

# PLANNING AND SCHEDULING

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# OVERVIEW

## » Planning

- Scope
- Determine Work Items or Activities
- Determine Sequential Relationships or “Job Logic”
- Present the Planning Information

## » Scheduling

- Estimating Activity Durations
- Computing Project Completion Date

## » Types of Schedules

- Narrative Calendar
- Bar Chart
- Software

# PLANNING

## SCOPE

- Detailed Study of Project Requirements
  - What is to be done?
  - How it is to be done?
  - What order or sequence is to be used?
- Team Effort for Inputs
  - Internal: Project Manager, Superintendent, etc...
  - External: Subcontractor's, Suppliers, etc...

# PLANNING

## SCOPE- Example

- Consider the following portion of a larger project
  - At the start of a simple building project involving concrete footings and a three-foot foundation wall on the continuous footing, certain things must occur.
  - Some interior footing pads for columns will be installed under the slab
  - A six-inch gravel layer with vapor barrier will be installed under the concrete slab on grade

# PLANNING

## Determine Work Items or Activities

- Have identifiable beginning and end
- Requires time for its accomplishment
- May involve labor, field work, submittals, etc...
- Typically broken down (subdivided) into distinct physical elements (e.g. footings, walls, columns, floors, etc...)
  - Each element is uniquely identified (by using numbers or codes)

# PLANNING

## Determine Work Items or Activities

- Size may be relatively large or quite small
- Experience, common sense, and need best guide for level of detail needed
  - Too little detail will limit planning and controlling effectiveness
  - Too much detail will inundate the users with redundant information
- Also consult contract specifications
  - Specific owner requirements might dictate the type or size

# PLANNING

## Determine Work Items or Activities - Example

### *START OF SIMPLE BUILDING PROJECT*

<u>Unique ID</u>	<u>Activities or Work Items</u>
1	Notice to Proceed
2	Mobilization
3	Layout Site
4	Site Excavation
5	Layout Building
6	Footing Excavation
7	Form and Pour Footings
8	Form and Pour Footing Pads
9	Underslab Plumbing Rough-in
10	Underslab Electrical Rough-in
11	Form and Pour Foundation Wall
12	Slab Gravel/Vapor Barrier
13	Form and Pour Concrete Slab

# PLANNING

## Determine Sequential Relationships or “Job Logic”

- Order that the activities are to take place
- Start of some activities depends upon completion of others
- On the other hand many activities are independent of one another (concurrently)
- Keep in mind that there may be more than one general approach
  - Goal: Select the best alternatives



# PLANNING

## Determine Sequential Relationships or “Job Logic”

- **Activity Relationships**
  - **Finish-to-Start (FS) relationship**
    - One activity must be completed before the next activity begins
  - **Start-to-Start (SS) relationship**
    - An activity starts after the beginning of another activity, but before the first activity is completed
  - **Finish-to-Finish (FF) relationship**
    - An activity must be finished before another activity is finished

# PLANNING

## Determine Sequential Relationships or “Job Logic”

- Activity Relationship Examples
  - Finish-to-Start (FS) relationship
    - Using the “START OF SIMPLE BUILDING PROJECT” the “Footing Excavation” activity must be finished before “Form and Pour Footings” can be started

# PLANNING

## Determine Sequential Relationships or “Job Logic”

- Activity Relationship Examples
  - Start-to-Start (SS) relationship
    - Using the same example, assume that “Footing Excavation” is a five-day activity
    - This activity will start at the west end of the building and progress east
    - After two-days of excavation, “Form and Pour Footings” crew can start at the west end of the building, while the excavator continues eastward
    - The two-days between the start of “Footing Excavation” and the start of “Form and Pour Footings” is called the lag (the difference between the starts of the two activities)

# PLANNING

## Determine Sequential Relationships or “Job Logic”

- Activity Relationship Examples
  - Finish-to-Finish (FF) relationship
    - The activities of installing plumbing sleeves (“Underslab Plumbing Rough-in” activity) and forming and pouring the foundation wall (“Form and Pour Foundation Wall” activity) can be done at the same time
    - However, the plumbing sleeves will need to be installed before the foundation wall can be completed

# PLANNING

## Determine Sequential Relationships or "Job Logic" - Example

### START OF SIMPLE BUILDING PROJECT

<u>Unique ID</u>	<u>Activities or Work Items</u>	<u>Sequential Relationships or "Job Logic" - (FS)</u>
1	Notice to Proceed	
2	Mobilization	1
3	Layout Site	2
4	Site Excavation	3
5	Layout Building	4
6	Footing Excavation	4, 5
7	Form and Pour Footings	6
8	Form and Pour Footing Pads	7
9	Underslab Plumbing Rough-in	7,8
10	Underslab Electrical Rough-in	7,8
11	Form and Pour Foundation Wall	7,8
12	Slab Gravel/Vapor Barrier	9,10,11
13	Form and Pour Concrete Slab	12

# PLANNING

## Present the Planning Information

- Next phase once planning is complete (all activities and job logic have been accounted for)
- Looks at the time required to complete an individual activity
- Determines the time required for the overall project
- Represents or models the planning process using a diagram or chart
- This process is referred to as “scheduling” and involves several steps

# **SCHEDULING**

## **Estimating Activity Durations**

- Durations customarily expressed in working days (typically not calendar days)
  - Some exceptions are: concrete cure times, material procurement, settlement periods, etc..)
- Should be familiar with the type of work when estimating activity durations
  - Internal: input from field team (Superintendent's, Foremen, etc...)
  - External: input from Subcontractor's

# **SCHEDULING**

## **Estimating Activity Durations**

- **Numerous methods are available for estimating activity durations:**
  - A. **Apply production rates to the total quantity of work to be done**
  - B. **Calculate the duration from the estimated labor hours**
  - C. **Calculate the duration from the estimated labor cost**
  - D. **Determine the duration by experience or judgement**



# SCHEDULING

## Estimating Activity Durations - Example

A. Apply production rates to the total quantity of work to be done

<b>Activity</b>	<b>Total Quantity</b>	<b>Production Rate</b>	<b>Duration</b>
Clear & Grub	20 Acres	2 Acres per Day	10 Days

# SCHEDULING

## Estimating Activity Durations - Example

**B. Calculate the duration from the estimated labor hours**

<b>Activity</b>	<b>Total Quantity</b>	<b>Total Estimated Labor Hours</b>	<b>Assumed Crew Size (8-hour shift per day)</b>	<b>Duration</b>
Erect Footing Forms	3,000 Square Feet	320 Total Labor Hours	5 People	8 Days

# SCHEDULING

## Estimating Activity Durations - Example

**C. Calculate the duration from the estimated labor cost**

<b>Activity</b>	<b>Total Quantity</b>	<b>Total Estimated Labor Dollars</b>	<b>Labor Rate</b>	<b>Assumed Crew Size (8-hour shift per day)</b>	<b>Duration</b>
Erect Footing Forms	3,000 Square Feet	6,000 Dollars	\$50.00	5 People	3 Days

# **SCHEDULING**

## **Estimating Activity Durations - Example**

**D. Determine the duration by experience or judgement**

<b>Activity</b>	<b>Duration</b>
Set up Construction Trailer	6 Days

# SCHEDULING

## Estimating Activity Durations – Start of Simple Building Example

### START OF SIMPLE BUILDING PROJECT

<u>Unique ID</u>	<u>Activities or Work Items</u>	<u>Sequential Relationships or "Job Logic" - (FS)</u>	<u>Duration</u>
1	Notice to Proceed		0
2	Mobilization	1	10
3	Layout Site	2	1
4	Site Excavation	3	5
5	Layout Building	4	1
6	Footing Excavation	4, 5	3
7	Form and Pour Footings	6	5
8	Form and Pour Footing Pads	7	3
9	Underslab Plumbing Rough-in	7,8	5
10	Underslab Electrical Rough-in	7,8	5
11	Form and Pour Foundation Wall	7,8	10
12	Slab Gravel/Vapor Barrier	9,10,11	2
13	Form and Pour Concrete Slab	12	3

# **SCHEDULING**

## **Computing Project Completion Date**

- Occurs after each activity duration is estimated
- Uses the “job logic” from the planning process to sequence the activities (along with judgement and trial and error too)
- Produces the actual project schedule
  - Find out if project finishes early, on-time, or late
- Some of the ways that project completion can be computed will be shown in the next section – “Types of Schedules”

# TYPES OF SCHEDULES

## Narrative Calendar

- Presents the activities on a calendar format
- Use narrative descriptions for the activities to show what is being done over a period of time (daily, weekly, or monthly)
- If you do this for all activities in their logical sequence (“job logic”)
  - The completion date should correspond to the date for the last activity shown on the calendar

# TYPES OF SCHEDULES

## Narrative Calendar - Example

Two Week Schedule

Activity	2/3/2020	2/4/2020	2/5/2020	2/6/2020	2/7/2020	2/10/2020	2/11/2020	2/12/2020	2/13/2020	2/14/2020
	Monday	Tuesday	Wednesday	Thursday	Friday	Monday	Tuesday	Wednesday	Thursday	Friday
Mobilization	Deliver porta potty	Set up job trailer	Run temporary power	Install security cameras	Transport equipment	Transport equipment				
Clear and Grub (C&G)							C&G Area 1			
Excavate								Excavate Area 1	Excavate Area 1	Excavate Area 1



# TYPES OF SCHEDULES

## Bar Chart

- Relatively easy to understand by a wide audience (project managers, field crews, owner, etc...)
- Presents the activities in a graphical way that allows us to picture the work versus time
  - Activities listed on the vertical scale
  - Time is shown on the horizontal scale

# TYPES OF SCHEDULES

## Bar Chart

- In general the bar chart shows:
  - Activities required
  - Overall construction period
  - Beginning and completion of each activity
  - Duration of each activity (length of bar)
  - Time periods required for the major parts

# TYPES OF SCHEDULES

Bar Chart - Example

# TYPES OF SCHEDULES

## Software

- Microsoft Excel
- Microsoft Project
- SmartSheet
- Many more out there: e.g. Search the web using the following keyword(s):
  - Scheduling Software
  - CPM Software

**QUESTIONS?**

THANK YOU!

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