

King Fahd University of Petroleum & Minerals
College of Environmental Design
Construction Engineering & Management Department
CEM 510
Construction Planning & Scheduling
Fall 2005/2006



Project time reduction



Project time reduction

If the total project duration that came out the scheduling stage is not appealing then, time reduction becomes a demand.

- Reason for reducing project duration:
 1. Meet the contract time requirements of the owner.
 2. Request that the contractor quotes a price for expediting work.
 3. Avoid adverse weather and force men and equipment for other works.
 4. Finish certain work within a prescribed fiscal period.



Project time reduction

5. Receive an early-completion bonus from the owner.
 - The concept and procedure of time reduction:
to gain any reduction in project duration focus exclusively on shortening the critical path as it is the longest path that determines the project duration.
 - Shortening the critical path:
 1. Modify the job logic somehow such that the longest path is diminished in length (No extra cost).
 2. Reduce the length of the critical path by reducing the duration of its constituent activities through:



Project time reduction

- Deploying Additional crews.
 - Working extra hours beyond the basic working hours.
 - Working for multiple shifts.
 - Subletting works to subcontractors.
 - Assigning more equipment temporarily.
 - These options are usually associated with extra costs.
- Reducing time at no extra direct costs:
 1. Restudy of critical activity durations



Project time reduction

Review the time estimates of the individual critical activities. Errors can be made, and it is worthwhile to verify the reasonableness of the original estimates.

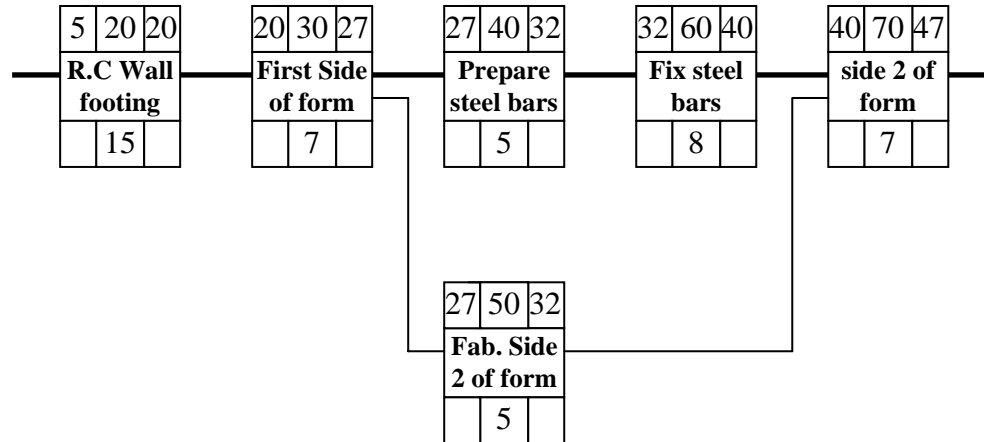
2. Restudy of project plan

Devise a reworking or refinement of the logic of a limited area of the network that will result in a shortening of the critical path.



Project time reduction

1. Critical activities in parallel



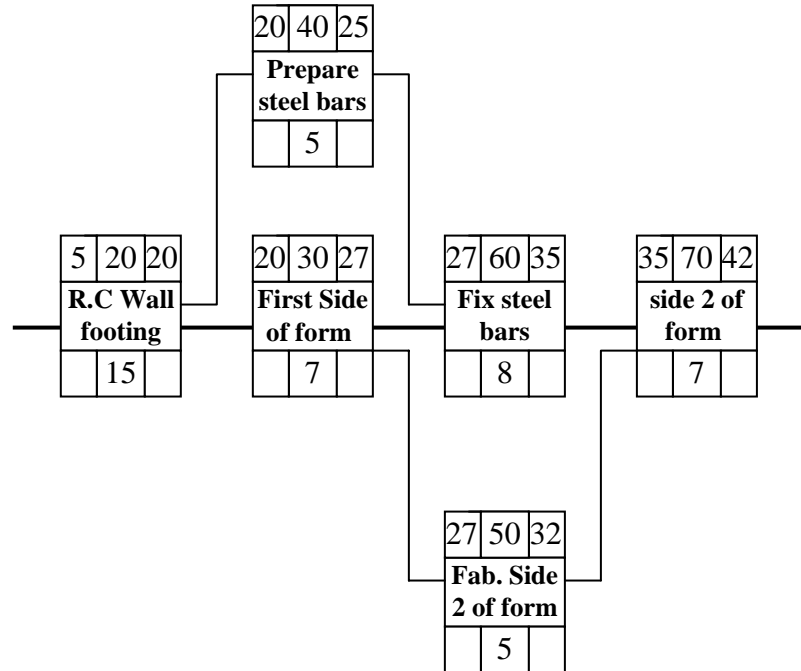
Critical path passes through activities 20, 30, 40, 60, 70

Length = 15 + 7 + 5 + 8 + 7 = 42



Project time reduction

1. Critical activities in parallel



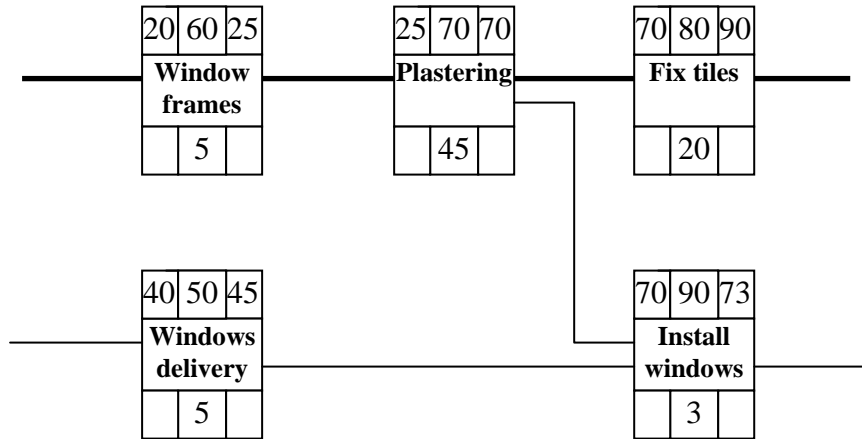
Critical path passes through activities 20, 30, 60, 70

Length = $15 + 7 + 8 + 7 = 37$



Project time reduction

2. Subdivision of critical activities



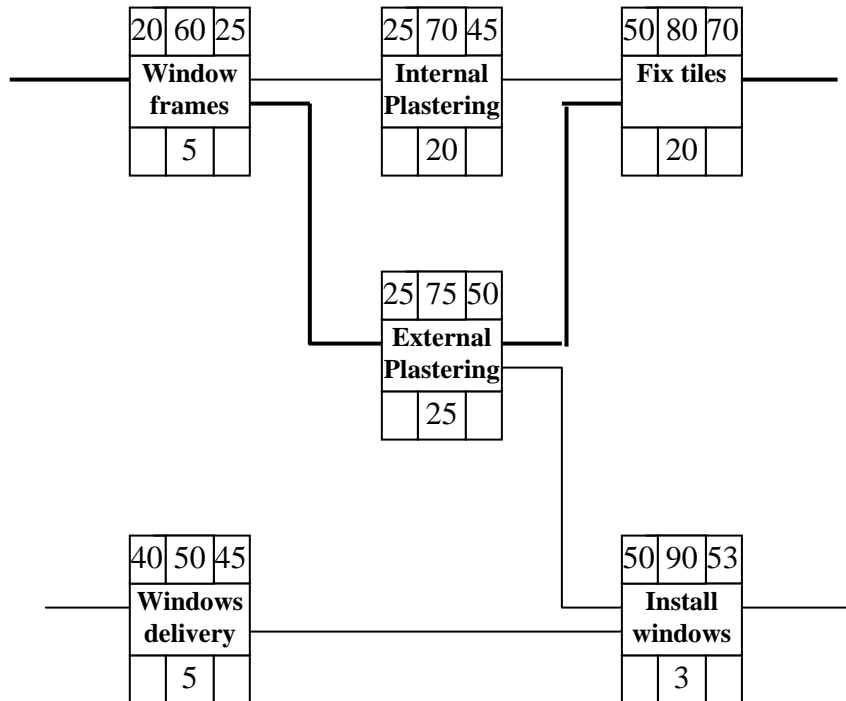
Critical path passes through activities 60, 70, 80

Length = 5 + 45 + 20 = 70



Project time reduction

2. Subdivision of critical activities



Critical path passes through activities 60, 70, 80

Length = 5 + 25 + 20 = 50



Project time reduction

3. Subcontracting

The project plan may show certain critical activities to be in series with one another just because they require the same limited resources.

Subcontracting all or portion of the work involved to a specialty contractor who has adequate equipment and manpower.

This action might enable the activities to be performed concurrently rather than one after other, thus saving considerable time.



Project time reduction

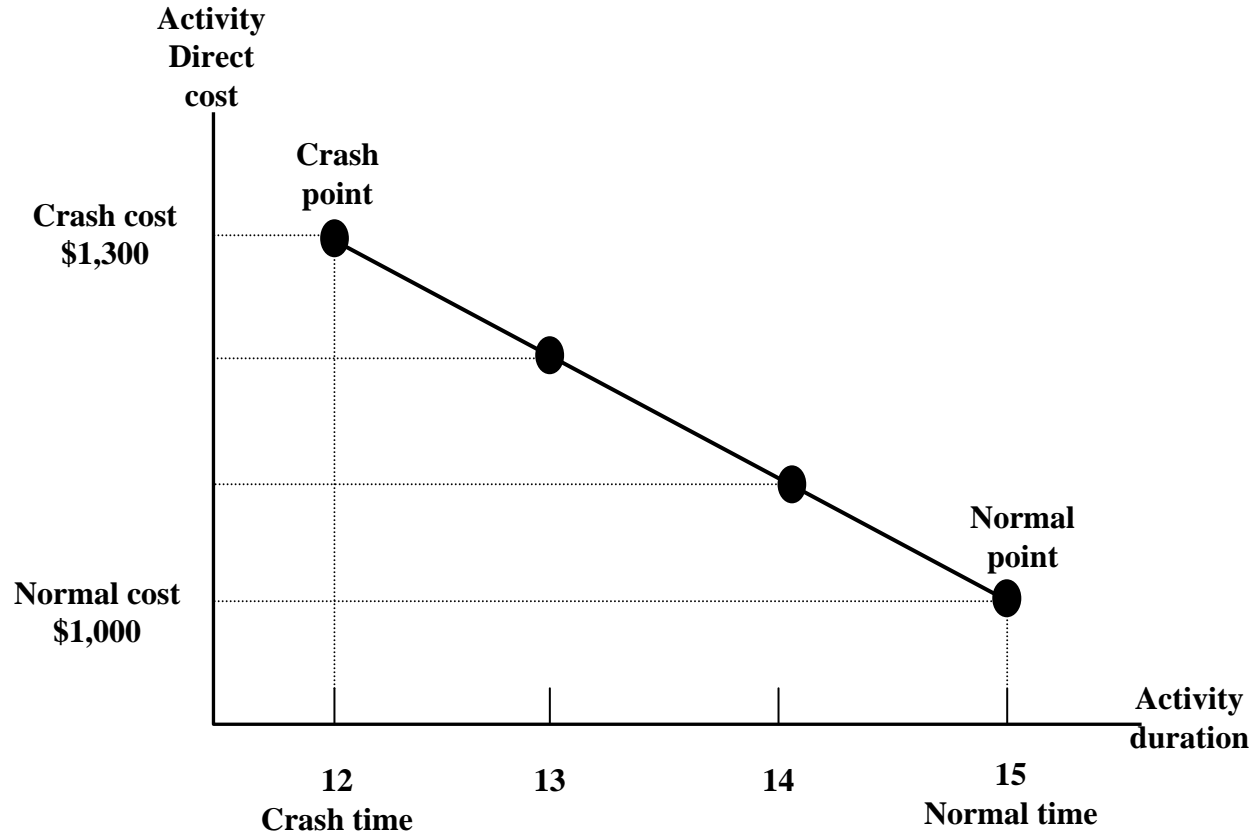
2. Reducing time at extra costs:

- This can be done by reducing the duration of critical activities.
- Reducing duration of critical activities leads to increasing the direct costs of activities and hence the project costs.
- Reducing duration of critical activities leads to shortening project duration and hence reducing project indirect costs.
- As project duration is being reduced, project direct cost increases while indirect cost decreases.



Project time reduction

Relationships between activity duration and direct cost:

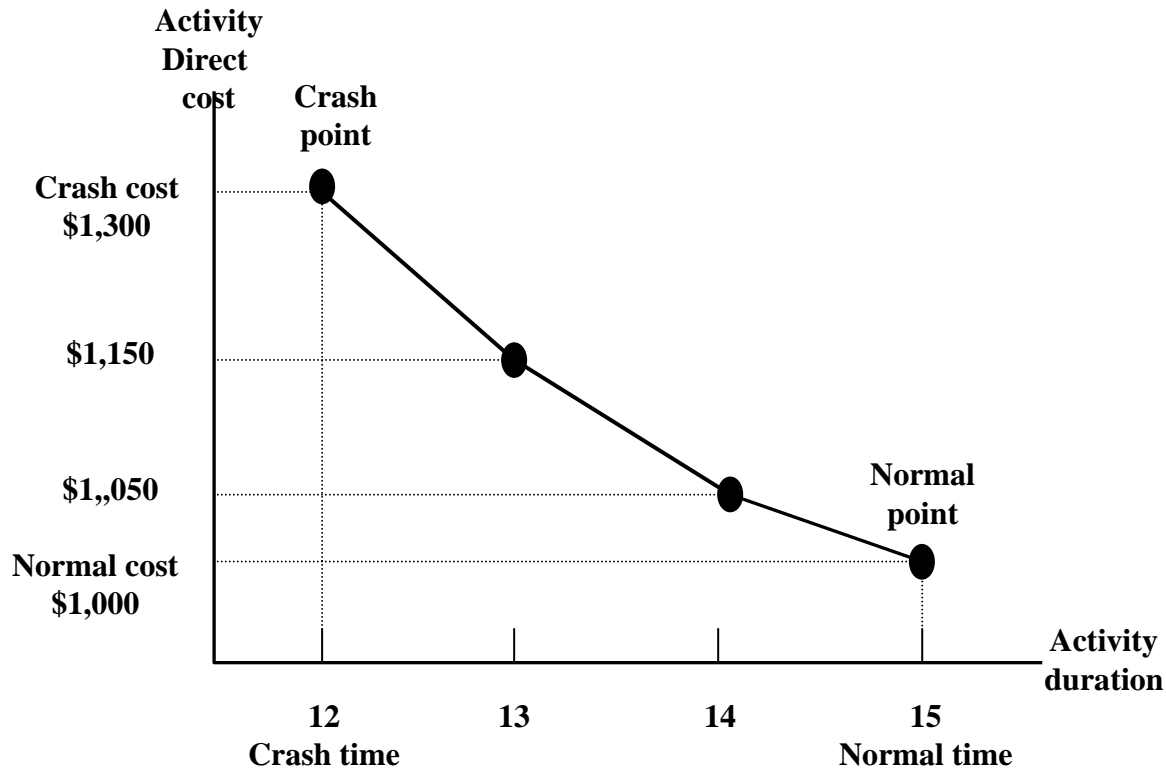


Continuous Linear Variation



Project time reduction

Relationships between activity duration and direct cost:

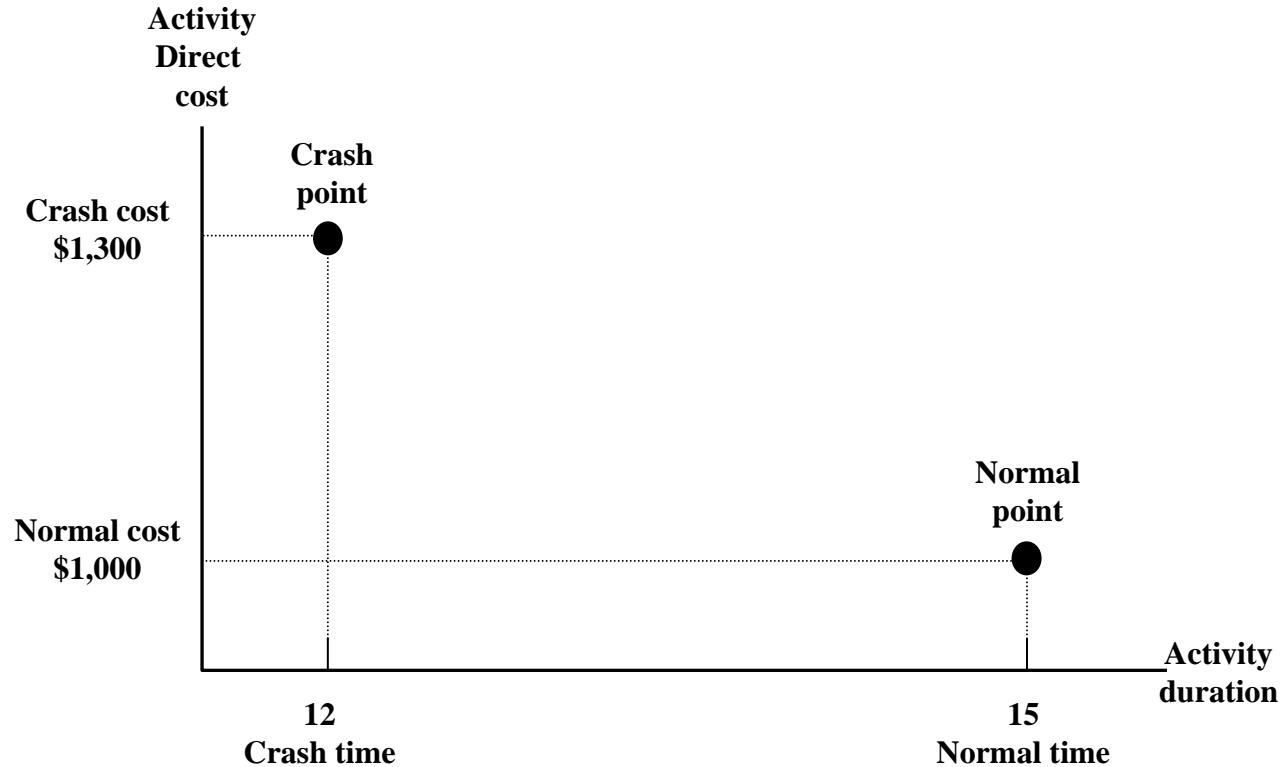


Continuous Piecewise Linear Variation



Project time reduction

Relationships between activity duration and direct cost:



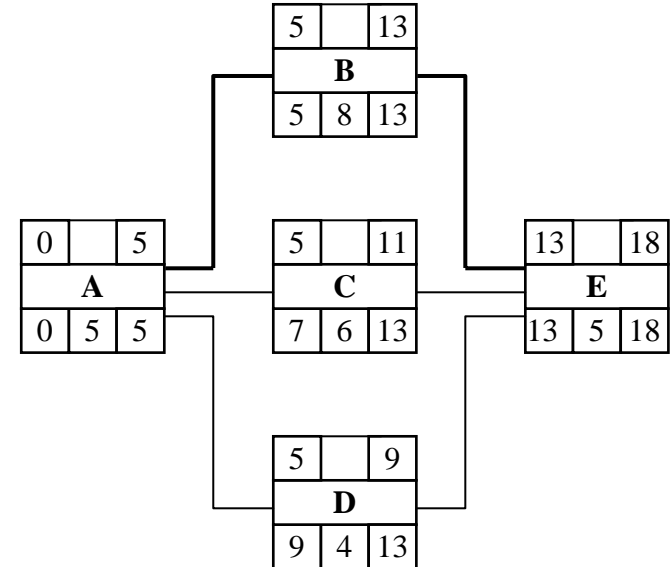
Noncontinuous Variation



Reducing time at extra costs

Example:

Activity	Normal duration	Crashed duration	Normal cost	Crashed cost	Crashing Cost (per day)
A	5	3	2000	2500	250
B	8	2	3000	5000	333
C	6	4	3000	4500	750
D	4	4	2500	2500	---
E	5	3	1500	4000	1250



Total direct cost = 12000

Total indirect cost = 6000 (reducing one day of duration saves 500)

Total cost = 12000 + 6000 = 18000



Reducing time at extra costs

Example (Contd.):

First stage:

-Crash activity A by two days since this is the cheapest scenario.

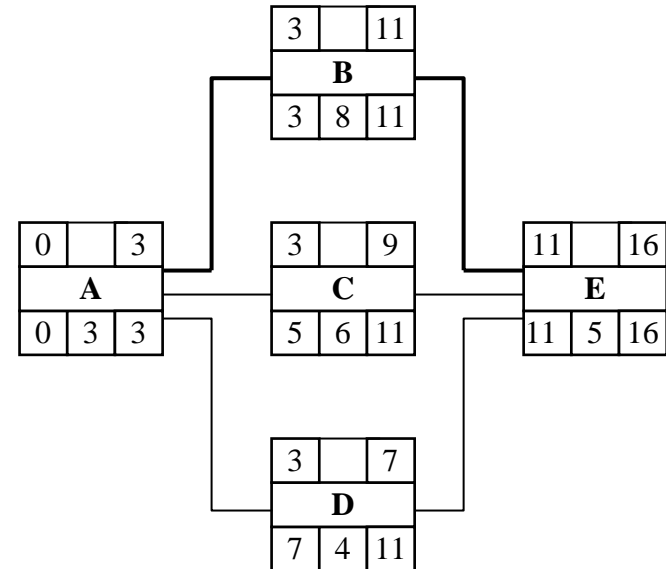
-Crashing cost = $250 \times 2 = 500$

-Total duration becomes 16 days (as shown in the figure)

-Indirect costs = 5000

-Direct costs = 12,500

-Total costs = 17500



Reducing time at extra costs

Example (Contd.):

Second stage:

-Crash activity B by two days since this is the cheapest scenario.

-Crashing cost = $333 \times 2 = 666$

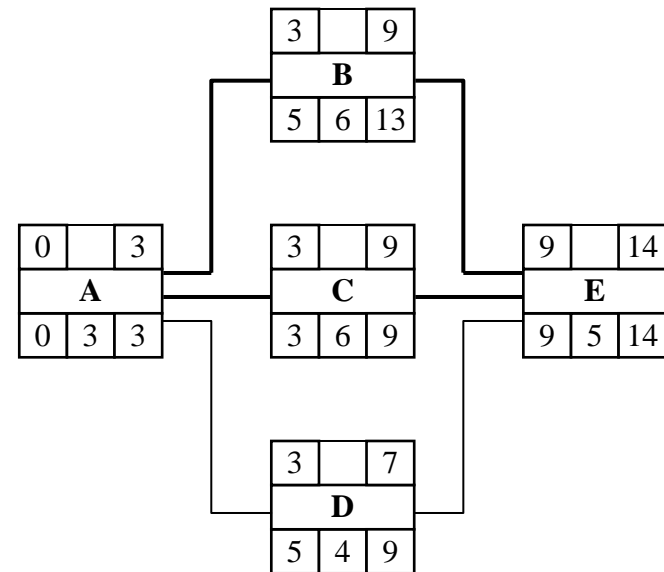
-Total duration becomes 14 days (as shown in the figure)

-Note: there is a new critical path ace

-Indirect costs = 4000

-Direct costs = 13,166

-Total costs = 17166



Reducing time at extra costs

Example (Contd.):

Third stage:

-Crash activities B, C by two days for each since this is the cheapest scenario.

-Crashing cost = $(333+750) \times 2 = 2166$

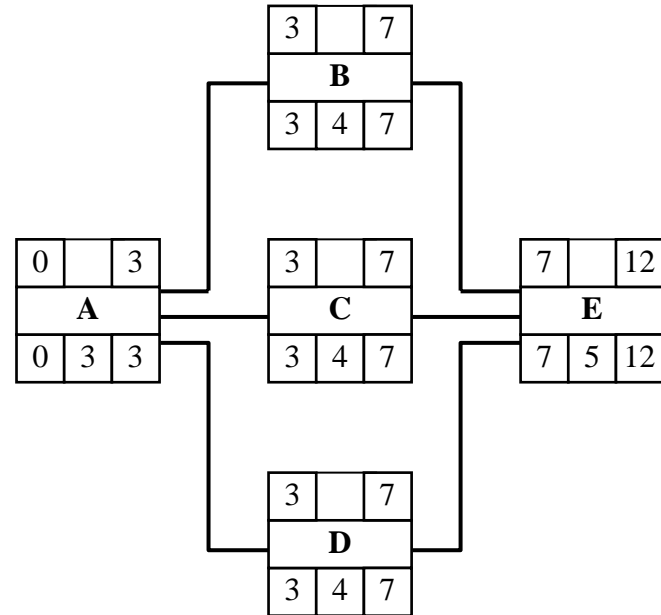
-Total duration becomes 12 days (as shown in the figure)

-Note: all paths became critical

-Indirect costs = 3000

-Direct costs = 15,332

-Total costs = 18,332



Reducing time at extra costs

Example (Contd.):

Fourth stage:

-Crash activity E by two days since this is the cheapest scenario.

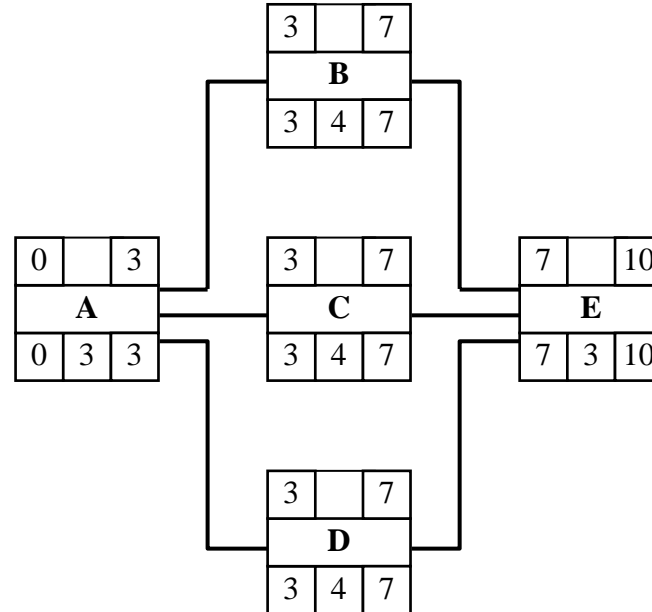
-Crashing cost = $1250 \times 2 = 2500$

-Total duration becomes 10 days (as shown in the figure)

-Indirect costs = 2000

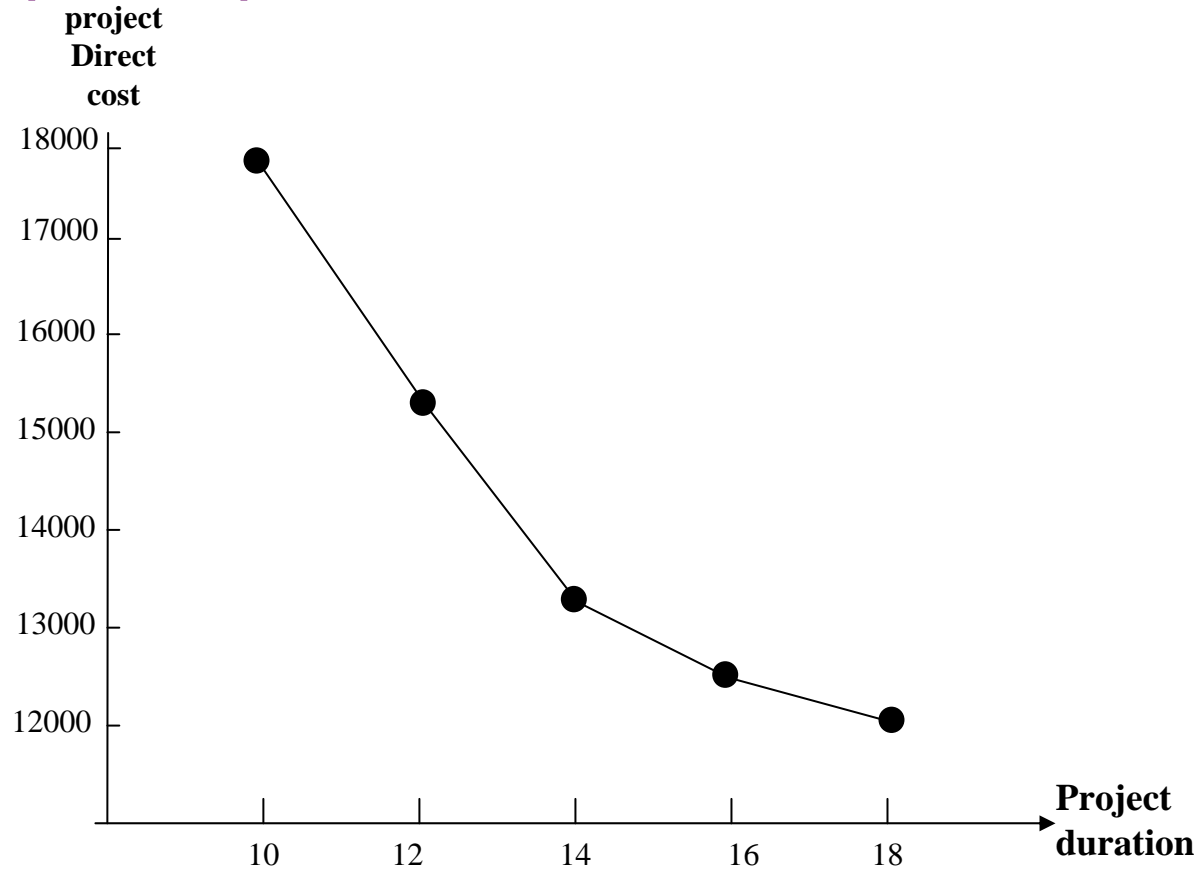
-Direct costs = 17,832

-Total costs = 19,832



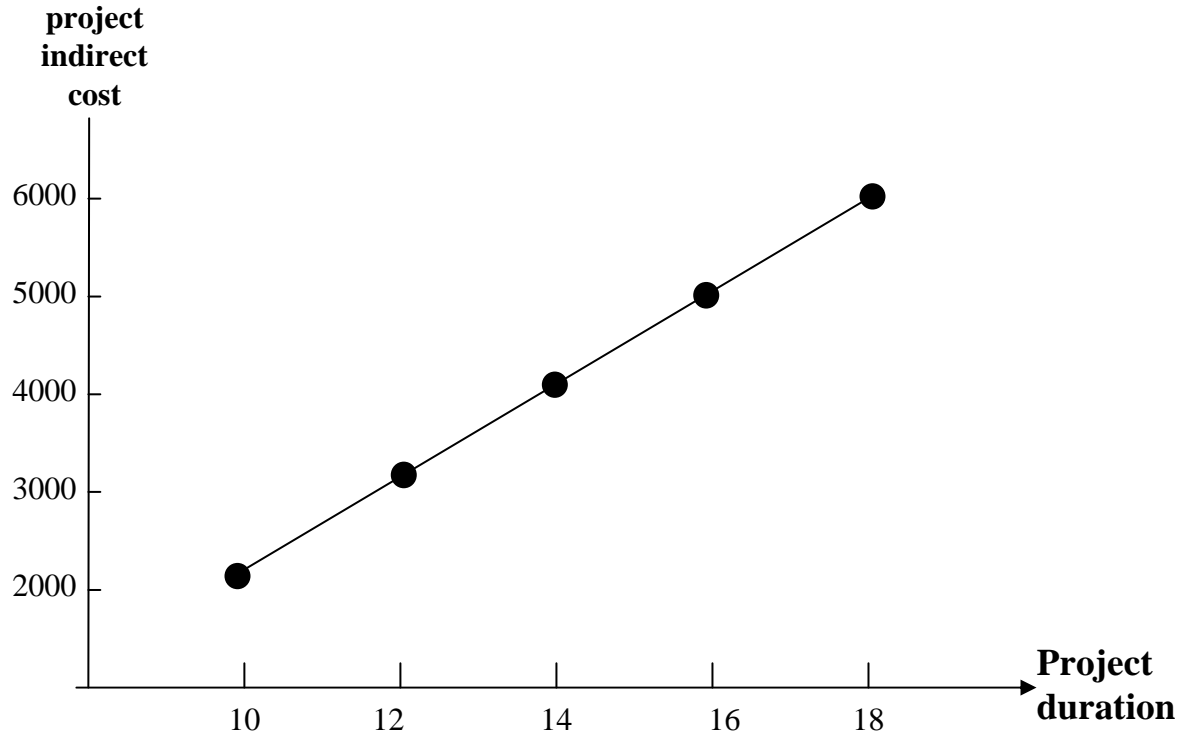
Reducing time at extra costs

Example (Contd.):



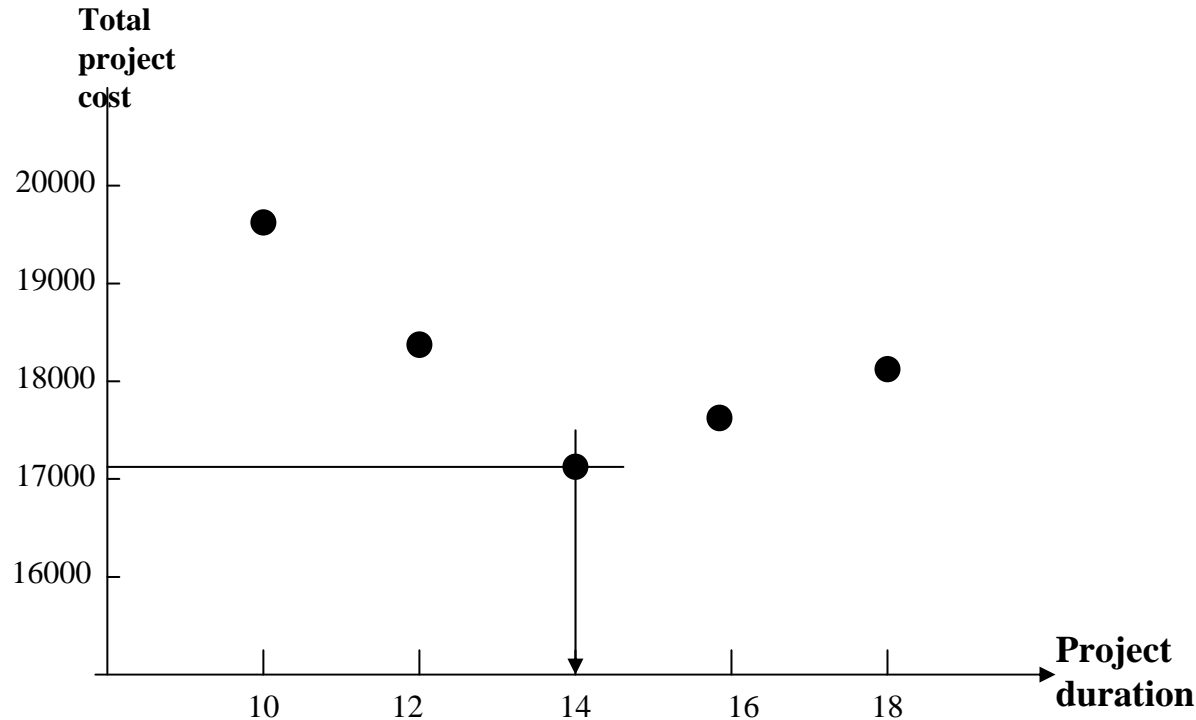
Reducing time at extra costs

Example (Contd.):



Reducing time at extra costs

Example (Contd.):



The minimum total project cost is associated with a total duration of 14 days

