

PROJECT MANAGEMENT

THE MANAGERIAL PROCESS

Clifford F. Gray
Eric W. Larson
Third Edition



Lecture 4

Developing a Project Plan Activity on Node (AON)

Activity on Node (AON)

Learning Objectives

- At the end of this topic you will be able to:
 - Draw the Activity on Node (AON) network
 - Analyze the Activity on Node (AON) network

Comparison of AON and AOA Methods

AON Method

Advantages

1. No dummy activities are used.
2. Events are not used.
3. AON is easy to draw if dependencies are not intense.
4. Activity emphasis is easily understood by first-level managers.
5. The CPM approach uses deterministic times to construct networks.

Disadvantages

1. Path tracing by activity number is difficult. If the network is not available, computer outputs must list the predecessor and successor activities for each activity.
2. Network drawing and understanding are more difficult when dependencies are numerous.

AOA Method

Advantages

1. Path tracing is simplified by activity/event numbering scheme.
2. AOA is easier to draw if dependencies are intense.
3. Key events or milestones can easily be flagged.

Disadvantages

1. Use of dummy activities increases data requirements.
2. Emphasis on events can detract from activities. Activity delays cause events and projects to be late.

Introduction of AON

- Node of AON
- No free float

Earliest Start	Latest Start
Label, Description, Resources	
Duration	Total Float

Formula of AON Analysis

- $EFT = EST + \text{Duration}$
- $LST = LFT - \text{Duration}$
- $LFT = LST + \text{Duration}$
- $\text{Total Float} = \text{Latest Start Time} - \text{Earliest Start Time}$

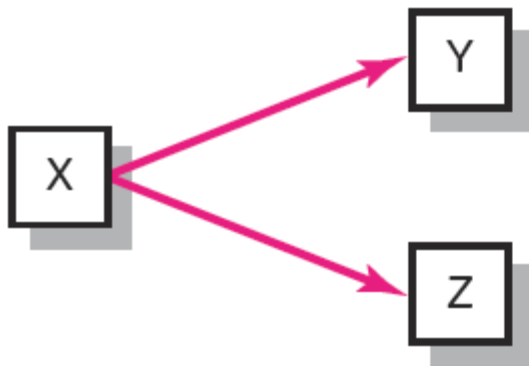
Earliest Start Time	Latest Start Time

Activity-on-Node Fundamentals



A is preceded by nothing
B is preceded by A
C is preceded by B

(A)

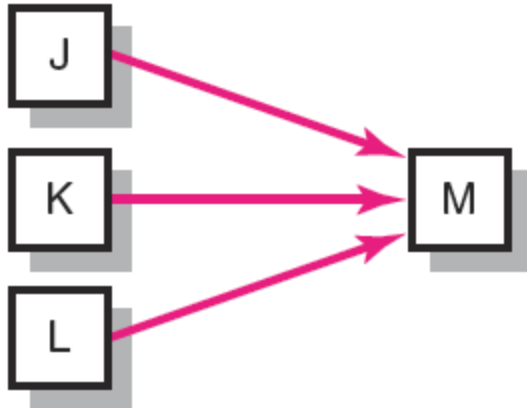


Y and Z are preceded by X

Y and Z can begin at the same time, if you wish

(B)

Activity-on-Node Fundamentals (cont'd)

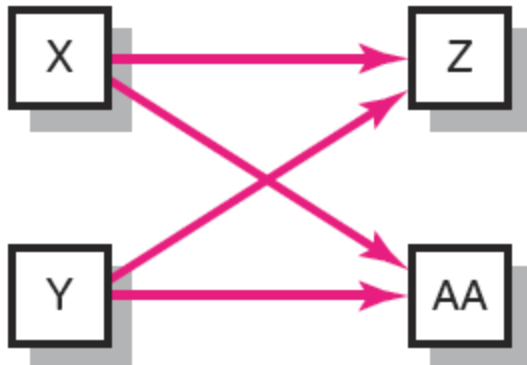


J, K, & L can all begin at the same time, if you wish (they need not occur simultaneously)

but

All (J, K, L) must be completed before M can begin

(C)



Z is preceded by X and Y

AA is preceded by X and Y

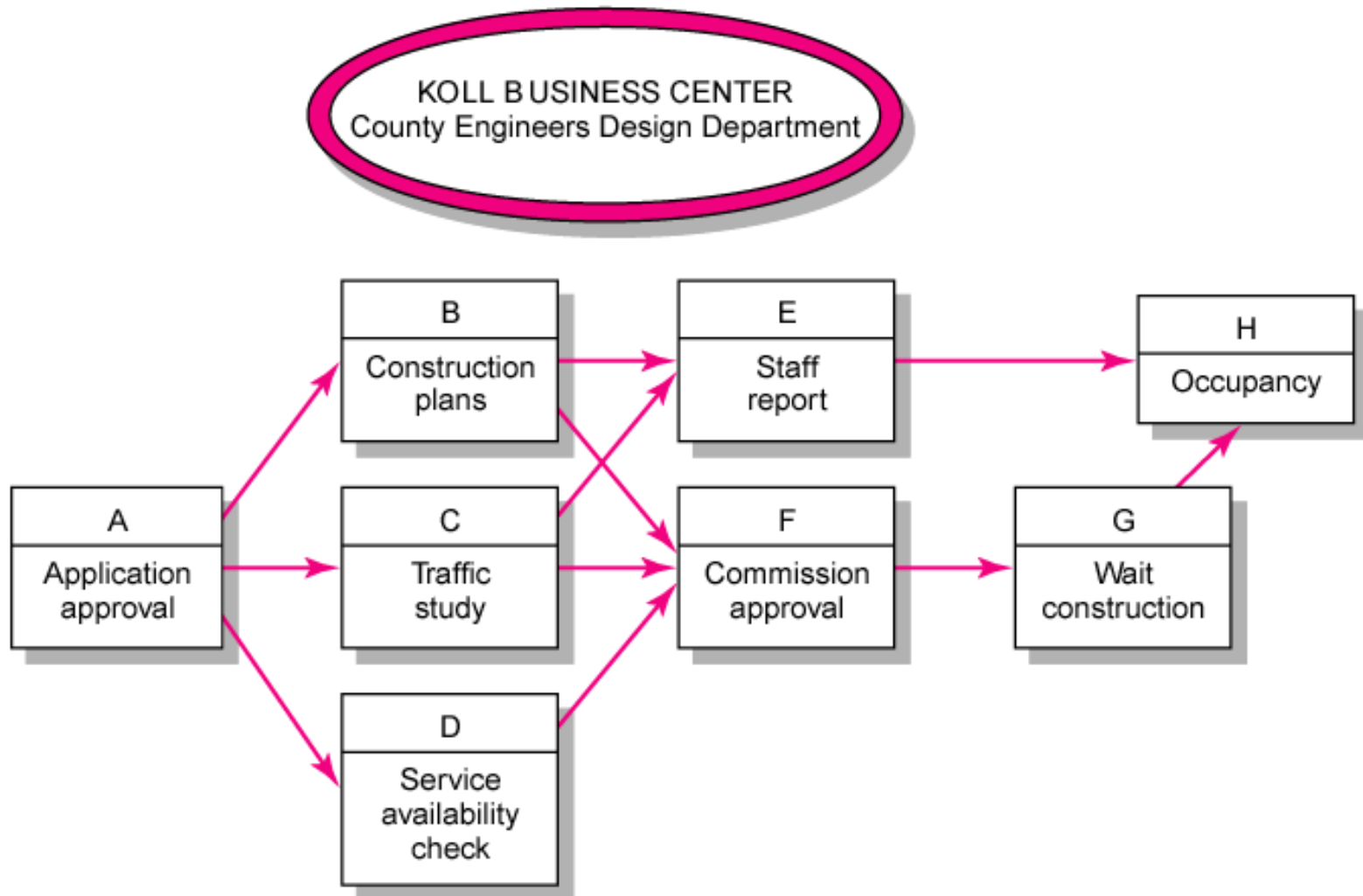
(D)

Network Information

KOLL BUSINESS CENTER County Engineers Design Department

Activity	Description	Preceding Activity
A	Application approval	None
B	Construction plans	A
C	Traffic study	A
D	Service availability check	A
E	Staff report	B, C
F	Commission approval	B, C, D
G	Wait for construction	F
H	Occupancy	E, G

Koll Business Center—Complete Network



Network Computation Process

- **Forward Pass—Earliest Times**
 - How soon can the activity start? (early start-EST)
 - How soon can the project finish? (expected time-EFT)
- **Backward Pass—Latest Times**
 - How late can the activity start? (late start-LST)
 - How late can the activity finish? (late finish-LFT)
 - Which activities represent the critical path?
 - How long can it be delayed? (total float-TF)

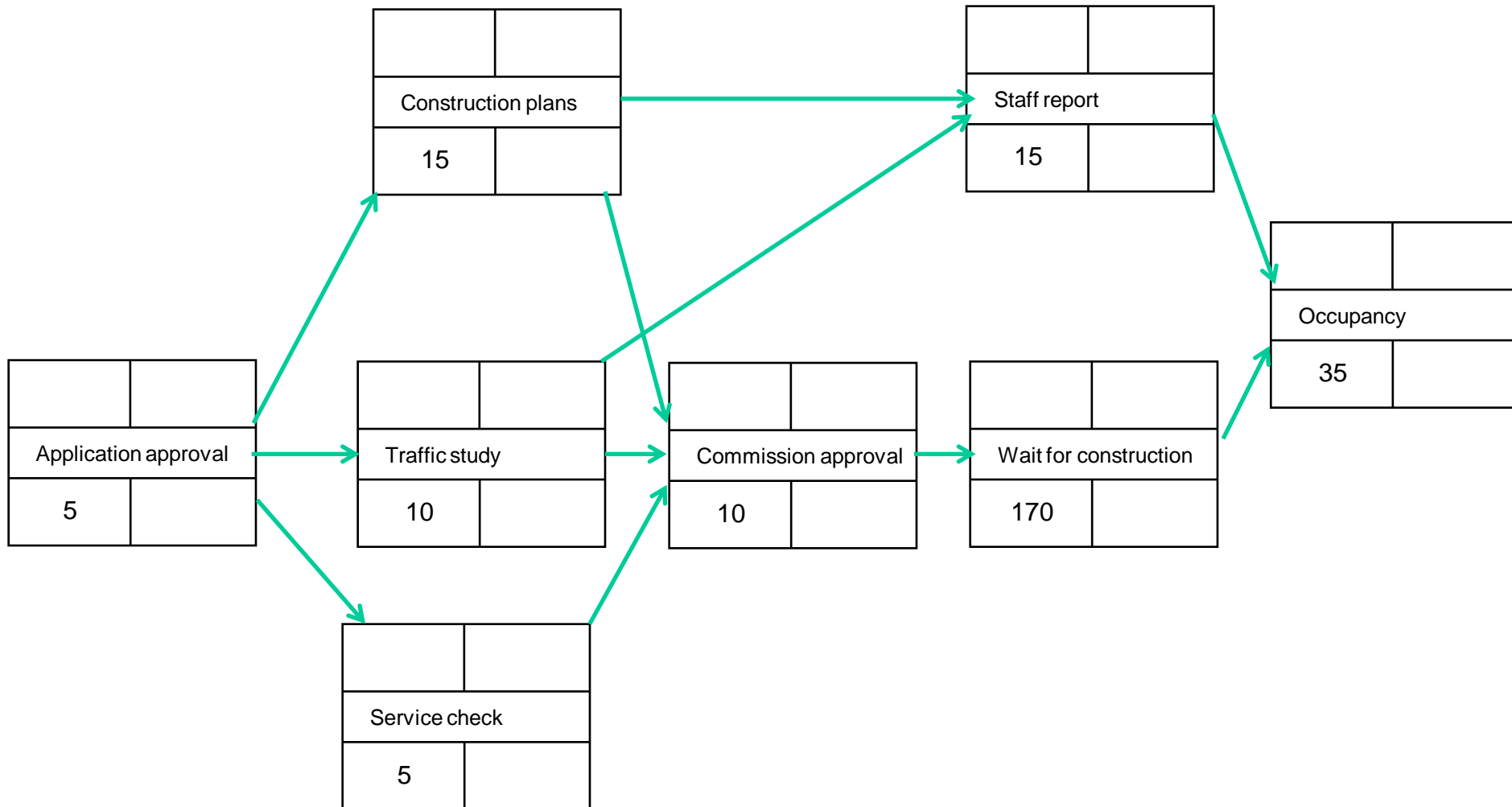
Network Information

KOLL BUSINESS CENTER County Engineers Design Department

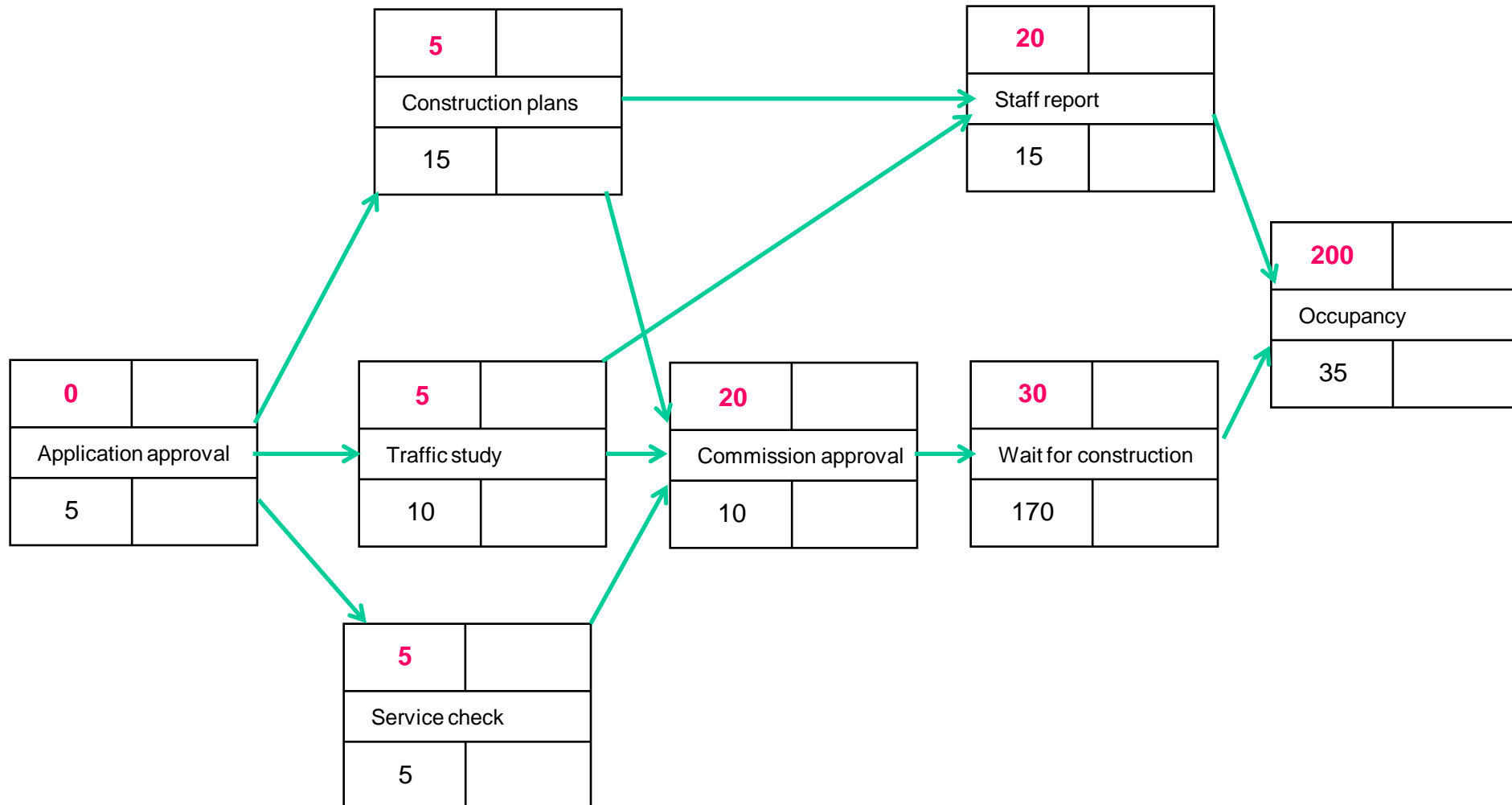
Activity	Description	Preceding Activity	Activity Time
A	Application approval	None	5
B	Construction plans	A	15
C	Traffic study	A	10
D	Service availability check	A	5
E	Staff report	B, C	15
F	Commission approval	B, C, D	10
G	Wait for construction	F	170
H	Occupancy	E, G	35

TABLE 6.2

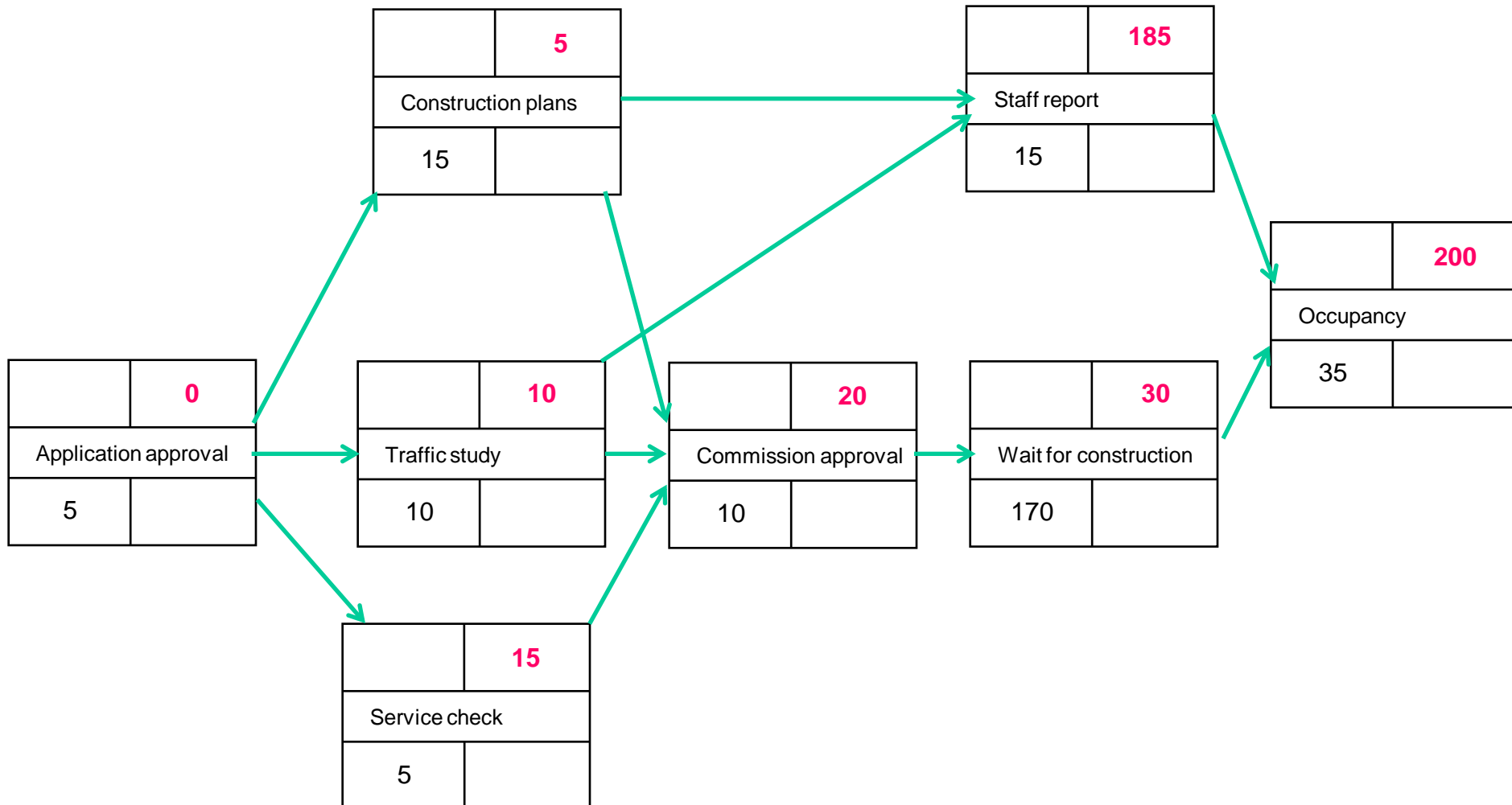
Activity-on-Node Network



Activity-on-Arrow Network Forward Pass



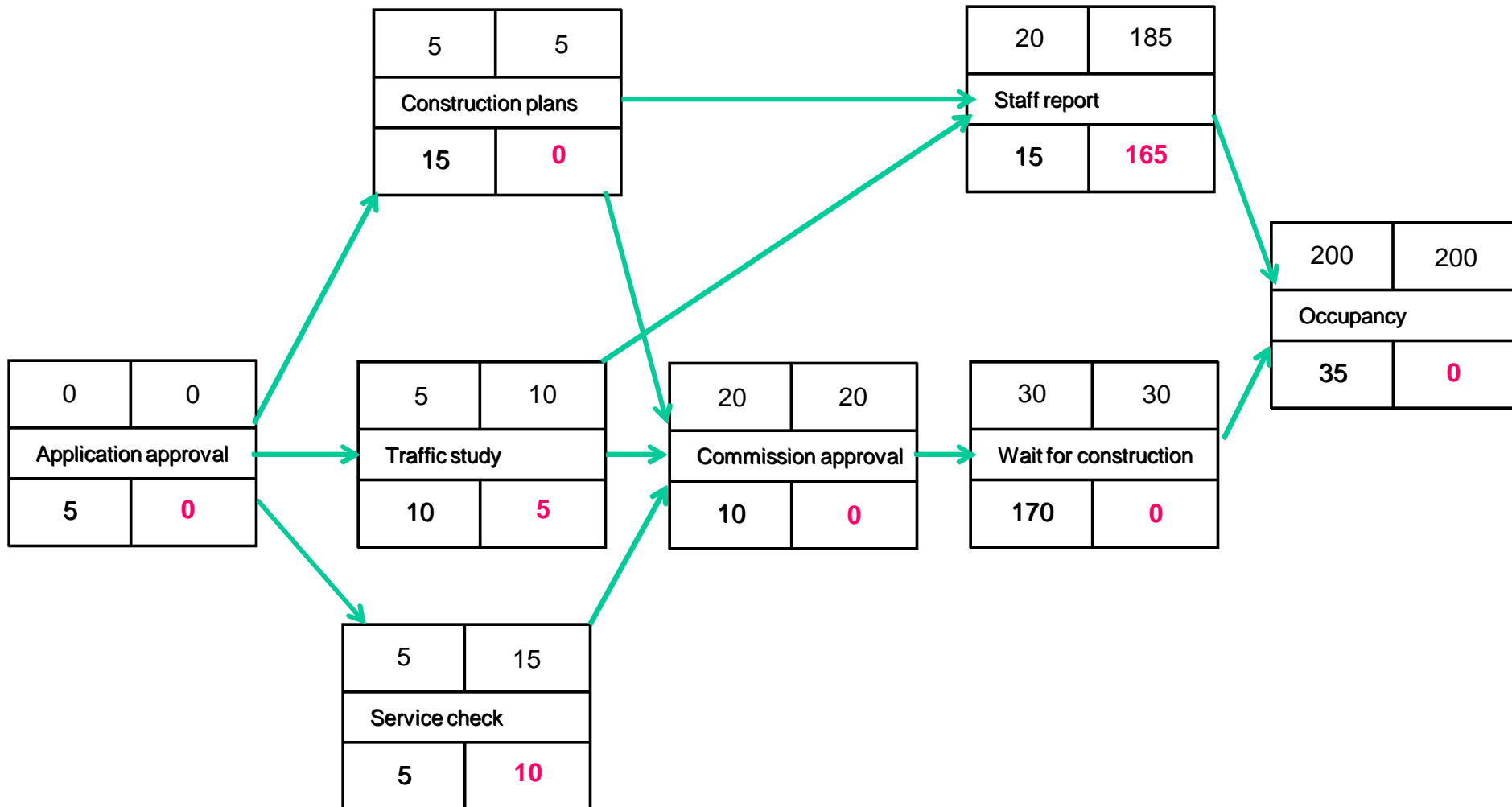
Activity-on-Arrow Network Backward Pass



Determining Slack (or Float)

- Slack (or Float)
 - The amount of time an activity can be delayed after the start of a longer parallel activity or activities.
- Total slack
 - The amount of time an activity can be delayed without delaying the entire project.

Activity-on-Node Network with Total Float



Summary Table

No.	Activity Description	Duration (weeks)	Earliest Start Time (EST)	Latest Start Time (LST)	Earliest Finish Time (EFT)	Latest Finish Time (LFT)	Total Float

Frequently Asked Questions

1. What is the critical path?
2. How long does it take to finish the project?
3. What are the total float for the non-critical activities?

Two Errors in Logic

1. Looping
2. Dangling

Illogical Loop

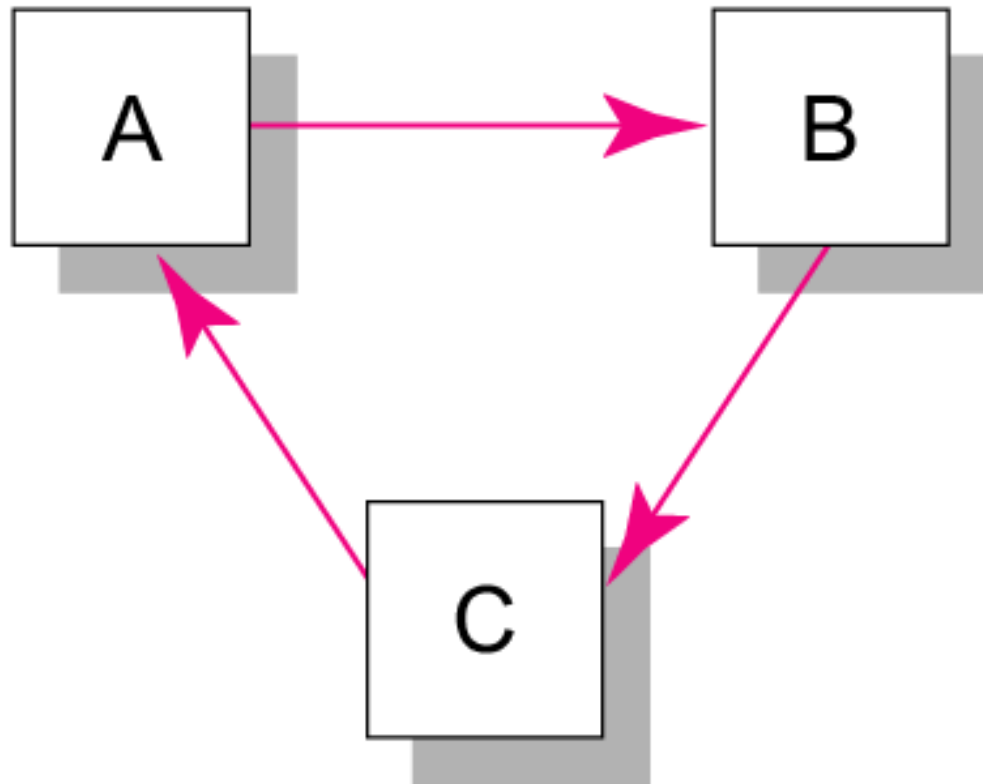
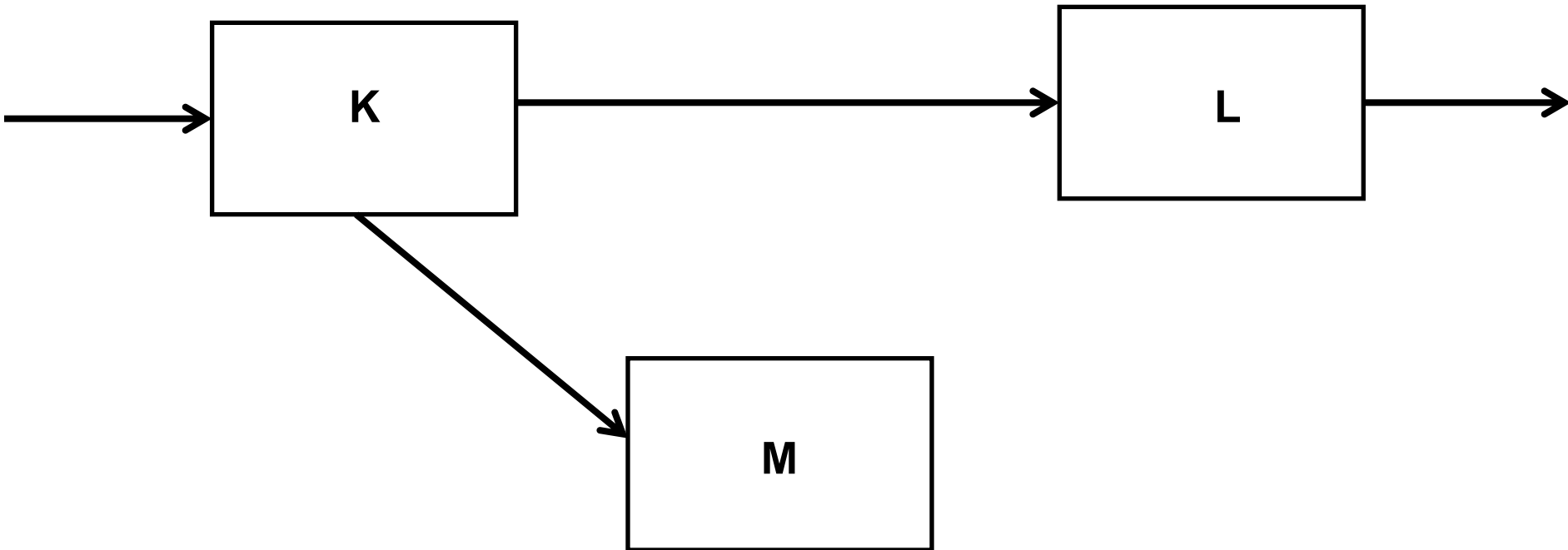


FIGURE 6.9

Dangling



Extended Network Techniques to Come Close to Reality

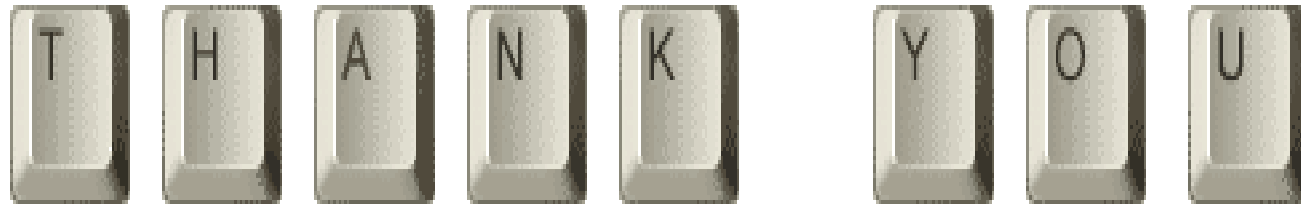
- Laddering

- Activities are broken into segments so the following activity can begin sooner and not delay the work.

- Lags

- The minimum amount of time a dependent activity must be delayed to begin or end.

- Lengthy activities are broken down to reduce the delay in the start of successor activities.
 - Lags can be used to constrain finish-to-start, start-to-start, finish-to-finish, start-to-finish, or combination relationships.



ANY QUESTIONS?