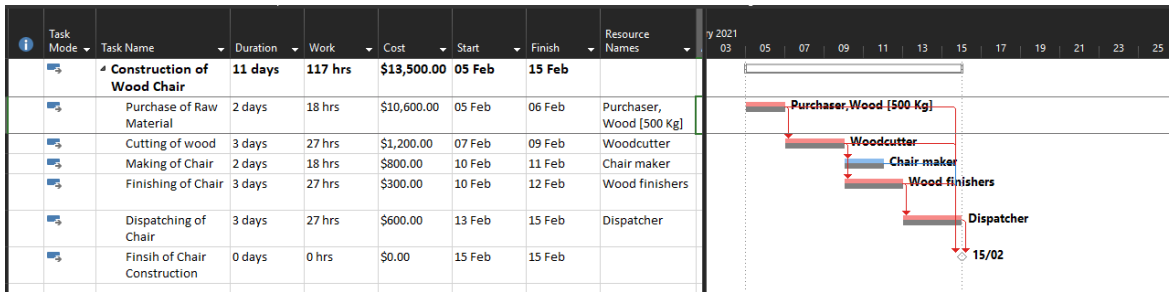


Figure 51 Construction of Wooden Chair

- Let's open the EV Table for the Generic example (View → Tables → More tables → Earned Value)

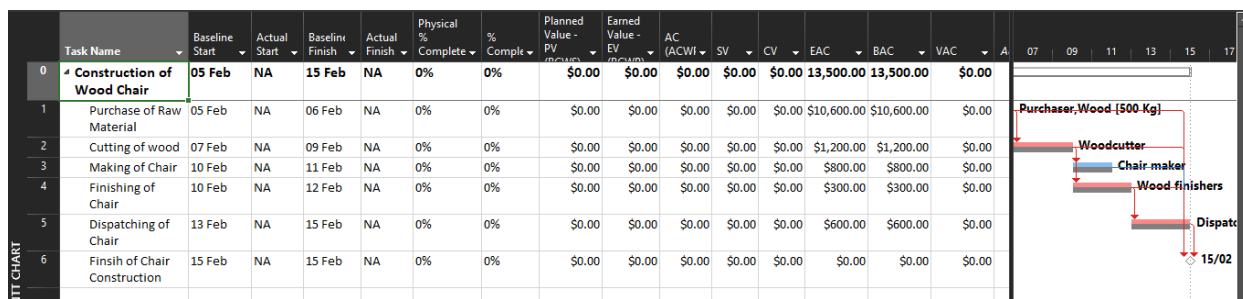


Figure 52 Earned Value Table

## Update 1

Current Date: 8<sup>th</sup> February

Status Date: 7<sup>th</sup> February

The generic project starts on 5<sup>th</sup> February and ends on 15<sup>th</sup> February. We are planning to update the project after every three days. In the first update, the project's current date is 8<sup>th</sup> February, whereas the status date is 7<sup>th</sup> February.



</

**Figure 55 Earned Value table after 1st update**

## Baseline / Actual Start and Finish dates

The baseline takes a snapshot of all the project activities and helps in project monitoring and reporting. When we track the project, we enter the actual start and finish dates of the project activities. While tracking, it is important to enter each task's actual data so we can compare the actual and planned performance of the project.

## % Complete

Purchase of raw material: For % complete, we update the project up to the status date, after entering the actual start and finish dates. Microsoft Project automatically calculates the % complete from the actual start and finish dates. Purchase of raw material under the % complete column is 100% complete.

Cutting of wood: For % complete, we update the project up to the status date, after entering the actual start and finish dates. Microsoft Project calculates cutting of wood under the % complete column is 33% complete up to the status date.

## Physical % Complete

Purchase of raw material: For physical % complete, we assumed that purchase of raw material is 100% physically complete up to the status date.

Cutting of wood: For physical % complete, we assumed that cutting of wood is 20% physically complete up to the status date. We are lagging in this activity by 13%. Its means that if the corrective measure is not taken, our project will be delayed.

### **Planned Value**

PV refers to the total cost that should have incurred up to now, looking at the tasks that should have been completed by today, and valued at the original budget. You would say: "According to the project schedule, we should have completed THESE tasks. The value of these tasks in original valuation amounts to \$X in planned value".

At any point in time, planned value (PV) defines the work that should have been accomplished. The PV is pinned with the baseline start and finish dates.

Purchase of raw material: The actual start and finish date of purchase of raw material is the same as baseline start and finish dates. It means that project performance is on track. Purchase of raw material was two days long activity, having a PV equal to \$10600.

Cutting of wood: The actual start of cutting of wood is the same as the baseline start date. PV calculated by Microsoft Project is \$400, so we can interpret from the given information that the cutting of wood's PV is \$400/day.

### **Earned Value (EV)**

Earned Value (EV) is the value of the work that has been effectively completed so far, using your initial cost estimations as valuation factor and not the AC. In simple terms: EV is the money you should have spent for the work that was *actually* done. EV has pinned with physical % complete.

Purchase of raw material: We assume that up to the status date purchase of raw material is 100% complete. We entered 100% under the physical % complete column, and the Microsoft project will automatically calculate the EV. EV calculated by the Microsoft project is \$10600 up to the status date.



Cutting of wood: We assume that cutting of Wood B is 20% complete up to the status date. We entered 20% under the physical % complete column, and the Microsoft project will automatically calculate the EV. The Microsoft Project's EV is \$240 ( $\$1200 \times .20$ ) up to the Status Date. The physical % complete is 13% less than the planned EV, which means we are lagging behind the physical progress, and the project can be delayed.

### **Actual Cost (AC)**

The amount of costs effectively incurred up until now.

Purchase of Raw Material: We assumed that the project is on track in terms of time and cost, so the AC computed by Microsoft project is \$10600.

Cutting of wood: We assumed that the project is on track in terms of time and cost up to the status date, so the AC computed by Microsoft project is \$400.

### **Schedule Variance (SV)**

How far ahead or behind is the project? The SV is calculated as the difference between Earned Value and Planned Value, meaning  $SV = EV - PV$ . SV keeps your project on schedule and helps us to complete our project on time. SV lets us know if we are ahead of schedule or behind schedule in dollar terms.

Purchase of raw material: Schedule variance for the purchase of raw material is \$0. \$0 represents that planned cost and EV are the same up to the status date so, the difference is zero dollars.

Cutting of wood: Schedule variance for the cutting of wood is -\$160. -\$160 is the difference between the planned cost (\$400) and EV (\$240) up to the status date. The negative sign represents that we are behind schedule in terms of dollars.

### **Cost Variance (CV)**

Looking at the project right now, how far under or over budget is it? The Cost variance is calculated as  $CV = EV - AC$ . CV is a measure of a project's cost performance and deals with the project's cost baseline. CV gives information on whether we are over or under budget, in dollar terms.

Purchase of raw material: Cost variance for the purchase of raw material is \$0. \$0 represents that AC and EV are the same up to the status date so, the difference is zero dollars. It means we are under budget.

Cutting of wood: Schedule variance for the cutting of wood is -\$160. -\$160 is the difference between the AC (\$400) and EV (\$240) up to the status date. It means we are over budget.

### **Estimate at Completion (EAC)**

The amount of money necessary to complete the budget, factoring in money you have spent until now. In other words: How much money is required to complete the project. These metrics help us to understand whether we can complete our project within the approved budget or not.

Purchase of raw material: EAC for the purchase of raw material is \$10600. Microsoft project uses this formula for the computation of EAC.

$$(ACWP + (\text{Baseline Cost X} - BCWP)) / (EV/AC)$$

$$= (10600 + (10600 - 10600)) / (10600/10600)$$

$$= \$10600.$$

Baseline Cost X

It means consider the Baseline Cost up to the Status Date.

Cutting of wood: EAC for the cutting of wood is \$2000. We will use the same formula as mentioned above for the EAC calculation. By looking at the EAC metrics, we can say that we are over budget. We need an additional budget to compete for this activity.

### **Baseline Cost (BAC)**

This cost field is generated when we save the baseline or the total approved budget. It shows how much budget is required to complete this activity.

Purchase of raw material: BAC for the purchase of raw material is \$10600.

Cutting of wood: BAC for the cutting of wood is \$1200.

### **Variance at Completion (VAC)**

The predicted final cost variance (CV), assuming the project continues with the same pace and quality it has shown so far. VAC is a projection of the budget surplus or deficit. It is expressed as the difference between the BAC to the EAC. If the VAC is a positive integer, it means that the project is under budget. If the result is negative, then it means that the project will be over budget.

Purchase of raw material: VAC for the purchase of raw material is \$0. It shows we are under budget.

Cutting of wood: VAC for the cutting of #wood is -\$800. It means we are over budget we need additional resources to complete the task.

### **Schedule Performance Index (SPI)**

How far ahead or behind schedule is the project, expressed as a ratio of the overall project duration. Formula:  $SPI = EV / PV$ . An SPI of less than 1 indicates your project is behind schedule, whereas a value greater than 1 means you are ahead of schedule.

Purchase of raw material: SPI for the purchase of raw material is 1. It shows that the project is on track.

Cutting of wood: SPI for the cutting of wood is 0.6. It means that we are lagging behind the planned schedule performance.

### **Cost Performance Index (CPI)**

How far above or below schedule the project is in comparison with the total approved project budget.  $CPI = EV / AC$ .

Purchase of raw material: CPI for the purchase of raw material is 1. It shows that the project is under budget.

Cutting of wood: CPI for the cutting of wood is 0.6. It means that the project is over budget.

## Earned Value Graph for 1<sup>st</sup> update

In this section, we will look toward the graphical representation of our project. To see the visual presentation of EV, PV and AC follow the following steps.

- Click on Reports, shown at the top
- Select the Visual Reports from the Reports group
- Select the Earned Value Over Time Report
- Click View, an excel file will open. In the excel file, we can see the Earned Value Over Time graph

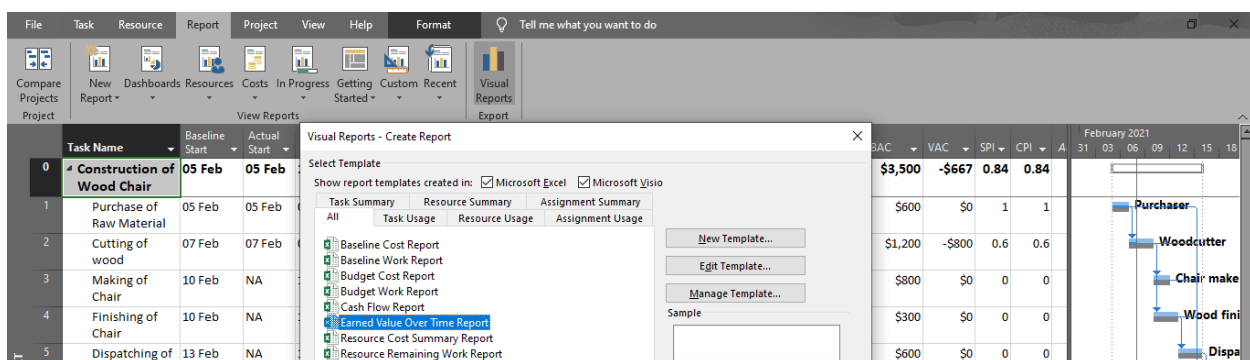
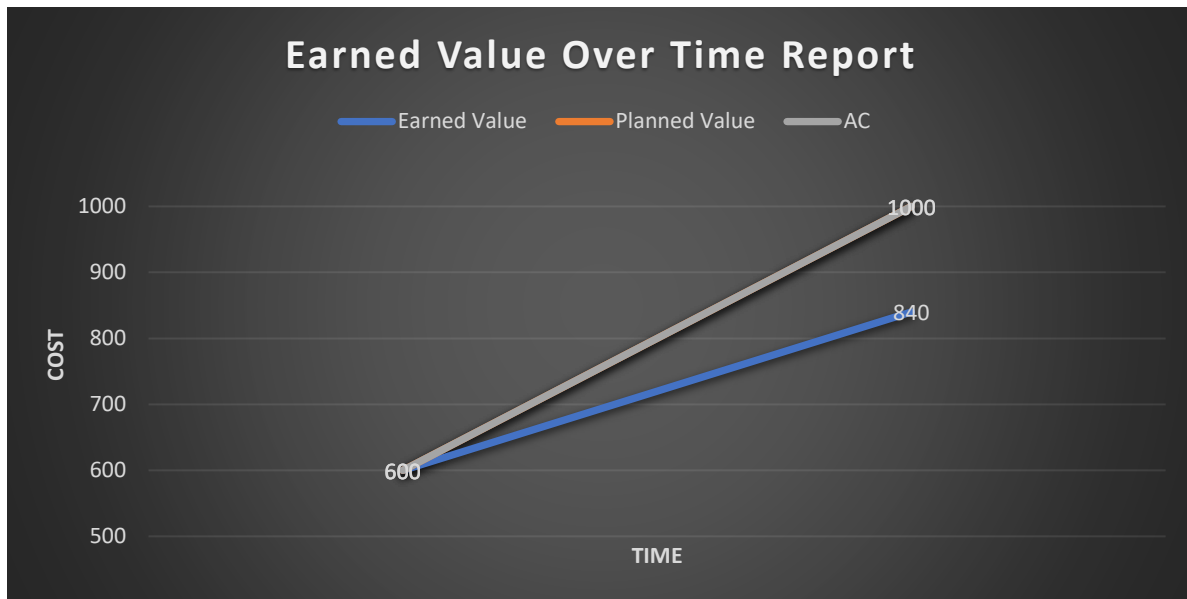


Figure 56 Earned Value Over Time

From the first update, we can see the following graph of EV. According to this graph, our EV is less than PV and AC. It means we are lagging behind schedule as well as the cost. PV is equal to AC in the 1<sup>st</sup> update; that is why we cannot see the PV.



**Figure 57 Earned Value Over Time Graph**

## Update 2

Current Date: *11th February*

Status Date: *10th February*

The 'Construction of a Wooden Chair' project was updated until 7<sup>th</sup> February. In the second update, the project's current date was 11<sup>th</sup> February, whereas the status date was 10<sup>th</sup> February.

The screenshot shows a 'Project Information' dialog box for the project 'Construction of Chair 2nd update'. The fields are as follows:

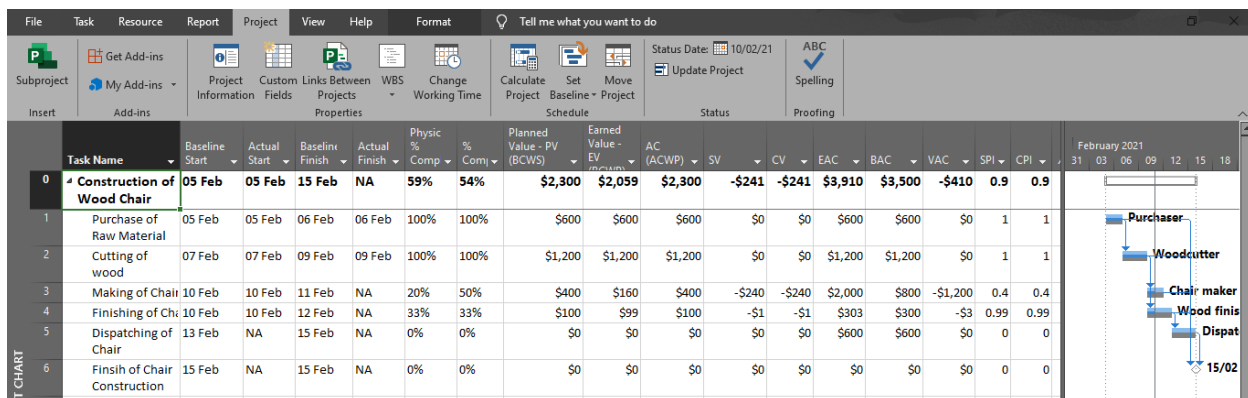
- Start date: 09 Feb
- Current date: 11 Feb
- Finish date: 15 Feb
- Status date: 10 Feb
- Schedule from: Project Start Date
- Calendar: Standard
- All tasks begin as soon as possible.
- Priority: 500
- Enterprise Custom Fields: Department (empty)
- Custom Field Name and Value table (empty)

Buttons at the bottom include Help, Statistics..., OK, and Cancel.

**Figure 58 Project Information for Construction of Wood Chair 2nd Update**

We will now add the actual start and finish dates of cutting of wood, making of chair, and finishing of chair activities. After entering the actual dates for cutting of wood, making of chair, and finishing of chair, we will manually add the physical %

complete for cutting of wood, making of chair, and finishing of chair. We will then update the project by using the update project dialogue box, as shown in the below figure. After clicking the OK button, Microsoft Project calculates the % complete of cutting of wood, making of chair, and finishing of chair activities. After entering all of the data up to status date, we will update the project up to the status date.



**Figure 59 Earned Value Table from 2nd Update**

## 2nd Update - SPI and CPI

We can see that the SPI and CPI value for making of chair is 0.4. It means that the making of chair activity is behind scheduled performance and over budget.

Whereas the finishing of chair, SPI, and CPI value is 0.99. It is nearly equal to 1, which means the finishing of chair activity performance is on track and under budget.

## Update 3

Current Date: *12th February*

Status Date: *11th February*

The 'Construction of Wooden Chair' project was updated until 10<sup>th</sup> February. In the third update, the project's current date is 12<sup>th</sup> February, whereas the status date is 11<sup>th</sup> February.

**Figure 60 Project Information for Construction of Wooden Chair for 3rd update**

We will now add the actual start and finish dates of the making of the chair and finishing of chair activities. It was planned to complete the finishing chair activity on February 11th, but due to the finishing material not being available, the activity is delayed for one day and will restart on February 11th. After entering the actual dates for the making of chair activity, we will manually add it's physical % complete. Then, we will update the project up to the status date.

So due to this delay event, we will check the "Reschedule uncompleted work to start after 11 Feb" rather than selecting "Update work as complete through:" Click the OK button to update the schedule.

**Figure 61 Reschedule the uncompleted work**

After clicking the OK button, we can see the split in the Gantt chart during finishing chair work. The split in the Gantt chart shows the non-working period.

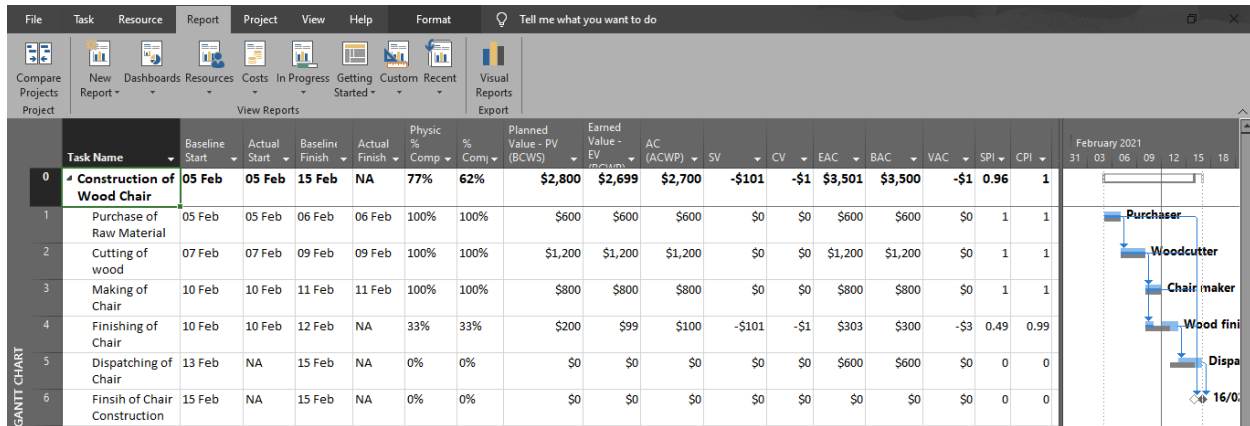


Figure 62 Earned Value Table from 3rd Update

### 3rd Update - SPI and CPI

We can see that the SPI and CPI value for the making of chair activity is 1. This means that the activity's performance is on track and is under budget.

Whereas the task finishing of chair has an SPI and CPI value is 0.49 and 0.99, respectively. This SPI value indicates that the project is behind schedule, and the CPI value suggests the task is performing under budget. The same result can be seen in the earned value overtime report graphs.

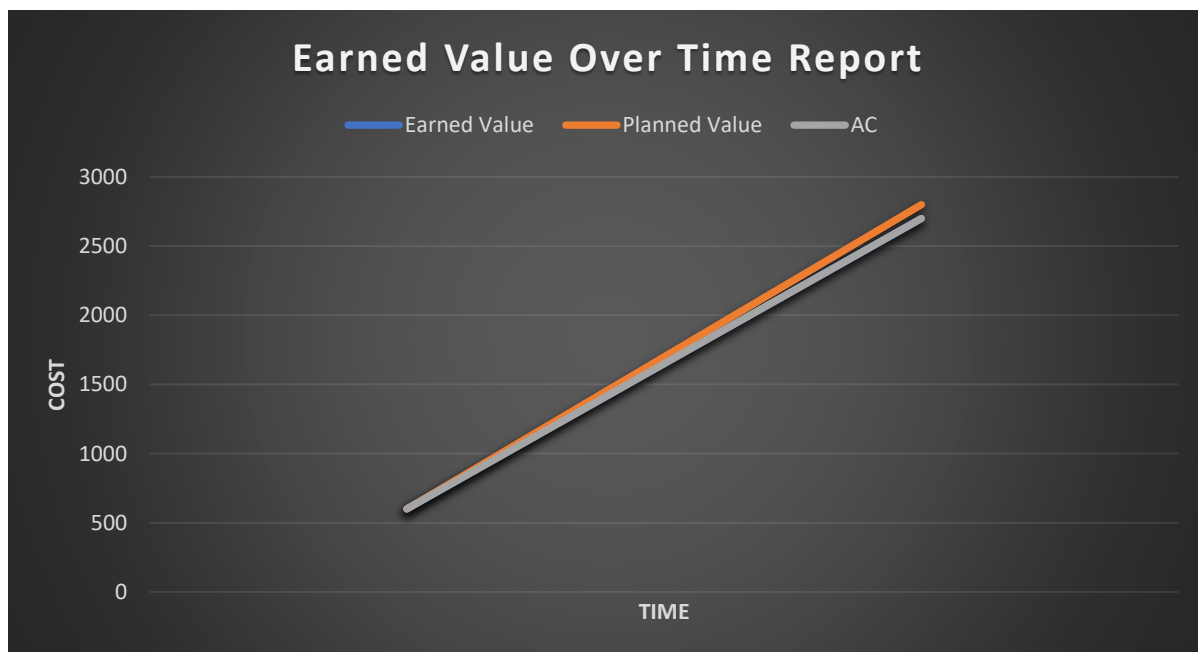


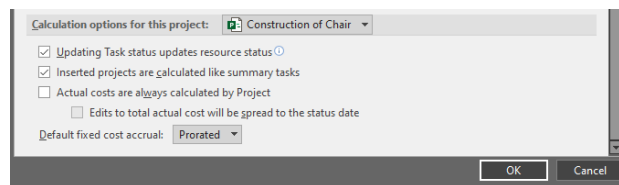
Figure 63 Earned Value Over Time Graph



### Example (a) – Uncheck Actual Cost Calculated by Project

Let's begin with scenario 2, when we uncheck the actual cost calculated by the project. In this scenario, we assumed that the project is affected by ground realities, for example, currency conversion rates and other adjustments that affect the AC.

To stop Microsoft Project from calculating the AC itself, follow these steps: Select File → Options → Schedule and uncheck the box "Actual costs are always calculated by Project."



**Figure 64 Uncheck Actual Cost Calculated by Project**

By unchecking this box it means we will now have to manually enter the cost incurred during the project's execution. So, in our first update, the project progress remains the same as mentioned above. In other words, we are not changing the actual project cost in the first update.

We have assumed the construction of a wooden chair as a generic project. This project will help us to understand the EVM in Microsoft Project better. The total working days for this project are 11 days and the working hours for this project are 117 hrs. We have assumed five resources for this project. The resources are shown under the column 'Resource Names' within the corresponding task name's row. The tasks purchase of raw material, cutting of wood, finishing of chair, and dispatching of chair fall within the critical path, whereas the making of chair activity falls on the non-critical path.

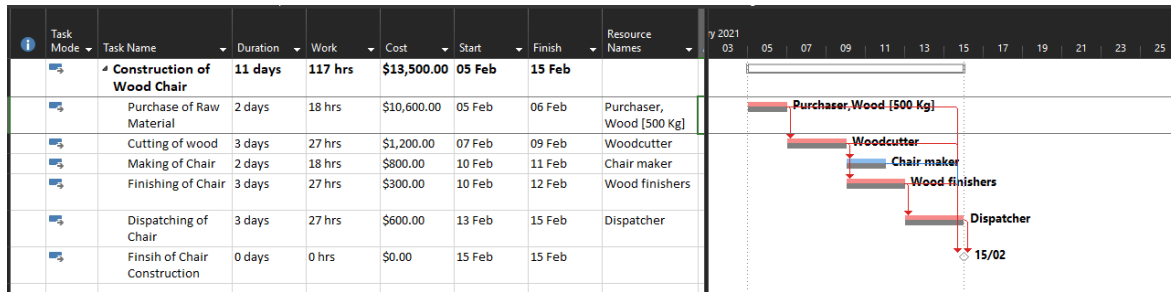


Figure 65 Construction of Wooden Chair

- Let's open the Earned Value Table for the generic example (View → Tables → More tables → Earned Value)

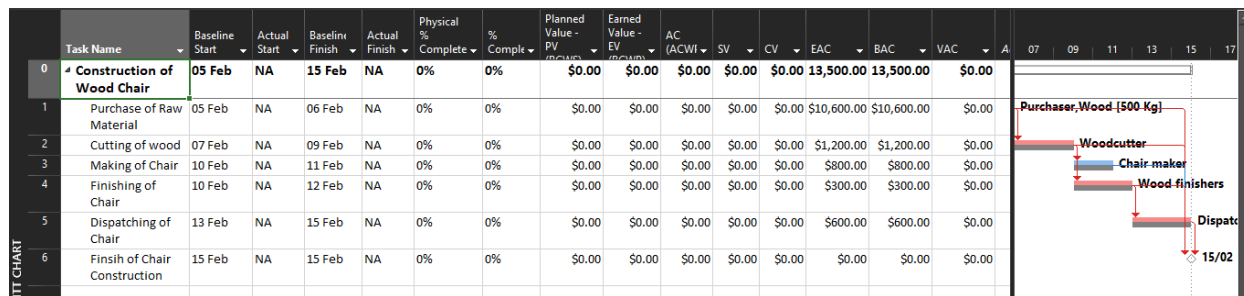


Figure 66 Earned Value Table

## Update 1

Current Date: 8<sup>th</sup> February

Status Date: 7<sup>th</sup> February

The generic project starts on 5<sup>th</sup> February and ends on 15<sup>th</sup> February. We are planning to update the project after every three days. In the first update, the project's current date will be 8<sup>th</sup> February, whereas the status date will be 7<sup>th</sup> February.

Project Information for 'Construction of Chair'

Start date: 05 Feb Current date: 08 Feb

Finish date: 15 Feb Status date: 17 Feb

Schedule from: Project Start Date Calendar: Standard

All tasks begin as soon as possible. Priority: 500

Enterprise Custom Fields

Custom Field Name	Value

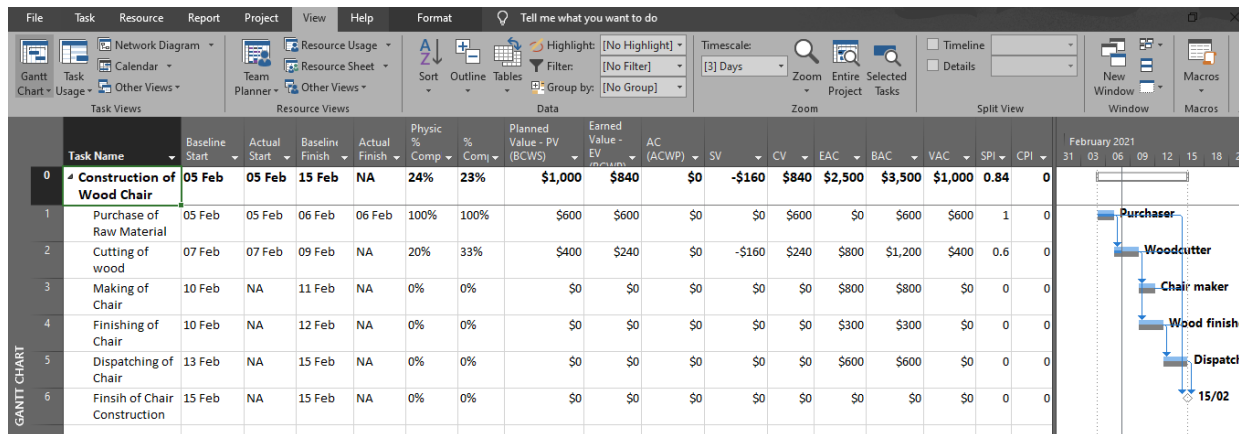
Help Statistics... OK Cancel

**Figure 67 Project Information for Construction of Wooden Chair 1st Update**

In this example, we will show three steps used to update.

- Entering the actual start and finish dates of the activities purchase of raw material and cutting of wood.
- Enter the AC manually.
- Update Project

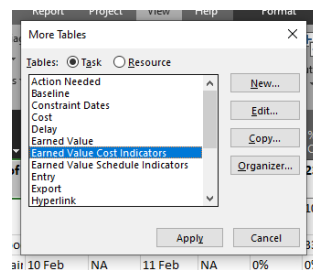
In this example, we will add the actual start and finish dates of purchase of raw material and cutting of wood activities. We will then manually add the physical % complete for the purchase of raw material and cutting of wood tasks. We will now update the project using the Update Project dialogue box, as shown in figure 71. After clicking the OK button, Microsoft Project calculates the % complete of tasks purchase of raw material and cutting of wood. After entering the data, we can see the EV and PV values, but the AC column will remain empty. This is because we have decided to fill the AC column manually up to the status date.



**Figure 68 Entering Actual Data for 1st update**

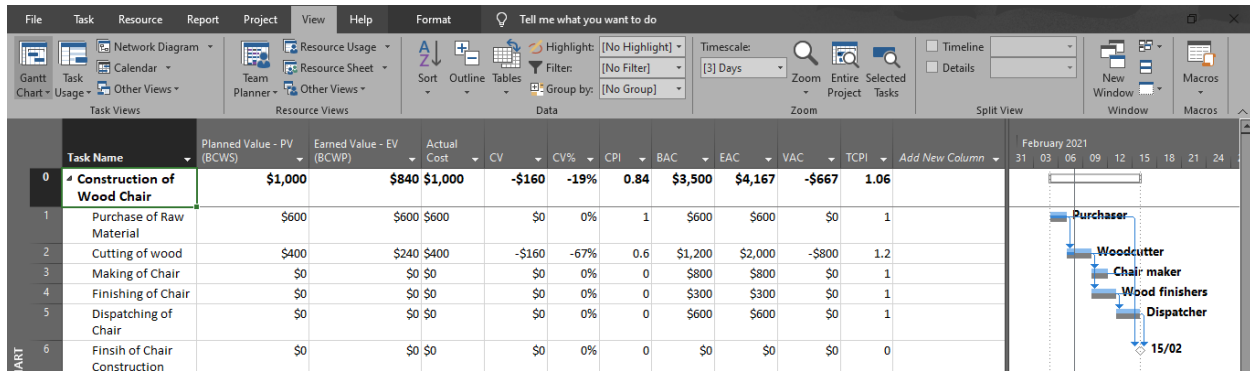
To manually enter the AC, we will click on the View tab shown at the top of the screen.

- Select 'Tables' from the data group.
- Select 'More Tables' from the drop-down list.
- Select the 'Earned value Cost Indicators' from the dialogue box, as shown in figure 69.



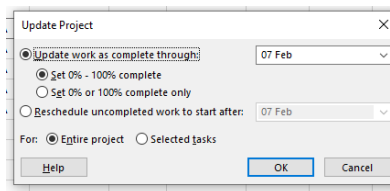
**Figure 69 More Tables for Entering Actual Cost**

In figure 70, we have entered the AC incurred during the execution of the project.



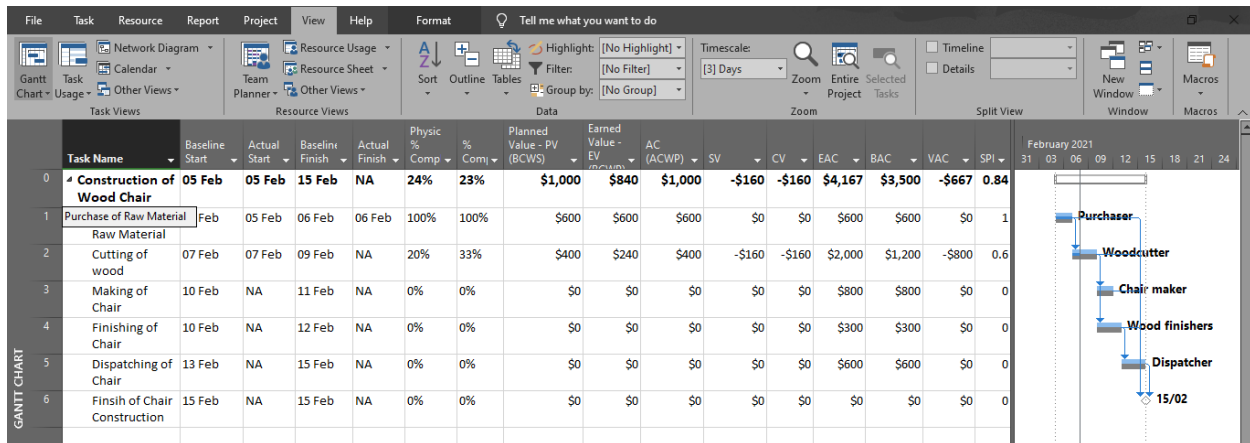
**Figure 70 Entering Actual Cost for 1st update**

After completing the steps mentioned above, we will update the project up to the status date. To update the task, we will click on the update status button, and then a dialogue box will appear. Then, we will click on the OK button.



**Figure 71 Update Project**

After clicking OK, the Earned Value table will be updated up to the status date.



**Figure 72 Earned Value Table from 1st update**

## Analysis of Earned Value Table

We can see the EV table in the above figure. We will discuss each column of the EV table one by one. EV table matrices help the project manager see the project's current performance and take corrective action if necessary for timely completion

of the project. The result of this EV table is the same as discussed earlier in scenario 1.

### 1st Update - SPI and CPI

'Purchase of Raw Material': SPI and CPI for this task are 1. It shows that the project is on track and under budget.

'Cutting of Wood': SPI and CPI for this task are 0.6. This means that we are lagging behind the planned schedule performance and are over budget.

### Update 2

Current Date: *11th February*

Status Date: *10th February*

The 'Construction of a Wooden Chair' project was updated until 7<sup>th</sup> February. In the second update, the project's current date is 11<sup>th</sup> February, whereas it's status date will be 10<sup>th</sup> February.

Project Information for 'Construction of Chair 2nd update'

Start date: 05 Feb Current date: 11 Feb

Finish date: 15 Feb Status date: 10 Feb

Schedule from: Project Start Date Calendar: Standard

All tasks begin as soon as possible. Priority: 500

Enterprise Custom Fields

Department:

Custom Field Name	Value
-------------------	-------

Help Statistics... OK Cancel

**Figure 73 Project Information for Construction of Wooden Chair 2nd Update**

Again, we will follow these three steps to update Project:

- Entering the actual start and finish dates of the purchasing of raw materials and cutting of wood tasks.
- Enter the AC manually.
- Update Project.

We will now add the actual start and finish dates of the tasks cutting of wood, making of chair, and finishing of chair. After entering the actual dates for these tasks, we will manually add the physical % complete for each. We will then update Project using the 'Update Project' dialogue box. After clicking the OK button, Microsoft Project calculates the % complete of each task. After entering all of the data up to status date, we will update Project up to the status date.

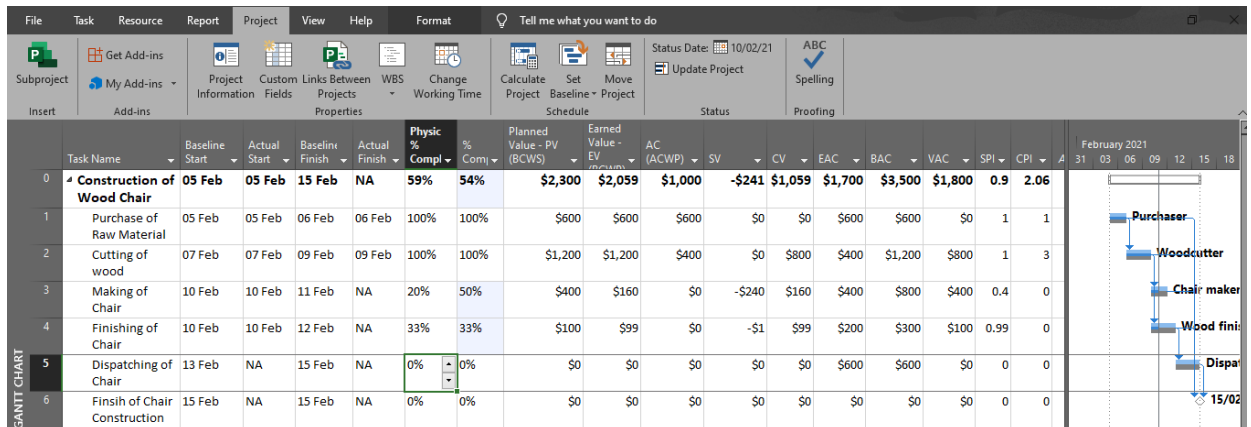


Figure 74 Entering Data for 2nd update

In figure 75, we have entered the AC incurred during the execution of the project.

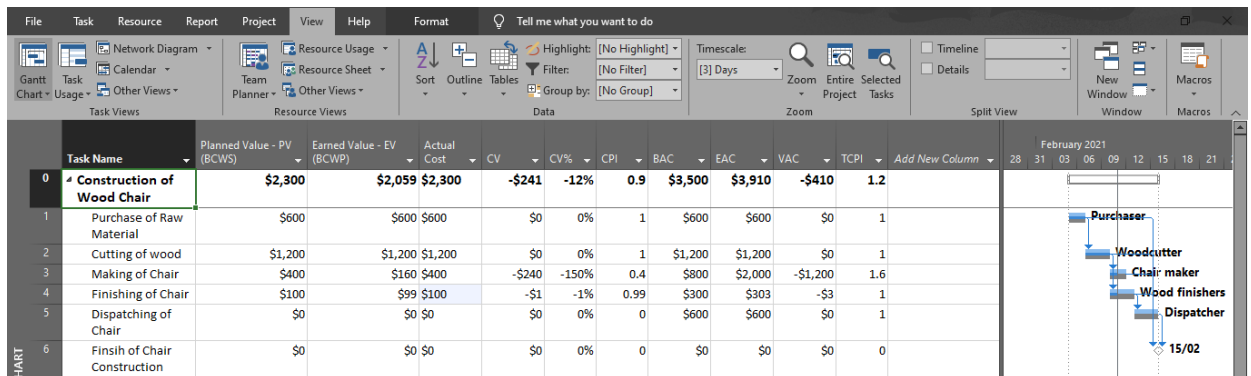
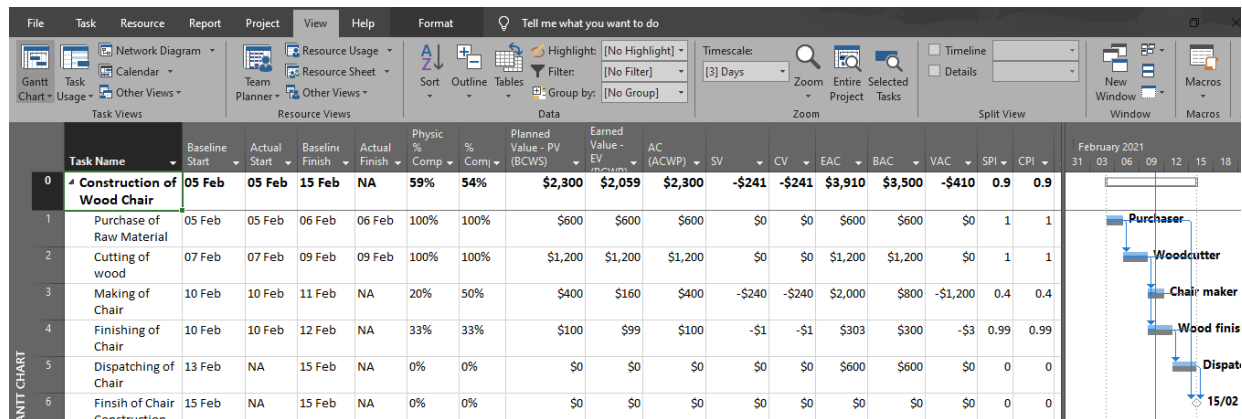


Figure 75 Entering Actual Cost for 2nd update

After completing the steps mentioned above, we will update the project up to the status date, and EV table will be updated up to the status date.



**Figure 76 Earned Value table from 2nd Update**

## 2nd Update - SPI and CPI

We can see that the SPI and CPI value for Making of Chair is 0.4. This means that the 'Making of Chair' task is lagging in schedule performance and is over budget.

Whereas the 'Finishing of Chair' tasks SPI and CPI value is 0.99. It is nearly equal to 1, which means the task performance is on track and under budget.

## Update 3

Current Date: *12th February*

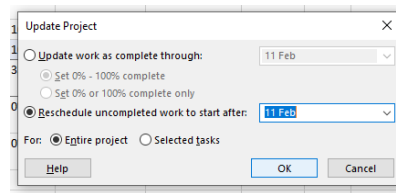
Status Date: *11th February*

The 'Construction of a Wooden Chair' project was updated until 10<sup>th</sup> February. In the third update, the project's current date will be 12<sup>th</sup> February, whereas the status date will be 11<sup>th</sup> February.





"Update the work completed through." Click the OK button to update the schedule up to the status date.



**Figure 79 Reschedule the Uncompleted Work**

After clicking the OK button, we can see the split in the Gantt chart for the activity 'finishing of chair' as shown in figure 81. The split in the Gantt chart shows the non-working period.

## Analysis of Earned Value Table

We can see the EV table in the below figure. We will discuss each column of the EV table one by one.

Task Name	Baseline Start	Actual Start	Baseline Finish	Actual Finish	Physic %	% Com	Planned Value - PV	Earned Value - EV	AC (ACWP)	SV	CV	EAC	BAC	VAC	SPI	CPI	AI
0 Construction of Wood Chair	05 Feb	05 Feb	15 Feb	NA	77%	62%	\$2,800	\$2,699	\$3,100	-\$101	-\$401	\$4,020	\$3,500	-\$520	0.96	0.87	
1 Purchase of Raw Material	05 Feb	05 Feb	06 Feb	06 Feb	100%	100%	\$600	\$600	\$600	\$0	\$0	\$600	\$600	\$0	1	1	
2 Cutting of wood	07 Feb	07 Feb	09 Feb	09 Feb	100%	100%	\$1,200	\$1,200	\$1,200	\$0	\$0	\$1,200	\$1,200	\$0	1	1	
3 Making of Chair	10 Feb	10 Feb	11 Feb	11 Feb	100%	100%	\$800	\$800	\$1,000	\$0	-\$200	\$1,000	\$800	-\$200	1	0.8	
4 Finishing of Chair	10 Feb	10 Feb	12 Feb	NA	33%	33%	\$200	\$99	\$300	-\$101	-\$201	\$909	\$300	-\$609	0.49	0.33	
5 Dispatching of Chair	13 Feb	NA	15 Feb	NA	0%	0%	\$0	\$0	\$0	\$0	\$0	\$600	\$600	\$0	0	0	
6 Finsih of Chair Construction	15 Feb	NA	15 Feb	NA	0%	0%	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0	0	

**Figure 80 Earned Value table after 3rd update**

## Baseline / Actual Start and Finish dates

Baseline/Actual Start: Making of Chair Baseline and Actual Start remains the same.

Baseline/Actual Finish: Making of Chair Baseline and Actual finish remains the same.

Baseline/Actual Start: Finishing of Chair Baseline and Actual Start remains the same.

Baseline/Actual Finish: Finishing of Chair Baseline and Actual is changed due to non-availability of the material. So, the Finishing of the Chair is delayed by a day.

### **% Complete**

Making of Chair: For % complete, we update the project up to the status date, after entering the actual start and finish dates. Microsoft Project automatically calculates the % complete from the actual start and finish dates. The task making of chair under the '% complete' column is 100% complete.

Finishing of Chair: For % complete, we update the project up to the status date without entering the actual finish date because the activity is delayed for one day. We can see a gap in the Gantt chart for the finishing chair task which represents the non-working period. Microsoft Project calculates the task's % complete under the '% complete' column which remained 33% complete up to the status ate.

### **Physical % Complete**

Making of Chair: For physical % complete, we assumed the task is 100% physically complete up to the status date.

Finishing of Chair: For physical % complete, we assumed the task is 33% physically complete up to the status date. We are lagging behind in this activity by 13%. This means that if the corrective measure is not taken, our project will be delayed.

### **Planned Value**

Making of Chair: The actual start and finish date of the task are the same as Baseline start and finish dates. The PV for the activity up to the status date is \$800.

Finishing of Chair: The actual start of the task is the same as Baseline start, however the actual finish date is not the same as the Baseline finish date. PV calculated by Microsoft Project is \$200, up to the status date.

### **Earned Value (EV)**

Making of Chair: We assume that up to the status date, this task is 100% complete. We entered 100% under the 'physical % complete' column. EV calculated by the Microsoft Project is \$800 up to the status date.

Finishing of Chair: This task is 33% complete up to the status date. We entered 33% under the 'physical % complete' column. The Microsoft Project's EV is \$99 ( $\$300 \times .33$ ) up to the status date. The physical % complete is 33% less than the planned EV because of a delay (33% for each day). It means we are lagging behind the physical progress, and the project can be delayed.

### **Actual Cost (ACWP)**

Making of Chair: We assumed that the activity is on track in terms of time. The AC incurred for the task is \$1000. An increase of \$200 in AC is due to the delayed event.

Finishing of Chair: We assumed that the activity is delayed for one day. So, the activity cost is increased up to the status date. AC incurred for the task is \$300. An increase in AC is because of the delayed event.

### **Schedule Variance (SV)**

Making of Chair: Schedule variance for this task is \$0. \$0 represents that planned cost and EV are the same up to the status date so, the difference is zero dollars.

Finishing of Chair: Schedule variance for this task is -\$101. -\$101 is the difference between the planned cost (\$200) and EV (\$99) up to the status date. The negative sign represents that we are behind schedule in terms of dollars.

### **Cost Variance (CV)**

Making of Chair: Cost variance for this task is -\$200. -\$200 represents that AC and EV are not the same up to the status date. It means we are over budget because of the delayed event.

Finishing of Chair: Cost variance for this task is -\$201. -\$201 is the difference between the AC (\$300) and EV (\$99) up to the status date. It means we are over budget.

#### **Estimate at Completion (EAC)**

Making of Chair: EAC for this task is \$1000. It means we require \$200 in additional funds to complete this activity.

Finishing of Chair: EAC for this task is \$909. By looking at the EAC metrics, we can say that we are over budget. We require an additional budget of \$609 to complete this activity.

#### **Baseline Cost (BAC)**

This cost field is generated when we save the baseline. This shows how much budget is required in order to complete the activity.

Making of Chair: BAC for this activity is \$800.

Finishing of Chair: BAC for this activity is \$300.

#### **Variance at Completion (VAC)**

Making of Chair: VAC for this activity is -\$200. It shows that we are over budget.

Finishing of Chair: VAC for this activity is -\$609. This means we are over budget and we need additional funds/resources in order to complete the task.

#### **Schedule Performance Index (SPI)**

Making of Chair: SPI for this task is 1. This shows that the project is on track.

Finishing of Chair: SPI for this task is 0.49. This means that we are lagging behind the planned schedule performance.

#### **Cost Performance Index (CPI)**

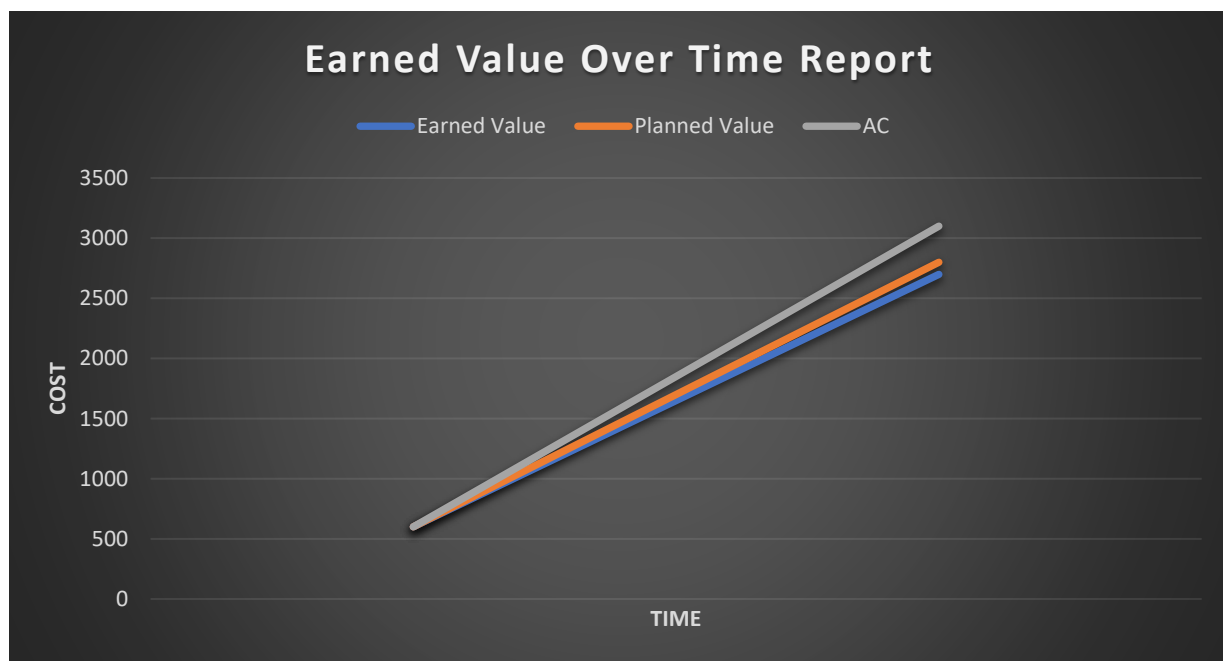
Making of Chair: CPI for this task is 0.8. It shows that the project is over budget.

Finishing of Chair: CPI for this task is 0.33. It means that the project is significantly over budget.

### Earned Value Graph for 3<sup>rd</sup> update

In this section, we will look toward the graphical representation of our project to see the visual presentation of EV, PV and AC.

From the first update, we can see the following graph of EV. According to this graph, our  $AC > PV > EV$ . It means the AC of the project is high in comparison to the planned cost. Secondly, we can see we are lagging behind the schedule performance as EV is less than PV.



**Figure 81 Earned Value Over Time Graph 3rd Update**

We completed both the scenarios for the 'Construction of Wooden Chair' project. In each scenario, we analysed the EVM matrices. These matrices help us to analyse the performance of the project up to the status date.

Now we will discuss our second example that is the construction of a single storey house. This example is also created in Microsoft Project. In each instance, we have two scenarios.

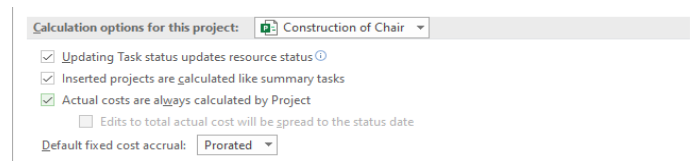
**Scenario 1:** Check - *Actual Cost Calculated by Project*

**Scenario 2:** Uncheck - *Actual Cost Calculated by Project*

### Example (b) - Actual Cost Calculated by Project

Let's begin with scenario 1 when the actual cost is calculated by Project. In this scenario, we assumed that the project is not affected by ground realities, for example, currency conversion rates and other adjustments that affect the AC.

To allow Microsoft Project to calculate the AC itself, following these steps, Go to File → Options → Schedule and check the box "Actual costs are always calculated by Project".



**Figure 82 Check the Actual Cost Calculated by the project**

We have assumed the construction of a single storey house. All the project detail related to the construction of the single storey house is discussed in detail in the previous chapters. In this section, we will conduct the EVM analysis.

### Update 1

Current Date: *8<sup>th</sup> February*

Status Date: *7<sup>th</sup> February*

The construction of a single storey house on 1<sup>st</sup> February and will be complete on 10<sup>th</sup> March. In the first update, the project's current date is 8<sup>th</sup> February, whereas the status date is 7<sup>th</sup> February.

**Figure 83 Project Information for Construction of Single Storey House 1st Update**

In this example, we will add the actual start and finish dates of the following project tasks: received approved drawings from the architect, start the excavation work, laying of lean, and construction of the foundation activities. We will then manually input the physical % complete for the same activities. At this point, we will update the project using the 'Update Project' dialogue box, as shown in the below figure. After clicking the OK button, Microsoft Project calculates the % complete of the above-stated activities.

**Figure 84 Update Project**

## Analysis of Earned Value Table

We can see the EV table in the below figure. EV table matrices help the project manager know the project's current performance and take corrective action if necessary to complete the project in a timely manner.



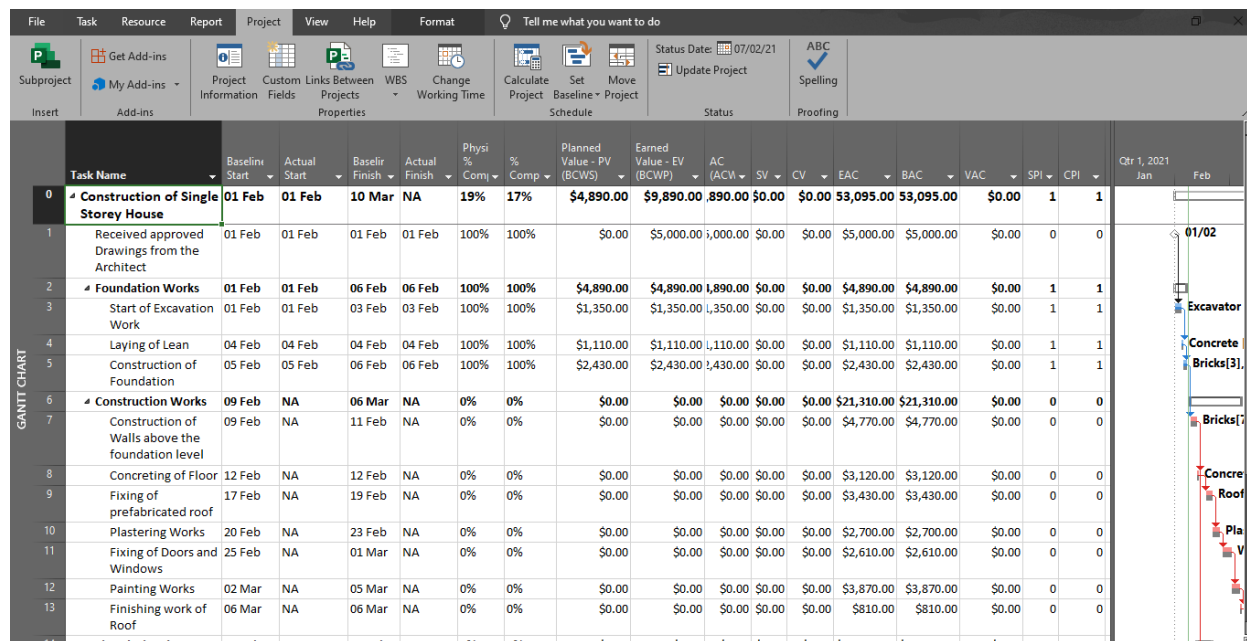


Figure 85 Earned Value table after 1<sup>st</sup> Update

### 1st Update - SPI and CPI

We can see that the SPI and CPI value for the tasks, received approved drawings from the architect, start of excavation work, laying of lean, and construction of foundation, is 1. It means that the stated activities are not lagging behind the time and budget.

### Update 2

Current Date: 21<sup>st</sup> February

Status Date: 20<sup>th</sup> February

The 'Construction of Single Storey House' project was updated until 7<sup>th</sup> February. In the second update, the project's current date is 21<sup>st</sup> February, whereas the status date is 20<sup>th</sup> February.

**Figure 86 Project Information for Construction of Single Storey House 2nd Update**

We will now add the actual start and finish dates of the task's construction of walls above the foundation level and concreting of the floor. The fixing of the prefabricated roof is delayed, so; we did not enter the actual finish date of this activity. After entering the actual dates for construction of walls above the foundation level, concreting of the floor, and fixing of the prefabricated roof, we manually add the physical % complete for these tasks. We will then update the project by checking the "Reschedule uncompleted work to start after 20<sup>th</sup> Feb" option. After the update, Microsoft Project calculates the % complete for the tasks.

**Figure 87 'Reschedule uncompleted work to start after' Option.**

## Analysis of Earned Value Table

We can see the EV table in the below figure. EV table matrices help the project manager know the project's current performance and take corrective action if necessary to complete the project in a timely manner.

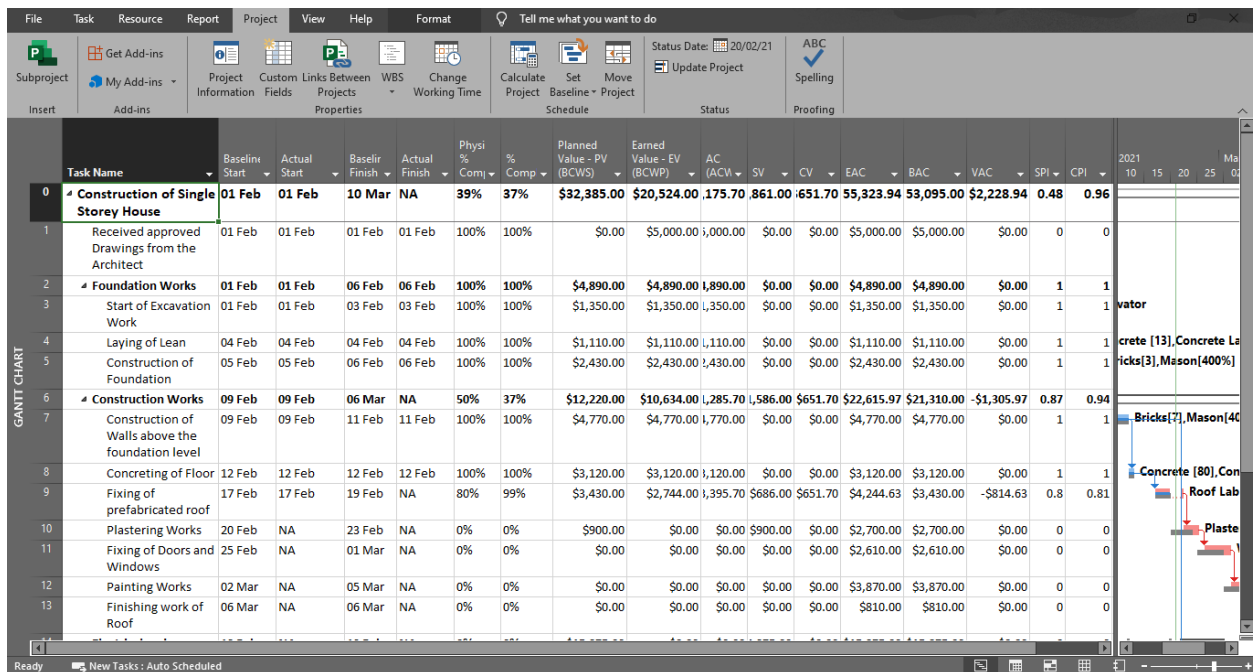


Figure 88 EVM results after the 2<sup>nd</sup> update

## 2nd Update - SPI and CPI

Construction of walls above the foundation level, concreting of the floor: SPI and CPI Value for stated tasks are 1. This means that the activities are not lagging behind the time and budget.

Fixing of the prefabricated roof: SPI and CPI Value for this task are 1. It means that the activity is lagging behind the time and budget.

## Earned Value Graph for 3<sup>rd</sup> update

In this section, we will look toward the graphical representation of our project to see the visual presentation of EV, PV and AC.

From the first update, we can see the following graph of EV. According to this graph, our  $PV > AC > EV$ . It means the PV of the project is high in comparison to EV and AC. Secondly, we can see we are lagging behind the schedule performance as the EV is less than PV.

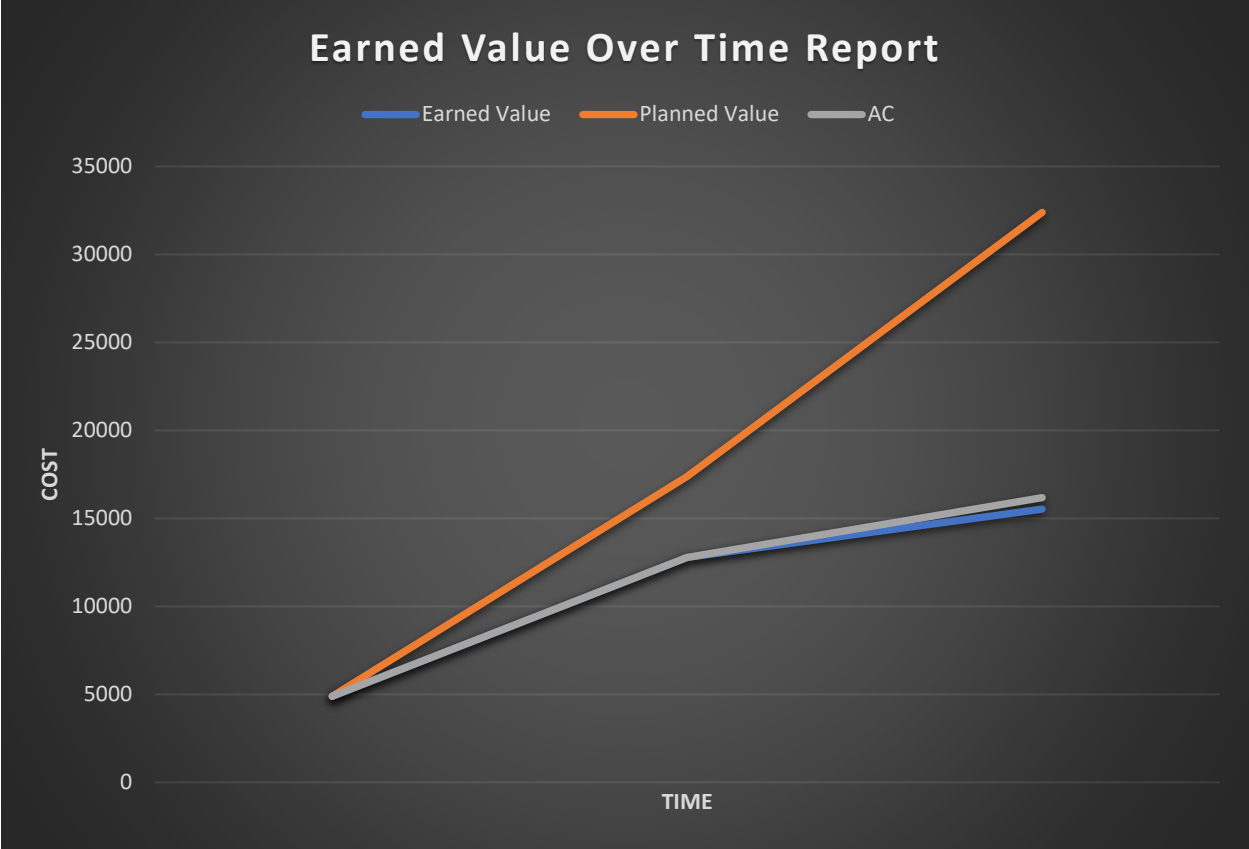


Figure 89 Earned Value Over Time Graph 2nd Update