ACI ITG-5.2-09

Requirements for Design of a Special Unbonded Post-Tensioned Precast Shear Wall Satisfying ACI ITG-5.1 (ACI ITG-5.2-09) and Commentary

An ACI Standard

Reported by ACI Innovation Task Group 5

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This standard defines procedures that may be used to design special precast concrete shear walls, coupled or uncoupled, composed of discretely jointed precast panels that are vertically post-tensioned to the foundation with unbonded tendons. Such walls are suitable for use in regions of high seismicity and for structures assigned to high seismic design categories. After a major seismic event, these walls can be expected to exhibit minimal damage in the flexural hinging region at the base of the wall as well as negligible permanent displacements. Such walls do not satisfy the prescriptive requirements of Chapter 21 of ACI 318-05 for shear walls of monolithic construction. According to 21.2.1.5 of ACI 318-05, their acceptance requires demonstration by experimental evidence and analysis that the walls have strength and toughness equal to or exceeding those provided by comparable monolithic reinforced concrete walls that satisfy the prescriptive requirements of Chapter 21. This standard describes the procedures that the designer may use to demonstrate, through analysis, that one type of unbonded post-tensioned precast wall has strength and toughness at least equal to that of comparable special reinforced concrete monolithic walls. The standard consists of Design Requirements and a Commentary.

Among the subjects covered in these Design Requirements are requirements for:

1. Materials, including considerations for the coupling or connection devices, that provide the primary source of energy dissipation for the wall system;

2. Individual walls, including considerations to ensure ductility, energy dissipation, integrity, stiffness, and strength; and

3. Coupled walls, including considerations of the roles of the post-tensioning tendons and coupling devices in providing energy dissipation, and strength and stiffness for coupled walls greater than the sum of those provided by the coupled walls acting as separate units.

The Commentary references documentary evidence, additional to the references of ACI ITG-5.1-07 and Chapter 21 of ACI 318R-05, that supports these Design Requirements. In this standard, however, no comparison is made between the performance of precast test modules satisfying the prescriptive requirements of ACI 318 and modules satisfying these Design Requirements but not satisfying ACI 318. Such comparisons, both experimental and analytical, are available in the cited references.

All references to ACI 318 and ACI 318R in these Design Requirements and Commentary refer to ACI 318-05 unless another edition of ACI 318 is specifically designated. All references to ASCE/SEI 7 in these Design Requirements and Commentary are to ASCE/SEI 7-05, including Supplement No. 1.

In this standard, consistent with the format of ACI 318-05, the word "Section" is not included before a reference to a section of ACI 318-05. To more clearly designate a section in this standard, however, the word "Section" is used before any reference to a section of this standard. Consistent with the format of ASCE/SEI 7-05, the word "Section" is included before a reference to a section of ASCE/SEI 7-05.

Keywords: coupling devices; drift angle; energy dissipation; lateral resistance; post-tensioning; precast concrete; prestressed concrete; seismic design; special shear wall; test module; toughness.

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