

Chapter 15

Using the Schedule to Forecast and Balance Resources

ARC 226 CONSTRUCTION SCHEDULING

Introduction

- CPM offers the ability to balance resources
 - Use resources evenly throughout the project
- Achieved by manipulating the float to start and finish activities when resources are available
- Resources to balance
 - Equipment
 - Number of workers on site
 - Cash flow

Creating Resource Relationships

○ Physical relationships

- Predecessor must be complete before the successor can start

○ Quality relationships

- Predecessor is completed to ensure higher quality for the successor
 - Exterior siding and drywall example

○ Safety relationships

- Predecessor is completed to ensure higher safety standards for the successor

○ Resource relationships

- Two activities that need the same piece of equipment
 - Equipment, costs, materials, workers

Forecasting and Balancing Cash Flow

⦿ Cost loaded schedule

- Costs are included in the schedule

⦿ Activity values must be known

- Amount the owner owes after an activity is completed
- All direct and indirect costs
- Bid price becomes the project budget

⦿ The total of the activity values should equal the project budget

Monthly Cash Flow

- **Monthly value =**
 - Estimated activity value / Duration
- **A bar chart is then created based on ES and EF and also showing float for each activity**
 - Lower portion shows a resource profile
 - How much is used in a particular time period (month)
- **How can resources be arranged so that cash flows remain steady or do not exceed a prescribed amount**
 - Easily done with a computer

Cash Flows, cont.

- The cash flows (amount the owner owes after completion of an activity) need to be forecast for the project
- If the amounts are too high for a particular month, activities with float need to be manipulated to even out the cash flows
- The importance of understanding the different types of float becomes paramount
 - Knowing how to handle the activities with float can be as or more important than handling the critical activities

Progress S-Curves

- Plots the cumulative costs over the time
- Cost usually slow to accumulate early and again late in the project
 - Steep curve early may indicate front-loaded billing
- Often based on the early start dates
 - The progress curve can be refigured from the late start dates

Banana Curves

- Early and late S-curves plotted together
 - Loosely resembles a banana figure
- If the actual progress curve is above the banana, the project is either over budget or ahead of schedule
- If the actual progress curve is below the banana, the project is either under budget or behind schedule
 - The actual line should be between the ES or LS lines
 - May work as a good early warning system
 - MS Project will only do ES or LS, but not both

Forecasting and Balancing Equipment

- ① **Equipment loaded schedule**
 - Equipment is added to the schedule
- ① **Similar methods to balancing for cash flows**
 - Analyze the number of pieces of equipment for each activity
 - Then create a bar chart showing float and load the chart with the equipment to be analyzed
 - Examine the loadings and adjust the bars within the float as desired
- ① **How can the project be complete under the constraints of the required equipment with the equipment that is available**

Forecasting and Balancing Human Resources

- **Labor loaded schedule**
 - Crew size is added to the schedule
 - Number of workers is forecast and balanced in the same way as the equipment and costs
- **Determine the number of workers and crew size for each activity**
- **How can the project be completed with the crew that is available?**
 - Manage the float activities
 - Difficult without the use of a computer

Automatically Balancing with Computers

● Two methods generally used

- Minimum float rule
 - More common
- Minimum duration rule

● The automatic results may not always be the most efficient method for the jobsite

- It may make more sense to use a piece of equipment in one area vs the other
- It may make more sense to do some of the work manually
 - Activities may be sorted by resources, etc.

Duration-Driven vs. Resource Driven Schedules

- So far, the schedule has a set duration and then resources are assigned
 - More common method
- Or, the project can have set resources and then assigned durations
 - Not as common of a method because projects are typically duration constrained

Conclusion

- For realistic scheduling, the required and available resources must be considered
 - Each project has its associated resource constraints
- Labor, equipment, money, and material must be available in sufficient but realistic quantities
- Understanding the different types of float helps balance the resource requirements