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TECHNIQUES FOR MANAGING

COMPLEX PROJECTS

WITH

PLANNING AND SCHEDULING SOFTWARE

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1 ABSTRACT

Project Managers and Directors often become frustrated with planners and schedulers when a schedule becomes so complex that even the scheduler has difficulty in understanding where he is or what is happening in the schedule.

This paper will discuss techniques that may be used for developing and managing schedules that have a large number of activities and a number of complex relationships.

These techniques may be used with other planning and scheduling software packages but were developed for and will be demonstrated using Primavera P3 and SureTrak.

The target audience are people who are beginner and intermediate project schedulers and people who are interested in schedule review and analysis.

The techniques to be demonstrated are:

- “**Activity Coding**” – This part of the presentation outlines some practical guideline on how to use Primavera WBS, Activity Codes and Activity ID Codes in large project schedules. It will outline the advantages and disadvantages of each and show some practical examples of each.
- “**Milestone Hammocks**” – This is a technique developed by the author for the management of a complex process plant commissioning schedule.
- “**Staged**” development of a schedule – A process following the PRINCE2 methodology of developing a master or project schedule dividing a project into Stages.

2 INTRODUCTION

2.1 The Problem

Have you ever become frustrated with planners and schedulers when:

- The schedule becomes so complex that even the scheduler has difficulty in understanding where he or she is, or what is important and not just what is on the critical path?
- You are unable to follow the flow of the logic because of complex and detailed logic relationships between unrelated activities.

2.2 Some Solutions

This paper will discuss techniques that may be used for developing and managing schedules that have a large number of activities.

These techniques may be used with many planning and scheduling software packages but were developed with and will be demonstrated using Primavera P3 and SureTrak.

3 AIM

This presentation will discuss the following topics:

- Milestone Hammocks
- Activity Coding
- “Staged” development of a schedule

4 MILESTONE HAMMOCKS

4.1 Introduction to Milestone Hammocks

This is a technique developed by the author for the management of complex projects.

The technique involves developing two levels of logic

4.1.1 Low Level Logic

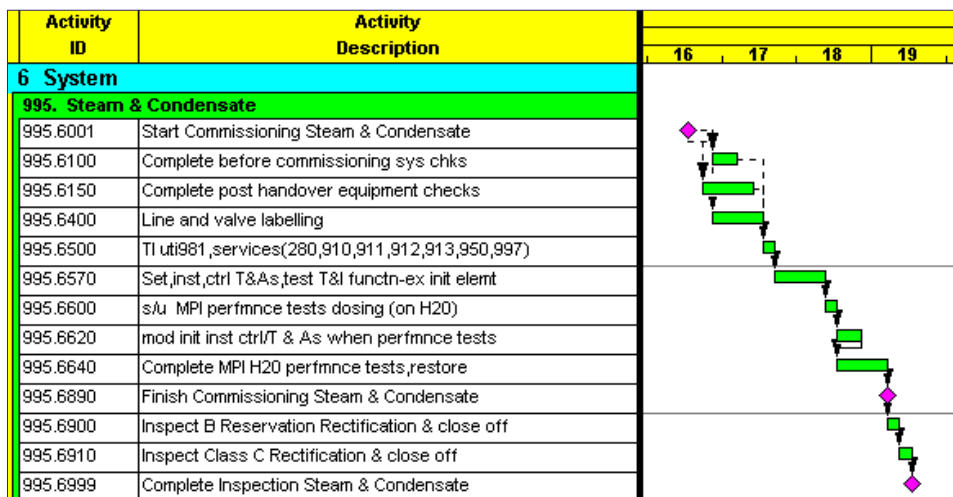
Small networks of detailed activities are created for groups of activities that represent parcels of work such as commissioning a process system or group of related activities in the same discipline in an area of a project. These activities span between a start and a finish milestone.

4.1.2 High Level Logic

All logic between groups of activities is made between these milestones thus providing a high level summary logic system.

4.2 Low Level Logic

Detailed logic is developed between groups of activities, see the example below and are preceded with a Start Milestone and Succeeded with a Finish Milestone



4.3 High Level Logic

The summary or high level logic is developed between the milestones

Act ID	Activity Description	Rem Dur	%
System handover acceptance(M/S)			
200.6001	Start Commissioning Paraffin Oil Storage	0	0
Finish Commissioning Paraffin Oil Storage			
221.6001	Start Commissioning Reactor 1	0	0
222.6001	Start Commissioning Reactor 2	0	0
# Start elec witness checks(M/S) Paraffin Wax St			
205.5500	# Start inst witness checks(M/S) Paraffin Wax St	0	0
System handover acceptance(M/S)			
205.6001	Start Commissioning Paraffin Wax Storage	0	0
Start Commissioning Paraffin Wax Storage			
205.6010	system ready for commissioning	0	0
Finish Commissioning Paraffin Wax Storage			
221.6001	Start Commissioning Reactor 1	0	0
222.6001	Start Commissioning Reactor 2	0	0
# Start elec witness checks(M/S) Reaction Add's			
210.5500	# Start inst witness checks(M/S) Reaction Add's	0	0
System handover acceptance(M/S)			
210.6001	Start Commissioning Reaction Additives	0	0
Start Commissioning Reaction Additives			
210.6010	system ready for commissioning	0	0
Finish Commissioning Reaction Additives			
221.6001	Start Commissioning Reactor 1	0	0
222.6001	Start Commissioning Reactor 2	0	0

The picture above displayed using SureTrak shows how simple it becomes to check the high level logic.

4.4 Advantages of Milestone Hammocks

There are two main advantages of milestone hammocking:

- It is simple to enter and check both the high level and the detail logic.
- Reports by Milestone make it simple for people to review the order of activity groups, see example below:

Activity ID	Activity Description	2000											
		A	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR			
971.6890	Finish Commissioning Office / Amenities building												
992.6890	Finish Commissioning Site Safety Systems												
913.6890	Finish Commissioning Firewater / Firefighting Sy												
280.6890	Finish Commissioning Effluent Treatment												
SG177890	Finish Group 280 & 950 Commission Effluent												
SG077890	Finish Group 910 & 910A Commission Cool Water												
SG107890	Finish Group 995,995A&995B Commission Steam & Con												
230.6890	Finish Commissioning Chlor Paraffin												
223.6890	Finish Commissioning Reaction Transfer												
210.6890	Finish Commissioning Reaction Additives												
221.6890	Finish Commissioning Reactor 1												
222.6890	Finish Commissioning Reactor 2												
SG017890	Finish Group 210 & 221 Commission RA&R1												
SG027890	Finish Group 200, 205 & 222 Commission ParOil&WWS												
AC1.8890	Finish Systems 200,205,210,221 & 222 Commission												
AC2.8890	Finish Sys 200,205,210,221,222,240,250&260 Comm												
AC3.8890	Fin200,205,210,221,222,223,224,230,245,250&260Cm												
PLA.9700	Project Closure												

4.5 Disadvantages of Milestone Hammocks

This method is not suited to all types of schedules, especially schedules where there are many matrix relationships, such as buildings where there are multiple trades working in one area with start to start relationships to the same trade in other areas.

5 ACTIVITY CODING

5.1 Understanding Activity Coding

Primavera Software has three types of codes:

- Activity Codes
- Activity ID Codes and
- WBS Codes

This part of the presentation outlines some practical guideline on how use the coding structures in large project schedules. It will outline the advantages and disadvantages of each and show some practical examples of each.

5.2 Activity Codes

Activity Codes should be used for the assigning items that may change such as:

- Responsibility
- Supplier
- Contractor

Activity Codes are useful for all schedules and provide a method of grouping activities under different headings.

I suggest that the length of the codes are kept short to reduce the amount of typing when the codes are manually typed in.

5.3 Activity ID Codes

Activity ID codes put logic into the Activity ID's. These should be used for the first four or five characters in the Activity ID and used for items such as:

- Phase, e.g. Design, Procure, Install
- Discipline, e.g. Electrical, Mechanical, Civil
- Area of site
- System or Process

It is advisable to keep the code to one character for each code dictionary otherwise you will end up running out of characters in your Activity ID.

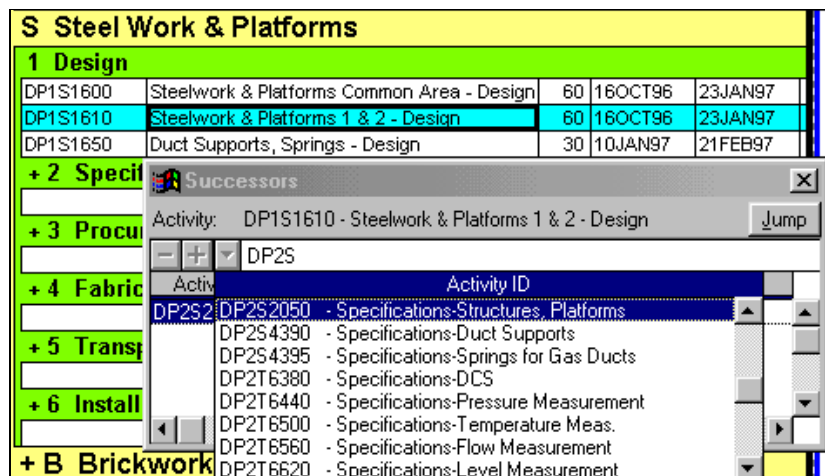
5.3.1 Disadvantage of Activity ID Codes

Complex use of Activity ID Codes may make it difficult to add new activities and you will have to type in the correct codes in the Act ID when adding an activity.

Should you renumber an activity to change it's code assignment then you will lose the relationship to a Target schedule.

5.3.2 Advantages of Activity ID Codes

Well planned Activity IDs make it easy to find activities and to add logic in large projects. Therefore when you type the first characters representing the Activity ID in an Activity ID drop-down box the software takes you to the correct place in the list of activities. The picture below shows DP2S has taken the user to the Structural Steel Specifications:



This is almost a prerequisite for schedules which have a large amount of logic.

It is suggested that you consider using:

- Activity ID Codes for activity attributes that are unlikely to change such as Phase or Discipline and use.
- Activity Codes for attributes that may change, such as Responsibility or Contractor

5.3.3 Typical Code Structures

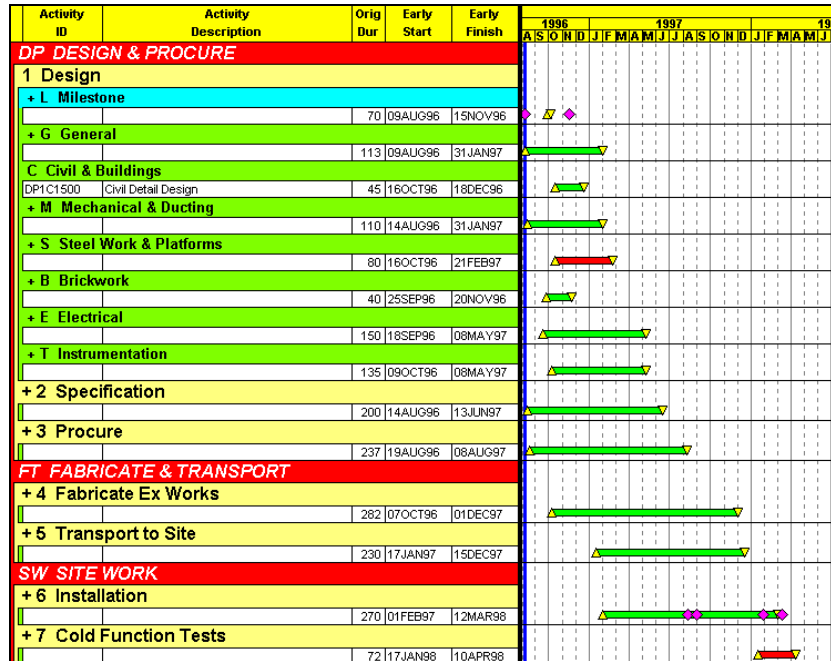
We will look at a typical Activity ID code structure of a process plant project.

SUBP	Subproject ID
DP	DESIGN & PROCURE
FT	FABRICATE & TRANSPORT
SW	SITE WORK

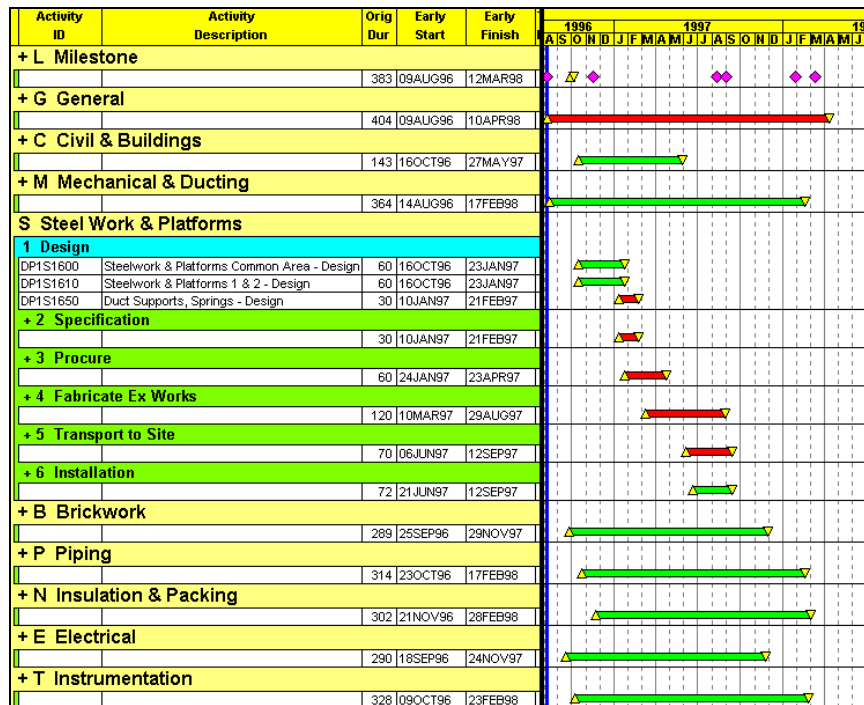
PHAS	Phase
1	Design
2	Specification
3	Procure
4	Fabricate Ex Works
5	Transport to Site
6	Installation
7	Cold Function Tests

DISC	Discipline
L	Milestone
G	General
C	Civil & Buildings
M	Mechanical & Ducting
S	Steel Work & Platforms
B	Brickwork
P	Piping
N	Insulation & Packing
E	Electrical
T	Instrumentation

We will look at a schedule organised with Activity ID Codes. The example below is organised by Sub Project, Phase and Discipline. You will notice the Civil Detail Design activity has the Activity ID Codes in the first four characters of the Activity ID.



The example below is organised by Discipline and then Phase:



5.4 Work Breakdown Structure

5.4.1 What Is A WBS?

A Project WBS represents a hierarchical breakdown of a project into elements.

Software packages like Primavera P3 & SureTrak provide a function titles WBS which may be used to represent a hierarchial breakdown of a project for any of the following:

- WBS - Work Breakdown Structure, which breaks down the project into the Work required to complete a project.
- OBS - Organisation Breakdown Structure, showing the hierarchical structure of a project.
- CBS - Contract Breakdown Structure, showing a breakdown of contracts and subcontracts.
- SBS - System Breakdown Structure, showing the elements of a complex system.

5.4.2 How To Use P3 WBS

P3 allows one hierarchical WBS structure and therefore only one of the above structures may be defined with the P3 WBS facility.

It is recommended that you use Activity Codes for all your Project Breakdown Structures unless you have specific requirements for a hierarchical WBS. Activity Codes are a lot more flexible than a WBS.

5.4.3 Understanding P3 WBS Codes

The P3 Work Breakdown Structure is a hierarchical structure to which activities are attached.

- Costs, durations and logic may not be applied to WBS codes; they are purely a structure to attach activities.
- Costs, resources and durations may be summarised at WBS levels in the same manner as organising with Activity Codes.
- There is a “WBS Activity Type” in P3 & SureTrak which is similar to Hammock but without the need for relationships and summarises all the activities in the area that it is assigned to.
- A maximum of 20 WBS levels are available.

5.4.4 Advantages of WBS

- The setting of a low level WBS code sets all the higher level codes at once. Therefore one code allocation sets many codes.
- WBS Activities summarise all the activities within a band and act like hammocks without predecessors and successors.

5.4.5 Disadvantages of WBS

- In SureTrak WBS and activity Codes may not be mixed in one Layout.
- Only one presentation is available and no other grouping is possible.

6 STAGED DEVELOPMENT OF A PLAN

The Staged development of a project plan is recommended when a project has a number of phases and only the near phases may be detailed. This is often the case with development projects when little or no detail design has been undertaken.

A process following the PRINCE2 methodology is recommended in this situation. It is based on developing a master or project schedule and then dividing a project into Stages. Each Stage of the project has its own schedule, which is developed and approved before the commencement of that Stage. The Stage is required to stay within the milestones of the project schedule.

PRINCE2 plans have a plan hierarchy of three levels, the first two are mandatory and the third is optional

- Project Plan
- Stage Plan and
- Team Plans are optional
- An exception plan is produced when a plan exceeds its limits.

6.1 Project Plan

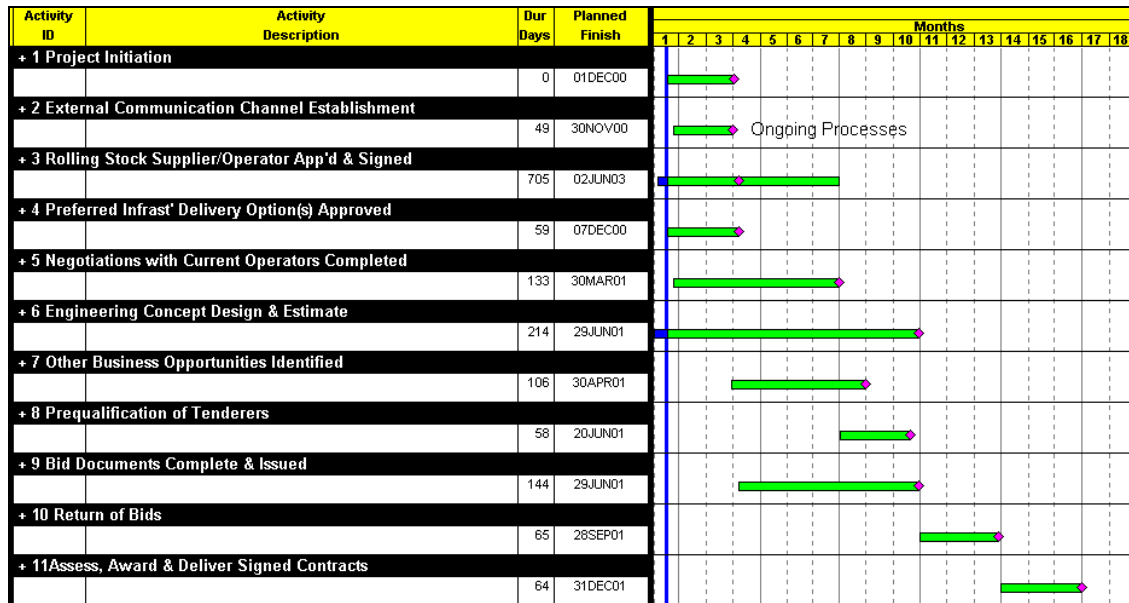
A Project Plan is a written document that outlines the following information:

- Provides a Total Picture of Project
- Provides Business Case and Project Costs
- Includes assumptions, risks, key deliverables and resources
- Provides a baseline against which to monitor actual costs and progress
- Defines major control Stages
- Revised at the end of each Stage

Project Time Schedule which supports the project plan would:

- Divide the schedule into Stages.
- The activities in each Stage would be deliverable based.
- Include the costs associated with each stage.
- Have all the key resources

Example of Deliverable Based Project Schedule

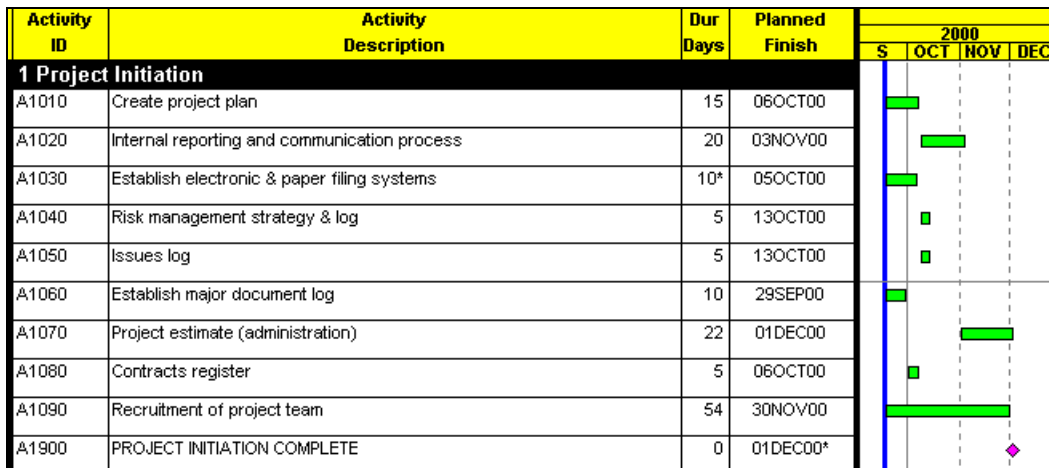


6.2 Stage Plan

A Stage plan would be:

- Produced before the start of a stage
- Basis of “Day to Day” control
- Constructed from Team plans
- Assumptions and Risks re-assessed and new risks added
- Team Plan is an optional lower level, which may be a sub-contractors plan
- Contains the Stage Quality Plan

An example of a simple Initiation Stage Plan is below:



6.3 Team Plan

When a schedule requires further granulation a Team Plan is generated.

6.4 Exception Plan

An exception plan is:

- Produced when a Stage forecast breaks tolerances and this is produced when Forecasts exceed plan not actuals.
- Replaces a current stage plan

6.5 Development of a Staged Plan

How do we apply the PRINCE2 Concepts to the construction industry?

Contracts on multi stage multi discipline projects often call for a fully detailed project with critical path within 2 weeks of contract award, usually impossible to achieve when the Detail Design is not complete, delivery dates unknown and construction method undecided until procurement delivery dates are available. These types of contracts should adopt a a high level project plan and assign stage plans for:

- Basic Design
- Detailed design & Specification
- Procurement & Expediting
- Installation and Pre-commissioning
- Commissioning

The client should approve each stage plan prior to the stage work being commenced.

7 SUMMARY

In this presentation we have looked at:

- Milestone Hammocks for managing schedule logic at two levels.
- Activity Coding and the different methods of using the structures available in P3.
- The “Staged” development of a schedule.