



American Concrete Institute

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## Meeting Agenda

### 435 Deflection of Concrete Building Structures

Spring 2021 Virtual Convention (Baltimore, MD)

March 29, 2020 6:00 PM – 9:00 PM EST

*Mission: Develop and report information on the deflection of concrete building structures.*

#### 1. Administrative [5 min]

1.1. Review & approve minutes from Fall Virtual Convention (Raleigh, NC), 10/26/2020 [Exhibit 1]

1.2. Membership update

#### 2. Planning and Discussion [45 min]

2.1. Status of ACI 435R-20 Report on Deflection of Nonprestressed Concrete Structures

2.2. ACI 435R Report on Deflection of Prestressed Concrete Structures document  
2.2.1. Updates from chapter authors (+/- 5 minutes per chapter)

#### 3. New Business [15 min]

3.1. Future Technical Sessions

3.1.1. Mini-session on 435R-20

3.2. Other new business

#### 4. Adjournment

#### Exhibits

**Exhibit 1** Meeting minutes from Fall 2020 Virtual Convention (Raleigh, NC), 10/26/2020



American Concrete Institute

# ACI Committee 435

## Deflection of Concrete Building Structures

### Fall 2020 Meeting Minutes - *Draft*

Virtual Meeting

26 October 2020  
6:00 - 9:00pm EDT  
GoTo Meeting

## Attendance

**Members in Attendance:** Dylan Freytag (Chair), David Shook (Secretary), Peter Bischoff, Allan Bommer, Eamonn Connoly, Norbert Delatte, Mamdouh El-Badry, Amin Ghali, Brock Hedegaard, Adam Knaack, Eric Muselman, Hani Nassif, Debrethann Orsak, Mahmoud Taha, Donald Carroll, Ramez Gayed, Jared Brewes, Ziad El Aghoury, Ricardo Henoch, Faris Malhas, Adi Obeidah

**Visitors in attendance:** Abraham Ramirez, Alireza Asadian, Craig Leech, Khaled Nahlawi

**Voting members not present:** Shawn Gross, Young Hak Lee, Adam Lubell (regrets), Clay Naito, Edward Nawy

**TAC Contact:** Barzin Mobasher (present)

## Introductions

Attendance taken. Visiting members welcomed. Dylan Freytag and David Shook introduced as new Chair and Secretary, respectively.

## Prior Meeting Minutes

Minutes from Cincinnati meeting previously posted on ACI website and distributed. Orsak motion to approve. Nassif second. Minutes approved without objection.



## Committee Membership

1. Consulting members voluntarily stepping down: Andrew Scanlon
2. New voting members: none

## Update on 435R-20 Report on Deflection of Nonprestressed Concrete Structures

1. Final document has been approved and will be published by the end of November 2020

## Update on 435R-XY Report on Deflection of Prestressed Concrete Structures

1. **Chapter 1 & 2 Introduction & Notation** (Shook) - Chapter will follow similar language of approved 435R-20 document with select revisions for prestressed.
2. **Chapter 3 Prestressing reinforcement** (Musselman) - Chapter will utilize prior ACI 435R-95 document since prestressing material has not changed. Some discussion of nonmetallic material like FRP tendons and coordinate with ACI 440.
3. **Chapter 4 General approach to deformation considerations curvature and deflections** (Nassif) - Will be updated from prior 435 document and will require numerous changes.
4. **Chapter 5 Short-term deflection and camber evaluation in prestressed beams** (Nassif) - Developing with Ghali will be pursued.
5. **Chapter 6 - Long-term deflection and camber evaluation in prestressed beams** (Bischoff, Naito) - Work is in progress. Jared Brewe offer to contribute and liaise with Committee 423
6. **Chapter 7 Deflections and camber evaluation of two-way prestressed slabs** (Saarkinen, Shook/Henoch, Allen?) - Discussion about the focus on the chapter scope occurred. A consensus developed towards practitioner-focused content that would help engineers calculating deflection of prestressed two-way flat slabs using current analysis tools. This would include current finite element analysis approaches commonly used by practicing engineers. Adoption of some content from ACI 447 twisting moments document could be repurposed to explain common FEA approaches. Ghali and Gayad offered to help this chapter.

Committee agreed that Chapters 4, 5, & 6 would focus on one-way slabs and beams to establish derived solutions including key topics such as moment-curvature, flexural cracking, creep, shrinkage, etc. This would lead into and compliment Chapter 7.

Adam Knaack & Don Carroll to assist in chapter development. Gayed and El Badry expressed interest in assisting after reviewing outline in detail.



## 7. **Appendix** - Not discussed

### New business

1. ACI 435R-20 mini session - Musselman, Bischoff & Freytag (Freytag to request)
  - a. Introduction - Eric Musselman
  - b. One-way systems - Bischoff
  - c. Two-way systems - TBD
2. Recent publications
  - a. Lund paper - Discussion of how most practicing engineers account for long-term creep and shrinkage. Shook commented that most engineers and software use the ACI method of a reduced modulus of rupture and multiplier of 3.5. Some engineers use age adjusted methods within SAFE. Shook commented that SOM does both on most projects.
  - b. Huang paper - Use of high strength rebar and concrete. Comment was made that high-strength concrete can have high shrinkage and that effect may have not been considered in the paper.
  - c. Ghali papers
3. Possible future session topic: Important Considerations of Deflection Performance - Adam Knaack & Peter Bischoff
  - a. Pour strips - how do they affect shrinkage cracking
  - b. Restraint from walls and columns - performance of slip joints
  - c. Freytag to revive Tech Note on column and wall shortening (axial deformations)

### Next Meeting

Spring 2020 convention.

### Adjourn

Motion to adjourn by Nassif, second by Knaack, and no objections.

# ACI 435R-XY - Approved Table of Contents for Report on Deflection of Prestressed Concrete Members TAC

## **Chapter 1 Introduction**

**[Shook]**

- 1.1 *Objectives*
- 1.2 *Scope*

## **Chapter 2 Notations and Definitions**

**[Shook]**

- 2.1 *Notations*
- 2.2 *Definitions*

## **Chapter 3 Prestressing reinforcement**

**[Musselman]**

- 3.1 *Types of reinforcement*
  - 3.1.1 *Stress-relieved wires and strands*
  - 3.1.2 *High-tensile-strength prestressing bars*
  - 3.1.3 *Non-metallic tendons*
- 3.2 *Modulus of elasticity*
- 3.3 *Steel relaxation Stress*

## **Chapter 4 - General approach to deformation considerations - curvature and deflections**

**[Nassif]**

- 4.1 *Beams subjected to prestressing only*
- 4.2 *Beams subjected to prestressing and external loads*
- 4.3 *Moment-curvature relationship*

## **Chapter 5 - Short-term deflection and camber evaluation in prestressed beams**

**[Peter, Nassif]**

- 5.1 *Uncracked members*
- 5.2 *Cracked members: effective  $I_e$  method*
- 5.3 *Bilinear computation method*
- 5.4 *Incremental moment-curvature method*

## **Chapter 6—Long-term deflection and camber evaluation in prestressed beams**

**[Naito + 423/209?]**

- 6.1 *PCI multipliers method*
- 6.2 *Incremental time-steps method*
- 6.3 *Approximate time-steps method*
- 6.4 *Axial strain and curvature method*
- 6.5 *Prestress loss method*
- 6.6 *FIB model code method*

## **Chapter 7 – Deflections and camber evaluation of two-way prestressed slabs**

**[Saarkinen/Shook/Henoch + Allen/Adam/Don/Ramez]**

## **APPENDIX A1 [TBD]**

**Example A1.1 - Short- and long-term single-tee beam deflections**