Meeting Agenda
ACI 544-D Structural Uses Sub-Committee Meeting
Spring Convention 2019, 544-D, FRC Stuctural uses
Tuesday, March 26th, 12:00 pm - 1:30 pm C-304A

1. Call to order and approval of agenda
2. Introductions
3. Remarks from the Chair
4. Sessions at the current ACI convention:
   Fiber-Reinforced Self-Consolidating Concrete: From Development to Use, MondayMarch 25

5. Status of five major document maintenance under with the current 544-D committee

   - ACI 544-9R Mechanical testing of FRC
   - ACI 544-8R Tensile Design Properties from flexural tests, back-calculation procedures
   - ACI 544-4R Design
   - ACI 544-6R Elevated slabs (2015) - Suggested second
   - ACI 544-7R Tunnel lining - Suggested first

6. Direction: 1) update, rework, rewrite, change ETR to Guide
   2) develop additional examples and case studies
   3) develop a compiled set of examples as design Guide

7. New Document Preparation
   - 544.FR - Guide for Design of Fiber-Reinforced Concrete Tunnel Linings, Task Group Lead: Axel G. Nitschke, WSP

8. Progress report current, ongoing, and proposed documents:
   a) ACI 239: UHPC development of design guides, submitted to the committee
   d) Minimum reinforcement design, Residential, Fibers in Plain Structural Concrete
   e) Long terms Shrinkage, creep, and fatigue of FRC, A design Perspective.

9. Other business / presentations / informal discussion of projects
10. Adjournment

ACI 544.FR
Guide for Design of Fiber-Reinforced Concrete Tunnel Linings
Task Group Lead: Axel G. Nitschke, WSP

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CHAPTER 1—INTRODUCTION AND SCOPE
1.1—Introduction

The utilization of steel and synthetic fiber-reinforced concrete in tunneling is constantly increasing. With the document “Report on Design and Construction of Fiber-Reinforced Precast Concrete Tunnel Segments” (ACI 544.7R-16) the ACI 544 committee provided a document for TBM segmental linings. However, a concise design guide, specialized on conventional tunneling is still missing. Tunnel projects using fiber-reinforced concrete are typically heavy-civil construction infrastructure projects. Industries affected will primarily include contractors and engineers working in this field. Since fiber-reinforced shotcrete (FRS) is a major application of fiber-reinforced concrete (FRC) in conventional tunneling, the guide was developed in close coordination with ACI committee 506 Shotcreting.

1.2—Scope and limitations

The aim of this guide is providing practicing engineers with design guidelines and recommendations for fiber reinforced tunnel linings for conventional tunneling. The guide will cover temporary shotcrete linings as well as cast-in-place and shotcrete final linings.
The primary audience for this document are specifiers, designers, and contractors using fiber-reinforced concrete tunnel linings. The secondary audience are agencies and authorities building or maintaining tunnel structures with fiber-reinforced concrete, but also manufacturer’s and researchers, interested in the current state-of-the art in fiber-reinforced concrete tunnel lining design. In addition, it is expected that the guide will be used in tunnel specific design guidelines issued by the Federal Highway Administration (FHWA), AASHTO as well as transportation authorities with large underground subway systems like New York MTA, Washington DC’s WMATA, Los Angeles Metro, or San Francisco MTA.

1.3—Applications and uses in existing tunnels

CHAPTER 2—NOTATION AND DEFINITIONS
2.1—Notation
2.2—Definitions

CHAPTER 3—DESIGN PHILOSOPHY
3.1—Fiber-reinforced concrete design codes, standards, and recommendations
3.2—Ultimate Strength Design (USD)
3.3—Load and Resistance Factor Design (LRFD)
3.4—Governing load cases and load factors for temporary tunnel linings
3.5—Design approach for temporary tunneling linings
3.6—Governing load cases and load factors for final tunnel linings
3.7—Design approach for final tunneling linings
3.8—Design approach for shear
3.9—Design approach for bridging and lagging between other support members

CHAPTER 4—DESIGN FOR BEARING CAPACITY OF TEMPORARY TUNNEL LININGS
4.1—Empirical design
4.2 – Design based on cross section bearing capacity
4.3 – Design based on system failure

4.4—Load Case x
4.5—Load Case x
4.6—Load Case x

CHAPTER 5—DESIGN FOR BEARING CAPACITY OF FINAL TUNNEL LININGS
5.1 – Design based on cross section bearing capacity
5.2 – Design based on system failure
5.3—Load Case x:
5.4—Load Case x:

CHAPTER 6—DESIGN FOR SERVICEABILITY OF FINAL TUNNEL LININGS
6.1 - Design based on cross section bearing capacity
6.2—Load Case x:
6.3—Load Case x

CHAPTER 7—MATERIAL PARAMETERS FOR DESIGN

CHAPTER 8—TESTS AND PERFORMANCE EVALUATION
8.1—Material parameters, tests, and analyses

CHAPTER 9—HYBRID REINFORCEMENT FOR TUNNEL LININGS

CHAPTER 10—DESIGN EXAMPLES
10.1—
10.2—

CHAPTER 11—REFERENCES
Authored documents
APPENDIX A—SIMPLIFIED DESIGN DIAGRAMS