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Review of Basic Concepts in the Development and execution of Construction Planning and its functional requirements

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Abstract : Construction planning is a fundamental and challenging activity in the management and execution of construction projects. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the different work tasks. A good construction plan is the basis for developing the budget and the schedule for work. Developing the construction plan is a critical task in the management of construction, even if the plan is not written or otherwise formally recorded. In addition to these technical aspects of construction planning, it may also be necessary to make organizational decisions about the relationships between project participants and even which organizations to include in a project. For example, the extent to which sub-contractors will be used on a project is often determined during construction planning.

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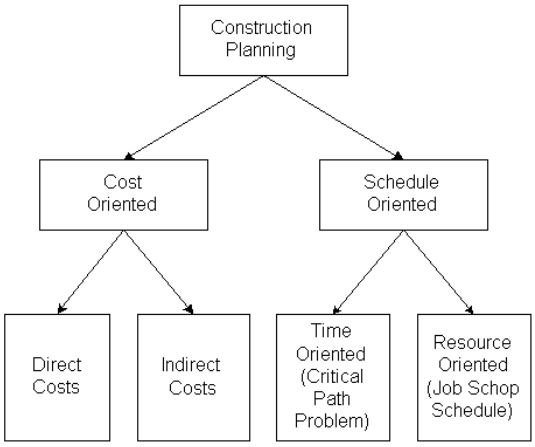
Introduction : In developing a construction plan, it is common to adopt a primary emphasis on either cost control or on schedule control as illustrated in Fig below . Some projects are primarily divided into expense categories with associated costs. In these cases, construction planning is cost or expense oriented. Within the categories of expenditure, a distinction is made between costs incurred directly in the performance of an activity and indirectly for the accomplishment of the project. For example, borrowing expenses for project financing and overhead items are commonly treated as indirect costs. For other projects, scheduling of work activities over time is critical and is emphasized in the planning process. In this case, the planner insures that the proper precedence among activities are maintained and that efficient scheduling of the available resources prevails. Traditional scheduling procedures emphasize the maintenance of task precedence (resulting in critical path scheduling procedures) or efficient use of resources over time (resulting in job shop scheduling procedures). Finally, most complex projects require consideration of both cost and scheduling over time, so that planning, monitoring and record keeping must consider both dimensions. In these cases, the integration of schedule and budget information is a major concern.



In this Paper, we shall consider the functional requirements for construction planning such as technology choice, work breakdown, and budgeting. Construction planning is not an activity which is restricted to the period after the award of a contract for construction. It should be an essential activity during the facility design. Also, if problems arise during construction, re-planning is required.

Functional Requirements For Construction Planning

1. ***Choice of Technology and Construction Method:***

   As in the development of appropriate alternatives for facility design, choices of appropriate technology and methods for construction are often ill-structured yet critical ingredients in the success of the project. For example, a decision whether to pump or to transport concrete in buckets will directly affect the cost and duration of tasks involved in building construction. A decision between these two alternatives should consider the

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relative costs, reliabilities, and availability of equipment for the two transport methods. Unfortunately, the exact implications of different methods depend upon numerous considerations for which information may be sketchy during the planning phase, such as the experience and expertise of workers or the particular underground condition at a site.

2. ***Defining Work Tasks :***

   At the same time that the choice of technology and general method are considered, a parallel step in the planning process is to define the various work tasks that must be accomplished. These work tasks represent the necessary framework to permit scheduling of construction activities, along with estimating the resources required by the individual work tasks, and any necessary precedences or required sequence among the tasks. The terms work "tasks" or "activities" are often used interchangeably in construction plans to refer to specific, defined items of work. In job shop or manufacturing terminology, a project would be called a "job" and an activity called an "operation", but the sense of the terms is equivalent. This detailed task breakdown of the activity "clean concrete forms" would not generally be done in standard construction planning, but it is essential in the process of programming or designing a robot to undertake this activity since the various specific tasks must be well defined for a robot implementation.

3. ***Defining Precedence Relationships Among Activities :***

   Once work activities have been defined, the relationships among the activities can be specified. Precedence relations between activities signify that the activities must take place in a particular sequence. Numerous natural sequences exist for construction activities due to requirements for structural integrity, regulations, and other technical requirements. For example, design drawings cannot be checked before they are drawn. Diagramatically, precedence relationships can be illustrated by a network or graph in which the activities are represented by arrows as in Figure. The arrows in Figure are called branches or links in the activity network, while the circles marking the beginning or end of each arrow are called nodes or events. In this figure, links represent particular activities, while the nodes represent milestone events.

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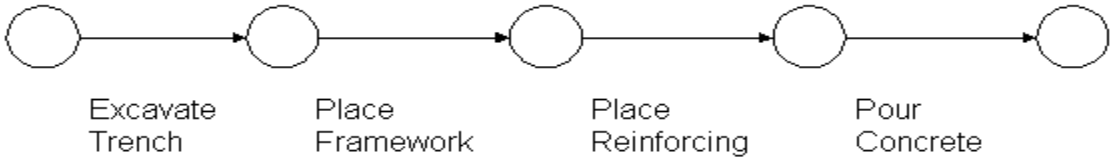

4. *Estimating Activity Durations*

In most scheduling procedures, each work activity has an associated time duration. These durations are used extensively in preparing a schedule. All formal scheduling procedures rely upon estimates of the durations of the various project activities as well as the definitions of the predecessor relationships among tasks. The variability of an activity's duration may also be considered. Formally, the probability distribution of an activity's duration as well as the expected or most likely duration may be used in scheduling. A probability distribution indicates the chance that a particular activity duration will occur. In advance of actually doing a particular task, we cannot be certain exactly how long the task will require.Weather effects are often very important and thus deserve particular attention in estimating durations. Weather has both systematic and random influences on activity durations. Whether or not a rainstorm will come on a particular day is certainly a random effect that will influence the productivity of many activities. However, the likelihood of a rainstorm is likely to vary systematically from one month or one site to the next. Adjustment factors for inclement weather as well as meteorological records can be used to incorporate the effects of weather on durations. As a simple example, an activity might require ten days in perfect weather, but the activity could not proceed in the rain. Furthermore, suppose that rain is expected ten percent of the days in a particular month. In this case, the expected activity duration is eleven days including one expected rain day. An activity duration might be assumed to be distributed as a normal or a beta distributed random variable as illustrated in Figure . This figure shows the probability or chance of experiencing a particular activity duration based on a probabilistic distribution. The beta distribution is often used to characterize activity durations, since it can have an absolute minimum and an absolute maximum of possible duration times. The normal distribution is a good approximation to the beta distribution in the center of the distribution and is easy to work with, so it is often used as an approximation.

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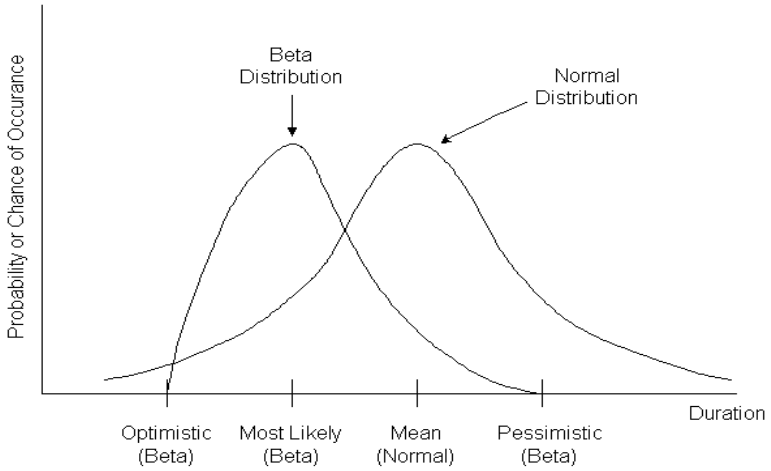

5. ***Estimating Resource Requirements for Work Activities***

In addition to precedence relationships and time durations, resource requirements are usually estimated for each activity. Since the work activities defined for a project are comprehensive, the total resources required for the project are the sum of the resources required for the various activities. By making resource requirement estimates for each activity, the requirements for particular resources during the course of the project can be identified. Potential bottlenecks can thus be identified, and schedule, resource allocation or technology changes made to avoid problems.

6. Coding Systems

One objective in many construction planning efforts is to define the plan within the constraints of a universal coding system for identifying activities. Each activity defined for a project would be identified by a pre-defined code specific to that activity. The use of a common nomenclature or identification system is basically motivated by the desire for better integration of organizational efforts and improved information flow. In particular, coding systems are adopted to provide a numbering system to replace verbal descriptions of items. These codes reduce the length or complexity of the information to be recorded. A common coding system within an organization also aids consistency in definitions and categories between projects and among the various parties involved in a project. Common coding systems also aid in the retrieval of historical records of cost, productivity and duration on particular activities.

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