Overview

- Adhesive Anchor Design Now
- IBC 2012 & Scope of ACI 318-11
- ACI 355.4-11 – What is it?
- ACI/CRSI Adhesive Anchor Certification
- Your Specifications/General Notes
Adhesive Anchor Design Now
Adhesive Anchor Design Now

Adhesive Anchors Must be Designed Using Strength Design:

SECTION 1912
ANCHORAGE TO CONCRETE—ALLOWABLE STRESS DESIGN

1912.1 Scope. The provisions of this section shall govern the allowable stress design of headed bolts and headed stud anchors cast in normal-weight concrete for purposes of transmitting structural loads from one connected element to the other. These provisions do not apply to anchors installed in hardened concrete or where load combinations include earthquake loads or effects. The bearing area of headed anchors shall be not less than one and one-half times the shank area. Where strength design is used, or where load combinations include earthquake loads or effects, the design strength of anchors shall be determined in accordance with Section 1913. Bolts shall conform to ASTM A 307 or an approved equivalent.
Adhesive Anchor Design Now

Adhesive Anchors Must be Designed Using Strength Design:

ANCHORAGE TO CONCRETE – STRENGTH DESIGN

1913.1 Scope. The provisions of this section shall govern the strength design of anchors installed in concrete for purposes of transmitting structural loads from one connected element to the other. Headed bolt, headed studs and hooked (J- or L-) bolts cast in concrete and expansion anchors and undercut anchors installed in hardened concrete shall be designed in accordance with Appendix D of ACI318, provided they are within the scope of Appendix D.

The strength design of anchors that are not within the scope of Appendix D of ACI318…shall be in accordance with an approved procedure.
D.2 — Scope

D.2.1 — This appendix provides design requirements for anchors in concrete used to transmit structural loads by means of tension, shear, or a combination of tension and shear between: (a) connected structural elements; or (b) safety-related attachments and structural elements. Safety levels specified are intended for in-service conditions, rather than for short-term handling and construction conditions.

D.2.2 — This appendix applies to both cast-in anchors and post-installed anchors. Specialty inserts, through-bolts, multiple anchors connected to a single steel plate at the embedded end of the anchors, adhesive or grouted anchors, and direct anchors such as powder or pneumatic actuated nails or bolts, are not included. Reinforcement used as part of the embedment shall be designed in accordance with other parts of this Code.
**Question:** How do I design adhesive anchors? Where do the calculations come from?
Question: How do I design adhesive anchors? Where do the calculations come from?

Answer: ICC-ES AC 308

- Provides criteria for qualifying adhesive anchors in concrete
- Provides calculations to determine adhesive anchor capacities in concrete
SECTION 1909
ANCHORAGE TO CONCRETE—STRENGTH DESIGN

1909.1 Scope. The provisions of this section shall govern the strength design of anchors installed in concrete for purposes of transmitting structural loads from one connected element to the other. Headed bolts, headed studs and hooked (J- or L-) bolts cast in concrete and expansion anchors and undercut anchors installed in hardened concrete shall be designed in accordance with Appendix D of ACI 318 as modified by Sections 1905.1.9 and 1905.1.10, provided they are within the scope of Appendix D.

The strength design of anchors that are not within the scope of Appendix D of ACI 318, and as amended in Sections 1905.1.9 and 1905.1.10, shall be in accordance with an approved procedure.
ACI 318-11 Appendix D

Scope:

- **Cast-In-Place Anchors:**
  - Headed Studs & Bolts
  - Hooked Bolts
- **Post-Installed Anchors:**
  - Expansion Anchors
  - Undercut Anchors
  - **NEW!** Adhesive Anchors
Scope:

D.2.2 — This appendix applies to cast-in anchors and to post-installed expansion (torque-controlled and displacement-controlled), undercut, and adhesive anchors. Adhesive anchors shall be installed in concrete having a minimum age of 21 days at time of anchor installation. Specialty inserts, through-bolts, multiple anchors connected to a single steel plate at the embedded end of the anchors, grouted anchors, and direct anchors such as powder or pneumatic actuated nails or bolts are not included in the provisions of Appendix D. Reinforcement used as part of the embedment shall be designed in accordance with other parts of this Code.
Qualification of Anchors:

D.2.3 — Design provisions are included for the following types of anchors:

(a) Headed studs and headed bolts having a geometry that has been demonstrated to result in a pullout strength in uncracked concrete equal to or exceeding \(1.4N_p\), where \(N_p\) is given in Eq. (D-14);

(b) Hooked bolts having a geometry that has been demonstrated to result in a pullout strength without the benefit of friction in uncracked concrete equal to or exceeding \(1.4N_p\), where \(N_p\) is given in Eq. (D-15);

(c) Post-installed expansion and undercut anchors that meet the assessment criteria of ACI 355.2; and

(d) Adhesive anchors that meet the assessment criteria of ACI 355.4.
Qualification of Anchors:

- Same as AC 308 Minus the Calculations
- Adhesive Can Only be Specified if Qualified Under ACI 355.4
- How do I know if the Adhesive I Specify Qualifies Under ACI 355.4?
Answer: If it has an ICC-ESR for Concrete

Which Adhesives Qualify for Use in Concrete:

- Simpson ET
- Simpson SET
- Simpson SET-XP
- Hilti HY 150
- Hilti RE 500
- Hilti RE 500-SD
**Answer:** If it has an ICC-ESR for Concrete

Which Adhesives Qualify for Use in Concrete:

- **Simpson ET**
- **Simpson SET**
- **Simpson SET-XP**
- **Hilti HY 150**
- **Hilti RE 500**
- **Hilti RE 500-SD**
ACI/CRSI Adhesive Anchor Installation (AAI) Certification
Some Adhesive Anchors Will Require Installer to be Certified Prior to Installation:

- What prompted the certification requirement?
- Which adhesive anchors require certification?
- Who will perform this certification?
- What does certification program entail?
Don’t Design the Next “Big Dig Collapse”:

- 25% Reduction for Overhead Sustained Loads
- Creep Test is Mandatory for Adhesives
- Creep Test is Performed at High Temperatures
- **New:** AAI Certification Requirement
Adhesive Anchor Installation Certification:

D.9.2 — Installation of anchors shall be inspected in accordance with 1.3 and the general building code. Adhesive anchors shall be subject to the following additional requirements:

D.9.2.1 — For adhesive anchors, the contract documents shall specify proof loading where required in accordance with ACI 355.4. The contract documents shall also specify all parameters associated with the characteristic bond stress used for the design according to D.5.5 including minimum age of concrete; concrete temperature range; moisture condition of concrete at time of installation; type of lightweight concrete, if applicable; and requirements for hole drilling and preparation.
Adhesive Anchor Installation Certification:

D.9.2.2 — Installation of adhesive anchors horizontally or upwardly inclined to support sustained tension loads shall be performed by personnel certified by an applicable certification program. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Anchor Installer Certification program, or equivalent.

D.9.2.3 — The acceptability of certification other than the ACI/CRSI Adhesive Anchor Installer Certification shall be the responsibility of the licensed design professional.
D.9.2.4 — Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by an inspector specially approved for that purpose by the building official. The special inspector shall furnish a report to the licensed design professional and building official that the work covered by the report has been performed and that the materials used and the installation procedures used conform with the approved contract documents and the manufacturer’s printed installation instructions.
ACI/CRSI Certification:

- Two-day commitment
- Written Exam and Three Performance Tests
  - Vertically Downward
  - Overhead with Piston Plug
  - Overhead with Retaining Cap

Problems:

- Frequency of Certification Classes
- Convenience of Classes (Location)
- Generic Training
Your Anchor Specifications
Your General Notes or Anchor Specifications Must, by Code Include:

- Adhesives that Qualify Under ACI 355.4
- Proof Load Test Parameters, Where Required
- Special Inspection Specific to Anchor Type
- Parameters that Affect Adhesive Bond Stress
- ACI/CRSI Certification Requirement or Alternate
Questions?

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