PROJECT CRASHING

Objectives:

- How to reduce the project timelines when you're forced to complete the project before time?
- How to optimize the time and resources when there is time constraint?
- To find out the optimum time and resources required in case of reducing the project timeline / crashing the project timelines.

Structure

1. Introduction
2. What is Project Crashing?
3. Time-Cost Relationship
4. Project Crashing Example
5. Self-Assessment Exercise

1. INTRODUCTION

Time is a very precious resource when it comes to project management. Schedules for each job or activity must be very carefully developed to ensure on-time completion of a project. But under certain circumstances and challenges, which may occur along a new project, it is necessary to adopt certain methods to overcome these challenges. As a project manager, you need to reassess and adjust a plan in response to arising needs. For this, there are several methods such as critical thinking, risk analysis and project crashing are used.

Crashing in project management relates to cost-evaluation of reducing those activities which are on the critical path. After which, the activities that correspond to the lowest cost for crashing should worked on. In this chapter, the underlying premise behind project crashing is explained and typical risks involved in a schedule crashing effort are described. Combined, the project crashing assessment and the risks can be brought to executive management when you advise them about how best to proceed with your project.

2. WHAT IS PROJECT CRASHING?

Crashing is a method used in project management that assists in boosting up the project timeline by employing additional resources in cases where the scope and deadline of the project cannot be changed instead, you're force to complete the project before time without compromising the scope. Although it will increase the cost of the project but in some cases, it is a good project strategy to be exercised when you’re forced to complete the project before time. There are several situations where one can think of crashing the project timelines, for example;

- When there is an emergency to complete the project before time
- When project is delayed due to unforeseen circumstances
- To avoid a delay in an upcoming phase of another project which is lined-up
- Availability of free resources

Since crashing a project entails a large budget increase for employing additional resources, it should only be used as a last resort when;

- It’s impossible to delay the project deadline.
- It’s impossible to reduce the scope of the project.
- When the cost of missing the deadline is greater than the cost of crashing the project.

That said, the best, and most effective time to begin crashing a project is as soon as the need for it is identified. But to be successful, project crashing should be calibrated, decided upon, and applied at the very start of a project for effective results.

Let’s consider this simple project crashing example. Your team is tasked with launching a magazine to celebrate your company’s 50th anniversary, but delays in approving the lead feature have caused the project to fall behind. In order to ensure the magazine is in hand by the anniversary party, an element of the project’s scope that can’t be changed, you choose to pay a rush fee for the printer. This project crashing step helped you meet the immovable deadline, but it also increased your project budget.

3. TIME-COST RELATIONSHIP

Estimation of time required for the performance of an activity depends upon the quantity of resources. Except some fixed duration activities such as a gestation, crop duration etc. for which it is possible to manage the duration of an activity by varying the quantity of resources. For an instance, if cost is not a constraint, adding more resources to the project might reduce the time duration i.e., time is inversely proportional to cost. The relation can be better understood from the figure below. The time for the activity at minimum cost is called normal time and the minimum time for the activity is called crash time. The costs associated with these times are called respectively the normal cost and the crash cost. Although it is possible to estimate the time and cost associated with the normal and crash conditions for each activity it is difficult to estimate the time and cost at any intermediate stage between these two points. To overcome this difficulty, it is assumed that the relationship between the time and cost as linear in the range between normal and crash situations.

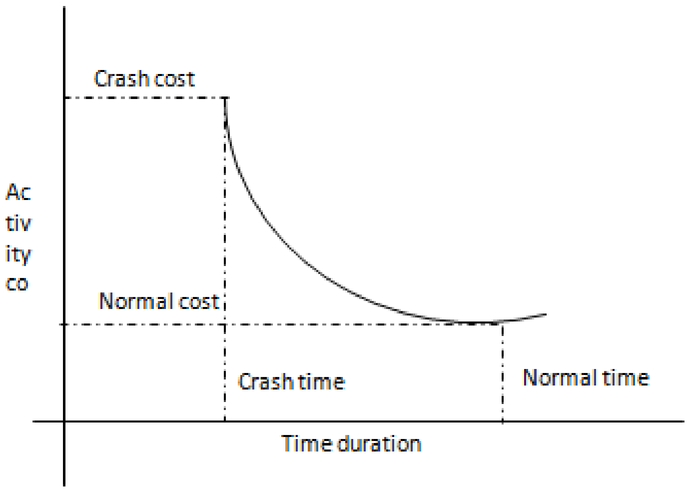

Figure 1: Time cost relationship

There is a possibility that when a project is crashed another non-critical activity may become critical and in next iteration this has to be considered for further crashing.

Steps involved in project crashing as follows;

1. Identify critical path and critical activity
2. Compute crash cost slope i.e. [(Crash cost – Normal cost) / (Normal Time – Crash Time)]
3. Select the activity with the least cost slope i.e., minimum crash cost per unit time.
4. Check for the critical path.

As the project shortening (crashing) continues, a point is reached at which no further crashing is possible. At this point, some activities might not have reached their crash points. If these activities are crashed further, costs are increased with no saving in project duration.

4. PROJECT CRASHING EXAMPLE

Example 1: The network and durations given in the following figure shows the normal schedule for a project. You can crash (decrease) the durations at an additional cost. The Table 1 given below summarizes the time-cost information for the activities. The owner wants you to complete the project in 110 days. Find the minimum possible cost for the project if you want to complete it in 110 days. Assume that for each activity there is a single linear, continuous function between the crash duration and normal duration points. Cost is given in dollars ($) and time duration in days.

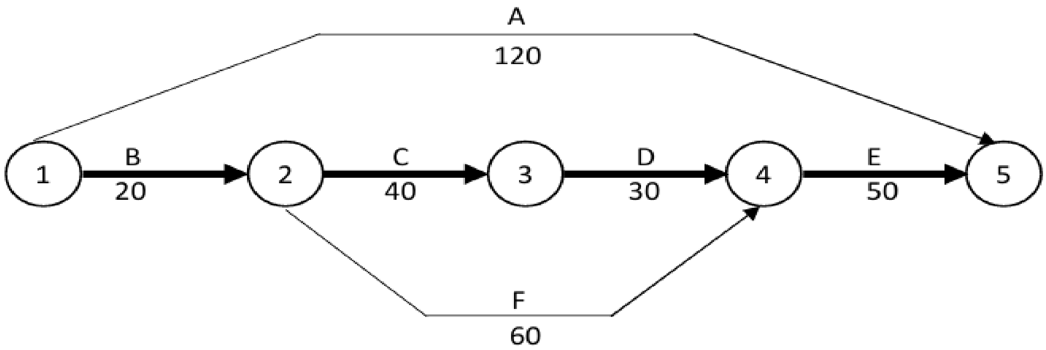

Figure 2:

Table 1:

Activity	Normal Duration	Crash Duration	Normal Cost	Crash Cost
A	120	100	13000	15000
B	20	15	1500	2500
C	40	30	18000	22500
D	30	20	1300	2000
E	50	40	3200	4200
F	60	55	12000	13050

Solution: Assume that the duration-cost relationship for each activity is a single linear, continuous function between the crash duration and normal duration points. Using the normal duration (T_N), crash duration (T_C), normal cost (C_N), and crash cost (C_C), the crash cost slope for each activity can be determined as follows;

$CP = \frac{C_C - C_N}{T_N - T_C}$,
$CPA = \frac{15000-13000}{120-100} = 100\$/\text{day}$, $CPB = 200\$/\text{day}$, $CPC = 450\$/\text{day}$,
$CPD = 70\$/\text{day}$, $CPE = 100\$/\text{day}$, $CPF = 250\$/\text{day}$

The normal cost for the project is the sum of a normal cost for each activity. The normal cost for the project is \$49000 and the normal duration is 320 days. The activity which should be crashed is the one on the critical path which will add the least amount to the overall project cost. This will be the activity with the flattest or least-cost slope. The duration can be reduced as long as the critical path is not changed, or a new critical path is created. In addition, the activity duration cannot be less than the crash duration.

CPD=70$/day (least-cost slope) Maximum of 10 days can be cut from this schedule by reducing the duration of activity D to the crash duration of 20 days.

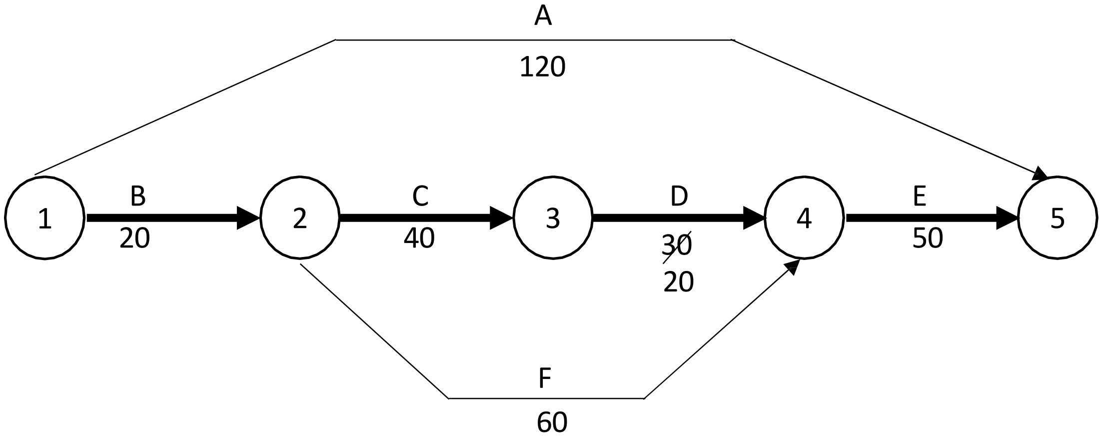

Figure 3

Overall duration is 130 days and there are multiple critical paths (B-F-E and B-C-D-E). Total project cost at this duration is the normal cost of $49000 plus the cost of crashing the activity D by 10 days (70 * 10 = $700) for a total of $49700.

The next activity to be crashed would be the activity E, since it has the least-cost slope ($100 per day) of any of the activities on the critical path. Activity E can be crashed by a total of 10 days. Crashing the activity E by 10 days will cost an additional $100 per day or $1000.

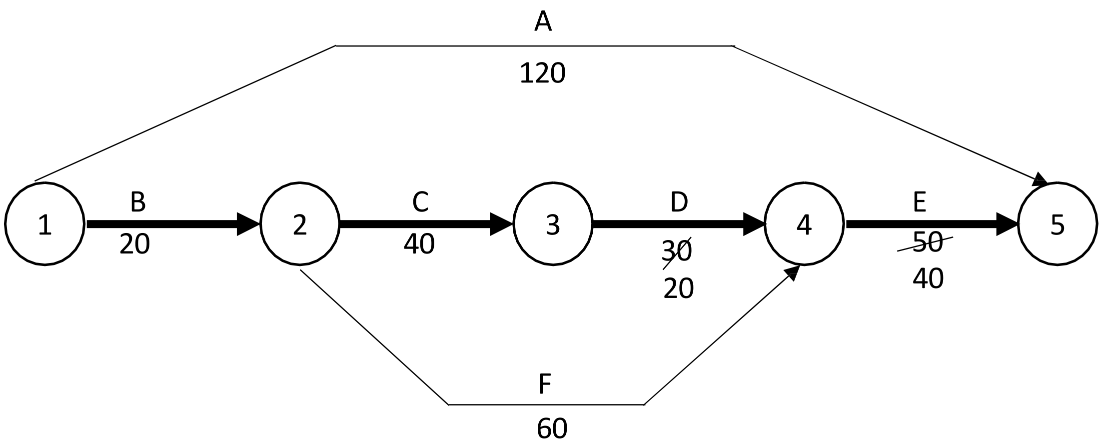

Figure 4

The project duration is now 120 days and the total project cost is $50700. There are now three critical paths (A, B-C-D-E, and B-F-E). The next stage of crashing requires a more thorough analysis since it is impossible to crash one activity alone and achieve a reduction in the overall project duration.

Activity A is paired with each of the other activities to determine which has the least overall cost slope for those activities which have remaining days to be crashed. Activity A ($100) + activity B ($200)

Activity A ($100) + activity C ($450) + activity F ($250)

The least-cost slope will be activity A + activity B for a cost increase of $300 per day. Reducing the project duration by 5 days will add 5*300 = $1500 dollar crashing cost and the total project cost would be $52200. Activity B cannot be crashed any more.

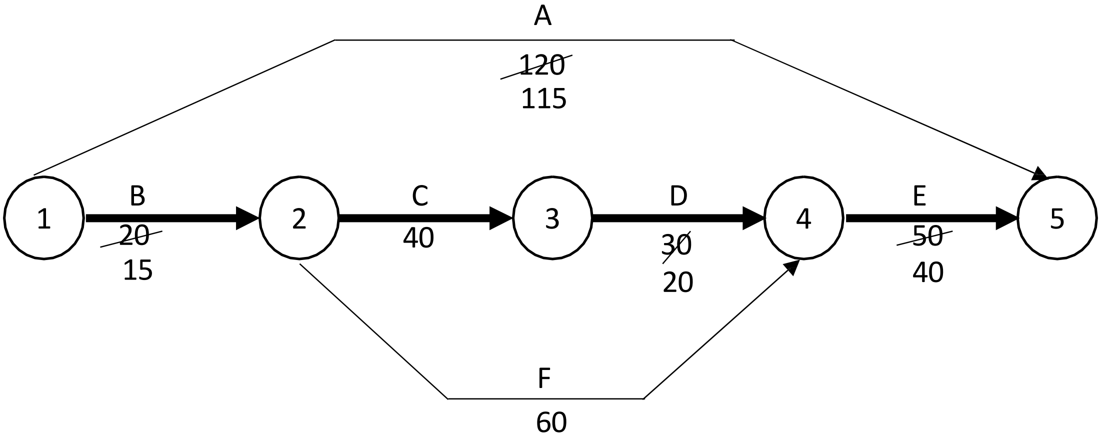

Figure 5

Final step in crashing the project to 110 days would be accomplished by reducing the duration of activity A by 5 days to 110 days, reducing activity C by 5 days to 35 days, and reducing activity F by 5 days to 55 days. The combined cost slope for the simultaneous reduction of activity A, activity C, and activity F would be $800 per day. For 5 days of reduction this would be an additional $4000 in total project cost. The total project cost for the crashed schedule to 110 days of duration would be $56200.

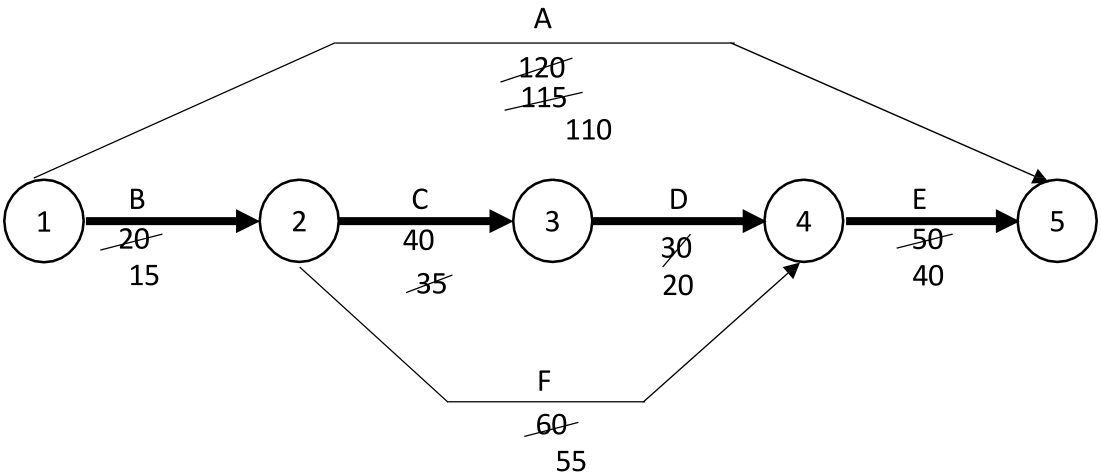

Figure 6

5. SELF ASSESSMENT EXCERCISE

1. A project has activities with the following normal and crash times and cost in dollars ($).

Table 2:

Activity	Predecessor Activity	Normal Duration (Weeks)	Crash Duration (Weeks)	Normal Cost	Crash Cost
A	-	6	4	18000	30000
B	A	7	5	14000	1000
C	A	4	3	19000	15000
D	B	8	6	34000	30000
E	C	2	1	3000	1500
F	D	7	5	12000	10000
G	E	4	2	15000	12000

Determine a crashing scheme for the above project so that the total project time is reduced by 3 weeks.