Regarding scheduling repetitive construction projects CPM has another set of disadvantages . They are summarized as follows [4] :

- CPM cannot adequately model or represent the repetitive nature of construction projects.
- CPM does not distinguish rates of progress among various activities.
- CPM does not show the number of units completed within any period of the activity duration.

3.15 The Program Evaluation and Review Technique (PERT)

Program Evaluation and Review Technique (PERT) is a technique that can be used to plan and control projects surrounded by uncertainty. The aim of PERT is to track the progress of a project and show, at different time intervals, the probability of completing that project on time. PERT depends on statistics, particularly the Central Limit Theorem in calculating the probability of project outcomes . It was developed in 1958, in parallel to the critical path method . However, by the late 1960s the critical path method gained in popularity and has become the most widely used planning and control technique . The lack of software support was probably the main reason why PERT is rarely used in the construction industry [6].

The concept of PERT is fundamentally sound and suitable for planning and control of construction projects. In its traditional format, PERT is concerned with specific events. These events are defined, and linked together by arrows to form a PERT network, which in fact is identical to the arrow network but different in information .The fundamental difference between PERT and CPM is related to the expression of duration of activities . CPM defines duration of activities deterministically as a single-value estimate, while PERT, being probabilistic in nature, assumes that activity duration is a random variable with relatively large variances . In PERT, distribution of activity duration is assumed to fall on a Beta probability distribution curve. Beta distribution is described by its mean and standard deviation [17]. These two parameters are calculated from three estimates of activity duration :

m = the most likely duration ,

a = the most optimistic time (the shortest time interval and is equivalent to a chance of 1 in 100)

b = the most pessimistic time estimate (the longest time interval representing the worst scenario and is equivalent to a chance of 1 in 100).

The mean 'te' of beta distribution is expressed in the following formula:

$$te = \frac{a + 4m + b}{6}$$

The standard deviation 's' of beta distribution is expressed as follows:

$$s = \frac{b - a}{6}$$

Figure (3.8) shows an example of a PERT distribution for an activity having : a = 2 days , b = 8 days and m = 4 days [18] .

Table (3.2) shows dependencies of those activities existed in table (3.1) with the three durations needed in PERT calculation . Figure (3.9) shows the PERT network according to table (3.2) .

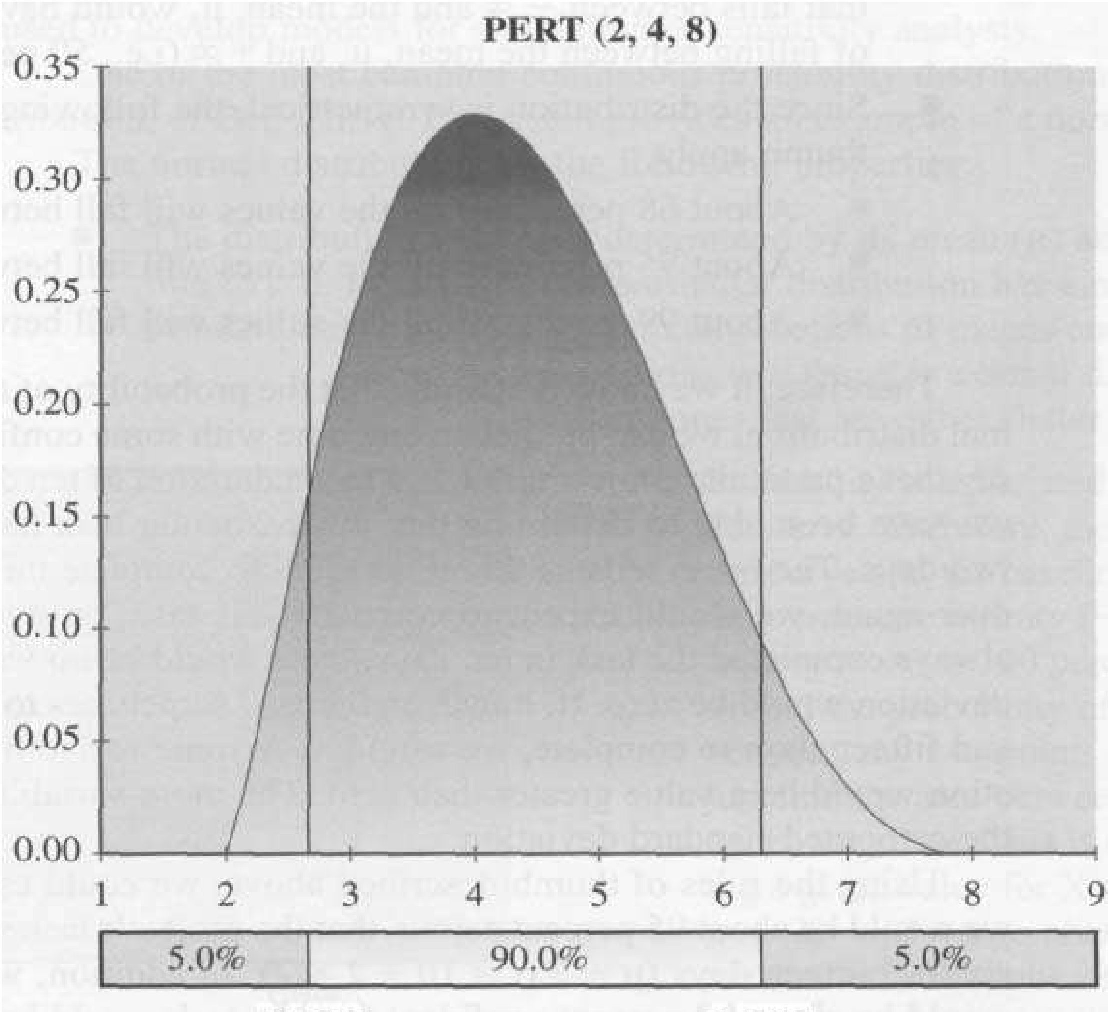

Figure (3.8) Example of a PERT distribution [18]

Table (3.2) , PERT example

Activity	Dependency	a	b	m	te	S	S^2
A	------	2	4	3	3.00	0.33	0.11
B	A	3	6	4	4.17		
C	A	4	7	5	5.17	0.50	0.25
D	B	1	3	2	2.00		
E	C	2	6	3	3.33	0.67	0.44
F	D,E	1	4	2	2.17	0.50	0.25

$\Sigma s^2 = 1.05$

$\sigma = \sqrt{1.05} = 1.025$

Now if it is required to determine the probability of finishing project for example in 14 days z value for normal distribution must be calculated and the corresponding probability can be determined :

$z = (14-13.67) / 1.025 = 0.325$

The corresponding probability of finishing project = 62.93 % [19] .

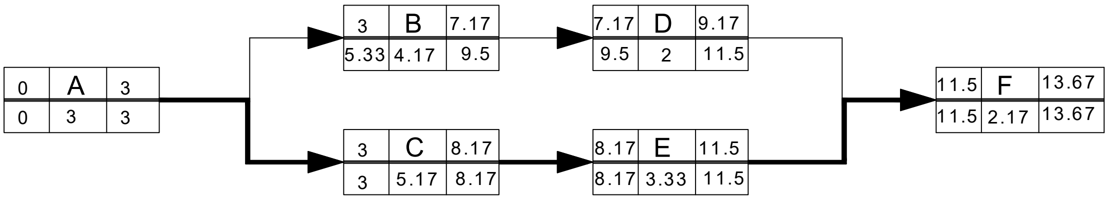

Figure (3.9) PERT example network