

## PROJECT MANAGEMENT FOR FOR ENGINEERING AND CONSTRUCTION

### Garold D. Oberlender, PhD, RE.

Professor of Civil Engineering Oklahoma State University



Boston Burr Ridge, IL Dubuque, IA Madison, WI New York San Francisco St. Louis Bangkok Bogota Caracas Lisbon London Madrid Mexico City Milan New Delhi Seoul Singapore Sydney Taipei Toronto

# **CONTENTS**

1	INTRODUCTION		1
	Purpose of this Book		1
	Arrangement of this Book		2
	Definition of a Project r		4
	Responsibilities of Parties		6
	Who Does the Project Manager Work For?		7
	Purpose of Project Management		8
	Types of Management		9
	Functions of Management		10
	Key Concepts of Project Management		11
	Role of the Project Manager		12
	Professional and Technical Organizations		14
	Questions for Chapter 1—Introduction		15
	References		16
2	WORKING WITH PROJECT TEAMS		17
	ProjectTeams	•	' 17
	Teamwork '		18
	Teams for Small Projects	١	18
	Working with Multiple Teams		19
	Design Teams •		20
	Construction Teams		21
	Team Management		22
	Teams and the Project Manager's Responsibilities		22
	Key Factors in Team Leadership		23
	Team Building		24
	Motivating Teams		25
	Conflict Management		27

Developing a Consensus Team Conduct Questions for Chapter 2—Working with Project Teams References

#### **3 PROJECT INITIATION**

Design and Construction Process Advances in the Engineering and Construction Process Private versus Public Projects Contractual Arrangements Phases of a Project Owner's Study Owner's Needs and Project Objectives Project Scope Definition Project Strategy Selection of Design Firms and Construction Contractors Partnering Questions for Chapter 3—Project Initiation References

#### 4 EARLY ESTIMATES

i.

Importance of Early Estimates Classification of Early Estimates Estimating Work Process Importance of Team Alignment in Preparing Early Estimates Scope Definition and Early Estimates Preparing Early Estimates Organizing to Prepare Estimates Establishing an Estimate Work Plan Methods and Techniques Cost-Capacity Curves. Capacity Ratios Raised to an Exponent Plant Cost per Unit of Production Equipment Factored Estimates **Computer-Generated Estimates** Estimate Check Lists Estimate Documentation Estimate Reviews **Risk Assessment Risk Analysis** Contingency Traditional Methods of Assigning Contingency Percentage of Base Estimate Expected Net Risk

	Simulation Assessing Estimate Sensitivity	70 71
	Assigning Contingency Based on the Quality and Completeness	72
	Estimate Feed-Back for GontinuousSforovement	74
	Questions for Chapter 4—Farly Estimates	76
	References	77
5	PROJECT BUDGETING	78
	Project Budgets	78
	Development of Project Estimates for Budgeting	78
	Levels of Accuracy	80
	Owner's Estimate for Budgeting	81
	Economic Feasibility Study	85
	Single Payments	85
	Uniform Payment Series	80 97
	Porige Budgets	90
	Contractor's Bid	93
	Questions for Chapter 5-Project Budgeting	97
	References	98
6	DEVELOPMENT OF WORK PLAN	99
	Project Manager's Initial Review	99
	Owner's Orientation	100
	Organizational Structures	101
	Work Breakdown Structure	106
	Forming the Project Team	108
	Kick-Off Meeting	109
	Work Packages	110
	Follow-Up Work	111
	Project Work Plan	115
	Questions for Chapter 6—Development of Work Plan	110
	References I.	117
7	DESIGN PROPOSALS	118
	Evolution of Projects	118
	Project Execution Plan	119
	Project Definition	119
	Problems in Developing Project Definition	121
	Design Proposals	121
	Engineering Organization	124
	Scope Baseline for Budget	124

I

1

Mini-Drawings Development of the Design Work Plan , Engineering Project Controls-Progress Measurement of Engineering Design Questions for Chapter 7—Design Proposals References

#### 8 PROJECT SCHEDULING

Project Planning and Project Scheduling Desired Results of Planning Principles of Planning and Scheduling Responsibilities of Parties Planning for Multiple Projects Techniques for Planning and Scheduling Network Analysis Systems Development of CPM Diagram from the WBS Assigning Realistic Durations **Computer Applications** Schedule Coding System Cost Distribution Resource Allocations for Design Resource Allocations for Construction Program Evaluation and Review Technique (PERT) Successor/Predecessor Relationships Problems Using Successor/Predecessor Relationships Questions for Chapter 8-Project Scheduling References

#### 9 TRACKING WORK

Control Systems Linking the WBS and CPM Coding Systems for Project Reports Control Schedules for Time and Cost Relationships Between Time and Work Integrated Cost/Schedule/Work Percent Complete Matrix Method Progress Measurement of Design Measurement of Construction Work Project Measurement and Control Earned-Value System Monitoring Project Performance Interpretation of Performance Indices ١ Analysis Tree of Total Float (TF) and Schedule Performance Index (SPI)

	Causes of Cost/Schedule Variances	228
	Trend Analysis and Forecasting-	229
	Work Status Syste <p-< th=""><th>233</th></p-<>	233
	Questions for Chapter 9—Tracking Work	236
	References	239
	ſ	
10	DESIGN COORDINATION	240
	Design Work Plan	240
	Producing Contract Documents	241
	Managing Scope Growth During Design	241
	Managing Small Projects	242
	Project Team Meetings	243
	Weekly/Monthly Reports	244
	Drawing and Equipment Index	244
	Distribution of Documents	246
	Authority/Responsibility Check List	247
	Check List of Duties for Design	248
	Team Management	248
	Evaluation of Design Effectiveness	251
	Constructability	253
	Post Design Review	255
	Questions for Chapter 10—Design Coordination	256
	References	256
11	CONSTRUCTION PHASE	258
••		250
	Importance of Construction	258
	Assumptions for Construction Phase	259
	Contract Pricing Formats. ,,	260
	Design/Bid/Build Method of Project Delivery	261
	Design/Build Method of Project Delivery	262
	Construction Management Method of Project Delivery	262
	Bridging Project Delivery Method	263
	Fast-Track Projects	264
	Turn-Key Projects	264
	Design Development and Performance Specifications	264
	Key Decisions for Project Delivery	264
	Number of Contracts	265
	Selection Criteria	265
	Contractual Relationship	265
	Terms of Payment	265
	Prospective Bladers and Blading	266
	Qualification-Based Selection (QBS) ~	267
		269
	neys to a Successful Project	270

Construction Schedules Problems with Construction Schedules Precautions for Construction Submittals Delivery Dates of Owner-Furnished Equipment or Materials Scheduling Contractor Procured and Installed Equipment Contract Schedule Constraints Sequestering Float Schedule Updates Relations with Contractors Check List of Duties Quality Control **Dispute Resolutions** Job-Site Safety Management of Changes **Resource Management** Questions for Chapter 11-Construction Phase References

#### 12 PROJECT CLOSE OUT

System Testing and Start-Up Final Inspection Guarantee and Warranties Lien Releases Record and As-Built Drawings Check List of Duties Disposition of Project Files Post Project Critique" Owner Feed-Back Questions for Chapter 12—Project Close Out References

#### 13 PERSONAL MANAGEMENT SKILLS

I Challenges and Opportunities Using New Innovations Human Aspects Assignment of Work Motivation Decision Making Time Management Communications Presentations ~" Meetings Reports and Letters

	Questions for Chapter 13—Personal Management Skills References	309 309
14	TOTAL QUALITY MANAGEMENT	311
	Background	<b>31</b> 1
	Customer Satisfaction	<b>31</b> 4
	Continual Improvement	315
	Management Commitment	318
	Training	<b>31</b> 9
	Teamwork	320
	Statistical Methods	322
	Cost of Quality	324
	Supplier Involvement	325
	Customer Service	326
	Implementation	326
	References	328
Appendix A	Example Project	329
Appendix B	List of EJCDC Contract Documents	348
Appendix C	List of AIA Contract Documents	351
Appendix D	List of AGC Contract Documents	354
Appendix E	MasterFormat™—Master List of Section Titles and Numbers	357