

 This work is protected by
US copyright laws and is for
instructors' use only.

Online Instructor's Manual
to accompany

Construction Methods and Management

Eighth Edition

S. W. Nunnally
Professor Emeritus
North Carolina State University

Prentice Hall

Boston Columbus Indianapolis New York San Francisco Upper Saddle River
Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montreal Toronto
Delhi Mexico City Sao Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo



This work is protected by United States copyright laws and is provided solely for the use of instructors in teaching their courses and assessing student learning. Dissemination or sale of any part of this work (including on the World Wide Web) will destroy the integrity of the work and is not permitted. The work and materials from it should never be made available to students except by instructors using the accompanying text in their classes. All recipients of this work are expected to abide by these restrictions and to honor the intended pedagogical purposes and the needs of other instructors who rely on these materials.

Copyright © 2011 Pearson Education, Inc., publishing as Prentice Hall, Upper Saddle River, New Jersey and Columbus, Ohio. All rights reserved. Manufactured in the United States of America. This publication is protected by Copyright, and permission should be obtained from the publisher prior to any prohibited reproduction, storage in a retrieval system, or transmission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise. To obtain permission(s) to use material from this work, please submit a written request to Pearson Education, Inc., Permissions Department, One Lake Street, Upper Saddle River, New Jersey.

Many of the designations by manufacturers and seller to distinguish their products are claimed as trademarks. Where those designations appear in this book, and the publisher was aware of a trademark claim, the designations have been printed in initial caps or all caps.

Instructors of classes using Nunnally, Construction Methods and Management, 8th Edition, may reproduce material from the instructor's manual for classroom use.

10 9 8 7 6 5 4 3 2 1

Prentice Hall
is an imprint of



www.pearsonhighered.com

ISBN-13: 978-0-13-245436-0
ISBN-10: 0-13-245436-X

CONTENTS

Chapter 1:	Introduction	1
Chapter 2:	Earthmoving Materials and Operations	3
Chapter 3:	Excavating and Lifting	6
Chapter 4:	Loading and Hauling	9
Chapter 5:	Compacting and Finishing	13
Chapter 6:	Rock Excavation	15
Chapter 7:	Production of Aggregate, Concrete, and Asphalt Mixes	20
Chapter 8:	Paving and Surface Treatments	25
Chapter 9:	Compressed Air and Water Systems	27
Chapter 10:	Foundations	31
Chapter 11:	Wood Construction	33
Chapter 12:	Concrete Construction	35
Chapter 13:	Concrete Form Design	37
Chapter 14:	Masonry Construction	48
Chapter 15:	Steel Construction	50
Chapter 16:	Planning and Scheduling	52
Chapter 17:	Construction Economics	57
Chapter 18:	Contract Construction	61
Chapter 19:	Construction Safety & Health and Equipment Maintenance	63
Chapter 20:	Improving Productivity and Performance	65

CHAPTER 1

INTRODUCTION

1. The U.S. construction industry accounts for some 10% of the nation's gross national product. The approximate distribution of new construction contract value within the industry includes: private building 71%; public nonbuilding 12%; public building 10%; and private nonbuilding 7%.
2. Some major characteristics of the U.S. construction industry include:
 - Highly competitive
 - Fragmented
 - Work is seasonal and sporadic
 - High rate of bankruptcy
 - High accident rate
3. The purpose of a building code is to protect the public by providing minimum design and construction standards for structural and fire safety of buildings.
4. Construction may be accomplished by any of the following methods:
 - Owner construction force
 - Owner management of construction:
 - Employing hired labor
 - Utilizing subcontractors
 - Contract construction by a general contractor
 - Employing a design/build (or turnkey) construction contract
 - Utilizing a Professional Construction Manager
5. A decline in construction productivity in relation to the price of goods and services will limit the demand for construction services. The effect on the national economy would be significant because the industry accounts for a significant portion of the nation's gross national product and its employment.
6. Heavy or horizontal construction projects include highways, airports, railroads, canals, harbors, dams, utility lines, and similar works. Since most such projects fall into the category of public works, they are primarily constructed with public funds.
7. Quality control is the process of assuring that all elements of a constructed project meet the requirements established by the project designer in the project plans and specifications

8. A majority of serious construction injuries occur during the following operations:
 - Concrete construction
 - Erection of prefabricated trusses, precast concrete elements, and structural steel
 - Construction and operation of temporary facilities and construction plant
 - Working from elevated positions
 - Construction equipment operations

9. An Environmental Impact Statement (EIS) describes and quantifies the effect a proposed project will have on the environment. The preparation of an EIS is a complex, time-consuming, and expensive task which should be undertaken only with the assistance of a professional experienced in such matters.

CHAPTER 2
EARTHMOVING MATERIALS AND OPERATIONS

1. Corner points = $6.0+4.6+3.0+4.0 = 17.6$ ft

$$[= 1.83+1.40+0.92+1.22 = 5.37 \text{ m }]$$

Border points = $5.8+5.2+4.2+3.6+3.5+4.8+4.8+5.5 = 37.4$ ft

$$[= 1.77+1.59+1.28+1.10+1.07+1.46+1.46+1.68 = 11.41 \text{ m }]$$

Interior points = $5.0+4.6+4.0+4.9 = 18.5$ ft

$$[= 1.52+1.40+1.22+1.49 = 5.63 \text{ m }]$$

Average depth = $\frac{17.6 + 2(37.4) + 4(18.5)}{36} = 4.62$ ft

$$[= \frac{5.37 + 2(11.41) + 4(5.63)}{36} = 1.41 \text{ m }]$$

2. Moisture content = $\frac{15.0 - 14.2}{14.2} \times 100 = 5.6$ % (Eq 2-3)

$$[= \frac{6.80 - 6.44}{6.44} \times 100 = 5.6 \text{ % }]$$

3. Loose volume = bank volume $\times (1 + \frac{\text{swell}}{100})$

$$= 500 \times (1 + \frac{30}{100}) = 650 \text{ LCY}$$

$$= 650 \times 27 = 17,550 \text{ cu ft}$$

$$[= 382 \times (1 + \frac{30}{100}) = 496.6 \text{ LCM }]$$

Base diameter = $(\frac{7.64 \times \text{volume}}{\tan R})^{1/3}$ (Eq 2-12)

$$= (\frac{7.64 \times 17,550}{\tan 35^\circ})^{1/3} = 57.6 \text{ ft}$$

$$[= (\frac{7.64 \times 496.6}{\tan 35^\circ})^{1/3} = 17.6 \text{ m }]$$

Height = $\frac{D}{2} \times \tan R$ (Eq 2-13)

$$= \frac{57.6}{2} \times \tan 35^\circ = 20.2 \text{ ft}$$

$$[= \frac{17.6}{2} \times \tan 35^\circ = 6.2 \text{ m }]$$

4.a. Cut = 150 + 100 = 250 x 10³ BCY

[= 115 + 76 = 191 x 10³ BCM]

Fill = 80 + 120 + 100 = 300 x 10³ BCY

[= 61 + 92 + 76 = 229 x 10³ BCM]

Waste = 0 BCY (BCM)

Borrow = 50 x 10³ BCY

[= 38 x 10³ BCM]

b. Average length of haul Section 2 = 1000 ft

[= 305 m]

5. Swell = $\left(\frac{\text{wt/bank volume}}{\text{wt/loose volume}} - 1 \right) \times 100$ (Eq 2-4)

= $\left(\frac{3050}{2400} - 1 \right) \times 100 = 27\%$

[= $\left(\frac{1383}{1089} - 1 \right) \times 100 = 27\%$]

6. Job efficiency = 0.69 (Table 2-1)

Estimated production:

$P = 3.0 \times \frac{60}{0.35} \times 0.69 = 355 \text{ LCY/hr}$

[= $2.3 \times \frac{60}{0.35} \times 0.69 = 272 \text{ LCM/hr}$]

7. Loose volume per foot (m) of ditch = area x 1 x $\frac{1 + \text{swell}}{100}$

$V = 50 \times 1 \times 1.25 = 62.5 \text{ cu ft/ft}$

[= $4.6 \times 1 \times 1.25 = 5.75 \text{ m}^3/\text{m}$]

Base width = $\left(\frac{4V}{L \times \tan R} \right)^{1/2}$ (Eq 2-10)

= $\left(\frac{4 \times 62.5}{1 - \tan 35^\circ} \right)^{1/2} = 18.9 \text{ ft}$

[= $\left(\frac{4 \times 5.75}{1 \times \tan 35^\circ} \right)^{1/2} = 5.7 \text{ m}$]

$$\text{Height} = \frac{B \times \tan R}{2} \quad (\text{Eq 2-11})$$

$$= \frac{18.9 \times \tan 35^\circ}{2} = 6.6 \text{ ft}$$

$$[= \frac{5.73 \times \tan 35^\circ}{2} = 2.0 \text{ m}]$$

8 Cost per unit of production

$$c = \frac{65 + (6)(35)}{300} = \$0.92/\text{BCY}$$

$$[= \frac{65 + (6)(35)}{229} = \$1.20/\text{BCM}]$$

9 A - 2 - 4