Planning

- **The road to project failure is paved with poor plans**

PLANNING: Influencing the future by making decisions today based on missions, needs and objectives.

- ***It is an art not science.***

Categories of planning:

- Time
- Cost
- Resources
- Quality
- Contingency

Time Planning

- When to start
- when to finish
- Time plans will be transformed to schedule (time scale)

Time planning steps

1) Divide project into component parts

2) Sequencing component parts in order of accomplishment

3) Assign durations to each component part

Cost Planning

- Allocating direct and indirect costs to the project components
- Summation of components costs. Total cost should equal the budget.
- (cost / schedule integration)

Resources Planning

- Construction Resources includes:

- money
- Material
- Human resources
- Equipments and tools

- Resources should be planned considering the budget.

- Attention to critical resources for project success

Quality Planning

- what is the minimum accepted quality?
- Should I exceed the required quality?
- How can I achieve this quality?

Contingency (Risk) Planning

- Planning for variability and uncertainty
- “What if” planning to include items subject to variability which are significantly impact project cost and time

Integrating Planning

- Integration of time, cost and resource planning against the same basic structure (WBS)
- Resource budgeting against time
- Cost budgets plotted against time

Thousands of tasks

- The psychologists say our brains can normally comprehend around 7-9 items simultaneously.
- So, divide and subdivide the project.

The WBS (Work Breakdown Structure)

- IT is used to break down the project from one main and relatively big entity into smaller, defined, manageable and controllable units, usually called work groups or tasks, or, at the finest level of detail (which is undesirable) activities

Take care!!!

- The deeper you go into the lower levels of the WBS, the more detailed knowledge you'll need to know.
- A good rule of thumb is the rule of 1-5-5-5, which entails that each level be broken down into a maximum of five lower levels.

Who develops the WBS?

- A WBS is developed by the A/E at the end of the design phase
- and/or by the bidders during the proposal (procurement phase)

The CWBS
(Contract Work breakdown Structure)

- After contract award, the project manager expands the WBS into a contract work breakdown structure (CWBS).

- as the initial step in the PLANNING process.

The CWBS

- The extended CWBS must include the levels at which required reporting information is summarized for submittal to the Owner

Uses of the WBS

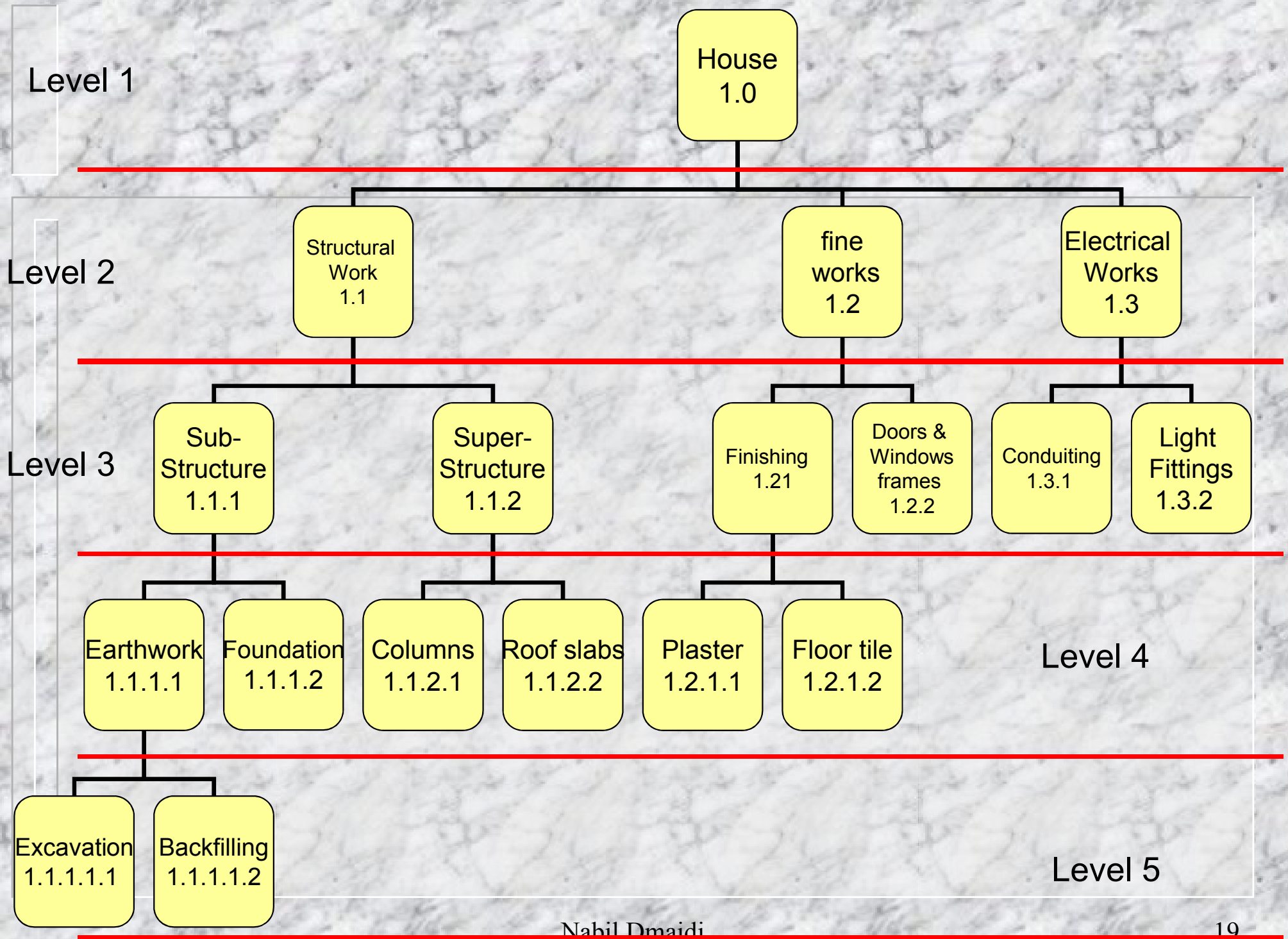
- The WBS is used to report program status externally to the Owner.
- The CWBS is used internally to plan the program in detail and to collect status information on a periodic basis for the lowest level of the CWBS, namely the schedule activities.
- The basis for technical planning and project achievement.

The CWBS

- it is a major task to undo.
- Why???
- Because cost collections begins at a CWBS element,

WBS/CWBS

- The individuals assigned the responsibility for WBS/CWBS development should never lose sight of the fact that the WBS is used for technical planning and status achievement.


Level 1
House
1.0
Level 2
Structural
Work
1.1
fine
works
1.2
Electrical
Works
1.3
Level 3
Sub-
Structure
1.1.1
Super-
Structure
1.1.2
Finishing
1.21
Doors &
Windows
frames
1.2.2
Conduiting
1.3.1
Light
Fittings
1.3.2
Earthwork
1.1.1.1
Foundation
1.1.1.2
Columns
1.1.2.1
Roof slabs
1.1.2.2
Plaster
1.2.1.1
Floor tile
1.2.1.2
Level 4
Excavation
1.1.1.1.1
Backfilling
1.1.1.1.2
Level 5

Conclusion

- The work breakdown structure defines the product elements (work packages).
- And their interrelations to each other and to the product.
- The WBS mostly ends with project tasks.
- Using the tasks you can extract project's activities.

Construction scheduling

- What is the difference between a schedule and a Plan?
- The schedule: putting the plan in time scale.

Most Common Scheduling methods

- common scheduling methodologies:

- Bar Charts (Gantt Charts)
- Critical Path Method (CPM)
- PERT (Project Evaluation & Review Techniques)
- Linear Scheduling Method (LSM)

Construction scheduling

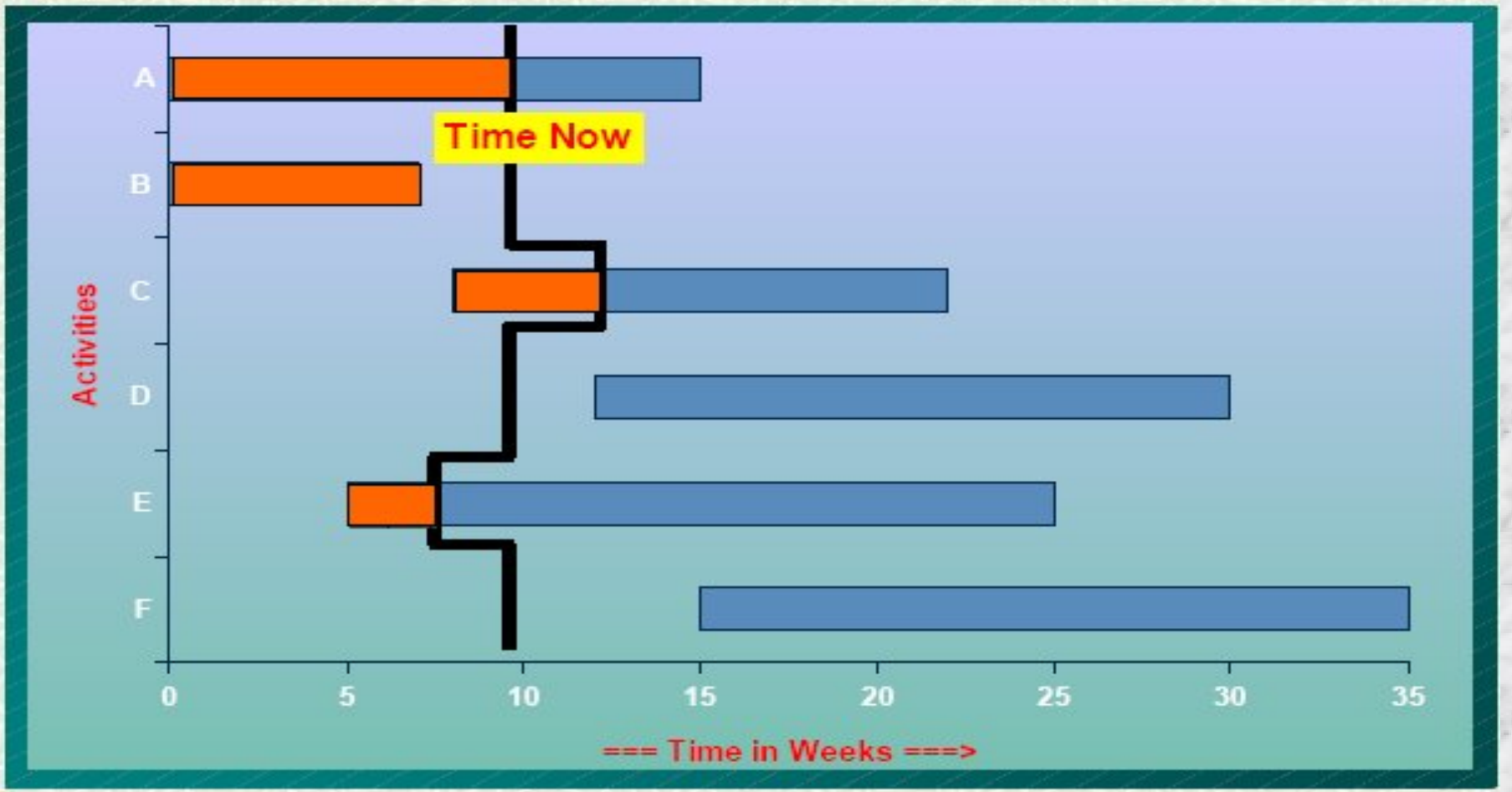
- To be able to build up a successful schedule. You need to:

1) Define activities
2) Order activities
3) Establish activities relationships
4) assign durations to activities
5) resources and costs allocation
6) calculate early and late start/finish times
7) calculate float values and identify the critical path

Bar Chart or Gantt chart

- **Bar chart is a collection of activities listed vertically, and the horizontal scale represents the time.**
- **First applied by HENRY GANTT**

Typical Bar / Gantt chart



Advantages of Bar / Gantt Chart

- Plan, schedule and progress are all depicted graphically on a single chart
- Easily read
- Provides simple way to schedule small projects
- Provides summary display of more detailed plans and schedules
- Best used for management briefings

Disadvantages of Bar / Gantt Chart

- Planning and scheduling are considered simultaneously
- Activity dependencies cannot adequately be shown
- Difficult to determine how activity progress delays affect project completion
- Difficult to establish and maintain for large projects

Critical Path Method (CPM)

- Two basic methods of analysis:

1) ADM -- Arrow Diagramming Method
   Activity On Arrow (AOA) or I-J Method
2) PDM -- Precedence Diagramming Method
   Activity On Node (AON) Method

Types of construction Constraints

1) Physical constraints.
2) Resource constraints.
3) Safety constraints.
4) Financial constraints.
5) Environmental constraints.
6) Management constraints.
7) Contractual constraints.
8) Regulatory constraints.

Physical constraints.

- Physical constraints exist due to physical process of construction.
- Physical constraints defined by “HOW” the project is to be carried out. (Method of construction).
- You need to erect formwork before you can cast concrete.

Resource constraints

- These constraints imposed wherever tow activities cannot be carried out simultaneously because insufficient resources are available.
- E.g. Tow activities require a crane to be performed and you have just one crane. So, they should not be performed at the same time.
- E.g. The amount of required concrete per day exceeds the production capacity of a batch plant.

Safety constraints.

- Safety constraints imposed by safety requirements through performing the work.
- Sometime imposes that tow activities could not be performed at the same time due to non-safe work conditions. (E.g. overhead and ground level work at the same area.)
- Imposes specific sequence of the work. (e.g. erecting of scaffolding before external paints can start)
- Imposes non-working days due to extremely hot or cold days.

Financial constraints

- Financial constraints: high cost activities could be delayed due to non-availability of cash requirements during construction.
- The amount of cost a company can pay within a specific period of time usually limited. So, try to avoid overlap between high cost activities.

Environmental constraints.

- Environmental constraints include restrictions to the work to avoid environmental violations.
- E.g. not working in certain area during specific times to avoid affecting proliferation of eagles, fish run.

Management constraints.

- Management constraints reflect decisions of management that result in a reasonable benefit of the company.
- E.g. the management decided to borrow from your project resources to be utilized in another project.
- E.g. the management decided to extend the new year holiday another 2 days.

Contractual constraints

- The owner may impose constraints on the construction process.
- E.g. the owner may require a particular phase of the project to be fully completed and occupied before start construction of next phase.
- And he may require to minimize the noise and dust because that portion is occupied and in operation.

Regulatory constraints.

- These type of constraints related to the regulations of the area of construction. Imposed by municipality, government, etc.

- E.g. if the construction site in the downtown, heavy vehicles like concrete mixers prohibited to access the site in a specific times of the day. So, you can just cast concrete at night.

Impacts of constraints on the network

- In the initial definition of the network, it is desirable to minimize the number of constraints, because excessive constraints have the following impact of the project.

1) Reduce scheduling flexibility.
2) Lengthen project duration.
3) Generally increase project costs.
4) Confuse basic scheduling logic.

Impacts of constraints on the network

- The imposition of constraints in the network results in linear ordering of activities. Which is not desired. (recall: the linear order of activities prolong the project duration and set most of the activities as critical).

Impacts of constraints on the network

- Only physical constraints should be considered in the early preparation of the network.
- Other constraints can be deferred until actual schedule of activities. Where it can be determined that :

1) the constraints are not met by the schedule.
2) It can be addressed by shifting of activities within their available float time.

Resources Allocation & Leveling

- So far, the network analysis has been considered using one resource only which is time.
- Construction activities in practice use other resources like labor, material, equipment and money.
- Moreover, the network analysis considered no limitations of the traditional resources (labor, material, equipment and money) which is not the case in practice.

Activities Relationships

- Types of relations between activities:

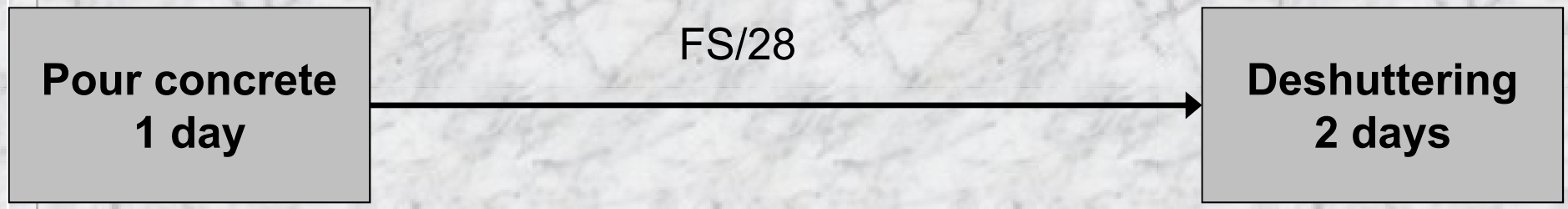
  1) Finish to start – FS
  2) Start to Finish – SF
  3) Finish to Finish – FF
  4) Start to Start - SS

1) Finish to start – FS Relationship

- The traditional relationship between activities.
- Implies that the preceding activity must finish before the succeeding activities can start.
- Example: the plaster must be finished before the tile can start.

Finish to start with delay relationship

Concrete curing an activity which consumes no resources other than time

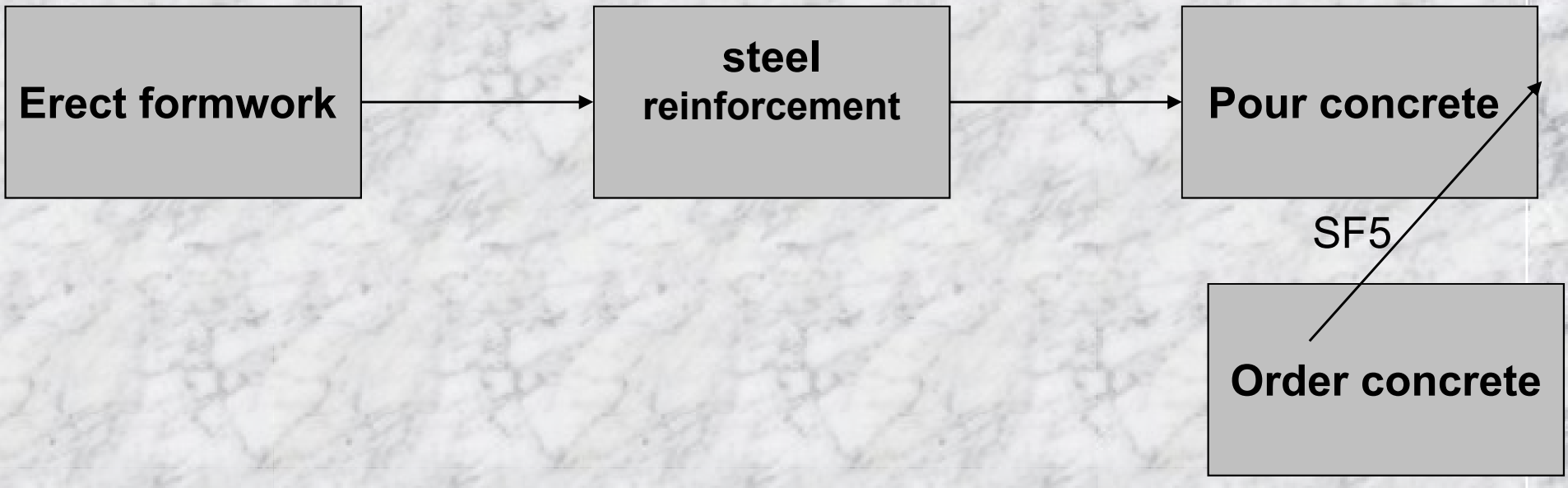


28 days is delay time or LAG means that: deshuttering can start 28 days after Concrete has been poured

3) Star to Finish – SF relationship

- Appear illogical or irrational.
- Typically used with delay time OR LAG.
- The following examples proofs that its logical.

2) Star to Finish – SF relationship

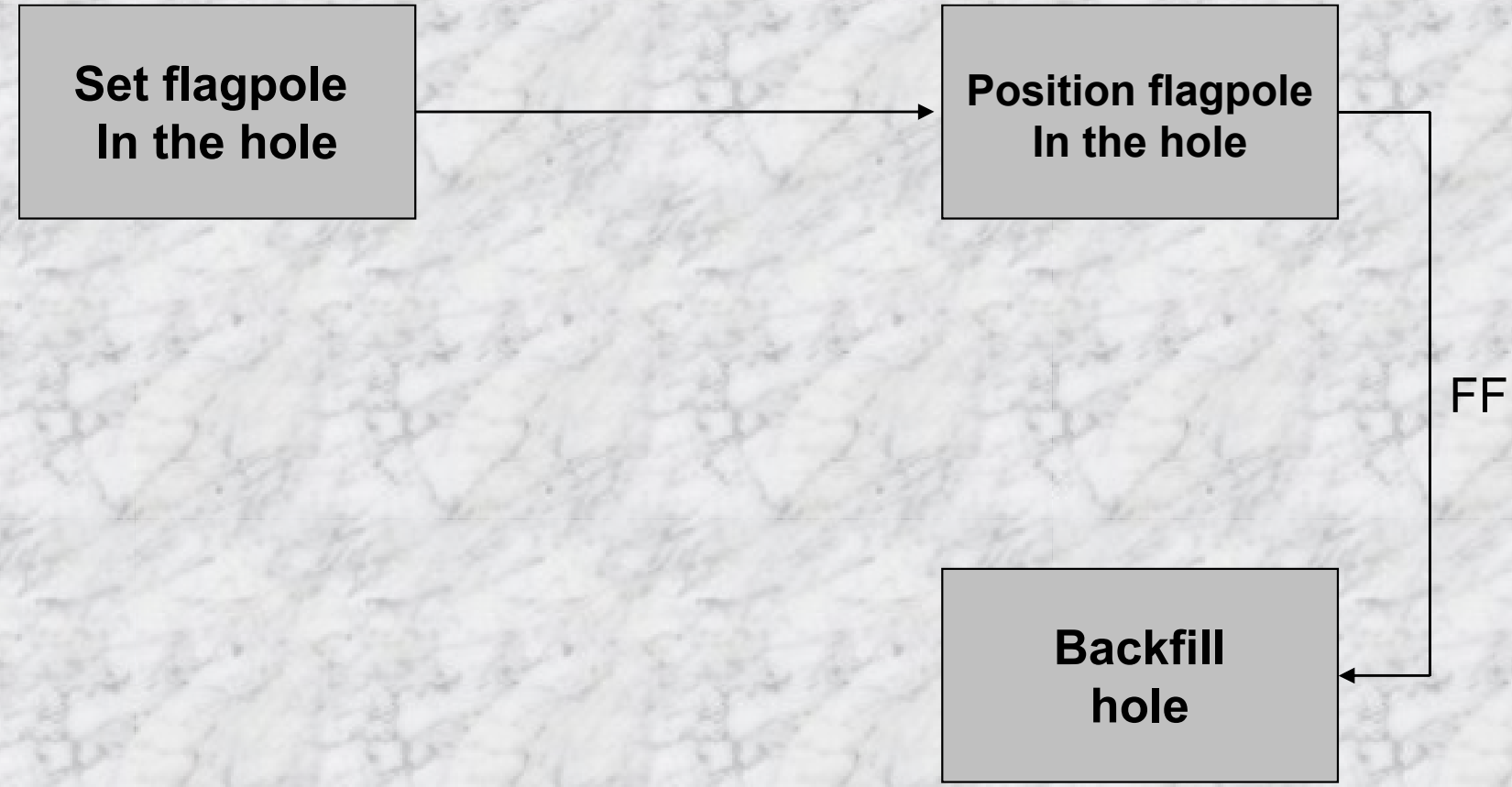


The concrete supplier stipulates 5 days order before delivery.

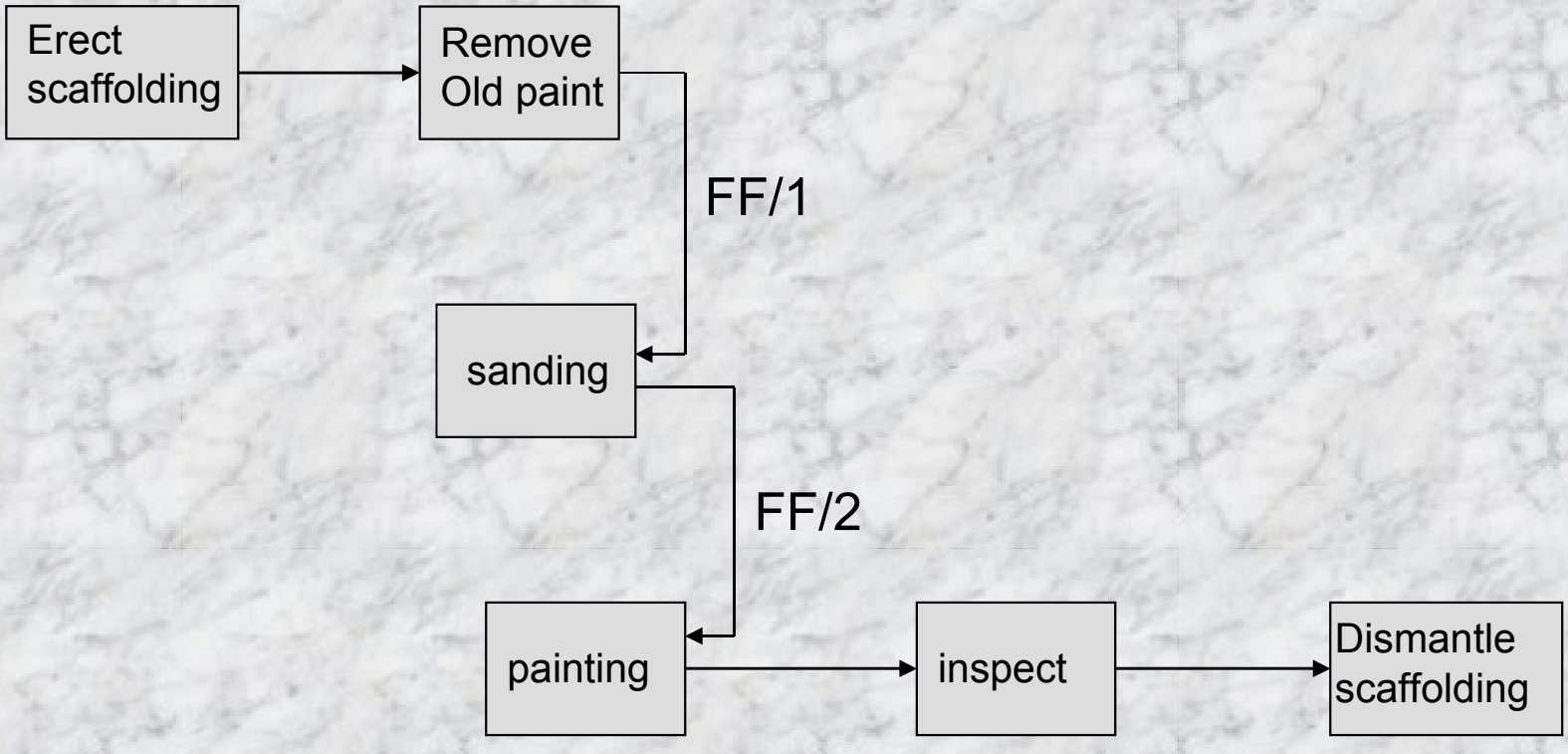
3) Finish to Finish – FF relationship

- Both activities must finish at the same time.
- Can be used where activities can overlap to a certain limit.

Finish to Finish – FF relationship



Finish to Finish with delay relationship



4) Start to Start – SS relationship