Manual

PCI Precast/Prestressed Concrete Institute

Quality Control Technician/Inspector Level III Training Manual

TM-103

First Edition

PCI

Quality Control Personnel

Level III

Training Manual

TM-103

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PCI TECHNICAL/INSPECTOR LEVEL III TRAINING MANUAL

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NOTATION

Symbols used in this manual are listed below. The meanings given apply to the symbols as used in this manual. Symbols used in Sec. 6.7 and in Appendix D are defined in Appendix D.

A = cross sectional area of strand

B = weight of saturated surface dry sample of coarse aggregate in air (App. C)

B = weight of pycnometer filled with water to the calibration mark (App. C)

C = weight of saturated surface dry coarse aggregate in water (App. C)

C = weight of pycnometer filled with sample of fine aggregate and water to calibration mark (App. C)

E = modulus of elasticity of prestressing steel

E_c = modulus of elasticity of concrete

f_{avg} = average of n strength tests

f'_c = compressive strength of concrete

f_{ct} = splitting tensile strength of concrete

f_i = individual strength test

G, G_n = specific gravity of a material

a = length of strand between hold-up and hold-down

H_d = hold-down force

H_u , H_{un} = hold-up force

L = length of strand under consideration

m = aggregate absorption in percent divided by 100

n = number of tests

P = horizontal component of force in deflected strand

S = weight of fine aggregate sample

V_1 , V_n = absolute volume of a given weight of a specific material

W_1 , W_n = weight of a given quantity of a specific material

Δ = increase in length of strand

σ = standard deviation

FOREWORD

This manual is part of a series of training and study guides published by the Precast/Prestressed Concrete Institute designed primarily for manufacturing plant quality control personnel. However, many companies use these books as references and for training of a much larger group of personnel. Further, the manuals are used outside the manufacturing plants by consulting testing agencies and various owner-agencies such as state and county highway departments.

The first training manual for quality control personnel was published by the PCI Plant Certification Committee in 1987. That publication (PCI TM-101) was a study manual and text for the Levels I and II Technician/Inspector Certification Program (now called the Quality Control Personnel Certification Program). The manual proved to be very useful not only for quality control personnel but for production and engineering personnel as well.

In 1989, the PCI Plant Certification Committee, Technician/Inspector Certification Subcommittee, developed an outline of topics it wanted included in a Level III training manual. The subjects were more advanced than those in TM-101 and added additional topics as well.

PCI selected a consultant to work with its committees in the preparation of the manual. Armand H. Gustaferro, Principal, The Consulting Engineers Group, Inc., Mount Prospect, Illinois managed the process and wrote much of the material in the manual.

Upon printing of this manual in 1996, the following PCI committees were providing oversight of the process:

Quality Assurance Council
Larry G. Fischer, Chairman

Edwin A. McDougle
Gary E. Oakes
Stanley J. Ruden
Dino J. Scalia

Personnel Training and Certification Committee
(Formerly the Technician/Inspector Certification Committee)
Edwin A. McDougle, Chairman

T. Henry Clark
Gary E. Oakes
Joe Roche
Dino J. Scalia

Early in the project, the PCI Plant Certification Committee was responsible for development and coordination. The committee members who participated at that time were:

PCI Plant Certification Committee
Gary E. Oakes*, Chairman

Ray Andrews
T. Henry Clark*
Theodore W. Coons
Peter D. Courtois†
John S. Dick*
David Eddy
Larry G. Fischer
Ted J. Gutt
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Michael W. Lanier
Robert McCrossen
Stanley J. Ruden
Dino J. Scalia**
Wes Westermann

*Formerly Members of the Technician/Inspector Certification Subcommittee
**Formerly Chairman of the Technician/Inspector Certification Subcommittee
†Deceased

John S. Dick, Editor
Precast/Prestressed Concrete Institute

INTRODUCTION
TM-103, First Edition

This manual has been developed for use as a classroom text in the Precast/Prestressed Concrete Institute's Level III Quality Control School. It will also be valuable as a self-study guide for those interested in learning the requirements for producing quality prestressed concrete and as a reference and training manual for plant personnel.

Beginning in 1973 the PCI Plant Certification Committee has conducted Quality Control Schools to instruct producer member employees in the technical details of manufacturing prestressed concrete and to familiarize them with the industry's quality standards. These standards include the *Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete*, (MNL-116) and *Manual for Quality Control for Plants and Production of Architectural Precast Concrete*, (MNL-117). In 1984 the Committee launched the Technician/Inspector* Certification Program to formalize the training process and to recognize those that completed a specific course of instruction. Since 1985, PCI has awarded certificates as certified Technician/Inspector* for Levels I and II. In 1987, the Committee published the *Quality Control Technician/Inspector Level I & II Training Manual*, (TM-101), to aid in preparation for taking the certification examinations. TM-103 is an expansion of the material contained in TM-101 and contains new material on advanced topics not previously presented. The material in TM-101 should be reviewed and understood before proceeding with the subjects in this text.

Outline of Contents

Quality concrete is fundamental to manufacturing quality precast concrete. Chapter 1, "Properties of Concrete Components" reviews the basic ingredients in concrete. Chapter 2, "Essentials of Quality Concrete" presents the processes required to obtain the desired finished concrete product. Chapters 3 and 4 describe the properties of fresh and hardened concrete that must be considered when selecting the appropriate concrete mix for a specific application. These chapters also describe the testing procedures for evaluation of concrete properties. Once a concrete mix has been selected for a project, the uniformity of the concrete throughout the project is a primary quality goal. Careful attention to the uniform application of concrete tests is critical to the successful control of concrete quality.

Detailed steps for the design of concrete mixtures are presented in Chapter 5. Some requirements of architectural concrete are the same as for structural concrete. Where special requirements occur for

*The program is now the Quality Control Personnel Certification Program