ARC 226 Construction Scheduling

Chapter 10
Using Lags In Network Logic Diagrams

Introduction

- The use of lags can reduce the number of activities
  - So far, the logic diagrams have one activity following another
  - It may be possible to overlap some activities
    - Successor starts, but the predecessor is not completely finished
- Lags are used to facilitate the overlaps
  - May also allow for time between activities

Types of Lags

- There are four types of lags
  - Finish-to-start (FS)
  - Start-to-start (SS)
  - Finish-to-finish (FF)
  - Start-to-finish (SF)
- The relationship between activities used so far has been finish-to-start
  - This is the default relationship
  - The predecessor must be finished before the successor starts

Finish to Start Relationship

- Activity A must finish before activity B can start
  - Assuming no lag (no number on the arrow)
  - A number on the arrow indicates the amount of lag
    - Activity B can start X days after activity A has finished
      - Commonly used for concrete curing operations or other curing or drying activities
      - Orders placed, the lag indicates the days before delivery
- Using a lag activities can be eliminated
  - Concrete example
    - Pour concrete Cure concrete Load concrete
      - Becomes Pour concrete → 5 → Load concrete
- Negative lag →
  - Indicates the activity starts X number of days before the finish of the predecessor

Start-to-Start Relationships

- Activity A starts, and activity B starts X number of days after the start of A
  - X indicates the number of days of lag
  - More common on medium to large projects
- Example
  - Steel studs started, rough electrical can start soon after
    - All the steel studs do no need to be completed
    - Various other examples
- No negative lags for a start-to-start relationship

Finish-to-Finish Relationships

- Activity A finishes and then X days later activity B finishes
  - X indicates the lag
  - Common to large projects
- Example
  - Place the drywall
  - X days later the mudding and taping is completed

Which Lag Should Be Used?

- Is an SS or an FF relationship more appropriate?
- Generally, the predecessor must be complete before the successor can be complete
  - This would make an FF relationship seem more logical
  - But the later activity can not start until after the earlier activity has started
- Rule-of-thumb:
  - If the successor has a longer duration than the predecessor, use an SS lag
  - If the successor has a shorter duration than the predecessor, use an FF lag
- Another option is to use both
  - Usually an easy option with scheduling software

Start-to-Finish Relationships

- Activity A starts and X days later activity B finishes
  - X indicates the days of lag
  - Not a common relationship
- The manager must decide when and where to use lags
- Keep in mind that the idea of the schedule is to keep the communication about project goals simple and effective
  - Do not let lags interfere with effective communication

Lags and Flexibility

- With lags in the schedule the field personnel can decide which areas are best to start
  - Field managers can adjust the work without affecting the schedule
- This may be a disadvantage as well
  - There may be reasons to start on a particular portion of work that are not obvious from looking at the schedule
    - Possible use a more detailed schedule to convey this information
- A bar chart can be used for field personnel
  - Eliminate confusion

Start and Finish Date Calculations with Lags

- Forward pass
  - Add the duration to the ES date to get the EF date
  - Then consider the relationships between the successor and predecessor activities
    - For an FF, add the lag to the predecessor's EF, then subtract the duration to get the ES
      - Will show an obvious SS relationship
        - See page 114 figure 10.11 and 10.12
- Follow the arrows, add and subtract accordingly
- Backward pass
  - Same operation, reverse order
    - Subtract the amount of lag and follow in reverse order

Bar Charts with Lags

- The bar chart will show the lags by the overlap of activities
- With more than one relationship the bar chart dates can become quite confusing
  - Often the computer is used to calculate the dates automatically

Review

- Lags can significantly reduce the number of activities on a schedule
- The overlap helps to reduce the duration of the project
- Lags allow for flexibility in the field
  - Reduces the amount of time spent updating the schedule
- Lags may not show the necessary detail needed to eliminate communication problems