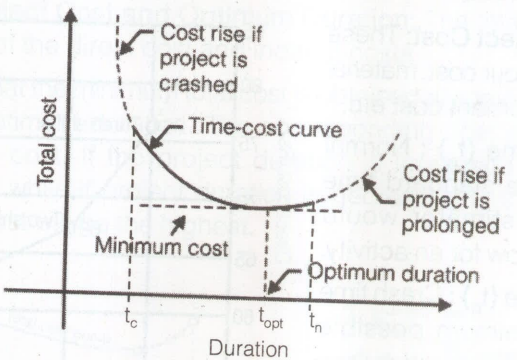
3. CRASHING OF NETWORKS

COST MODEL ANALYSIS

In whole of CPM Cost Model, we will be assuming that project duration is reduced by deploying more resources on critical activities.

PROJECT COST

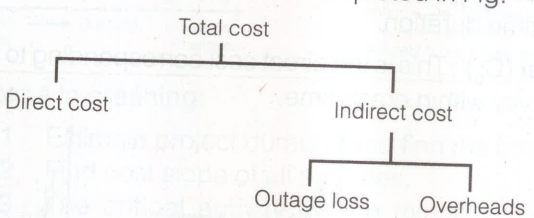


Total Project cost is the sum of two separate cost:

(a) the direct cost for accomplishing the work, and

(b) the indirect cost related to the control or direction of that work, financial overhead, lost production, and the hike.

The components of the total cost are depicted in Fig.

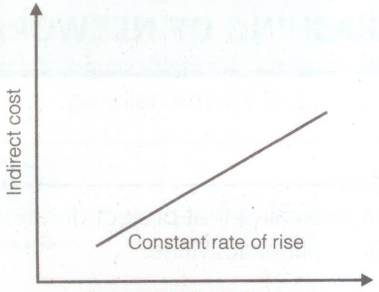


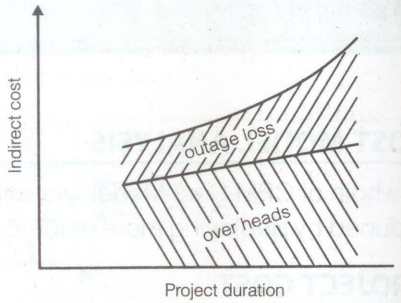
COMPONENTS OF PROJECT COST

- **Indirect Project Cost:** Indirect costs on a project are those expenditures which cannot be apportioned or clearly allocated to the individual activities of a project, but are assessed as a whole.

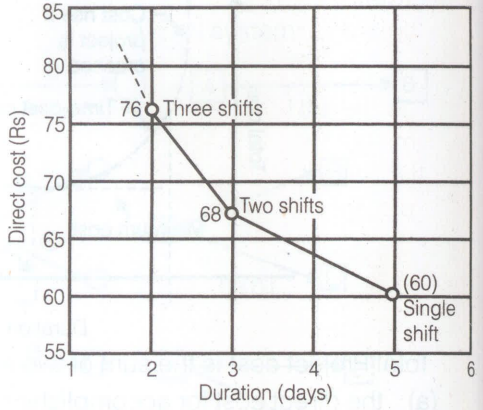
  Indirect cost rises with increased duration.

  The total indirect cost curve will thus be curved.



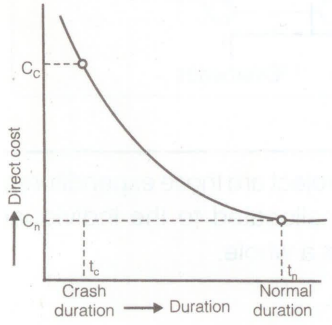


- **Direct Project Cost:** These include labour cost, material cost, equipment cost etc.
- **Normal time (t_n) :** Normal time is the standard time that an estimator would usually allow for an activity.
- **Crash time (t_c) :** Crash time is the minimum possible time in which an activity can be completed, by employing extra resources.

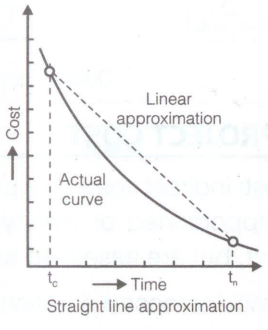


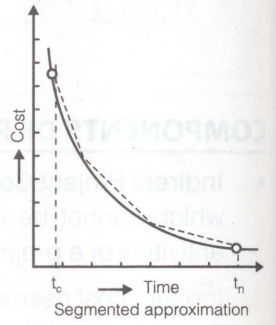
Crash time is that time, beyond which the activity cannot be shortened by any amount of increase in resources.

- **Normal cost (C_n) :** This is direct cost required to complete the activity in normal time duration.
- **Crash cost (C_c) :** This is the direct cost corresponding to the completion of the activity within crash time.



Generalized direct cost-time curve





Direct cost curve approximation

- The straight line or segmented approximation of the direct cost curve is helpful in carrying out the project cost analysis. In such analysis, the cost slope is used.
- **Cost Slope:** The cost slope is the slope of the direct cost curve, approximated as straight line. It is defined as follows:

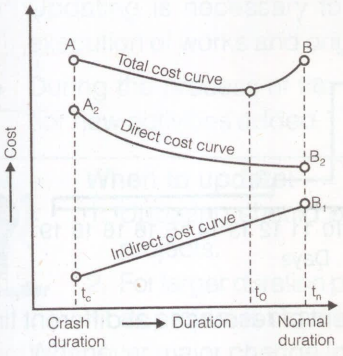
$$\text{Cost slope} = \frac{\text{Crash cost} - \text{Normal cost}}{\text{Normal time} - \text{Crash time}}$$

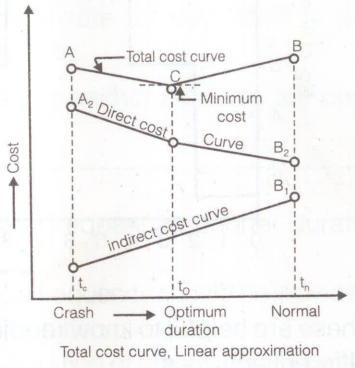
or

$$CS = \frac{C_c - C_n}{t_n - t_c} = \frac{\Delta c}{\Delta t}$$

- **Total Project Cost and Optimum Duration:** The total project cost is the sum of the direct cost and indirect costs.

We find that the minimum total cost is obtained at some duration known as the optimum duration. The corresponding cost is known as the minimum cost. If the project duration is increased, total cost will increase, while if project duration is decreased to the crash value, project cost will be the highest.





Total cost curve, Linear approximation

Steps in crashing:

1. Estimate project duration and find the critical path.
2. Find cost slope of all activities.
3. The critical activity having minimum cost slope is crashed in 1st stage. The next stage crashing will involve activity having second lower cost slope in critical path.
4. Total cost of project at this stage is calculated.
5. Step 3 and 4 are repeated till all activities of project are crashed along critical paths, corresponding time is crash time of project.
6. It is to be noted that only critical activities should be crashed.

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