

CONSTRUCTION PROJECT MANAGEMENT

PROGRAMME EVALUATION AND REVIEW TECHNIQUE (PERT)

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PROGRAMME EVALUATION AND REVIEW TECHNIQUE (PERT)

Duration of activities sometimes is not ensured:

- Unknown construction methods
- Special activities (e.g. refurbishment)
- Unpredictable weather conditions
- Research and development involved
- Reliability on subcontractors

We need to study uncertainty



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To allow for uncertainty, we need 3 measures:

Optimistic duration (d_o)

Most likely duration (d_m)

Pessimistic duration (d_p)

These 3 measures are defined for every activity



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We calculate the following estimates:

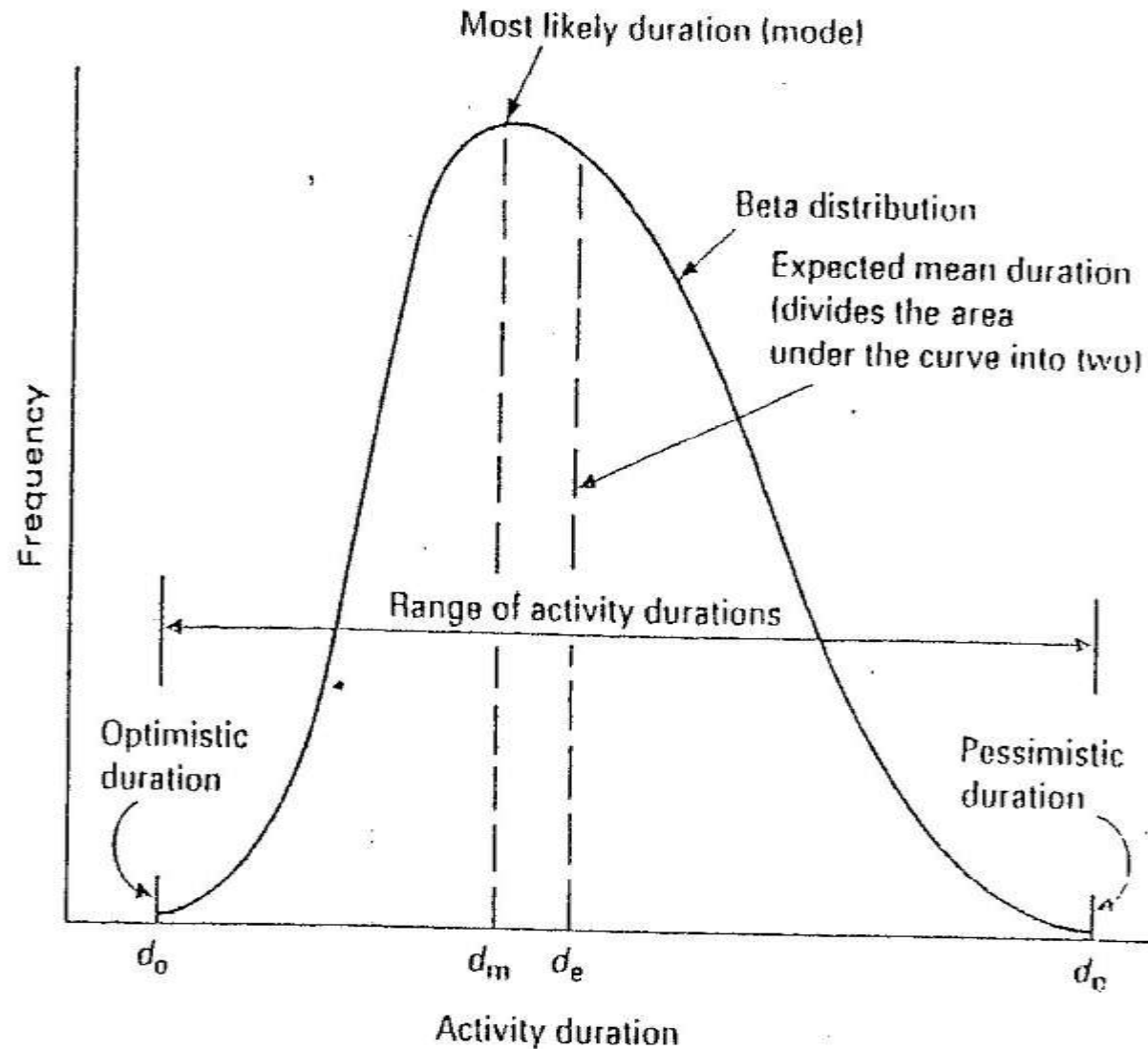
expected mean duration, $d_e = \frac{d_o + 4d_m + d_p}{6}$

standard deviation, $\sigma d_e = \frac{d_p - d_o}{6}$

variance, $vd_e = \left(\frac{d_p - d_o}{6} \right)^2$



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Critical path calculations:

Estimation of expected mean event time

- Sumation of all expected mean durations in the critical path

Estimation of event variance

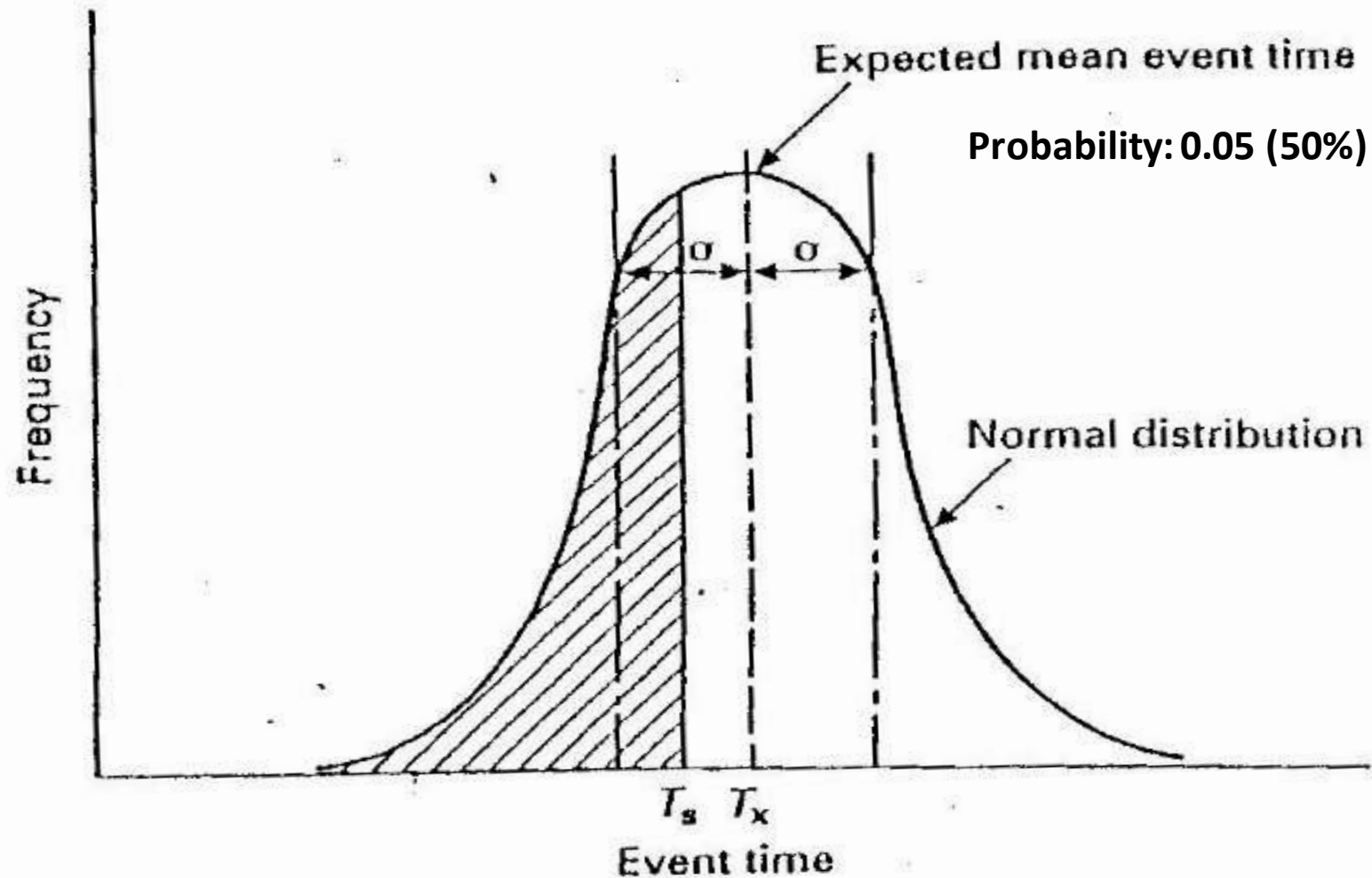
- Sumation of all variances in the critical path

Estimation of standard deviation

- With the event variance



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To calculate probability with specific event scheduled time:

$$Z = \frac{T_s - T_x}{\sigma T_x}$$

With “z” we enter the table and obtain directly the probability

**PROGRAMME EVALUATION AND REVIEW TECHNIQUE (PERT)****EXAMPLE**

Activity	d_o	d_m	d_p			
Foundations	45	60	70			
Frame	14	16	18			
Roof structure	47	52	65			
Roof finish	14	17	18			
Brickwork	42	49	70			
Partitions	69	8	11			
First fix	30	34	38			
Plastering	38	40	50			
Second fix	37	41	45			
Internal painting	7	9	12			
Cladding frames	12	16	22			
Glazing	12	16	25			
External painting	22	27	40			
Brickwork to boundary walls	42	49	60			
Clear up	6	8	10			

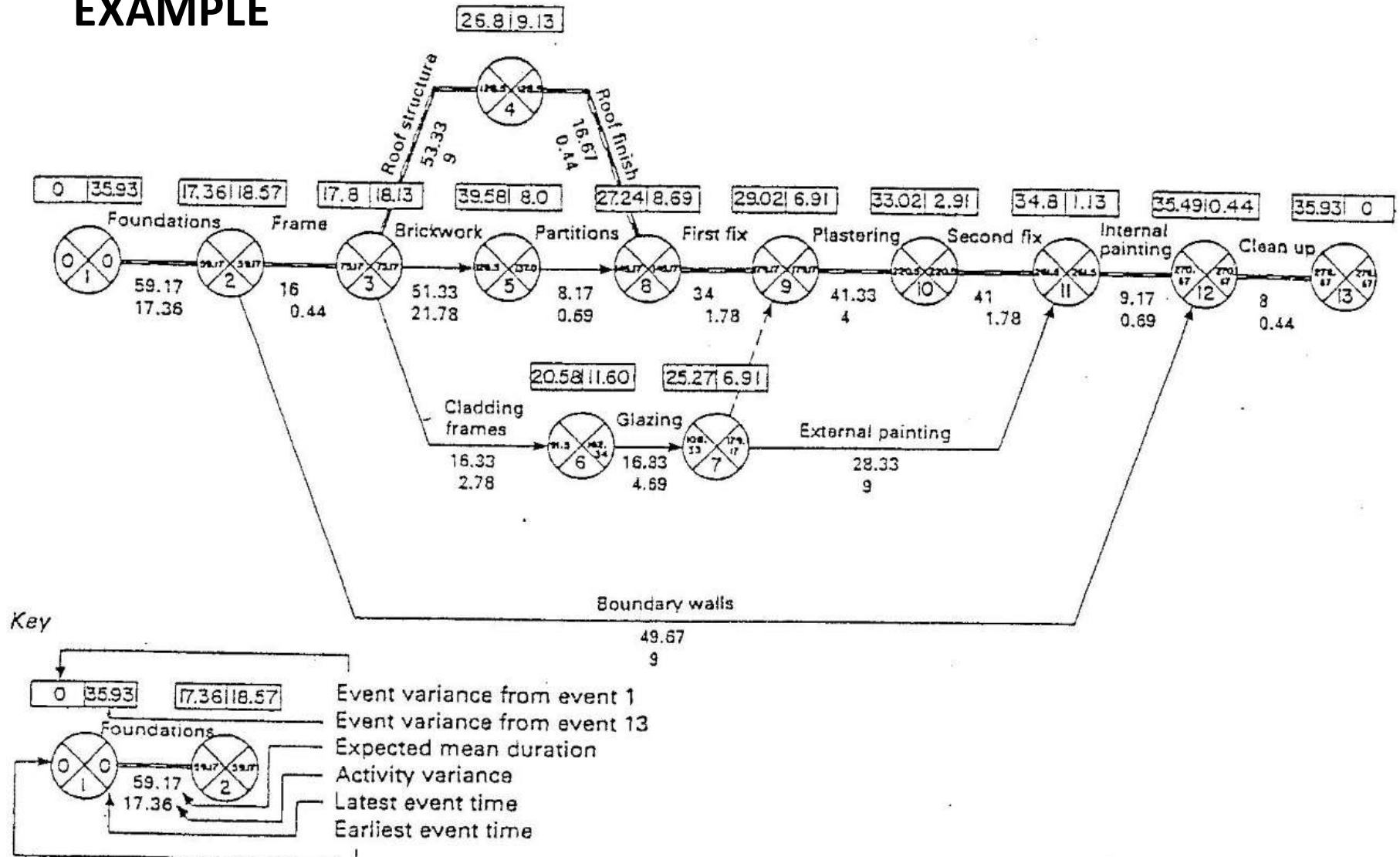
**PROGRAMME EVALUATION AND REVIEW TECHNIQUE (PERT)****EXAMPLE**

Activity	d_o	d_m	d_p	d_e	V_{de}	σ_{de}
Foundations	45	60	70	59.17	17.36	4.17
Frame	14	16	18	16.00	0.44	0.67
Roof structure	47	52	65	53.33	9.00	3.00
Roof finish	14	17	18	16.67	0.44	0.67
Brickwork	42	49	70	51.33	21.78	4.67
Partitions	69	8	11	8.17	0.69	0.83
First fix	30	34	38	34.00	1.78	1.33
Plastering	38	40	50	41.33	4.00	2.00
Second fix	37	41	45	41.00	1.78	1.33
Internal painting	7	9	12	9.17	0.69	0.83
Cladding frames	12	16	22	16.33	2.78	1.67
Glazing	12	16	25	16.83	4.69	2.17
External painting	22	27	40	28.33	9.00	3.00
Brickwork to boundary walls	42	49	60	49.67	9.00	3.00
Clear up	6	8	10	8.00	0.41	0.67



PROGRAMME EVALUATION AND REVIEW TECHNIQUE (PERT)

EXAMPLE





PROGRAMME EVALUATION AND REVIEW TECHNIQUE (PERT)

EXAMPLE

Project Duration: **278.67 days**

Variance of the last event: **35.93**



Standard deviation: **5.99**



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EXAMPLE

Probability of completing the project in 270 days?

$$z = \frac{270 - 278.67}{5.99} = -1.45$$

From Table 1, probability is 0.07 or 7%



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EXAMPLE

Project duration if it is required to be 90% certain?

$$\frac{x - 278.67}{5.99} = 1.3$$

(from table 1)

$$x = 286.46 \text{ days}$$