

# Construction Management (6 marks)

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# Course Outline

6. **Construction Management** (6 marks)
- 6.1 Construction scheduling and planning: network techniques (CPM, PERT) and bar charts
  - 6.2 Contractual procedure and management: types of contract, bid and bid notice, preparation of bidding document, contractors pre-qualification, evaluation of tenders and selection of contractor, contract acceptance, condition of contract, quotation and direct purchase, classifications of contractors, dispute resolution, muster roll
  - 6.3 Material management: procurement procedures and materials handling
  - 6.4 Cost, quality and time control
  - 6.5 Project management
  - 6.6 Occupational health and safety
  - 6.7 Project monitoring and evaluation
  - 6.8 Quality assurance plan
  - 6.9 Variation, alteration and omissions

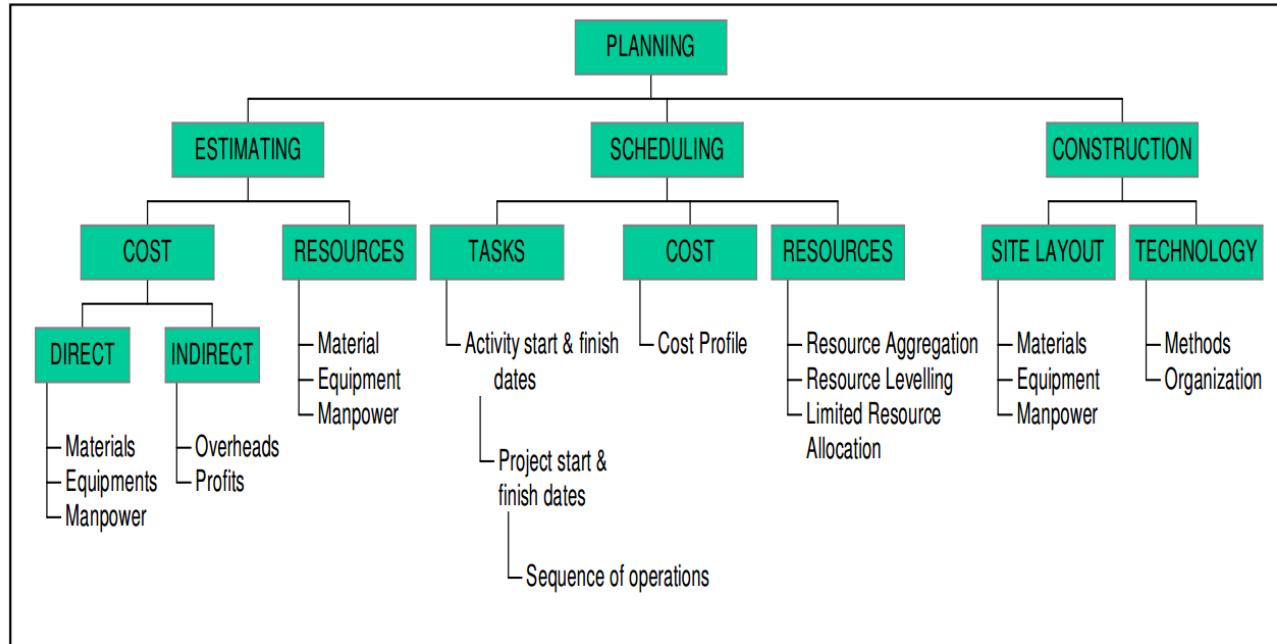
# Construction Scheduling and Planning

- Construction Management deals with the management in which group of people of different categories work together, to execute the project economically without affecting the quality in a well planned and organized manner.
- **IMPORTANCE**
  - To check up the wastage of material and Labour
  - To complete the work in the shortest possible time
  - To have less construction cost
  - To reduce the risk of accident.
  - To improve the quality of work by using modern construction equipments.
  - Effective Utilizations of resources ie. (3M / 5M)
- 3M ?
  - Materials, Machine, Manpower

# Definitions

## Concept of Planning and its Importance

- Planning:
  - “what” is going to be done, “how”, “where”, by “whom”, and “when”
  - for effective monitoring and control of complex projects
- Planning is the thinking before doing, looking ahead, anticipating future and deciding the course of action to be taken.
- Project Planning involves defining clear, discrete “Activities” or “Tasks” and the work needed to complete each Activity.
- Managers who do not plan cannot control because they have no yardstick to judge the progress.
- **“Failing to plan is planning to fail”**



## Definitions

# Construction Scheduling and Planning'

- Construction project is related with the construction of infrastructure within the budget, time and quality.
- Construction Planning may be defined as a rational, sequential and appropriate way of directing the construction activities.
- The Construction Planning may be classified as follows
- **1. Job Planning** – Deciding the nature of job, duration of job and resources
- **2. Technical Planning** – Preparation of detailed Drawing, specifications, detailed estimate, planning resources ( Done by engineer)
- **Pre Tender Planning** – Finalization and Acquisition of site, Planning of resources and time
- **Construction Stage Planning** – Arranging Repair and Maintenance, Maintain daily work Dairy, Muster Roll, Arranging transport for Labour from and to the site and back.
- Post Construction Stage Planning

# General Principles of Planning

- The plan should be readily understandable.
- The plan should be realistic not an optimistic.
- The plan should be flexible.
- The plan should be comprehensive.
- The plan should incorporate the system of monitoring and controlling.

### 3.1 Concept of Project Planning and its Importance

#### **Objective of Planning:**

- ❖ Procurement of material well in advance
- ❖ Employment of trained and experienced staff on the project
- ❖ Proper selection of Equipment and Machinery
- ❖ To arrange proper safety Measures such as proper ventilation, light, water
- ❖ Economy and Efficiency in operation
- ❖ Reduces risk and uncertainty
- ❖ Provide the basis for control
- ❖ Facilitates decision makings

# GOALS OF Project

- **S:** Specific, clearly defined, not vague.
- **M:** Measurable, so that the project achievement can be measured, compared and controlled.
- **A:** Agree, by all the members of the team. Agreed goals raise the sense and commitment.
- **R:** Realistic considering the given possible resources, experience, knowledge and time available.
- **T:** Time bound, if there is no time to complete the process it will never be completed.

## Concept of Scheduling

- Scheduling:
  - “what” will be done, and “who” will be working
    - relative timing of tasks & time frames
    - a concise description of the plan ( Number of operations, activities, Output of Labour, Number of field Workers)
- A schedule is a graphical representation which shows the starting and completion dates of each activity and the sequential relationship among the various activities.

### 3.1 Planning and Scheduling

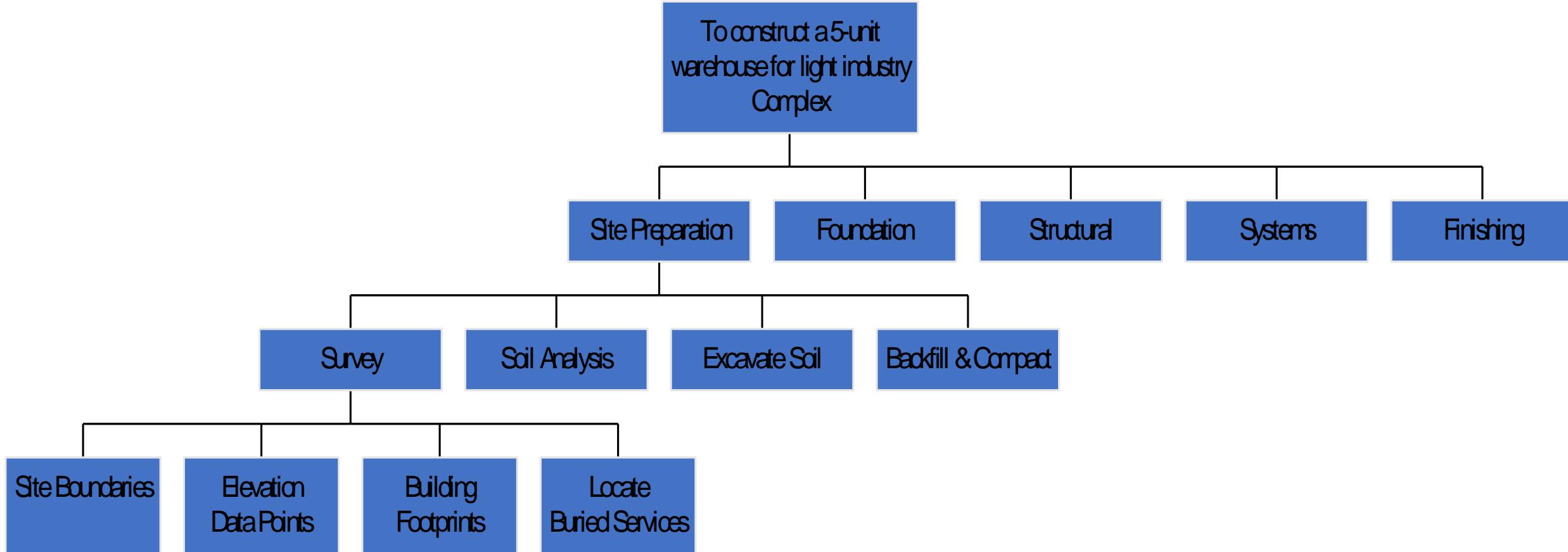
- Why Schedule?
  - To predict the project completion time and activity completion time
  - To control financing and payment
  - To serve as a record.
  - To support delay claim.
  - To manage change and uncertainties.

# The Work Break Down Structure (WBS)

- An organizational tool for complex projects
  - A first step in creating a schedule
  - Useful for defining the Scope of Work
    - After decided how to do the work
- Consists of:
  - Goal statement for project
  - Subdividing goal into smaller & smaller portions

## 3.2 The Work Break Down Structure (WBS)

Warehouse WBS



# Classifications of Construction Works

- A. Minor Works Project /Major Work Project
- B. Capital Intensive / Labor Intensive project

## **Light Construction –**

commercial building, village and city road, small water supply and sewage works, ware houses

## **Heavy Construction – Heavy Structural Members on Massive Foundations**

Tunnel, Bridge, oil pipe line, Airport, Dams,

## **Industrial Construction**

Fertilizers Chemical Plants , Refineries, Steel Mills , Power Grid

## 3.2 Representing & Scheduling Project Plans

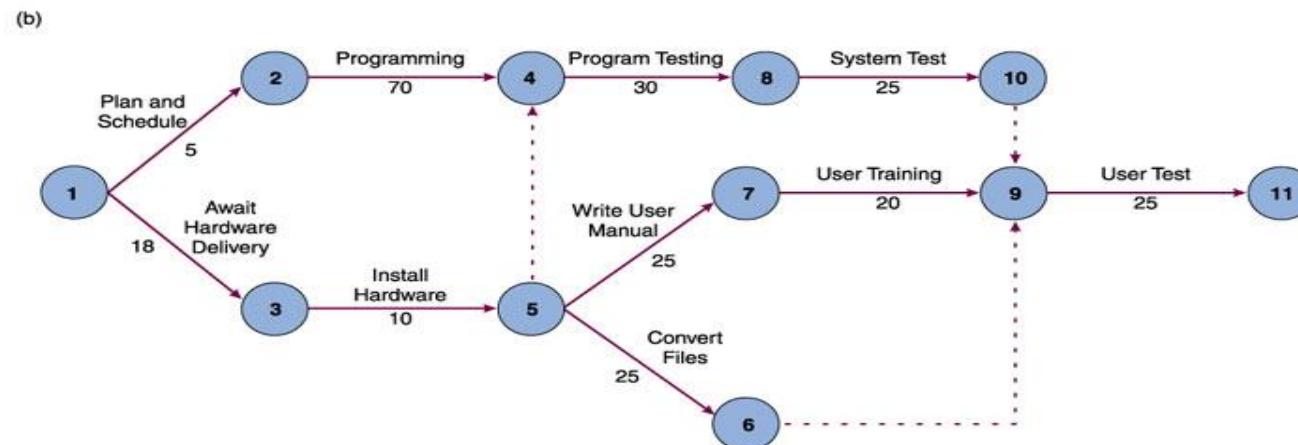
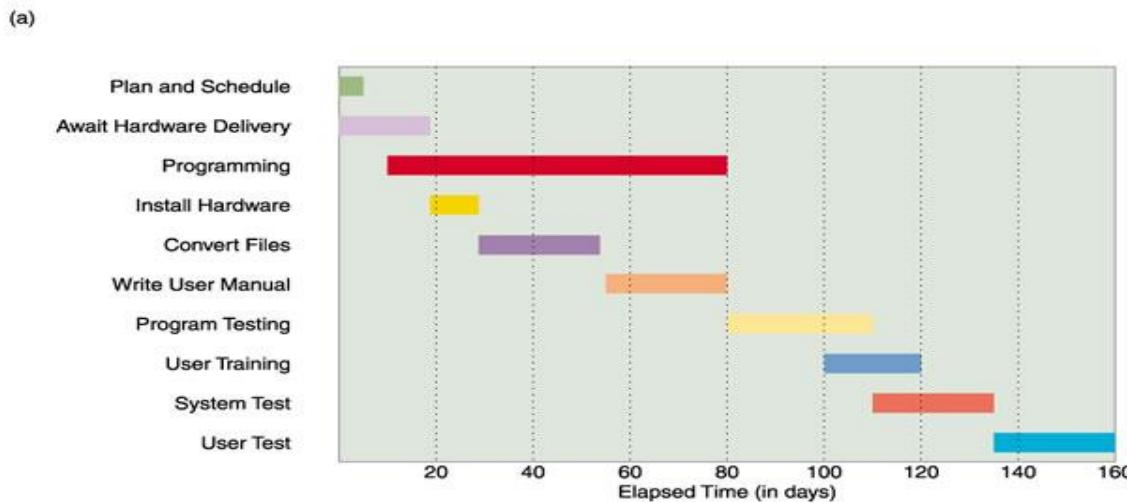
The Most commonly used methods are :-

- Bar Chart /**GANTT CHART**
  - Milestone chart
  - Linked Bar chart
- **NETWORK DIAGRAMS (PERT/ CPM)**
- Critical Path Method (CPM)
  - Project Evaluation and Review Technique (PERT)

## 3.2 GANTT CHART

- Developed by Henry Gantt around 1900 AD. ( Earliest Method)
- Activity VS Time
- A graphical representation of a Project that shows each task as a horizontal bar whose length is proportional to its time for completion.
- A GANTT Chart is a horizontal bar chart that illustrates a Project schedule.
- In the GANTT Chart Time is displayed on the horizontal axis and the Tasks/ Activities are arranged vertically from top to bottom, in order of their start dates.
- Bar is divided longitudinally into two portions. TOP PORTION INDICATES PROGRESS WHILE BOTTOM PORTION INDICATES DURATION of activity.
- A detailed GANTT Chart for a large project might be quite complex and hard to understand. To simplify the chart Project manager can combine related activities into one Task

## 3.2 Gantt Chart/Bar Chart



**FIGURE TK 3-10** A Gantt chart and a PERT/CPM chart for the implementation phase of the same project shown in Figure TK 3-5 on page TK 3.7.

# Advantage and Disadvantage of Bar Chart

## Advantage:

1. Simple to understand
2. Easy to prepare
3. It can be used to show progress
4. It can be used for resource planning such as manpower, materials and budget
5. It gives clear pictorial model of project

## Dis-advantage

1. Physical limit in size of bar chart
2. Cannot be used as control device for large projects
3. The sequence of activities is not clearly defined
4. Uncertainties in activities can not be clearly forecasted
5. Critical activities and float can not be shown

# Mile stone chart (1940)

❑ Mile stone chart is a modification over bar chart/Gantt chart where important events are identified. Beginning and end of such-activities are called mile-stones. It is usually represented by using triangle



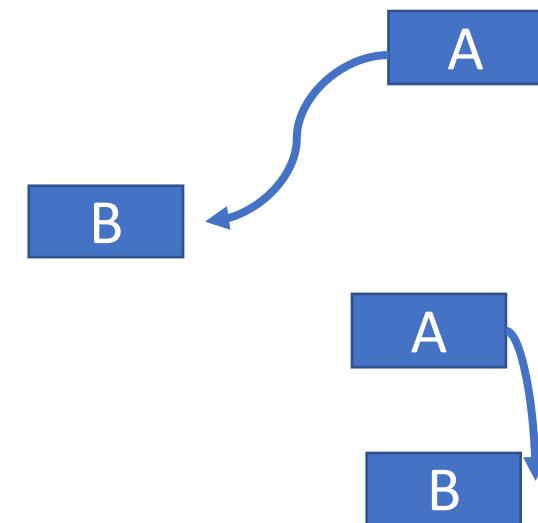
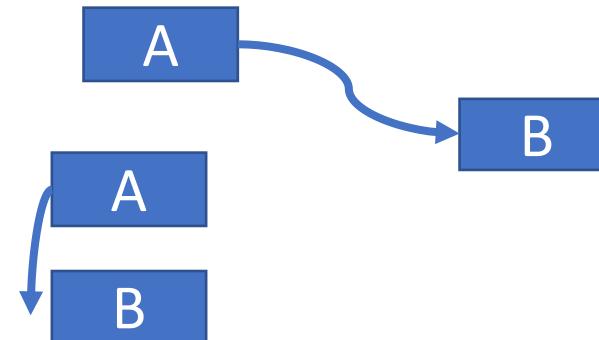
- ❑ It can also be represented by circle, squares
- ❑ In mile stone chart events are placed in chronological order/ rather than logical order
- ❑ It can mark specific points in the project where checks can be made to see whether the project is on time or not (e.g. In building milestone points can be laying foundation stone, concreting in foundation etc.)

# Linked bar chart

- ❑ One of the main drawback of simple Gantt/Bar chart is that it does not show the inter-relation ship between activities
- ❑ Linked bar chart are used to show the relationship between activities

## Types

- a) Finish to start
- b) Start to start
- c) Start to finish
- d) Finish to finish



# MCQS

1. A Milestone chart

- A) Shows the interdependencies of various jobs
- B) depicts the delay of jobs, if any
- C) Points outgoing ahead of schedule of jobs, if any.
- D) **None of these**

2. Henry Gantt Developed Bar Charts for Planning and Scheduling of projects in

- a) 1880      b)**1900**      c) 1920      d)1940

# MCQS

3. Bar chart is drawn for

- **A) Time versus Activity**
- C) Resources Vs Progress
- B) Activity Vs Resources
- D) Progress Vs Time

4. The types of constructions in which more Equipment are used is

- a) Machine Intensive      **b)Capital Intensive**
- c) Labor Intensive      d) All of above

# MCQS

5. A Construction schedule is prepared after collecting

- A) Number of operations B) output of Labour
- C) Output of Machinery D) Quantity of Various Items
- **E) All of above**

6. A Project is

- A) A large Dam constructed across a river to earn profit
- B) any job involving many people and Large money
- C)A work of major importance involving huge man and Material
- **D) An organized Team work to achieve a Set of task within the timeframe.**

# MCQS

7. Gantt chart indicates

- A) balance of work to be done
- B) efficiency progress
- **C) Comparison of Actual Progress with the Scheduled Progress (of activity)**
- D) Progressive Cost of Project

Can be also ask as **Jobs going ahead of Schedule are Conveniently Shown in ? GANTT**

8. Bar Charts Are Suitable for

- A) Major Projects
- **B) Minor Projects**
- C) Large Projects
- D) All of the above

# MCQS

9. The Upper Portion of Horizontal Bars in a bar chart indicates

- A) Total Duration for Completion of an Activity
- **B) Progress of Work in the Specified Time**
- C) Due Duration for the Completion of an Activity
- D) All of the Above

10. The interrelationship between the functional elements of a programme is achieved through

- A) Bar Chart
- B) Mile Stone Chart
- **C) Work Break Down Structure**
- D) All of the above

# Line of Balance (LOB)

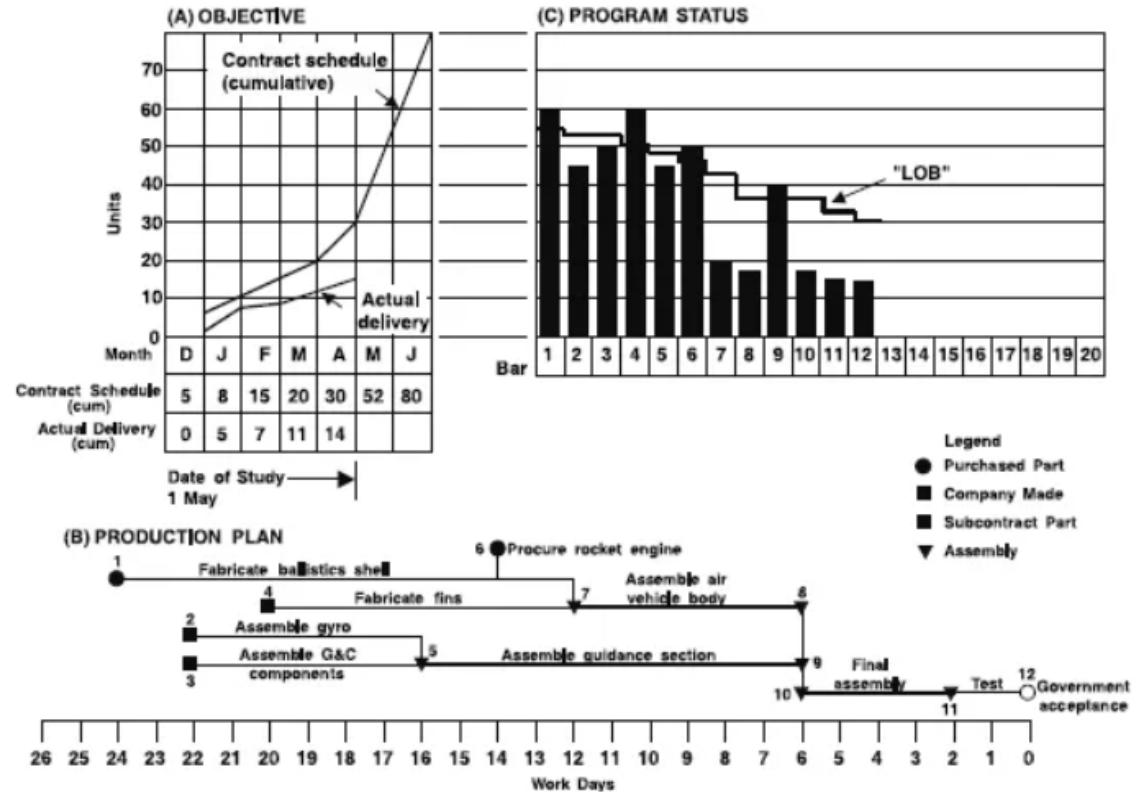
- Line of Balance (LOB) is a management control process for collecting, measuring and presenting facts relating to time cost and accomplishment – all measured against a specific plan.
- It shows the process, status, background, timing and phasing of the project activities, thus providing management with measuring tools that help:
  - 1.Comparing actual progress with a formal objective plan.
  - 2.Examining only the deviations from established plans, and gauging their degree of severity with respect to the remainder of the project.
  - 3.Receiving timely information concerning trouble areas and indicating areas where appropriate corrective action is required.
  - 4.Forecasting future performance.

# LOB

11. Line of Balance Technique is used for
- A) Planning of Project
  - B) Planning of an activity
  - C) Planning of an event
  - D) Comparison of Actual Progress with the Scheduled Progress

Introduced by Good Year Tire and Rubber Company in 1941

LOB shows the process, status, Background, timing of the project activities



Example: Line of Balance Figure 7.1 [1]

# NETWORK DIAGRAM

- Is a graphical depiction of Project tasks and their inter-relationships.
- The distinguishing feature of a Network Diagram is that the ordering of Tasks is shown by connecting with its predecessor and successor tasks
- Network Diagramming is a Critical Path Scheduling Technique used for controlling resources.
  
- **CRITICAL PATH SCHEDULING**  
A scheduling technique whose order and duration of a sequence of task activities directly affect the Completion Date of a Project

# NETWORK DIAGRAM

**You would use a Network Diagram when Project Tasks:-**

- Are well defined and have clear beginning and end point
- Can be worked on independently of other tasks
- Are ordered
- Serve the purpose of project

## **Fulkerson's Rule**

**For any activity, the number on the Tail Event should not be greater than that on the Head Event.**

**In other words, the number on Head Event must always be greater than that on Tail Event.**

# Critical Path Method

**Developed by Margon R. Walker of DU Pont & James E Kelly of Rand Corporation in 1957**

An analytical tool that provides a schedule that completes the project in minimum time subject to the precedence constraints. In addition, CPM provides:

- Starting and ending times for each activity
- Identification of the **critical activities** (i.e., the ones whose delay necessarily delay the project).
- Identification of the non-critical activities, and the amount of slack time available when scheduling these activities.
- Expected project duration in CPM Follows – Normal Distribution.

# Definitions

- **Network** – a graphical representation of a project depicting the precedence relationships among the activities and events.
- **Activity** – an effort (task) that requires resources and takes a certain amount of time.
  - Concurrent Activities
  - Serial Activities
- **Activity Duration**
- **Event (Node/ Connector)** – a specific accomplishment or milestone (the start or finish of an activity). It represents specific point in time and does not consume resources.
- **Critical Activity** – an activity that if delayed will hold up the scheduled completion of a project.
- **Critical Path** – the sequence of critical activities that forms a continuous path from the start of a project to its completion.
- **Dummy Activity** – It is an imaginary activity included in a network. It is represented by dotted arrow.
- **What resources is needed for Dummy Activity ?**

# Critical Path Method (CPM)

## **Activity-on-Arrow (AOA)**

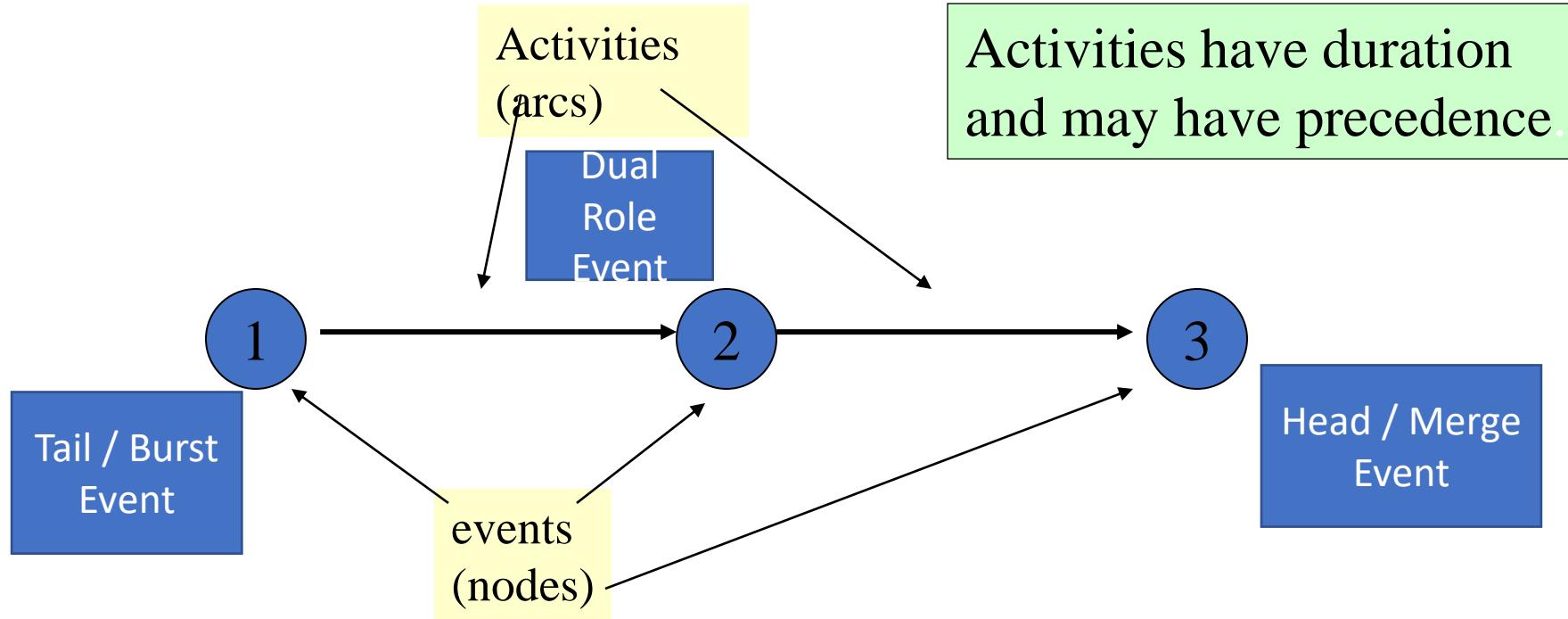
- activities are represented by the straight arrows with circles at the both ends.
  - The direction of arrow indicates the direction of flow of the project.
  - Length of arrow does not represents the duration of the activity.
- 
- **Activity on Node (AON)**
    - activities are nodes connected together by lines

# Network Representation

Projects may be represented as networks with:

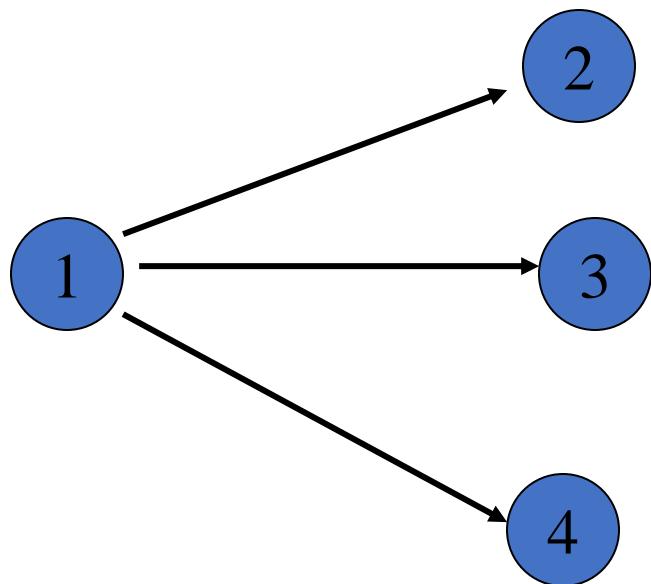
- Arrows representing activities.
- Nodes representing completion of a set of activities (milestones).
- Dummy (Pseudo) activities may be required to satisfy precedence relationships.

# Network Development



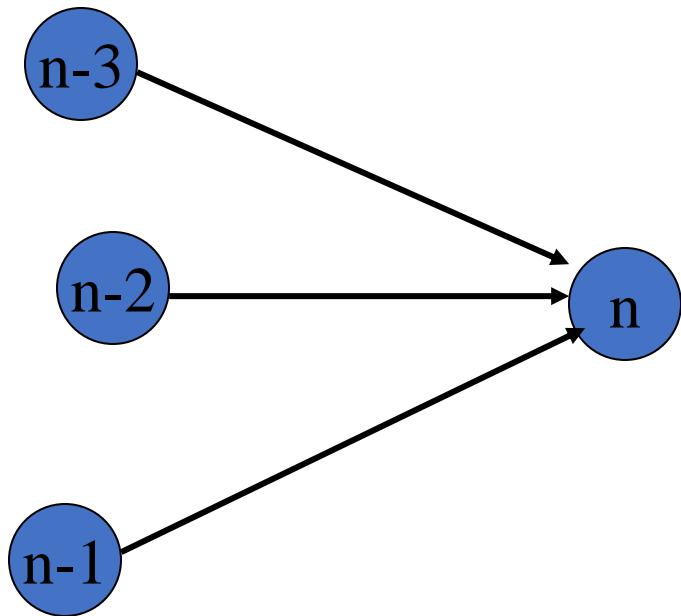
Define activities in terms of  
their beginning and ending events.  
e.g. Activity 1-2 must precede Activity 2-3

# Network Development (continued)



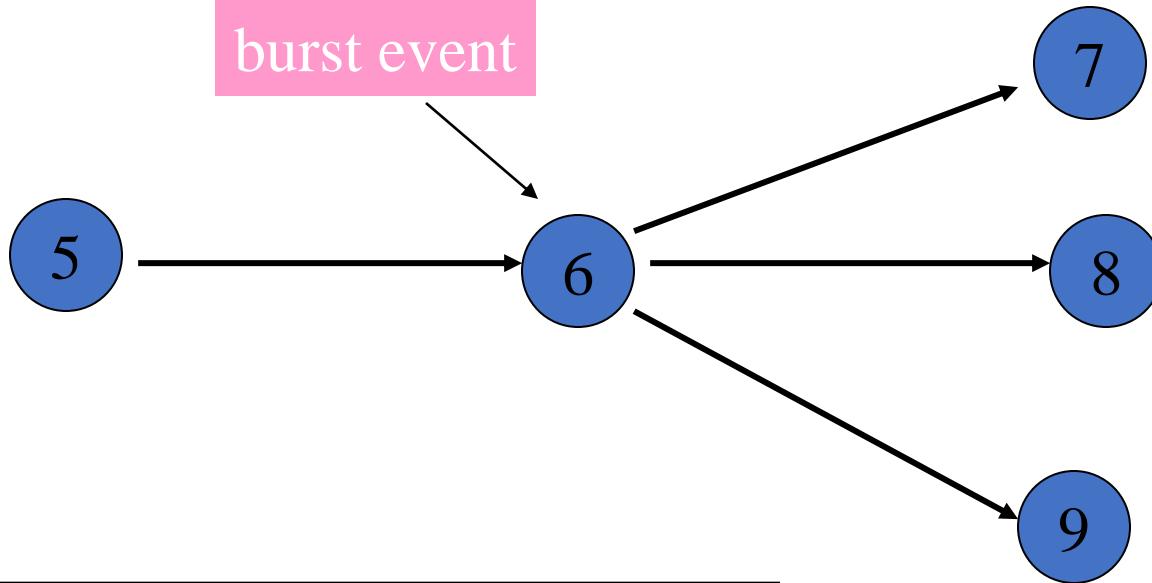
Event 1 is start of project  
Activities 1-2, 1-3, and  
1-4 have no predecessors  
and **may** start simultaneously

# Network Development (continued)



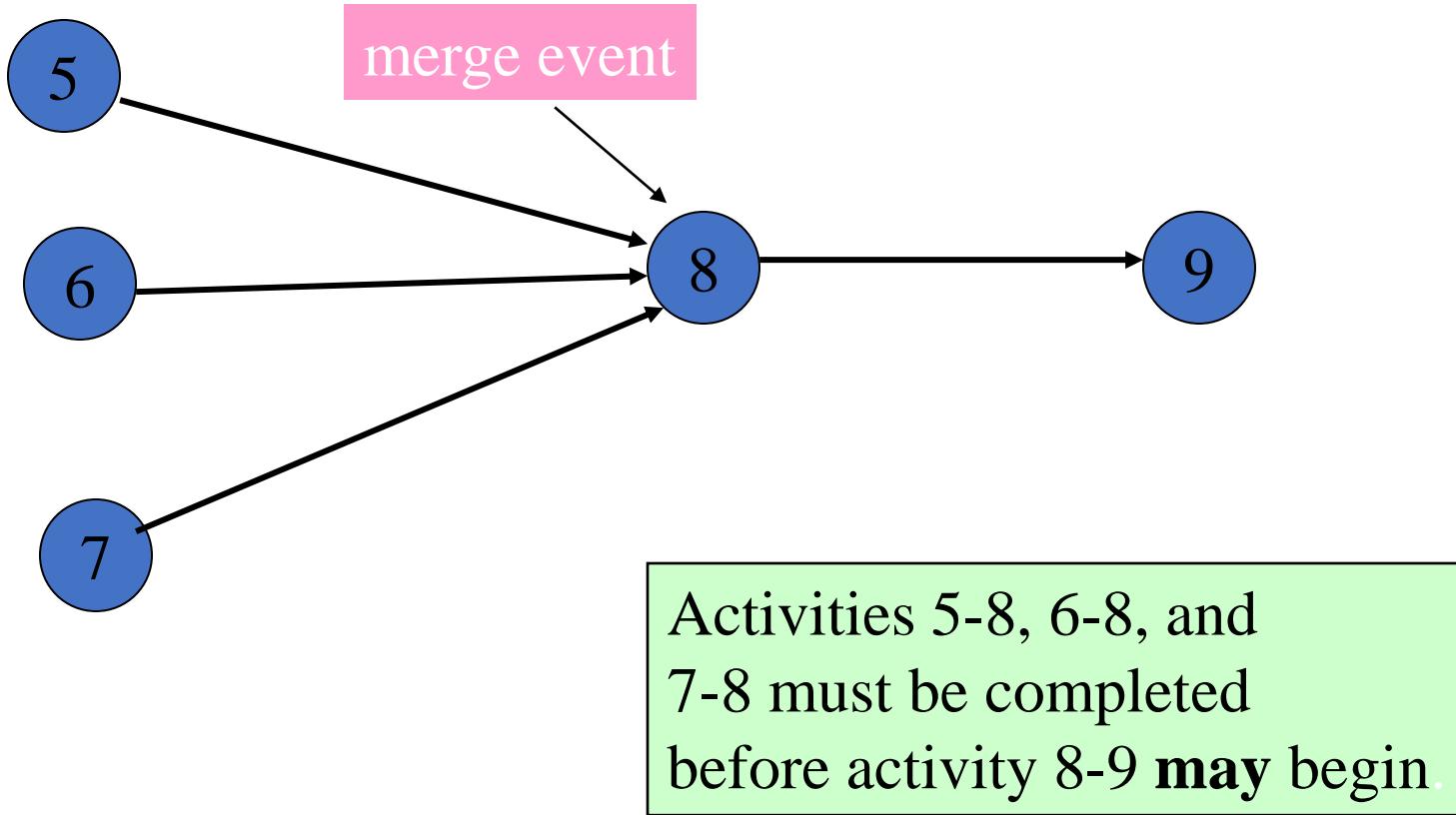
Event n is the end of the project. Activities  $(n-3) - n$ ,  $(n-2) - n$ , and  $(n-1) - n$  must be completed for the project to be completed.

# Network Development (continued)

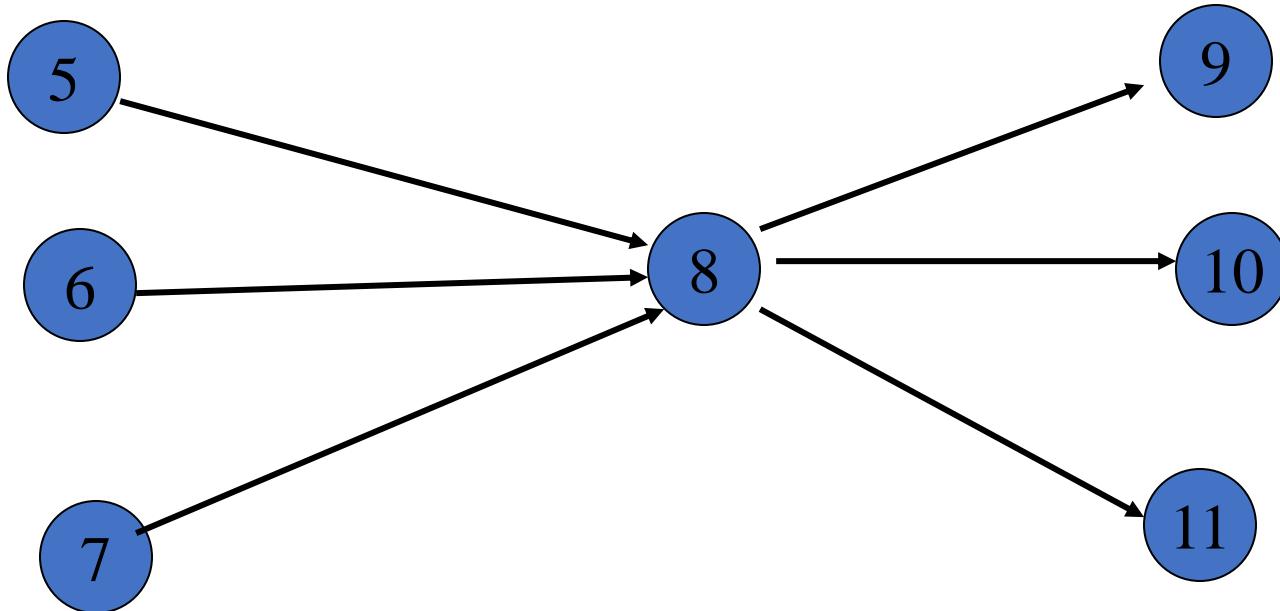


Activities 6-7, 6-8, and 6-9 cannot start until activity 5-6 has been completed.

# Network Development (continued)



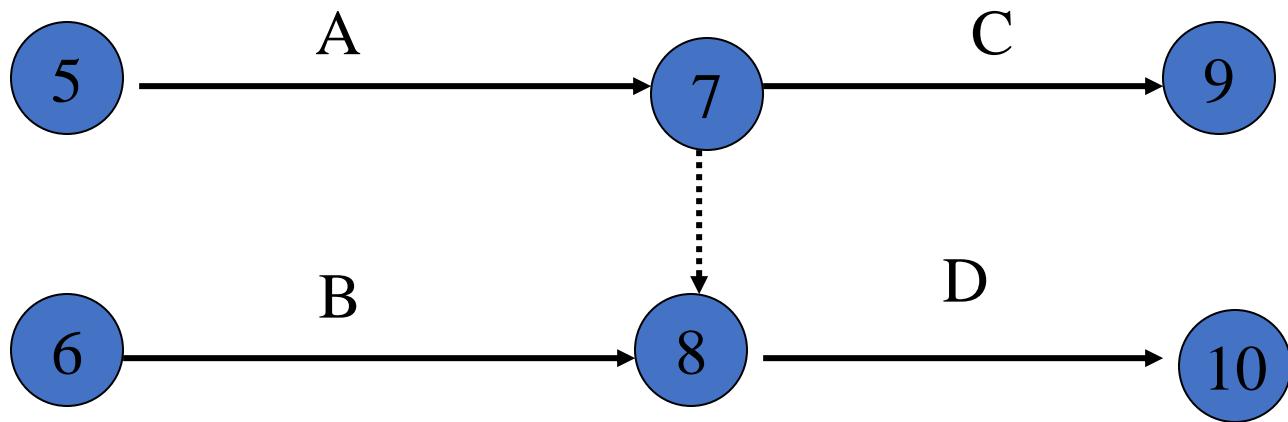
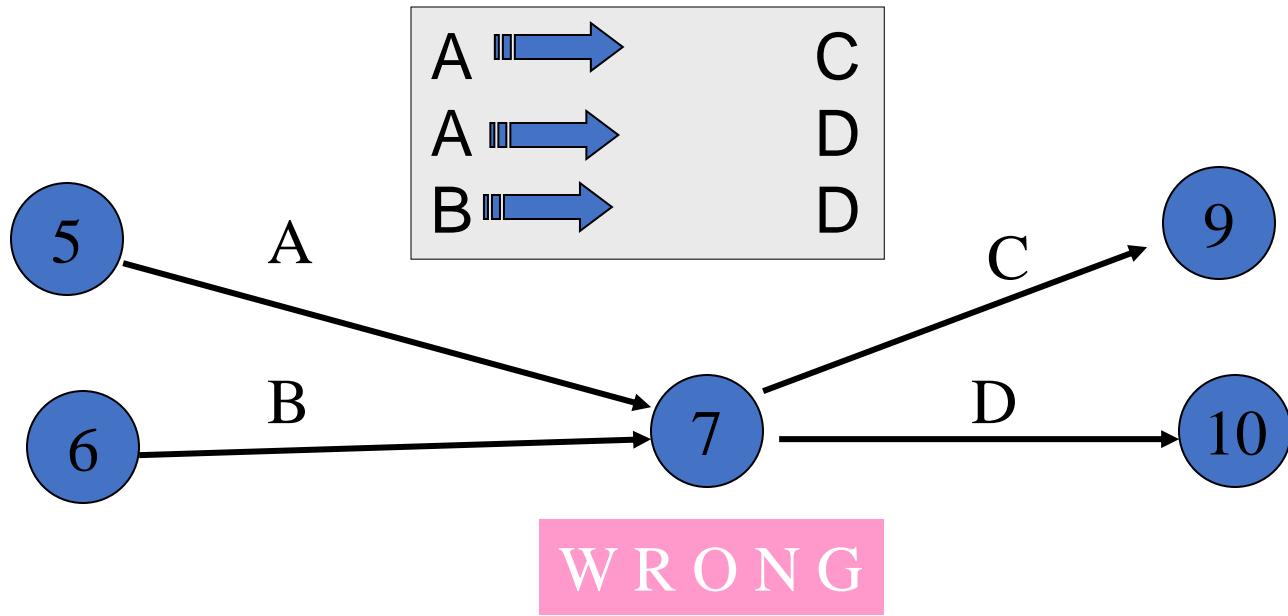
# Network Development (continued)



Gosh! A combined merge and burst event. Are these rare or what?

Activities 5-8, 6-8, and 7-8 must be completed before activity 8-9, 8-10, or 8-11 **may** begin.

# Dummy activity



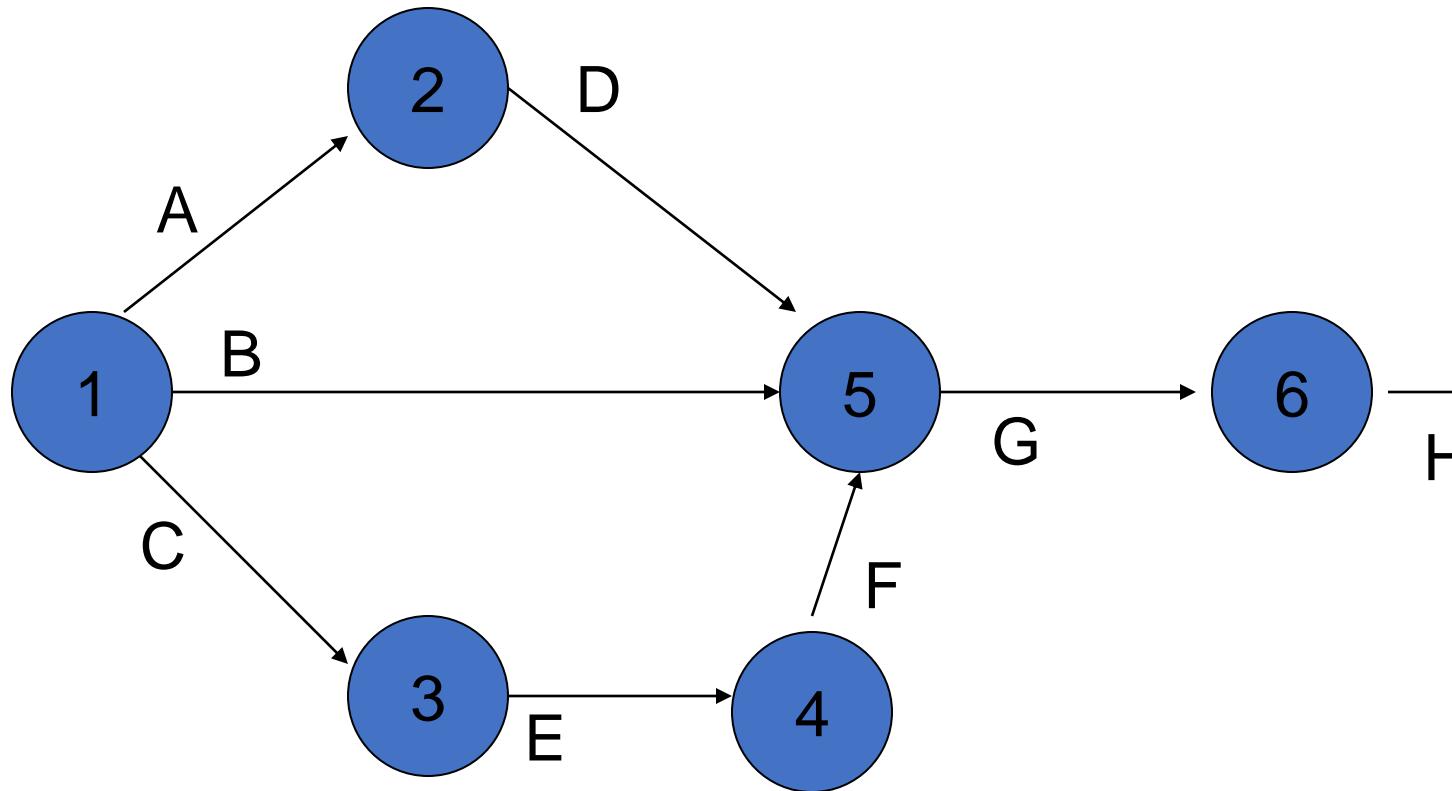
dummy has no resources and no duration

Some time such a logical error is also called Wagon Wheel Error.

# Project Networks

- Collection of nodes and activities
- Depicted graphically
- Events are uniquely numbered
- Arcs are labeled according to their beginning and ending events
  - Ending events always have higher numbers than beginning events
- Two activities cannot have the same beginning and ending events
- Activity lengths have no significance

# Product development Example



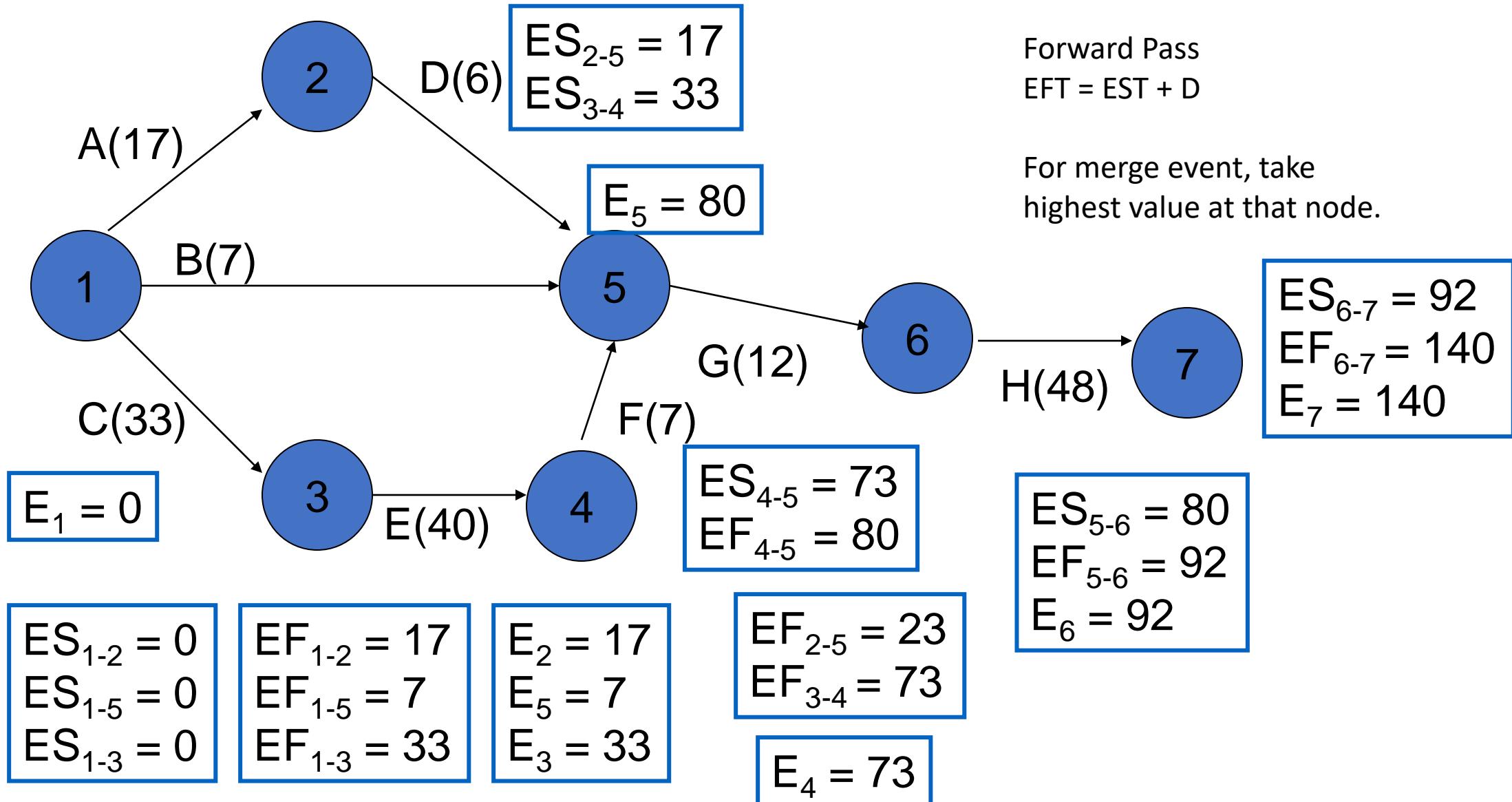
activity	description	precedence
A	design promotion campaign	-
B	initial pricing	-
C	product design	-
D	promotion cost analysis	A
E	manufacture prototype	C
F	test and redesign	E
G	final pricing	
H	B,D,F market test	G

# Notation



- $i-j$  = an activity of a project
- $d_{i-j}$  = the duration of activity  $i-j$
- $E_i$  = the earliest time event  $i$  can occur
- $ES_{i-j}$  = the earliest start time of activity  $i-j$
- $EF_{i-j}$  = the earliest finish time of activity  $i-j$
- $LS_{i-j}$  = the latest start time of activity  $i-j$
- $LF_{i-j}$  = the latest finish time of activity  $i-j$
- $L_i$  = the latest time event  $i$  can occur

# product development – forward pass



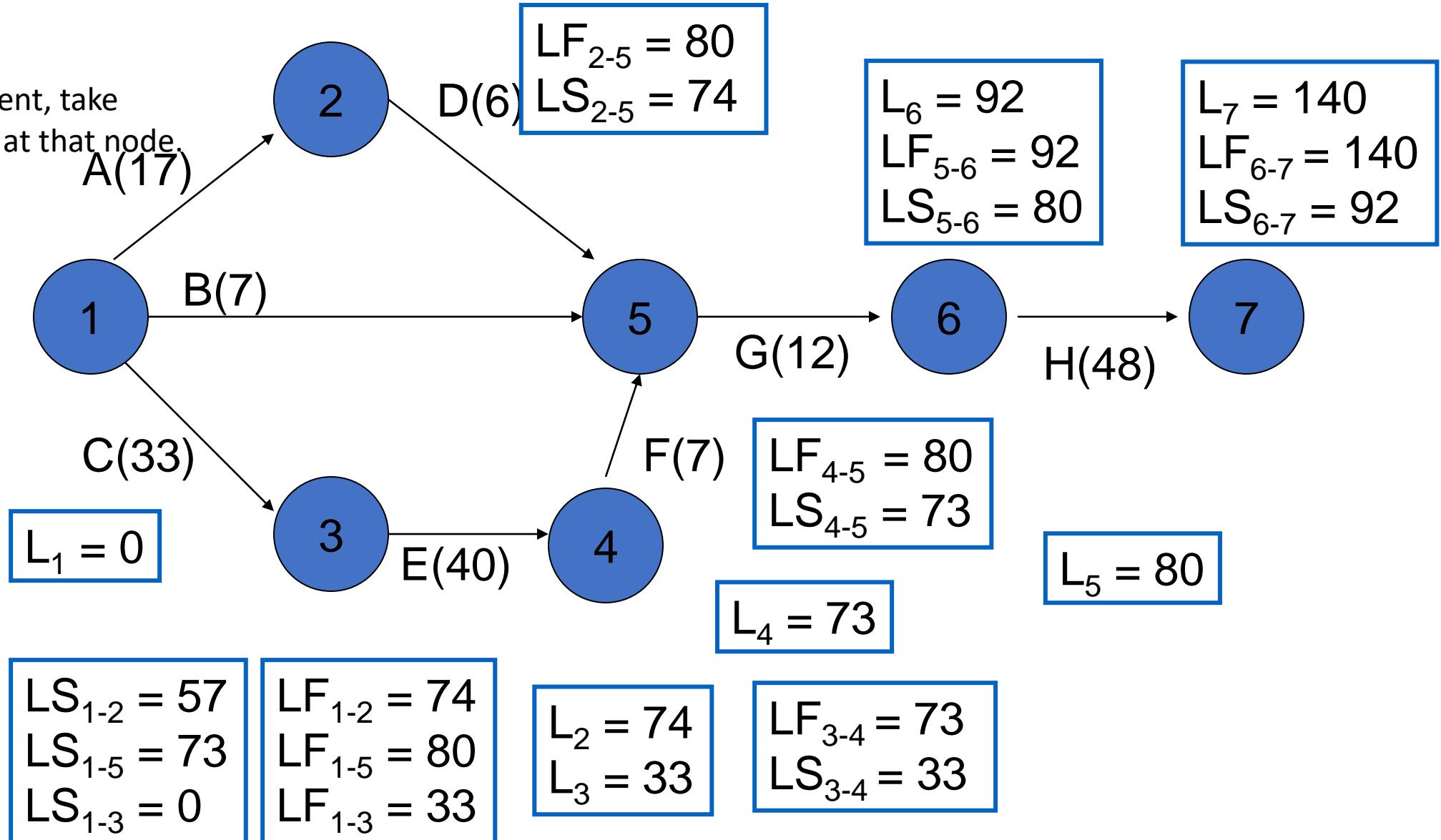
# Product development – backward pass

Forward Pass

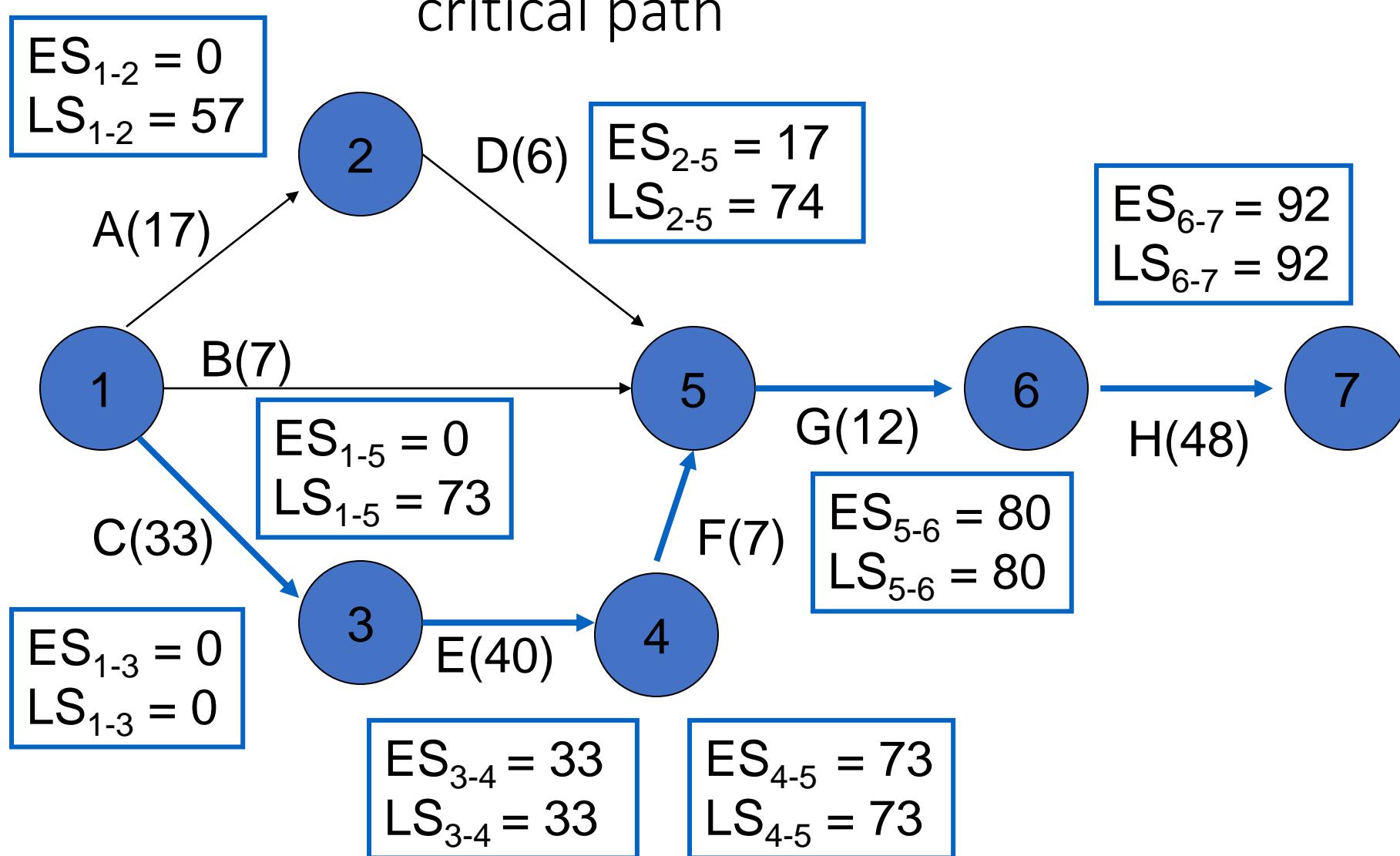
$$LST = LFT - D$$

For merge event, take

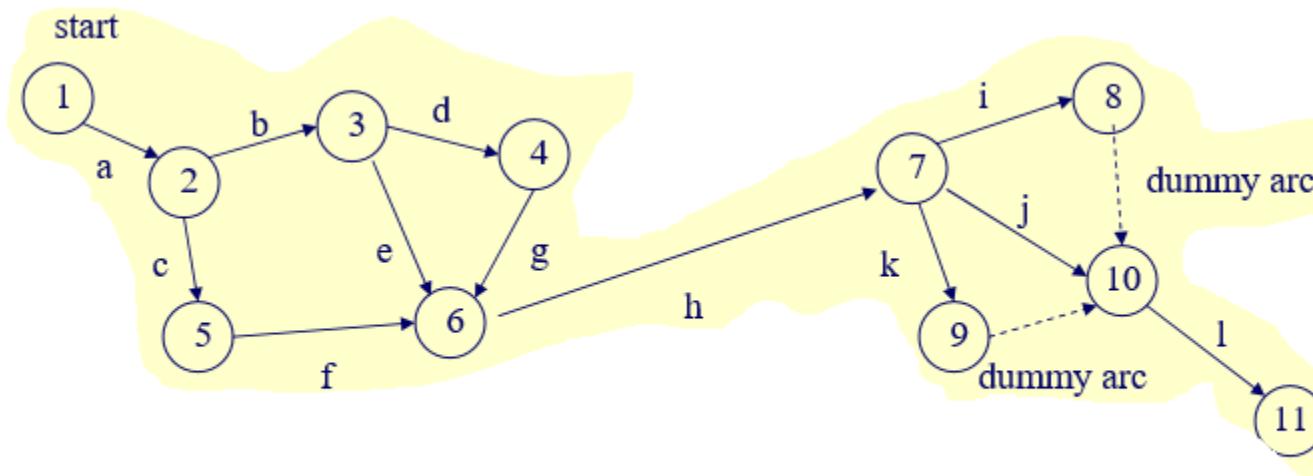
Lowest value at that node.



## critical path



Draw a network diagram for the following data give below



S.N	Activity	Predecessor
1	A	-
2	B	A
3	C	A
4	D	B
5	E	B
6	F	C
7	G	D
8	H	E,F,G
9	I	H
10	J	H
11	K	H
12	L	I,J,K
13	M	L

# Float /Slack

- A detailed study of non-critical activity with regards to the free time available is worth doing since it will help in better control of the project implementation and allocation of resources.
- **Float is calculated for activity and slack is for event in a network diagram**

An activity has four types of floats

- a) Total float
- b) Free Float
- c) Independent Float and
- d) Interfering float

- Total float (TF) - Maximum time by which the completion of the activity can be delayed without affecting the project completion time. If an activity is delayed by a time equal to its total float, that activity and all other subsequent activities in that path become critical

# Float /Slack

- Free Float (FF)- Delay that can be permitted in an activity so that succeeding activity in the path are not affected.
- Independent float (IF)- spare time available for the activity, if preceding activity is started as late as possible and succeeding activity finished as early as possible
- Interfering float (IF)- Also called head event slack. It is the difference between total float and free float

# Float/Slack Calculation



Total float (TF)

Free float (FF)

Independent Float

Interfering float

= LF<sub>j</sub>-ES<sub>i</sub>-D (LFT-EFT or LST-EST)

= EF<sub>j</sub>-ES<sub>i</sub>-D < TF ( TF – Head event Slack)

= EF<sub>j</sub>-LS<sub>i</sub>-D < FF-tail event slack (may be negative put 0)

= TF-FF (slack of head event)

## **Free Float (TF)**

It is the spare time allowable for an activity so that the start time of succeeding activities are not affected.

$$\text{FF of An activity} = \text{EST of Succeeding Activity} - \text{EFT of that Activity}$$

## **Independent Float (IF or Ind. Float)**

It is the maximum delay allowable for an activity so that the start time of succeeding activities are not affected. It may come negative but should be taken as zero.

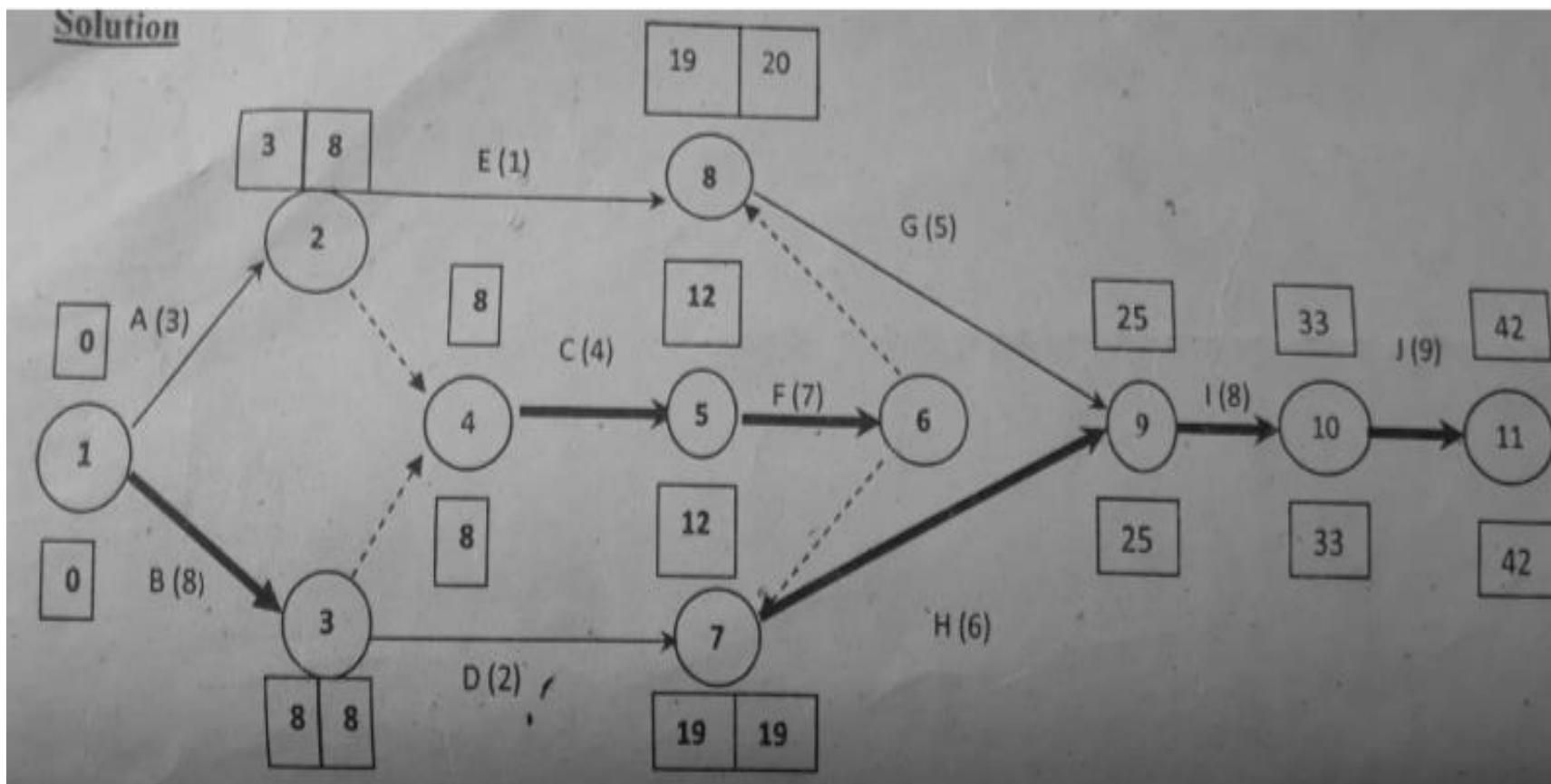
$$\text{IF of An activity} = \text{EST of Succeeding Activity} - \text{LFT of that Activity}$$

# Critical Path Activities

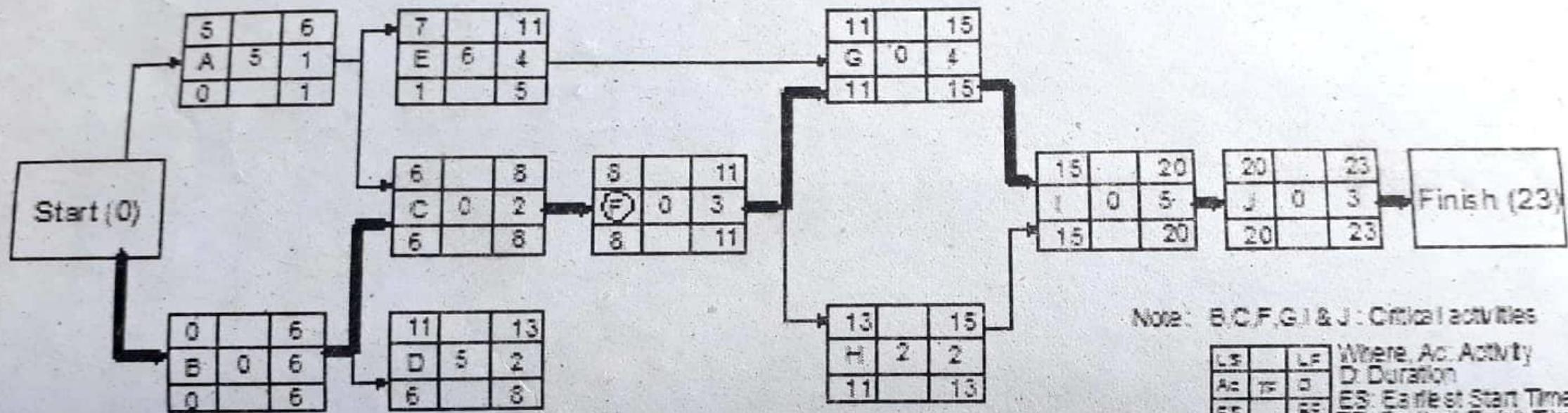
- focus management attention
- increase resources
- eliminate delays
- eliminate critical activities
- overlap critical activities
- break activity into smaller tasks
- outsource or subcontract

# Numerical Example

S N	Activ ity	Predec essor	Succe ssor	Durati on
1	A	-	C,E	1
2	B	-	C,D	6
3	C	A,B	F	2
4	D	B	H	2
5	E	A	G	4
6	F	C	G,H	3
7	G	E,F	I	4
8	H	D,F	I	2
9	I	G,H	J	5
10	J	I	-	3



Above example by AON or PDM



Note: B/C/F/G/I & J : Critical activities

LS	EF	Where, Ac, Activity
Ac	TF	D Duration
0	6	ES: Earliest Start Time
7	11	EF: Earliest Finish Time
11	15	LS: Latest Start Time
15	20	LF: Latest Finish Time
20	23	TF: Total Float

Project Completion duration: 23 days

# Numerical Example

SN	Activity	Duration	EST	EFT	LST	LFT	TF	FF	Ind	Inf	Remark
1	A	3	0	3	5	8	3	0	5	3	
2	B	8	0	8	0	8	0	0	0	0	Critical
3	C	4	8	12	8	12	0	0	0	0	Critical
4	D	2	8	10	17	19	9	9	9	0	
5	E	1	3	4	19	20	16	15	16	1	
6	F	7	12	19	12	19	0	0	0	0	Critical
7	G	5	19	24	20	25	1	1	0	0	
8	H	6	19	25	19	25	0	0	0	0	Critical
9	I	8	25	33	25	33	0	0	0	0	Critical
10	J	9	33	42	33	42	0	0	0	0	critical

# Critical Path

- It is the longest path of the activities
- It determines the required project duration
- There may be more than one critical path in a network
- A critical path may consist of less no of activities than Non- critical path.
- It is the starting point for project planning.
- The critical Activities demand the requirement of resources prior to other activities to complete the project in time.

# HOW TO CONSTRUCT A NETWORK DIAGRAM (PERT / CPM)

**DEVELOPING A NETWORK DOAGRAM IS A FOUR STEP PROCESS:-**

- 1. Identify each Project Activity to be completed**
  
- 2. Determine Time estimates and calculate Expected Completion Time for each Activity**
  
- 3. For each Activity, identify the immediate predecessor Activities**
  
- 4. Enter the Activities with connecting arrows based on Dependencies and calculate Start and End times based on Duration and Resources.**

# Common Errors in Drawing Networks

- 1. Dangling –
  - The error in the network caused due to non emerging of activity, is called Dangling
- 2. Looping/Cycling-
  - The path of the activities back into itself is called Looping.
- 3. Redundancy
  - Unnecessarily inserting the dummy activity in a network logic is known as error of redundancy.

# Some more definitions

- 1. Slack time –
  - It is the time available for the performance of an activity without delaying the completion date of the project.
  - It is the difference between the latest allowable time and the earliest expected time
- 2. Float
  - It indicates the range within which an activity start time or its finish time may fluctuate without affecting completion of the project.
- 3. Crashing
  - The process for reducing the duration of critical path activities by locating maximum resources to those activities.
- 4. Crashing Cost
  - This is the Direct cost corresponding to the completion of activity within crash time
- 5. Crash Time
  - It is the minimum time which an activity will take to complete after Crashing.
- 6. Critical Path
- 7. Non critical Activity

# Super Critical, Sub Critical and Critical Activity

a critical path is the sequence of project network activities which add up to the longest overall duration, regardless if that longest duration has float or not.

This determines the shortest time possible to complete the project.

Sub critical path means the second longest path in the network. It is shorter than the critical path but longer than all other paths in the network. They have **Float positive**.

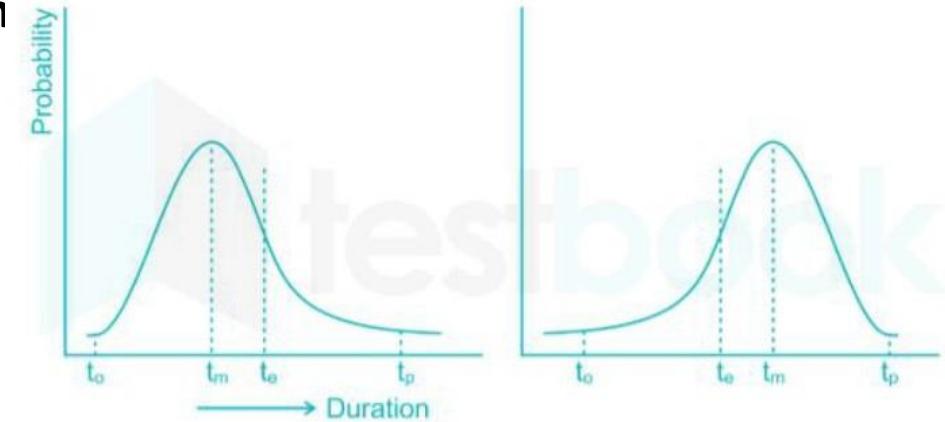
**Supercritical Activity:** These Activities have negative float. It results when activity duration is more than time available. It indicates abnormal situation requiring as to how to compress the activity.

**Subcritical path:** The path with the next least floats than critical path is subcritical path.

# PROGRAM EVALUATION REVIEW TECHNIQUE (PERT)

- One of the most difficult and most error prone activities when constructing a Project Schedule is the determination of the **TIME DURATION** for each task within a Work Breakdown Structure (WBS), specially when there is a high degree of complexity and uncertainty about a task.
- PERT is a technique used to calculate the Expected Time for a tasks.
- PERT is a technique that uses Optimistic time (O), Pessimistic time (P) and Realistic Time (R) estimates to calculate the **EXPECTED TIME (ET)** or a particular task.
- Time estimates follow  $\beta$ - distribution.
- Activity follows  $\beta$ - distribution.
- Project follows normal distribution. ( Central Limit Theorem

In PERT the individual activity follows  $\beta$  – distribution but the total project duration follows normal distribution.



So the  $\beta$  – distribution cannot be divided into equal halves by probable time. But the expected duration of the project divide the total project duration by two equal halves.

PERT	CPM
Originated from R&D projects	Originated from construction project
Time estimates are probabilistic	Time estimates are deterministic
Event oriented	Activity oriented
Focused on time	Focused on time-cost trade-off
More suitable for new projects.	More suitable for repetitive projects.

# PROGRAM EVALUATION REVIEW TECHNIQUE (PERT)

- PERT is a technique that uses Optimistic time (o), Pessimistic time (p) and Realistic Time (r) estimates to calculate the EXPECTED TIME (ET) of a particular task.
- The Optimistic time (o) and Pessimistic time (p) reflects the minimum and maximum possible periods of time for an activity to be completed.
- The Realistic time (r) or the Most likely time , reflects the Project manager's "Best Guess" of the amount of time required for a task completion.

## CALCULATING EXPECTED COMPLETION TIME (ET)

$$ET = \frac{t_o + 4tm + t_p}{6}$$

Because the expected Completion time should be closer to the realistic time (r), it is typically weighed Four times more than the Optimistic time (o) and the Pessimistic time (p). Once you add these values together , it must be divided by 6 to determine the Expected Time for a task.

- PERT was devised in 1958 for Polaris Missile Program

# TE And TL

- A systematic and scientific method of finding critical path lies in the calculation of event time which is described by
  - i) The Earliest Expected Occurrence Time (TE)
  - ii) The Latest Allowable Occurrence Time (TL)
- **The Earliest Expected Time (TE)** is the time when an event can be expected to occur earliest. The calculation of TE of an event is same as calculation of EOT of CPM network. If more than one activity are directed to the event, maximum of the sum of TE's along various path will give the expected mean time of the event.

Expected mean time of the initial event is taken as zero and process is repeated for each succeeding event and ultimately to the final event. The method is usually called the forward pass.  $(TE)_j = \text{Max } [(TE)_i + t_{ij}]$

- **The Latest Allowable Occurrence Time (TL)** : The latest time by which an event must occur to keep the project on schedule is called the latest allowable occurrence time (TL).

The calculation of TL of an event is same as that LOT of CPM network by the method known as Backward Pass. ;  $(TL)_i = \min ((TL)_j - t_{ij})$

### ***Example***

**An R & D project has a list of tasks to be performed whose time estimates are given in the Table 8.11, as follows.**

**Table 8.11: Time Estimates for R & D Project**

i	Activity j	Activity Name	$T_0$	$t_m$ ( in days)	$t_p$
1-2	A		4	6	8
1-3	B		2	3	10
1-4	C		6	8	16
2-4	D		1	2	3
3-4	E		6	7	8
3-5	F		6	7	14
4-6	G		3	5	7
4-7	H		4	11	12
5-7	I		2	4	6
6-7	J		2	9	10

- a. Draw the project network.
- b. Find the critical path.
- c. Find the probability that the project is completed in 19 days. If the probability is less than 20%, find the probability of completing it in 24 days.

Time expected for each activity is calculated using the formula (5):

Similarly, the expected time is calculated for all the activities.

$$T_a = \frac{t_0 + 4tm + tp}{6}$$

$$= \frac{4 + 4(6) + 8}{6} = \frac{36}{6} = 6 \text{ days for activity A}$$

The variance of activity time is calculated using the formula (6).

Similarly, variances of all the activities are calculated.

$$\sigma_i^2 = \left( \frac{tp - t_0}{6} \right)^2$$

$$= \left( \frac{8 - 4}{6} \right)^2 = 0.444$$

Table 8.12:  $T_e$  &  $\sigma^2$  Calculated

Activity	$T_0$	$T_m$	$T_p$	$T_e$	$\sigma^2$
1-2	4	6	8	6	0.444
1-3	2	3	10	4	1.777
1-4	6	8	16	9	2.777
2-4	1	2	3	2	0.111
3-4	6	7	8	7	0.111
3-5	6	7	14	8	1.777
4-6	3	5	7	5	0.444
4-7	4	11	12	10	1.777
5-7	2	4	6	4	0.444
6-7	2	9	10	8	1.777

# Difference between 'resource smoothing' and 'resource levelling'

- A scheduling calculation that involves utilizing float or increasing or decreasing the resources required for specific activities, such that any peaks and troughs of resource usage are smoothed out. This does not affect the overall duration. It is also known as time limited resource scheduling.
- **What is the difference between 'resource smoothing' and 'resource levelling'?**
- Resource smoothing is used **when the time constraint** takes priority. The objective is to complete the work by the required date while avoiding peaks and troughs of resource demand. Resource levelling is used when limits on the availability of resources are paramount. It simply answers the question 'With the resources available, when will the work be finished?'.
- Few re-usable resources are limitless, so the time schedule has to be adjusted to take into account the limited availability of resources over time. There are two approaches to reconciling **resource limits and time constraints**; **resource smoothing (or time limited resource scheduling)** and **resource levelling (or resource limited scheduling)**.

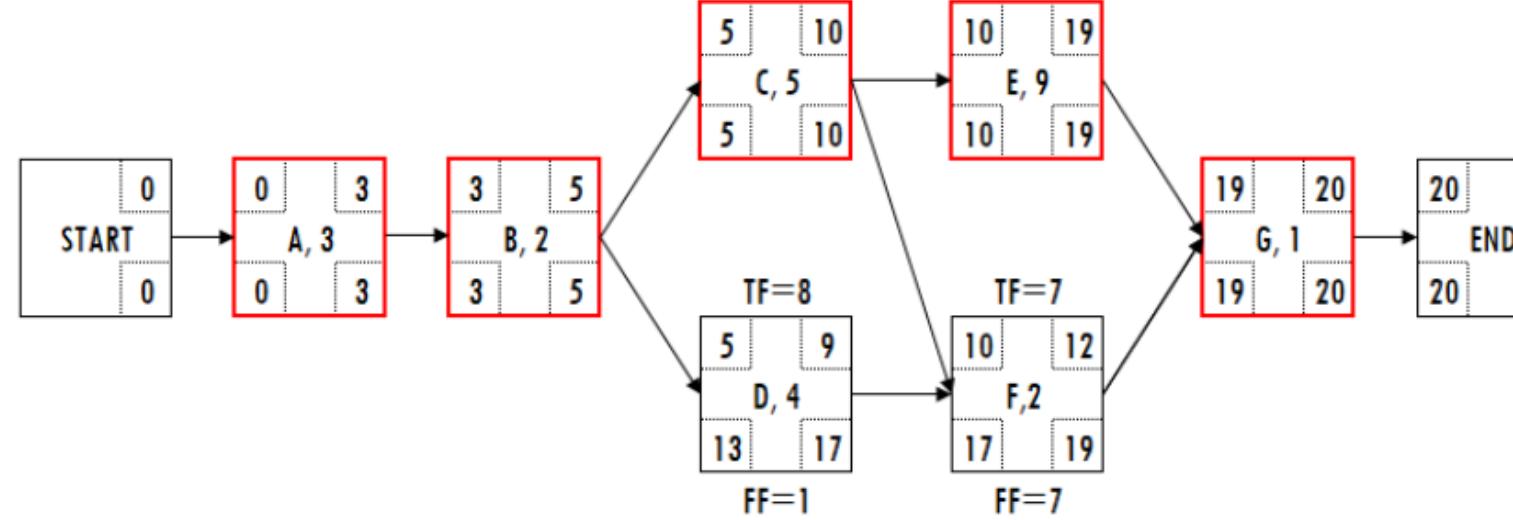
	<b>Resource leveling</b>	<b>Resource smoothing</b>
1	Resource limited scheduling technique; Importance is given to the limited resources	Time limited scheduling technique; Importance is given to the duration of the project
2	Removes all resource conflicts	Removes as much resource conflicts as possible; but, may not remove all resource conflicts
3	May not require additional resources	May require additional resources to address left over resource conflicts
4	Activities may be shifted beyond the float available while rescheduling the activities	Activities are shifted only to the extent of the float available
5	Generally, the project duration gets extended	The project duration remains the same
6	May change the critical path	No change in critical path

# Resource Aggregation, Levelling & Smoothing

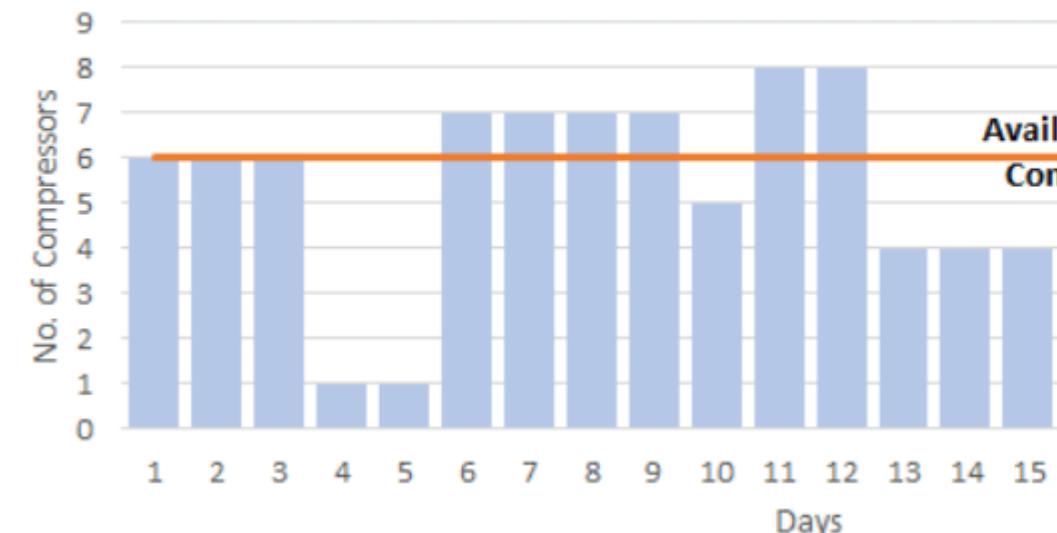
- Resource smoothing is used when the time constraint takes priority. The objective is to complete the work by the required date while avoiding peaks and troughs of resource demand.
- A smoothed resource profile will be achieved by delaying some work. This will remove some flexibility from the schedule and its ability to deal with unavoidable delays, but the advantage is usually a more efficient and cost-effective use of resources.
- Resource levelling is used when limits on the availability of resources are paramount. It simply answers the question 'With the resources available, when will the work be finished?'
- Resource Aggregation or Resource Loading, is simply the summation on a period by period basis, of the resources required to complete all the activities.
- The process of calculation of the resource requirement is ?
- Main Constraint on Resource levelling is ?

<b>Activity</b>	<b>Predecessors</b>	<b>Duration (days)</b>	<b>No. of compressors needed</b>
A	-	3	6
B	A	2	1
C	B	5	5
D	B	4	2
E	C	9	4
F	C, D	2	4
G	E, F	1	6

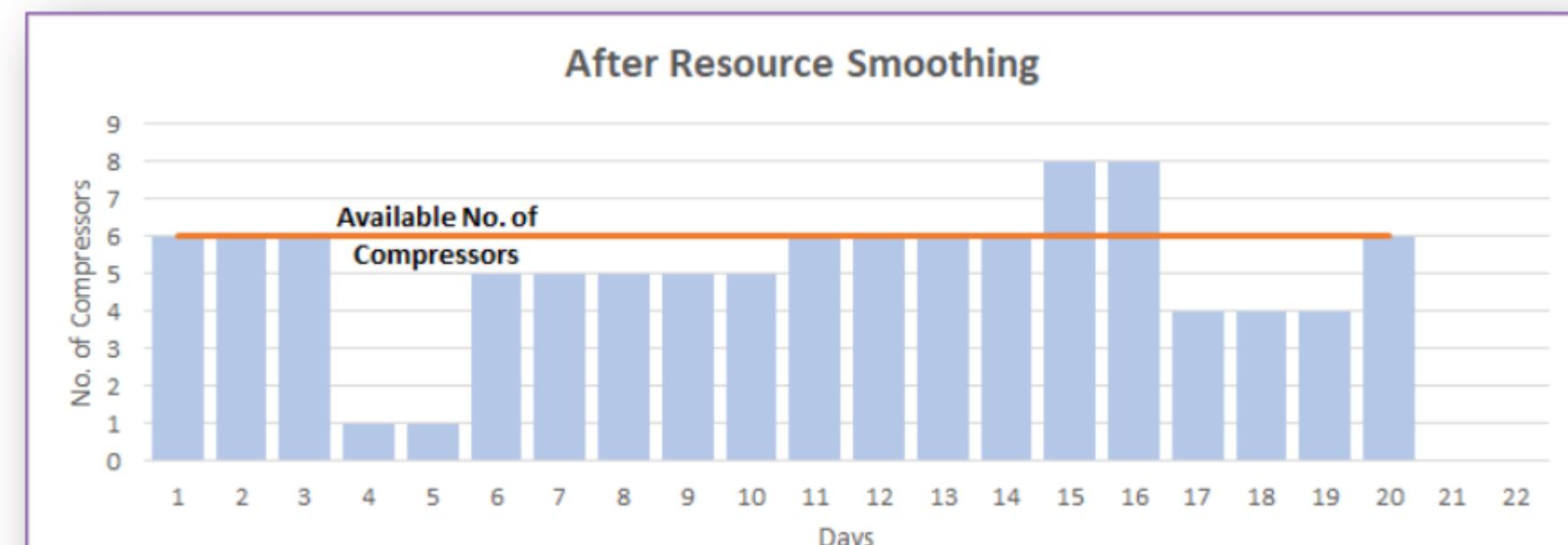
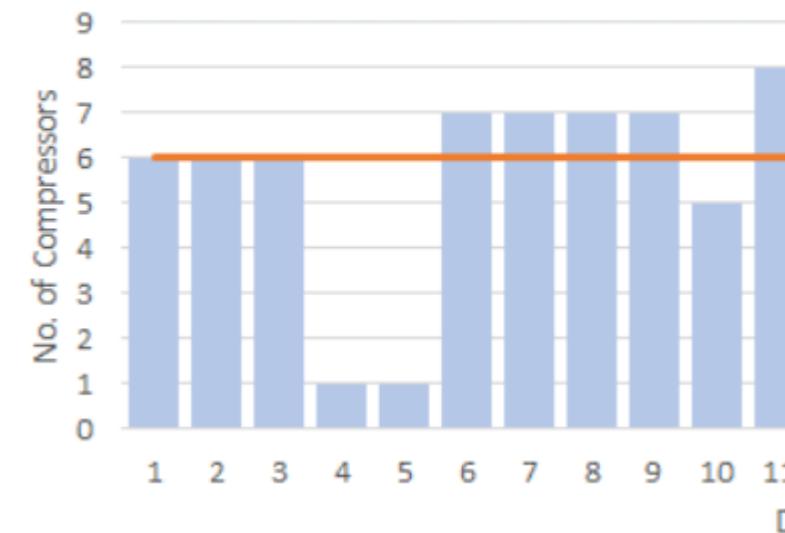
r available = 6 compressor



## Resource Allocation as per CPM Schedule



## Resource Allocation as per CPM Schedule



# Resources

- Cement bags should be kept 30 cm apart from the walls.
  - Stack of cement shall contain normally about 12 bags.
  - Stack of Brick/tiles should be done in levelled ground.
  - Height of stack of Brick/tiles should not exceed 1.5 m
  - Fine and Coarse aggregate should be kept on hard surface
  - Normal stacking size for fine and coarse aggregate is  $2 \times 2 \times 0.5$  m.
- 
- Activity which crashed first has – **Least Cost Slope**
  - **Dummy activity** is also called redundant activity.
  - **For what purpose dummy is used ?**  
For Logical Sequence and Grammatical purpose

# Various Topics

- Master Schedule – It indicates the relative importance of manufacturing/ construction orders.
- Updating – The process of incorporating changes and rescheduling
- The technique for establishing and maintain priorities among the various jobs of a project is known as **Critical Ratio Scheduling**
- The relation between jobs of a particular type and various durations they have consumed for completion is expressed by **Frequency Distribution Curve**.
- **Earned Value Analysis** is a method of construction of the actual value of the work accomplished and comparing it with planned work and actual expenditure.
- It enables the project manager to access the true stages/progress of the project.

# Critical Ratio (CR)

- An index number found by dividing the time remaining until the due date by the work time remaining on the job
- Jobs with low critical ratios are scheduled ahead of jobs with higher critical ratios
- Performs well on average job lateness criterion

$$CR = \frac{\text{Time remaining}}{\text{Workdays remaining}} \quad \frac{\text{Due date} - \text{Today's date}}{\text{Work (lead) time remaining}}$$

If CR > 1, Ahead of the schedule

CR = 1, Exactly on schedule

CR < 1, Behind the schedule

## Advantages of the Critical Ratio Scheduling Rule

Use of the critical ratio can help to:

- ♦ determine the status of a specific job
- ♦ establish a relative priority among jobs on a common basis
- ♦ relate both stock and make-to-order jobs on a common basis
- ♦ adjust priorities and revise schedules automatically for changes in both demand and job progress
- ♦ dynamically track job progress and location

# Types of Organizations

- A ) Line Organizations / Military Organizations / Scalar Organizations
  - Suitable in Small Size Construction
  - But Rigid Organization
- B) Line and Staff Organizations
  - Combination of Line and Functional Organizations
  - Suitable for Medium Size Construction
  - The Line Authority Maintains Discipline while the staff responsibility is carried out by functional specialist
- C) Functional Organizations ( Introduced by FW Taylor)
  - Suitable in Large Construction
  - Responsibility cannot be fixed directly on any individual
  - Everyone is to maintain their own functional efficiency

# MCQs

CPM Is

- **A) Activity oriented**
- C) Time Oriented
- B) Resource Oriented
- D) Event Oriented

PERT Is

- A) Activity oriented
- C) Time Oriented
- B) Resource Oriented
- D) Event Oriented**

PERT adopts

- A) Deterministic Approach
- C) Stochastic Approach
- B) Probabilistic Approach**
- D) None of the above

You are going to design a new COVID Vaccine, Which would you like to prefer

- A) Bar Chart
- C) CPM
- B) Milestone Chart
- D) PERT**

# MCQS

Standard deviation when the optimistic time is 1 day, pessimistic time is 11 days and most likely time is 3 days

- A) 2 days                    b) 3.5 days                    c) 3 days                    d) **1.67 days**

If D is the duration, ES and EF are the earliest start and finish, LS and LF are latest start and latest finish time, then the following relation holds good

- A.         $EF = ES + D$             B.         $LS = LF - D$                     C.         $LF = LS + D$   
D.         $D = EF - ES$             E.        **all the above.**

Pick up the incorrect statement from the following:

- A.        An activity of a project is denoted by an arrow on the net work  
B.        The tail of the arrow indicates the start of the activity  
C.        The head of the arrow indicates the end of the activity  
D.        **The arrows are drawn to scale from left to right**  
E.        Each activity consumes a given time.

# MCQS

The technique for establishing and maintaining priorities among the various jobs of a project, is known

- A. Event flow scheduling technique
- B. **Critical ratio scheduling**
- C. Slotting technique for scheduling
- D. Short interval scheduling.

Frederick W. Taylor introduced a system of working known as

- A. line organization
- B. line and staff organisation
- C. **functional organization**
- D. effective organisation.

The performance of a specific task in CPM, is known

- A. Dummy
  - B. Event
  - C. **Activity**
  - D. Contract.
- The point  
of Start or  
completion  
of activity  
is event

# McQS

Pick up the correct statement from the following:

- A. The float may be positive, zero or negative
- B. If the float is positive and the activity is delayed by a period equal to its total float, the completion of project is not delayed
- C. If the float of an activity is negative, delay in its performance is bound to delay the completion of project
- D. If the float of an activity is zero, the activity is critical and any delay in its performance will delay the whole project
- E. **All the above.**

A dummy activity

- A. is artificially introduced
- B. is represented by a dotted line
- C. does not consume time
- D. **all the above.**

# McQS

Various activities of a project, are shown on bar charts by

- A. vertical lines
- B. horizontal lines**
- C. Dots
- D. crosses.

The time by which activity completion time can be delayed without affecting the start of succeeding activities, is known as

- A. duration
- B. total flat
- C. free float**
- D. interfering float.

# McQS

The most popular type of organisation used for Civil Engineering Constructions, is

- A. **line organisation**
- B. line and staff organisation
- C. functional organisation
- D. effective organisation.

The salient feature of functional organisation is

- A. strict adherence to specifications
- B. separation of planning and design part
- C. each individual maintains functional efficiency
- D. work is properly planned and distributed
- E. **all the above.**

# McQS

If the total float and duration of an activity are 5 and 10 days respectively, the particular activity can be

- A. started 5 days later
- B. completed 5 days later
- C. performed at slower rate in 15 days
- D. **all the above.**

Railway projects are treated as

- A. light construction
- B. **heavy construction**
- C. industrial construction
- D. none of these.

# McQS

In PERT, **the actual time duration of an activity** along the critical path for the project completion time is probabilistic. It is usually presumed to follow which one of the following ?

- [A].Beta distribution
- [B]. Poisson distribution
- [C]. Normal distribution
- [D]. Log-normal distribution.

..... Float = EST for successor activity – EFT of present activity

- A. Total float
- B. Free float**
- C. Independent Float
- D. Interfering float

..... Float = EST for successor activity – LFT of present activity

- A. Total float
- B. Free float
- C. Independent Float**
- D. Interfering float

# MCqs

If the path of activities **leads back to itself**, the resulting error in the network is known as

- A) **looping**
- b) Interfacing
- C) Splicing
- D) Dangling

At an event (other than final event), **if no activity emerges**, it results in an error called

- A) looping
- b) Interfacing
- C) Splicing
- D) **Dangling**

The occurrence of the completion of an activity is called its

- a) **Head event**
- b) tail event
- c) A dual role event

# MCQS

- Negative Slack indicates

A) ahead of schedule condition    **b) behind of schedule condition**  
C) on schedule condition                d) all of above

- Positive Slack indicates

**A) ahead of schedule condition** b) behind of schedule condition  
C) on schedule condition                d) all of above

**The time by which a particular activity may be delayed without affecting the preceding and succeeding activities is known as ?**

**Independent Float**

# MCQs

The difference between total float and the free float is termed as

- A) Start float b) finish float
  - C) Interfering float** d) independent float

When all the paths are arranged according to the descending order of the float, the path which is next to the critical path is known as

- a) Under critical path
  - b) Sub critical path
  - c) Semi – criticalpath
  - d) all of the above.

# MCQS

Pick up the incorrect statement from the following:

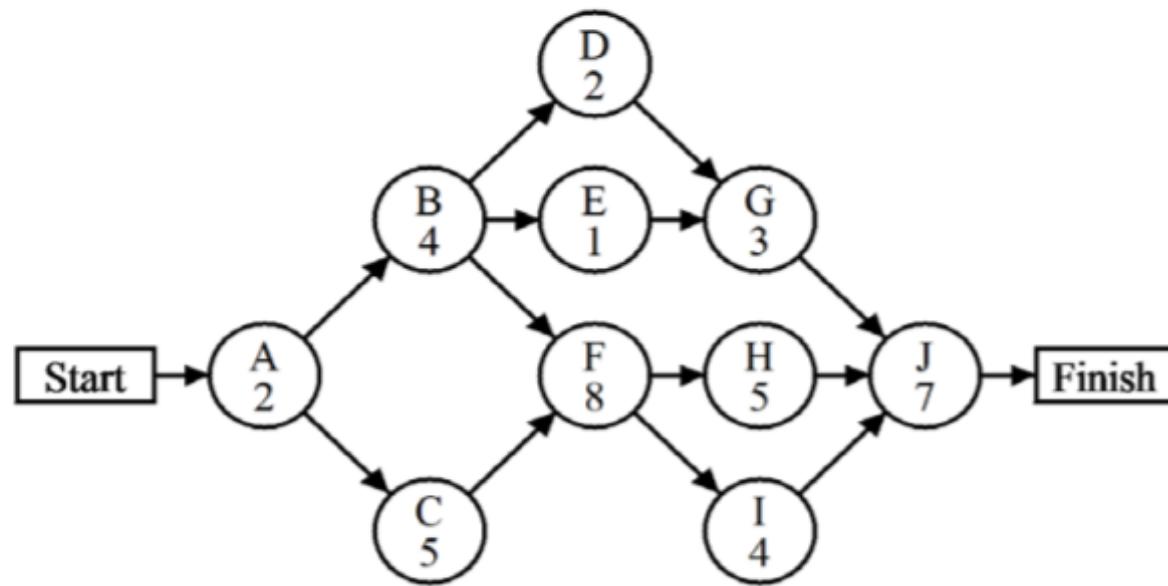
- A) The activity which consumes maximum time, is called a node
- B) The activity is the time consuming part of a project
- C) The beginning and end of a job, are called events
- D) Logically and sequentially connected activities and events form a network

In any project, how many head event and tail event occurs

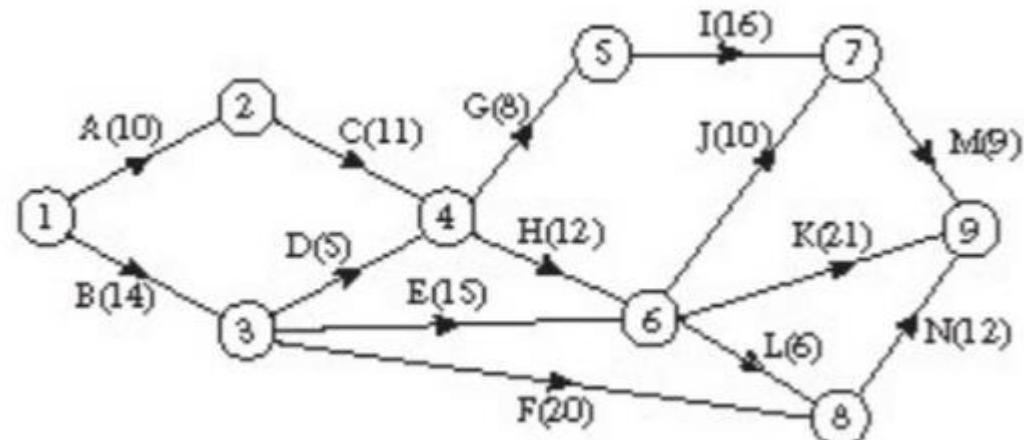
- A) each more than one                    b) can be zero
- C) each one (first and last only)                    d) none of the above

# Numerical Example

3. Consider the following project network. Determine the critical path and the project duration.



- A) The critical path is A-C-F-H-J with a completion time of 28 days
- B) The critical path is A-C-F-H-J with a completion time of 27 days
- C) The critical path is A-B-E-G-J with a completion time of 28 days
- D) The critical path is A-B-D-G-J with a completion time of 27 days



# Classification of Scheduling

- Construction Schedule
- Labor Schedule
- Material Schedule
- Equipment Schedule
- Expenditure Schedule
- Control Schedule

# Classification of Scheduling

## Material schedule

- This schedule is prepared well in advance of the start of the work. This schedule may be prepared from the construction schedule. To avoid delay in execution of work, all construction materials should be at the site of work well in advance. While preparing material schedule following points must be considered:
  - The materials should be delivered at site **at least one week earlier than** its use
  - Materials in site should **not remain un-used** for long duration

## Labor schedule

- The aim of this schedule is to determine the **number of skilled and unskilled labor** required for the execution of different operations on different dates. With the help of this schedule required labor can be arranged well in time. It is difficult and costly to arrange the labor when required. It helps in reducing the labor cost. A labor schedule can be prepared from the construction schedule.

# Classification of Scheduling

## **Equipment schedule**

- To decide the type, number and dates on which a particular equipment will be needed, equipment use schedule has to be prepared before the start of the project, so it is arranged well in advance and brought at site as and when needed. The aim of this schedule is to derive maximum advantage of the equipment when at site and remove it from site when its job is over. This will save money.

## **Financial schedule**

- The estimated amount of money which owner or contractor has to provide to finance the project can be obtained from the construction schedule.

## **Control schedule**

- At the end of a fixed date in charge of the project has to send the progress report of the project to the headquarter. In order to complete the project within the specified time limits, the chief executive plans to provide resources as equipments, machines and money.

# Project Cost

For any project total expenditure incurred in terms of man power, equipment, machinery and materials and time to achieve a particular goal is known as **total cost of the project**. The total sum of the project is the sum of two distinct costs.

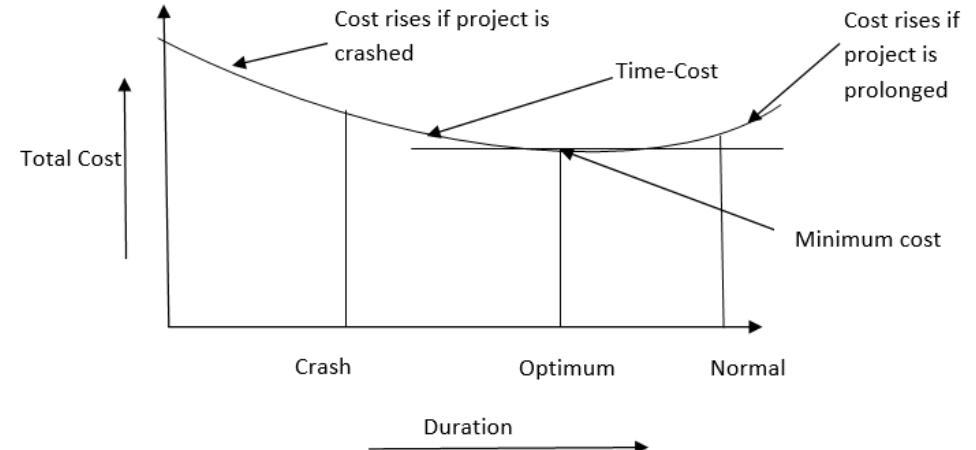
- Direct cost
- Indirect cost
  - Overhead charges
  - Outage losses

Direct cost:

- The cost of materials, equipment and money spent on man power form the direct cost. The direct costs of project are of major concern and behavior pattern of direct costs with time is of importance. Direct cost of a project depends on the completion time of project, but the variation is not linear

Indirect cost:

- The expenditures which cannot be allotted clearly to the individual activities of the project, but are assessed as a whole are called indirect costs. The indirect cost includes overhead charges, administrative and establishment charges, supervision charges, loss of revenue, loss in profit and penalty etc



# ABC Classification of Construction Materials

- The most commonly used method for classifying construction materials is to group them into high usage value, medium usage value and low usage value materials. This classification is achieved using the ABC analysis.
- The ABC analysis is generally used for the control of regular stock items. Studies show that regular stock items, depending upon their periodic requirement and costs, e.g., quarterly or yearly, can be grouped into three groups of materials, i.e. A, B and C, generally conforming to the following pattern shown below:

ABC Grouping		
Group class	Total items	Inventory costs
A	10%	70%
B	20%	20%
C	70%	10%

# Some other

- **Golden rule for the procurement of Construction –**
  - 2/3<sup>rd</sup> of construction store should be at work site and 1/3<sup>rd</sup> under procurement

## **Site order BOOK**

- Used for recording the instruction of the executive engineer

## **Inventory Management**

- It is the techniques to maintain the optimal level of stock good.

# Some other Definition

- Lead time – The time between the ordering of the goods or materials and receiving the delivery of inventory.
- Goods in Transit – Goods which have been ordered but have not been yet received.
- Reorder Level – The level of inventory at which the reorder should be placed.

ROL =Safety Stock +lead time x average consumption -  
GIT

# Some other Definition

- Reorder Level – The level of inventory at which the reorder should be placed.

**ROL =Safety Stock +lead time x average consumption – GIT**

- Economic order quantity – Quantity at which Total Inventory cost is minimum

$$TIC = \sqrt{2AOC}$$

( when TOC = TCC) where

$$Q = \sqrt{2AO/C}$$

A = Total requirement

Q= ordering Quantity

O = ordering Cost ,

C = Carrying Cost=cost of holding an inventory.

# Introduction to Monitoring, Evaluation and Controlling

Areas of Control

Cost,

Quality ,

Time

Method of cost control

- Short time planning and control
- Accounting method of control

overall profit and loss account

Profit- loss on valuation date

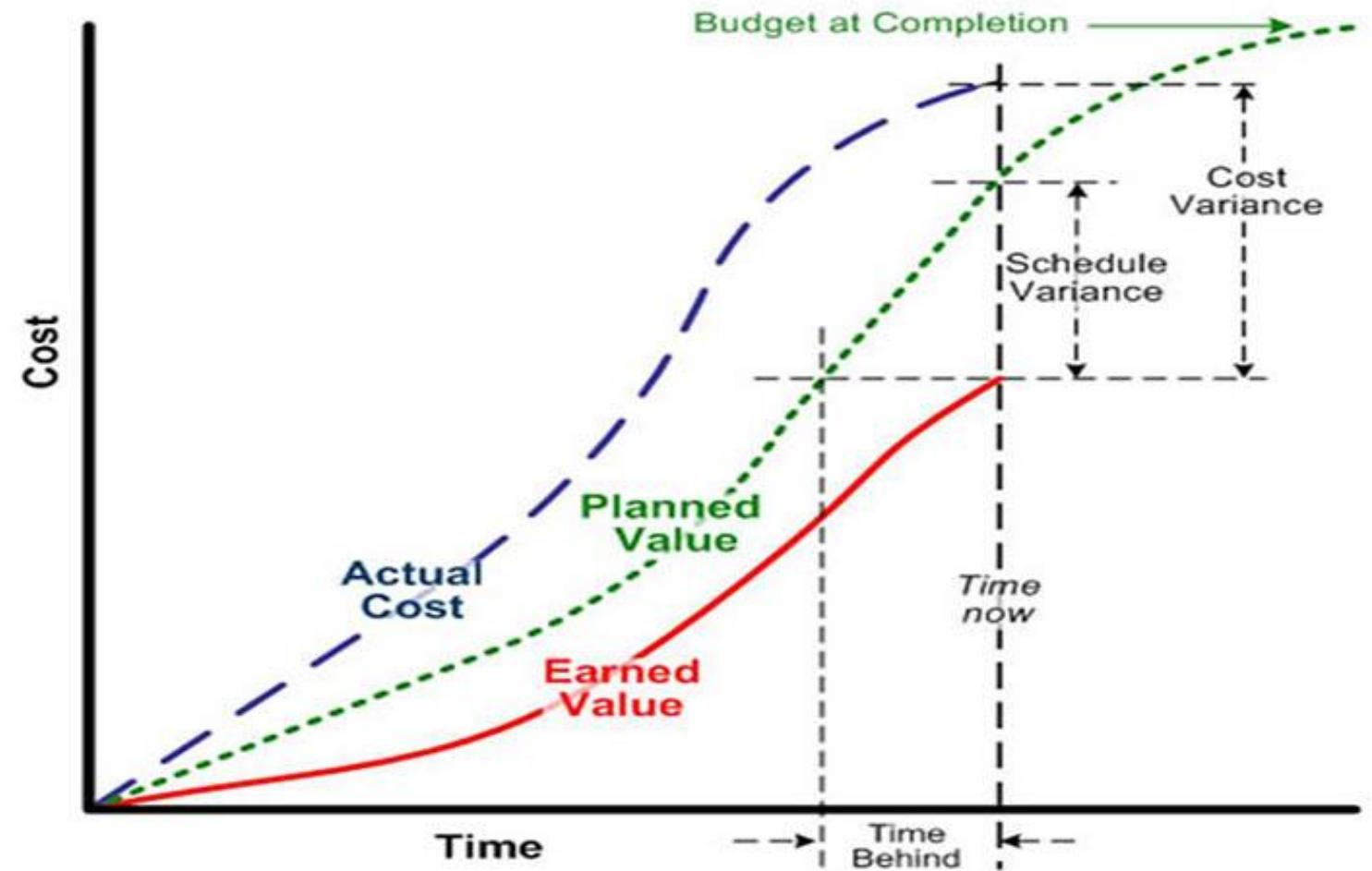
Unit costing

Project cost models- S curve and EVA

- “Earned Value Analysis” is an industry standard way to measure a project’s progress, forecast its completion date and final cost, and provide schedule and budget variances along the way.
- Based on just 3 data points, it can provide consistent, numerical indicators with which you can evaluate and compare projects.

# The 3 fundamental metrics

- Budgeted Cost of Work Performed (BCWP)
- Budgeted Cost of Work Schedule (BCWS)
- Actual Cost of Work Performed (ACWP)



# Budgeted Cost of Work Performed

- This is the “Earned Value.”
- Abbreviated as **BCWP**.
- For completed work, it is the cost originally budgeted to accomplish that work.
- “How much work was actually done?”

## Budgeted Cost of Work Scheduled

- Abbreviated **BCWS**.
- It is the total budgeted cost up to the analysis date.
- Approximated by the total budget multiplied by the fraction of total project duration at the analysis date.
- “How much work should have been done?”

# Actual Cost of Work Performed

- Abbreviated **ACWP**.
- What it actually cost to accomplish all the work completed as of the analysis date.
- “What did the work that was actually done actually cost?”

## Derived Metrics

- Schedule Variance (**SV**)
- Schedule Performance Index (**SPI**)
- Cost Variance (**CV**)
- Cost Performance Index (**CPI**)

# A Few More Acronyms

**BAC - Budget At Completion**

= Total Original Budgeted Cost

Same as BCWS at completion

**EAC - Estimate At Completion**

= Cumulative Actuals + Estimate-To-Complete

**VAC - Variance At Completion**

= Forecast of final cost variance

## Doing The Math

- $SV = BCWP - BCWS$ 
  - Negative means Behind Schedule
- $SPI = BCWP / BCWS$ 
  - Less than 1.00 means Behind Schedule
- $CV = BCWP - ACWP$ 
  - Negative means Over Budget
- $CPI = BCWP / ACWP$ 
  - Less than 1.00 means Over Budget
- $EAC = BAC / CPI$

# An Example: Lemonade

- Make 1,000 cups over 50 days
- Steady rate of 20 cups per day
- Budgeted cost per cup is \$0.50
- Total project budget is \$500

## Lemonade Progress

- At end of day 10:
- 150 cups have been made
- Total actual cost is \$90 (ACWP)

# Lemonade Status

- BCWS = \$100
  - 10 days x 20 cups per day x .50/cup budget
- BCWP = \$75 (Earned Value)
  - 150 cups x .50/cup budget
- SV = BCWP - BCWS = -\$25
- SPI = BCWP / BCWS = 0.75
- CV = BCWP - ACWP = \$75 - \$90 = -\$15
- CPI = BCWP / ACWP = 0.833

## Lemonade Forecast

- EAC = BAC / CPI = \$500 / 0.833 = \$600
- VAC = BAC - EAC = \$500 - \$600 = \$100 (unfavorable)
- Schedule at Completion =  
50 / SPI =  
50 / 0.75 =  
66.67 days

# Five Simple Criteria for Earned Value Applications

1. Define (scope) the project. . .with a WBS
2. Plan and schedule the project scope
3. Budget cost account plans to functions
4. Establish and maintain a performance baseline
5. Monitor performance and forecast final results

# CONTRACT MANAGEMENT, TENDERING, DISPUTES MANAGEMENT AND LABOR LAW

Sushil Rijal

# Contract

2

## 1. Contract Law

- It is the legal obligation regarding contract

## 2. Contract

- Contract is define as agreement concluded between two or more parties for performing or not performing any work.
- If any person advances any proposal to any other person and the later gives acceptance his acceptance there to, they shall be deemed to have concluded to have a contract.
- The main objective of entering to contract is to seek legal action/ remedies if any party breach the contract.

# 3. Agreement

3

## 3. Agreement

- The acceptance to the offer (proposal) with or without any condition is the agreement. It may not have legal obligation.

**“All contracts are agreements but all agreements are not contracts.”**

- The agreement is the consent between owner and the contractor for a meaningful undertaking. It includes all the terms and references to execute the job.

# 4. Elements of Contract

4

- For a contract legally binding and enforceable by law, the following elements must be present.
  - I. **Two or more competent parties.**
  - II. **Offer and acceptance:** Proposal put forward by one person to another person with expectation and obtaining his consent for performing or not performing any work. Acceptance is the consent given by a person in the same sense in which the proposer taken the substance of the proposal presented by him to the former.

# 4.Elements of Contract

5

- A. If a person advances a proposal to a person who gives his acceptance contract exists.
- B. If a person making a proposal to a person that he should be given notice of acceptance of the proposal with in the specified period but does not receive such notice with such period then no contract exists.
- C. If no time limit specified in the proposal then it must be accepted within the reasonable time.

# 4.Elements of Contract

6

- D. An offeror cannot bind the offeree by a stipulation that if the offerer is not given notice of rejection within specified time then he shall be deemed to have accepted the offer.
- E. If the offerer dies or become insane before his proposal being accepted then no contract exit.
- F. If the offeree gives his consent with revision offer then no contract exist.
- G. If the offeror offers proposal with conditioned to be fulfilled by the offeree before accepting the proposal and the later does not do so, there is no contract.

# 4.Elements of Contract

7

- III. The intention of creating legal relation by both the parties.**
- IV. Consideration:** It is the cause motive price or impelling the induced the contracting party to enter into contract. Consideration can described as something of value that is exchange by the contracting parties.

# 4. Elements of Contract

8

- v. **Capacity of contract/ Competence to contract:** For a Contract to be legally binding and enforceable, all the parties be capable to enter the contract. As per the contract act the following are not capable of contract.
  - a. Age less than 16 years
  - b. Insane persons, Idiots, drunkards, frauds.

However for the welfare of the persons listed above guardians can enter the contract in his interest or on his behalf.

# 4.Elements of Contract

9

- VI. Free consent:** No coercion, fraud , influence, deceit (A misleading falsehood)
- VII. Lawful purpose:** Purpose of contract should not be illegal immoral and against the public policy.
- VIII. Possibility of performance:** Impossible contracts are invalid.
- IX. written and registration:** verbal agreement cannot be a contract

# 5. Classification of Contract

10

In construction, there are two types of contract-

1. Competitive bid contract,
  2. Negotiated contract.
1. Competitive bid contract: It is executed on the competitive bid basis. It leads towards low contract price but with high quality works. it is practiced two ways-
    - a. Lump or stipulated sum contract, and
    - b. Unit price contract.

**Lump or stipulated sum contract-** In this contract, a single sum of money pays for all parts of construction of a project.BOT, BOO and BOOT contracts are some examples.

**Unit Price contract-** Rates are quoted for each item of works. As the bill of quantity (BOQ) is presented in the bid document, the final amount is worked out by adding the amounts of each item of work for comparison.

2. Negotiated contract: If the owner wishes to assign the construction work to a reliable party through a dialogue, it is then termed as Negotiated contract. The owner is free to select any party.. They are of the following types-
  1. Cost + percent of cost,
  2. Cost + fixed fee,
  3. Cost + Fixed fee + Profit sharing clause, and
  4. Cost + sliding fee.

**1. Cost + percent of cost:**

Lucrative to the contractor,

Possibility of increasing construction cost,

**2. Cost + Fixed Rate:**

Possibility of delay in competition of the work,  
quality may be affected.

**3. Cost + Fixed fee + profit sharing clause:**

Encourage the contractor to control cost on the work,  
owner need to be aware of the quality of work,

**4. Cost + Sliding fee:**

It is presented by the following-

Contractor's fee =  $R(2T-A)$ , where, R = base % age rate allocated to the contractor, T = target / estimated cost, and A = Actual cost of the work

# 5. Classification of Contract

13

## Enforceability of contract

- a. Void contract
  - a. Unenforceable contract
  - b. Illegal contract
- b. Voidable contract
- c. Lawful and valid contract

# 6. Voidable Contract

14

As per contract Act, 2000(2056BS) the following contracts are voidable, i.e. if the parties desire to make it void.

- i. A contract concluded through coercion
- ii. A contract concluded through of undue influence
- iii. A contract concluded through fraud

# 7. Void contract

15

As per contract act the following contracts are null and void .

- (a) Contrary to statutory Law: A Contract preventing anyone from engaging him/herself in any occupation, profession or trade which is prohibited by prevailing law.
- (b) Ambiguous , Vague and Unlimited contract: A contract which is vague as it does not provide reasonable meaning thereof.

# 7. Void contract

16

- c) Not possibility of performance: A contract which is considered impossible to fulfill even at the time is concluded.
- d) Contrary to public policy and welfare: A contract concluded for immoral purpose or against Public morality or public interest.
- e) Signed by incompetent parties: A contract concluded by an incompetent person to conclude such contract.

# Types of Contract

17

Based on Method of payment of work

- a. Unit Rate contract
- b. Lump Sum contract
- c. Cost plus contract

# On the Basis of Purpose

18

- Materials Contract
- Labor Contract
- Equipment Contract

# Types of Contract

19

## Based upon methods of selecting the Contractor

### i. Competitively Tendered Contracts

-bids called upon from all willing contractors to select the most responsive bid for award of contract.

-very applicable for work under contract that can be clearly identified and quantified.

### ii. Negotiated Contracts

-selected contractors are negotiated by owner to reach upon a common satisfactory level of agreement.

# **Types of contract based on Responsibilities allocated**

20

There are a number of classifications under this method, the principal ones being:

- Conventional/ Traditional Approach
- Owner-Builder Approach
- Design–Build or Design- Manage (Turn Key)
- Build-Own-Operate-Transfer (BOOT)
- Construction Management Contract
- EPC Contract

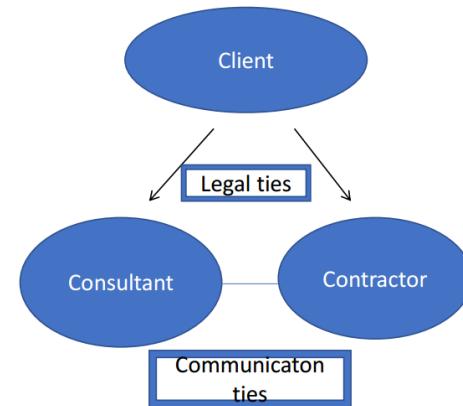
# Traditional Approach

21

- A traditional procurement approach may be adopted where the clients design team is appointed to prepare a detail engineering design, cost-estimates and specifications before the choice of contractor is considered.
- The owner employs a designer who first prepares the plans and specifications, then exercises some degree of inspection, monitoring or control during construction.
- Construction itself is the responsibility of single general contractor under contract to the owner.
  - The design is complete before the tender stage (Price certainty)
  - The designer understands how the construction will be Undertaken (build ability)
  - The design does not change substantially during Construction (avoiding delay and disruption)

Types of contracts:

Lump sum contracts, unit-price contracts , negotiated cost plus fee contracts can be adopted under traditional approach.



# 1. Traditional Approach

22

- a. Unit rate contract:** in making payment for the work done pursuant to his contract, payment shall be made of the amount to be found out from computing the quantity of construction work as ascertained from measurement of construction site by per unit rate.
- b. Lump sum contract:** with this kind of contract the engineer or contractor agrees to do prescribed project for a fixed price.
- c. Cost plus fee contract**

## 2. Owner builder approach

23

- In this approach, owners perform both their own design work and some or all of the actual construction with their own forces.
- This approach is often referred to as “force account”.
- Owner may utilize, while retaining many of the management and conceptual design responsibilities themselves, consultants for some or all of the detail design and can depend upon construction contractor for the actual hiring and supervision of the labor.

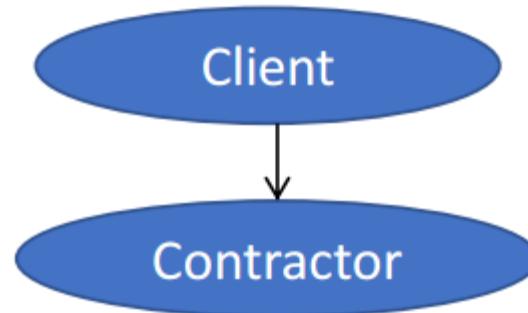
### 3. Design and build contract/ Turn key contract

24

**Design and build contract/ Turn key contract** may be concluded in order to have a design and construction of a work carried out by the same construction entrepreneur.

A turnkey contract is a business arrangement in which a project is delivered in a completed state.

- Rather than contracting with an owner to develop a project in stages, the developer is hired to finish the entire project without owner input.
- In a turnkey contract, the owner is generally left out of the building process entirely as the developer handles all decisions and problems related to construction.



# 4. BOOT

25

- A build-own-operate-transfer (BOOT) project, sometimes referred to as a **Concession Contract** may be defined as:
  - “A project based on the granting of a concession by a principal, usually a government, to a promoter, sometimes known as the concessionaire, who is responsible for the construction, financing, operation and maintenance of a facility over the period of the concession before finally transferring the facility, at no cost to the principal, as a fully operational facility.”  
(Smith and Merna, 1992)
  - The major components of a BOOT Project include:

**Build:** design, manage, project implementation, procurement, construct and finance

**Own:** own the asset for the concession period and the license for the equipment used.

**Operate:** manage and operate plant, carryout maintenance, deliver product or service and receive off take Payments.

**Transfer:** handover plant in operating condition at the end of the concession period.

# BOOT VS Turnkey

26

- BOOT projects are contractor financed turnkey contracts.
- BOOT project strategies grew out of turnkey contracting.
- In conventional turnkey contracts, governments have attempted to shift the risk for the project construction to the private sector while still bearing the risk of financing and operating the project. In a concession project i.e. BOOT project, the major risks of finance and operation, however, borne by the promoter.
- In turnkey contracts, feasibility studies are often carried out by the principal while in BOOT project, the promoter will be responsible for feasibility studies.
- Commercialization of a turnkey contract is normally the responsibility of the principal, who will often pay the contractor a mobilization fee and monthly payments for the work carried out. In BOOT projects, the promoter will carry out commercialization.
- In turnkey contracts, operation of the facility is carried out by the principal after one or two years of commissioning while in BOOT projects, the promoter will operate the facility over the concession period before finally transferring the facility to the principal.

# EPC Contract

27

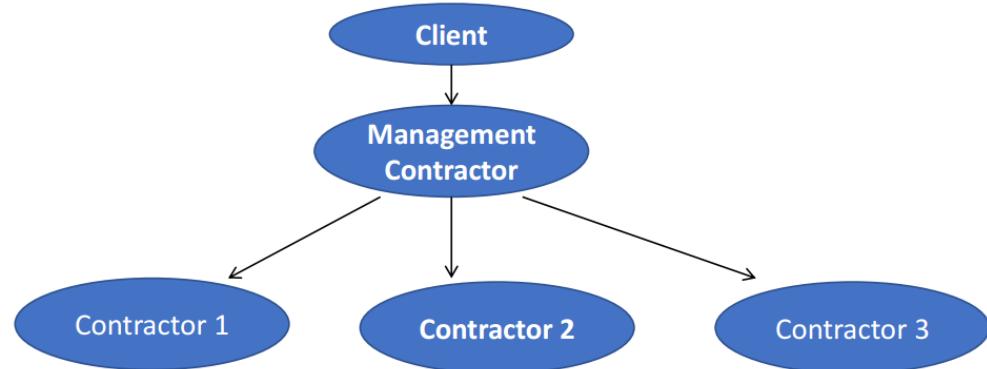
- Engineering, Procurement and Construction Contract
- Contractor Design the project, procure all the equipments and materials necessary, and construct to deliver a functioning facility or assets to the clients.
- Commonly known as LumpSum TurnKey Contract
- Risk of schedule and budget on EPC Contractor

# Management Contracts

29

In management type contract, one firm is retained to co-ordinate all activities from concept design through acceptance of the facility. The firm represents the owner in all *construction management* activities.

Construction management is defined as- “ that group of management activities related to a construction program, carried out during the pre-design, design, and construction phases, that contributes to the control of time and cost in the construction of a new facility. This approach unites a three party team consisting of owner, designer and CM in a non- adversary relationship.



# 8.Significance of contract

30

- i. To make agreements legally enforceable
- ii. To record the terms of agreement
- iii. To specify what the contractor must do and what the owner must pay
- iv. To specify what will be done if either party fails to perform
- v. To specify quantity and quality to be done
- vi. To specify time frame within which the work to be completed and payment to be made.
- vii. To specify means methods, terms and time of payment

## 8.Significance of contract...

31

- viii. To identify the parties to the agreement
- ix. To identify the official agents or representatives of parties to the agreement and define their authorities
- x. To set up in advance the courses of action that will be taken in different possible situations
- xi. To define words and establish common meanings.
- xii. To specify what is and what is not included in the contract

## 8.Significance of contract...

32

- xiii.To specify how the contract will be terminated
- xiv.To specify the responsibilities of the parties not just to each other but to third party such as government, community, in which the work to be done, workers, subcontractor, material supplied, unions.



# **METHODS OF WORK EXECUTION/CONTRACTING**

# Upto 11<sup>th</sup> Amendment

34

No	Method of Procurement	Contract Size	Contractor
1	Force Account	Up to 1,00,000	none
2	Direct procurement	Up to 10 L ( Goods & Services ) 5 L( Consulting)	Standing List
3	Sealed Quotation	Up to 20 L	All
4	NCB/LCB	20 L – 3 Arab	All
5	ICB	➤ > 3 Arab ➤ Lesser than 3 Arab if NCB fail to do so	International , JV National or International
6	User Committee	Upto 5 Crore ( By Competition for Non Technical )	
7	Other Special types of Procurement	Depends on Circumstances	

Changes can occur  
Follow Regulation

# **1.National Competitive Bidding (NCB)**

35

- **National Competitive Bidding (NCB):** NCB is sometime called as local competitive bidding . In this bidding all the competitive bidders are invited to participate in bidding.
- This process is adopted if the amount of job is more than 2 million and less than 2 billion.
- For NCB tender notice is to be published in national news paper. Such tender notice shall be published in the project office, District Administration office, DDC, land revenue office, treasury office. Period given will be minimum 30 days.

## **2. International Competitive Bidding (ICB):**

36

- If the amount of work is big and national/ domestic contractors can not perform the job eligible bidders are invited from all over the world. Such type of bidding are called ICB.
- In general if the amount of work is greater than 3 billions( for procurement of goods) and greater than 3 billions (for procurement of works) ICB process is followed.
- In this process tender notice is provided to Diplomatic missions working in the country.

- In ICB foreign bidder shall furnish information in the bid.
  1. Whether the bidder is having the local agent or not.
  2. Name and address of the agent if any
  3. Types of service being provided by the agent
  4. Currency and procedure of payment to the agent
  5. Other agent with the agent if any.
  6. Preference can be given upto 5% if Nepali are involved

### 3. Sealed quotation

38

- Goods and other services valuing up to 20 lakhs rupees may be procured by inviting a sealed quotation. (Source: PPA 2063)
- A form of sealed quotation clearly stating therein the specifications, quality, quantity terms and conditions of supply of goods, construction work or other services to be procured shall have to be prepared.
- In inviting a sealed quotation, a notice shall be published in a national level newspaper by giving a period at least of fifteen days.
- The lowest evaluated sealed quotation falling within the cost estimate after fulfilling the terms and conditions shall have to be approved.

# 4. Direct procurement

39

- Expendable or capital goods or consultancy services and construction work valuing up to 10 lakhs may be directly procured. Under DP, a firm/person can only execute one construction work in that fiscal year.

Direct procurement can be done in following conditions:

1. If only one supplier or construction entrepreneur or consultant or service provider has the technical efficiency or capacity to fulfill the procurement requirement.
2. If only one supplier has the exclusive right to supply the goods to be procured and no other appropriate alternative is available.
3. If the services of a particular consultant with his unique qualifications is immediately needed for the concerned work or where the service of the same consultant is indispensable.

# Direct procurement contd..

4

१२. मूल नियमावलीको नियम ८५ मा संशोधन : मूल नियमावलीको नियम ८५ को,-

(१) उपनियम (१) को,-

(क) खण्ड (क) को सट्टा देहायको खण्ड (क) राखिएको छः-

"(क) दश लाख रुपैयाँसम्मको लागत अनुमान भएको निर्माण कार्य वा मालसामान,"

(ख) खण्ड (क) पछि देहायको खण्ड (क१) थपिएको छः-

"(क१) पाँच लाख रुपैयाँसम्मको लागत अनुमान भएको परामर्श सेवा,"

## 5. Works through users committee

- Cost estimate up to 500 lakhs rupees may be carried out or obtained from users committee or beneficiary community.
- If the main objective of the project is to create employment and to have the beneficiary community involved.

"९७क. लाभग्राही समुदायबाट काम गराउन सकिने: (१) यस नियमावलीमा अन्यत्र जुनसुकै कुरा लेखिएको भए तापनि पाँच करोड रुपैयाँसम्म लागत अनुमान भएको देहाय बमोजिमको निर्माण कार्य लाभग्राही समुदायबीच प्रतिस्पर्धा गराई गराउन सकिनेछः-

(क) जटिल प्राविधिक क्षमता आवश्यक नपर्ने,

(२) यस नियममा अन्यत्र जुनसुकै कुरा लेखिएको भए तापनि देहायको निर्माण कार्य लाभग्राही समुदायबाट गराउन सकिने छैनः-

- (क) एक आपसमा अन्तरसम्बन्धित भई एउटै प्याकेजमा काम गर्नु पर्ने प्रकृतिको निर्माण कार्यलाई खण्डीकरण गरी अलग अलग प्याकेज बनाईएको,
- (ख) लागत अनुमान अनुसार श्रमिकको लागत भार पचास प्रतिशत भन्दा कम भएको,
- (ग) लागत अनुमान अनुसार मेसिन औजारको लागत भार बीस प्रतिशत भन्दा बढी भएको ।

## **6. Works may be done by force account (Amanat)**

42

- Force account means any construction work to be carried out by public entity(ministry, department of GON or other government offices) itself.
- Minor tasks such as repair & maintenance, regular work of washing/cleaning jobs can be implemented.
- Work may be broken into piece of not exceeding 1 lakhs rupees carried out through negotiations or be awarded on wage basis making available necessary construction materials.

# TENDERING (BIDDING)



Government of Nepal (GoN)

**Ministry of Physical Infrastructure and Transport**

**Department of Railways**

**Rail, Metrorail and Monorail Development Project**

## CANCELLATION OF BIDS

**Date of publication: 2077/05/23 (Sept 8, 2020)**

The bids published on Annapurna National daily dated 2077/03/14 under Notice No. 02/076/077 and on Nagarik National daily dated 2077/03/17 under Notice No. 03/076/077 have been cancelled as per Clause 37.1 of Section I: Instruction to Bidders of the bidding document.

**Director General**

# TENDERING

44

- Tender is an offer in writing by the tenderer (the person who offer the tender) to execute some specifies work or to supply some specified some goods at certain rate/ amount within a fixed time period under certain conditions of agreement.
- This is the first step in the formulation of contract.

# Purpose of bidding

45

The following principles is observed in bidding:

1. Funds provided for the project implementation shall be used only for intended purpose.
2. Economy and efficiency shall be observed – best value of money.
3. All eligible bidders shall be given equal opportunity to compete.
4. Development of domestic contracting and manufacturing industries shall be encouraged.
5. There shall be transparency in all stage for the procurement process.

# Summary

46

- **Bid Documents Preparation**
- **Invitation to Tender/Bid**
- **Sales and Registration of Bid Documents**
- **Bid Submission ( Earnest money by all bidder)**
- **Bid Opening**
- **Bid Evaluation**
- **Letter of Intent**
- **Letter of Acceptance ( Performance Security by successful bidder)**
- **Contract**
- **Notice to proceed – after which the actual work start**

# TENDER NOTICE

47

- A tender notice is the information inviting bids from competent and capable contractors and forms a part of tender document. It should be widely published in the national daily news paper.
- Detail information in tender notice:
  1. Name of the authority publishing the notice
  2. First date of publication

# TENDER NOTICE

48

3. Brief description of the job.
4. Date time and place where and when the tender document is available and to be submitted.
5. Cost of the tender document
6. Cost estimate (optional) up to 2 crore work
7. Date, time and place of opening bid
8. Earnest money and security deposit amount
9. Expected date of acceptance of successful bids etc.

# **Preparation before inviting Tenders (Before tender notice publication)**

49

- i. **Project preparation:** The scheme of the project is prepared with the detail feasibility study/ DETAIL DESIGN.
- ii. **Estimating of quantities:** Quantities of all the activities involved in the project is estimated.
- iii. **Cost estimate:** Tentative cost estimate is prepared with the prevailing rates of the items involved in the works.
- iv. **Approval of estimate:** The cost estimate is approved by the concerned authority.

# **Preparation before inviting Tenders...**

50

- iv. **Resource Planning:** The owner allocates all the necessary resources basically the budget is arranged for the construction at different stages.
- v. **Tender document preparation:** All the document regarding the tender is prepared and approved by the concerned authority.
- vi. **Tender invitation:** A notice is published for inviting tenders.

# Earnest money (Bid Security)

51

- **Earnest money:** It is the amount of money deposited while bidding a tender as a guarantee of the party willingness of carrying out the work awarded to him. Its amount generally from 2% to 3% .
- Double the cost for a foreign party.
- This fund is refund to unsuccessful bidder. If successful bidder fails to carry on the contract, this amount is forfeited.

रकम नगदै वा \*वाणिज्य बैंक वा वित्तीय संस्थाले जारी गरेको सो रकम बराबरको बोलपत्र जमानत हुनु पर्नेछ ।

# Performance Security

52

- **Security Deposit:** It is the amount of money deposited by a successful bidder as a security for satisfactory performance. Within Fifteen (15) days of the receipt of Letter of Acceptance from the Employer, the successful Bidder shall furnish the performance security as under mentioned from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in
  - i) If bid price of the bidder selected for acceptance is up to 15 (fifteen) percent below the approved cost estimate, the performance security amount shall be 5 (five) percent of the bid price.
  - ii) For the bid price of the bidder selected for acceptance is more than 15 (fifteen) percent below of the cost estimate, the performance security amount shall be determined as follows:
    - **Performance Security Amount = [(0.85 x Cost Estimate –Bid Price) x 0.5] + 5% of Bid Price.**
- It included security deposit. This is refunded after completion of defect liability period (DLP) i.e. Maintenance period. **DLP generally taken as 365 days**
- If the work is unsatisfactory or contractor fails to perform his duty this fund is forfeited.
- Double the amount for foreign contractor.

MBNL issues, amends, extends, and liquidates guarantees, all based on customer's requests.

We issue every type of guarantees as per your requirements. The most commonly used guarantees are as under:

### **1. Bid Bond (tender bond)**

Its purpose is to secure any claims by the party inviting the tender on the tenderer in the event of withdrawal of the bid before its expiry date or if the bid is modified unilaterally. It is also used if the tender, upon being awarded the contract, refuses to sign the contract or provide further guarantees on request.

For issuance of bid bonds, customers need credit line from the bank.

### **2. Performance Bond Guarantee**

As the name implies, performance bonds are a means of guaranteeing the performance of a company to live up to what it is promising to do. This also applies to any subcontractors or material suppliers that company may employ. All parties must adhere to certain cost, time, and quality criteria based on what they've been contracted to produce.

This guarantee is asked for by the beneficiary once it has elected a party to perform a certain task. In case the terms and conditions are violated by the customer, the beneficiary will invoke the guarantee and will obtain compensation for his loss.

### **3. Advance Payment Guarantees**

Some contracts require that some percentage of Advance payment be made against the contract awarded. In such cases the Buyer or the employer may seek an advance payment guarantee from the bank with an undertaking to pay the guaranteed sum to the buyer if the contractor has failed to comply with the terms and conditions of the contract.

### **4. Counter Guarantee**

(४) विदेशी बैंकले जारी गरेको बोलपत्र जमानत नेपालभित्रको वाणिज्य बैंकले प्रति-प्रत्याभूति (काउन्टर ग्यारेन्टी) गरेको हुनु पर्नेछ ।

For foreign bidders, who intend to participate in tenders or intend to enter into a contract in a project in Nepal must submit a guarantee acceptable to the beneficiary. In that case, the foreign party obtains a guarantee from the bank (acceptable to MBNL) in favor of MBNL, which in turn will issue a guarantee on behalf of the foreign party.

Such guarantees issued on the backing or against the security of a foreign bank acceptable to local banks are called Counter Guarantee. A counter guarantee may either be a Bid Bond, Performance bond or an Advance Payment Guarantee.

# Bidding Documents

54

6.1 The Bidding Document consist of Parts I, II, and III, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8.

- PART I Bidding Procedures

- Section I Instructions to Bidders (ITB)

- Section II Bid Data Sheet (BDS)

- Section III Evaluation and Qualification Criteria (EQC)

- Section IV Bidding Forms (BDF)

- PART II Requirements

- Section V Works Requirements (WRQ)

- Section VI Bill of Quantities (BOQ)

- PART III Conditions of Contract and Contract Forms

- Section VII General Conditions of Contract (GCC)

- Section VIII Special Conditions of Contract (SCC)

- Section IX Contract Forms (COF)

# Condition of contact

55

- Whatever agreement is reached between different parties, it is followed by certain terms and references that bind all the parties reaching the agreement .
- This helps for the easy and smooth functioning of work and minimized disputes. These terms and reference or the condition are called the condition of contracts.
- These may be of two parts.
  - i. General condition of contract
  - ii. Special provision of contract

# General condition of contract

- i. Definition and interpretations
- ii. Security deposits
- iii. Time for completion and delays
- iv. Payment to contractor
- v. Alteration, additions and omissions
- vi. Execution of work and measurement of completed work
- vii. Defect and maintenance of defect

## Condition of contract cont.....

57

- viii. Subletting(to lease or rent all or part of a property)
- ix. Breach of contract
- x. Arbitration – settlement of disputes
- xi. Suspension of work
- xii. General obligation of contractor
- xiii. Labor and labor welfare
- xiv. Changes in cost and legislative
- xv. Materials and workmanship etc

# Contract Document

58

- Contractors' bids forms are offers to construct a facility or supply of materials in exchange of payment of fixed or variable amount of money,
- All the bid documents including specifications, drawings, etc are reference part of bid submission.
- The bids received are considered by the owners including a review by consultant/ lawyer and then decides to accept one (or more) of them.
- This offer and acceptance form the basis of the agreement (contract) between owner and contractor

# Contract document

59

- You are free to make any bargain you wish but when you have made your bargain then carry it out or compensate the other party for the bargain he has lost.
- If there is a dispute your contract do not mean what you think they mean, they mean what a judge would think that they mean. Hence the standard documents are followed.
- The document that describes in detail the scope of the agreement and responsibilities of the parties of it is called “**Contract document**”.

# List of contract document Priority of contract document

60

- The document that lead towards a contract are referred to as contract documents and are mutually explanatory to one another.
- All the documents must be accurately cross referred according to the following serial.
  - i. The contract agreement
  - ii. The letter of acceptance
  - iii. The tender

# List of contract document Priority of contract document....

61

## iv. Conditions of contract

- Special condition of contract/ condition of particular application
- General condition of contract

## v. The specifications

## vi. The drawings

## vii. Priced bill of quantities

## viii. Addenda (It clarifies corrects and provide additional information)

# Rules of contract Interpretation

62

- i. **Self explanatory:** Intention of the parties from the contract words themselves.
- ii. **Court interpret in case of ambiguity:** If the words in the contract are ambiguity the court looks at outside to help interpret the parties intent.

# Rules of contract Interpretation....

63

- iii. “**The contra proferentem rule** ” rule of interpretation: some time word or term to be interpreted is capable of two different meaning with one favoring the party that did not draft the contract document the ambiguity will be resolved in favor of party not responsible for drafting the contract. **The contra proferentem rule** is a legal doctrine in contract law which states that any clause considered to be ambiguous should be interpreted against the interests of the party that created, introduced, or requested that a clause be included.
  
- iv. **Contractual exclusion clauses:** the clauses that take away or limits the rights of a party that may be expected to have under a contract.

# Pre qualification(PQ)

64

- It is a kind of short listing of eligible bidder and avoids crowding of bidder.
- It ensure that the invitation of bid is extended only to those prospective bidders who have adequate capacity and resources to perform the particular contract satisfactorily taking into account their:
  - i. Experience and past performance on similar contracts.
  - ii. Capabilities with respect to personnel, equipments, and construction and manufacturing facilities

# PQ ...

65

- iii. Financial position
- iv. Litigation history
- v. PQ is done when amount of the work is greater than 20 Million rupees.

[https://www.adb.org/business/how-  
to/what-bidding-procedures-are-used-  
adb-financed-projects](https://www.adb.org/business/how-to/what-bidding-procedures-are-used-adb-financed-projects)

# Post qualification:

66

- No prequalification process is adopted. All the eligible bidders participate in the bidding process. It may include single envelop system (Financial proposal only) or double envelop system ( Financial proposal in a envelop and technical proposal in another envelop). In double envelop system successful bidders are selected by adopting one of the three following methods:
  - i. Short list from technical proposal and select the lowest bidder to award the contact. ( We follow this in Nepal)

# Post qualification...

67

- ii. Select the lowest bidder first and check the technical proposal. If technical proposal is ok select the party. If technical proposal is not ok select lowest bidder and check the technical proposal.
  - iii. Give weight to both technical proposal as well as financial proposal. Select the bidder getting highest mark.
- First two methods should give the same result.

Date of Authentication and Publication

14 January 2007 (30 Poush 2063)

Amending Acts:

1.	The Act Amending Some Nepal Acts, 2016 (2072)	25 February 2016 (2072.11.13)
2.	The Public Procurement (First Amendment) Act, 2016 (2073)	14 July 2016 (2073.3.30)
3.	The Act Amending Some Nepal Acts for Making Compatible with the Constitution of Nepal, 2019 (2075)	13 March 2019 (2075.11.29)

Act Number 36 of the year 2006/2007 (2063)

52A.<sup>49</sup> Provision relating to advance: (1) The public entity may, following the procurement contract, pay advance not exceeding twenty percent of the amount of the procurement contract by taking an advance bank guarantee from the supplier, construction entrepreneur or service provider.

(2) In making payment of advance pursuant to sub-section (1), the amount not exceeding half the amount of the approved advance may be paid for the first time and the remaining amount may be paid on the basis of the work progress.

Date of publication in the Nepal Gazette

2064.5.3 (20 August 2007)

Amendment

नेपाल सरकार

प्रधानमन्त्री तथा मन्त्रिपरिषद्को कार्यालयको  
सूचना

सार्वजनिक खरिद (एघारौ संशोधन) नियमावली, २०७८

सार्वजनिक खरिद नियमावली, २०६४ लाई संशोधन गर्ने  
वाञ्छनीय भएकोले,

सार्वजनिक खरिद ऐन, २०६३ को दफा ७४ ले दिएको  
अधिकार प्रयोग गरी नेपाल सरकारले देहायका नियमहरू बनाएको छ।

[https://ppmo.gov.np/act  
s and regulations](https://ppmo.gov.np/act_s_and_regulations) for  
latest amendments

<sup>49</sup> Inserted by the First Amendment.

# Some other Terms

69

## **Mobilization Fund : up to 20% ( Half in first installment and half in 2<sup>nd</sup> Installment)**

The Advance Payments shall be: *[Insert amount]* and shall be paid in two equal installments and to the Contractor.*[specify how and when the installments will be paid] (Yesto hunxa Contract ma.)*

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum..... name of the currency and amount in figures\*...*(.... amount in words ....)* is to be made **against an advance payment guarantee.**

This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that eighty (80) percent of the Contract Price has been certified for payment, or on the ..... day of .....\*\*, whichever is earlier (\*\*Thirty days after the expected completion date)

## **Retention Money**

5 % of total billing amount is retained as retention money. The payment for the service or works or goods that is withheld for the completion of specified conditions.

## **Price Escalation**

Construction Contract having longer duration (> 12 months or multi year contract) should have price escalation clause

Should not exceed 25% of original price

- The Price Adjustment amount shall be limited to a maximum of:
- : *[Insert percent, normally 25 %]* percentage of the initial Contract Amount.

# THE PROCUREMENT OF

Sitapur Subarnakhal Netapokhara Road ( Yagya Min Smriti Marg)

# THE PROCUREMENT OF

Construction of Peepal Chowk dekhi Saraswati Adharvut Vidhyalaya hudai Wada No - 06 Simana Samma Sadak Kalopatre

## National Competitive Bidding (NCB)

IFB No: 45-SM/W25/NCB/2078/079

Contract Identification No. : 45-SM/W25/NCB/2078/079

70

## National Competitive Bidding (NCB)

IFB No: SUNMUN/ROAD/078/79-05

Contract Identification No. : SUNMUN/ROAD/078/79-05

In next page



Shitangana Municipality

Issued on: 16-06-2022 10:00

Sunawarshi Municipality, Morang

Issued on: 17-06-2022 10:00

GCC 57.1	The Advance Payments shall be 20.00 % and shall be paid in two equal installments and to the Contractor.		
	Installment	Percentage	Requirement
	Advance	10.0	Letter of Acceptance
	Mobilization	10.0	Initiation of work
GCC 57.3	Deductions from Payment Certificates will commence in the first certificate in which the value of works executed exceeds 30% of the Contract Price. Deduction will be at the rate of 30% of the respective Monthly Interim Payment Certificate until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the end of 80% of the approved contract price.		

# IN Another Contract

71

GCC 53.7	The Price Adjustment amount shall be limited to a maximum 25 % of the initial Contract Amount		
GCC 54.1	The proportion of payments retained is: 5 %		
GCC 55.1	The liquidated damages for the whole of the Works are 0.05 % of the final Contract Price per day. The maximum amount of liquidated damages for the whole of the Works is 10 % of the final Contract Price.		
GCC 56.1	The Bonus for the whole of the Works is 0 % per day. The maximum amount of Bonus for the whole of the Works is 0 % of the Contract Price.		
GCC 57.1	The Advance Payments shall be 10.00 % and shall be paid in two equal installments and to the Contractor.		
	Installment	Percentage	Requirement
	1st	5.0	5% of initial contract price , excluding ps, Days work and VAT
	2nd	5.0	5% of initial contract price , excluding ps, Days work and VAT
GCC 57.3	Deductions from Payment Certificates will commence in the first certificate in which the value of works executed exceeds 30% of the Contract Price. Deduction will be at the rate of 30% of the respective Monthly Interim Payment Certificate until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the end of 80% of the approved contract price.		

# Some other Terms

72

- **Interim Payment Certificates**
  - Sums paid on account of whatever the contractor might eventually be entitled to recover from the employer.
- **Final Payment Certificate**
  - Last Payment
- **Taking over certificate**
  - Handing over the works to the clients
  - DLP starts from the date of issuing TOC.

४९. बोलपत्रको सूचनामा लागत अनुमान खुलाउनु पर्ने: <sup>®</sup>दुई करोड रुपैयाँसम्मको लागत अनुमान भएको निर्माण कार्यको बोलपत्र आहानको सूचनामा लागत अनुमान रकम खुलाउनु पर्नेछ ।

- Bid Validity period
  - <100 million -90 days
  - >100 million -120 days

## For Complaining

1% of bidding amount

10 % of bid security in case of technical proposal

- VAT Bill Needed > 20000
- Upto rate analysis, no VAT amount is calculated.

१७. नेपालमा उत्पादित मालसामान खरिद गर्नु पर्ने: सार्वजनिक निकायले यस नियमावलीमा उल्लिखित कुनै विधि छनौट गरी खरिद गर्दा विदेशी मालसामान भन्दा नेपालमा उत्पादित मालसामान <sup>पन्थ</sup>प्रतिशतसम्म महंगो भए तापनि नेपाली मालसामान नै खरिद गर्नु पर्नेछ ।

# Estimation Approval Limit

74

## □ In Construction Works

- (क) पाँच करोड रुपैयाँसम्मको लागत अनुमान राजपत्राङ्कित तृतीय श्रेणीको कार्यालय प्रमुखबाट,
- (ख) दश करोड रुपैयाँसम्मको लागत अनुमान राजपत्राङ्कित द्वितीय श्रेणीको कार्यालय प्रमुखबाट,
- (ग) बीस करोड रुपैयाँसम्मको लागत अनुमान राजपत्राङ्कित प्रथम श्रेणीको कार्यालय प्रमुखबाट, र
- (घ) बीस करोड रुपैयाँभन्दा बढी रकमको लागत अनुमान विभागीय प्रमुखबाट।

# Estimation Approval Limit

75

## □ In Consultancy Works

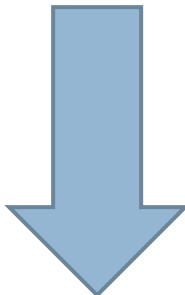
- (क) बीस लाख रुपैयाँसम्मको लागत अनुमान राजपत्राङ्कित तृतीय श्रेणीको कार्यालय प्रमुखबाट,
- (ख) पचास लाख रुपैयाँसम्मको लागत अनुमान राजपत्राङ्कित द्वितीय श्रेणीको कार्यालय प्रमुखबाट,
- (ग) एक करोड रुपैयाँसम्मको लागत अनुमान राजपत्राङ्कित प्रथम श्रेणीको कार्यालय प्रमुखबाट, र
- (घ) एक करोड रुपैयाँभन्दा बढी रकमको लागत अनुमान विभागीय प्रमुखबाट। ”

३१ड. स्वदेशी बोलपत्रदाताहरू बीच मात्र प्रतिस्पर्धा गराई खरिद गरिने: (१) ऐनको दफा ११ को उपदफा (२) बमोजिम एक चरणको खुला बोलपत्र आहान गर्दा दुई करोड रुपैयाँभन्दा बढी र \*एक अर्ब रुपैयाँसम्मको लागत अनुमान भएको निर्माण कार्यको खरिदमा ऐनको दफा १५ को अवस्थामा बाहेक राष्ट्रियस्तरको खुला बोलपत्रको माध्यमद्वारा स्वदेशी बोलपत्रदाताहरू बीच मात्र प्रतिस्पर्धा गराई खरिद गर्नु पर्नेछ ।

(२) उपनियम (१) बमोजिम खरिद गर्नु पर्दा प्राविधिक र आर्थिक प्रस्ताव दुई अलग अलग खाममा राखी सिलबन्दी गरी प्रत्येक खामको बाहिर कुन प्रस्ताव हो स्पष्ट

- ♦ चौथो संशोधनद्वारा थप ।
- ♦ आठौं संशोधनद्वारा संशोधित ।

By 11<sup>th</sup> amendment  
NCB upto 3 Arab



मूल नियमावलीको नियम ३१ड. मा संशोधन : मूल नियमावलीको नियम ३१ड. को उपनियम (१) मा रहेका “एक अर्ब रुपैयाँ” भन्ने शब्दहरूको सङ्ग “तीन अर्ब रुपैयाँ” भन्ने शब्दहरू राखिएका छन् ।

"३१च. स्वदेशी बोलपत्रदातालाई प्राथमिकता दिने:

(१) अन्तर्राष्ट्रियस्तरको बोलपत्रमा एकल रूपमा वा स्वदेशी फर्म, संस्था वा कम्पनीसँग संयुक्त उपक्रम गरी सहभागी हुने स्वदेशी फर्म, संस्था वा कम्पनीलाई तथा स्वदेशी फर्म, संस्था वा कम्पनीको हिस्सा कम्तीमा पच्चीस प्रतिशत हुने गरी संयुक्त उपक्रम गरी विदेशी फर्म, संस्था वा कम्पनी सहभागी भएकोमा त्यसरी संयुक्त उपक्रममा सहभागी हुने फर्म, संस्था वा कम्पनीलाई प्राथमिकता (डोमेस्टिक प्रिफेरेन्स) दिनु पर्नेछ ।

(२) उपनियम (१) बमोजिम प्राथमिकता दिँदा सबैभन्दा कम कबुल गर्ने विदेशी फर्म, संस्था वा कम्पनीले कबोल गरेको बोल अङ्ग रकमको पाँच प्रतिशतसम्म बढी बोल अङ्ग भएको स्वदेशी फर्म, संस्था वा कम्पनीको प्रस्तावलाई स्वीकृत गर्न सकिनेछ ।

25 % minimum  
share of domestic  
company requied  
from 3 -10 arab

5 % domestic  
prefernce

४) उपनियम (१), (२) र (३) मा जुनसुकै कुरा लेखिएको भए तापनि दश अर्ब रुपैयाँसम्मको लागत अनुमान भएको निर्माण कार्य सम्बन्धी अन्तर्राष्ट्रियस्तरको बोलपत्रमा सहभागी हुन चाहने विदेशी फर्म, संस्था वा कम्पनीले स्वदेशी फर्म, संस्था वा कम्पनीसँग संयुक्त उपक्रम गरी सहभागी हुनु पर्नेछ ।"

## □ PQ Documents price

- (क) दुई करोड रूपैयाँभन्दा माथि दश करोड रूपैयाँसम्मको लागि पाँच हजार रूपैयाँ,
- (ख) दश करोड रूपैयाँभन्दा माथि पच्चीस करोड रूपैयाँसम्मको लागि दश हजार रूपैयाँ,
- (ग) पच्चीस करोड रूपैयाँभन्दा माथि जतिसुकै रकमका लागि पन्ध हजार रूपैयाँ ।

मूल नियमावलीको नियम ३५ मा संशोधन : मूल नियमावलीको नियम ३५ को उपनियम (१) पछि देहायको उपनियम (१क) थपिएको छ:-

“(१क) उपनियम (१) बमोजिम योग्यताका सबै आधार पूरा गर्ने पूर्व योग्यताका आवेदक छनौट गर्दा कम्तीमा तीनवटा योग्य आवेदक छनौट हुन नसकेमा सार्वजनिक निकायले पूर्व निर्धारित पूर्व योग्यताको आधार पुनरावलोकन गरी पुनः सूचना प्रकाशन गरी योग्य आवेदक छनौट गर्नु पर्नेछ।”

**बोलपत्र सम्बन्धी कागजातको दस्तुरः** (१) बोलपत्र सम्बन्धी कागजात खरिद गर्न चाहने इच्छुक व्यक्ति, फर्म, संस्था वा कम्पनीले सम्बन्धित सार्वजनिक निकायको प्रमुख वा निजले तोकेको कर्मचारीको दस्तखत र कार्यालयको छाप लागेको बोलपत्र सम्बन्धी कागजात सो निकाय वा सो निकायले तोकेको दुई वा दुईभन्दा बढी अन्य निकायबाट देहाय बमोजिमको दस्तुर तिरी लिनु पर्नेछः-

- ①(क) बीस लाख रूपैयाँभन्दा माथि दुई करोड रूपैयाँसम्मको लागि तीन हजार रूपैयाँ,
- ①(ख) दुई करोड रूपैयाँभन्दा माथि दश करोड रूपैयाँसम्मको लागि पाँच हजार रूपैयाँ,
- ①(ग) दश करोड रूपैयाँभन्दा माथि पच्चीस करोड रूपैयाँसम्मको लागि दश हजार रूपैयाँ,
- ①(घ) पच्चीस करोड रूपैयाँभन्दा माथि जतिसुकै रकमका लागि बीस हजार रूपैयाँ ।

(४) सिलबन्दी दरभाउपत्र पेश गर्न इच्छुक व्यक्ति, फर्म, संस्था वा कम्पनीले एक हजार रुपैयाँ तिरी सम्बन्धित सार्वजनिक निकायबाट दरभाउपत्रको फाराम खरिद गरी सोही फाराममा सिलबन्दी दरभाउपत्र पेश गर्नु पर्नेछ ।

Sealed  
Quotation  
document  
fee: 1000

# PRE-BID Meeting

80

- At least 15 days Ahead For ICB & 10 days Ahead for NCB in first Bid notice

५२. **बोलपत्र पेश गर्नु पूर्वको बैठक:** (१) सार्वजनिक निकायले बोलपत्रदातालाई बोलपत्र सम्बन्धी कागजात, प्राविधिक स्पेसिफिकेशन, निर्माणस्थल वा अन्य यस्तै कुरा सम्बन्धी जानकारी गराउन बोलपत्र पेश गर्ने अन्तिम दिनभन्दा राष्ट्रियस्तरको बोलपत्र आहानको सूचनाको हकमा कम्तीमा दश दिन र अन्तर्राष्ट्रियस्तरको बोलपत्र आहानको सूचनाको हकमा कम्तीमा पन्थ दिन अगावै बोलपत्रदाताहरूको बैठकको आयोजना गर्न सक्नेछ ।
- २ तर ऐनको दफा १४ को उपदफा (४क) र (४ख) बमोजिम पुनःबोलपत्र आहानको सूचना गरिएको अवस्थामा बोलपत्र पेश गर्नु पूर्वको बैठक सञ्चालन भई नसकेको भए बोलपत्रदातालाई पुनःबोलपत्र सम्बन्धी कुराहरूको थप जानकारी दिन राष्ट्रियस्तरको बोलपत्रको हकमा कम्तीमा पाँच दिन र अन्तर्राष्ट्रियस्तरको बोलपत्रको हकमा कम्तीमा सात दिन अगावै त्यस्तो बैठकको आयोजना गर्न सकिनेछ ।
- (२) उपनियम (१) बमोजिमको बैठकमा बोलपत्रदाताले सार्वजनिक निकाय समक्ष खरिद कारबाही सम्बन्धी कुनै प्रश्न वा जिज्ञासा राख्न सक्नेछ र त्यस्तो निकायले प्रश्नकर्ताहरूको श्रोत उल्लेख नगरी सबै बोलपत्रदातालाई त्यस्तो प्रश्न वा जिज्ञासाको जवाफ र बैठकको माइन्यूट यथाशीघ्र उपलब्ध गराउनु पर्नेछ ।
- (३) उपनियम (१) बमोजिम भएको बैठकबाट बोलपत्र सम्बन्धी कागजातको कुनै प्राविधिक वा व्यापारिक पक्षमा हेरफेर गर्नु पर्ने देखिएमा सार्वजनिक निकायले सो

- (२) उपनियम (४घ) मा रहेका "सात गुणाले" भन्ने शब्दहरूको सदृश "पाँच गुणाले" भन्ने शब्दहरू राखिएका छन्।
- (३) उपनियम (४घ) पछि देहायको उपनियम (४घ१), (४घ२), (४घ३) र (४घ४) थपिएका छन्:-

"(४घ१) यस नियमावलीमा अन्यत्र जुनसुकै कुरा लेखिएको भए तापनि यो उपनियम प्रारम्भ भएपछि निर्माण कार्यको लागि आहान हुने खुल्ला बोलपत्र प्रकृयामा निर्माण व्यवसायीले एकल वा संयुक्त उपक्रमको रूपमा बढीमा पाँच वटा बोलपत्रको प्रकृयामा भाग लिन सक्नेछ।

(४घ२) उपनियम (४घ१) मा जुनसुकै कुरा लेखिएको भए तापनि देहायको निर्माण कार्य सो उपनियमको प्रयोजनको लागि गणना गरिने छैन:-

- (क) यो उपनियम प्रारम्भ हुनु अघि बोलपत्र आहान भएको वा खरिद समझौता भएको, वा
- (ख) यो उपनियम प्रारम्भ भए पछि बोलपत्र आहान भई खरिद समझौता भएकोमा नियम ११७ बमोजिमको कार्य स्वीकार प्रतिवेदन पेश भई स्वीकृत भएको।

(४घ३) यो उपनियम प्रारम्भ भए पछि आहान भएको बोलपत्र प्रकृयामा भाग लिँदा निर्माण व्यवसायीले

- Only the 5 times the turnover
- Turnover = **average of 3 max turnover out of the last 10 years**
- NO of contract limited to 5

■(४ग) बोलपत्रदाताले आफूले गरेको अधिकतम कारोबार भएका कुनै ती

आर्थिक वर्षको निर्माण कार्यको वार्षिक कारोबार रकमको औसत वार्षिक कारोबार (ट

पाँच वटा भन्दा बढी बोलपत्र प्रकृयामा भाग नलिएको स्वघोषणा गर्नु पर्नेछ र त्यसरी स्वघोषणा गरिएको विषयलाई सार्वजनिक निकायले बोलपत्र मूल्याङ्कन गर्दा नियम १४९ को उपनियम (६क) बमोजिमको अभिलेखसँग भिडाउनु पर्नेछ।

(४घ४) उपनियम (४घ१) मा जुनसुकै कुरा लेखिएको भए तापनि अन्तर्राष्ट्रियस्तरको बोलपत्रमा बढीमा पच्चीस प्रतिशत सम्मको साझेदारीमा संयुक्त उपक्रममा सहभागी हुने निर्माण व्यवसायीले एकल वा संयुक्त उपक्रमको रूपमा अन्तर्राष्ट्रिय स्तरको पाँच वटा भन्दा बढी बोलपत्रको प्रकृयामा समेत भाग लिन सक्नेछ।

तर त्यस्तो निर्माण व्यवसायीले यो उपनियम प्रारम्भ भए पछि आहान हुने एकै प्रकृतिको कामको लागि अन्तर्राष्ट्रिय स्तरको तीन वटा वा सो भन्दा बढी बोलपत्रको प्रकृयामा भाग लिई खरिद समझौता गरेको भएमा सो समेत पाँच वटा भन्दा बढी बोलपत्रको प्रकृयामा भाग लिन सक्ने छैन।"

# Performance security( Front loading)

- (क) निर्माण कार्यको कार्य योजना, कार्यसम्पादन तालिका र परिचालन समय बोलपत्र सम्बन्धी कागजातमा उल्लेख भए अनुसारको भए वा नभएको,
- (ख) बोलपत्रदाताले बिल अफ क्वान्टिटीमा संलग्न आइटमको लागि उल्लेख गरेको प्रति एकाइ दर विश्वसनीय भए वा नभएको,
- (ग) कबोल अङ्क देहायको कारणले असन्तुलित भए वा नभएको:-
- (१) खरिद सम्झौताको प्रारम्भिक चरणमा गर्नु पर्ने कामको आइटमको लागि बोलपत्रदाताले अस्वाभाविक उच्च दर उल्लेख गरेकोले, वा
- (२) बोलपत्रदाताले बिल अफ क्वान्टिटीको कुनै आइटममा न्यून अनुमान भएको भनी विश्वास गरेको आइटमको लागि निजले अस्वाभाविक उच्च दर उल्लेख गरेकोले ।

\*(घ) बोलपत्रदाताले पेश गरेको ऐनको दफा १३ को उपदफा (२) को खण्ड (३) बमोजिमको विवरण अनुरूप सो निर्माण कार्य सम्पन्न गर्न सक्ने निजको प्राविधिक क्षमता भए वा नभएको ।

(२) उपनियम (१) को खण्ड (ग) बमोजिमको अवस्थामा वा बोलपत्रदाताले सन्तोषजनक रूपमा काम सम्पन्न गर्न नसक्ने गरी न्यून कबोल अङ्क उल्लेख गरेको वा निर्माण कार्यको क्षेत्र वा प्राविधिक स्पेसिफिकेशन गलत रूपमा बुझि वा नबुझि अस्वाभाविक न्यून कबोल अङ्क उल्लेख गरेको वा प्रारम्भिक चरणमा गरिने निर्माण कार्यको लागि बढी दरले उल्लेख गरेको (फ्रन्ट लोडिङ) छ, छैन भन्ने कुरा मूल्याङ्कन समितिले जाँच गर्नु पर्नेछ । त्यसरी न्यून कबोल अङ्क उल्लेख गरेको \*वा उपनियम (१) को खण्ड (ग) बमोजिमको अवस्थामा मूल्याङ्कन समितिले त्यस्तो बोलपत्रदातासँग दर विश्वेषण सहितको स्पष्टीकरण माग गर्नु पर्नेछ ।

(३) मूल्याङ्कन समितिले उपनियम (२) बमोजिम मागेको स्पष्टीकरण सन्तोषजनक भएमा त्यस्तो बोलपत्रदातासँग निजको कबोल अङ्कको आठ प्रतिशतले हुने रकम

Incase of Front loading,

8 % of Bid amount

(क) दश करोड रुपैयाँसम्म लागत अनुमान भएको बोलपत्र वा  
परामर्श सेवाको प्रस्तावको लागि - नब्बे दिन

(ख) दश करोड रुपैयाँ भन्दा जति सुकै बढी लागत अनुमान  
भएको बोलपत्र वा परामर्श सेवाको प्रस्तावको लागि - एकसय बीस दिन

(२) उपनियम (१) बमोजिमको बोलपत्र जमानतको मान्य अवधि बोलपत्रको  
मान्य अवधिभन्दा कम्तीमा तीस दिन बढीको हुनु पर्नेछ ।

■(६) सार्वजनिक निकायले सिलबन्दी दरभाउपत्रको जमानत माग गर्दा स्वीकृत  
लागत अनुमान रकमको दुईदेखि तीन प्रतिशत रकमको सीमाभित्र रही निश्चित रकम  
तोकी सिलबन्दी दरभाउपत्र मागको सूचनामा जमानत रकम उल्लेख गर्नु पर्नेछ । यस्तो  
जमानत रकम नगद वा वाणिज्य बैंडबाट पचहत्तर दिनको मान्य अवधि रहने गरी जारी  
भएको बैंड जमानत (बैंड र्यारेन्टी) सिलबन्दी दरभाउपत्र दिने व्यक्ति, फर्म, कम्पनी वा  
संस्थाले सिलबन्दी दरभाउपत्रसाथ पेश गर्नु पर्नेछ ।

(७) सिलबन्दी दरभाउपत्रको मान्य अवधि पैंतालीस दिनको हुनेछ ।

Sealed  
quotation  
validity: 45  
days

Bid up to  
100 Million  
:90 days

Bid greater  
than 100  
million :  
120 days

30 days  
extra for  
security  
amount

## Authority to approve Work Bid

8

मूल नियमावलीको नियम ६७ मा संशोधन : मूल नियमावलीको नियम ६७ को उपनियम (१) को सट्टा देहायको उपनियम (१) राखिएको छः-

“(१) देहायको रकमको बोलपत्र स्वीकृत गर्ने अधिकार देहायको अधिकारीलाई हुनेछ :-

- (क) दश करोड रुपैयाँसम्मको राजपत्राङ्कित तृतीय श्रेणीको कार्यालय प्रमुख,
- (ख) बीस करोड रुपैयाँसम्मको राजपत्राङ्कित द्वितीय श्रेणीको कार्यालय प्रमुख,
- (ग) पचास करोड रुपैयाँसम्मको राजपत्राङ्कित प्रथम श्रेणीको कार्यालय प्रमुख,
- (घ) पचास करोड रुपैयाँभन्दा बढीको विभागीय प्रमुख।”

**< 10 Crore – Office  
Incharge 3<sup>rd</sup> Class**

**< 20 Crore – Office  
Incharge 2<sup>nd</sup> Class**

**< 50 Crore – Office  
Incharge 1st Class**

**> 50 Crore – DG (Department Head)**

# Consultancy Service

85

## Authority to approve Consultancy Service

- < 20 Lakh – Office Incharge 3<sup>rd</sup> Class
- 20 -100 lakh– Office Incharge 2<sup>nd</sup> Class
- 1 Crore - 5 Crore– Office Incharge 1st Class
- > 5 Crore– DG ( Department Head)
- Notice for Consultancy Service
  - Up to 2 million ( From Standing list, Minimum 15 days
  - 2 -150 million ( National paper, minimum 30 days)
  - > 150 million ( International Paper, minimum 30 days)

“(१) उपनियम (२) र (२क) मा रहेका “दश करोड” भन्ने  
शब्दहरूको सहा “पन्थ करोड” भन्ने शब्दहरू राखिएका  
छन।

## Contractor Class

A

१४द. दररेट निर्धारण समिति: \*(१) प्रत्येक जिल्लामा पूरै जिल्लाभरी वा जिल्लाको कुनै भागमा छुटै लागू हुने गरी निर्माण सामग्री र ढुवानीको दररेट, मेशिन तथा उपकरणको भाडा र कामदारको ज्याला निश्चित गर्न देहायका सदस्यहरू रहेको दररेट निर्धारण समिति रहनेछ:-

B

(क) प्रमुख जिल्ला अधिकारी – अध्यक्ष

C

(ख) जिल्ला समन्वय समितिले तोकेको जिल्ला समन्वय समितिको

D ( upto 2 corore now )

**Letter of intent ( for consultancy service) to be concluded within 35 days**

“(१३) उपनियम (५) बमोजिम आशयपत्रदाताको छनौट गर्दा आशयपत्र खोलेको मितिले पैंतीस दिनभित्र कार्य सम्पन्न हुने गरी छनौट गर्नु पर्नेछ।”

# Variation

87

- Variation – Any Changes required , whether due to change in quantities of items in the quantities in the item in the BOQ or to the scope of work

## Who should approve?

- Upto 5% - **Gazetted 2<sup>nd</sup> Class**
- Upto 10% - **Gazetted 1<sup>st</sup> Class**
- Upto 15% - **Department Head ( DG) (even greater than 15 % upto 60 lakh)**
- **15 – 25 % - Secretary of Concerned Ministry**
- **More than 25 % - Council of Ministers**

# Claim

88

- Claim arises when the contractor believes that he has been impeded in some way from executing the works according to the contract

## Some reason for Claims

- Delay in possession and access to site
- Delay in obtaining drawings
- Delay in Payment
- Disputes over Quantities
- Over Interpretation of Specification

**They should give notice of intention to claim within 28 days of the event.**

## Defect Liability

It is the legal responsibility that a contractor has to repair or cover the cost of any defects found in a completed or renovated works.

# Liquidated Damage/

89

- Liquidated Damages (LD) are remedies available to any contracting party to compensate for the financial loss suffered as the result of a proven breach of contract
  - 0.05% per day
  - But not exceeding 10% of contract amount

Liquidated Damage are not applicable if

- Delay in giving possession of site
- Interfering in carrying out of works
- Increase in scope of works

## Similar Criteria for Puraskar

**The Bonus** for the whole of the Works is 0.05 Percent per day , **not exceeding ..... but given to contractor exactly the amount that contractor has to pay in LD if the same day are delayed (which are saved now)**

# Dispute Resolutions

90

- Disputes
  - It arises in project when the client is not ready to accept the claims made by the contractor.
- Disputes resolutions
  - Negotiation/ Amicable settlement
  - Mediation / Conciliation
  - Neutral Evaluation/ Experts Determination
  - Adjudication
  - Arbitration
  - Litigation

# Some other Terms

91

- **Muster Roll**
  - ❑ It commonly used to make payment to the labor engaged in daily wages.
  - ❑ Maintained to keep the proper record of the laborers employed daily for executing works
- **Measurement Book**
  - ❑ Mb is a book showing original record of work done or supply of materials received duly weighed, measured or counted
  - ❑ It is an evidence of work done and measurement

# Some other Terms

92

- Site Order Book
  - The Engineer in charge or his authorized representative shall duly record his observations regarding any work which needs actions like improvement in quality of work.
- Force Majeure
  - Force Majeure is an unforeseen event or condition that is not caused by, or could not be prevented by any of the parties to the contract, by which resulted in delay or suspension of execution of the contract.
- Sub Letting – Should be clear in Contract

# Some other topics

93

- **Day work**
  - A procedure of costing an item work on the basis of actual labourers and material required like : Front architectural finish, Design in Plaster Work
- **Departmental works**
  - Works are executed directly by the department or owner ( if the work is of regular maintenance or smaller size)
- **Construction Supervision**
  - To ensure the quality of works (according to specification) , supervision is most.
- **Travel Chart**
  - Tabular record for representing the quantitative data representing the movement of workers, materials or equipment between different stations during a given period of time.

# LABOR LAW

94

- Labor law is concerned over the rights, interest, facility and safety of workers and employee working in the enterprises of various sectors.
- Labor is a productive activity. By labor anything shapes its form from abstract to concrete.
- Labor also acts as a means of changing external nature and thus labor is the main condition of the specifically human existence.
- Labor was the fundamental element that brought out man from the animal world. Without labor nothing is possible – no machine function, no rupee/work.

# LABOR LAW

95

- The significant role played by labor can easily seen everywhere in construction work, in factories and etc.
- An engineer should be able to work with workers. S/he should be able to inspire workers and get maximum output.
- For this engineer should understand the welfare activities that influence the efficiency of the worker.
- We shall discuss in brief some of the definitions and provisions of Labor Act, 2074 (Earlier 2048).

# **LABOR Act, 2074 (Earlier 2048)**

96

1. Labor Act, 2048 and now 2074 has some of special provision related with construction works
2. Before this there was no special law regarding labor in the construction industry.
3. There was a trace of interpretation regarding workers in factory and Factory workers 2019

# Child, minor, major (matured)

97

- **Child** is the person having age less than 16 years
- **Minor** is the person having age 16 to 18 years
- **Major** is the person completing the age and 18 years
- No minor shall be engaged in works without adequate directives about the concerned working areas or vocational training.

Inserted by the Child Labor (Prohibition and Regulation) Act , 2056

# Working hour

98

## 1. Working hours

- 8 hours a day or 48 hours a week has been fixed as working hours.
- Workers are provided a day leave in a week.

## 2. Computation of beginning of working hours

- The beginning of the work shall be prescribed by the proprietor.

## 3. Attendance register to be kept

- Each Enterprise shall maintain attendance register of its workers and employees.

# Working hour...

99

## 4. Interval for refreshment and rest

- No workers can be kept working continuously for more than 5 hours.
- Workers shall be provided with 30 minutes of break for Tiffin and rest.
- This break is counted as regular working hour.  
In any enterprises, where works have to be carried out continuously without interruption such breaks are provided in rotation.

# Working hour...

100

- 5. Extra wage for overtime works**
  - i. Workers or employee (staffs) shall be provided extra remuneration for the over time work, working more than 8 hours a day or 48 hours a week.
  - ii. Workers shall be paid one and half of the ordinary wage for the over time.
  - iii. In general no worker or staff shall be allowed to work over time for more than 4 hours a day or 24 hours in a week.

# Remuneration

101

## 1. Minimum remuneration fixing committee

Government shall fix the minimum remuneration, dearness allowance and facilities of workers or employees of enterprises on the recommendation of Minimum remuneration fixing committee

## 2. Payment of remuneration

It shall be the responsibility of the Establishment to provide the remuneration allowances and facilities to be entitled by the workers or employees of the enterprise.

# *Provision relating to health and safety*

102

Establishment shall make arrangements in the enterprise as below

- a) to keep clean and tidy, arrangements of proper drainage and preventing from bad odour
- b) to make arrangement for adequate supply of fresh air and light as well as proper temperature in the working rooms
- c) To make arrangement for removal and disposal of solid waste and sewage out coming from production process;
- d) To make arrangements of prevention of accumulation of dust, fume, vapour and other impure materials in working rooms which would adversely affect the health;

# **Provision relating to health and safety**

103

- (e) To make arrangements of necessary preventive personal devices for protection of health from adverse any other source, and make provisions this would produce less noise during the work process;
- (f) To avoid any congestion in the work-room or work place leading to injurious to the health of workers or employees and to avail working space to each worker or employee, according to the nature of the job, or normally **fifteen cubic meters** and, the **height above four meters from the floor surface shall not be counted for such purposes.**

# ***Provision relating to health and safety***

104

- (g) To make provisions for sufficient supply of pure potable water during the working hours,
- (h) To make provisions for separate modern type toilets for male and female workers or employees at convenient place;
- (i) To declare as non-smoking zone in all or some parts of the Enterprise, according to the nature of its works;
- (j) To cause to conduct compulsory health check-ups of the workers or employees once every year in the Enterprises where the nature of works is likely to affect the health adversely.

# Protection of Eyes:

105

- (1) Necessary protective means shall have to be arranged for the protection of eyes of the workers and employees from injuries likely to be caused by dust or pieces while working in the Enterprise using glass, mercury, magnet, pallets, iron, concrete, cement, lime, stone and explosive substances.
- (2) Necessary protective devices shall have to be arranged to protect the eyes from harmful rays coming from during the process of welding or gas-cutting, or other similar works.

# Provision for Safety Against Fire:

106

- The Proprietor shall have
  1. to make arrangements of necessary modern equipment for safety against fire in each Enterprise.
  2. to make for easy exit from the Enterprise during emergency.
  3. to make safety from fire including fire-fighting devices shall be as prescribed.

# Hazardous Machines to be fenced

107

- Strong fences shall have to be placed around every part of hazardous machines, instruments and equipment operated by energy.

## Protection from Chemical Substance

- The Proprietor shall have to make provisions for necessary personal protective devices for the protection of workers or employees handling chemical substances.

# Notice to be Provided

108

- (1) Each Enterprise shall have to inform the Labour Office within **three days** if any worker or employee dies **or** is injured making him/her disabled to work for more than **forty eight hours**, from an accident occurred in the Enterprise **or** for any other reason, and **within seven days** if such worker or employee has been caught by any disease resulting from the profession.

# Tool Box Talk

109

- A Tool Box Talk is an informal safety meeting that focuses on safety topics related to the specific job, such as workplace hazards and safe work practices
- 10 to 15 mins duration
- To prevent accident and injuries at work
- It is one of the very effective methods to refresh workers' knowledge, cover last-minute safety checks, and exchange information with the experienced workers.
- Tool Box Talks are also intended to facilitate health and safety discussions on the job site and promote your organization's safety culture.
- Tool Box Talks meetings are sometimes referred to as tailgate meetings or safety briefings.

# Types of Maintenance

110

Maintenance includes the repair or preservation of an existing facility to prevent from reaching to unsafe or irreparable state.

- Planned Maintenance – Carried with forethought
  - Preventive Maintenance
  - Corrective Maintenance – out of order
  - Routine / Schedule Maintenance
- Unplanned Maintenance
  - Emergency Maintenance

# Some other Definition

111

- Alteration – Change in Design of Structure during the construction of project.
- Omission – Deletion of some of the items from the project.
- **What happened to duration ?**

- Performance security is necessary :
  - A) after contract agreement to successful bidder
  - B) before bid opening to all bidders
  - C) during bid opening to all bidders
  - D) before contract agreement to successful bidders
- Bid security / earnest Money is necessary :
  - A) after contract agreement to successful bidder
  - B) before bid opening to all bidders
  - C) during bid opening to all bidders
  - D) before contract agreement to successful bidders

- An EPC Contract means :
    - End of planning and construction
    - Evaluation, planning and construction
    - Engineering, planning and construction
    - Engineering, procurement and construction
  - Minimum no of parties for contract/ disputes is
    - 1
    - 2
    - 3
    - 3 and more
  - Documents announcing to prospective bidders that the owner is ready to receive bid is called
    - Notice to bidders
    - Bills of quantities

- The opening of bidding in the process of procurement is known as
  - Contracting
  - Tendering
  - Negotiation
  - Mediation
- The first stage of a construction is
  - Preparation of estimate
  - Survey of the site
  - Initiation of the proposal
  - Allotment of the funds

- Contractor Prequalification is required for
  - All works
  - Small works
  - Major and Specified works**
  - None of the above
- Total cost of the project
  - Increases with the increase in time
  - Decrease with decrease in time
  - Initially reduces and then increase with time**
  - Initially increases and then reduce with time

- Pre-tender stages requires
  - Acquisition of land
  - Finalizations of designs and preparation of estimate
  - Finalization of alignment of work
  - All of the above
- Retention Money is deposited after ? DLP
- Quality assurance plan is prepared by ? Contractor
- A contractor can start the construction works following the receipt of
  - A) award of contract
  - b) contract agreement
  - C) Notice to proceed
  - d) Variation order

- Technical planning is carried for the
  - A) preparation of detail drawing
  - B) Preparation of detail estimate
  - C) Planning resource and initiating procurement action
  - D) **all of the above**
- For procurement of works upto 1 million, which method of procurement is considered
  - By direct negotiation
  - By International Bidding
  - By local / National Bidding
  - **By Sealed Quotation**

# Project Control

- Control is managerial process. It is interrelated with planning. Planning provides standards for control.
- Control measures actual performance and compares it with standards to identify deviations.
- Deviations are analyzed to take corrective actions.
- To be effective, it should give attention to critical control points or benchmarks where deviations adversely affect the attainment of targets

# Types of Control

**Pre –control :** It anticipates problems in advance and takes preventive corrective actions

- Eg : Specifications for quality control, Capital budgeting Methods.

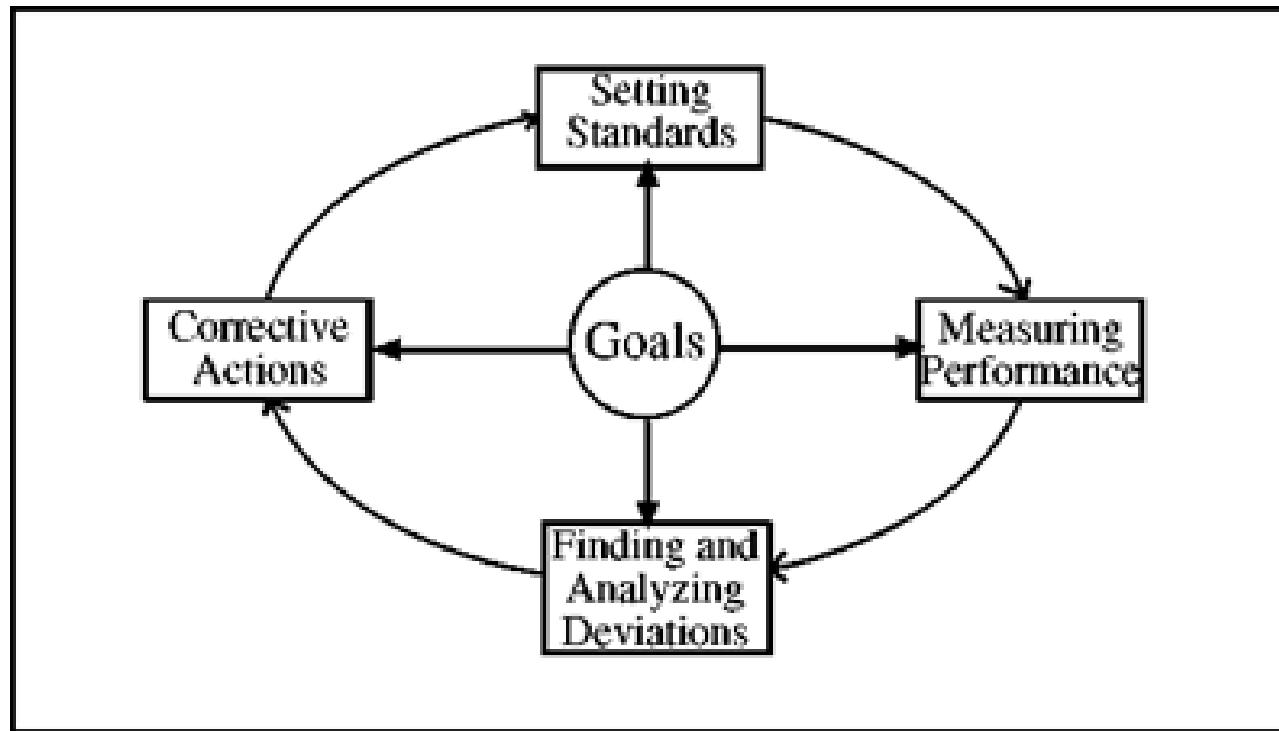
**Concurrent Control :** It consists of actions to ensure that operations are being conducted according to plans. Problems are corrected as they arise.

- Example is quality control from process to process.

**Post control :** it is initiated after the completion of the activity. It is based on feedback of performance results.

- Example is financial analysis.

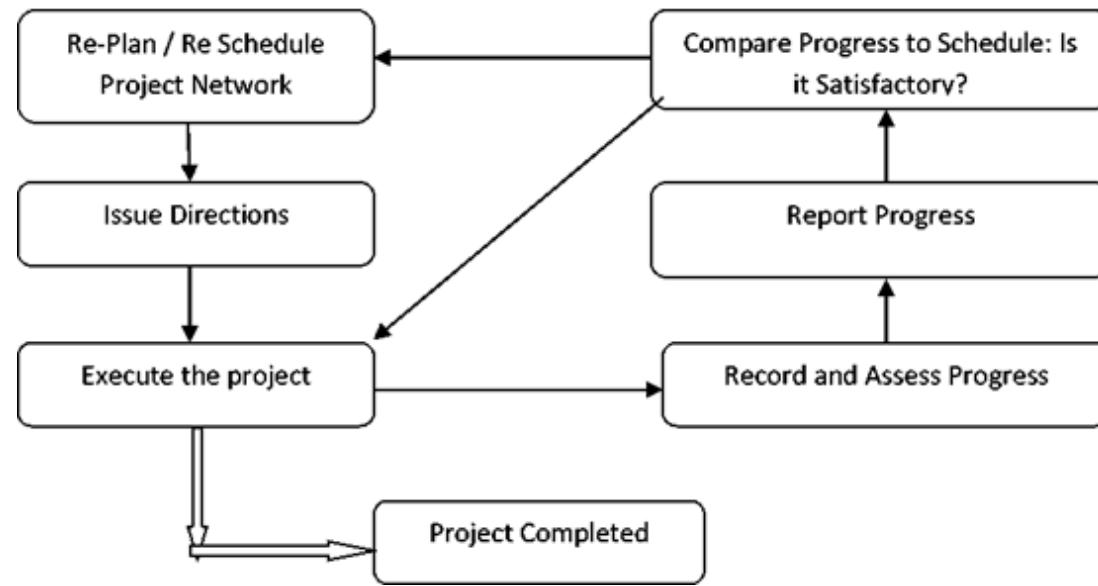
# Project Control Cycle



# Elements of Project Control

- **1. Time/ Schedule control**
- Time control can be of two types:
  - 1)Normal Time Control: It is the estimated time for completion of an activity. Increase beyond this time is not likely to result in cost reduction.
  - 2) Crash Time Control: It is the estimated time of completion of an activity which cannot be reduced further irrespective of cost considerations.
- Every project has an optimal time schedule which is effectively controlled to check time overruns. Time delays result in cost overruns.
- Work Breakdown Structure, Bar Chart and Network analysis are used to control schedules.
- Crash time- direct cost maximum, indirect cost minimum
- Normal time- direct cost minimum, indirect cost maximum
- Optimum time- time between crash time and normal time, under which total cost is minimum

# The Updating Cycle



# Elements of Project Control

## 2. Cost Control

- Project cost estimation and budgeting serves as a foundation for cost control. Evaluation and control of project costs are important components of project evaluation and controlling.
- It must start right from the inception
- As the project Advances, the chances of controlling cost through various cost control measures reduces.
- Delay in decision making incurs more cost and hence, prompt decision is prerequisite for better cost control

# Cost control

- Establishing a project cost baseline plan
- Developing standard costing and budgetary control system for the project
- Establishing authority, responsibility and accountability for cost control at task level
- Ensure proper allocation of cost to project codes, authorization for decision making
- Measuring actual cost and comparing with standards
- Tracing out deviations
- Maintain financial discipline through internal auditing and external auditing
- Taking remedial and corrective actions

# General methods of cost control

- 1. Short term planning and control

Break down into smaller components

- 2. Accounting methods of control

Profit/loss account, Unit Costing

- 3. Project Cost Models (S-curves) / Earned Value Analysis

# Elements of Project Control

- 3. Quality Control
- Quality control is checking errors during project implementation. Quality control inspectors are used for checking quality.
- Statistical quality control techniques are also applied for monitoring quality. Conformity to agreed specifications are monitored.
- Adjustments are made for deviations.
- Project outputs not meeting the standards are rejected, scrapped or reworked.

# Quality ??

- According to advanced learner dictionary, quality is degree of goodness.
- Similarly cross-by defines as conformance to requirements.
- According to Juran, Quality is fitness for purpose.

Other defines quality as:

- Zero defects
- Consistent conformance to expectation
- Doing things right the first time
- Quality is the totality of characteristics of an entity that bears on its ability to satisfy stated and implied needs

# Quality Control, Assurance & Management

128

- Quality control concerned with the operational means to fulfill the quality requirement
- Quality Assurance contains all those plan and systematic actions required to provide adequate confidence that a product or service will satisfy given requirement for quality.
  - Shift Emphasis from mere detection towards preventing of non conformance.
- Quality Management includes both quality assurance and quality control as well as other concepts of quality planning like cost, safety etc.

# Quality Control

129

- Well Written Specification
- National and International Standards: NS, ISO
- Procedural Guidelines
- Training
  
- Specification is the document where the level of the intended quality is specified.
- QC -Product Oriented

# Quality Assurance Plan

130

- Inspection
- Testing
- Sampling
  
- QAP is prepared by **contractor** and made available to client for frequent supervision by the consultant.

# QC and QA

## Quality Assurance

Quality Assurance (QA) is a set of planned and systematic activities which are laid out before a building project starts. The aim of this activity plan is to give confidence that quality requirements will be fulfilled. We can put it simply, like this:

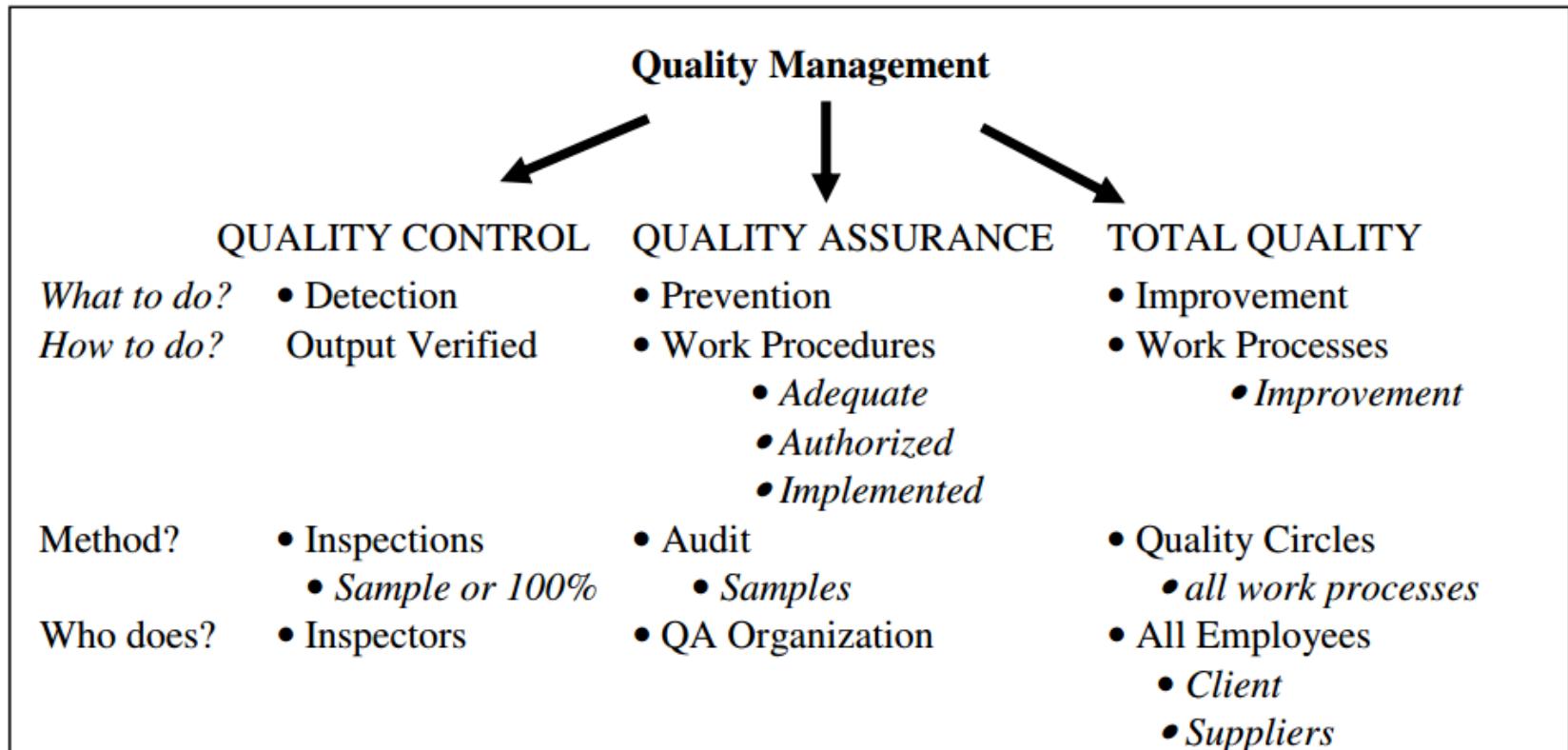
Quality Assurance is planning to do the right things at the right time and the right way.

## Quality Control

Quality Control (QC) are observation techniques and activities which aim to identify whether the final product actually fulfills customer requirements. Quality Control also identifies the need for corrective measures. In other, simpler, words:

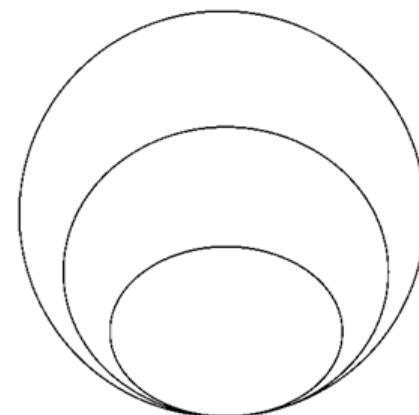
Quality Control **monitors** work as it happens and **ensures that the results satisfy the requirements specified**. **Done by Engineer / Consultant**

# Evolution of Quality Management Concept



# Total Quality Management

- Total quality management is a new concept of quality management and is that aspect of the overall management function that determines and implements the quality policy. The essential elements of TQM are:
  - • Quality Planning
  - • Quality Control
  - • Quality audit
  - • Quality surveillance
  - • Quality Assurance
  - • quality Circles



# Quality Related Term and Definitions

- Quality Plan
- A Quality Plan (QP) is a document setting out the specific quality practices, resources, and sequences of activities relevant to a particular product, service, contract or project. It should define:
  - The quality objectives to be attained
  - The specific allocation of responsibilities/authority during the different phases of the project.
  - The specific procedures, methods and work instructions to be applied.
  - Suitable testing, inspection and audit programs at appropriate stages.
  - A method of modification for the quality plan as the project proceeds.
  - Other measures necessary to meet the objectives

# Quality Costs

- Quality cost can be divided into two parts
- A) Quality Management Costs
  - i) Prevention Cost
  - ii) Appraisal Cost
- B) Failure Costs

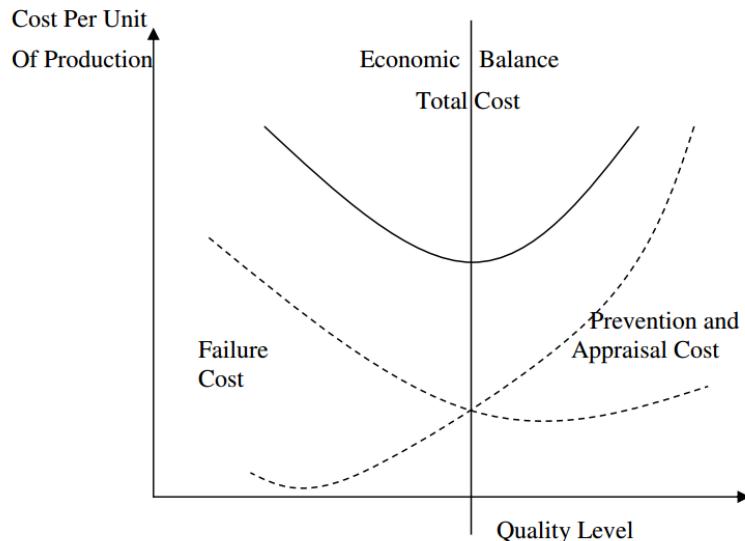


Fig: Cost of Quality

# Quality Management Tools

- Brain Storming: Brainstorming is an idea-generating process. Alternatives are generated spontaneously through group creativity.
- Cause and Effect Analysis: Cause and effect analysis is very useful for investigating root causes of problems. A solution applied after finding root causes of problem will have chance of lasting success in eradicating the problem. Also called Fish Bone Analysis.
  - Quality circle.
  - Process Flow Chart: A process is anything, which converts an input into an output by doing work. Flow chart provides substantial help to picture a process where overlaps, duplication and iterative loops are easily identified.
  - Check List: Check list is the collection of different activities accompanied with required quality standards in each activity expressed in a sequential order so that each item is checked with the stipulated performance standard.

# **Alternative Dispute Resolutions**

## **1. Introduction**

Alternative dispute resolution has expanded over the last several years to include many areas besides the traditional commercial dispute.

Construction mainly is messy, high-risk business with huge amounts of money involved. Problems, unanticipated outcomes and misunderstandings all too often end up in some form of dispute resolution. The civil court system provides the most traditional means of sorting out legal problems, but has some sobering consequences. Going to court can be breathtakingly expensive and, of course, painfully slow. In the months, sometimes years, that it takes to work through taking depositions, waiting for court dates and enduring the legal proceedings, huge amounts of nervous energy and valuable work time can be consumed.

There are few following features of alternative dispute resolution and they are pronounced as:

- There is a wide range of ADR processes;
- ADR excludes litigation;
- ADR is a structured process;
- ADR normally involves an impartial and independent third party; Depending on the ADR process, the third party assists the other two parties in reaching a decision, or decides on their behalf;
- A decision reached in ADR may be binding or non-binding.

Based on the party's willingness to look forth to the solution of the disputes. There are many methods to reach the resolving satisfaction of the problem. There could be formal and informal resolving elements in the alternative dispute resolution which could further have sub system that are:

### **Informal dispute resolution**

- Negotiation
- Mediation
- Collaborative law

### **Formal dispute resolution**

- Adjudication/Dispute Review Boards
- Arbitration

# **Alternative Dispute Resolutions**

## **2. Informal Dispute Resolution**

### **2.1 Negotiation:**

In the negotiation, participation is voluntary and no third party is involved who facilitates or imposes the resolution. There would be a coach for both the parties behind the scene by a common friend—‘helping people help themselves’.

### **2.2 Collaborative law**

In collaborative law, each party has an attorney who facilitates the resolution process within specially contracted terms. The parties reach to an agreement with support of attorneys and mutually agreed experts.

### **2.3 Mediation:**

In Mediation, there would be a third party called a mediator. Mediator facilitates the resolution process or sometimes suggest a resolution as ‘mediator’s proposal’. However, Mediator does not impose a resolution on the parties. Conciliation is similar to mediation, however Conciliator could either be named in the contract as agreed by the parties or usually by three names being given to the responding party for it to select one and in case, if agreement is not made, appointed by the competent Authority as prescribed in the Contract.

Mediation is based on principles of problem solving that focus on the needs and interests of the participants; fairness; privacy; self-determination; and the best interests of all parties.

### **Advantages of Mediation:**

- Time and costs
- Management time
- Maintains business relationships
- Creative solutions
- Flexibility of procedure
- Private/Confidential
- It works (or so they say)

### **Disadvantage of Mediation**

- Settlement at all costs
- Client perception
- Settlement regardless of merits
- Settlement without full appreciation of the facts/law
- Shows weakness
- Gives away case
- Delay tactic/Non-binding

# Alternative Dispute Resolutions

## 3. Formal Dispute Resolution

### 3.1 Arbitration:

Arbitration is a method of dispute resolution used as an alternative to litigation. It is commonly designated in collective agreements between employers and employees as the way to resolve disputes. The parties select a neutral third party (an arbiter) to hold a formal or informal hearing on the disagreement. The arbiter then issues a decision, binding on the parties.

The Arbitrator is a person selected by the parties to hear evidence and to make a binding award to resolve the litigation. The Arbitrator is a creature of contract between the parties. An arbitrator can be selected either directly by the parties, by a court. The parties voluntarily agree to use the arbitration process either by

- Following an arbitration clause in a contract, or
- Agreeing to submit the existing dispute to arbitration instead of the judicial system

The classic advantages of arbitration are:

- Speed to hearing
- Lower attorney costs
- The binding nature of the award
- Relaxed rules of evidence
- The private nature of the proceedings, and
- The expertise of the decision-maker. Most commercial cases can be heard in arbitration within 90 days

### 3.2 Adjudication

Adjudication is the legal process by which an arbiter or judge reviews evidence and argumentation, including legal reasoning set forth by opposing parties or litigants, to decide which determines rights and obligations between the parties involved. An adjudicator should possess

- Technical knowledge across the full range of potential disputes that may arise
- Contract administration and interpretation experience
- Practical experience in the industry
- Familiarity with ADR

Each party selects one member of the Dispute Board with the third (chairman) either jointly appointed by the parties or by the other two selected members. The decision made by the adjudicator or dispute resolution board (DRB) is final and binding on either of the parties. However, those recommendation or decision which the parties are free to comply with or reject and proceed directly to arbitration or litigation.

# **Alternative Dispute Resolutions**

Characteristics of Adjudication:

- Private and confidential
- Fair and impartial decision
- Faster than litigation or arbitrator
- Disputes can be resolved while works are still in progress
- Fewer expenses and informal

## **4. Scenario of dispute resolution in Nepal**

In Nepal, there is a provision of appointing a single adjudicator for small and medium scale contract, whose amount is less than Rs. 100 million, and Dispute Resolution Board/ Adjudication Dispute Board comprising three adjudicators member for large contract having value exceeding Rs. 100million.

Some of example of arbitration and adjudication that have gone under to resolve a dispute between the large projects between different clients in Nepali project are:

1. Hunan - Lama JV	ADB Project - Arbitration
2. Lumbini-Synohydro JV	DOR Project, Arbitration
3. CCECC- SHARMA - LAMA	Melamchi Project - ICC Arbitration
4. CGGC- LAMA JV	ADB Project - Arbitration
5. SUMEC-SHARMA JV	ADB Project - Arbitration
6. Trishuli Construction	DOR Project- Arbitration
7. RSDP PROJECT	RSDP Project -Adjudication
10.Sumec-Lama JV	KUKI , Adjudication /DAB

## **3. Conclusion**

Though the parties involved in contract rarely expects these sorts of dispute arises which need to be properly dealt with the according to prevailing law. However, based on the time and the issues of the dispute and results of such different tiers of dispute resolution, the parties could go in agreement to follow specific resolution board.

## **4. References**

<http://www.nepca.org.np/> <http://en.wikipedia.org/wiki/Adjudication>  
<http://cdi.com.np/index/page/arbitrations-adjudication>

## **Brief Comparison between Mediation, Adjudication, Arbitration and Litigation**

	MEDIATION	ADJUDICATION	ARBITRATION	LITIGATION
<b>Definition</b>	Negotiation with assistance of a third party (the mediator).	Submission of disputes by consensual agreement to a third party (the adjudicator) for an interim decision which will be binding unless the Court refuses leave to enforce decision or it is substituted by a final arbitral award or Court judgment. Legislation will introduce compulsory adjudication for the construction industry soon.	Submission of disputes by consensual agreement to a third party (the arbitrator) for a binding decision.	Process of making a civil claim in a Court of Law.
<b>Time</b>	Shortest period, may be as short as 1-2 days but depends on the skills of the mediator.	Very much shorter than arbitration and litigation. Adjudicator has 30 days to decide dispute.	May extend over a long period if hearing protracted; it may take months or even years to conclude. Procedure and time frame to be agreed by parties.	Longest period because of backlog of cases in Court.
<b>Costs</b>	Lower than arbitration costs.	Lower than arbitration costs because of faster hearing.	Higher than mediation and generally higher than litigation because of thoroughness and expediency.	Expensive because it takes a long period.
<b>Confidentiality</b>	Private.	Private for consensual adjudication but may become public for compulsory adjudication as the adjudication decision has to be enforced through the Courts.	Private but may become public if there is Court intervention.	Public, judgment reported.
<b>Formalities</b>	Very informal.	Less formal than arbitration, strict rules of evidence do not apply. Procedural rules may be imposed by nominating body.	Less formal than litigation, strict rules of evidence do not apply but procedural rules may be based on institutional rules. Otherwise parties to agree or arbitrator to decide.	Formal, rigid, strict evidential and procedural rules are prescribed

<b>Involvement of third party &amp; control by parties</b>	A third party, the mediator, facilitates the process but parties are in control of content and outcome.	A third party, the adjudicator, controls content and outcome of proceedings but parties have some degree of control choice of adjudicator, language, time, venue, applicable law and procedural rules.	A third party, the arbitrator, controls content and outcome of proceedings but parties control choice of arbitrator, language, time, venue applicable law and procedural rules.	A third party, the judge controls outcome of proceedings, parties have no control over choice of judge, language, time, venue of processing and procedural rules.
<b>Remedies</b>	Wide ranging, with assistance of mediator, parties need not confine themselves to strict legal remedies, creative remedies possible.	Monetary remedies only usually. Adjudicator's decision on non-monetary issues may not be binding.	More restricted, must be a legal remedy capable of being performed, subject to arbitrability, legislation and rules, creative remedies not possible.	Strict, only legal remedies, creative remedies not possible but judges can grant remedies which arbitrators cannot e.g. injunctions, security, subpoena, etc.
<b>Degree of parties satisfaction with outcome</b>	High because parties work together to reach settlement unless allegation of lack of independence on mediator, a win / win outcome	Low because decision imposed by adjudicator, win/lose outcome.	Medium despite win/lose outcome because decided by chosen trade or specialist arbitrator because award imposed by arbitrator, win / lose outcome.	Low because judgment imposed by Court, win /lose outcome.
<b>Effect on relationship of parties</b>	Preserves relationship.	May destroy relationship.	May destroy relationship.	High chance of destroying relationship because can be very acrimonious.
<b>Communications</b>	Mediator usually communicates with one party without the presence of the other during the process known as 'caucus'.	Generally both parties are expected to participate in proceedings. May even involve owner in proceedings although he is not the respondent. May proceed <i>ex parte</i> if respondent doesn't participate. Legal representation is allowed.	General prohibition against <i>ex parte</i> communications. Test of justifiable doubt on impartiality and independence of arbitrator.	Strict, <i>ex parte</i> communications with judge only allowed during <i>ex parte</i> hearings, parties to communicate with each other through their respective lawyers.
<b>Certainty of achieving settlement</b>	With assistance of mediator, there is more certainty of achieving settlement than in arbitration; depends heavily on skills of mediator.	Certainty in getting a decision at the end of the adjudication. Decision is interim in the sense that it may be replaced by a final arbitral award or Court judgment.	Certainty in getting an award at the end of the arbitration.	Certainty on getting a judgment at the end of trial.