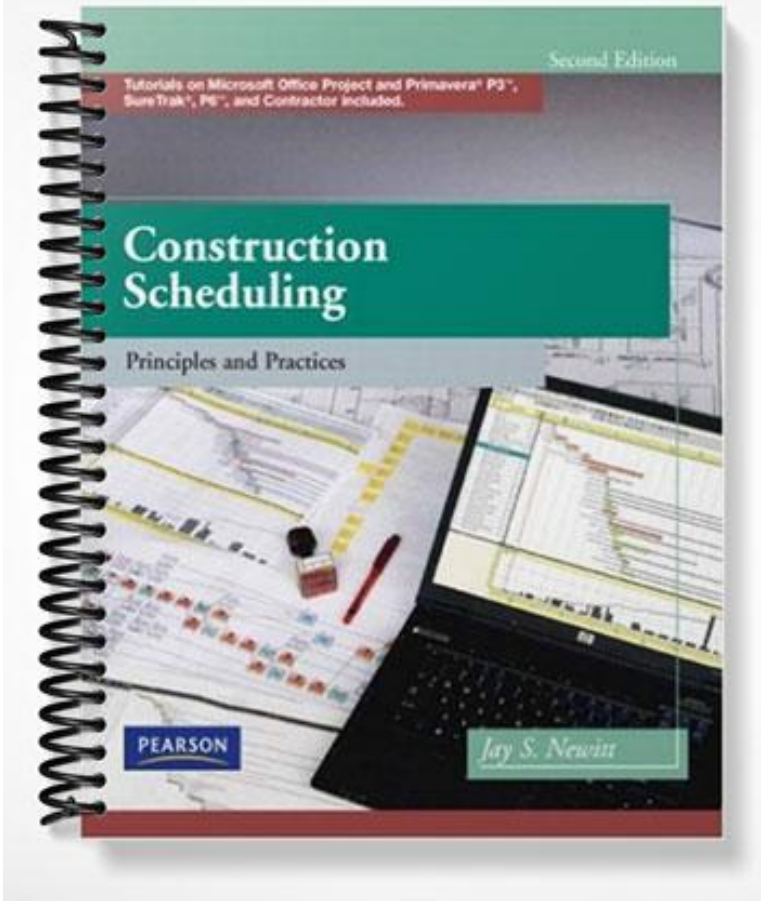
SOLUTIONS MANUAL



Online Instructor's Manual
to accompany

Construction Scheduling: Principles and Practices Second Edition

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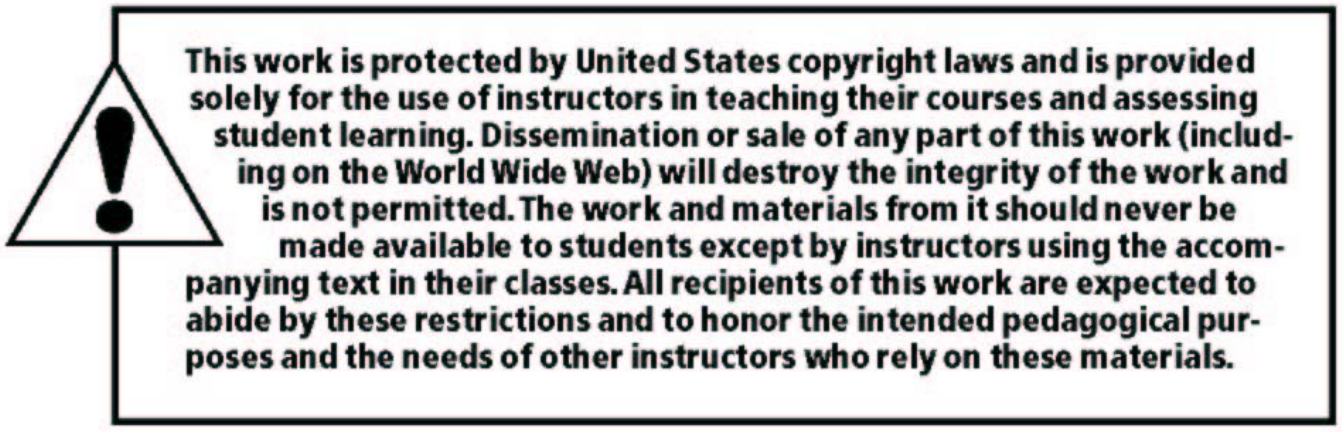
Brigham Young University

PEARSON Prentice Hall

Upper Saddle River, New Jersey
Columbus, Ohio



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PEARSON
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Contents

Overall Thoughts About Teaching Scheduling

Scheduling is a class where students learn to do by doing, not just by reading about it. The trouble with this is it takes a major portion of the semester for the students to learn the basics of scheduling and then Critical Path Method before they can begin working on meaningful assignments in project scheduling. At my university the catalog shows scheduling as a 3 semester credit hour class scheduled as 2 hours of lecture and 2 hours of lab per week. This gives me 4 hours a week for the class. The first part of the semester is primarily lecture and the last portion is "living and dying" (that's what the students say) in the computer lab. But the 4 hour per week format has been essential.

A technique I have used for the past several years that has worked out very well is to allow the students to choose between the 4 hour format explained above or to meet for one long day (the students call it "Super Saturday") to cover the basics of CPM. This day needs to be during the first or second week of the semester. Occasionally the students have chosen a Friday to hold this session due to light class loads on Fridays. We meet at 7 or 8 in the morning and go to 4 or 5 in the afternoon with a half hour break for lunch. (Have lots of jokes to tell to help keep the students awake) That is a tough lecture for the professor but after doing it a couple of times I found it very doable. From that point on the class only meets 3 times a week rather than the 4 scheduled. Since I have made this option available every class except one has chosen the one long day format. I have found this to be a great asset to the students. The major assignments are then more evenly spread throughout the semester and the quality of the homework assignments has improved. This also provides for a more uniform load in the computer lab.

I have included the overheads I use during this and some of the other lectures in this manual. I have made a power point presentation of much of the material I use in this class but I have gone back to overhead transparencies because I can more easily change the order and sequence of the presentation based on questions and comments from the students. Plus, I have found it helpful for the students to see the forward and backward passes completed by actually writing on the overheads with a non-permanent marker. It seems to be easier to learn by seeing the calculations actually being done than to have the dates pop up on a power point presentation.

I also acknowledge the difficulty in teaching software. I admit I do not know the proper way. As I talk to other professors who are excellent with spreadsheets, estimating programs, or word processing I find most of them have had no formal training on the software that they are so excellent at. They learned it by the school of hard knocks. We try to make it easier for the students to learn it by hands on demonstrations while the students are setting at the computer and following our directions. I think I have come to believe that is not the way to learn it. The students in such a situation are basically just following instructions, not really thinking. Everyone feels warm and fuzzy but the challenge is when the student is setting at the computer all alone and able to actually schedule and print dynamic, yet practical, reports and use the software as an actual management tool. Too detailed of printed instructions seem to be the same way. No real thinking by the students, plus way too much detail to read. I think maybe the best method is a series of demonstrations in the classroom without the students on computers. Then

some printed instructions similar to the last few chapters in the text book that are designed to help them over the rough spots and yet still requires them to think as they complete the assignments. That is the approach I have tried to use in the computer instructions in the text book.

I offer the following, not as one who knows the best way to teach this subject, but as one who has taught it wrong enough that I have found what works for me. I find I am constantly changing my approach, but the following works better than a lot of other ways I have done it. I only offer it here as ideas. Each professor needs to find the methods and approach that seems to fit his or her style best. This manual contains information that I think would help me to teach this class using this textbook. Especially if I were a new teacher. I probably would not use all of it, however, I would appreciate examining it.

A Note on Class Projects

I have not included a set of plans in the text for a class scheduling project because project plans are not that difficult to come up with and I firmly believe that the professor needs to assign class projects for the students to schedule that you are familiar with. You need to schedule the project prior to having the students do it. Also don't expect their schedule to match yours. Many times I find the student's schedule to be superior to mine and I have a vast amount of experience in scheduling construction projects. I also find that rotating major assignments each semester or so is helpful in forcing the students to do the work themselves without the residual effects from past students too anxious to help current students.

A Typical Syllabus
Following is a syllabus that flows fairly well with the text.

Course Syllabus

TITLE: Construction Scheduling

Catalog Description: Planning, scheduling and monitoring of construction projects. Including development of critical path networks (CPM & PERT), Gantt bar charts and construction cost control and reporting practices.

3 Credit Hours: 2 Lecture Hours: 2 Lab Hours: The class generally meets 4 hrs. per week

Prerequisites: CM 311 - Quantity Takeoffs or instructors approval

Text: *Construction Scheduling – Principles and Practices*
Prentice Hall

PURPOSE AND OBJECTIVES:
The purpose of this course is to provide the students with the necessary skills to adequately schedule and control residential, commercial, industrial, manufacturing, engineering, or business projects. Each student will generate bar charts; critical path networks; including early start, late start, early finish, late finish, durations, float, and identification of the critical activities that affect the timely completion of the project. The students will also correlate manpower loading and costs to the schedule and learn how to control and accurately report progress of the project. The students will be introduced to the use of computers in the scheduling of construction projects and be required to schedule using computers and read computer printouts.

HANDOUTS: All handouts and assignments will be located on *Blackboard*, accessible from any computer on the internet. You will be notified by your route Y e-mail address as to which handouts to use throughout the semester. If you are using another e-mail address, set up your route Y address to forward to your primary e-mail location. If you desire a copy of the handouts, copy them to your J:drive and then you can read them, make your own copy, add your own class lecture notes, or basically use them as you desire to help you learn the critical concepts of this class.

LAB ACTIVITIES: The lab activities are primarily computer lab assignments using SureTrak. SureTrak is only available on the computers in the CM computer lab in the Snell Building.

EXAMS: *Exams must be taken on the dates specified in the instructional sequence*. If you know you will be absent the day of an exam, you need to make arrangements to take the exam early. If extenuating circumstances occur, permission may be obtained to take the exam late **if the department secretary is notified by phone on the day of the exam**.

ASSIGNMENTS: The major assignments are due at the **beginning** of the class period on the dates specified. Late assignments will be penalized **50 percent**. **The last date that late assignments will be accepted will be the last regular class day of the semester.**

The major assignments are to be prepared in a professional manner of presentation quality as if you were expecting to favorably impress a prospective owner or loaning institution. The size should be such that you are presenting to an individual, not a group. Rough, scratched-out schedules on the back of napkins, envelopes, scratch paper or even 2 X 4's won't do. They should be drafted with straight lines, circles drawn with templates, and lettering with a template or hand drawn, if you are good at hand lettering, it must be legible. You should demonstrate the professionalism of your company and set a standard for others to achieve.

The software we will be using is Primavera's SureTrak
You can purchase a student copy of SureTrak, including documentation, for $53.13 from Primavera; but we need to send in the order at one time as a total class. If you want a copy let me know during the first week of the semester. I will need a check made out to **Primavera** for $53.13. This version will allow only 60 activities, which is not enough for all the assignments but it will be a great asset to you if you have your own computer, especially if you have a difficult time getting into the computer lab during the normal lab hours.

COURSE OUTLINE:

1. Bar Charts
2. Check Sheets
3. Progress Charts and Curves
4. Matrix Schedules
5. Network Type Schedules (CPM, PERT, & PRECEDENCE - Scheduling Techniques)
    a. Activity on arrow notation
    b. Activity on node notation
    c. Determining activity durations
    d. Early and Late Start calculations
    e. Early and Late Finish calculations
    f. Float or slack time calculations
    g. Total Float, Free Float, Shared Float, Independent Float
    h. Lags
    i. Network logic to include dependence, concurrence, and precedence.
    j. Identification of Critical Activities
    k. Updating techniques
6. Project Control Techniques (time & money)
7. Project Monitoring
8. Computerized Scheduling Techniques
9. Cost Control - as it relates to scheduling

MAJOR ASSIGNMENTS:	Points
Bar chart of a residential project	50
Activity on Node Network Logic Diagram	20
Residential Schedule Set; AON network and a Regular Bar Chart based on the network (90 net/20 bar)	110
Manpower load of practice problem #3	10
Cash level of practice problem #3	10
Progress S Curve of practice problem #3	10
SureTrak Computer assignment	75
Highway Overpass	75
Major Project	75
Update Assignment	50
Computerized Residential assignment	50
Quizzes, Approximately	65
Exam I	100
Exam II	100
Final Exam	200
Approximate Total	1000

Note: Assignments will be evaluated based on content and neatness. All assignments should look professional. Don't get behind on the assignments, you will have a hard time catching up, plus there is a maximum of 50% on late assignments. Plan on last minute problems with printing or plotting in the computer lab. If you wait to the last day to start on a computer assignment and the lab is experiencing problems, that is similar to real life, the assignment due date remains fixed. Plan to do your projects early in order to avoid unnecessary frustrations and to give you "soak time" to think about the assignments. This is a key to learning the most in this class and to improve your final grade. Assignments done at the last minute eliminate this "soak time" and it is this "soak time" that really helps to improve a schedule. You will find this true in real life also, a good schedule requires time to think about, review, and revise.

CM 412
Construction Scheduling
Instructional Sequence - Fall Term 2004

JAY NEWITT, PhD.
230 SNLB 422-2021 jay_newitt@byu.edu

DATE	TOPIC	READING ASSIGNMENT

You should be spending at least two hours (some say 3) outside of class for every hour of lecture, so a 3 hr. class should require at least 9 to 12 total hours of your time per week. Plan your time accordingly.

Read Chapter Assignments from *Construction Scheduling - Principles & Practices* prior to class on the following dates: There will possibly be quizzes on the day the reading assignment is discussed in order to motivate you to be current in reading the text book.
Note: unless stated otherwise **All assignments are due at the beginning of the class period**. All assignments should include a cover/evaluation sheet obtainable from Blackboard, Assignments, 1st Page.

Aug 30	Course Introduction Overview of Project Management Basics Do you want a personal copy of SureTrak? Turn in a personal check for $53.13 made out to Primavera not later than next Monday morning.	Chapter 1
31	Why Schedule?	2
Sept 1	Simple Scheduling Techniques Automated Checklists	3
2	Bar Chart Schedules Introduce the Bar Chart assignment Video of the Four Hour House	4
3	Super Friday 7:00 am to 3:30 pm Full day seminar on CPM Scheduling Introduction to CPM Scheduling Scheduling Residential Projects	5
	Creating the Network Logic Diagram	6
	Determining Durations	7
	Calculating ES, EF, LS, LF, TF	8
	Types of Float	9
	Bar Charts based on a network Linear Bar Charts Introduce Graded Practice Problem assignment	12
6	Labor Day Holiday	
7	Introduce the Residential CPM Network and Bar Chart assignment Using Lags in Network Logic Diagrams	10

	Need a check made out to Primavera today if you want the software	
8	**RESIDENTIAL BAR CHART ASSIGNMENT DUE**	
	Reviewing & Analyzing the Schedule	11
13	Creating Bar Charts & Tabular Reports from the Logic Diagram	12
	Video of The As Planned CPM Schedule	
14	**ACTIVITY ON NODE NETWORK LOGIC DIAGRAM DUE**	
	Linear or Line-of-Balance Schedules	13
	Updating the Schedule	14
15	Resource Management - Cash & Manpower Loaded Schedules	15
	Introduce Resource loading (cash, manpower, banana curve) assignment	
	Ethics relating to scheduling	
20	**RESIDENTIAL AON NETWORK & BAR CHART DUE (HAND DRAWN)**	
	Cost Schedule Control System Criteria	16
20-25	**EXAM 1 CHAPTERS 1-12 AT THE TESTING CENTER** (bring a straight edge)	
21&22	No class these two days. Take the exam and work on the resource loading assignment	
27	Using the Schedule to Create Teamwork	17
28	**RESOURCE LOADING (CASH, MANPOWER, & BANANA CURVE) PROJECT DUE**	
	Other Scheduling Techniques	18
29	Review Exam 1	
Oct. 4	Introduction to Computerized CPM Scheduling	19
	Introduction to SureTrak CPM Project Management Software	21
	Project Setup, Calendars, Activity Codes	
	Activity Data Input, and Calculations	
5	Filtering, Formatting, and Organizing Reports	21
	Layouts	
6	**SURETRAK REPORT #1 DUE (Text Pg 289)**	21
	Making Standard Reports	
	Printing a Series of Reports	
	Introduction to Overpass Assignment	
11	Logos, Clip Art, Tabular and Graphic Reports	21
12	Updating the Schedule	21
	Copying and Pasting Activities	
	Continue working on the Overpass Assignment	
13	**SURETRAK REPORTS 2 - 7 DUE**	

Note: If some of these assignments do not make sense, review the chapters in the text relating to these concepts
Resource Loading a Schedule 21

18 Work on SureTrak Reports & Overpass Assignment 21

19 Work on SureTrak Reports & Overpass Assignment 21

20 **SURETRAK REPORTS 8 - 15 DUE** 21
Demo input for Overpass

25 Work on Overpass Assignment

26 Work on Overpass Assignment

27 **OVERPASS ASSIGNMENT DUE**
Introduction of Major Project (Power Point Presentation)
Video on The Practical Use of the CPM Schedule

26-30 **EXAM 2 CHAPTERS 13-19** (IN THE TESTING CENTER)

Nov. 1 Work on Major Project assignment

2 Work on Major Project assignment

3 **TURN IN A LIST OF THE ACTIVITIES IN THE MAJOR PROJECT ASSIGNMENT FOR AT LEAST ONE FLOOR AND WING**
Review Exam 2

8 Work on Major Project assignment

9 **SOME TYPE OF EDIT LISTING SHOWING YOU HAVE INPUT MOST OF THE DATA FOR AT LEAST ONE FLOOR AND WING OF THE MAJOR PROJECT DUE**
Demo input of Major Project

10 Introduce Project Update Assignment

15 Work on the major project assignment

16 Work on the major project assignment

17 **MAJOR PROJECT ASSIGNMENT DUE** (Turn the assignment into the secretary before 5:00 pm. 230 SNLB)

22 Work on the project update assignment

23 Friday at BYU

24 Thanksgiving Break

29 Work on project update assignment

30 **PROJECT UPDATE ASSIGNMENT DUE**
Introduce the Computerized Residential Assignment
Demo of Primavera Project Planner

Dec. 1 Demo of Microsoft Project

6 Work on the computerized residential assignment

7 **COMPUTERIZED RESIDENTIAL ASSIGNMENT DUE**
Demo of organizing the network logic, managing float, etc.

8 Review for the final

9 (**ALL LATE ASSIGNMENTS ARE DUE ON THE 9TH** - will not accept assignments after the last day of classes)

Final Exam - Will be in the computer lab. The final is worth 200 points. It will be held on Friday December 17th 7-10 am OR 11 - 2 pm.

Construction Scheduling Principles and Practices

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Primary Objectives of Project Management

Time **Costs**

Quality **Safety**

Tough Balancing Act

P O D C

Time is Money						
		Based on a	9%	Annual Interest Rate		
Amount	**Work Minute**	**Work Hour**	**Work Day**	**Week**	**Month**	**Year**
$75,000,000.00	$54.09	$3,245.19	$25,962	$129,808	$562,500	$6,750,000
$50,000,000.00	$36.06	$2,163.46	$17,308	$86,538	$375,000	$4,500,000
$40,000,000.00	$28.85	$1,730.77	$13,846	$69,231	$300,000	$3,600,000
$30,000,000.00	$21.63	$1,298.08	$10,385	$51,923	$225,000	$2,700,000
$20,000,000.00	$14.42	$865.38	$6,923	$34,615	$150,000	$1,800,000
$10,000,000.00	$7.21	$432.69	$3,462	$17,308	$75,000	$900,000
$5,000,000.00	$3.61	$216.35	$1,731	$8,654	$37,500	$450,000
$4,000,000.00	$2.88	$173.08	$1,385	$6,923	$30,000	$360,000
$2,000,000.00	$1.44	$86.54	$692	$3,462	$15,000	$180,000
$1,000,000.00	$0.72	$43.27	$346	$1,731	$7,500	$90,000
$800,000.00	$0.58	$34.62	$277	$1,385	$6,000	$72,000
$500,000.00	$0.36	$21.63	$173	$865	$3,750	$45,000
$300,000.00	$0.22	$12.98	$104	$519	$2,250	$27,000
$150,000.00	$0.11	$6.49	$52	$260	$1,125	$13,500
$100,000.00	$0.07	$4.33	$35	$173	$750	$9,000
$75,000.00	$0.05	$3.25	$26	$130	$563	$6,750

Why Use Formal Schedules

- **Reduces Total Construction Time**
- **Reduces Costs of Labor, Overhead, Interest on Loans and Capital**
- **Provides a More Regular Continuous Flow of Work**
- **Increases Productivity**
- **Gives Employees and Subcontractors a Goal to Work Toward**
- **Improves Your Company Image – Makes You Look Professional**
- **Meets Owner's Requirements**
- **Gives Better Control and Management of Materials, Labor, Money, Equipment and Subcontractors**
- **Forces Detailed Thinking and Planning**
- **Improves Communications**