

**SESSION 4
PLANNING THE PROJECT**

PROJECT PLANNING

- Scope planning
- Time planning
- Cost planning
- Human resource planning
- Procurement planning
- Quality planning
- Communication planning

DEFINITIONS

- The project plan is a list of activities that need to be accomplished to meet the project objectives.
- The project schedule is the project plan plotted against a timeline.
- An event is an identifiable single point in time in the project life cycle.
- A milestone is a significant event in the project life cycle.

TOOLS THAT ASSIST IN PLANNING

- Historical Reports
- Experience
- Handbooks
- Standards and procedures
- Checklists
- Model plans

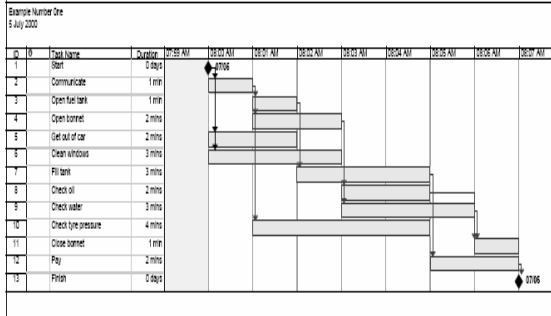
PLANNING TECHNIQUES

- Manual barcharts
- Critical path analysis
- Line of balance
- Last schedule
- Critical chain

MANUAL BARCHARTS (1)

- Easy to read
- Shows the time scale
- Shows the activities on a single barchart
- Easy to monitor and schedule
- Manual updating is required
- No logic links are shown on the barchart
- Difficult to maintain and update on large projects
- Difficult to track changes on the barchart

MANUAL BARCHARTS (2)



CRITICAL PATH ANALYSIS (1)

- The method of planning and controlling projects by recording their interdependence in a diagrammatic form.
- Two methods are commonly used namely:
 - Activity on arrow
 - Activity on node/precedence diagramming method

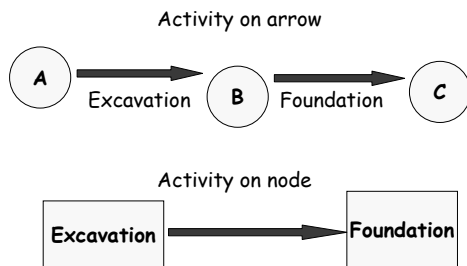
CRITICAL PATH ANALYSIS (2)

- With the arrow on node system the activity is shown by arrows, with a node at each end (normally a circle).
- The length and direction of the arrow have no meaning.
- The arrow only implies logic.
- Dummy activities must be added to complete logic.

CRITICAL PATH ANALYSIS (3)

- With the activity on node system the activity is represented by boxes or nodes.
- The length and direction of the arrow have no meaning.
- The arrow only implies logic.
- Relationships or lags can be included in the logic diagram.

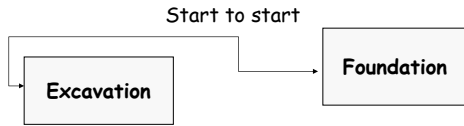
CRITICAL PATH ANALYSIS (3)



CRITICAL PATH ANALYSIS (4)

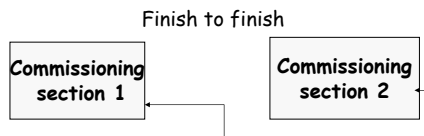
- The default relationship that is normally shown on the precedence diagram is finish to start.
- The following relationships can however also be taken into account:
 - Start to start
 - Finish to finish
 - Start to finish

CRITICAL PATH ANALYSIS (6)



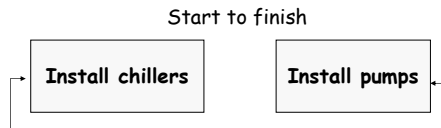
An example would be the excavation and placing of concrete. You do not have to complete all the excavations before casting the concrete. In this instance the start to start lag could be e.g. 3 days after you have started on the excavation you would pour start pouring concrete.

CRITICAL PATH ANALYSIS (7)



An example would be the commissioning of a number of sections. The important issue is not when the commissioning is started but when they are completed and you would e.g. have these happening 3 days after each other.

CRITICAL PATH ANALYSIS (5)



An example would be when a specific time frame has been determined for a set of activities like for example the period a crane will be on site. That implies that activity A will start when the crane arrives but that activity B must be completed by the time the crane leaves site.

ADVANTAGES OF USING CPA

- Shows the interdependency between activities
- Prevents unrealistic planning
- Identifies the critical activities on the project
- Determines the shortest time to completion
- Shows available float for non-critical activities
- Allows what if scenarios

CPA TERMINOLOGY (1)

- Early start - the earliest possible time an activity can begin based on network logic.
- Early finish - the earliest possible time an activity can finish based on network logic.
- Late start - the latest possible time an activity can begin without delaying project completion.
- Late finish - the latest possible time an activity can finish without delaying project completion.

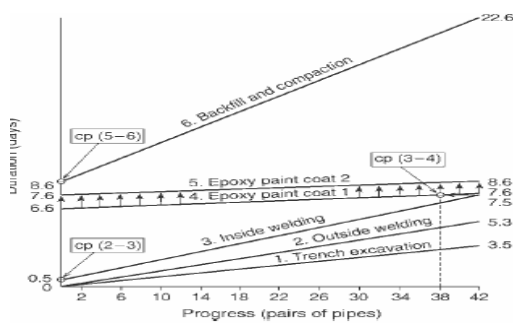
CPA TERMINOLOGY (2)

- Critical path - is the longest path through the network which determines the shortest time in which the project can be completed.
- Total float - is the amount of free time that is allocated to a string of activities.
- Free float - is the amount of time an activity can use up without delaying the project.

LINE OF BALANCE

- ✦ This is a planning technique that is suited for repetitive projects like mass housing, road construction, pipe line installation or rail installation.
- ✦ The number of units are plotted on one axis and the duration of the project on the other.

LINE OF BALANCE



LEAN PRODUCTION TECHNIQUES

The concept of lean production which originated within the production environment is being adopted and applied within the construction industry. This method of production has however lead to a different approach to planning and has lead to the development of new planning techniques like last planner and critical chain.

**PREPARE THE PROJECT TIME SCHEDULE
USING CPA (1)**

- ✦ Formulate the project scope statement
- ✦ Establish the project phases
- ✦ Develop the work breakdown structure
- ✦ Identify the project activities
- ✦ Determine the activity duration
- ✦ Calculate the resources required to complete the activities

**PREPARE THE PROJECT TIME SCHEDULE
USING CPA (2)**

- ✦ Determine the logic links and construct the logic diagram
- ✦ Verify the logic diagram
- ✦ Determine the project duration
- ✦ Verify the project duration
- ✦ Construct a resource histogram
- ✦ Apply resource scheduling

**FORMULATE THE PROJECT SCOPE
STATEMENT**

This step was covered in detail in the session on scope planning. The outcome of this step is to clearly identify what needs to be delivered.

ESTABLISH THE PROJECT PHASES (1)

- This is also referred to as determining the project life cycle.
- The project can be broken down into smaller manageable sections which link together like activities.
- The titles given to these phases will vary from project to project and industry to industry.
- The generic titles given to these phases are initiation phase, implementation phase and closeout phase.

ESTABLISH THE PROJECT PHASES (2)

- The phases commonly used on built environment projects are feasibility phase, design phase, procurement phase, construction phase, commissioning phase and operational phase.
- Traditionally these phases were sequenced in series however project managers have been overlapping these phases due to time constraints placed on projects by clients.

DEVELOP THE WORK BREAKDOWN STRUCTURE

- The development of the WBS can follow a number of conventions but should however ensure that it allows for easy project integration.
- The different project plans cannot be considered in isolation and therefore need to be integrated against a common basic structure. The work breakdown structure is the most suited techniques to use within the project environment.

IDENTIFY THE PROJECT ACTIVITIES (1)

- Project activities can be identified from the WBS. This information can also be obtained from historical reports, experience or the people who will be carrying out the activities.
- Once identified the activities should be listed in an activity list.
- Once an activity list has been developed it can also serve as the default list for future project.

IDENTIFY THE PROJECT ACTIVITIES - ACTIVITY LIST (2)

Code	Activity	Depend	Duration	Resources	Remarks
A	Wake up in the morning				
B	Have a shower				
C	Make coffee				
D	Make breakfast				
E	Eat and drink breakfast				
F	Get dressed				
G	Leave for varsity				

IDENTIFY THE PROJECT ACTIVITIES (3)

- The level of detail decided on for each activity is important at this stage. This is where the WBS can be useful. E.g. making coffee can be broken down into four smaller activities namely get ingredients, add to cup, add water and stir.
- It is also important to identify whether any other methods are available to complete the activity. In construction a method statement is normally drawn up to document these alternatives.

DETERMINE THE ACTIVITY DURATION

- The activity duration is a prediction based on current knowledge at the time the activity is expected to take place under normal circumstances.
- The duration can be calculated based on known industry specific production outputs. E.g. a bricklayer can lay 800 bricks in one day. If we know we that 80 000 bricks are in the project we can determine that the project will take 100 days to complete.

CALCULATE THE RESOURCE REQUIRMENTS (1)

- Resources relate to material, manpower, equipment etc.
- Initially we need to assume that we have unlimited resources available for the project.
- We do however need to find out what the resource availability is to determine the realistic duration for an activity.
- If e.g. 5 bricklayers are available we can reduce the duration from 100 days to 20 days.

CALCULATE THE RESOURCE REQUIRMENTS (2)

- Normal resource production outputs need to be considered initially.
- Anticipated absenteeism also needs to be considered.
- All existing commitments need to be taken into account.
- Space limitations need to be considered - diminishing returns.
- Capacity of equipment needs to be considered.

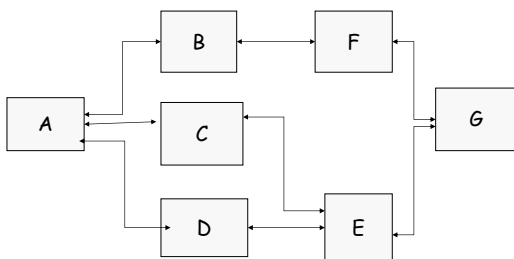
DETERMINE THE PROJECT LOGIC (1)

- ✦ This step requires the application of strict logic as all we are trying to determine is what is standing in the way of the commencement of an activity.
- ✦ It is therefore necessary to question standard practices to determine whether new or alternatives ways of carrying out the activity are available.

DETERMINE THE PROJECT LOGIC (2)

Code	Activity	Depend	Duration	Resources
A	Get out of bed	Start	5 minutes	1
B	Have a shower	A	5 minutes	1
C	Make coffee	A	3 minutes	1
D	Make breakfast	A	2 minutes	1
E	Eat and drink breakfast	C,D	10 minutes	1
F	Get dressed	B	6 minutes	1
G	Leave for varsity	E,F	5 minutes	1

CONSTRUCT THE LOGIC DIAGRAM



VERIFY THE LOGIC DIAGRAM

- The logic diagram must be checked to ensure the logic built into it is correct.
- It is possible that certain project constraints might have been overlooked when focusing on specific activities.
- Once the verification process has been completed you can move on to the next step and calculate the project duration.
- These steps are normally integrated when using a PM planning package.

DETERMINE THE PROJECT DURATION (1)

- We use the term forward pass to define the process of calculating the early start and early finish dates for all activities.

Early start + activity duration = early finish

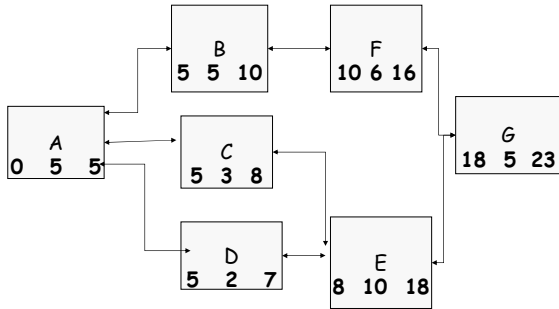
- We use the term backward pass to define the process of calculating the late start and late finish dates for all activities.

Late finish - activity duration = late start

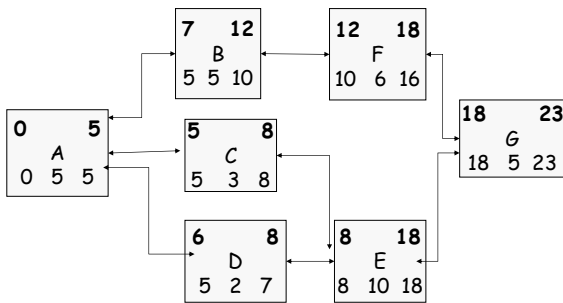
**DETERMINE THE PROJECT DURATION -
ACTIVITY BLOCK (2)**

Late start		Late finish
	Description	Float
Early start	Duration	Early finish

DETERMINE THE PROJECT DURATION -
THE FORWARD PASS CALCULATION (3)



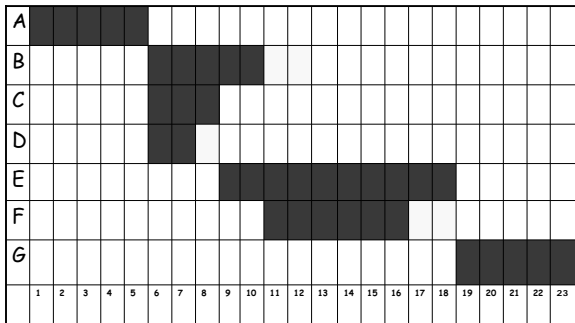
DETERMINE THE PROJECT DURATION -
THE BACKWARD PASS (4)



DETERMINE THE PROJECT DURATION - THE
CRITICAL PATH (6)

- ✦ You will notice that *path A - C - E - G* has no free time. This therefore implies that this path has no float and is called the critical path.
- ✦ The critical path can and will change over the duration of the project.
- ✦ It is important to check the critical path after each update the master programme.
- ✦ It is possible to have more than one critical path on the project.

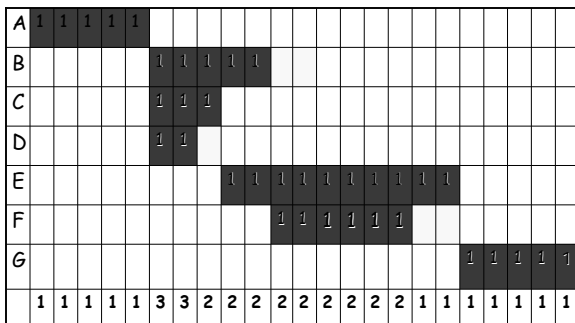
DETERMINE THE PROJECT DURATION - THE EARLY START BARCHART (7)



VERIFY THE PROJECT DURATION

- At this stage you can verify whether the project time objective will be achieved.
- You can also verify whether all of the milestone dates will be achieved.
- All other key operations need to be verified at this stage to ensure that the times calculated meet the project objectives.
- As you can see it is much easier to verify the project duration using a barchart.

CONSTRUCT THE RESOURCE HISTOGRAM (1)



CONSTRUCT THE RESOURCE HISTOGRAM (5)

- The amount of free float available needs to be considered.
- Complexity of tasks need to be considered as you do not want to delay an activity and then find it running late.
- The number of resources available need to be considered.
- The impact of the change on other activities.

ALLOCATING THE CALENDER

- Once the project duration has been calculated it needs to be superimposed on the project calendar.
- The calendar can be a 5, 6 or even 7 day working week.
- When allocating the calendar holidays and other non working days need to be taken into account.
- Certain PM packages allow for the use of multi-calendars on a project.

UPDATING THE SCHEDULE

- Project progress must be monitored on a regular basis. This can be weekly monthly or even daily.
- Progress is recorded as percentage work completed or percentage of work still to be completed.
- The actual work completed must be compared with the work scheduled for the period and any deviation must be analysed to determine the impact of the change on the project.
- A revised schedule must be produced and distributed to all concerned.

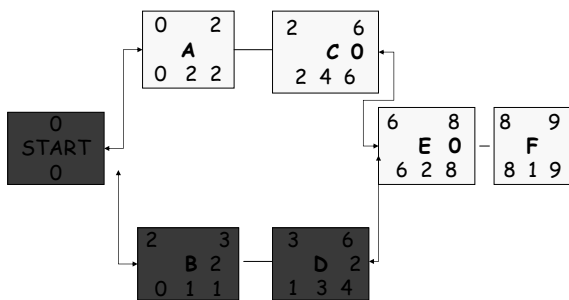
PROJECT PROGRESS AT END OF PERIOD 2

Activity	Scheduled	Actual
A	100%	100%
B	60%	40%
C	100%	One day late
D	100%	One day late
E	20%	Not started
F	0%	0%
G	0%	0%

CONSTRUCT A LOGIC NETWORK (1)

Activity	Duration	Dependency
A	2	Start
B	1	Start
C	4	A
D	3	B
E	2	C, D
F	1	E

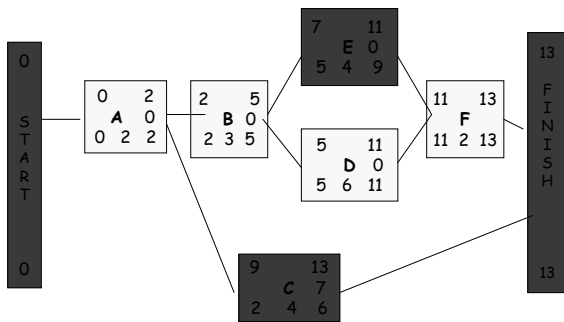
SOLUTION EXAMPLE 1



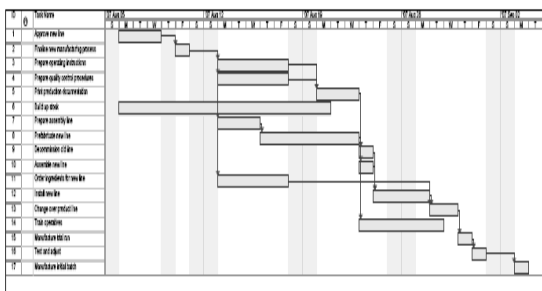
CONSTRUCT A LOGIC NETWORK (2)

Activity	Duration	Dependency
A	2	Start
B	3	A
C	4	A
D	6	B
E	4	B
F	2	D, E

SOLUTION EXAMPLE 2



SOLUTION EXAMPLE 3



READINGS IN LIBRARY (1)

Burke, (Rory), Project management planning and control techniques, Promatec International, 1999.

Cooke, (Brian), Construction planning, programming and control / 1998 Lockyer.

K. G.(Keith Gerald) Project management and project network techniques / 1996.

Woodgate, Harry Samuel Planning by network : 1977

Hoare, Henry Ronald Project management using network analysis / 1973 Burman.

READINGS IN LIBRARY (2)

Peter J. Precedence networks for project planning and control / 1972

Ogander, Mats. The practical application of project planning by network techniques / 1972

International Congress for Project Planning by Network Analysis(1969 :Amsterdam, Netherlands)
Project planning by network analysis / 1969

Moder, Joseph J. Project management with CPM and PERT / 1964

REFERENCES

* Burke, (Rory), Project management planning and control techniques, Promatec International, 1999.

* Scheduling systems with focus on practical concerns in repetitive projects, I-Tung Yang & P.G. Ioannou, Construction Management and Economics, July 2004, Volume 22.
