ACI 423.3R-17

Recommendations for Concrete Members Prestressed with Single-Strand Unbonded Tendons

Reported by Joint ACI-ASCE Committee 423

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Reported by Joint ACI-ASCE Committee 423

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This report provides information for the design of flexural concrete members in buildings post-tensioned with single-strand unbonded tendons. The report is intended to complement the commentary in ACI 318 and to provide suggestions for revisions and additions to ACI 318. Consideration is given to design for gravity and lateral loads, determination of fire endurance, design for seismic forces, and design for catastrophic loadings. Recommendations concerning details and properties of tendons, protection against corrosion, and construction procedures are presented.

Keywords: concrete slabs; cracking; fire resistance; joints; punching shear; unbonded post-tensioning.

CONTENTS

ACI 423.3R-17 supersedes ACI 423.3R-05 and was adopted and published June 2017.

CHAPTER 1—INTRODUCTION

1.1—General

Since the publication of previous ACI 423.3R reports, many of their recommendations have been incorporated into ACI 318. All references to ACI 318 refer to ACI 318-14 unless specifically noted. The recommendations in this report have been prepared to provide a comprehensive guide for design, materials, and construction for concrete members prestressed with single-strand unbonded tendons. Suggested revisions and additions to ACI 318 are also included in this report. Mandatory language used in this report reflects requirements in ACI 318.

1.2—Objective

This report presents recommendations for design, materials, and construction for concrete structures prestressed with unbonded tendons that are commensurate with the strength, serviceability, and safety requirements of ACI 318. Practitioners should use their judgment when applying the recommendations of this report. This report is not intended for reference in a specification or a code.

1.3—Scope

Recommendations pertinent to design with single-strand unbonded tendons considered in this report include the design of slabs, beams, and continuous members; details and properties of tendons and anchors; and protection from corrosion during construction and throughout the life of the structure.

The recommendations in this report are not intended for unbonded construction stages of elements using bonded tendons; for multistrand unbonded tendons used as external tendons; for members subject to direct tension, such as tiebacks, cable stays, arch ties, or circumferential tendons for containment structures; or for ground-supported post-tensioned slabs for light residential construction.

CHAPTER 2—NOTATION AND DEFINITIONS

2.1—Notation

A_b = net bearing plate area. in.^{2} (mm^2)
A_b' = maximum area of the portion of the concrete anchorage surface that is geometrically similar to and concentric with the area of the anchorage, in.^{2} (mm^2)
A_c' = cross-sectional area of the slab, perpendicular to the slab edge, between the center of the exterior span and the slab edge, in.^{2} (mm^2)
A_{cf} = larger of gross cross-sectional areas of the slab-beam strips of the two orthogonal equivalent frames intersecting at the column, in.^{2} (mm^2)
A_{ps} = area of prestressed longitudinal tension reinforcement, in.^{2} (mm^2)
$A_{s,min}$= minimum bonded reinforcement in negative moment areas of two-way systems
b = width of compression face of member, in. (mm)
b_f = total flange width
b_n = effective overhang flange width for normal forces, in. (mm)
b_o = perimeter of critical section for two-way shear in slabs, in. (mm)
b_w = effective flange width for normal forces at post-tension anchor, in. (mm)
d_p = distance from extreme compression fiber to centroid of prestressing reinforcement, in. (mm)
E_s = modulus of elasticity of prestressing reinforcement, psi (MPa)
f_{ci}' = strength of concrete at time of initial prestress, psi (MPa)
f_{cp} = permissible concrete compressive stress, psi (MPa)
f_{pc} = compressive stress in concrete, after allowance for all prestress losses, at centroid of cross section resisting externally applied loads or at junction of web and ñange where the centroid lies within the ñange, psi (MPa); in a composite member, f_{pc} is the resultant compressive stress at centroid of composite section, or at junction of web and ñange where the centroid lies within the ñange, due to both prestress and moments resisted by precast member acting alone, psi (MPa)