# Project Planning & Scheduling

Summary of Lecture

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October, 13, 1985

# PROJECT PLANNING AND SCHEDULING

## INTRODUCTION:

Project management may be described as the process of planning executing and controlling a project from start to completion in agiven time, at a given cost , within a given human and technical resources for a given end product.


The management process should be capable of accepting possible alteration at any stage that may result ~~from~~ when:

* Basic assumptions change.
* Original estimates are no longer valid.
* New facts, changes and restrictions occur which could not be anticipated.

In general the management process must be dynamic, its most important goal is not necessarily completion of project exactly as planned the principle aim should be to achieve the intended objectives of the project in the best possible way and with the best possible result.

The following diagram shows the main activities of the dynamic cycle of the management process.

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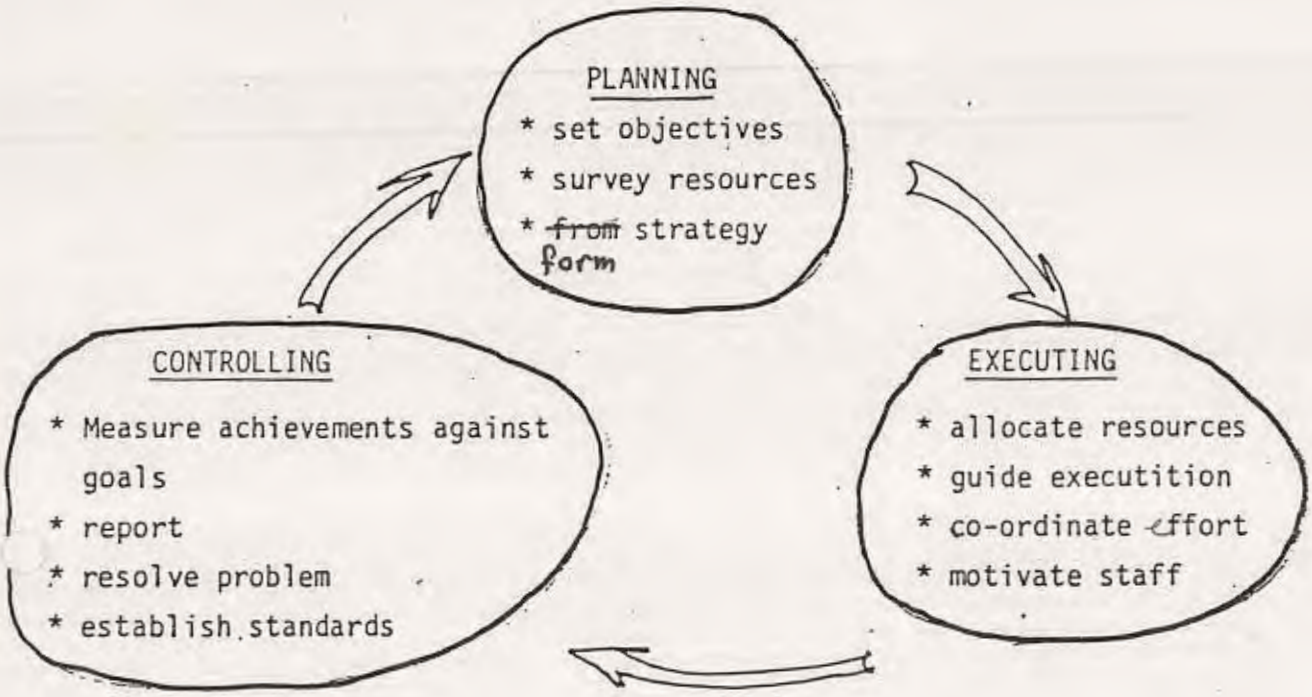

PLANNING
* set objectives
* survey resources
* ~~from~~ strategy form
EXECUTING
* allocate resources
* guide executition
* co-ordinate effort
* motivate staff
CONTROLLING
* Measure achievements against goals
* report
* resolve problem
* establish standards

## PLANNING

* Planning is the most challenging task faced by the "PROJECT MANAGEMENT".

Normally it involves all stages from brefing, designing, construction to commissioning.

Proper planning makes it possible to achieve the goals of the project completion in due time within the specified funds and time - [redacted] :
and within the available Human & Technical Resources - by

- Ensuring adequate resources are availble at the right moments(labour, materials, equipments).
- Ensuring adequate time is allowed for each stage in the process and that all various component activities start at the appropriate time.
- Ensuring the adequate funds are available in due time within the total budget.

## PLANNING AND CONTROL TOOLS:

Planning and control are the major twin functions of the management responsibilities:

Characteristics of a good plan:

* The plan must have definite objectives
* It should be simple . the aim is to outline complex situations in a simple way.
* It should be flexible, it must be possible to alter certain elements of the plan without disrupting ~~disrapting~~ the entire plan and there must be a reasonable degree of slack built into the plan
* It should provide proper standards of expectations, by providing identified and quantified mile stones along the way so that easy control may be exercised.
* It should use available resources to the utmost

## PLANNING TOOLS:

There are many different tools and graphical techinques for the planning scheduling and control of operation and resources.

They range from , simple check lists and bar charts to sophisticated net work plans inculding inter-relation of different activities.

For almost all projects a bar chart is normally adequate.

Preparing the bar-chart planning we need to consider the following:

* Prepare a check list of the appropriate activities to be under taken.
* Analyse each item in the check list, considering when it needs to be carried out, and what length of time it requires.
* Indicate all activities on a bar-chart,all activities to listed in a col at left side of the diagram . A horizontal time scale extend to right of the list with line corresponding and each activity in the list.

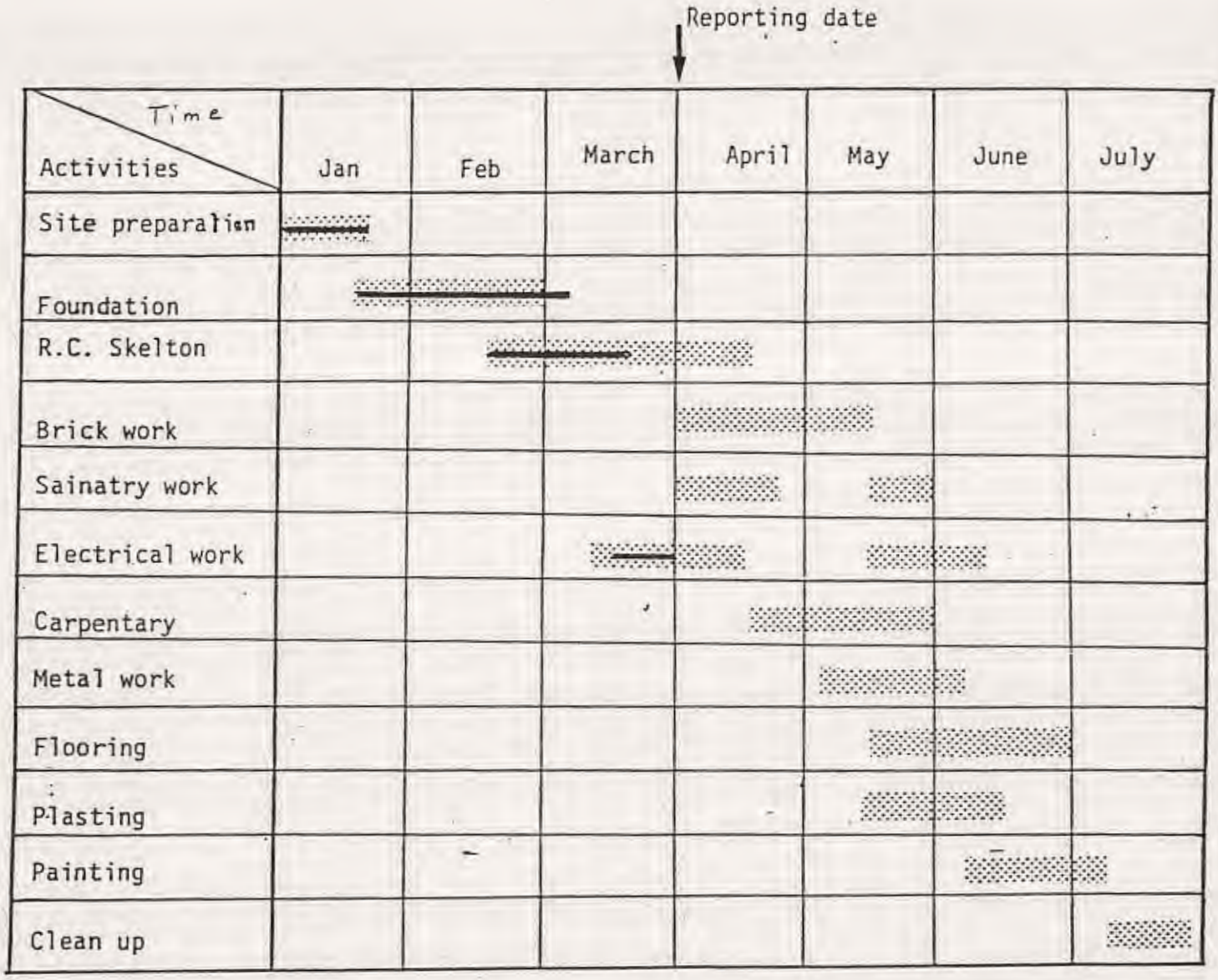
Planning of project activities should cover the following major aspects:

* Time .
* Briefing and design capacity.
* Constructing and commissioning capacity.
* Supply of equipments and materials.
* Allocation of funds.
* Staffing.

- Global planning for realistic time-schedule is to be prepared by the project manager from the very begining of the early prepect, stage. This will serve as basic frame work within which all by activitities(milestone events) can be indicated.

Detailed time-schedule are prepared for all other different stages by the team responsible of each stage.

BAR CHART:

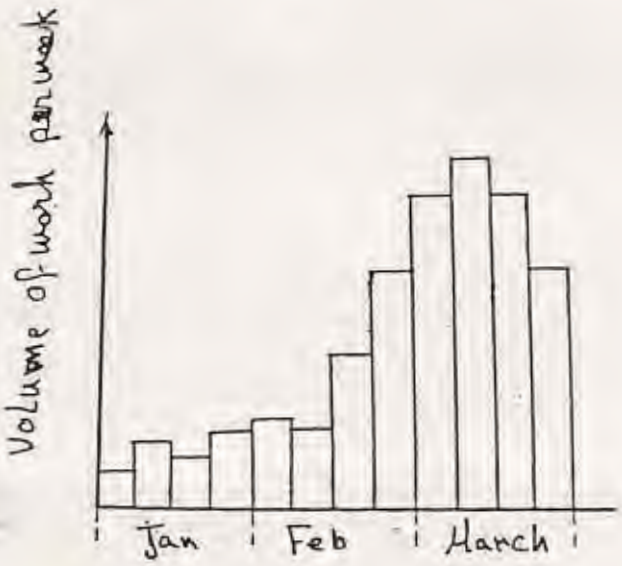


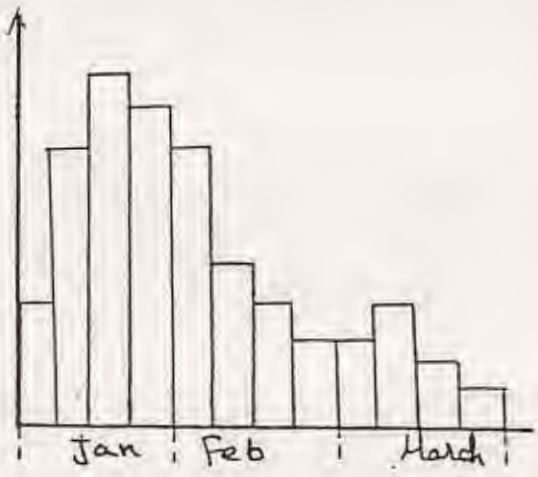

Simple form of bat chart

linear time-scaled for planning -(Linear progress-scaled for reporting).

Bar chart-time scaled for planning- variable progress for reporting.

Volume of work for any activity may not be evenly distributed over the period allocated. Bulk of work may be scheduled either late or early as shown in fig.




BULK OF WORK SCHEDULED LATE
Late

BULK OF WORK SCHEDULED EARLY
early

ADVANTAGES AND LIMITATION OF BAR CHARTS:

ADVANTAGES:

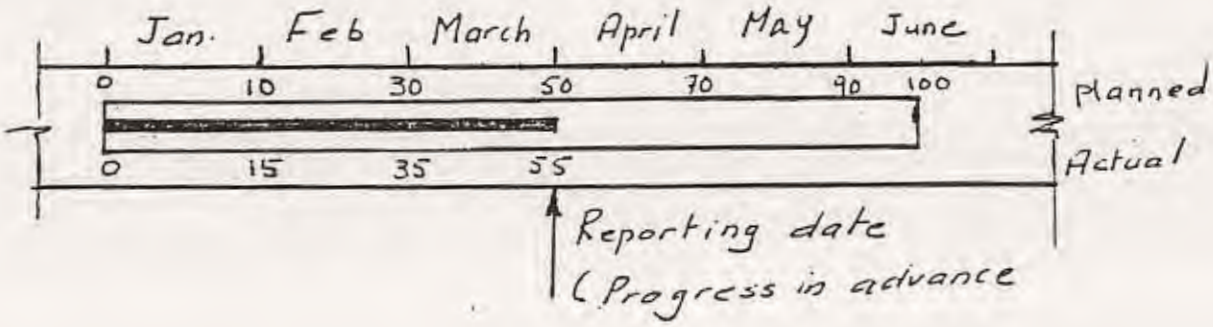
* Simple graphical form results in relatively easy general comperhension.
* Require less revision and up dating than more sophisticated systems.
* Very helpful in the turbulent early stages of the project when frequent revision are a fact of life.

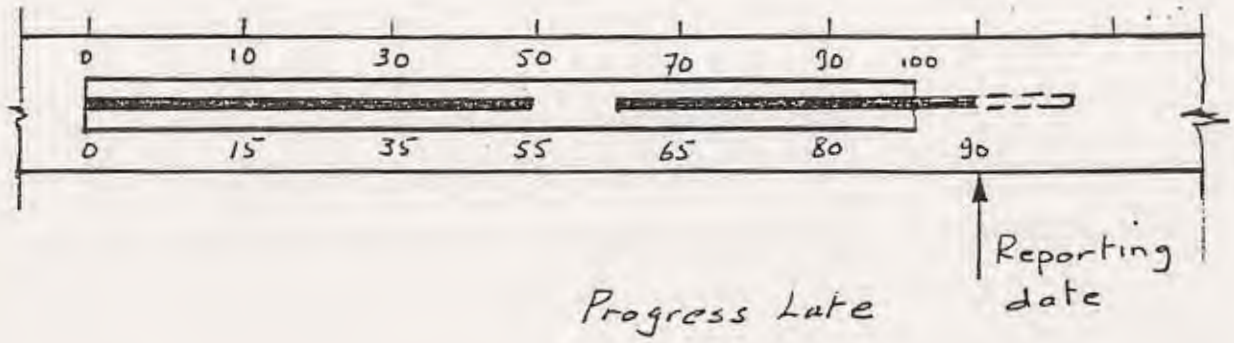
LIMITATION:

* Because of their brood planning ,they become cumbusome as the No. of activities increases and required more streets.
* Logical inter connection and constraints of the various activties in the project is not expressed in the diagtam .
* It is different to recognize sequence constraints unless substantial amount of documentation is included in the chart.

* It is difficult to usefor forcasting the effects that changes in particular activitiy will have on the ~~anuall~~ overall schedule , or even to project the progress of an indivdual activtiy.

It is therefor limited on a control tool.



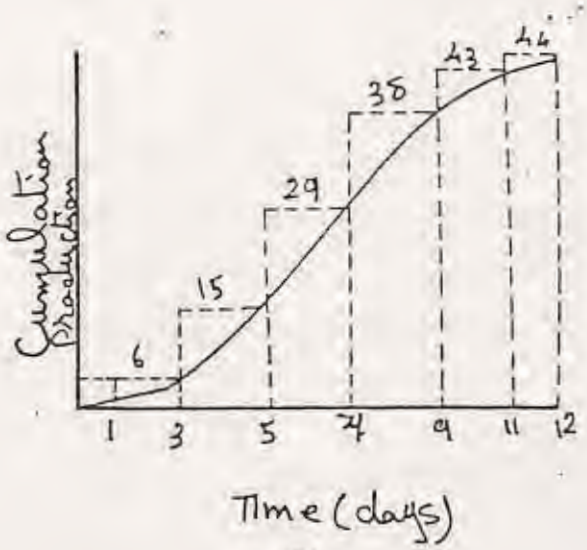
PROGRESS CURVES:

Progress curves can express some aspects of project plans.

Progress can be measured in terms of money expended, quantity of work , man hours expended, or any other measure which makes sense. This can be expressed in terms of actual units( pounds, per m2 ..etc.) or as a percentage if the estimated total quantity to be measured.

The shape of a typical progress curve, also called S curve result from integrating progress per unit of time( day, week, month) in order to obtain cumalative progress.

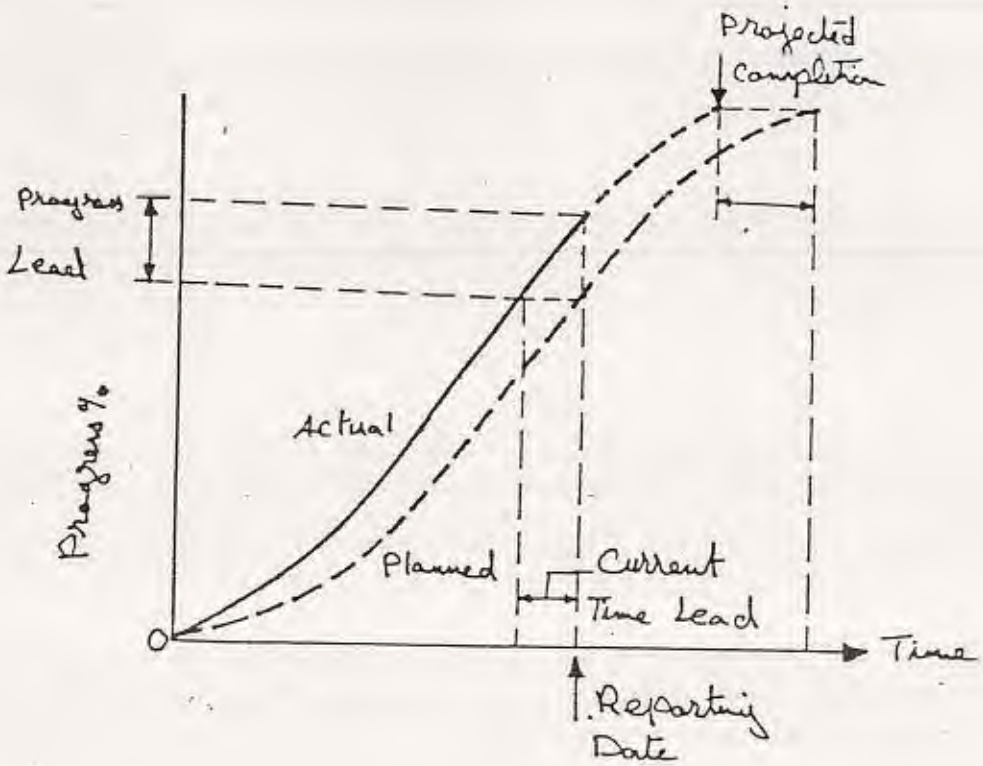

(1)

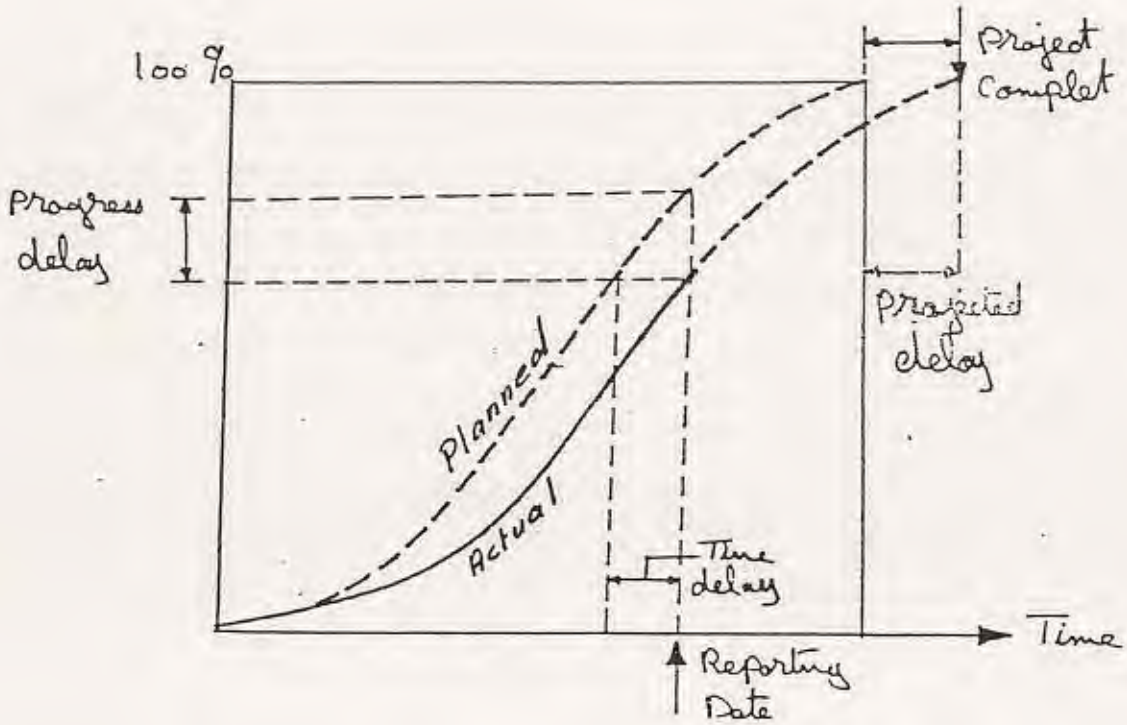



(2)

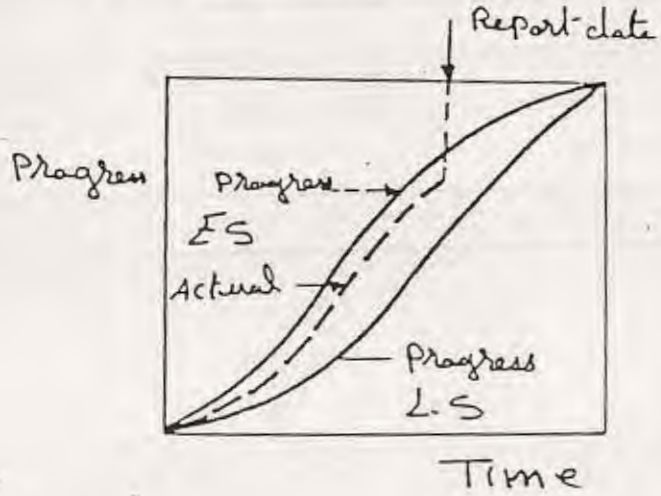
On most project volume of work per unit time tends to start slowly, built up to apeak, then taper off near the end . This is known as the bell shape distribution, fig (1) . The corresponding cumulative curve is the S curve.

Basic concepts of planning ,reporting and projecting progress are shown in the following fig.


Projected Completion
Progress Lead
Progress %
Actual
Planned
Current Time Lead
O
Time
Reporting Date

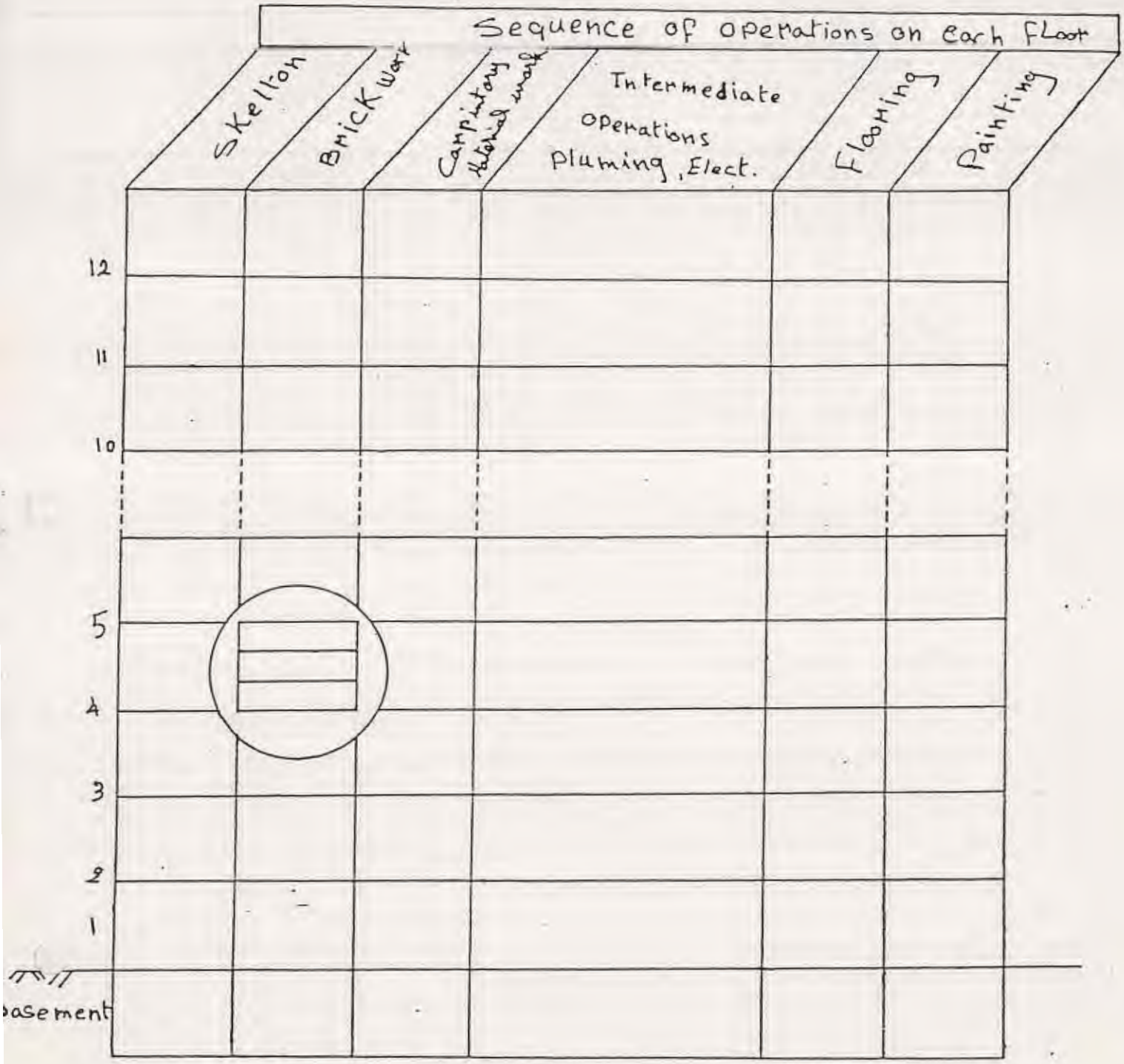

100 %
Project Complet
Progress delay
Projected delay
Planned
Actual
Time delay
Time
Reporting Date

Progress curves may also be planned by considering early and late start, this will produce two S curves with the same start and end phints.




MATRIX : SCHEDULE:

For projects containing repeating typical operation this matrix schedule is the simplest and quite effective for documenting and communicating a plan. It is fairly common on high-rise building .



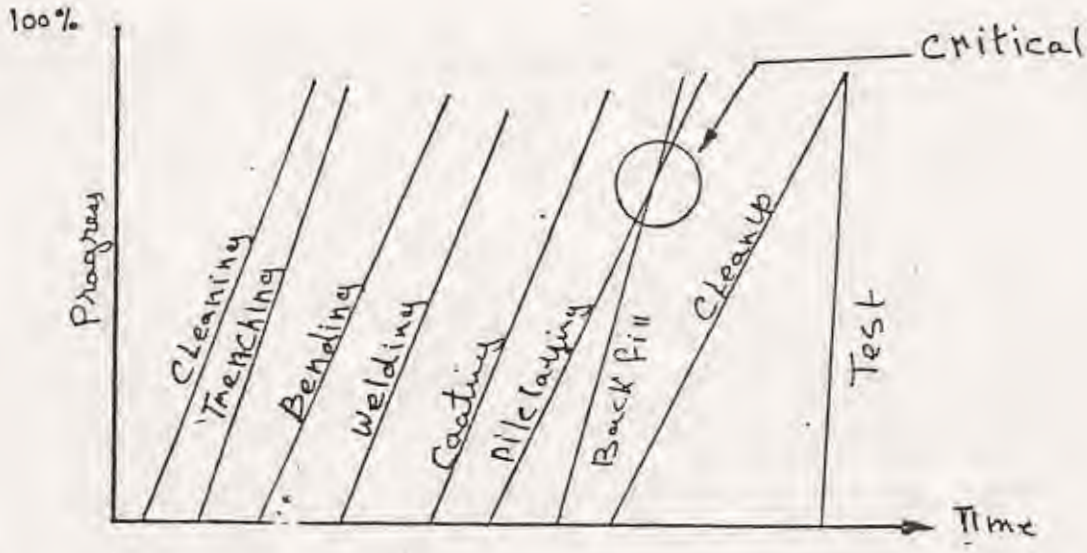

| | | | |
|---|---|---|---|
| Scheduled start | 14 - 4 - 81 | 20 - 4 - 81 | Actual start |
| Scheduled finish | 21 - 4 - 81 | 25 - 4 - 81 | Actual finish |
| duration | 4 | 5 | duration |

LINEAR BALANCE CHARTS:

This technique is also called vertical production method"VPM" and it is similar in concept to the line balance chart used by indutrial engineers for optimizing output on manufacturing production lines.

This method applies best to linear and repetitive operations such as pipelines, high ways, tunnels.

The cumulative progress of each trade, subcontractor is plotted on the vertical axes, The horizontal axis plots time.




For project with lenear sequence- as long as the slope of the following operation is the same or less the project should proceed satisfactory.

NET WORK - BASED SCHEDULES:

Beside the four alternative methods discussed for planning , the critical path net works and their related techniques for schedule, resource and cost analysis are still by far the most powerful analytical tools that we have for project planning and control.

# Planning by CPM

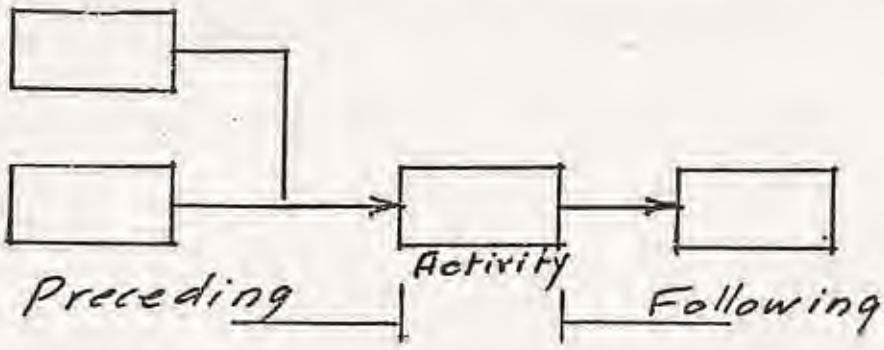
- The works needed to be performed to complete the project are divided into a number of activities.

- The activities may be global or detailed in accordance with the level of planning (Example)

- The Logic sequence for performing the different activities is determined and clearly defined by the specialists (Consultants, Site Engineers, chief site workers, other technical assistants mechanical, Electrical - -- etc.. )

- The adequate needed duration for each activity is also fixed.

- For each activity, the immediate preceding and following activities are clearly defined.



- For each activity, we have the following notations and relations.

| | |
|---|---|
| Early start | ES |
| Early finish | EF |
| Late start | LS |
| Late finish | LF |
| Duration | D |

- Time computation is made by both:

  Forward Path : $\underline{ES + D = EF}$

  Backward Path : $\underline{LF - D = LS}$

- The total float
  $= LF - EF$

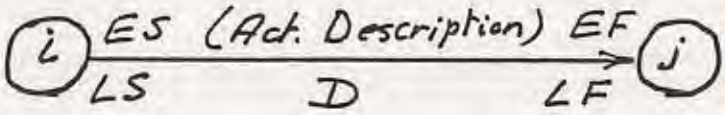
- <u>If total float is zero</u>

  <u>the activity is critical</u>

- The critical path is the one giving the max. duration

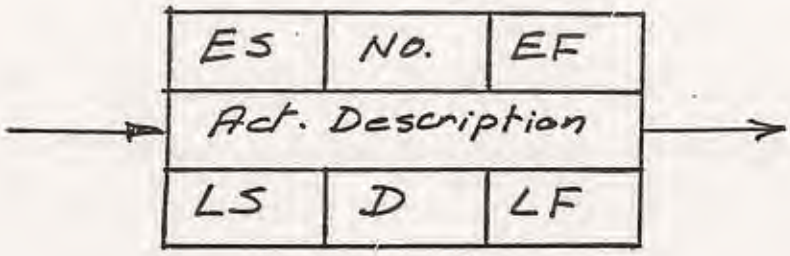
- The basic graphical presentation of the network for the activities is made by either:

  - Arrow - i-j Notations




OR

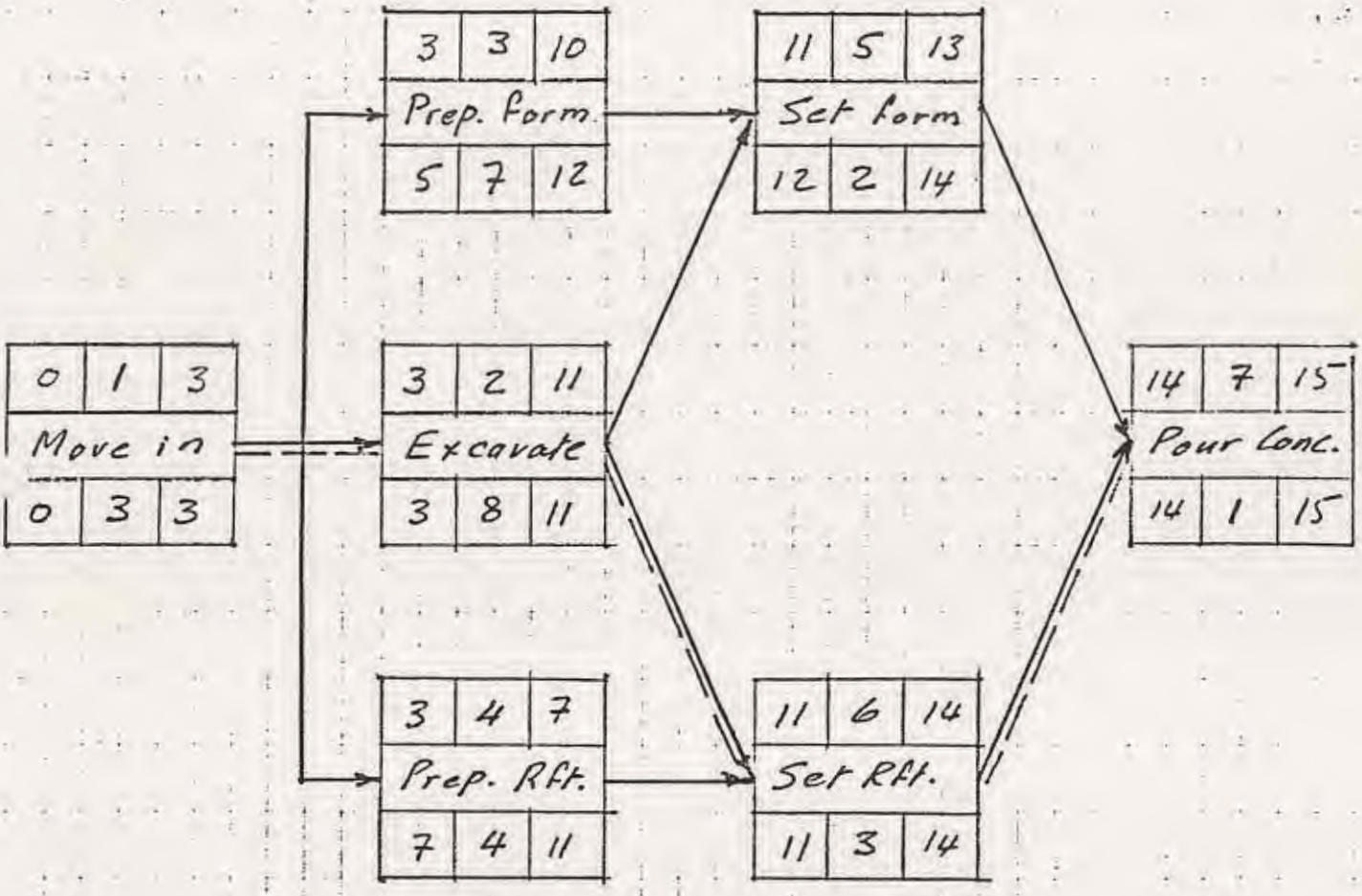
  - Precedence - Activity-on-node



Example:

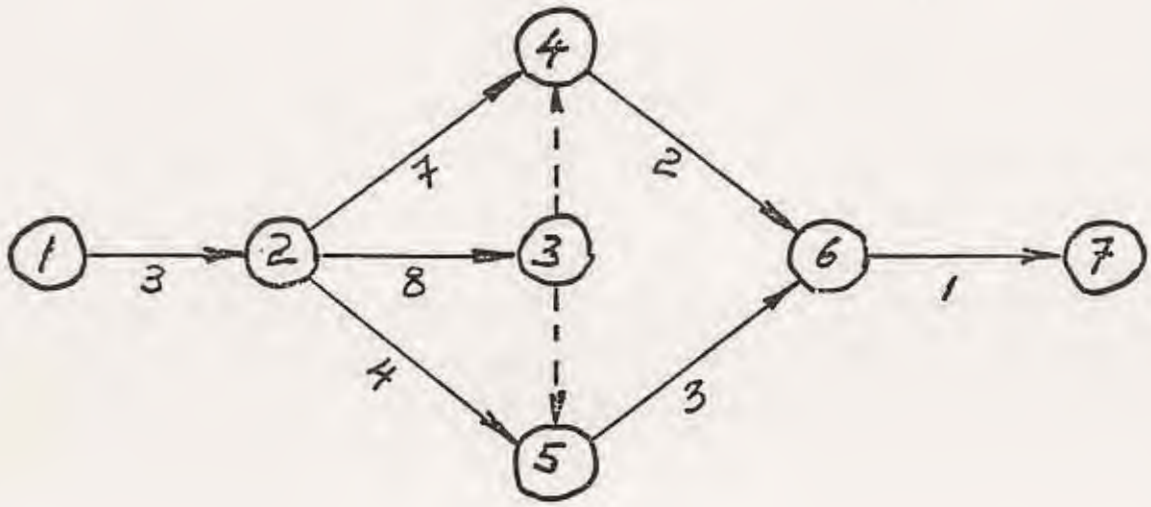
Draw the network for the given activities :-

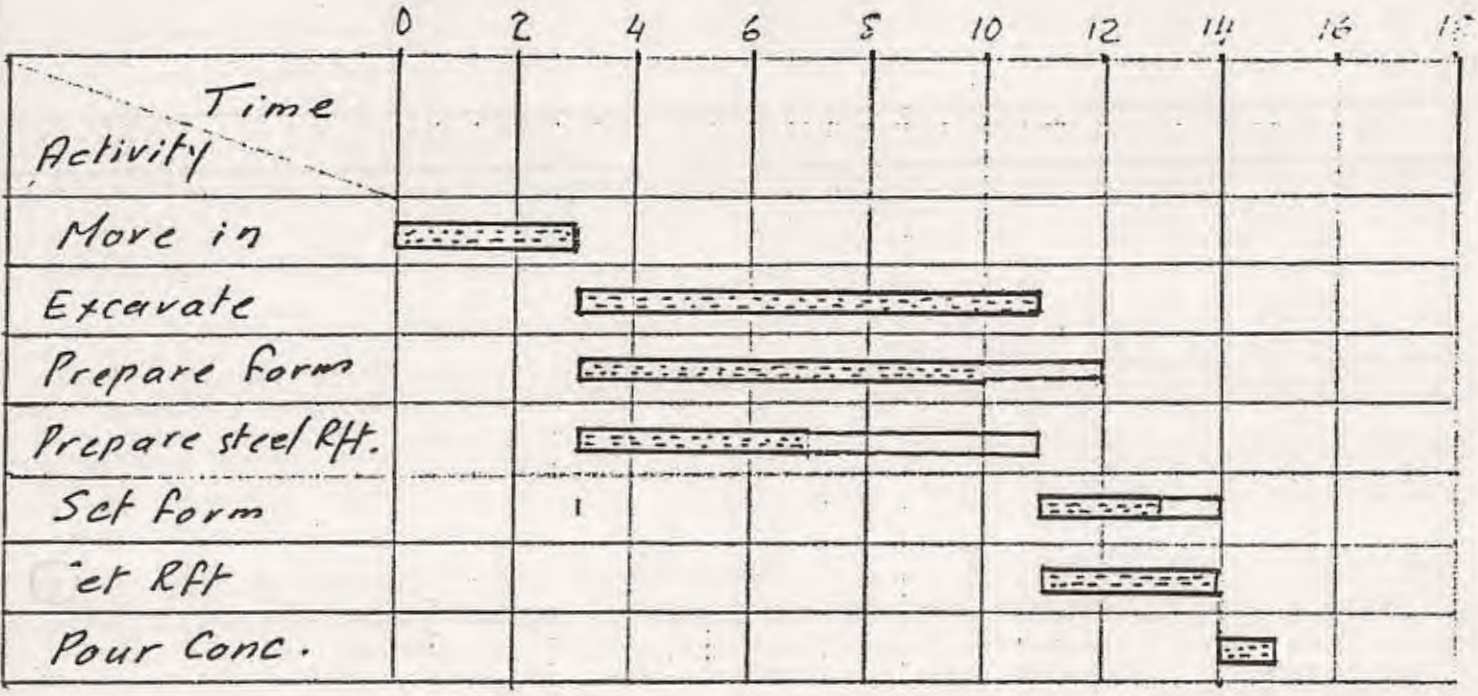
| Activities No. | Description | Duration days | Preceding Activities |
|---|---|---|---|
| 1 | Move in | 3 | — |
| 2 | Excavate | 8 | 1 |
| 3 | Prepare form | 7 | 1 |
| 4 | Prepare steel Rft. | 4 | 1 |
| 5 | Set form | 2 | 2, 3 |
| 6 | Set Rft | 3 | 2, 4 |
| 7 | Pour Concrete | 1 | 5, 6 |
| | | 28 days. | |




Critical Path — — — —

| Activities No. | Description | Duration days | Preceding Activities |
|---|---|---|---|
| 1-2 | Move in | 3 | — |
| 2-3 | Excavate | 8 | 1-2 |
| 2-4 | Prepare form | 7 | 1-2 |
| 2-5 | Prepare Rft | 4 | 1-2 |
| 4-6 | Set form | 2 | 2-3, 2-4 |
| 5-6 | Set Rft | 3 | 2-3, 2-5 |
| 6-7 | Pour Conc. | 1 | 4-6, 5-6 |






Planned

Slack
Total Float

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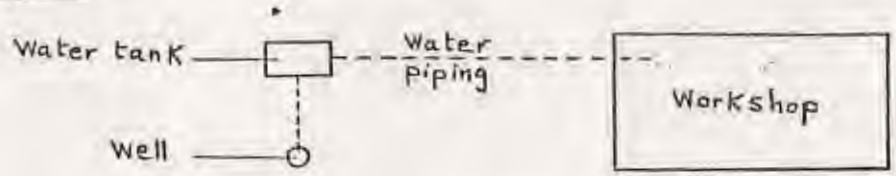
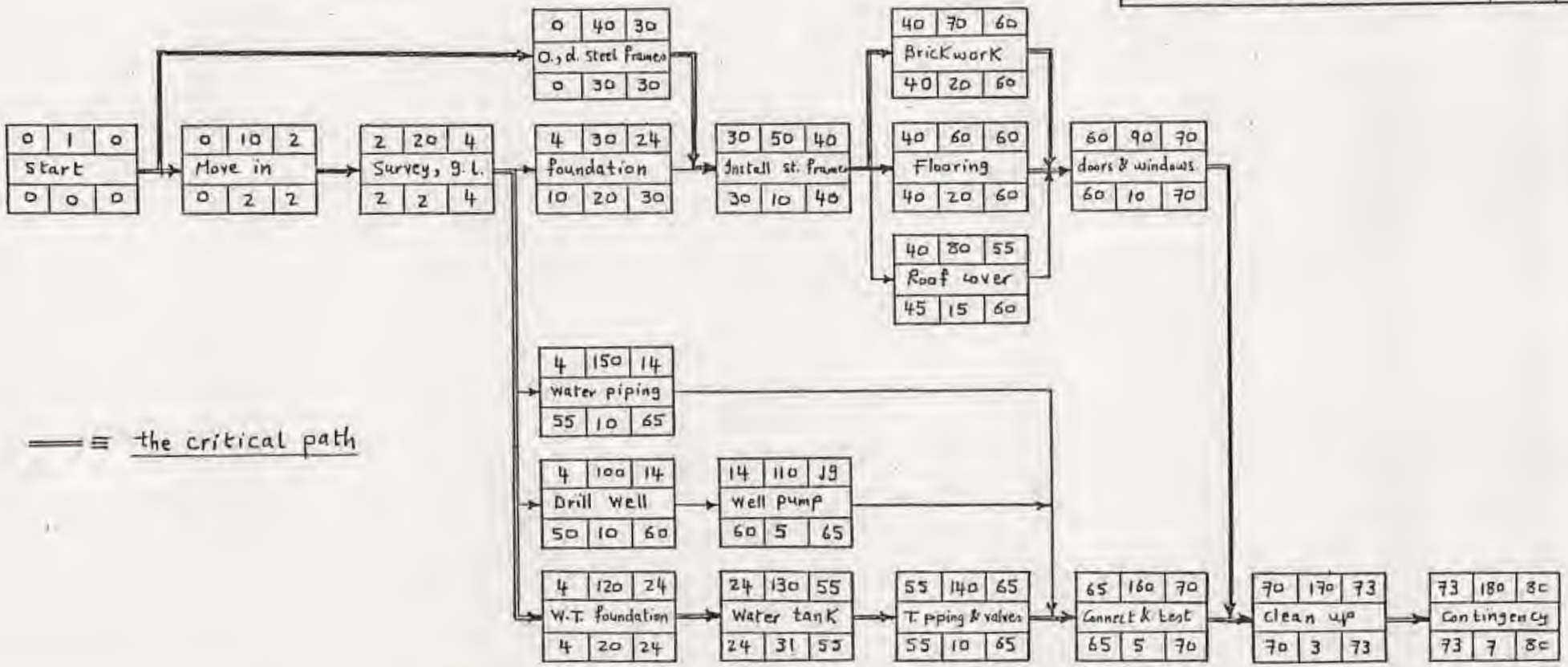
For a project as shown in fig. , the main activities to construct a workshop and provide water facilities are as given in the table.

It is required to draw the network for the given activities using the precedence notation with time computation and show the critical path.

| Activities | No. | Duration (days) |
|---|---|---|
| Start | 1 | 0 |
| Move in | 10 | 2 |
| Survery & General layout | 20 | 2 |
| Foundation for workshop | 30 | 20 |
| Order & deliver steel frames | 40 | 30 |
| Install steel frames | 50 | 10 |
| Flooring | 60 | 20 |
| Brickwork for perimeter wall | 70 | 20 |
| Roof cover | 80 | 15 |
| Installing doors & windows | 90 | 10 |
| Drill well | 100 | 10 |
| Install well pump | 110 | 5 |
| water tank foundation | 120 | 20 |
| Water tank | 130 | 31 |
| Tank piping & valves | 140 | 10 |
| Water piping | 150 | 10 |
| Connect piping and test | 160 | 5 |
| Clean up | 170 | 3 |
| Contingency | 180 | 7 |




═══ ≡ the critical path