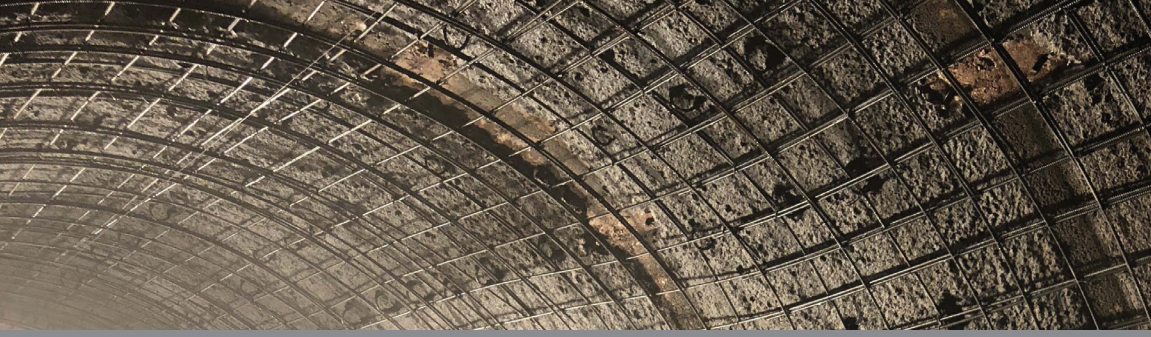

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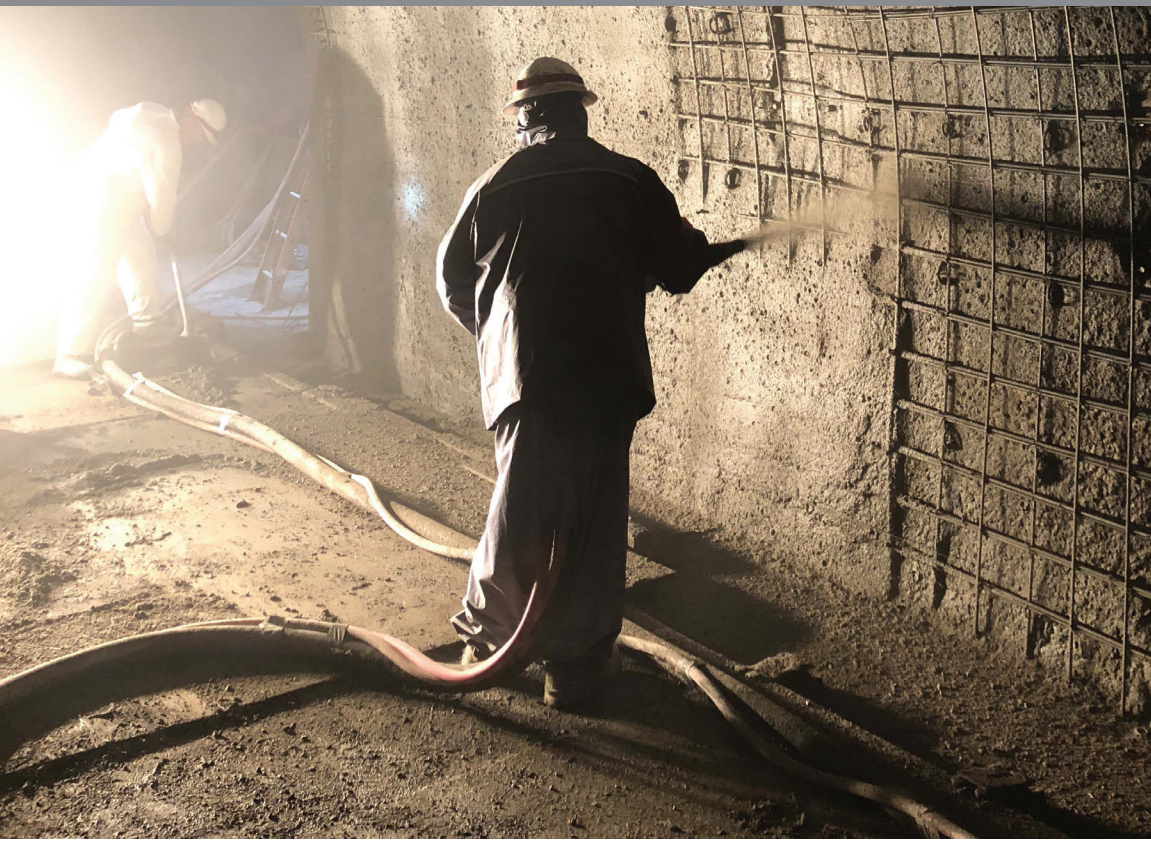

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PREFACE

The purpose of this document is to provide the nozzleman an understanding of basic concrete technology and describe and illustrate how to properly place quality shotcrete.

Information in this workbook should be used as a guide to good practice. ACI 506.2, “Specification for Shotcrete,” and ACI 506R, “Guide to Shotcrete,” should also be consulted. Above all, the plans and specifications for a specific construction project must be followed.

CHAPTER 1—WHAT IS SHOTCRETE?

Shotcrete is concrete conveyed through a hose and pneumatically projected at high velocity onto a surface to achieve compaction. It is a method of placing concrete used primarily in vertical and overhead surfaces. Shotcrete allows construction of walls and other structures with no form or only a one-sided form. It is often more economical than form-and-pour concrete because of its versatility and substantially reduced formwork. Tanks, swimming pools, tunnels, mines, sculptured rocks, structural walls, high-rise basements, erosion control embankments, retaining walls, and shear walls are all examples of new concrete structures commonly built using shotcrete. In addition, a wide variety of concrete repairs also employ shotcrete.

Shotcrete can be placed at various thicknesses against one-sided forms (or existing concrete or masonry structures and rock, earth, or other surfaces). Thickness of the material placed varies depending on several parameters, further described in Chapter 8, Shotcrete Placement Principles and Techniques.

The nozzleman is the craftsman that physically directs the shotcrete placement of the concrete. The nozzleman has final responsibility for the quality of the placed shotcrete and is an extremely important member of the shotcrete crew. The nozzleman should have an understanding of the materials, equipment, safety procedures, and the proper placement techniques to produce high-quality, durable concrete.

Although this document is directed to the nozzleman, they are not the only important person involved in a shotcrete project. The owner, engineer, contractor, job superintendent, foreman, and shotcrete crew are all important. Only with the cooperation and dedication of everyone involved will a project be successful.

1.1—Introduction

The two shotcrete processes are dry-mix and wet-mix.

1.1.1. Dry-mix shotcrete

Dry-mix shotcrete is the process where a dry mixture of concrete materials is conveyed pneumatically (with air flow) through a delivery hose to the nozzle where water is added (Fig. 1.1.1).

In dry mix, all the concrete ingredients, except liquids, are thoroughly mixed together and then fed into a mechanical feeder or gun. The dry concrete material is then carried by compressed air flowing through the delivery hose to a

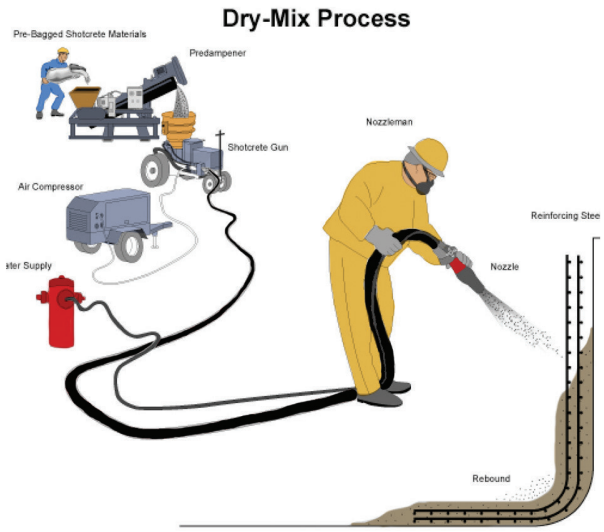

Fig. 1.1.1—Dry-mix shotcrete process.

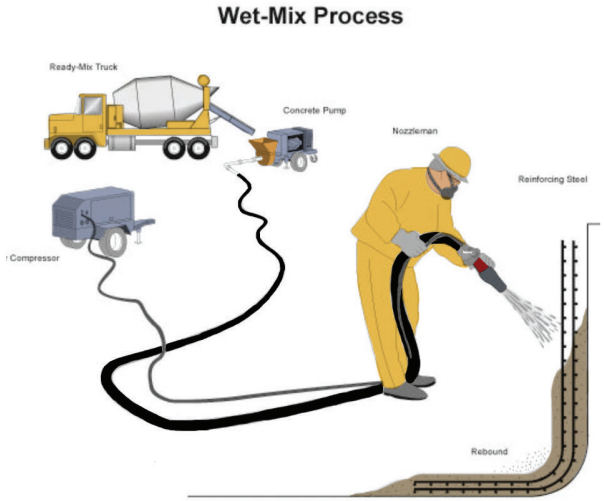

Fig. 1.1.2—Wet-mix shotcrete.

nozzle body. The nozzle body has an internal water ring where water is injected under high pressure and thoroughly mixed with the concrete ingredients. The concrete is shot from the nozzle at high velocity onto the receiving surface. Mixing of all the concrete materials occurs in the nozzle and as the material impacts the surface.

The term gunite was once proprietary but has become a generic term. The American Concrete Institute adopted the term dry-mix shotcrete as a nonproprietary term for gunite and it is the terminology used in this document.

1.1.2. Wet-mix Shotcrete

The wet-mix process (Fig. 1.1.2) has all the ingredients—including cement, supplemental cementitious materials, chemical admixtures, aggregate, and mixing water—thoroughly mixed before being pumped into a delivery hose or pipeline. Compressed air is injected at the nozzle to increase the material velocity. The concrete is then shot from the nozzle at high velocity onto the receiving surface.

1.1.3 Comparison of the shotcrete processes

Either shotcrete process can produce quality shotcrete suitable for normal construction requirements. Different factors will determine the appropriate process for an application. These factors include experience of shotcrete crew, area of shotcrete to be applied, volume and thickness of shotcrete to be applied, jobsite access, availability of materials, and more.