Indian Standard

GLOSSARY OF TERMS IN PROJECT NETWORK ANALYSIS

(First Revision)

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INDIAN STANDARDS INSTITUTION
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NEW DELHI 110002

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Indian Standard

GLOSSARY OF TERMS IN PROJECT NETWORK ANALYSIS

(First Revision)

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(*Continued on page* 2)

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Indian Standard

GLOSSARY OF TERMS IN PROJECT NETWORK ANALYSIS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 29 March 1985, after the draft finalized by the Management and Productivity Sectional Committee had been approved by the Executive Committee.

0.2 Network analysis is a process leading to the planning, scheduling and controlling of a project through a graphical representation of its various components. Its concepts and applications have expanded considerably during the recent years, thereby making it absolutely important to avoid ambiguities in the interpretation of the terms used.

0.3 This standard was originally published in 1974. This revision has been prepared to include many additional terms relating to planning, scheduling, monitoring, updating and controlling of projects. Some of the terms in earlier version have been redefined in the light of latest developments and experience.

0.4 This standard defines the terms commonly used in network analysis so as to facilitate communication and the spread of knowledge in its practice. Whenever a term defined in the standard has been utilized in the definition of another term, that term has been italicized. The definition of the italicized term can be obtained by reference to the index.

1. SCOPE

1.1 This standard gives definitions of terms relating to project network analysis. The symbols used for various terms as also the graphical explanation is given wherever it is felt necessary.

2. BASIC TERMS

2.1 Network Analysis* — A group of techniques for presenting information

*Encompasses PERT (Programme Evaluation Review Technique) aud CPM (Critical Path Method).

relating to time and resources so as to assist in the planning, scheduling and controlling of projects. The information usually represented by a *network* includes the sequences, interdependencies, inter-relationships and criticality of various activities of the project. There are two basic types of networks (a)* Conventional networks having activity on arrow (b) Activity on node network like *precedence networks.*

2.2 Project Control — The ability to determine project status as it relates to the selected time plan and schedule.

2.3 Project Management — It is all embracing term involving the application and adaptation of the functions of management in a defined project from its inception to its final completion.

2.4 Performing Organization (Executive Department) — The organization that will perform work on *work package.*

2.5 Forward Pass Rule — Earliest time of an *event,* is obtained by adding to the earliest time of each preceding event, duration of *activity* which connects it and selecting the highest of the values thus obtained.

2.6 Backward Pass Rule — Latest time of an *event,* is obtained by subtracting from the latest time of each succeeding event, duration of the *activity* which connects it and selecting the lowest of the values thus obtained.

3. GENERAL TERMS

3.1 Activity — A clearly definable portion of a project, which could be an operation, a process or situation consuming time and normally other resources. An activity lies between two *events* and is represented by an *arrow.*

FIG. 1

3.1.1 *Activity Description* — A condensed title of the nature of the work to be performed.

3.1.2 *Critical Activity* — An *activity* on the *critical path.* The delay in performance of the *activity* will affect project completion.

*Encompasses PERT (Programme Evaluation Review Technique) and CPM (Critical Path Method).

FIG. 2

3.1.3 *Dummy Activity (Dummy)* — An *activity* which represents only an interdependency and does not consume either resources or time.

NOTE — It is sometimes referred to as 'Zero time activity'.

FIG. 3

3.1.4 *Ladder Activity* — Two or more *activities* in a *network*, which though interdependent, are capable of being scheduled concurrently for most part of their duration by introducing the concept of *lead time* and *lag time*.

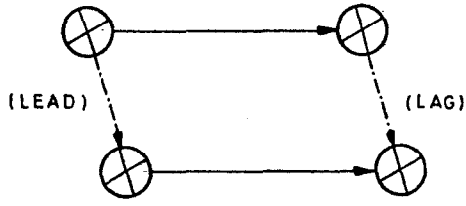

FIG. 4

3.2 Arrow—A graphic representation of an *activity* in the *network*. One arrow represents one *activity*. The arrow is not a vector quantity and is not drawn to scale. All arrows in the *network* shall be unidirectional. The tail end and head of arrow indicate respectively commencement and termination of the *activity*.

NOTE 1 — Time flows from the tail to the head of the arrow; the length and the direction of the arrow are of no significance either geographically or in terms of time.

NOTE 2 — The same unit of time should be used throughout the network.

3.3 Event — A point in time which marks the beginning or the end of one or more *activities*. Events do not consume time or resources.

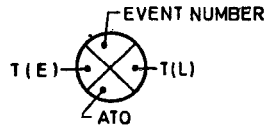

FIG. 5

NOTE—Top segment contains event number left segment the earliest event time T (E) right segment the latest event time T (L) and bottom segment actual time of occurence (ATO.) of the event.

3.3.1 *Preceding Event* — The *event* at the commencement of an *activity.*

3.3.2 *Succeeding Event* — The *event* at the termination of an *activity.*

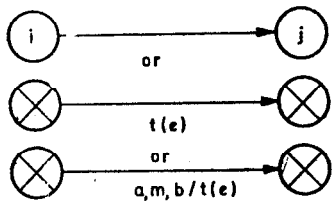

FIG. 6

NOTE 1 — Event i is the preceding event of activity i - j.

NOTE 2 — Event j is the succeeding event of activity i - j.

NOTE 3 — Suceeding events have a higher number than their preceding events.

3.3.3 *Start Event* — An *event* with succeeding but no *preceding activities.*

3.3.4 *End Event* — An *event* with preceding but no *succeeding activities.*

3.3.5 *Milestone Event* — An important or key *event* on a *network* which is of significance to the management.

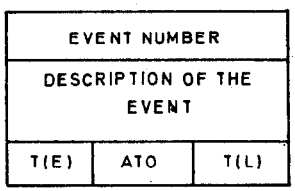

FIG. 7

3.3.6 *Interface Event* — An *event* which is common to two or more networks and occure concurrently in them.

NOTE — An interface may also denote an event which signals the necessary transfer of responsibility or information from one network to another.

FIG. 8

3.3.7 *Critical Event* — An *event* on the *critical path.*

3.4 Expected Activity Time (Activity Duration) — The time, which an *activity* is estimated to require for its completion. Denoted by $t\ (e)$ or t_e.

NOTE 1 — Time estimates are valid for a given set of resources.

NOTE 2 — In a single time estimate this would be the same as the most likely time: when three estimates are available (the optimistic, the most likely and the pessimistic times), this is derived from statistically weighted time estimate incorporating the three time estimates [assuming β (beta) distribution] as follows:

$$t\ (e) = \frac{a + 4m + b}{6}$$

3.5 Level Number — The number of the level on the *work breakdown structure* at which the *charge* or *number* appears.

3.6 Monitoring — Following up the progress of work and indicating and highlighting the deviation from schedule.

3.7 Network (Arrow Diagram) — A diagram depicting the *activities* and *events* which must be accomplished to complete the project, showing their planned sequence of accomplishment, interdependencies and inter-relationships.

3.7.1 (*Sub-network Fragnet*) — A *network* which is part of a larger network, depicting greater details wherever necessary.

3.7.2 *Master Network* — A *network* drawn on the basis of *work breakdown structure* (WBS) showing all the milestone and *interface events.*

3.7.3 *Squared Network* — A *network* generally a fragnet, wherein *critical events* and all *activities* are depicted on a time scale.

3.7.4 *Precedence Network Diagram* — An activity-on-node network in which sequence *arrow* represents one of three forms of precedence relationship depending on the positioning of the head and the tail of the sequence *arrow* (*see* Appendix A).

3.7.5 *Summary Network* — A *network* in which the amount of detail presented is condensed to a predetermined level.

3.8 Path — A continuous sequence of activities.

3.8.1 *Critical Path* — A *path* from the *start event* to the *end event* the total duration of which is not less than that of any *other path* between the same *two events.*

3.8.2 *Sub-critical Path* — A *path* with a float next after the *critical path.* There can be more than one sub-critical path in a network.

3.9 Planning (Implementation Planning) — Planning is devising a workable scheme of operations designed to achieve an established objective, when put in action.

3.10 Project— A project is generally a non-recurring task having a definable beginning and end, with a definite mission and has a set of objectives and achievements.

3.10.1 *Work Breakdown Structure* — A framework derived from the primary objectives of the project, which highlights the identifiable components requiring fulfilment to achieve project completion.

3.10.2 *Work Package* — A group of network activities in a project, not necessarily inter-connected which can be collectively identified for ease of planning and control of resources. The *work package* forms the basic unit for allotment of *charge numbers.*

NOTE — The activities included in the package generally fall under a single area of functional responsibility.

3.10.3 *Charge Number* — It is a code number used for identifying individual *work packages* to facilitate their costing.

3.10.4 *Estimate to Completion* — The estimated costs and time required to complete a *work package.*

3.10.5 *Event Number* — A number allotted to an event for identification purposes.

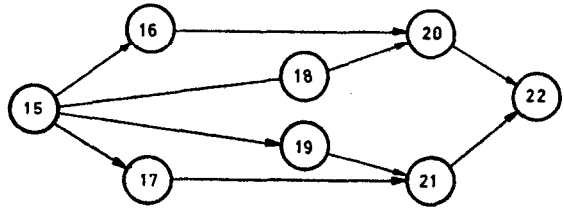

FIG. 9

NOTE — All succeding events of a given preceding event should be numbered serially from top to bottom.

3.10.6 *Crashing* (*Activity Compression*) — The process of advancing the completion date of the project to suit a revsied and reduced project duration by reducing the duration of one or more *activities* on the *critical path.*

3.11 Scheduling—Preparation of time bound programme for performance of *activities* according to agreed plan.

3.11.1 *Standard Schedules* — Standard Schedules are the guidelines to prepare realistic Project Schedules by establishing (a) the total *activities* carried out by different disciplines, taking into consideration the division of work among various disciplines (b) the inter-faces, inter-dependencies and sequences of various *activities* by giving the initial information required and source of information for starting each *activity.*

3.11.2 *Engineering Schedules* — Engineering schedule consists of specifications, drawings, approvals, etc, of individual engineering discipline such as architecture, civil, mechanical, electrical, instrumentation, and pressure vessels.

NOTE — This used to monitor the activities of engineering department.

3.11.3 *Procurement Schedule* — Procurement schedule is broken up into three different schedules, namely:

a) Ordering schedule,

b) Manufacturing fabrication and delivery schedule, and

c) Custom and transportation schedule.

***3.11.3.1** *Ordering schedule* — A time table for various *activities* and milestones involved from the receipt of Material Requisition (M/R) (from

*Special attention should be paid to these terms if these detail terms are helpful and need be included in the standard.

engineering disciplines) up to the placement of order. The ordering schedule indicated M/R wise *activities* and shows the achievements of milestones both for indigenous and foreign procurement.

NOTE — It is used to monitor the activities of the procurement department.

*3.11.3.2 *Manufacturing/fabrication and delivery schedule* — Time table indicating various milestones from ordering to delivery stage. This schedule for a department will be systemwise rather than M/R wise and it highlights the milestones between ordering and delivery to site-vendor's shop such as receipt of vendor prints, approval of vendor prints, and delivery of free issue material to vendors. Placement of sub-order by vendors, fabrication started, etc.

NOTE — This schedule is used to monitor the activities of inspection and expediting department and to keep a check on the progress of vendor manufactured items.

*3.11.3.3 *Custom and transportation schedule* — A time table giving the various *activities* of custom and transportation department. This will include conducting route surveys for over dimensional consignment (ODC), negotiations with various state and central authorities, railways; lining up of contractors for ODC handling of equipment at points, registration with customs, etc.

3.11.4 *Tender Schedule* — A time table showing various milestones for tendering *activities* up to award of contract and will indicate the start and completion of construction activities for each tender.

NOTE 1 — The tenders will be listed in the order in which the construction progress takes place at site.

NOTE 2 — This schedule is used to monitor the activities of tender cell.

3.11.5 *Resource Schedule* — Resource schedule indicates the allocation of resources such as manpower, material, time, cost, equipment, space and fund (separate schedule for each resource) based on *network analysis.*

3.11.6 *Contract Schedule* —A timetable for various *activities* and milestone involved up to the award of contract for various standards, such as civil, mechanical, electrical, instrumentation, insulation and painting.

NOTE — The knowledge of such schedule is helpful in awarding the contract at the right time.

*Special attention should be paid to these terms if these detail items are helpful and need be included in the standard.

3.12 Slack — The difference between the *latest event time* and the *earliest event time* for a particular *event.*

NOTE — The term slack pertains to events only and may be negative.

3.13 Time

3.13.1 *Optimistic Time* (*a*) — The estimated time in which the *activity* can be completed if everything goes exceptionally well.

3.13.2 *Pessimistic Time* (*b*) — The estimated time in which an *activity* can be completed under very adverse circumstances.

3.13.3 *Most Likely Time* (*m*) — The most probable time estimate for the completion of an *activity.*

3.13.4 *Earliest Event Time* — The earliest possible time at which an *event* may occur. Denoted by T (E) or T_E.

3.13.5 *Latest Event Time* — The latest possible time at which an *event* shall occur so that the targeted project duration is not exceeded. Denoted by T (L) or T_L.

3.13.6 *Earliest Start Time* — The earliest possible time at which an *activity* may start and is given by the *earliest event time* of the preceding *event.*

3.13.7 *Earliest Finish Time* — The earliest possible time at which an *activity* may finish and is given by adding its duration to its *earliest start time.*

3.13.8 *Latest Finish Time* — The latest possible time at which an *activity* should finish so that the targeted project duration is not exceeded. This is given by the *latest event time* of the succeeding *event.*

3.13.9 *Latest Start Time* — The latest possible time at which an *activity* should start so that the targeted project duration is not exceeded. This is given by subtracting its duration from the *latest finish time.*

3.13.10 *Lead Time* — Applies to *ladder activities*; it is the interval of time between the start of the preceding *ladder activity* in a set of *ladder activities* and the start of the subsequent *ladder activity.*

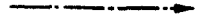

FIG. 10

NOTE — The symbol is same as shown in **3.13.11.**

3.13.11 *Lag Time* — Applies to *ladder activities*; it is the interval of time between the finish of the preceding *ladder activity* in a set of *ladder activities* and finish of the succeeding *ladder activity*.

3.13.12 *Zero Date* — It is the effective date from which the project duration is reckoned

3.13.13 *Scheduled Completion Date* — A date assigned for completion of an *activity* or accomplishment of an event for purposes of meeting specified schedule requirements.

3.13.14 *Scheduled Event Time* — A point of time at which an event is scheduled to occur.

3.13.15 *Milestone Report* — An output report at a specified level showing the latest allowable date, expected date, scheduled completion date and slack for the successor *event*.

3.13.16 *Activity Crash Time* — The revised and reduced *activity* time.

3.14 Up-dating — The process of periodic reviewing, reallocating the resources where necessary, and redrafting the network, when the project is in actual progress.

3.15 Total Float (Float) — The time available for an *activity* in addition to its duration. This is given by the difference between the maximum time available for an *activity* (*latest event time* of the succeeding event minus the *earliest event time* of the preceding event) and its duration time.

$$\text{Total float} = \left\{ \begin{matrix} T(L) \\ \text{Succeeding} \\ \text{event} \end{matrix} \quad - \quad \begin{matrix} T(E) \\ \text{Preceding} \\ \text{event} \end{matrix} \right\} - t(e)$$

NOTE — The term float pertains to activities only.

3.15.1 *Negative Float* — The time by which an *activity duration* should be reduced for the project to be completed by the targeted date.

3.15.2 *Free Float* — That part of the *total float* which will not reduce the float of any succeeding *activity*. This is given by the difference of *earliest event* time of the succeeding event and *earliest finish time* of an *activity*.

$$\text{Free float} = \left\{ \begin{matrix} T(E) \\ \text{Succeeding} \\ \text{event} \end{matrix} \quad - \quad \begin{matrix} T(E) \\ \text{Preceding} \\ \text{event} \end{matrix} \right\} - t(e)$$

3.15.3 *Independent Float* — This is the surplus time available to an *activity* which cannot be shared by either preceding or succeeding *activities* and is available exclusively to itself.

$$\text{Independent float} = \left\{ \begin{matrix} T(E) \\ \text{Succeeding} \\ \text{event} \end{matrix} \right. - \left. \begin{matrix} T(L) \\ \text{Preceding} \\ \text{event} \end{matrix} \right\} - t(e)$$

NOTE — If negative, the independent float has no significance.

3.15.4 *Interference Float* — The difference between *total float* and *free float*. This indicates the potential interference which an *activity* can cause to down stream *activities*.

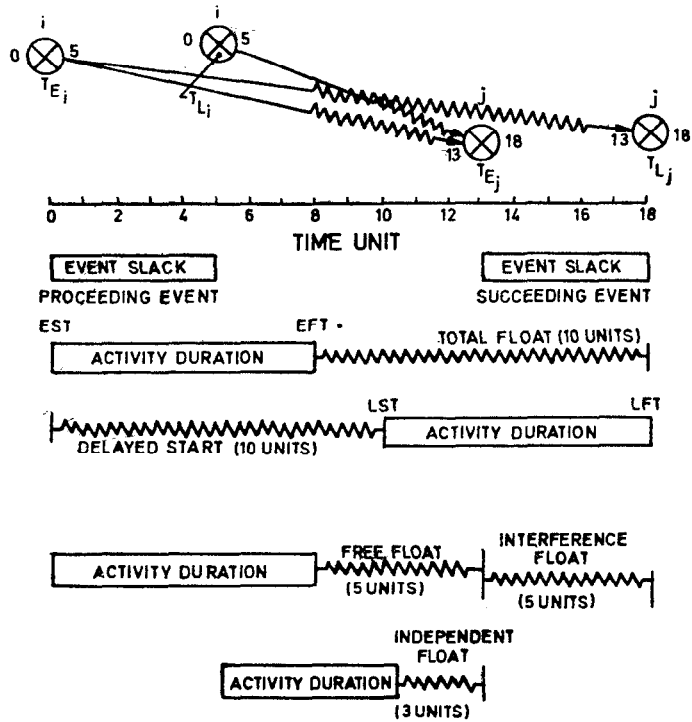

FIG. 11

4. TERMS USED IN CONNECTION WITH RESOURCE REQUIREMENTS

4.1 Multi-Project Scheduling — The use of the techniques of *resource allocation* to schedule more than one project by considering all projects together and scheduling by *activity* priority within the constraints of available resources.

4.2 Resource Aggregation (Resource Totalling) — The totalling of resource required for concurrent *activities* having a commonality of such resources during a discrete portion of a project.

4.3 Resource Allocation — The general technique of scheduling *activities* and the resources required by those activities so that predetermined constraints of resource availability and/or project time are not exceeded.

4.4 Resource Leveling — The scheduling of activity start times within the resource levels are kept at the minimum possible.

4.5 Resource Limited Scheduling — The scheduling of *activities* so that predetermined resource levels are not exceeded, and extension to the project duration is minimized.

4.6 Resource Smoothing — The scheduling of *activity* start times within the limits of their *total floats* such that the targeted project duration is maintained and fluctuations in resource requirements are minimized.

4.7 Schedule — A list of *activity* start and finish times based on the allocation of resources.

5. TERMS USED IN CONNECTION WITH COSTS

5.1 Crash Cost — The increased cost of crashing an activity/project.

5.2 Cost Optimization — Utilizes *normal cost* and *crash cost* estimates for each *activity* to make time-cost trade-off computations; provides list of alternative project durations and associated costs.

5.3 Cost Slope — The additional cost to be incurred in reducing an *activity* time per unit time.

5.4 Normal Cost — The cost of activity/project when it is performed under normal set of conditions.

5.5 Over (Under) Plan — The estimated cost to date minus the latest revised estimate of cost to date. When estimated cost exceeds latest revised estimate, a projected underplan conditions exists. When latest revised estimate exceeds estimated cost, a projected overplan conditions exist.

5.6 Over Run (Under Run) — The estimated cost for the work performed to date minus the actual cost for that some work. When estimated cost exceeds actual cost, an under run condition exists. When actual cost exceeds estimated cost, an over run condition exists.

NOTE—Similar terms may be used in respect of time over/under run.

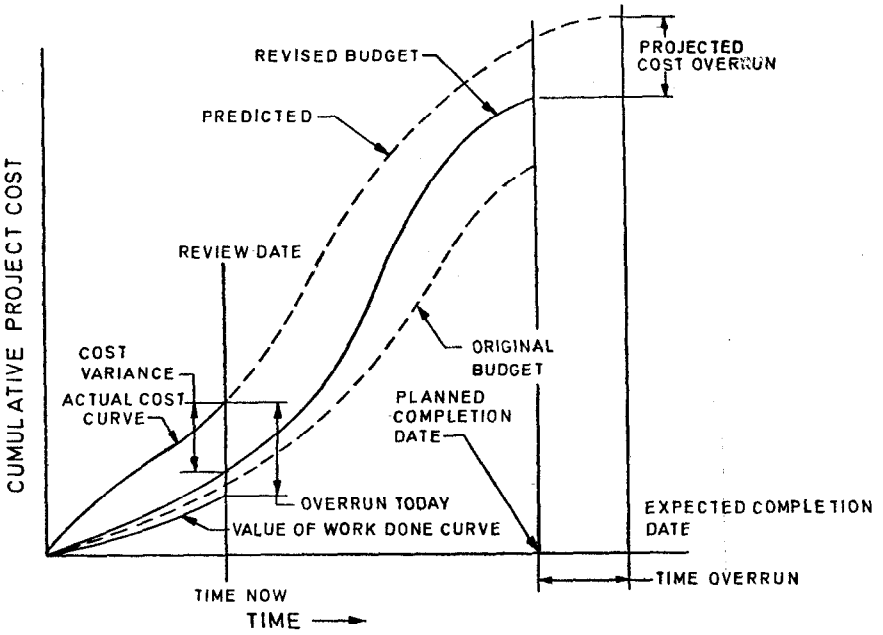

FIG. 12

APPENDIX A

(*Clause* 3. 7. 4.)

NOTES ON PRECEDENCE NETWORK OR PRECEDENCE DIAGRAM

1) Modifications and corrections of activity on networks (precedence network) is easier than it is for activity on arrow networks.

2) Each activity can be assigned a single unique number which can be used to classify the work by cost code, location and the tmie.

3) A line that connects two activity nodes can have a time duration. This feature tends to reduce the number of activities that must be included in a network.

4) It is easily adaptable to computer because it contains more information about each activity.

PRECEDENCE ACTIVITY/PRECEDENCE DIAGRAM

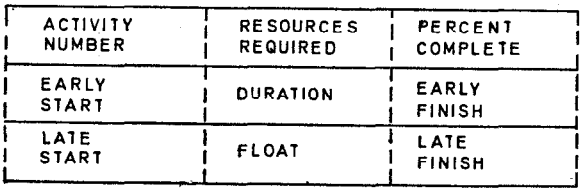

FIG. 13

INDEX

NOTE—The index has been prepared in accordance with IS: 1275-1976*. Index numbers are clause numbers.

*Rules for making alphabetical indexes.

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E

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