

# **CFL Guidelines for Developing Critical Path Method Schedules (CPMs)**

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## 1. INTRODUCTION

### 1.1 Purpose and Background for Construction Schedules

Construction schedules for our projects are used to determine reasonable and accurate contract time for construction. Contract time is the maximum time allowed in the contract for completion of all work contained in the contract documents.

A construction schedule will establish the number of days needed to complete the project. This will help the FHWA in planning during the development of the project. It will help construction management teams with time frames for staffing a project, for public notifications and help determining warranted closures. It will help in determining construction sequencing, phasing, milestones or alternate bid schedules. It will help to develop funding for CE costs during constructions, and it will also provide background support during reviews of Contractor submitted construction schedules.

If contract time is insufficient to complete the work, bid prices may be higher and there may be an unusual number of time overruns and contractor claims. Contractors should be provided the ability to schedule work to maximize equipment and labor. If contract time is too short, these efficiencies are more difficult to obtain resulting in higher prices.

If the time allowed is excessive, there may be cost inefficiencies by the contractor. The public may be inconvenienced unnecessarily and subjected to traveling on an unsafe roadway for an extended period of time. In establishing contract time, strive for the shortest practical traffic interruptions to the road user. If the time set is such that all work on a project may be stopped for an extended period (not including necessary winter shutdowns) and the contractor can still complete the project on schedule, it means the contract time allowed was excessive.

#### **Important Note:**

The purpose of the Designer's construction schedule is to determine the number of days that is reasonable to complete the work. The schedule may be used as a reference by the Construction staff. The FHWA generated schedule is usually not used by the Contractor. However, it can be requested during Freedom of Information Act reviews and often scrutinized by attorneys and expert witnesses during depositions and legal proceeding.

### 1.2 Construction Schedule Submittal Guidelines

For typical 4R projects, create the first construction schedule during the 50% design development. Update the schedule for all remaining PS&E submittals. Special issues for some projects may require that the construction schedule be prepared at an earlier stage of design.

For typical 3R projects, create the first construction schedule during the 70% design review. Update the schedule for all remaining office and field reviews. Again, special issues for some projects may require that the construction schedule be prepared at an earlier stage of design.

The prepared construction schedule should be submitted for review along with PS&E submittals.

## **2. ELEMENTS IN DETERMINING CONTRACT TIME**

### **2.1 Production Rates**

A production rate is the quantity produced or constructed over a specified time period. Estimating realistic production rates is important when determining appropriate contract completion time. Production rates may vary considerably depending on project size, geographic location, whether the project is in a rural or urban setting.

To establish accurate production rates, use normal historic rates of efficient contractors. A common method of establishing production rates is to divide the total quantity of an item on previously completed projects by the number of days/hours the contractor used to complete the item. Some possible resources to find historical production rates or construction performance data are the local state's DOT and the RSMeans Cost Data Books. See also Section 5 (Additional Resources) for links and information on obtaining established production rates. Base production rates upon five-day weeks and eight-hour crew days or per piece of equipment.

**Important Note:** Many FHWA projects will not have 8-hour work days. The production rate used should be adjusted for the project's average work-day for that activity. See example in Subsection 3.4.

Production rates developed by reviewing total quantities and total time are not recommended as they may result in misleading rates which tend to be low since they may include startup, cleanup, interruptions, etc. Base the production rates on the desired level of resource commitment (labor, crew sizes, equipment, etc.) deemed practical given the physical limitations of the project. Representatives of the construction industry are also usually willing to assist in developing rates and time schedules.

Update rates regularly to assure accurate representation of the average rate of production in the area. Place an emphasis on developing production rates for activities known to be on the critical path. It is very important to document and/or coordinate the production rates with the project's Construction Operation Engineer (COE).

Adjustments to production rates should be based upon using engineering judgment and specific project aspects noted above. For example:

**Hot Asphalt Concrete Pavement (HACP) production rate:**

HACP Paving (max) - 1,980 tons/day (from local DOT)  
HACP Paving (min) - 1,320 tons/day (from local DOT)

Starting rate =  $(1980 + 1320)/2 = \underline{1,650 \text{ tons/day}}$  (assuming an 8-hr day)

Project Specifics (must document):

Paving in early spring. Due to cold temperatures, reduce to a 6-hr day (11am-5pm).

Remote project location will increase haul times, no temporary batch-plant, reduce to a 5-hr day.

Used/adjusted production rate =  $1,650 * 5/8 = \underline{1,030 \text{ tons/day (rounded)}}$

## 2.2 Other Factors Affecting Contract Times

Some of the following items should be considered when determining contract time:

1. Effects of traffic on scheduling, production rates and the sequence of operations.
2. Curing time and waiting periods between successive paving courses or between concrete placement operations, as well as specified embankment settlement periods.
3. Setup times, mobilization, special equipment required.
4. Seasonal limitations for certain items when determining both the number of days the contractor will be able to work as well as production rates such as: rain, runoff, high water conditions and snow.
5. Conflicting operations of adjacent projects, both public and private.
6. Time for Government review of false-work plans, shop drawings, post-tensioning plans, mix designs, etc.
7. Time for fabrication of structural steel and other specialty items.
8. Lead time to obtain necessary permits.
9. The effect of permitting conditions and/or restrictions.
10. Restrictions for nighttime and weekend operations.
11. Time of the year of the letting as well as duration of the project.
12. Additional time for obtaining specialty items or materials with long-lead requirements, such as steel girders and treated timber.
13. Delays due to normal seasonal weather.
14. Other pertinent items as determined by the client agency.
15. Project or non-project special events and/or milestones, such as holidays, hunting seasons, local celebrations, etc.
16. Number of crews and crew sizes.
17. Type of project (i.e. ERFO) and difficulty of work.
18. Environmental Commitments (i.e. migratory bird restrictions).
19. Construction of temporary works, diversion dikes and berms.
20. Earthwork type (i.e. rock, clay, sands, etc.)

## **3. STEPS FOR CREATING CPM CONSTRUCTION SCHEDULES**

### **3.1 Define Work Day**

Work hours establish the daily work times the contractor could work and may be set for each project and/or task calendar. Use an eight hour workday defined as 8:00 am to 5:00 pm unless you have project specific restrictions or requirements.

See Subsection 4.2 for guidance on how to define the normal working day into Microsoft Project.

### **3.2 Define the Project Calendar and Task Calendar**

The project calendar defines the project's work and non-work days. Non-work days usually include Saturdays, Sundays, Holidays, and any other contractual non-work days. They may also include local events when they would adversely impact construction. Each project will have its own unique set of restrictions.

A task calendar defines the work and non-work days for a task or activity. If the task can only be performed during a limited time frame, the task calendar would show the work and non-work days. For example, the project calendar shows the project lasting one year, January through December. If seeding and turf establishment must be performed after September 1, then a seeding task calendar would show non-work days from January through August and show work days from September through December. Only one task calendar can be assigned to a specific activity.

See Subsection 4.2 for guidance on how to define the working calendar in Microsoft Project.

### **3.3 Identify, Group and Sequence the Activities**

A key factor in developing a realistic schedule is to include the right activities. Consider the uniqueness of each project and use engineering judgment. In most cases, it is not necessary to include every bid item in the schedule. For example, the following items generally are not shown: construction schedule, QC/QA plan, Contractor testing and watering. Notice to Proceed (NTP) and Project Closeout should be the first and last activities in a schedule. Once the activities are identified and grouped, determine the general sequence of the activities.

The table below offers guidance for typical activity groupings, inclusions and exclusions in a construction schedule.

Activity	Comment
Staking	Only show staking tasks that are necessary to start the project (e.g., clearing limits and slope stakes). Do not show staking as a continuous activity throughout the project.
Clearing & Grubbing	Show clearing & grubbing work needed in order to commence major construction activities.
Erosion Control	Show items of work that are required to be in-place before clearing or grading operations can begin, such as silt fence.
Earthwork	Break out rock excavation as a separate activity from other earthwork items.
Pavement Structure Items	Combine associated bid items into one work activity. For example, if asphalt cement is a separate 401 item, you only need to show the work items, i.e. paving. However, separate the major pavement structure items such as; base course and asphalt.
Bridge Activities	Show by phase of construction - foundation, substructure, superstructure, not by individual bid items.
Subexcavaton	Combine subexcavation, geotextile, and select borrow into one activity
Drainage	Show individual major culverts larger than 48 inches in diameter or box culverts that cause significant impacts to traffic or other operations. Generally, most other drainage items can be combined into one activity and not shown on the construction schedule if they don't substantially impact other operations and can be constructed with other activities.
Turf Establishment	Show as one item. Verify that work occurs in seeding window.
Signing & Striping	Combine all permanent traffic control signing and striping into one activity.
Guardrail	Combine all type of guardrail into one activity.

See Subsection 4.3 for guidance on how to input the activities into Microsoft Project.

### 3.4 Set Activity Durations

Developing activity or grouped activity durations is the most important part of establishing reasonable and accurate schedules. Therefore, it is critical that time, effort, research and thought go into these durations. The production rates will need to be computed based on the average anticipated hours in a work day. That is, activity durations are set on a per day basis not by hour. Therefore, to adjust an activity's duration, always use the ratio of the actual day work hours to the established workday. If the production for HACP was 1,030 tons/day (based on an 8 hour work day) and the contractor was only going to work 6 hour day (limited daylight hours) then the adjusted rate would be:

$1,030 \text{ tons/day} \times 6 \text{ hours} / 8 \text{ hours} = 770 \text{ tons/day (rounded)}$ .

The Factors Affecting Contract Time items listed in Subsection 2.2 should be given thought and included in durations. Documenting your assumptions and reviewing the information with the Construction Operations Engineer (COE) is imperative to finalize the construction schedule. Try to limit the duration for any activity to 20 days. If the duration is longer, consider breaking the activity into phases based on station ranges or other project milestones.

See Subsection 4.3 for guidance on how to input activity durations and assumptions into Microsoft Project.

### 3.5 Link Activities

Once all the activities necessary to complete a project have been listed, the relationship of these activities to one another needs to be determined by linking activities. In some instances, several activities can be undertaken concurrently, and at other times, certain activities cannot be undertaken until others have been completed. Generally, when determining the sequence of operations, some questions need to be asked such as: "What needs to be done before proceeding with this activity" or "what can be done concurrently?" Every activity has a definite event to mark its relationship with others with respect to completing a task.

See Subsection 4.4 for guidance on how to link project activities.

### 3.6 Documentation

Document any assumptions such as: production rates, equipment types, quantities and number/size of crews used. That way, if the schedule is modified, the logic can be followed. It is recommended to document notes using Task Information Notes in the Microsoft Project scheduling software.



See Subsection 4.3 for guidance on documenting assumptions Using Microsoft Project.

### **3.7 Review CPM Schedule with the COE**

Make sure that applicable notes have been added to the activities and phases. For review by the COE it is a good idea to print the schedule from the Gantt Chart view, the Network Diagram view (showing links/logic) and the notes.

See Subsection 4.5 for guidance on how to view or print the schedule in Microsoft Project.

### **3.8 Modify the Construction Schedule**

Modify the CPM schedule in conjunction with the COE by applying constraints, modifying production rates, project or task calendars, or activity sequences.

See Subsection 4.7 for guidance on how to add activity constraints in Microsoft Project.

## **4. USING MICROSOFT PROJECT**

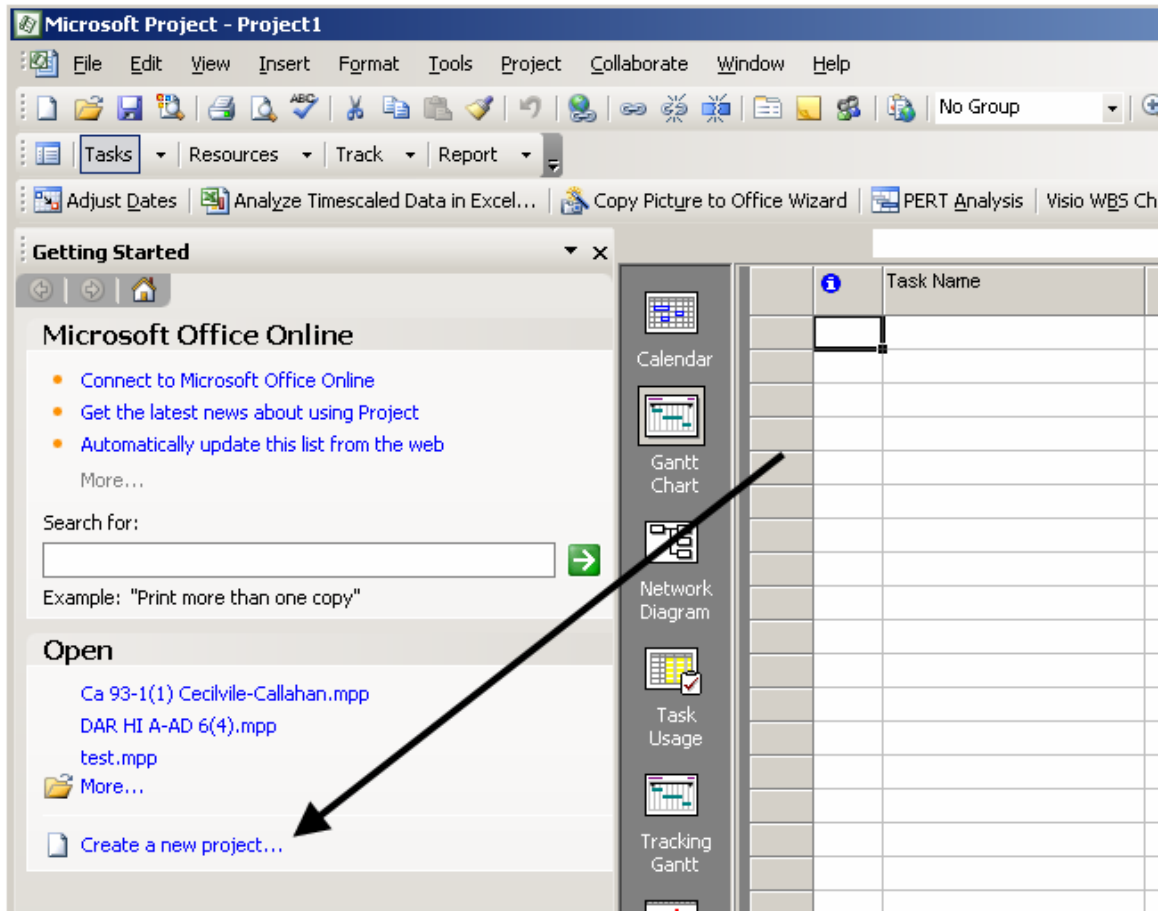
### **4.1 Create a New CPM Schedule**

Open Microsoft Project.

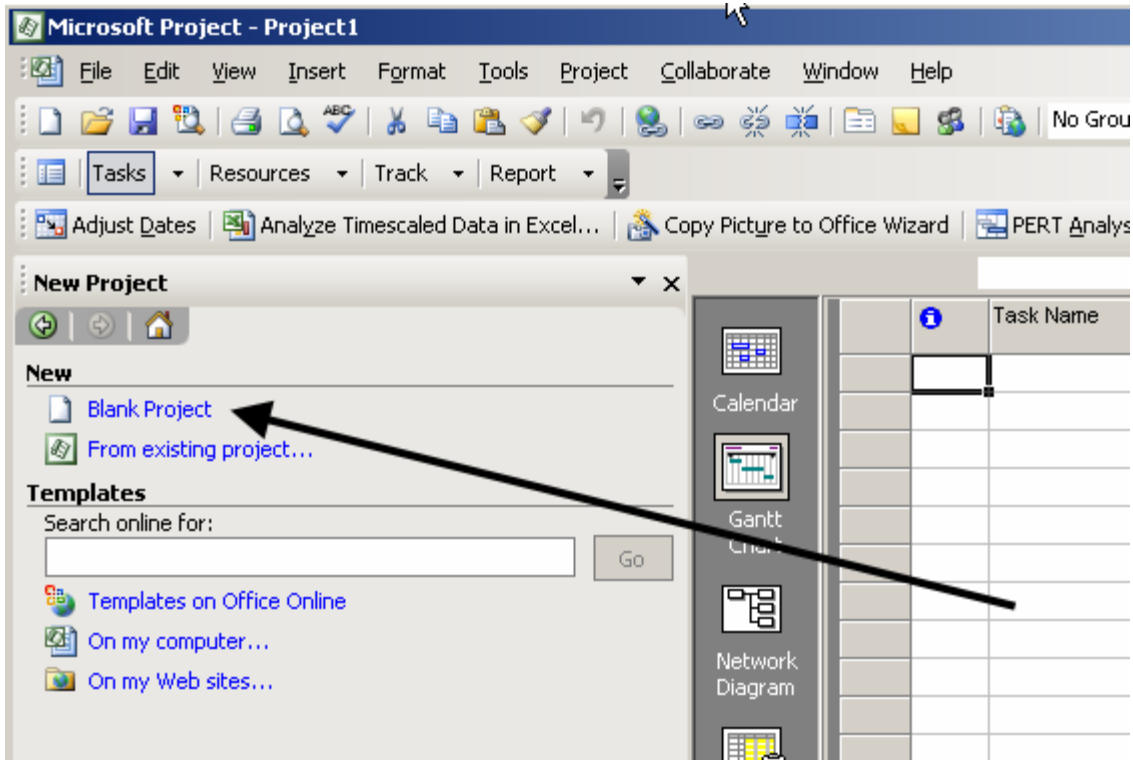
#### **Hint:**

To set up a basic schedule, Microsoft Project offers a “Project Guide”. The Project Guide should appear on the left side of the screen. If not, turn on the guide from the main pull down menu by selecting **View/Toolbars/Project Guide**. The left icon toggles the guide on and off. Follow the steps sequentially to create your schedule. If the Project Guide is not used, then follow the following steps:

Select “**Create new project**” or from the pull down menus select **File/New**



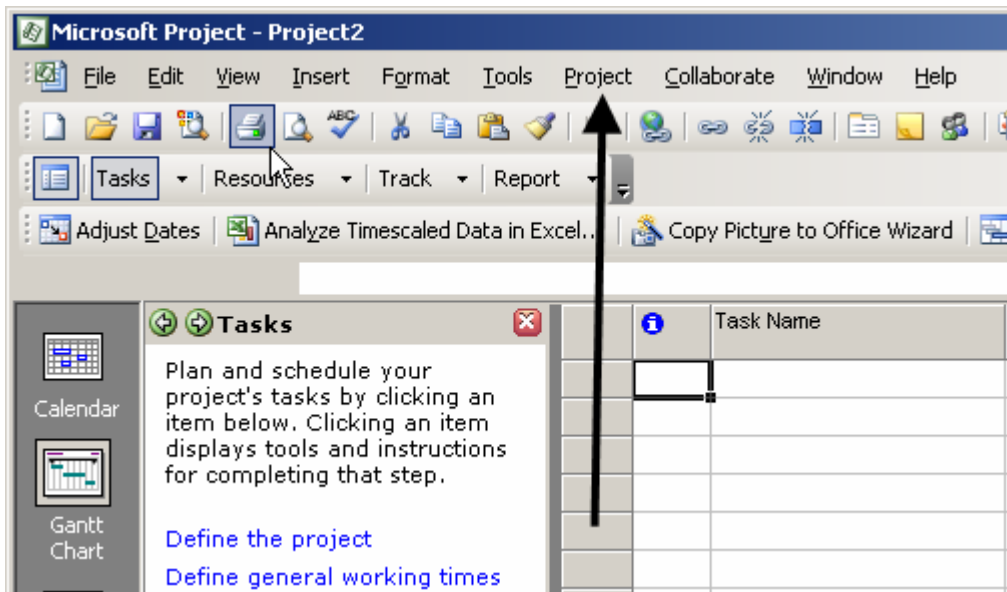
Select “**blank project**”



Save the file to your project directory with an appropriate naming convention using **File/Save** from the main pull down menu.

## 4.2 Define the Project

Select **Project** then **Project Information**.



Enter the approximate start date (Notice to Proceed). Either type in the date or use the drop down calendar. Check the other entries in the Project Information dialog box. These defaults should work for almost all projects. Unless it is known that the majority of the project will be constructed at night or with 24 hour shifts, keep the Standard calendar selected.

**Project Information for 'Project2'**

Start date:  Current date:

Finish date:  Status date:

Schedule from:  Calendar:

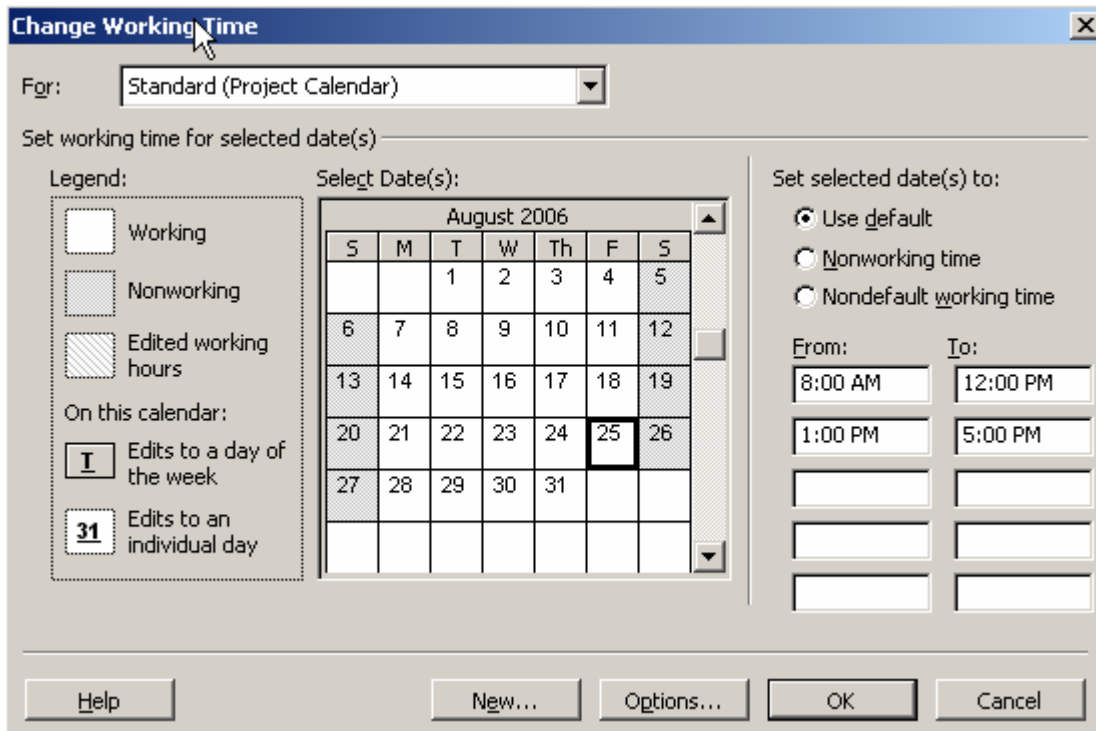
All tasks begin as soon as possible. Priority:

Enterprise Custom Fields

Custom Field Name	Value
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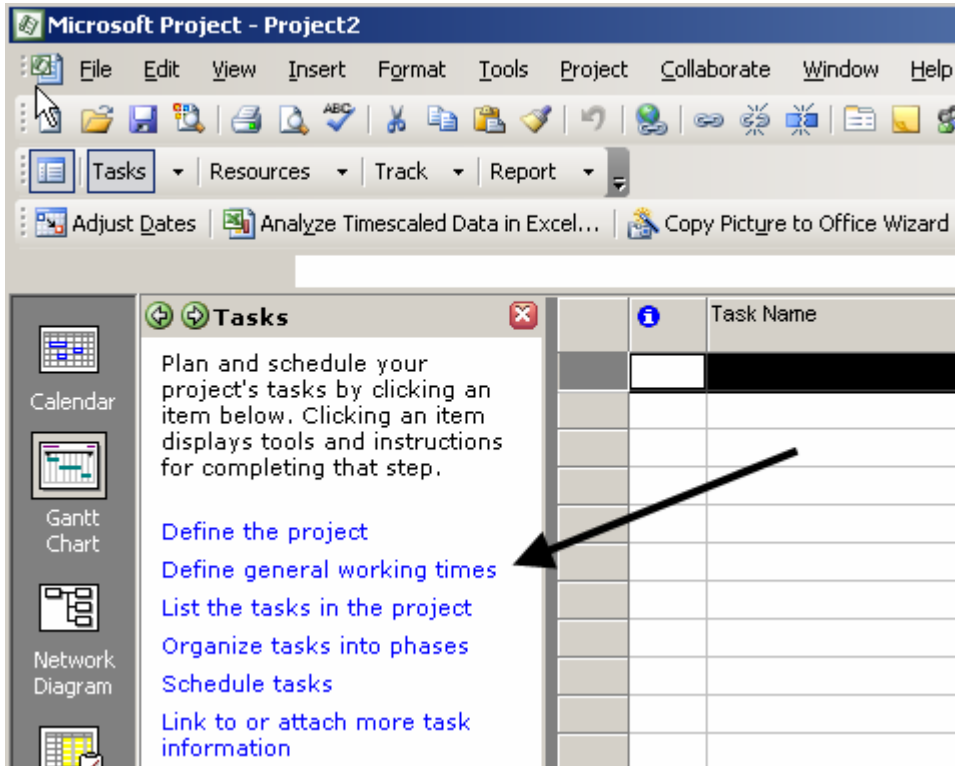
Help Statistics... OK Cancel

Set the project calendar/s by selecting from the main menu **Tools/Change Working Time**. Modify the Standard calendar (project calendar) for the project. Highlight days/weeks/months for project specific restrictions (non-working days). Do this for the expected duration of the project plus an extended period of time (at least 3-6 months) beyond the expected finish of the project. Do not edit the default working times here, times will be changed under a different step. Show holidays and other non-working days as non-working days.

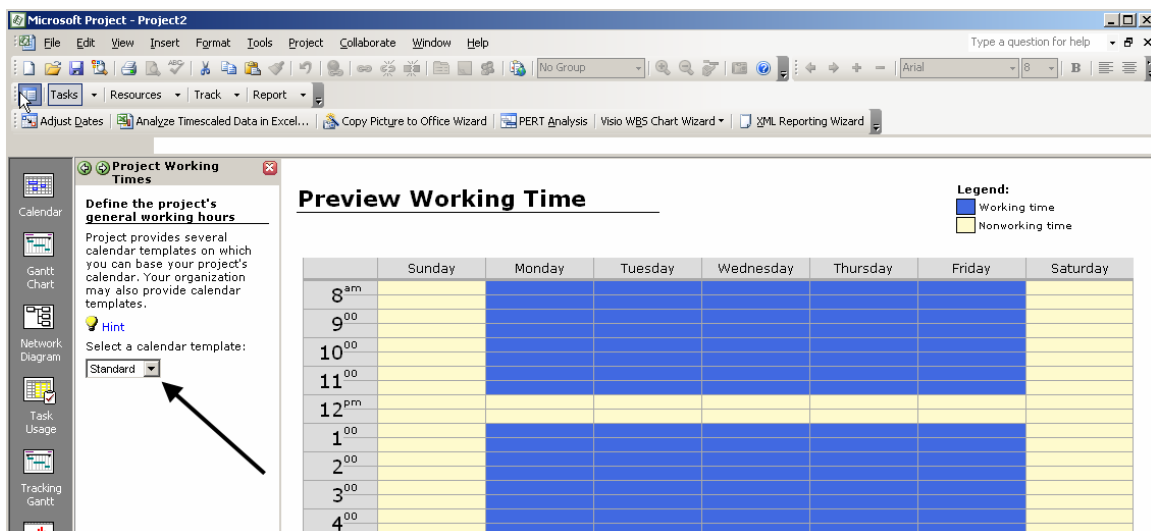


If the project requires more than one calendar for specific construction activities, select the New tab at the bottom of the Change Working Time dialog box. Complete the task calendar in the same way as the project or “Standard” calendar.

To change daily working hours for each calendar, it is easiest to use the Project Guide. On the Project Guide toolbar, select **Tasks/Define general working times**.



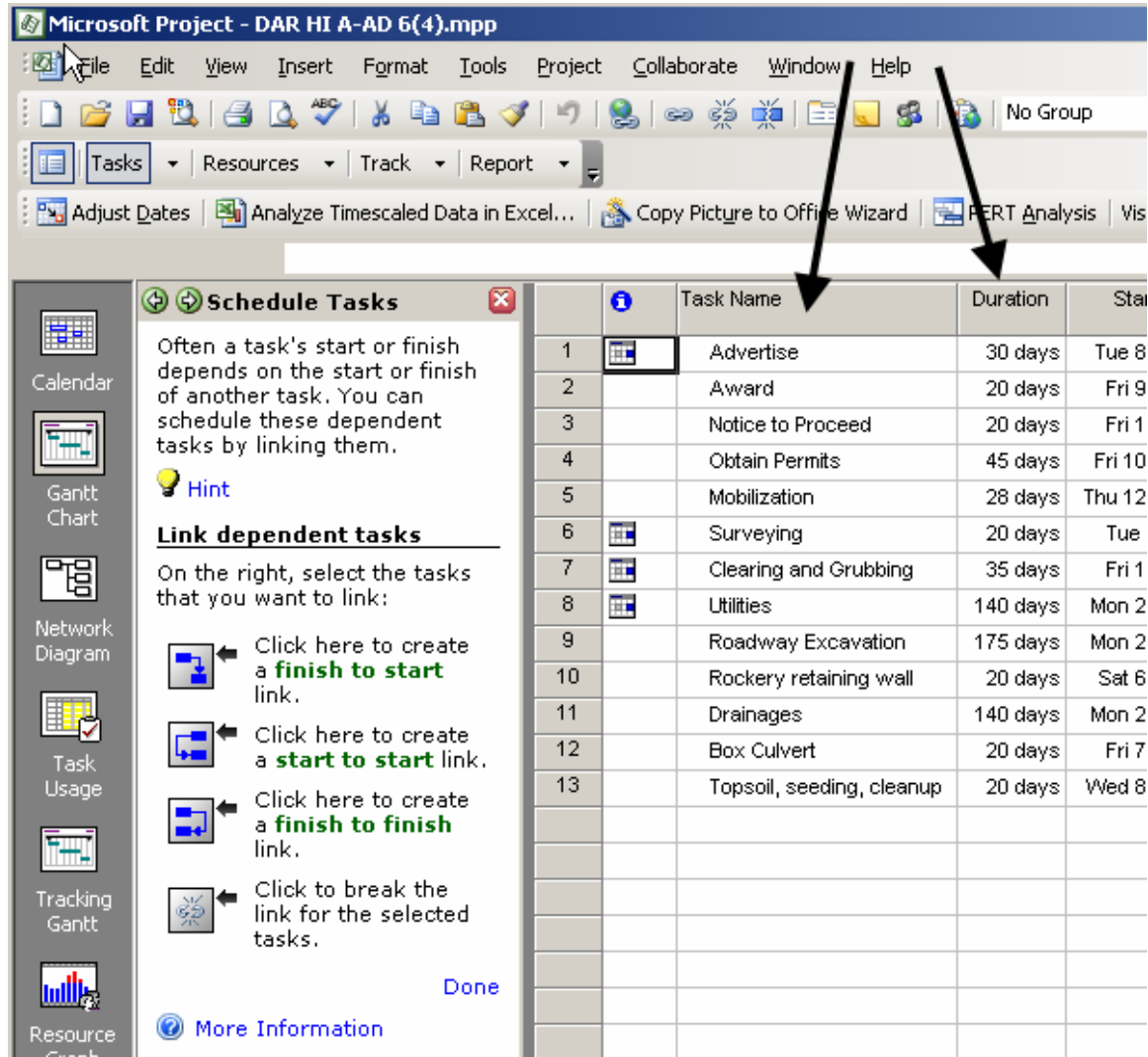
Select the calendar to modify and make the appropriate changes. Keep in mind that this is mostly insignificant to construction schedules. The production rates should be established for working hours in a day. This will determine your durations.



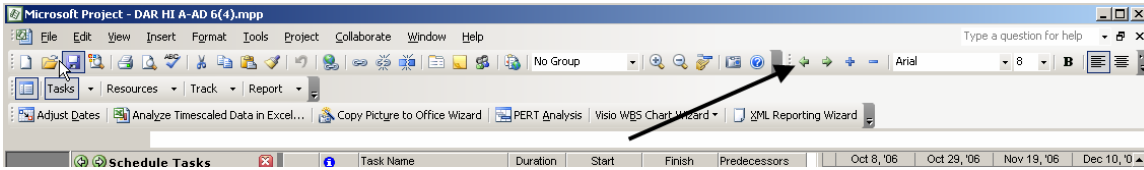
### 4.3 Input and Organize Project Activities and Data

Make sure the appropriate view is currently in use. Select **View/Gantt Chart** from the main menu.

Under the Task Name column, enter the construction activities in sequential order.



If activities can be grouped as shown below, group construction activities under the appropriate phase by selecting one or more activities and then indent “right”. The indent controls are the green arrow icons located on the formatting toolbar.



Add durations to the construction activities. If the activity is a milestone, put a zero for the duration. Do not add durations for summary tasks. The summary tasks (in bold) will summarize subtasks durations.

**Schedule Tasks**

Often a task's start or finish depends on the start or finish of another task. You can schedule these dependent tasks by linking them.

**Hint**

**Link dependent tasks**

On the right, select the tasks that you want to link:

- Click here to create a **finish to start** link.
- Click here to create a **start to start** link.
- Click here to create a **finish to finish** link.
- Click to break the link for the selected tasks.

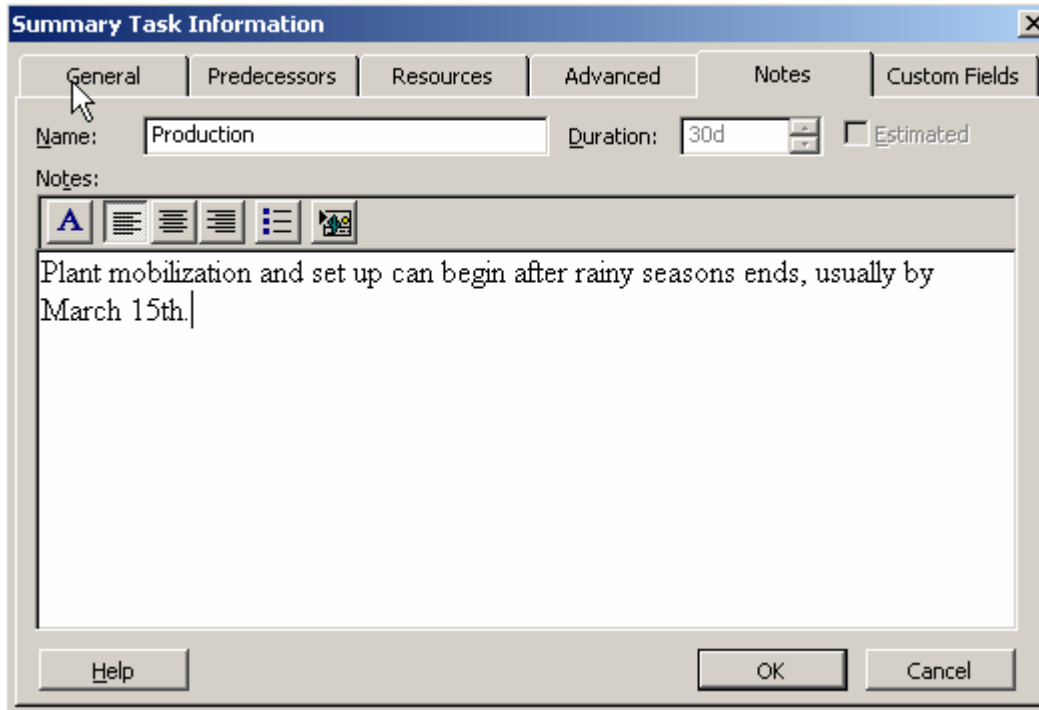
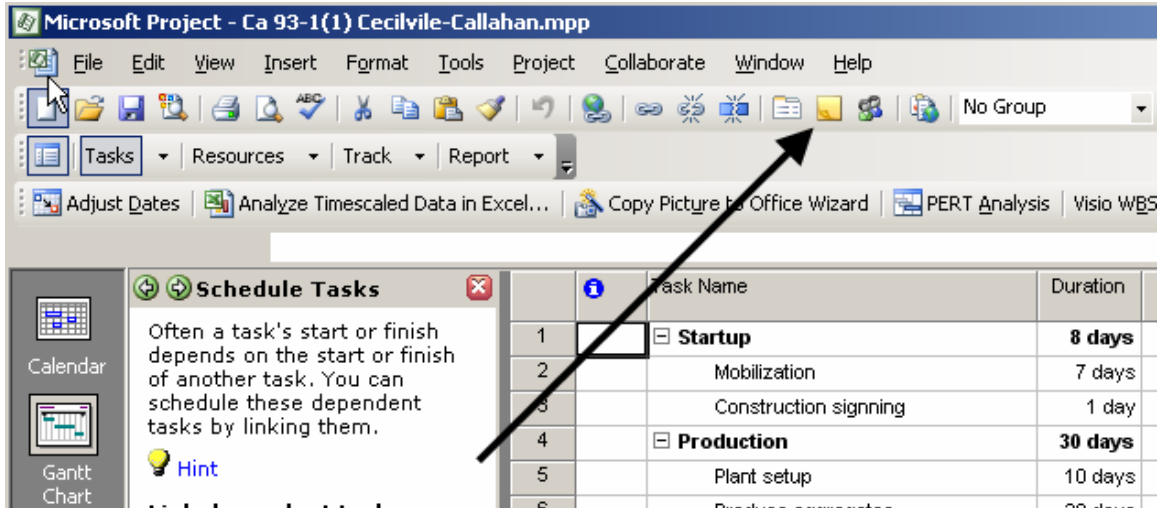
Done

[More Information](#)

Task ID	Task Name	Duration	Start	Finish	Predecessors
1	<b>Startup</b>	8 days			
2	Mobilization	7 days			
3	Construction signing	1 day			
4	<b>Production</b>	30 days			
5	Plant setup	10 days			
6	Produce aggregates	20 days			
7	<b>Recycling</b>	23 days			
8	Road reconditioning, pulverizing	23 days			
9	<b>Paving</b>	42 days			
10	Paving	42 days			
11	<b>Bridge rail</b>	39 days			
12	Set temporary barrier	1 day			
13	Remove bridge rail	3 days			
14	Install new rail	15 days			
15	Relocate temporary barrier	1 day			
16	Remove bridge rail	3 days			
17	Install new rail	15 days			
18	Remove temporary barrier	1 day			
19	<b>Stripping</b>	8 days			
20	Layout stripping pattern	5 days			
21	Apply stripe	3 days			
22	<b>Cleanup</b>	5 days			
23	Remove stakes and debris	5 days			
24	Remove construction signs	2 days			



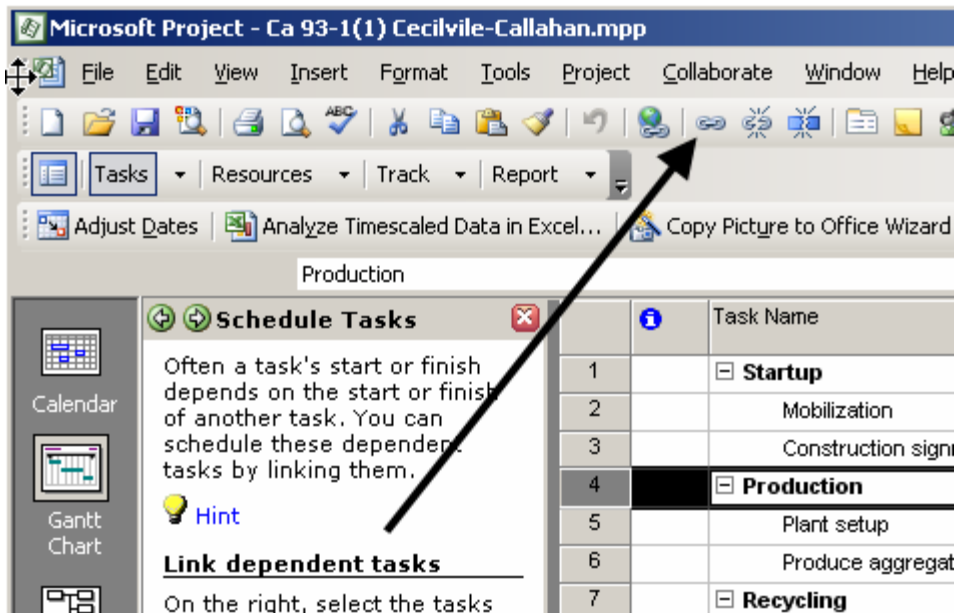
Document assumptions at this time by one of the two following methods: Either double-click on an activity/task and select the **Notes** tab in the Task Information dialog, or highlight the activity/task and select the **Task Notes** icon from the Standard toolbar. Type in quantities, assumptions used for production rates, assumed bad weather days and other items that have an effect on the duration.



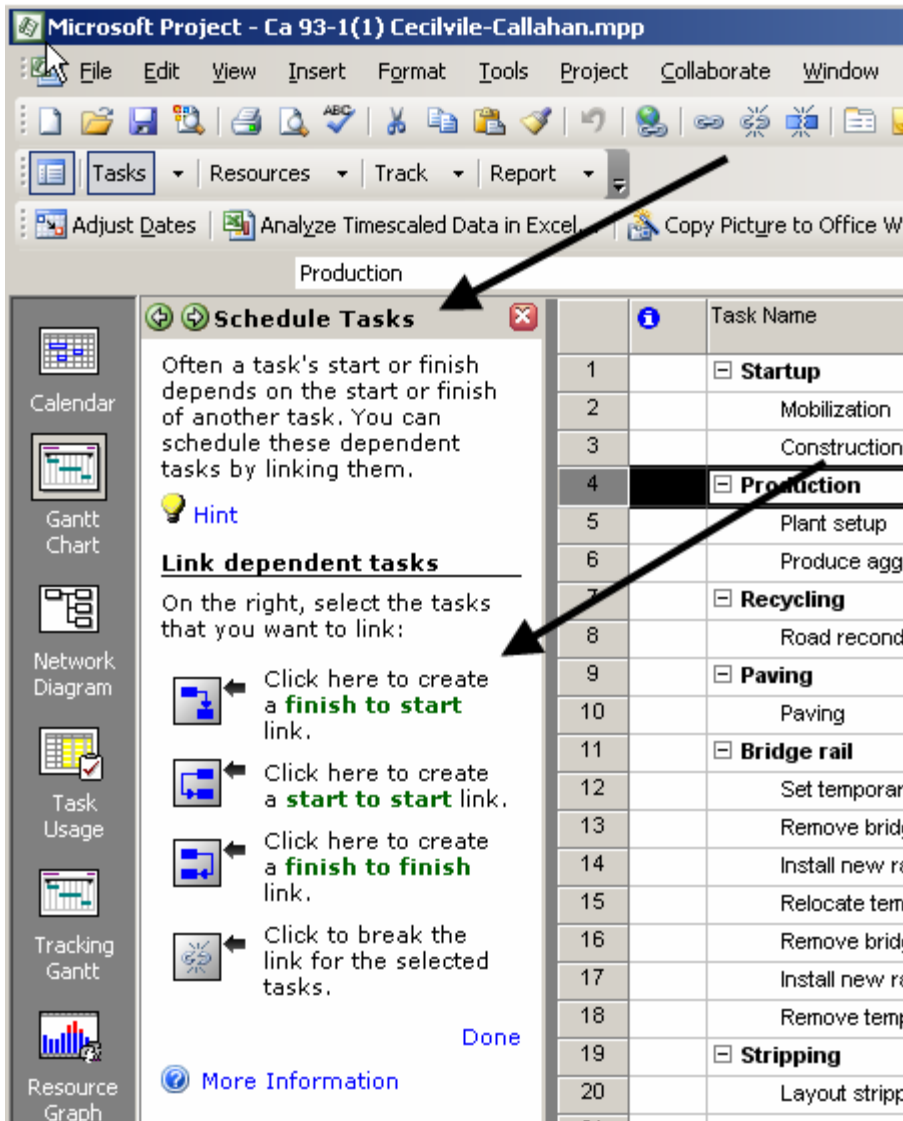
#### 4.4 Link the Tasks/Activities

The next step in creating the schedule is to assign “links” between activities. This is often called adding “logic” to the schedule. Here it is important to know the relationship between activities and when the activities can commence or finish as related to other activities. Along with activity durations, this linking will need the most coordination and review with the COE.

To assign a link, use the link tasks icon from the standard toolbar. This is the icon with a segment of chain on it. Doing this will always create a Finish-to-Start link. Or, for additional linking help, use the Project Guide.



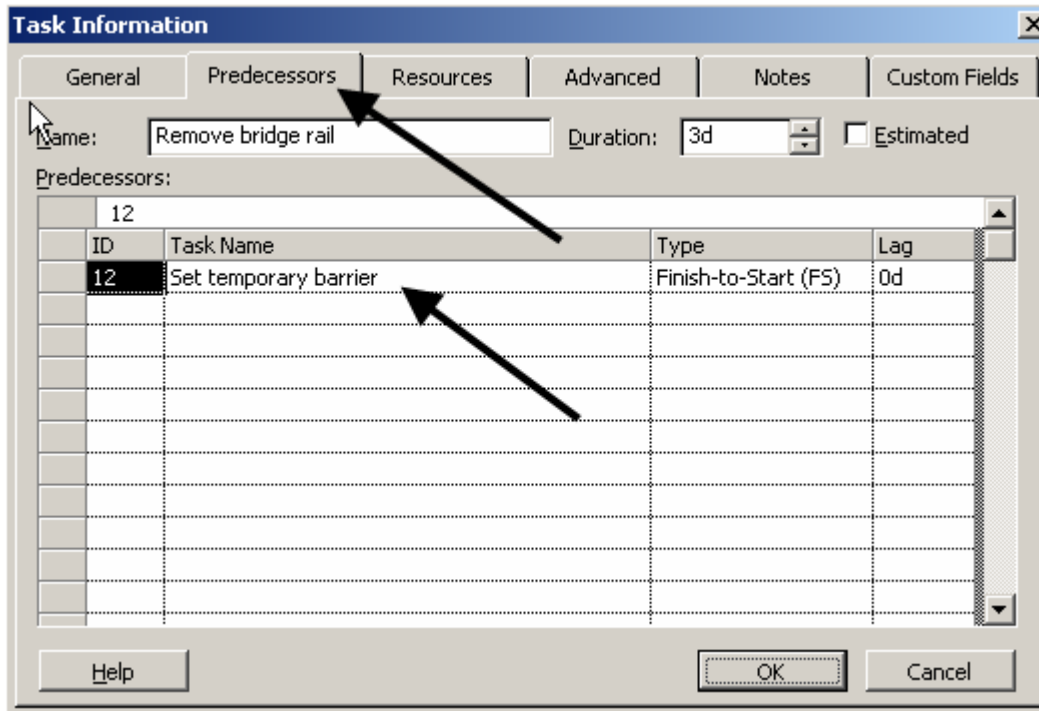
Or, On the Project Guide toolbar, select **Tasks/Schedule Tasks**.



**Important Note:**

Microsoft Project will always link the activity selected first as the predecessor and the activity selected second as the successor.

To modify the type of link between tasks, double-click the activity that is the successor. A Task Information dialog box will appear. From here, it is possible to select a different type of link and to assign lags. It is possible to have both positive and negative lags as either a specific duration or a percentage of the task's predecessor.



In the above example, the predecessor is “Remove bridge rail” and the successor is “Set temporary barrier”. The temporary barrier must be in-place before any bridge railing is removed.

#### 4.5 View and Print the Schedule

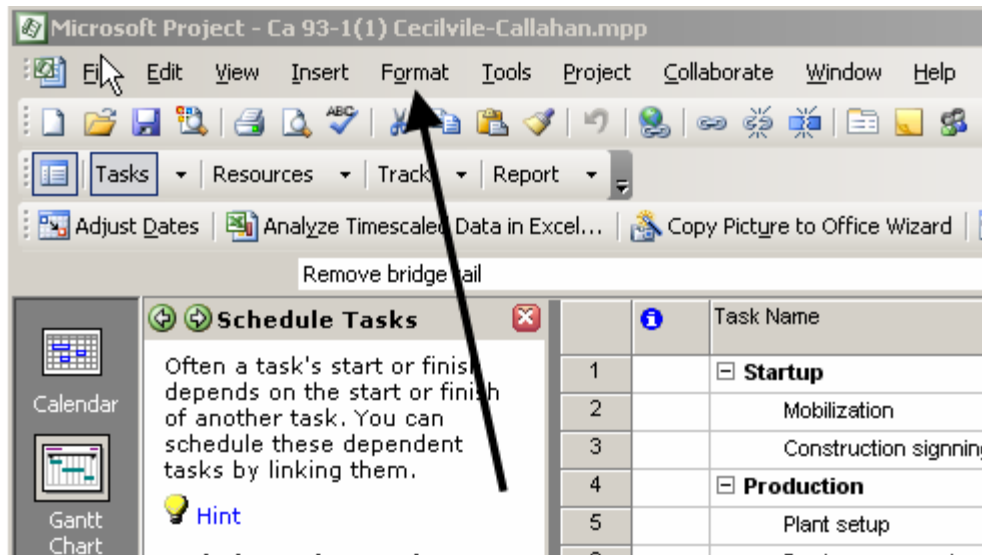
Viewing and printing a construction schedule can be made easier by using the Gantt Chart Wizard. To access this tool, on the main menu, go to **Tools/Gantt Chart Wizard**. Follow the steps as directed.

Select **Standard** then next. Select **None** or **Dates** then next. Select **Yes** to show links then next. Select **Format It** and **Exit Wizard**. If you want to show the critical path, select the “Critical Path”. It is not necessary to view resources on CFL schedules. Resources are typically used for management tracking on a progress schedule.

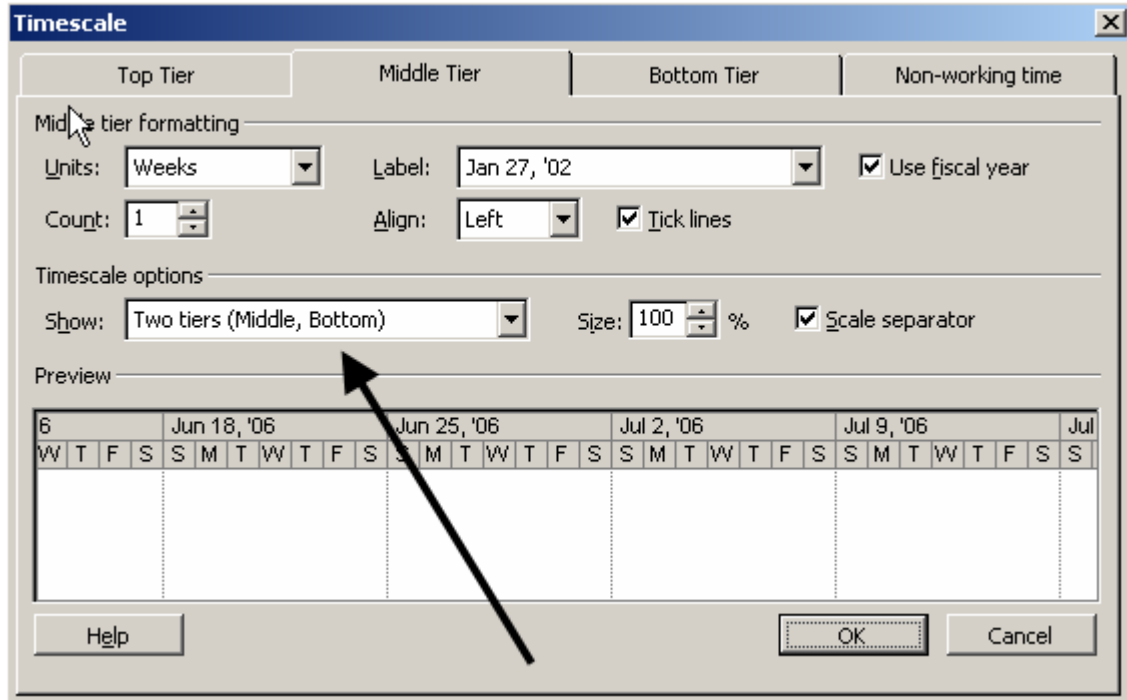
**Some additional recommendations:**

**Set the timescale prompts**

The timescale that you use depends on the overall project duration. To begin open the timescale menu by selecting **Formats/Timescale**.



In the “Show” field, using the right side scroll select **Two Tiers (Middle, Bottom)**.



For very short projects (less than 2 months) use **WEEKS** for the **Middle Tier** and **DAYS** for the **Bottom Tier**. For longer projects, use **MONTHS** for the **Middle Tier** and **WEEKS** for the **Bottom Tier**.

For short duration projects, label the **Middle Tier** with the week date and year, label the **Bottom Tier** with the name of the day (S, M, T, etc.).

For longer duration projects, label the **Middle Tier** with the month and year; label the **Bottom Tier** with the start date of the week.

### Page setup

As with normal Microsoft programs, on the main menu, select **File/Page Setup...**

From the **Page tab**, typically choose **Landscape** orientation and **Fit to 1 x 1 pages**. You may need two sheets for many activities. Also note that Summary activities can be reduced to hide all sub-activities. Choose the **Paper Size** required.

From the **Legend tab**, select **Legend on every page**.

Add footers and/or headers as a normal Microsoft document.

Select **Print Preview** or **Print**. Note that if working on a laptop, it may be necessary to print to PDF and transferred to a computer with a network connection to print. To create a PDF, just select Adobe PDF as the printer.

### To print documented notes follow these steps:

On the **View** menu, click the view you want. Use **Network Diagram**.

To use a view that is not on the **View** menu, click **More Views**, click the view you want to use in the **Views** list, and then click **Apply**.

On the **File** menu, click **Page Setup**, and then click the **View** tab.

Select the **Print notes** check box.

Click **Print**.

## 4.6 Activity Constraints

A constraint is a restriction placed on the start or finish date of a task. Constraints can be “flexible” (not tied to a specific date, but instead ties to another task) or “inflexible” (tied to a specific date.) Constraints are not deadlines. A deadline is a target completion date for an activity. Example constraint types applied to an activity are: As Late As Possible, As Soon As Possible, Finish No Earlier Than, Finish No Later Than, Must Start On, Must Finish On, Start No Earlier Than & Start No Later Than.

Generally, it is not necessary or desirable to add a constraint to an activity. Linking activities usually is all that is needed. Limit the use of constraints. An example of an activity that should have a constraint is “Setting Bridge Girder.” In this case it would make sense to add a “Start No Earlier Than” or “Must Start On” the date the girder will be delivered to the project. Another example would be to set “Seeding” to “Start No Earlier Than” the first day of the seeding/germination period.

To add or change a constraint in Microsoft Project:

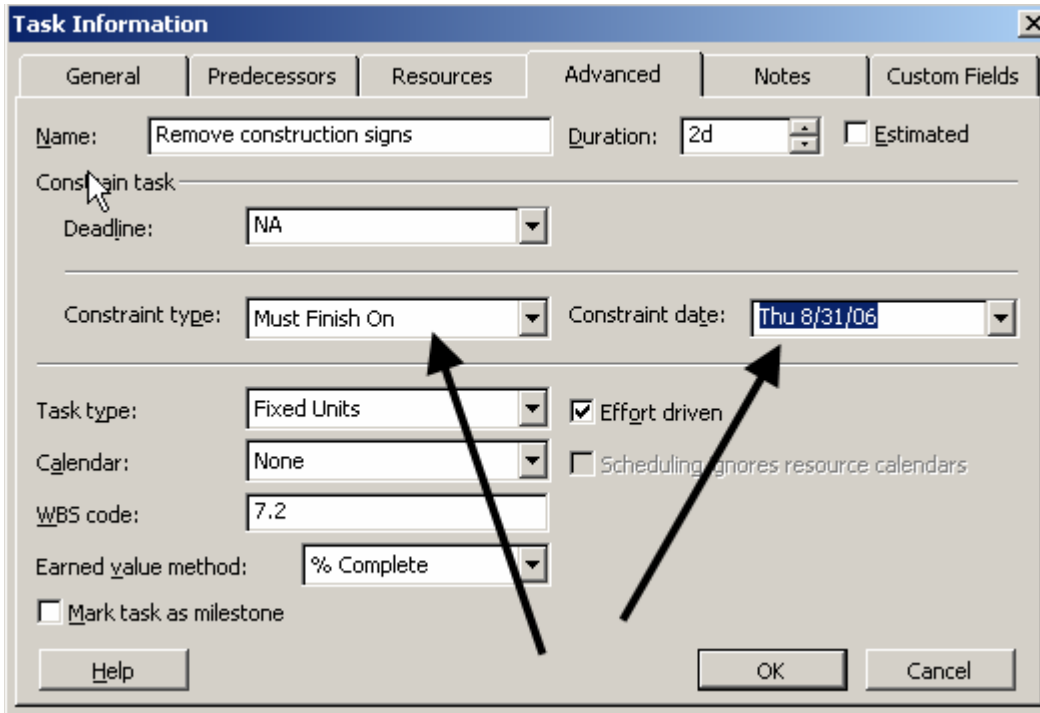
On the **View** menu, click **Gantt Chart**.

In the **Task Name** field, select a task, and then click **Task Information**. (You can also right click on any activity and then click **Task Information**).

Click the **Advanced** tab.

In the **Constraint type** box, click a constraint type.

If you selected a constraint other than **As Late As Possible** or **As Soon As Possible**, type a constraint date in the **Constraint date** box.



## 5. ADDITIONAL RESOURCES AND INFORMATION

### 5.1 CMP Schedules

Western Federal Lands (WFL) has published their own guide for preparing schedules. To access WFL's "Tips for Developing CPMs" click on the following link.

[http://www.wfl.fha.dot.gov/design/resource/cpm\\_tips.pdf](http://www.wfl.fha.dot.gov/design/resource/cpm_tips.pdf)

To access a guide published by FHWA "FHWA GUIDE FOR CONSTRUCTION CONTRACT TIME DETERMINATION PROCEDURES", use the following link:

<http://www.fhwa.dot.gov/legsregs/directives/techadv/t508015.htm>



## **5.2 Microsoft Project**

For additional guidance on using Microsoft Project, per WFL:

[http://www.wfl.fha.dot.gov/design/resource/cpm\\_made\\_easy.pdf](http://www.wfl.fha.dot.gov/design/resource/cpm_made_easy.pdf)

Using Microsoft Project – Project Guide:

Using Microsoft Project – Gantt Chart Wizard:

## **5.3 Production Rates**

<http://www.methvin.org/ProductionRates/tabid/229/Default.aspx>

<http://www.oregon.gov/ODOT/HWY/SEOPL/docs/forms/production-rates.xls>

<http://www.lib.utexas.edu/etd/d/2004/kuoy81347/kuoy81347.pdf#page=3>

<http://www.dot.state.fl.us/Construction/Design%20Build/guidelines/english.pdf>

## 5.4 Terms and Definitions

<b>Activity:</b> Performance of a specific task having a duration.
<b>Bar Chart (Gantt Chart):</b> A schedule format (type) showing activities, sequencing, durations, task interrelationships and start & finish dates.
<b>Calendar:</b> The scheduling mechanism that determines working time for resources and tasks.
<b>Concurrent Activities:</b> Activities which occur at the same time.
<b>Constraint:</b> Limitations placed on an activity, usually a "must start" or "must finish" date.
<b>CPM:</b> Critical Path Method predicts project duration by analyzing with sequence of activities.
<b>Critical Path:</b> The series of tasks that must be completed on schedule for a project to finish on schedule. Or, the longest path for the earliest completion having zero (or least) float.
<b>Duration:</b> Time to complete an activity.
<b>Early Start (ES)/Early Finish (EF):</b> The earliest an activity can start or finish on the schedule.
<b>Event:</b> A zero-duration activity.
<b>Finish-to-Finish (FF):</b> Relationship between activities where the finish of the first activity is tied to the finish of the second activity.
<b>Finish-to-Start (FS):</b> Relationship between activities where the start of the first activity is tied to the finish of the second activity. (Most common).
<b>Float:</b> The amount of time between the early start and late start of an activity or group of activities.
<b>Free Float (FF):</b> The amount of time an activity can be delayed before it impacts the next activity.
<b>Lag:</b> Time offset between activities.
<b>Late Start (LS)/Late Finish (FS):</b> The latest an activity can start or finish without delaying project completion.
<b>Logic Loop:</b> Sequence of activities with no end.
<b>Logic:</b> The relationship or "link" between activities or groups of activities.
<b>Milestone:</b> A reference point marking a major event in a project and used to monitor the project's progress. Any task with zero duration is automatically displayed as a milestone within Microsoft Project.
<b>Negative Float:</b> Total float that is less than zero.
<b>Network:</b> graphical model of the project which shows activities and interrelationships.
<b>Nonworking time:</b> Hours or days designated in a resource or project calendar when Project should not schedule tasks because work is not done. Nonworking time can include lunch breaks, weekends, and holidays, for example.
<b>Predecessors:</b> Activities that must precede any given activity.
<b>Pure Logic Diagram:</b> A schedule format (type) showing tasks, sequencing and interrelationships between tasks.
<b>Start-to-Finish (SF):</b> Relationship between activities where the start of the first activity is tied to the finish of the second activity.
<b>Start-to-Start (SS):</b> Relationship between activities where the start of the first activity is tied to the start of the second activity.
<b>Subtask:</b> A task that is part of a summary task. The subtask information is consolidated into the summary task.
<b>Successors:</b> Activities that must succeed any given activity.
<b>Task:</b> An activity that has a beginning and an end.
<b>Time Logic Network Diagrams (CPM):</b> A schedule format (type) showing activities, sequencing, time-scaled durations, and task interrelationships with lags, float and start & finish dates.
<b>Total Float (TF):</b> The amount of time an event can be delayed without delaying project completion.

## 5.5 Contract Time and Schedule Checklist Items

The following is a list of items to review the completeness of the construction schedule:

- Reviews/Submittals
  - Are there critical Submittals? What time is needed?
  - Are there critical testing periods and how long?
  - Are there critical review times and how long?
  - What are the assigned calendars for submittals & review times?
  - What are the logical connections between review activities and contractor's actual work?
  - Procurement activities
  - Time for reviewing false-work plans, shop drawings, post-tensioning plans, mix designs, etc.
  
- Permits
  - Are permits required?
  - Time to obtain necessary permits?
  
- Specific Activity Requirements
  - Additional time for obtaining specialty items or materials with long-lead requirements (i.e. Traffic Signal Equipment)
  - Curing time and waiting periods between successive paving courses or between concrete operations
  - Embankment settlement periods or embankment surcharges.
  - Coordination with utilities
  - False-work & shoring activities
  - Punch-list and cleanup activities
  
- Material/Product Testing and Delays
  - Government Furnished Material request?
  - Trial shafts or piles
  - Sample walls
  - Time for fabrication of structural steel and other specialty items
  - Staining, painting or other samples needing approvals
  
- Construction Limitations and Requirements
  - Haul characteristics
  - Type of earthwork (sliver cuts, benching)
  - Work area restrictions
  - Equipment congestion
  - Allowable bad weather days
  - Material availability
  - Labor shortages and resource loading
  - Traffic Volumes

- Traffic Staging events (closures, detours, etc)
- Critical interface activities (utilities, RR, etc.)
- Restrictions for nighttime and weekend operations
- Conflicting operations of adjacent projects, both public and private
- Are the NTP and Project Closeout activities shown?
  
- Project Commitments
  - Environmental Commitments
    - Winter season
    - clearing, grubbing, grading restrictions in FP
    - Noise restrictions
    - SWPPP
    - Seasonal limitations for certain activities
  - Project Calendar Requirements
    - Work week (5-day, 7-day weeks)
    - Holidays
    - Other non-working times
  
- Does the final schedule include/show:
  - Critical Path?
  - NTP date and completion date
  - Entire work scope, all activities in plans and specs?
  - Construction Staging and Mobilization?
  - Realistic duration of individual activities?
  - Maximum 20-day duration for any one activity? If longer, add phases for the activity.
  - Activities have at least one predecessor and 1 successor, except for first and last activity?
  - No negative lag for activities?
  - Project Duration, Interim Milestones, Black-out dates, Contract work Days