

BUTE Department of Construction Management and Technology

Basics of scheduling

22.11.2011

What is a schedule?

- Why?
 - To forecast the events/activities in the building project
 - To lay down deadlines
 - To forecast the requirements of money and other resources
- Affecting factors:
 - Law, regulation;
 - Financing;
 - Technology;
 - Location...

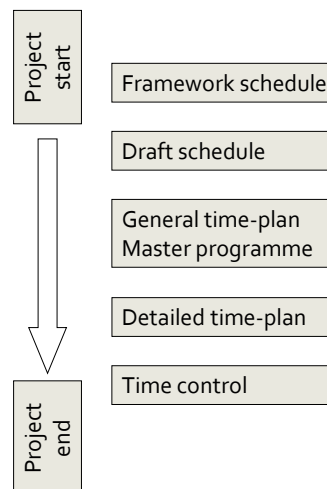
What is a schedule?

- Purposes and aims
 - To give the duration of a project/construction
 - To expose likely difficulties of the future, and help to solve them
 - To minimize the unproductive time of men and machines
 - To use as a control tool

It has to be detailed (and accurate) enough for the actual use – project manager, construction manager, general foreman, skilled workers, etc.

What is a schedule?

- Types of schedules (during a building project)
 - The later it is made, the more accurate and detailed it can be

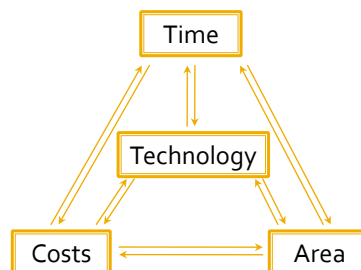


„Time planning“

„Time planning“

Information needed

- What to do?
 - Operations, activities;
 - Events;
 - Quality and quantity.
- How to do it?
 - Technology;
 - Type of labour (trades);
 - Type of machine, equipment;
 - Subcontractors.
- Costs?



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What to do?

- Determine what is to be done: OUTCOMES
- Work Breakdown Structure (WBS)
 - It is a technique for breaking down a total job into its component elements;
 - It is a tool used to define and group a project's discrete work elements in a way that helps organize and define the total work scope of the project;
 - It is NOT a project plan, a schedule, or a chronological listing.

„Time planning“

- Work Breakdown Structure (WBS) - example
 - ...
 - 07 Concrete works
 - 07-01 Blinding
 - 07-02 Concreting foundation slab
 - 07-02 Concreting walls
 - ...
 - 11 Wood works
 - 11-04 Formworking foundation slab
 - 11-04-02 Preparing formwork sheets
 - 11-04-05 Assembling and supporting
 - 11-04-11 Removing formwork
 - 11-04-12 Repairing formwork sheets
 - 11-06 Formworking walls
 - 11-06-02 Preparing formwork sheets
 - 11-06-04 Assembling and supporting internal formwork
 - 11-06-06 Assembling external formwork
 - 11-06-09 Scaffolding and supporting external formwork
 - 11-06-11 Removing formwork
 - 11-06-12 Repairing formwork sheets
 - ...

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What to do?

- WBS →
- List of operations (activities)
 - Production processes →
 - Building processes →
 - Technology processes →
 - Activities
- Quantities for each activity

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Assigning resources

- Material (construction material, auxiliary structures, ...)
- Human (management, skilled workers – labour)
- Equipment (machines, heavy equipment, power tools, ...)
- Area
- Money

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Standards: tools for estimating time required for the processes

- Performance standard [time/unit] (h/m³, h/m²...)
- Standard output [unit/time] (m³/h, pcs/h)
- The standards are determined by statistical/technical analysis, by measuring and comparing former performance.
- The standards have to be adjusted to the actual circumstances (location, resources, ...)

„Time planning“

Estimating time: the duration of the processes

$$\text{Work [time]} = \frac{\text{Volume [unit]}}{\text{Standard output [unit/time]}}$$

Work: time of process for one unit of resource

$$\text{Work [time]} = \text{Volume [unit]} \times \text{Performance standard [time/unit]}$$

$$\text{Duration [time]} = \frac{\text{Work [time]}}{\text{Allocated resource [unit]}}$$

Duration: time of process for the allocated units of resource

Result information:

- Operation (task), Quantity
- Labour / equipment, quantity
- Duration

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From these results

- the time-plan,
- the labour schedule,
- the equipment (plant) schedule,
- the material schedule,
- and the payment schedule can be made.

Connections between operations:

- Consecutive
 - Parallel
 - Overlapping
- Activities

Schedule representations

Schedule representations

Timetable (tabular or alpha-numerical schedule)

- It is accurate
- Hard to see the current status at the first sight

Example: a retaining wall

ID	Activity	Time	Start	Finish	Labour	Machine	Cost	Remark
1	Demolish top soil	2 d	02-04-10	03-04-10		1 bulld.	€...	
2	Excavating trench	2 d	04-04-10	05-04-10	3 labr.	1 backh.	€...	15% labr.
3	Blinding	3 d	06-04-10	08-04-10	5 labr.		€...	
4	Formwork (foundation slab)	3 d	08-04-10	10-04-10	2 carp.		€...	
5	Reinforcement (foundation slab)	5 d	08-04-10	12-04-10	4 steel.		€...	35% prefabr.

Schedule representations

Bar chart – Gantt chart

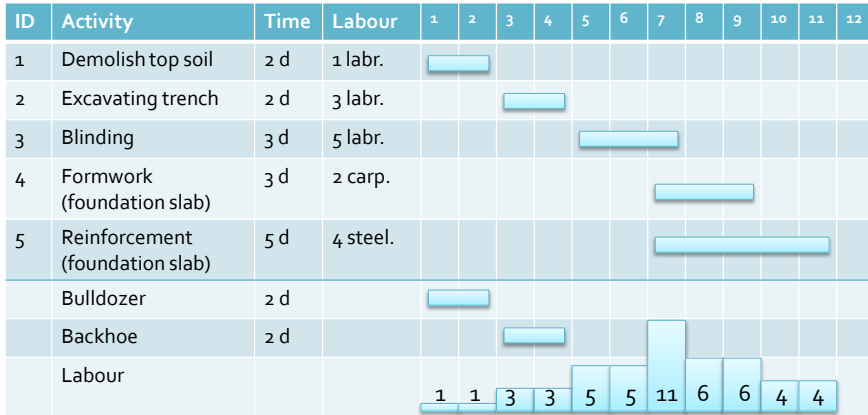
- Most widely used technique
- It consists of a scale – units of time (e. g. days, weeks,...) and a list of project elements (+other information)

ID	Activity	Time	Labour	1	2	3	4	5	6	7	8	9	10	11	12
1	Demolish top soil	2 d		█											
2	Excavating trench	2 d	3 labr.		█										
3	Blinding	3 d	5 labr.			█	█								
4	Formwork (foundation slab)	3 d	2 carp.					█	█						
5	Reinforcement (foundation slab)	5 d	4 steel.							█	█	█	█		

Schedule representations

Bar chart – Gantt chart

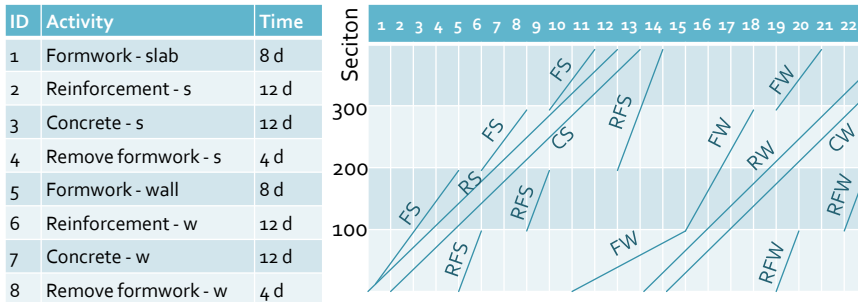
- Resource management: workers, equipment



Schedule representations

Linear schedule – Cyclogram

- Used usually by construction of linear objects or repeating tasks
- It shows spatial progress
- It consists of two scales – one for time (e. g. days, weeks,...) and one for space (+tabular info)



Schedule representations

Network diagram – e.g. CPM, PERT, MPM networks

- Two types of network diagrams:
 - activity on arrow (AOA) CPM
 - activity on node (AON) – these are generally easier to create and interpret. (MPM)
- It contains information about relations of activities
- Easy to see the critical path: activities that affect finishing time of the whole project, and activities that have slack.

Schedule representations

Network diagram – MPM network

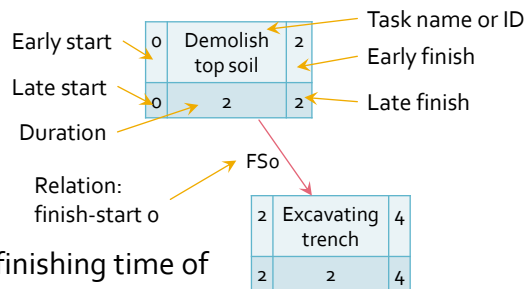
- Information about relations of activities:

- Finish-Start
- Start-Start
- Finish-Finish...

- Critical path:

- Activities that affect finishing time of the whole project
- Critical activities have no slack

- $Slack = LS - ES = LF - EF$



Schedule representations

Network diagram

- Activity on node (AON) network - MPM

