

Chapter 1 Introduction

1-1. Purpose

This manual provides information and guidance on the selection, proportioning, and application of shotcrete. It is intended for use by engineers and technical staff tasked with the planning, design, contract preparation, and construction management phases of a shotcrete project. A quality assurance chapter is included which details necessary technical activities during the construction phase. Subjects discussed include shotcrete and applications, materials, equipment and crew, preconstruction testing and evaluation, placement, quality control, and quality assurance. This manual does not provide guidelines for structural analysis of shotcrete applications. Refer to EM 1110-2-2000 for additional general guidance on concrete.

1-2. Applicability

This manual is applicable to all HQUSACE/OCE elements, major subordinate commands, districts, laboratories, and field operating activities (FOA) having civil works responsibilities.

1-3. References

Appendix A consists of a list of cited references that appear in the body of the text as well as a selected bibliography pertaining to the use of shotcrete. The reader is encouraged to study applicable references to supplement the guidance provided by this manual. In particular, the reader is encouraged to refer to American Concrete Institute (ACI) Committee Report 506R-90, "Guide to Shotcrete" (paragraph A-1, ACI (1991d)), and other ACI 506 documents (paragraph A-1, ACI (1991e), paragraph A-2, ACI (1991c and 1991d)).

1-4. Glossary

Appendix B consists of definitions of terms commonly used in shotcrete.

1-5. Background

a. Special equipment and techniques. Equipment for pneumatically applying a fine aggregate cement mixture was first introduced in 1910. Since that time, many improvements have been made in the equipment and in the specialized techniques required for application of

pneumatically applied mortar or concrete. The wide acceptance of shotcrete for slope and surface protection, swimming pool construction, tunnel lining, special architectural features, and renovating existing structures has resulted in the availability of a wide variety of manufactured pneumatic placement equipment.

b. Shotcrete denotes various mixtures. Shotcrete has been referred to by such terms as Gunitite, formerly a tradename for pneumatically applied mortar or concrete, sprayed concrete, spraycrete, air-blown mortar and concrete, gunned concrete, and others. In some areas "gunitite" has been used to denote small-aggregate shotcrete and mortar mixtures, and "shotcrete" to denote large-aggregate mixtures. The preferred term today for all gunned material is shotcrete, regardless of the aggregate size.

c. Specialty shotcretes. While most shotcrete placed is the traditional dry-mix and wet-mix shotcrete, the use of specialty shotcretes has become common. The addition of accelerators, fibers, and silica fume can provide shotcrete with significantly enhanced performance.

d. Varied applications. Typical applications for Corps of Engineers (Corps) projects further discussed in Chapter 2 include slope protection and stabilization, temporary excavation protection, tunnel support, and various structural and remedial applications. Appendix C provides a listing of some Corps projects that have used shotcrete for various applications.

1-6. Activities and Documentation

Involvement in shotcrete activities ranges from preliminary planning studies through the engineering and design phases, preparation of contract documents, to construction management. During these activities the engineer or other professional must perform investigations, prepare documents, and review design requirements. These activities often result in the production of the following documents:

- Shotcrete Investigation Report
- Technical Specifications
- Engineering Considerations and Instructions for Field Personnel

a. Shotcrete investigation report. The information listed is to be included in a shotcrete investigation report and prepared either as a separate report or part of a design memorandum, as a preparatory step to the

EM 1110-2-2005
31 Jan 93

production of technical specifications. The formalization of such a report depends on the size and complexity of the shotcrete project.

(1) Shotcrete quantity to be used and quality required.

(2) Climatic and service conditions to which the shotcrete will be subjected.

(3) Types of shotcrete processes and delivery equipment to be used.

(4) Types, kinds, and sources of cementitious materials to be specified, including special requirements.

(5) Potential aggregate sources, quality, and constituents.

(6) Grading of aggregate to be specified.

(7) Types and kinds of admixtures to be specified, including test requirements.

b. Technical specifications. Civil Works Guide Specification CW 03361 provides a basis for preparation of a specification for shotcrete.

c. Engineering considerations and instruction for field personnel. In accordance with EM 1110-2-2000, the designer should provide explanation of the intent of the shotcrete application, special precautions, critical items to monitor, and any other information that may be beneficial to the field staff.

1-7. Point of Contact

Questions or discussion concerning this manual should be directed through Headquarters, US Army Corps of Engineers, ATTN: CECW-EG.