

CONSTRUCTION PROJECT MANAGEMENT

CIVIL ENGINEERING PROJECT MANAGEMENT AND EIA

TIME-COST OPTIMISATION

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Objective

Reduction of time for project/work execution

It costs money:

- Additional labourers
- Additional gangs
- Extra hours or days working (weekends)
- Increasing plant resources
- Additional materials



Assessment of direct and indirect costs

Direct costs

- labour costs
- Plant costs
- Material costs
- Sub-contractor costs
- Recovery of profit

Indirect costs

- Preliminaries
- Supervision
- Head office expenses

Indirect costs increase as the project duration increases

Direct costs increase with resource increasing

**TERMINOLOGY**

Normal time vs Crash time
Normal cost vs Crash cost

Total project cost: direct + indirect cost

$$\text{Cost slope} = \frac{\text{Increase in cost}}{\text{Reduction in time}} = \text{£ per unit of time}$$



PROCEDURE

1. Draw the network diagram of these works with the normal time (and normal cost)
2. Calculate the cost slope for all activities
3. Study the critical path and possible reductions of time in these specific activities (Maybe the critical path changes)
4. Assess the indirect cost associated to this project
5. Calculate the total project cost



EXAMPLE

A work schedule is divided in the following activities shown in this arrow diagram.





EXAMPLE

The time-optimisation of this work results in the following possibilities for direct costs:

Activity	Normal time	Normal cost	Crash time	Crash cost
1-2	5 weeks	£5,000	4 weeks	£8,000
2-3	4 weeks	£9,000	2 weeks	£11,000
3-4	7 weeks	£15,000	5 weeks	£19,000

Indirect costs are £500 per week.

Analyse different possibilities for time-optimisation and the resulting total project cost.



EXAMPLE





EXAMPLE



**Cost
slope**

3,000/week

$2,000/2 \text{ weeks} =$
1,000/week

$4,000/2 \text{ weeks} =$
2,000/week

**Indirect
costs**

500/week

500/week

500/week



EXAMPLE

Total project cost

1. Reducing activity 1-2. Duration 15 weeks

$$£29,000 + 1 \times 3,000 - 1 \times 500 = £31,500$$

2. Reducing activity 2-3. Duration 14 weeks

$$£29,000 + 2 \times 1,000 - 2 \times 500 = £30,000$$

3. Reducing activity 3-4. Duration 14 weeks

$$£29,000 + 2 \times 2,000 - 2 \times 500 = £32,000$$



EXAMPLE

Total project cost

4. Reducing activity 1-2 + 2-3. Duration 13 weeks

$$£29,000 + 1 \times 3,000 + 2 \times 1,000 - 3 \times 500 = £32,500$$

5. Reducing activity 1-2 + 3-4. Duration 13 weeks

$$£29,000 + 1 \times 3,000 + 2 \times 2,000 - 3 \times 500 = £34,500$$

6. Reducing activity 2-3 + 3-4. Duration 12 weeks

$$£29,000 + 2 \times 1,000 + 2 \times 2,000 - 3 \times 500 = £33,500$$

7. Reducing activity 1-2 + 2-3 + 3-4. Duration 11 weeks

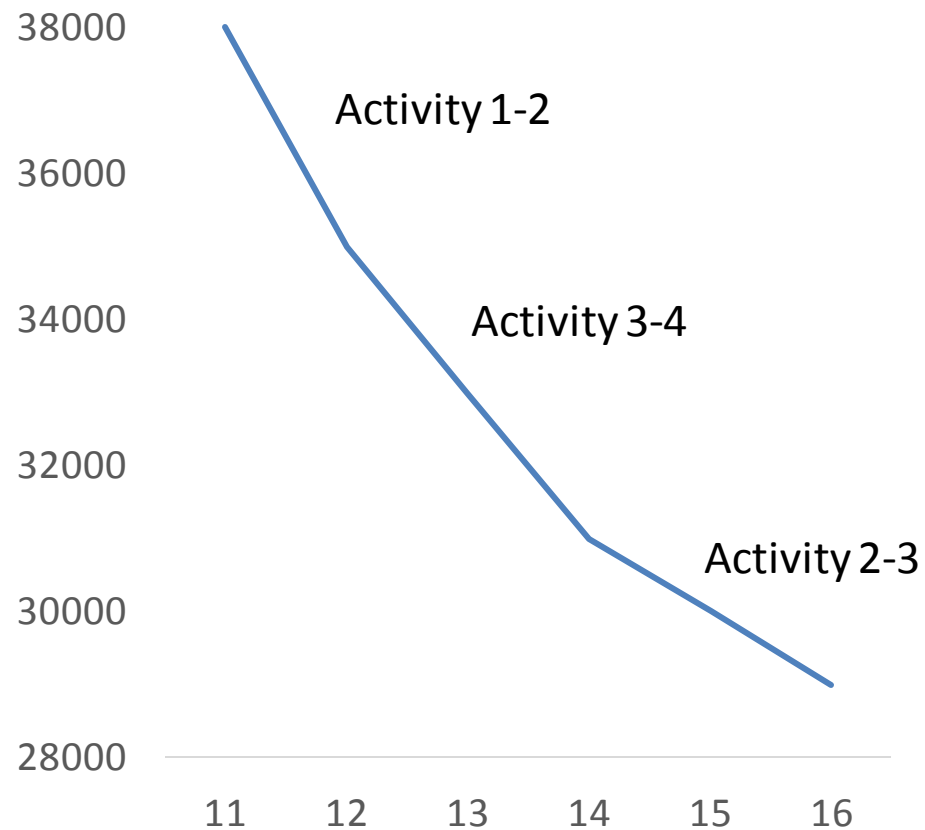
$$£29,000 + 1 \times 3,000 + 2 \times 1,000 + 2 \times 2,000 - 4 \times 500 = £36,000$$



EXAMPLE

We can represent a diagram

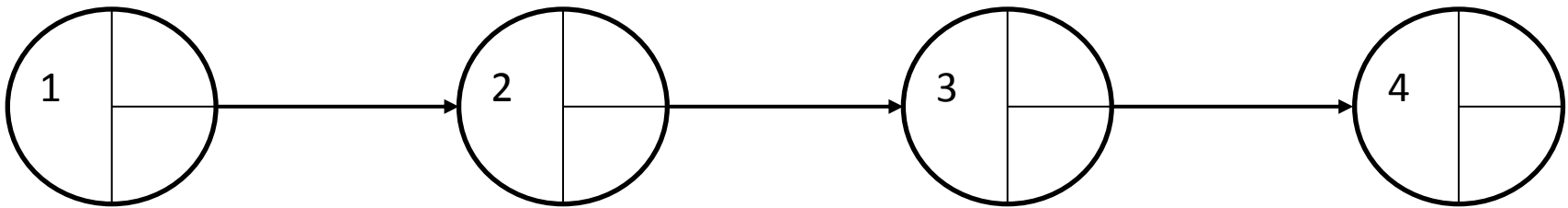
1. Order the cost slopes from the smallest to the biggest one
2. Draw this diagram which will help for the best choice





EXERCISE 1

We need to reduce this work in 4 days. Choose the best option in these activities and calculate the total project cost.



Activity	Normal time	Normal cost	Crash time	Crash cost
1-2	8 weeks	£9,000	6 weeks	£11,000
2-3	10 weeks	£12,000	8 weeks	£19,000
3-4	5 weeks	£20,000	3 weeks	£25,000

Indirect costs are £200 per week.