

CHAPTER 5

SCHEDULING

InFocus

WPL_J404

Tasks in a project are usually dependent on one another and happen in a specific order. Quite often, one task cannot begin until a previous task has been completed.

In order for tasks to happen at the right time, you need to link dependent tasks and specify the type of dependency they have.

This can be done by developing task relationships between predecessor tasks and successor tasks.

Once you establish task relationships, your project plan will begin to look like a real **schedule**. Possible start dates and finish dates for individual tasks and phases will become available.

In this session you will:

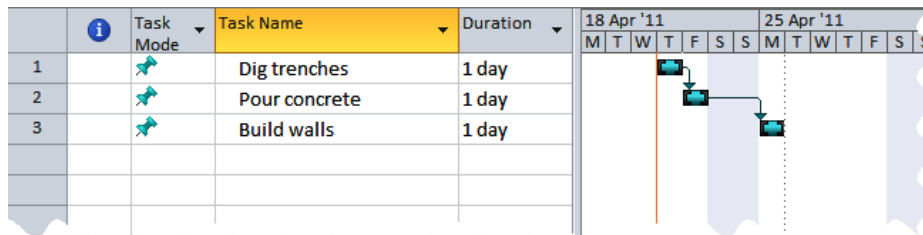
- ✓ gain an understanding of task dependencies
- ✓ learn how to automatically create **Finish-to-Start** dependencies
- ✓ learn how to create task relationships in **Task Entry** view
- ✓ learn how to create task dependencies using the **Task Information** dialog box
- ✓ learn how to create task dependencies in a sheet view
- ✓ learn how to manipulate the schedule using task dependencies
- ✓ learn how to switch the tasks to auto schedule mode
- ✓ gain an understanding of the **Critical Path Method** and project slack
- ✓ learn how to view the critical path
- ✓ learn how to examine the slack time available to non-critical tasks
- ✓ gain an understanding of lag time
- ✓ learn how to enter lag time
- ✓ gain an understanding of lead time
- ✓ learn how to enter lead time.

UNDERSTANDING TASK DEPENDENCIES

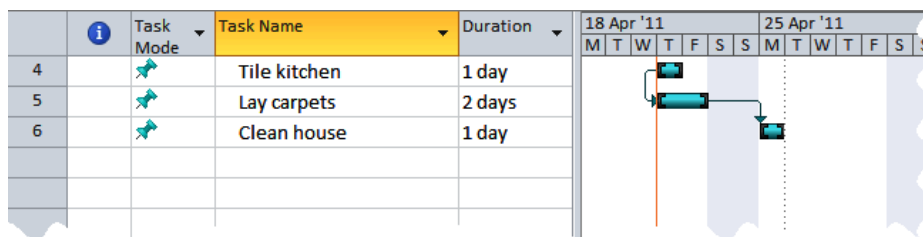
When you first enter tasks into a project they are not linked in any way. This is evident from the fact that they all start on the same day, and in the Gantt Chart, appear flush left along the start date

line. In the real world, tasks are inter-dependent, and most tasks in your project will relate to one another in some way. Microsoft Project offers four different types of task **dependencies**.

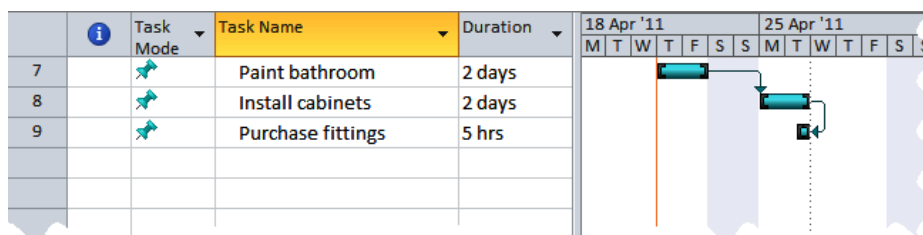
- 1 **Finish-to-Start** relationships are those where a task cannot start until its predecessor has been finished. In reality, this is probably the most common, especially where resources are scarce. A typical example would be when constructing a house: you dig the trenches for the foundations, then pour concrete, then build the foundations – all after one another.



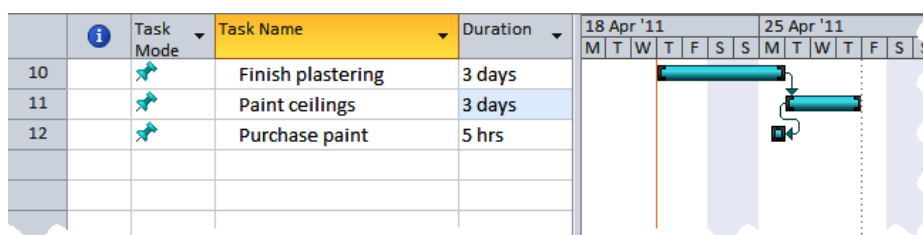
- 2 **Start-to-Start** relationships are those where both tasks commence at the same time. For example, you might arrange the tiling of the kitchen at the same time as carpeting the lounge.



- 3 **Finish-to-Finish** relationships are those where both tasks finish at the same time. For example you might want to install bathroom cabinets and have the task finish at the same time that you have organised to purchase the bathroom fittings.



- 4 **Start-to-Finish** relationships are those where the completion of one task is dependent on the start of another. Generally this is used when you are scheduling a task to finish just in time to start a more important task. This is a little harder to comprehend, but a typical example would be dismantling a superseded piece of equipment in a factory. You do not want to start dismantling until the new equipment is fully operational. This type of relationship is often used when scheduling a task to finish just in time to start a more important task that it supports.



CREATING DEPENDENCIES AUTOMATICALLY

The most common form of task dependency is a **Finish-to-Start** type where one task starts after its predecessor finishes. This type of dependency is also the easiest to create as Microsoft Project

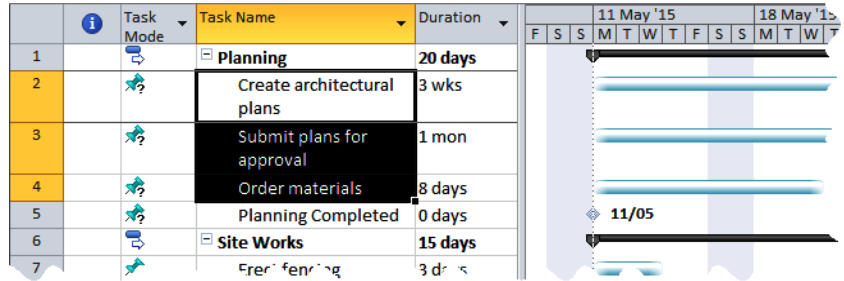
actually has a command on the **Ribbon** that automatically creates this relationship between tasks in the project that have been selected.

Try This Yourself:

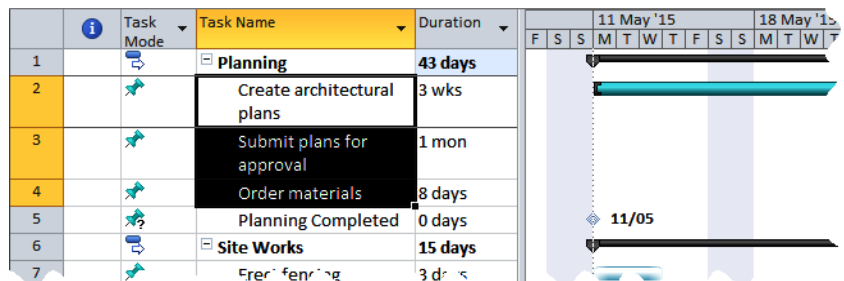
Open
File

Before starting this exercise you **MUST** open the file J404 Scheduling_1.mpp...

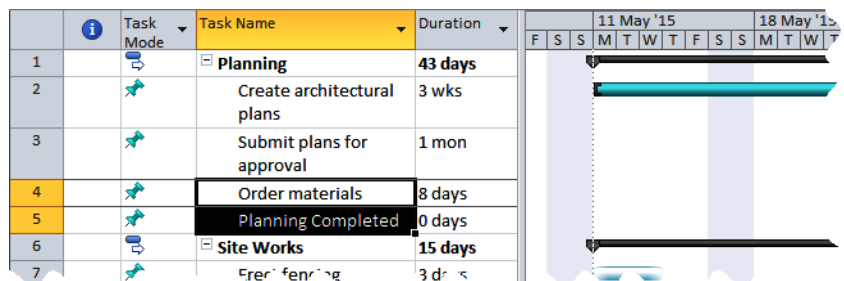
- 1 Click on **Create architectural plans**, hold down the **Shift** key and click on **Order materials** to select the first three tasks
- 2 Click on the **Tasks** tab on the **Ribbon**, and click on **Link Tasks** in the **Schedule** group to link the selected tasks
- 3 Click on **Order materials**, hold down the **Shift** key and click on **Planning Completed**
- 4 Click on **Link Tasks** in the **Schedule** group to link the selected tasks



1



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For Your Reference...

To automatically create a dependency:

1. Select the tasks you want to link
2. Click on the **Tasks** tab on the **Ribbon**, and click on **Link Tasks** in the **Schedule** group

Handy to Know...

- The duration of summary tasks will change when you link tasks as **Finish-to-Start**. Summary tasks are automatically scheduled and their duration depends upon the total duration of their dependencies. In our case study the Planning summary tasks now has a duration of 43 days.

CREATING DEPENDENCIES IN TASK ENTRY

Dependencies can be defined between tasks using a form view. **Task Entry** view is a good choice for entering dependencies as it is a split view which shows the Gantt Chart at the top and

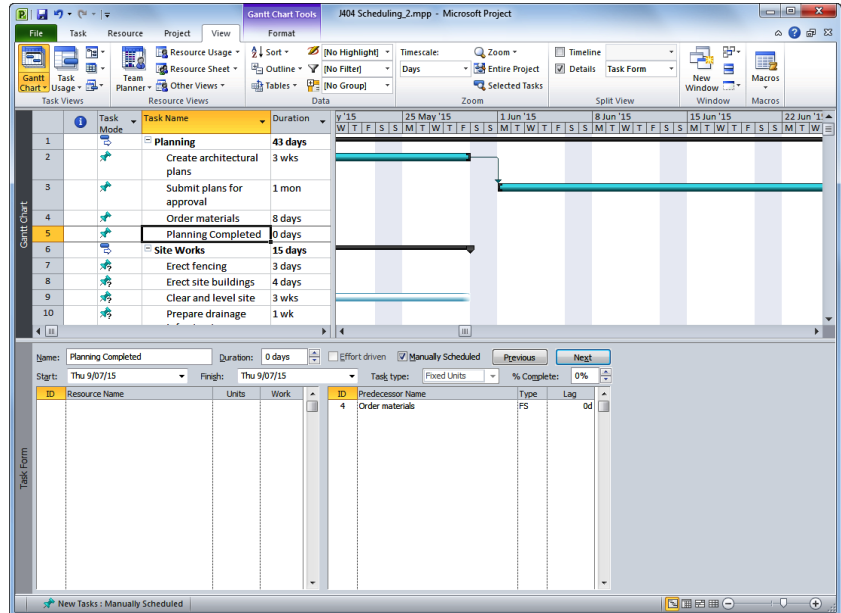
a task form at the bottom of the screen. You can see the relationships drawn graphically on the Gantt bars, and the details entered into a form. Forms are ideal for more complex dependencies.

Try This Yourself:

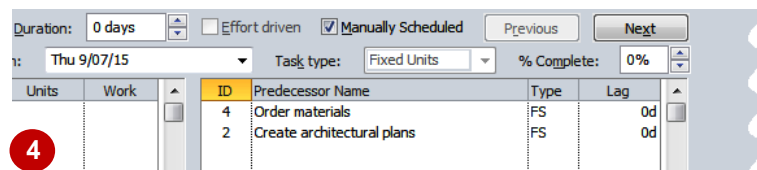
Same File

Continue using the previous file with this exercise, or open the file J404 Scheduling_2.mpp...

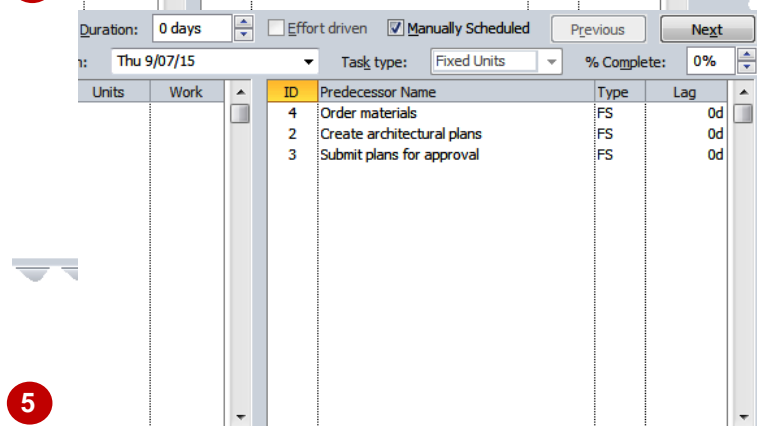
- 1 Click on the **View** tab and click on **Details** in the **Split View** group to see the **task entry** view
- 2 Click on **Planning Completed** in the **Task Name** column of the **Gantt Chart**
- 3 The details for this task should appear in the form...
- 4 Click below the current entry in the **ID** column in the **Predecessor** panel (right side) of the form
- 5 Type 2 (which is the **ID** of **Create architectural plans**) and click on **[OK]**
- 6 Repeat step 4 and add **ID 3** to the predecessor list
- 6 Click on **Details** in the **Split View** group to return to a single view



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4



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For Your Reference...

To create dependencies in a form view:

1. Click on the **View** tab and click on **Details** in the **Split View** group
2. Click on the desired task
3. Enter the appropriate dependencies in the **Predecessor** column on the form

Handy to Know...

- Milestone tasks logically can only be completed when the tasks before it have been completed. With milestone tasks it is a good idea therefore to enter all of its predecessors and the appropriate dependency type – usually a **Finish-to-Start (FS)** for each.

CREATING DEPENDENCIES IN TASK INFORMATION

The **Task Information** dialog box is your source for all information pertaining to a task in your project. It is made up of a number of tabs one of which is the **Predecessors** tab which shows you

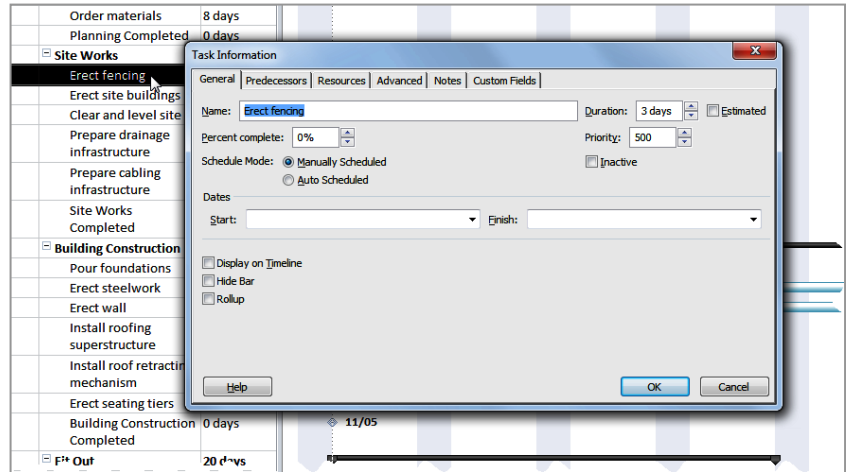
the dependencies that exist for the task. This area of the dialog box also allows you to enter dependency information.

Try This Yourself:

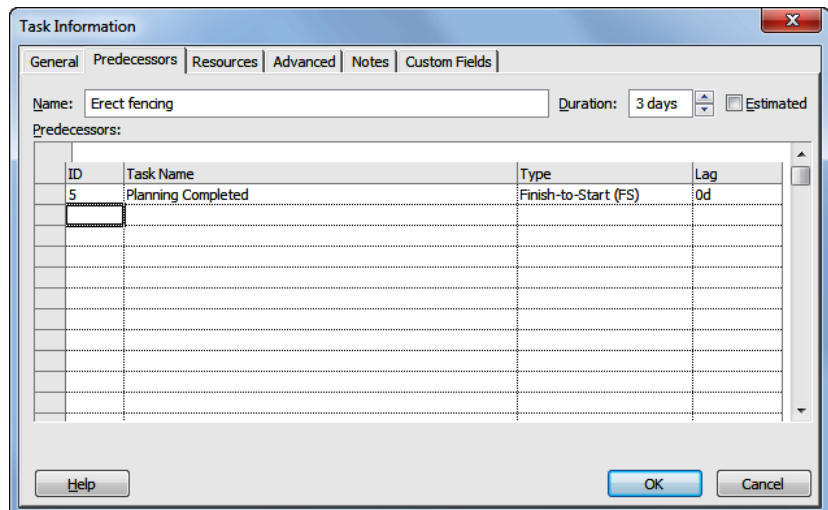
Same File

Continue using the previous file with this exercise, or open the file J404 Scheduling_3.mpp...

- 1 Double click on **Erect fencing** to display the **Task Information** dialog box
- 2 Click on the **Predecessors** tab
- 3 Click in the **ID** column, type **5**, and press **Enter** to see the details
- 4 Click on **[OK]** to record the entry and close the dialog box



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For Your Reference...

To create dependencies in a **Task Information** box:

1. Double click on the task
2. Click on the **Predecessors** tab and enter the appropriate details

Handy to Know...

- When you type a number into the **ID** column in a **Predecessors** form, Microsoft Project automatically assumes that you wish to create a **Finish-to-Start** dependency. You can change the type of dependency using the **Type** column in the form.

CREATING DEPENDENCIES IN A SHEET VIEW

Creating dependencies in forms and dialog boxes is great for complex dependency types. It can, however, be tedious if you have lots of dependencies you wish to enter – such as at the

time you are setting up your schedule. The best way to quickly enter dependencies is in a sheet view where you can easily see task **ID** numbers and have access to the **Predecessors** column.

Try This Yourself:

Same File

Continue using the previous file with this exercise, or open the file J404 Scheduling_4.mpp...

- 1 Click on the **View** tab on the **Ribbon**, click on **Other Views** in the **Task Views** group and click on **Task Sheet**
- 2 Click on **Tables** in the **Data** group and click on **Entry**
- 3 Click in the **Predecessors** cell for **Erect site buildings**, type **7** and press **Enter**
- 4 Repeat step 3 and enter the predecessor details for the remaining tasks as shown
- 5 Hold down the **Ctrl** key and press **Home** to return to the first task

Task	Task Name	Duration	Start	Finish	Predecessors	Resource Names	Ad.
1	Planning	43 days	Mon 11/05/15	Thu 9/07/15			
2	Create architectural pl	3 wks	Mon 11/05/15	Fri 29/05/15			
3	Submit plans for appr	1 mon	Mon 1/06/15	Fri 26/06/15	2		
4	Order materials	8 days	Mon 29/06/15	Wed 8/07/15	3		
5	Planning Completed	0 days	Thu 9/07/15	Thu 9/07/15	4,2,3		
6	Site Works	15 days	Thu 9/07/15	Wed 29/07/15			
7	Erect fencing	3 days	Thu 9/07/15	Mon 13/07/15	5		
8	Erect site buildings	4 days					
9	Clear and level site	3 wks					
10	Prepare drainage infra	1 wk					
11	Prepare cabling infrastr	1 wk					
12	Site Works Completed	0 days					
13	Building Construction	60 days	Mon 11/05/15	Fri 11/07/15			

2

4

Site Works	
Erect fencing	5
Erect site buildings	7
Clear and level site	8
Prepare drainage infrastructure	9
Prepare cabling infrastructure	9
Site works completed	7,8,9,10,11
Building Construction	
Pour foundations	12
Erect steelwork	14
Erect wall	15
Install roofing superstructure	16
Install roof retracting mechanism	17
Erect seating tiers	18
Building Construction Completed	14,15,16,17,18,19
Fit Out	
Fit all windows and doors	20
Install electrical cabling	20
Install electrical fittings and fixtures	23
Install all plumbing	20
Install plumbing fittings and fixtures	25
Lay astro turf	20
Erect handrails and fencing	27
Paint rooms, fixtures, fittings, etc	28
Install PA system	23
Install video imaging equipment	23
Fit out control room	29,30,31
Fit Out Completed	22,23,24,25,26,27,28,29,30,31,32
Commissioning	
Test roof mechanism	33
Test PA system	33
Test video imaging equipment	33
Test control room equipment	35,36,37
Obtain official occupancy certificates	38
Obtain safety certification	39
Official opening	40
Commissioning Completed	35,36,37,38,39,40,41

For Your Reference...

To create dependencies in a **sheet view**:

1. Display the **Entry** table in a **Task Sheet** view
2. Type relevant **ID** numbers in the **Predecessors** column in the table

Handy to Know...

- To create alternative relationships you need to have a good grasp of the abbreviations that Project uses when defining relationships. The predecessor **ID** is followed by the dependency type eg. **Finish-to-Start (FS)**, **Start-to-Start (SS)**, **Finish-to-Finish (FF)**, **Start-to-Finish (SF)**.

FINE TUNING A SCHEDULE USING DEPENDENCIES

We've just been informed that the powers-that-be have decided to schedule the first football match at the stadium on Saturday May 21. As all of the relationships have been entered we can see what

Microsoft Project has calculated as a finish date. Now we can make whatever adjustments that may be necessary to bring the conclusion of the schedule back to an acceptable date.

Try This Yourself:

Same File

Continue using the previous file with this exercise, or open the file *J404 Scheduling_5.mpp*...

- 1 Click on the **Project** tab on the **Ribbon** and click on **Project Information** in the **Properties** group and notice that the project is currently scheduled to finish on *Friday May 20* – a bit too close

- 2 Click on **[OK]** to close the dialog box

We should be able to finish the project earlier by tinkering with some of the dependencies. The seating tiers, for example, can be erected at the same time as the roof is installed...

- 3 Click on the **Predecessors** cell for **Erect seating tiers**

- 4 Type **18SS** and press **Enter** to make this task start at the same time the roof is installed

We can also bring the timing of the handrail installation forward...

- 5 Click on the **Predecessors** cell for **Erect handrails and fencing**, type **20** and press **Enter**

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Building Construction	134 days	Mon 17/08/15	Mon 7/03/16		
Pour foundations	4 days	Mon 17/08/15	Thu 20/08/15	12	
Erect steelwork	3 mons	Fri 21/08/15	Thu 12/11/15	14	
Erect wall	2 mons	Fri 13/11/15	Fri 22/01/16	15	
Install roofing superst	2 wks	Mon 25/01/16	Fri 5/02/16	16	
Install roof retracting	1 wk	Mon 8/02/16	Fri 12/02/16	17	
Erect seating tiers	3 wks	Mon 8/02/16	Fri 26/02/16	18SS	
Building Construction	0 days	Mon 7/03/16	Mon 7/03/16	14,15,16,17,18,1	
Fit Out	40 days	Mon 7/03/16	Mon 2/05/16		
Fit all windows and dc	2 wks	Mon 7/03/16	Fri 18/03/16	20	
Install electrical cablin	1 wk	Mon 7/03/16	Fri 11/03/16	20	
Install electrical fitting	2 wks	Mon 14/03/16	Fri 25/03/16	23	

5

Fit Out	40 days	Mon 7/03/16	Mon 2/05/16		
Fit all windows and dc	2 wks	Mon 7/03/16	Fri 18/03/16	20	
Install electrical cablin	1 wk	Mon 7/03/16	Fri 11/03/16	20	
Install electrical fitting	2 wks	Mon 14/03/16	Fri 25/03/16	23	
Install all plumbing	2 wks	Mon 7/03/16	Fri 18/03/16	20	
Install plumbing fitting	1 wk	Mon 21/03/16	Fri 25/03/16	25	
Lay astro turf	1 wk	Mon 7/03/16	Fri 11/03/16	20	
Erect handrails and fen	2 wks	Mon 14/03/16	Fri 25/03/16	20	
Paint rooms, fixtures,	1 mon	Mon 28/03/16	Fri 22/04/16	28	
Install PA system	2 days	Mon 14/03/16	Tue 15/03/16	23	
Install video imaging e	3 days	Mon 14/03/16	Wed 16/03/16	23	

For Your Reference...

To **fine tune** dependencies:

1. Click in the **Predecessors** cell of the relevant task
2. Adjust the value as appropriate by either typing a different task **ID** or changing the dependency type

Handy to Know...

- The overall project end date has not changed. This is because all of the tasks are manually scheduled. You can switch the project to auto scheduling mode or use the **Respect Links** command on the **Task** tab to update the links between selected tasks.

AUTO SCHEDULING TASKS

It's crunch time in our project. Is it better for us to have Microsoft Project instantly recalculate the project's end date based on our changes and manipulations (if so, we should switch to *auto*

scheduling), or should we maintain complete control over the task scheduling (which will require us to be very vigilant)? In our case study we want Microsoft Project to control the scheduling for us.

Try This Yourself:

Same File

Continue using the previous file with this exercise, or open the file J404 Scheduling_6.mpp...

- 1 Move the mouse pointer to the grey box where the task **IDs** meet the column headings and click to select all of the tasks
- 2 Click on the **Task** tab on the **Ribbon** and click on **Auto Schedule** in **Tasks** to auto schedule all of the selected tasks
- 3 Click on any task to remove the selection highlighting
- 4 Click on the **Project** tab and click on **Project Information** in the **Properties** group

Notice that the project is now scheduled to finish on Thursday May 5...

- Click on **[OK]** to close the dialog box
- Scroll to the bottom and have a look at the start and end dates of the tasks

	Task	Task Name	Duration	Start	Finish	Predecessors	Resource
1		Planning	43 days	Mon 11/05/15	Thu 9/07/15		
2		Create architectural pl	3 wks	Mon 11/05/15	Fri 29/05/15		
3		Submit plans for appr	1 mon	Mon 1/06/15	Fri 26/06/15	2	
4		Order materials	8 days	Mon 29/06/15	Wed 8/07/15	3	
5		Planning Completed	0 days	Thu 9/07/15	Thu 9/07/15	4,2,3	
6		Site Works	27 days	Thu 9/07/15	Mon 17/08/15		
7		Erect fencing	3 days	Thu 9/07/15	Mon 13/07/15	5	
8		Erect site buildings	4 days	Tue 14/07/15	Fri 17/07/15	7	
9		Clear and level site	3 wks	Mon 20/07/15	Fri 7/08/15	8	
10		Prepare drainage infr	1 wk	Mon 10/08/15	Fri 14/08/15	9	
11		Prepare cabling infras	1 wk	Mon 10/08/15	Fri 14/08/15	9	
12		Site Works Complete	0 days	Mon 17/08/15	Mon 17/08/15	7,8,9,10,11	
13		Building Construction	129 days	Mon 17/08/15	Mon 29/02/16		
14		Pour foundations	4 days	Mon 17/08/15	Thu 20/08/15	12	
15		Erect steelwork	3 mons	Fri 21/08/15	Thu 12/11/15	14	
16		Erect wall	2 mons	Fri 13/11/15	Fri 22/01/16	15	

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Project Information for 'J404 Scheduling_6.mpp'

Start date: Mon 11/05/15 Current date: Thu 21/04/11

Finish date: Thu 5/05/16 Status date: NA

Schedule from: Project Start Date Calendar: Standard

All tasks begin as soon as possible. Priority: 500

Enterprise Custom Fields

Department:

Custom Field Name	Value
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Help Statistics... OK Cancel

6

Commissioning	14 days	Mon 18/04/16	Thu 5/05/16		
Test roof mechanism	1 wk	Mon 18/04/16	Fri 22/04/16	33	
Test PA system	2 days	Mon 18/04/16	Tue 19/04/16	33	
Test video imaging eq	2 days	Mon 18/04/16	Tue 19/04/16	33	
Test control room equ	1 wk	Mon 25/04/16	Fri 29/04/16	35,36,37	
Obtain official occupa	1 day	Mon 2/05/16	Mon 2/05/16	38	
Obtain safety certifica	2 days	Tue 3/05/16	Wed 4/05/16	39	
Official opening	1 day	Thu 5/05/16	Thu 5/05/16	40	
Commissioning Compl	0 days	Thu 5/05/16	Thu 5/05/16	35,36,37,38,39,4	

For Your Reference...

To **auto schedule** tasks:

1. Select the tasks to be auto scheduled
2. Click on the **Task** tab on the **Ribbon** and click on **Auto Schedule** in **Tasks**

Handy to Know...

- Even though we have made the selected tasks **auto scheduled** the overall project is still in manual mode for new tasks. If you want to ensure that new tasks that you add to the project are automatically scheduled too you'll need to set the **New Tasks** button at the bottom left of the screen.

CRITICAL PATH AND PROJECT SLACK

Once all of the project tasks together with their durations and dependencies have been entered into a project it is possible to view the critical path. The critical path controls a project's

finishing date because it represents the longest sequence of tasks in a project. Finding the critical path is essential for controlling the overall scheduling of a project.

Critical Path Method

The critical path is the series of tasks that will affect the project's end date if they are changed. For example, if you shorten the duration of one of these critical tasks on the path the project will finish earlier. Conversely if you lengthen the duration of a task, or if it is delayed in some way, then the finish date for the project will be later.

The **Critical Path Method** (CPM) is a well-documented and common algorithm that calculates the critical path in a project. The critical path method is used to calculate the earliest and the latest that each task can start and finish without blowing out the project's end date.

If a task's earliest and latest start dates and earliest and latest finish dates are the same the task is said to be on the *critical* path because it has no free time available to it. Any change to the start or finish dates of these critical tasks will directly impact on the project's finish date.

Slack Time

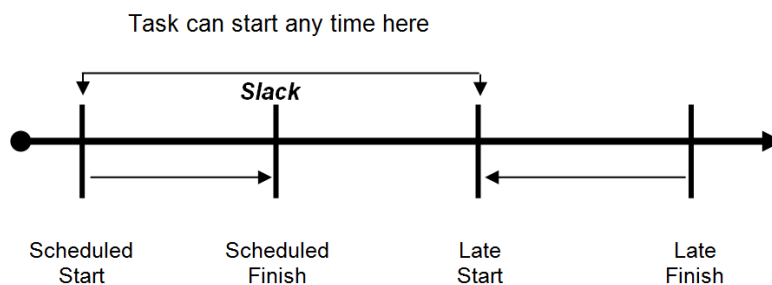
The **Critical Path Method** (CPM) also identifies **non-critical** tasks. Non-critical tasks have slack time (sometimes known as **float**) meaning that there is some variation between the task's earliest and latest start dates and earliest and latest finish dates.

In Microsoft Project a non-critical task can have two types of slack – **free slack** and **total slack**. Slack can act like a buffer, allowing the task to slip a certain amount of time before it becomes critical, and causes a delay in the schedule.

Free slack is the amount of slippage time before one task delays another, while **total slack** is the amount of time a task can slip before affecting the project completion date.

The **scheduled start** and **finish dates** represent the dates that Microsoft Project calculates during its forward pass through your tasks and the critical path, using the durations and dependencies that you supplied.

Once the finish date of the path is established it is then used as the point at which Microsoft Project commences its backward pass through the tasks to calculate slack.



A Moving Target

A critical path is not normally a static item – it changes as you make adjustments to tasks and scheduling in your project. Furthermore, a task becomes non-critical once it has been completed as it obviously no longer can affect the outcome of the project.

VIEWING THE CRITICAL PATH

The **Gantt Chart** view in Microsoft Project can be used to display those tasks that are deemed to be on the **critical path**. The **critical path** is always there on the **Gantt Chart** but you must

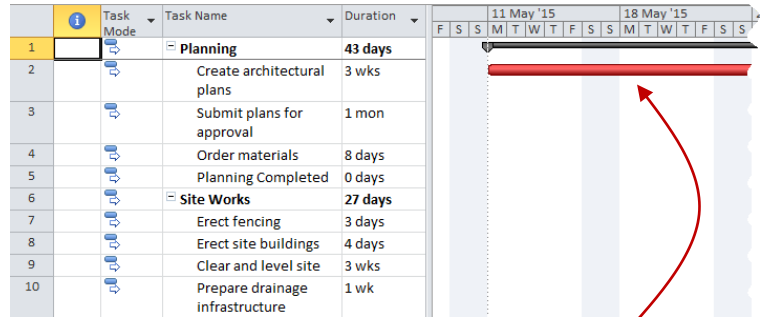
actually choose an appropriate formatting option for the **critical path** (and also the **slack** time) to be seen.

Try This Yourself:

Open File

Before starting this exercise you **MUST** open the file J404 Scheduling_7.mpp...

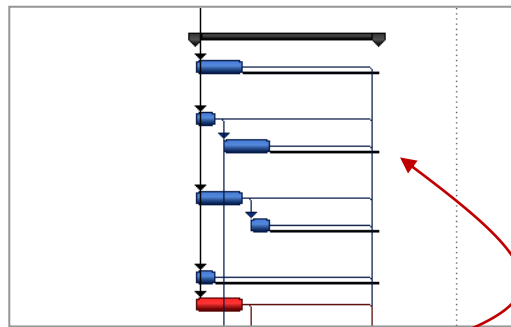
- 1 Click on the **Task** tab on the **Ribbon** and click on **Gantt Chart** in the **View** group
- 2 Use **Ctrl** + **Home**, then **Alt** + **Home** to move to the top task
- 3 Click on the **Format** tab and click on **Critical Tasks** in **Bar Styles** until it appears ticked
All tasks on the critical path will now appear with red bars...
- 4 Click on the minus button of the **Zoom Slider** (bottom right of the screen) until you can see most of the bars on the screen
Notice that many of the Fit Out bars are in blue indicating that they are non-critical...
- 5 Click on **Slack** in **Bar Styles** until it appears ticked to see slack lines in non-critical tasks
- 6 Click on the plus button of the **Zoom Slider** until you can see the days of the week
- 7 Use **Alt** + **Home** to return to the start bar of the project



3

The task bar here should appear in red...

5



They're not the easiest of things to see but the slack lines are there if you look hard enough....

For Your Reference...

To view the **critical path**:

1. Click on the **Format** tab and click on **Critical Tasks** in **Bar Styles** until it appears ticked

Handy to Know...

- There are many other options on the **Format** tab of the Ribbon for making certain aspects of your project stand out. However, Microsoft Project traditionally has displayed critical tasks in red and non-critical tasks in blue. It is probably best to stick with this colour scheme for the moment.

EXAMINING TASK SLACK

Viewing critical and non-critical tasks in the Gantt Chart is quite useful. However, using the Gantt Chart to determine the amount of slack in a non-critical task can be a bit tricky to do – it just isn't

accurate enough. If you really want to find out how much slack time a task has it is best done by viewing the **Schedule** table on a task sheet view.

Try This Yourself:

Open
File

Before starting this exercise you **MUST** open the file **J404 Scheduling_8.mpp...**

- 1 Use **Ctrl** + **Home** to move up to the first task
- 2 Click on the **View** tab on the **Ribbon**, click on **Other Views** in **Task Views**, and click on **Task Sheet**
- 3 Click on **Tables** in the **Data** group and click on **Schedule** to see the **Schedule** table
There's not a lot of slack time at the top of the tasks because these are mostly on the critical path...
- 4 Scroll down until the **Fit Out** tasks are at the top of the screen

Task	Task Name	Duration	Start	Finish	Predecessors	Resource
1	Planning	43 days	Mon 11/05/15	Wed 8/07/15		
2	Create architectural plans	3 wks	Mon 11/05/15	Fri 29/05/15		
3	Submit plans for approval	1 mon	Mon 1/06/15	Fri 26/06/15	2	
4	Order materials	8 days	Mon 29/06/15	Wed 8/07/15	3	
5	Planning Completed	0 days	Wed 8/07/15	Wed 8/07/15	4,2,3	
6	Site Works	27 days	Thu 9/07/15	Fri 14/08/15		
7	Erect fencing	3 days	Thu 9/07/15	Mon 13/07/15	5	
8	Erect site buildings	4 days	Tue 14/07/15	Fri 17/07/15	7	
9	Clear and level site	3 wks	Mon 20/07/15	Fri 7/08/15	8	
10	Prepare drainage infrastructure	1 wk	Mon 10/08/15	Fri 14/08/15	9	
11	Prepare cabling infrastructure	1 wk	Mon 10/08/15	Fri 14/08/15	9	

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Task	Task Name	Start	Finish	Late Start	Late Finish	Free Slack	Total Slack	Add New
1	Planning	Mon 11/05/15	Wed 8/07/15	Mon 11/05/15	Thu 9/07/15	0 days	0 days	
2	Create architectural plans	Mon 11/05/15	Fri 29/05/15	Mon 11/05/15	Fri 29/05/15	0 wks	0 wks	
3	Submit plans for approval	Mon 1/06/15	Fri 26/06/15	Mon 1/06/15	Fri 26/06/15	0 wks	0 wks	
4	Order materials	Mon 29/06/15	Wed 8/07/15	Mon 29/06/15	Wed 8/07/15	0 days	0 days	
5	Planning Completed	Wed 8/07/15	Wed 8/07/15	Thu 9/07/15	Thu 9/07/15	0 days	0 days	
6	Site Works	Thu 9/07/15	Fri 14/08/15	Thu 9/07/15	Mon 17/08/15	0 days	0 days	
7	Erect fencing	Thu 9/07/15	Mon 13/07/15	Thu 9/07/15	Mon 13/07/15	0 days	0 days	
8	Erect site buildings	Tue 14/07/15	Fri 17/07/15	Tue 14/07/15	Fri 17/07/15	0 days	0 days	
9	Clear and level site	Mon 20/07/15	Fri 7/08/15	Mon 20/07/15	Fri 7/08/15	0 wks	0 wks	
10	Prepare drainage infrastructure	Mon 10/08/15	Fri 14/08/15	Mon 10/08/15	Fri 14/08/15	0 wks	0 wks	
11	Prepare cabling infrastructure	Mon 10/08/15	Fri 14/08/15	Mon 10/08/15	Fri 14/08/15	0 wks	0 wks	
12	Site Works Completed	Fri 14/08/15	Fri 14/08/15	Mon 17/08/15	Mon 17/08/15	0 days	0 days	
13	Building Construction	Mon 17/08/15	Fri 26/02/16	Mon 17/08/15	Mon 29/02/16	0 days	0 days	
14	Pour foundations	Mon 17/08/15	Thu 22/08/15	Mon 17/08/15	Thu 22/08/15	0 days	0 days	

3

Task	Task Name	Start	Finish	Late Start	Late Finish	Free Slack	Total Slack	Add New
21	Fit Out	Mon 29/02/16	Fri 15/04/16	Mon 29/02/16	Mon 18/04/16	0 days	0 days	
22	Fit all windows and doors	Mon 29/02/16	Fri 11/03/16	Mon 4/04/16	Fri 15/04/16	5 wks	5 wks	
23	Install electrical cabling	Mon 29/02/16	Fri 4/03/16	Mon 28/03/16	Fri 1/04/16	0 wks	4 wks	
24	Install electrical fixtures	Mon 7/03/16	Fri 18/03/16	Mon 4/04/16	Fri 15/04/16	4 wks	4 wks	
25	Install all plumbing	Mon 29/02/16	Fri 11/03/16	Mon 28/03/16	Fri 8/04/16	0 wks	4 wks	
26	Install plumbing fixtures	Mon 14/03/16	Fri 18/03/16	Mon 11/04/16	Fri 15/04/16	4 wks	4 wks	
27	Lay astro turf	Mon 29/02/16	Fri 4/03/16	Mon 11/04/16	Fri 15/04/16	6 wks	6 wks	
28	Erect handrails and gates	Mon 29/02/16	Fri 11/03/16	Mon 29/02/16	Fri 11/03/16	0 wks	0 wks	
29	Paint rooms, fixtures	Mon 14/03/16	Fri 8/04/16	Mon 14/03/16	Fri 8/04/16	0 wks	0 wks	
30	Install PA system	Mon 7/03/16	Tue 8/03/16	Thu 7/04/16	Fri 8/04/16	23 days	23 days	
31	Install video imaging	Mon 7/03/16	Wed 9/03/16	Wed 6/04/16	Fri 8/04/16	22 days	22 days	
32	Fit out control room	Mon 11/04/16	Fri 15/04/16	Mon 11/04/16	Fri 15/04/16	0 wks	0 wks	
33	Fit Out Completed	Fri 15/04/16	Fri 15/04/16	Mon 18/04/16	Mon 18/04/16	0 days	0 days	
34	Commissioning	Mon 18/04/16	Thu 1/05/16	Mon 18/04/16	Thu 1/05/16	0 days	0 days	

4

For Your Reference...

To examine **task slack**:

1. Click on the **View** tab on the **Ribbon**, click on **Other Views** in **Task Views**, and click on **Task Sheet**
2. Click on **Tables** in the **Data** group and click on **Schedule**

Handy to Know...

- It's important to keep an eye on slack time as it can greatly help you reschedule tasks without impinging on the overall project's finish date.

UNDERSTANDING LAG TIME

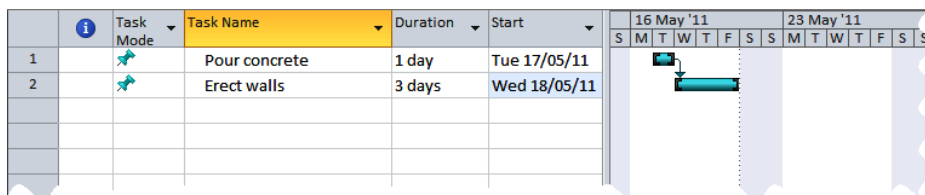
Once you have established dependencies between tasks you may find it necessary to further **delay** the start of one of the tasks. Microsoft Project provides four different types of

task dependency offering you plenty of scoping. Any one of those dependency types can be further delayed using a **lag time** calculation.

Lag Time

In the real world, relationships are even more complex than the four relationship types that we have seen thus far.

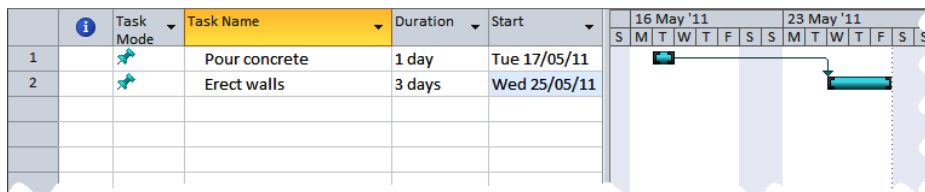
Consider the situation of a house to be built on a concrete slab. The erection of walls cannot commence until the concrete has properly cured. The two tasks, pouring the slab and erecting the walls, constitute a definite finish-to-start relationship.



However, the laying of the slab may be finished some five days before the frame can be erected so that the concrete can sufficiently cure. It would not be wise to factor this into the project, as time taken for the curing would also include any resource allocation such as cost of concrete workers. These guys are probably well into another job while the slab for your house is curing.

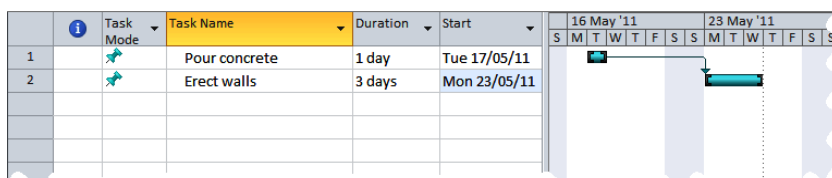
Project therefore allows you to delay the start of a task, even though there may be a finish-to-start relationship. This delay between the two tasks is called **lag time**.

Lag times are represented numerically, either as a direct duration value or as a percentage. For example, waiting for the concrete to cure may take 5 days. This would be written as 5d in the lag field of the Erect walls task (because this is the task that lags behind its predecessor) and would appear in the Gantt Chart as shown below.

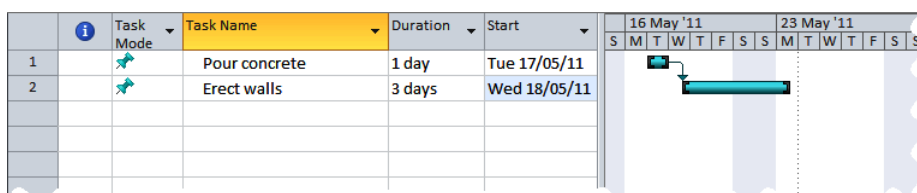


There is only one problem with the scenario above. While we have entered a lag of 5d, Microsoft Project has determined these as 5 work days. If you add all of the days you'll notice that there is a lag of 5 work days and 2 weekend days. In our experience concrete cures even on weekends!

In the scenario above we need to enter elapsed days. This would be written as 5ed rather than **5d**. With this adjustment the lag will look as shown below.



You can also enter lag as a percentage. The percentage is calculated as a percentage of the predecessor task. In the example below a lag of 80% has been entered in the lag field of the Erect walls field – the lag is calculated as 80% of the **Pour Concrete** duration.



It can be entered in the **Lag** field in the **Task Information** dialog box. In our project, under construction guidelines we must wait 100 hours after pouring foundations before erecting anything.

**Same
File**

1 Click on the **View** tab on the **Ribbon** and click on **Gantt Chart in Task Views**, then press **Ctrl** + **Home** to return to the top task

3 Drag the vertical bar between the sheet and the chart until you can see the start and finish date columns

5 Double click on **Erect steelwork** to display the **Task Information** dialog box and click on the **Predecessors** tab

7 Click on **[OK]** to see the lag in the timeline

3

6

7

1. Double click on the successor task and click on the **Predecessors** tab of the **Task Information** dialog box
2. Type the desired amount of **lag** into the **Lag** field in the dialog box

- You can also enter lag time in a **Task Form** view. This form can be seen using the split screen view, or by accessing a **Task Form** using the **Other Views** command on the **View** tab of the **Ribbon**.

UNDERSTANDING LEAD TIME

There may be times in your project when you realise that a predecessor doesn't have to be finished for the successor to start. In Microsoft Project, you can make tasks overlap. This

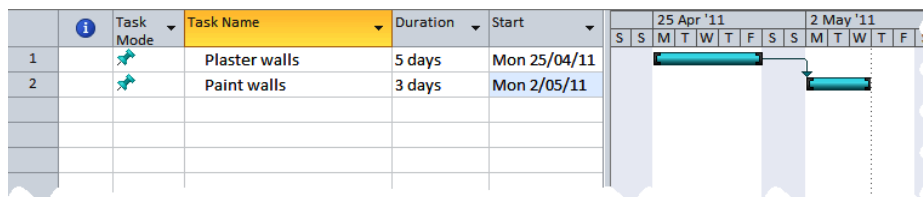
overlap is known as **lead time**. **Lead time** is an overlap between tasks that have a dependency. You enter a **lead time** as a negative value in the **Lag** field for a task.

Lead Time

Lead is the opposite of lag. Rather than delaying the start of a successor task it accelerates it.

Lead is normally used where a task may be starting earlier than the one concluding.

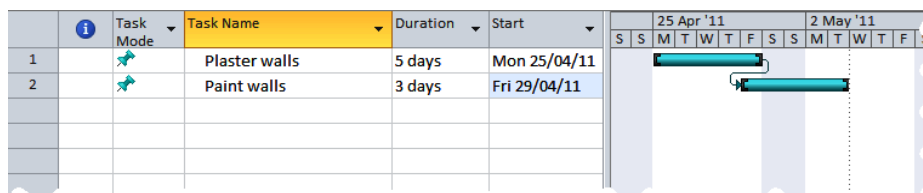
Consider the building of a house. Normally, you would expect that the painting couldn't be finished until the plasterwork has been done. Therefore, you would set a finish-to-start relationship between the two.



In a larger house however, the painters may be able to move in and paint one room while the plasterers are still working on another. The painters may be able to start work when the plasterers have completed 80% of their task – in other words, the painters can start when the plasterers only have 20% of their work left to do.

This is still a finish-to-start relationship. However, there is a slight overlap between the two, which allows the painting to commence while the plastering is almost complete. In project jargon the time between when the second task begins and the first task ends is known as lead time.

Lead time can be entered into a sheet or a form. It can be entered as a duration or as a percentage. Lead times, because of their overlapping nature, are preceded with a minus sign.



For example, to represent the fact that painters can start work with a lead time of 1 day you can enter -1d. If this represents 20% of the task's total duration you can enter it as -20%.

ENTERING LEAD TIME

Lead time is an overlap between tasks that have a dependency. By assigning lead time to a relationship, the successor gets a head start. Lead time can be entered as a negative number

or a negative percentage. **Lead time** reduces elapsed time in the schedule and, when applied to critical tasks, can shorten the overall time of the project.

Try This Yourself:

Same File

Continue using the previous file with this exercise, or open the file J404 Scheduling_10.mpp...

1

Click on **Erect wall** and click on **Scroll to Task** in the **Editing** group on the **Task** tab

In our case study we can actually start erecting walls when 90% of the steelwork is done...

2

Double click on **Erect wall** and click on the **Predecessors** tab

3

Click on **0d** in **Lag**, type - **10%** and press **Enter**

4

Click on **[OK]**

5

Repeat the above steps to apply a lead time of **-2d** to the **Paint rooms, fixtures, fittings, etc** task

6

Click on the **Project** tab and click on **Project Information** in the **Properties** group

The project should now be scheduled to finish on Wednesday 27/4...

7

Click on **[OK]** to close the dialog box

3

Task Name	Duration	Start	Finish
Building Construction	125 days	Mon 17/08/15	Mon 22/02/16
Pour foundations	4 days	Mon 17/08/15	Thu 20/08/15
Erect steelwork	3 mons	Tue 25/08/15	Mon 16/11/15
Erect wall	2 mons	Mon 9/11/15	Mon 18/01/16
Install roofing superstructure	2 wks	Tue 19/01/16	Mon 1/02/16
Install roof retracting	1 wk	Tue 2/02/16	Mon 8/02/16

4

Notice that **Erect wall** has now come forward 6 days. The calculation represents 10% of the duration for **Erect steelwork**, which is 3 months. The calculation is derived by finding the total hours for erecting steelwork (20 days per month x 3 months x 7.5 hours per day = 450 hours). 10% of the total hours divided by the hours per day determines the amount of lead time (10% x 450 hours = 45/7.5 = 6 days). You can also specify a precise amount for lead.

Task Name	Duration	Start	Finish
Erect handrails and fencing	2 wks	Tue 23/02/16	Mon 7/03/16
Paint rooms, fixtures, fittings, etc	1 mon	Fri 4/03/16	Thu 31/03/16
Install PA system	2 days	Tue 1/03/16	Wed 2/03/16
Install video imaging equipment	3 days	Tue 1/03/16	Thu 3/03/16

5

For Your Reference...

To enter **lead time** for a task:

1. Double click on the successor task and click on the **Predecessors** tab of the **Task Information** dialog box
2. Type the desired amount of **lead** as a negative value into the **Lag** field

Handy to Know...

- You can enter lead time directly into the **Task Sheet**. Click in **Predecessors** for the successor task. You can enter the lead time at the end of the task ID for the allocated relationship. For example, Task 3 has a FS relationship with Task 2. To indicate a 2-day lead, the entry would appear as **2FS -2d**.

NOTES:

[illegible]