

SECOND EDITION

# MANAGING CONSTRUCTION EQUIPMENT



Suranaree University of Technology



31051000600469

S. W. NUNNALLY

# **Contents**

## **1 Introduction 1**

- 1–1 The Construction Industry 1 • 1–2 Construction Laws and Regulations 3 •
- 1–3 Construction Management and the Equipment Manager 4 • Problems 6 •
- References 6

## **2 Earthmoving Basics 7**

- 2–1 Equipment Selection and Production 7 • 2–2 Earthmoving Materials 9 •
- 2–3 Soil Identification and Classification 11 • 2–4 Soil Volume Change 16 •
- 2–5 Spoil Banks and Spoil Piles 17 • Problems 21 • References 22

## **3 Excavators 23**

- 3–1 Introduction 23 • 3–2 Shovels 27 • 3–3 Hydraulic Excavators 32 •
- 3–4 Draglines 37 • 3–5 Clamshells 43 • 3–6 Trenchers and Trenchless Technology 46 • Problems 49 • References 51

## **4 Dozers and Loaders 53**

- 4–1 Introduction 53 • 4–2 Estimating Equipment Performance 55 •
- 4–3 Dozers 65 • 4–4 Loaders 72 • Problems 80 • References 82

## **5 Scrapers 83**

- 5–1 Estimating Travel Time 83 • 5–2 Scraper Characteristics 86 • 5–3 Scraper Production 88 • 5–4 Push-Loading 93 • 5–5 Optimum Load Time 95 • 5–6 Job Management 102 • Problems 105 • References 107

## **6 Trucks and Wagons 109**

- 6–1 Hauling Equipment 109 • 6–2 Determining the Number of Haul Units Required 112 • 6–3 Queueing Theory Method 117 • 6–4 Job Management 122 • Problems 124 • References 125

## **7 Lifting Equipment 127**

- 7–1 Mobile Cranes 127 • 7–2 Tower Cranes 136 • 7–3 Other Lifting Equipment 138 • 7–4 Pile Drivers 141 • Problems 145 • References 146

## **8 Compaction and Finishing 147**

8–1 Principles of Compaction 147 • 8–2 Compaction Equipment and Procedures 150 • 8–3 Soil Stabilization 164 • 8–4 Grading and Finishing 165 • Problems 174 • References 175

## **9 Rock Excavation 177**

9–1 Introduction 177 • 9–2 Drilling 182 • 9–3 Blasting 190 • 9–4 Rock Ripping 198 • 9–5 Estimating Production and Cost 202 • Problems 205 • References 207

## **10 Production of Aggregate, Concrete, and Asphalt Mixes 209**

10–1 Production of Aggregate 209 • 10–2 Production of Concrete 220 • 10–3 Production of Asphalt Mixes 233 • Problems 237 • References 240

## **11 Paving and Surface Treatments 241**

11–1 Concrete Paving 241 • 11–2 Asphalt Paving and Surface Treatments 245 • 11–3 Pavement Repair and Rehabilitation 262 • Problems 265 • References 266

## **12 Compressed Air and Water Systems 267**

12–1 Introduction 267 • 12–2 Compressed Air Systems 267 • 12–3 Water Supply Systems 280 • Problems 291 • References 293

## **13 Equipment Economics 295**

13–1 Introduction 295 • 13–2 Equipment Cost 296 • 13–3 The Replacement Decision 308 • 13–4 The Rent-Lease-Buy Decision 314 • 13–5 Equipment Cost Control 317 • Problems 318 • References 321

## **14 Maintenance, Tires, and Safety 323**

14–1 Equipment Maintenance 323 • 14–2 Tires 326 • 14–3 Safety and Environmental Health 329 • Problems 337 • References 337

## **15 Improving Productivity and Performance 339**

15–1 How Do You Improve Productivity? 339 • 15–2 Work Improvement 340 • 15–3 Quantitative Management Methods 351 • Problems 356 • References 358

## **16 Computers and Other Tools 359**

16–1 Computers in Construction 359 • 16–2 Design of Construction Equipment Systems 360 • 16–3 Simulation of Construction Systems 363 • 16–4 Robots and Other New Tools 377 • Problems 380 • References 380

## **Appendix A: Metric Conversion Factors 381**

## **Appendix B: Construction Industry Organizations 382**

## **Appendix C: Simulating Construction with GPSS 383**

## **Index 395**