

# Preplanning And Scheduling Of Road Construction By Using PPM

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## ABSTRACT

*The Preplanning Project Management module is comprehensive, multi-project planning and control software, built on Oracle and Microsoft SQL Server relational databases for enterprise-wide project management scalability. The Project Management module enables your organization to store and manage its projects in a central location. The module supports work breakdown structures (WBS), organizational breakdown structures (OBS), user-defined fields and codes, critical-path-method (CPM) scheduling, and resource leveling. Preplanning Project Management is required to Give complete Project Management Solution, Internationally Reputed, Having Flexibility to Manage Multiple Projects in Centralized location, Provides facility to Integrate ERP or Accounting System. Project schedule can be calculated one of two ways: when we choose the Scheduling command or each time we make a change that affects schedule dates. The Critical Path Method (CPM) scheduling technique is used to calculate project schedules. CPM uses activity durations and relationships between activities to calculate the project schedule.*

**Keywords:** Preplanning, Scheduling, Road Construction, Using, PPM

## 1.INTRODUCTION

Preplanning Project Management Systems Inc. provides project and program management software for the Architecture, Engineering and Construction industry. Focused on project portfolio management, or PPM, Primavera's solutions let users measure progress, assure governance, improve team collaboration and prioritize project investments and resources. Primavera's software packages include P6, ProSight, Contract Manager, Cost Manager, Pertmaster, SureTrak, Evolve and Inspire. The newest addition to the suite of project management solutions is Primavera P6, which is an integrated PPM (project portfolio management) solution that provides a real-time view of portfolio performance. P6 also offers what-if scenario modeling, tabular scorecards and capacity analysis. First of all we must know which product of Primavera should be used. As there are many Primavera Products out there in the market, therefore, it is utmost necessary for us to analyze our requirements before going for a specific product. In this article, we will be talking about P6 PPM R8.1 which stands for Primavera 6 Professional Project Management Module R8.1. A review of the different Primavera products can be found at Introduction to Primavera Products. State Departments of Transportation utilize a variety of techniques for estimating contract time. The most popular are bar charts, CPM, and spreadsheets. Some DOTs use simplified procedures for rapid determination of contract time for small or routine projects. The most basic of these procedures uses a predetermined list of controlling operations for which durations are estimated. The sum of the durations is then used as the contract time. The scheduler will then adjust the schedule based on judgment and convert the contract time to working days, calendar days, or a completion date as appropriate using some conversion factor. These benefits accrue to the contractors, owners, suppliers and workers in the form of improvements in productivity, quality and resource utilization been applied to highway type construction projects by the transportation departments in most states. The ability of CPM to these kinds of projects raises questions. Line of Balance (LOB) and its variations are developed to search for a better solution for highway type projects, such as tunnel construction, road, pipe line projects, and even utility projects. Some researchers declare that LOB software is ready for commercial usage.

## 2.ROAD CONSTRUCTION

A road is a thoroughfare, route, or way on land between two places that has been paved or otherwise improved to allow travel by some conveyance, including a horse, cart, bicycle, or motor vehicle. Roads consist of one or two roadways, each with one or more lanes and any associated sidewalks and road verges. Roads that are available for use by the public may be referred to as public roads or as highways. The Organisation for Economic Co-operation and Development (OECD) defines a road as "a line of communication using a stabilized base other than rails or air strips open to public traffic, primarily for the use of road motor vehicles running on their own wheels," which includes "bridges, tunnels, supporting structures, junctions, crossings, interchanges, and toll roads, but not cycle paths.

## **2.1 Road Construction**

Road construction requires the creation of a continuous right-of-way, overcoming geographic obstacles and having grades low enough to permit vehicle or foot travel and may be required to meet standards set by law or official guidelines. The process is often begun with the removal of earth and rock by digging or blasting, construction of embankments, bridges and tunnels, and removal of vegetation (this may involve deforestation) and followed by the laying of pavement material. A variety of road building equipment is employed in road building.

## **3.PROJECT MANAGEMENT**

### **3.1 Preplanning Project Management**

The Preplanning Project Management module is comprehensive, multi-project planning and control software, built on Oracle and Microsoft SQL Server relational databases for enterprise-wide project management scalability. The Project Management module enables your organization to store and manage its projects in a central location. The module supports work breakdown structures (WBS), organizational breakdown structures (OBS), user-defined fields and codes, critical-path-method (CPM) scheduling, and resource leveling.

### **3.2 Advantages Of Using Preplanning Project Management**

- **Centralized Project Repository** : With all projects are in a centralized database, the robust security module protects project data and offers flexibility when determining who can access each project.
- **Enterprise Project Structure & Codes** : A configurable Enterprise Project Structure (EPS) helps forms the hierarchical structure of the projects based on your organizational needs. Extensible Project Codes help capture different attributes of projects, such as the region where the project is being executed or the type of project
- **Cross-project Analysis and Reporting** : Quickly and easily create cross-project dependencies and see how projects impact one another. Built-in analysis shows whether resources are over- or under-allocated across projects
- **CPM Scheduling** : P6 provides Critical Path Method (CPM) Scheduling, which uses the activity durations, relationships between activities and calendars to calculate a schedule for the project. CPM identifies the critical path of activities, those activities that affect the completion date for the project or an intermediate deadline, and if delayed will delay the finish of the project.
- **Float Path Analysis** : Float Path Analysis identifies all critical paths within a project to help avoid potential delays before they occur and to help visualize an activity's importance to overall project plan.
- **Cross-Project Dependencies** : Cross-project dependencies helps to monitor overall critical path of the program and reduces the risk of multiple parties working together.
- **Resource Assignments** : When project resources needs have been determined, they can easily be assigned to the schedule activities. P6 tracks labor, material, equipment and expense needs for activities and WBS nodes.
- **ERP or Accounting Integration** : The P6 architecture allows for integration with ERP or Accounting Systems so that schedule and cost information can be shared.
- **Resource Leveling** : Resource leveling helps ensure that sufficient resources are available to perform the activities in the project plan.
- **Baseline Management** : Store unlimited versions of the schedule, resources and cost assignments to compare how the project is progressing vs. the original plan vs. the last update cycle, vs. 6 months ago, etc.
- **Projects Reports** : Select from 150+ predefined reports and unlimited custom reports.

### **3.3 Techniques Used For Scheduling Projects**

#### **3.3.1 Cpm – Critical Path Method**

The method by which activity durations and the relationships between activities are used to mathematically calculate a schedule for the entire project. CPM focuses attention on the critical path of activities that affect the completion date for the project or an intermediate deadline. Early dates, the earliest possible dates each activity can start and finish, and late dates, the latest possible dates each activity can start and finish without delaying the project finish or an intermediate deadline (constraint) are also calculated.

#### **3.3.2 PERT**

The program evaluation and review technique (PERT) uses the same ideas as CPM; but instead of using just the most likely time estimate, it uses a probabilistic estimate of time for completion of an activity.

### **3.4 Structuring Projects**

1. Setting-up and define EPS (Enterprise Project Structure).
2. Add a project to the EPS hierarchy.
3. Defining WBS (Work breakdown structure) to the Project.
4. Defining OBS (Organisational breakdown structure)
5. Defining Resources.
6. Create Calendar for Activities & Resources.
7. Add activities to WBS.
8. Input activity details.

9. Schedule project.
10. Updating progress after project starts.
11. Preview / Print reports (Default / Custom made reports).

**3.5 EPS (Enterprise Project Structure)**

Projects are arranged in a hierarchy called “enterprise project structure”. The EPS can be subdivided into as many levels or nodes as needed to parallel work in the organization. Nodes at the highest or root level represent divisions within the agency, next level nodes represent Zones, then Regional Offices, then Construction Supervisors, then construction contracts; or they could be by other major groupings that reflect how or by whom projects are delegated and tasked.

The EPS is made up of roots and nodes.

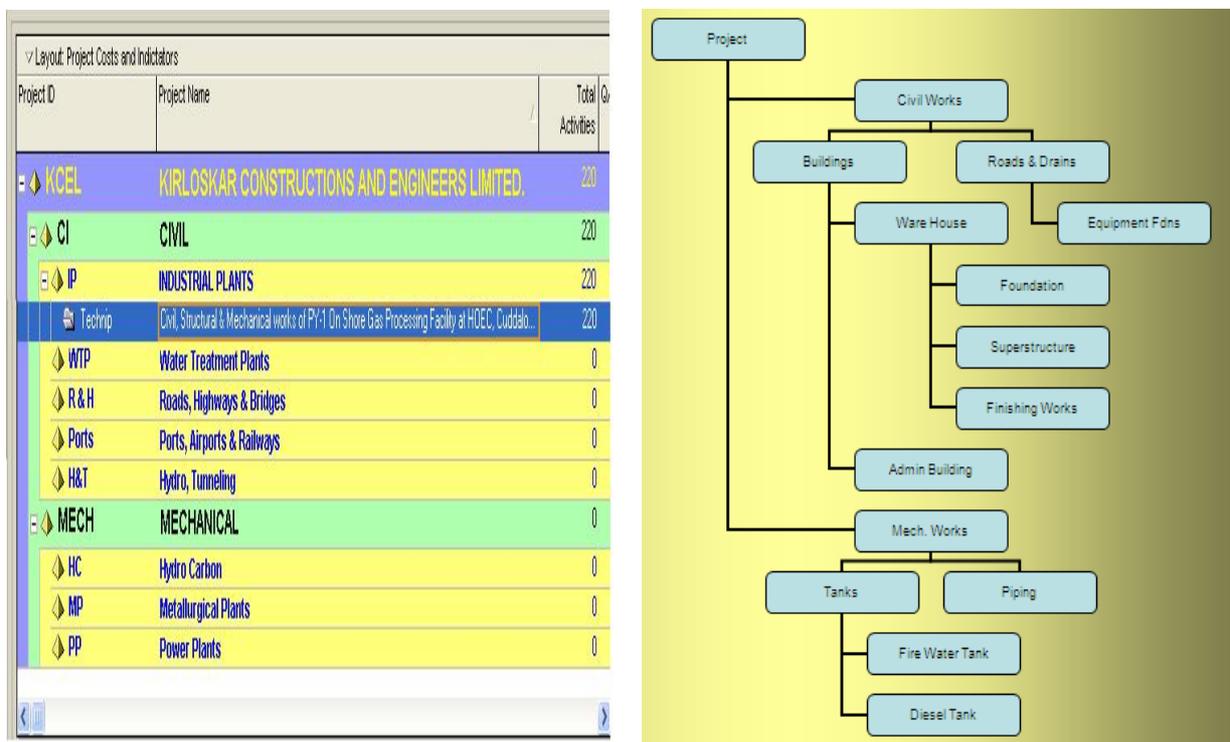
- Each root in the project structure can be subdivided into many nodes.
- Nodes represent different levels within the NYSDOT project structure.
- For example Divisions, Zones, Regions, Area Construction Supervisors, Construction Contracts, etc.

All projects must be included in a node.

- Each node can contain an unlimited number of projects.
- Projects always represent the lowest level of the hierarchy.
- Placement of a project in the hierarchy determines the summary level in which it is included.

**3.5.1 Adding Project To EPS Hierarchy**

We can organise unlimited number of Projects in EPS in groups.(Figure.3.1)



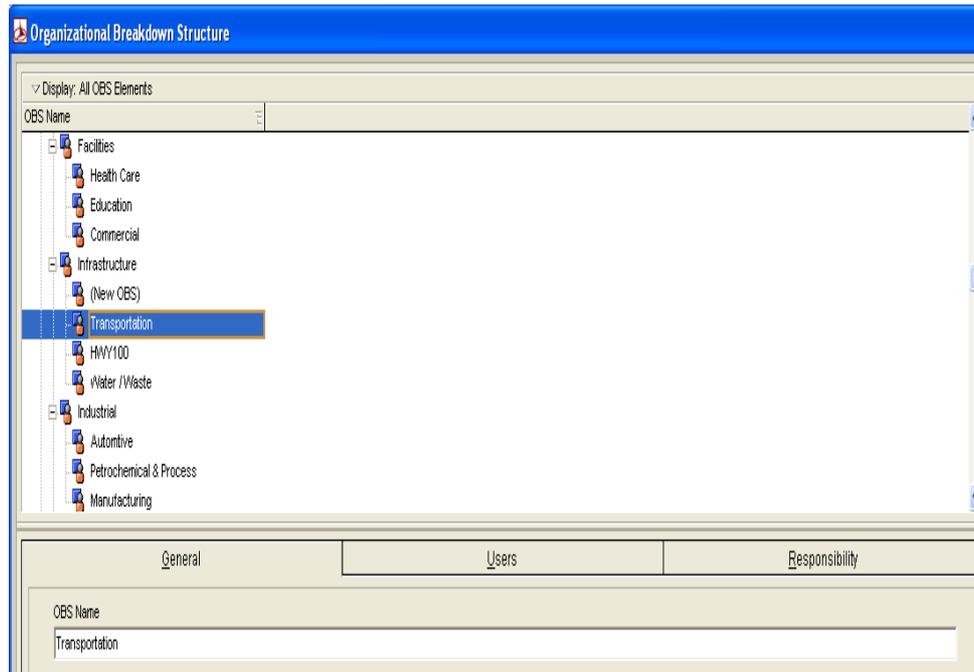
**Figure.3.1** Eps Hierarchy

**3.6 WBS (Work Breakdown Structure)**

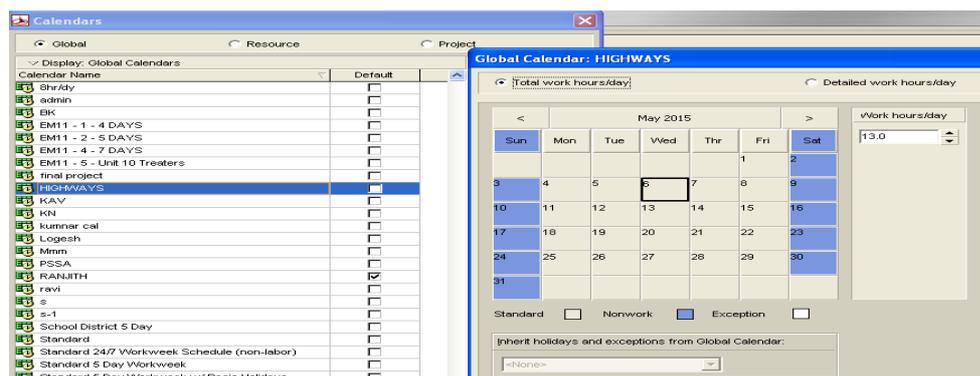
A WBS is a hierarchy of work that must be accomplished to complete a project, which defines a product or service to be produced. The WBS is structured in levels of work detail, beginning with the deliverable itself, and is then separated into identifiable work elements. Work Breakdown Structure is a hierarchical arrangement of the products and services produced during and by the project. The project is the highest level while an individual activity (or an action item) to create a product or service is at the lowest level.

**3.7 OBS (Organisational Breakdown Structure)**

The organizational breakdown structure (OBS) is a global hierarchy that represents the managers responsible for the projects in enterprise. The OBS usually reflects the management structure of organization, from top-level personnel down through the various levels constituting your business (Figure.3.2). Associate the responsible managers with their areas of the EPS either nodes or individual projects. Associate the responsible managers with their areas of the enterprise project structure (EPS) with either an EPS node or a project. When you associate a responsible manager with an EPS node, any projects you add to that branch of the EPS are assigned that manager element by default. An OBS supports large projects that involve several project managers with different areas of responsibility.



**Figure.3.2** Organizational breakdown structure window



**Figure.3.3** Calendar window

### 3.8 Creating Calendars

Create and assign calendars to each resource and each activity. These calendars define the available work-hours in each calendar day(Figure.3.3). Also specify national holidays, organization's holidays, project-specific work/non-workdays, and resource vacation days. Calendar assignments are used for activity scheduling, tracking, and resource leveling.

### 3.9 Activities

Also known as tasks, events, or work packages, activities are the lowest level manageable work elements in a project or WBS.(Figure.3.4). Activities typically have expected durations, costs, and resource or role requirements. Milestone activities, however, have no duration or cost. Collectively, all activities form the foundation of the entire project, driving resource assignments, relationships, constraints, expenses, and durations. Activities are sometimes further divided into any number of discrete steps.

#### 3.9.1 List Of Common Inputs / Information To Be Given To An Activity

- Activity ID, Name & Type of activity.
- Start, Finish Dates (Early, Late).
- Steps of an Activity (Breakdown the activity to smaller units).
- Relationship between activities (Predecessor, Successor).
- Resource Assignment (Labour, Non-Labour & Material)
- Activity Calendar.
- Constraints.
- Status of activity (Actual start & finish dates, % of progress).
- Expenses.
- Any other comments, notes etc.

Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	Start	Finish
<b>RC ROAD CONSTRUCTION</b>						
<b>RC.1 management Systems setup</b>						
A1000	Tendering	26	26	100%	6.4.15	7.4.15
A1020	Award of contract	14	14	100%	7.4.15	7.4.15
A1020	Environmental management plans...	64	64	100%	8.4.15*	13.4.15
<b>RC.2 Site establishment</b>						
A1030	Site set out	84	84	100%	13.4.15	20.4.15
A1040	Site compounds	74	74	100%	20.4.15*	26.4.15
A1050	Subsidiary site	54	54	100%	26.4.15	30.4.15
A1060	Initial environmental safeguards	34	34	100%	30.4.15	2.5.15
<b>RC.3 Relocation of services</b>						
A1070	Identification and consultation	64	64	49.47%	2.5.15	8.5.15
A1080	Relocation	44	44	0%	8.5.15*	12.5.15
<b>RC.4 Site preparation</b>						
A1090	Cleaning and grubbing	64	64	0%	12.5.15*	18.5.15
A1100	Mulching	44	44	0%	18.5.15*	21.5.15
A1110	Staking and staking of topsoil...	34	34	0%	21.5.15*	23.5.15
A1120	Construction access	54	54	0%	23.5.15*	28.5.15
<b>RC.5 Earthworks</b>						
A1130	Cuttings	44	44	0%	28.5.15*	1.6.15
A1140	Fill embankments	54	54	0%	1.6.15*	5.6.15
A1150	Select material zones	54	54	0%	5.6.15*	10.6.15
A1160	Export to site	64	64	0%	9.6.15*	14.6.15
<b>RC.6 Drainage</b>						
A1170	Highway drainage	74	74	0%	14.6.15*	20.6.15
A1180	Water quality control basins	84	84	0%	20.6.15*	27.6.15
<b>RC.7 Other works</b>						
A1190	Pavement construction	74	74	0%	27.6.15*	3.7.15
A1200	Landscaping	64	64	0%	3.7.15*	8.7.15
A1210	Waste burners	24	24	0%	8.7.15*	9.7.15
A1220	Safety barriers	34	34	0%	9.7.15*	11.7.15
A1230	Shared user path	54	54	0%	11.7.15*	16.7.15
A1240	Lighting, lensemaking and signpos...	64	64	0%	15.7.15*	20.7.15

Figure.3.4 Activities window

Resource ID	Resource Name	Resource Type	Unit of Measure	Primary Role	Default Units / Time
LC	CHIEF ENGINEER	Labor		project head	100%
cem	cement 45	Material	Each		100ea/d
job1	machine001	Nonlabor			100%
1111	materials	Material	Lump Sum		8LS/d
P-2	(New Resource)	Nonlabor		Accessories	100%
123	roller	Nonlabor			100%
P-3	(New Resource)	Material	Lump Sum		8LS/d
SUR	SURVEYOR	Nonlabor			100%
Theod001	Theodolite	Labor			100%
CROSS STAFF	CROSS STAFF	Labor			100%
PLUMB BOD	PLUMB BOD	Labor			100%
CF	CF	Labor			100%
PB	PB	Labor			100%
r4	chain/tape	Material			8/d
r5	dumpy/level	Material			8/d
r6	levelling staff	Material			8/d
SUR001	Senior Surveyor	Nonlabor			100%
R	(New Resource)	Nonlabor			100%
r2	contractor	Labor			100%
r1	owner	Labor			100%
r3	engineer	Labor			100%
chief man	123	Labor			100%
Asst man	1231	Labor			100%
Labour	1234	Labor			100%
Material	006	Material			8/d
R-101	S&ND	Material	Lump Sum		8LS/d
R4	foundation concrete	Material			8/d
job	machine	Material	Hour		8hr/d

Figure.3.5 Resource Window

An Activity Network is a graphical display of activities and their logical relationships according to the WBS. You can use an Activity Network to view activity relationship paths and the flow of work through a project. Activity Networks also allow you to examine and edit an activity and its predecessors and successors.

- Activity Types
- Start Milestone
- Finish Milestone
- Task Dependent
- Resource Dependent

### 3.10 Resources

A resource is any quantifiable item in limited supply and of sufficient value to justify tracking and assigning to specific activities for a project. Resources include general or specialized labor, non-labor items such as equipment, and material items such as bricks. Resources perform roles, if defined. Resources are indirectly assigned to activities by first planning the role required. It is also possible to directly assign resources to activities (Figure.3.5). For example, Chris, a level 2 contractor with the confirmed skills and status, is directly assigned to activity 01. However, a technician level 4 role is assigned to activity 02. The project will proceed while management determines the best available resource to fulfill this role.

A resource is anything used to complete an activity. Resources are divided into three categories:

#### 3.10.1 Labor (people, crews)

- Measured in units of time, Generally reused between activities/projects. Exception will be individual contractor's resources., Recorded in terms of days or hours (e.g. \$50.00/hour)

#### 3.10.2 Non labor (Equipment)

- Measured in units of time, Recorded in terms of days or hours

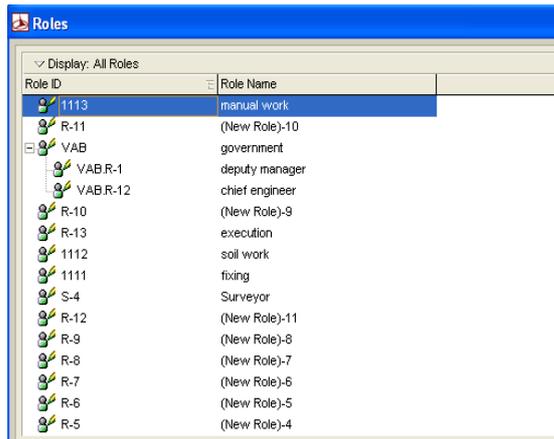
#### 3.10.3 Material (contract pay items)

- Measured in units other than time, meters, square meters, etc.

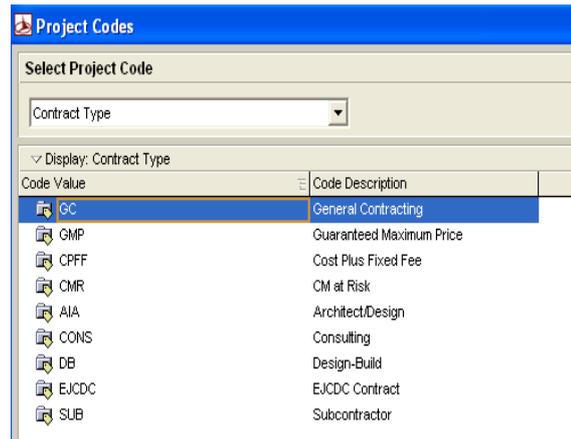
Resource teams provide a convenient way for you to associate personnel into smaller, more meaningful groups within an organization. Using resource teams increases efficiency in staffing activities, tracking allocation, and communicating project progress and performance. When working with pages and tabs that display resource data, such as the Resources Planning, Assignments, or Analysis pages, you can choose to organize by resource team. Choose to view team data, such as total units for the team, or view individual unit values for each team member. For example, the Resource Usage tab available from the Analysis page provides total allocation data for the team, as well as for each team resource when the tab is grouped by Resource Team.

### 3.11 Role

Roles represent personnel job titles or skills needed to execute projects. Architect, general laborer, quality assurance tester, and engineer are all examples of possible roles. Create a standard set of roles that assign to labor and non-labor resources and activities for all projects in the organization. Establish an unlimited number of roles and organize them in a hierarchy for easier management and assignment. The set of roles to an activity defines the activity's skill requirements.(Figure.3.5)



**Figure.3.5** Role Window



**Figure.3.6** Project Code Window

**3.12 Project Codes**

Project codes help to track different projects based on characteristics they share. Use project codes to arrange projects hierarchically when EPS contains many projects within many levels. Many projects in the hierarchy, project codes help group and filter potentially vast amounts of information spanning different areas of the organization. The application supports an almost unlimited number of hierarchical project codes and values; establish as many as need to meet the filtering, sorting, and reporting requirements of organization (Figure.3.6).

**3.12.1 Resource Codes**

With potentially hundreds of resources in use across the enterprise, resource codes provide an efficient means for tracking and sorting resources for reporting or analysis. Use this procedure to assign resource codes to resources. Once assigned, categorize resources using codes (Figure.3.7).

**3.12.2 Activity Codes**

Activity codes enable to categorize activities into logical groups based on organization's criteria. An activity code can be one of three types: Global, EPS, or Project. Global activity codes organize activities across all projects in an organization. EPS activity codes organize activities within a specific branch or node of the enterprise project structure (EPS). Project activity codes categorize activities based on specific features within a project. Activity codes represent broad categories of information, a department or project manager for instance. Create multiple activity codes according to specific categories, then assign different values for each code. Activity codes are like tags, assigned to each activity within a schedule, allowing customizing of data. They represent broad categories of information, such as phase, division of work, or location. For each activity code, specific values (activity code value) must be defined that further describe that category. For example, if the project is occurring at multiple locations, a Location code with values such as Main Street, Elm Street, Hill Street, and so forth, should be created. Activities can then be associated with a specific location, such as Main Street, by assigning that specific code value to the activity (Figure.3.8)

Use activity codes to view and roll up activities in the activity table; build reports in the Report Wizard or Report Editor; organize a layout by grouping activities into specific categories; and select and summarize activities.

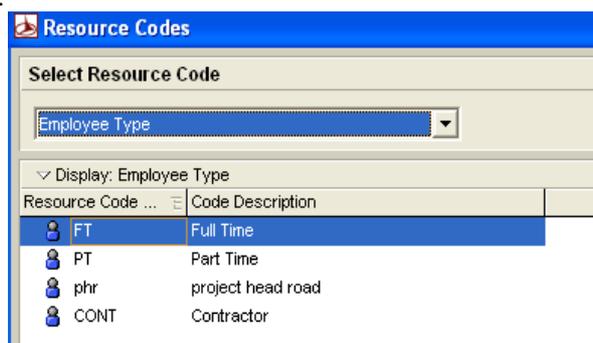
**Activity codes can be global:**

- Organize within a project or across the entire organization
- The Department can create an unlimited number of global activity codes

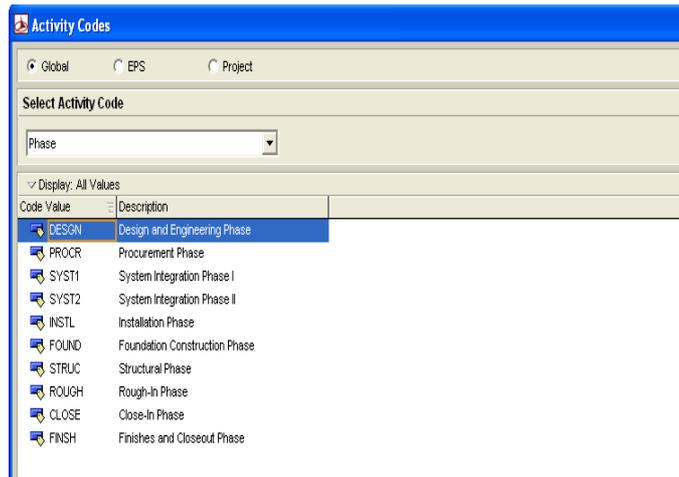
**Activity codes can be project specific:**

- The Contractor can create up to 500 project-specific activity codes

Each activity code (global, EPS, and project) may contain an unlimited number of activity code values. Activity codes can be organized in a hierarchy.



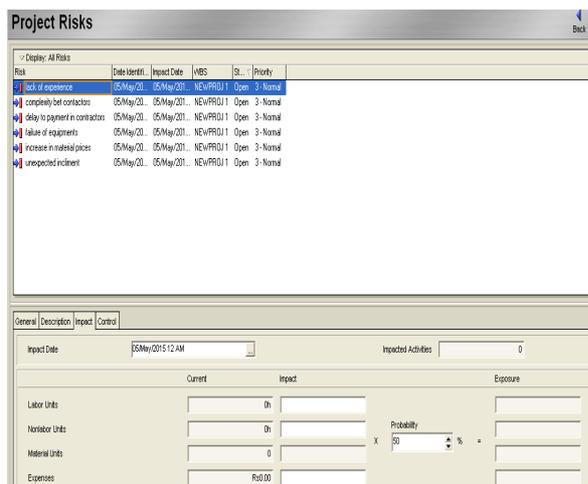
**Figure.3.7** Resource Code Window



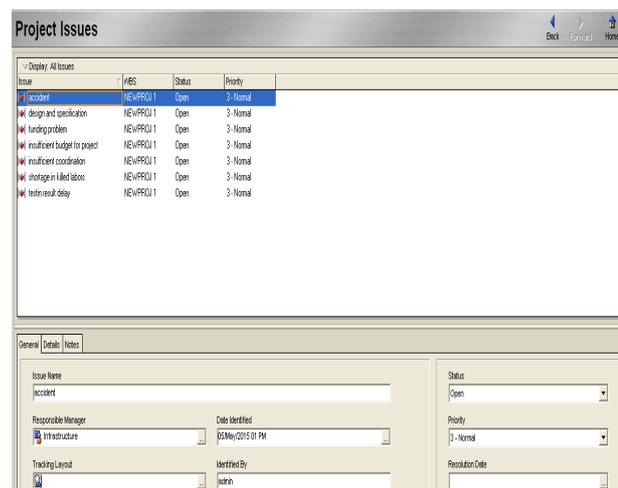
**Figure.3.8** Activity Code Window

**3.13 Risks**

Risks are any uncertain events or conditions that, if they occur, have a positive or negative effect on project objectives. Risks are also known as threats, warnings, imperatives, escalation notices, or jeopardies. Positive risks are often classified as opportunities which, if they occur, are realized as rewards. Thorough documentation and analysis of risks over multiple projects offer lessons, and potentially cost and time savings, for all future projects (Figure.3.9)



**Figure.3.9** Project Risk Window



**Figure.3.10** Project Issue Window

The risk register on the Risks page is the main area of the application where you identify and manage risks for a project. Additionally, you can add risks to a project from the EPS page, and add risks to a project and assign the risks to activities from the Activities page. Once you add a risk to the risk register, you can perform further analysis on the risk and create one or more risk response plans which include activities to reduce the negative impact of the risk. Risk Scoring shows the project risk scoring matrix. Includes threshold definitions grouped by type (Probability, Schedule, Cost, User-defined, and Tolerance) and numeric and alphanumeric probability and impact diagrams (PIDs). Risk Scoring (v2) shows project risk scoring matrix. Includes threshold definitions grouped by type (Tolerance Threshold, Probability and Tolerance), PIDs for Risk Matrix, Risk Count and Risk Score and Total Risk Score.

**3.14 Issues**

Issues are perceived problems within a schedule that require attention or corrective action. When create them in the Activities section, associate them with a single project or workgroup and assign them to a responsible manager in the OBS for follow-up based on priority. Associate issues with a single activity. When adding new issues to a project or workgroup, control the information capture for each new issue. Choose to receive e-mail notifications when new issues of a certain priority are added, when existing issues are modified, or when issues are assigned a specific issue code. Also think of issues as impediments, action items, open items, punch lists, logs, or concerns. Over time, if do not resolve or close open issues or issues placed on hold, they can become risks. Issue codes enable you to organize and categorize issues in a way that is meaningful to you. For example, create an issue code titled Severity, and subsequently create issue code values: High, Medium, and Low. Assign each of these code values to issues across multiple projects, enabling to categorize each issue according to how severe it is. Similarly, create codes to categorize issues by

responsibility, subproject, or any other classification require to organize issues. Assigning issue codes enables to quickly search for and view issues according to specific criteria. Figure.3.10 shows Project Issue Window. In each of these areas, customize how issues are presented. For example, choose to view issues in either a list or chart format. Also configure column, group, sort, and filter options to focus on issue data that is most important to you. Additionally, you can add, revise, or delete issues from each of these areas. When adding new issues to a project or workgroup, the issue forms feature enables to control the information capture for each new issue. If add issues from a detail window, the issue is added as a line item and does not require the selection of an issue form. To help organize and manage issues for project or workgroup, additional issue management features are available, depending on security privileges. To organize issues, assign enterprise-level issue codes, which enable to categorize issues in a way that is meaningful. The features for organizing and managing issues are accessible via the Enterprise Data option on the Administer menu. Use the issues options in the Enterprise Data pane to add, edit, and delete issue codes and issue user-defined fields. These options appear only if required privileges.

#### **3.14.1 Issue Codes**

Issue codes enable to organize and categorize issues in a way that is meaningful. For example, create an issue code titled Severity, and subsequently create issue code values: High, Medium, and Low. Assign each of these code values to issues across multiple projects, enabling to categorize each issue according to how severe it is. Similarly, create codes to categorize issues by responsibility, subproject, or any other classification require to organize issues. Assigning issue codes enables quickly search for and view issues according to specific criteria.

#### **3.14.2 Issue Forms**

Create an issue form to capture all the attributes your organization wants to track when users add issues to a project. Each form helps maintain consistency when future issues are identified. Project members must select an issue form to serve as a template when they want to create a new issue.

## **4. SCHEDULING**

Critical path method (CPM) is a project planning and scheduling technique that defines the project activities, activity duration, and relationships between activities. The schedule connects activities through relationships and calculates the total time required to complete the project. Almost every industry uses CPM principles in schedule management.

### **4.1 Critical Path Method (CPM) Scheduling**

CPM uses activity durations and relationships between activities to calculate schedule dates. This calculation is done in two passes through the activities in a project.

- The critical path is the path of activities through a project that determines the project duration and therefore, the anticipated project completion date.
- A delay in one activity delays other activities and the project as a whole.
- Primavera allows users to calculate the critical path either total float or the longest path in the project. However, NYSDOT requires the Contractor to schedule the project using the Longest Path and not Total Float when determining the Critical Path.

#### **4.1.1 Data Date**

Data Date - the "Data Date" shall be the date the Project Scheduler last edits the schedule prior to submission to the Engineer (generally the last working day of the contract payment period). The Project Scheduler can modify the project's Data Date through the Schedule tool. The date used as the starting point for scheduling calculations. The date used to schedule all future work. For the baseline progress schedule submittal, the data date shall be the contractor award date. For monthly progress schedule submittal, the data date shall be consistent with the last working day of the monthly contract payment period.

### **4.2 Scheduling Concepts**

#### **4.2.1 Forward Pass**

- Calculates an activity's early dates.
- Early dates are the earliest times an activity can start and finish once its predecessors have been completed.
- The calculation begins with the activities without predecessors.

$$\text{Early Start} + \text{Duration} - 1 = \text{Early Finish}$$

#### **4.2.2 Backward Pass**

- Calculates an activity's late dates.
- Late dates are the latest times an activity can start and finish without delaying the end date of the project. The late dates are the NYSDOT contractual dates.
- The calculation begins with the activities without successors.

$$\text{Late Finish} - \text{Duration} + 1 = \text{Late Start}$$

#### **4.2.3 Total Float**

- The amount of time an activity can slip from its early start without delaying the project.
- The difference between an activity's late dates and early dates.

- Activities with zero total float are critical.

$$\text{Late date} - \text{Early date} = \text{Total Float (TF)}$$

#### **4.3 Benefits Of Scheduling**

Using CPM for scheduling is very beneficial to the overall project objectives. The benefits of scheduling using CPM techniques are Promotes logical thinking, Helps in evaluating options, Improves communications, Tracks progress, Identifies delays, Facilitates recovery, Meets legal proof requirements

#### **4.4 Scheduling Methods**

Industry uses various scheduling methods today. The scheduling method shows how the activities and relationships relate to one another. Among these types are:

- Bar chart
- Fenced bar chart (time-scaled)
- Arrow diagram method
- Precedence diagram method

##### **4.4.1 Bar Chart**

The bar chart is a two-dimensional schedule. The x-axis of the chart shows the project timeline. The y-axis of the chart is a list of specific activities that must be accomplished to complete the project Paint Wall. These activities are typically listed in order of earliest start on the project . Since the tasks are usually arranged from earliest to latest, most bar charts show a pattern of bars that begin in the upper left of the chart and proceed to bars that complete the project displayed in the bottom right of the chart. The difficulty with the bar chart lies in the implied sequence in the chart layout. Without explicit designation of the sequence of activities, there could be confusion. In other words, in this chart, nothing is stopping the Paint Wall activity from starting before or during the Prep Wall activity.

##### **4.4.2 Fenced Bar Chart (Time-Scaled)**

The fenced bar chart is another type of bar chart, but this graphic shows the schedule network while also showing the sequence of activities. Prime Wall succeeds Prep Wall and Dry Time-prime succeeds Prime Wall. To show this, a line with an arrow, is added between activities.

##### **4.4.3 Arrow Diagram**

The arrow diagramming method combines the representation of sequence and duration. The two elements of arrow diagramming are arrows and nodes . One arrow is created for each activity to be accomplished. The tail of the arrow is the start of the activity. The head of the arrow is the end of the activity. While not required, the length of the arrow is often scaled to be proportional to the duration of the activity. Nodes are used to graphically show where activities end and begin in sequence.

##### **4.4.4 Precedence Diagram**

In a precedence diagram method (PDM) schedule, each activity duration is a box or block, and each relationship is graphically shown as an arrow The relationship arrows show the direction of the schedule. A project typically travels along the path from left to right, from the start of a project to completion. Each activity is preceded by an activity logically along the schedule.

#### **4.5 Critical Path Activities**

Critical path activities are project tasks that must start and finish on time to ensure that a project ends on schedule. A delay in any critical path activity will delay completion of the project, unless the project plan can be adjusted so that successor tasks finish more quickly than planned. Critical activities can be one of two types: float and longest path.

##### **4.6.1 Network Logic Diagram**

A network logic diagram is a logical representation of all the activities in a project showing their dependency relationships.

#### **4.7 Relationship Types**

A relationship defines how an activity relates to the start or finish of another activity or assignment. An activity can have as many relationships as necessary to model the work that must be done. These relationships are used together with activity durations to determine schedule dates. Relationships can also exist between activities in different projects; this type of relationship is referred to as an external relationship. Activities that are dependent on one another are known as predecessors and successors, where the first activity is the predecessor and the second is the successor. Between these two types of activities, there are four possible relationship types:

##### **Finish-to-start (FS)**

The successor activity cannot start until the predecessor finishes (for example, Activity B starts after the end of Activity A), the most commonly used relationship.

##### **Start-to-start (SS)**

The successor activity cannot start until the predecessor starts (for example, Activity B can start only after the start of Activity A).

##### **Finish-to-finish (FF)**

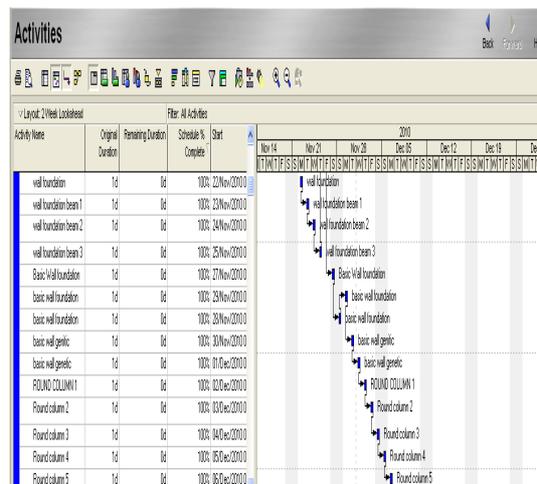
The successor activity finishes at the same time as the predecessor (for example, Activity B must finish at the same time as Activity A finishes).

**Start-to-finish (SF)**

The successor activity finishes after start of the predecessor (for example, Activity B finishes after the start of Activity A), the least commonly used relationship.

**4.8 Relationships In Gantt Chart**

A Gantt chart is a graphical representation of the duration and sequence of activities or projects. It is useful for planning, scheduling, and monitoring progress against a timeline. Easily update dates and durations by resizing or moving Gantt chart bars. When you change bar positions in a Gantt chart, the start and finish date columns update automatically to reflect the new bar position. After moving a Gantt bar, when save changes, the remaining duration is recalculated based on the new dates and the activity or project calendar. Because this calendar is applied when save, if move but do not resize a Gantt bar, the duration might shorten or lengthen based on the calendar's non work time.(Figure.4.1)



**Figure.4.1** Gantt Chart window

**4.9 Critical Path Analysis**

At this point, the propriety of the un impacted schedule as the basis for comparison, the quality of the impacted schedule in representing only related to the fragnet insertions, and the quality of the fragnet itself has been verified. If all these aspects of the TIA has been found to be satisfactory, then the critical paths of the two schedules can be compared. This ultimately determines the duration of the delay, if any, and provides the basis for negotiation of a time extension or for a revised schedule that will get the project back on schedule. To compare the critical paths:

- a) Identify the critical path in the un impacted schedule, by running a filter in P6 with the appropriate critical path filter.
- b) Identify the critical path in the impacted schedule, by running a filter in P6 with the appropriate critical path filter.
- c) If the predicted completion date has not changed, then the event and the added work did not affect the critical path.
- d) If the predicted completion date has changed, then the event and added work affected the critical path. It is then necessary to review the critical paths of the two schedules to determine specifically why the predicted completion date shifted.
- e) If the activities on critical paths are the same, except for the fragnet, then the event and added work directly affected the critical path.
- f) If the activities on the critical paths are not the same, the event and added work caused a shift in critical path. Follow the activities on the critical path, and identify how the critical path shifted.

The determination that the event and the added work delayed the project forms the basis for negotiation of a time extension and the direct costs associated with performing the added work. It is also possible to have a further discussion with the contractor of the possibility of accelerating the remaining original scope of work in order to bring the project in at the current contract completion date.

**5. CONCLUSION**

This study gives brief explanation for preplanning project management, Pre planning helps to schedulize the working period in a proper manner and also purchase the goods at the right time. Advantages of using this software is Centralized Project Repository With all projects are in a centralized database, the robust security module protects project data and offers flexibility when determining who can access each project. CPM Scheduling provides Critical Path Method (CPM) Scheduling, which uses the activity durations, relationships between activities and calendars to

calculate a schedule for the project. CPM identifies the critical path of activities, those activities that affect the completion date for the project or an intermediate deadline, and if delayed will delay the finish of the project.

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