

## GENERAL INSTRUCTIONS FOR THE DESIGNER

These general instructions for the designer are provided to ensure the proper selection and installation of Simpson Strong-Tie Company Inc. products and must be followed carefully. These general instructions are in addition to the specific design and installation instructions and notes provided for each particular product, all of which should be consulted prior to and during the design process.

- a) The term "Designer" used throughout this catalog is intended to mean a licensed/certified building design professional, a licensed professional engineer, or a licensed architect.
- b) All connected members and related elements shall be designed by the Designer and must have sufficient strength (bending, shear, etc) to resist the loads imposed by the anchors.
- c) When the allowable stress design method is used, the design service loads shall not exceed the published allowable loads.
- d) When the ultimate strength design method is used, the factored loads shall not exceed the design strengths calculated in accordance with the published design data.
- e) Simpson Strong-Tie® strongly recommends the following addition to construction drawings and specifications: "Simpson Strong-Tie products are specifically required to meet the structural calculations of plan. Before substituting another brand, confirm load capacity based on reliable published testing data or calculations. The Engineer/Designer of Record should evaluate and give written approval for substitution prior to installation."
- f) Local and/or regional building codes may require meeting special conditions. Building codes often require special inspections of anchors installed in concrete or masonry. For compliance with these requirements, it is necessary to contact the local and/or regional building authority. Except where mandated by code, Simpson Strong-Tie® products do not require special inspection.
- g) Allowable loads and design strengths are determined from test results, calculations, and experience. These are guide values for sound base materials with known properties. Due to variation in base materials and site conditions, site-specific testing should be conducted if exact performance in a specific base material at a specific site must be known.
- h) Unless stated otherwise, tests conducted to derive performance information were performed in members with minimum thickness equal to 1.5 times the anchor embedment depth. Anchoring into thinner members requires the evaluation and judgment of a qualified Designer.
- i) Tests are conducted with anchors installed perpendicular ( $\pm 6^\circ$ ) to the surface of the base material. Deviations can result in anchor bending stresses and reduce the load carrying capacity of the anchor.
- j) Allowable loads and design strengths do not consider bending stresses due to shear loads applied with large eccentricities.
- k) Metal anchors and fasteners will corrode and may lose load-carrying capacity when installed in corrosive environments or exposed to corrosive materials. See Supplemental Topic G3.
- l) Mechanical anchors should not be installed into concrete that is less than 7 days old. The allowable loads and design strengths of mechanical anchors that are installed into concrete less than 28 days old should be based on the actual compressive strength of the concrete at the time of installation.
- m) Nominal embedment depth (embedment depth) is the distance from the surface of the base material to the installed end of the anchor and is measured prior to application of an installation torque (if applicable). Effective embedment depth is the distance from the surface of the base material to the deepest point at which the load is transferred to the base material.
- n) Drill bits shall meet the diameter requirements of ANSI B212.15. For adhesive anchor installations in oversized holes, see Supplemental Topic A1. For adhesive anchor installations into core-drilled holes, see Supplemental Topic A2.
- o) Threaded-rod inserts for adhesive anchors shall be UNC fully threaded steel.
- p) Allowable loads and design strengths are generally based on testing of adhesive anchors installed into dry holes. For installations in damp, wet and submerged environments, see Supplemental Topic A3.
- q) Adhesive anchors should not be installed into concrete that is less than 7 days old. The allowable loads and design strengths of adhesive anchors that are installed into concrete less than 28 days old should be based on the actual compressive strength of the concrete at the time load is applied.
- r) Adhesive anchors can be affected by elevated base material temperature. See Supplemental Topic A4.
- s) Anchors are permitted to support fire-resistive construction provided at least one of the following conditions is fulfilled: a) Anchors are used to resist wind or seismic forces only. b) Anchors that support gravity load-bearing structural elements are within a fire-resistance-rated envelope or a fire-resistance-rated membrane, are protected by approved fire-resistance rated materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards. c) Anchors are used to support nonstructural elements.
- t) Some adhesives are not qualified for resisting long-term sustained loads. These adhesives are for resisting short-term loads such as wind or seismic loads only. See Supplemental Topic A5.
- u) Exposure to some chemicals may degrade the bond strength of adhesive anchors. Refer to the product description for chemical resistance information. Information is also available in Simpson Strong-Tie Company Inc. Technical Bulletin T-SAS-CHEMRES.

## SUPPLEMENTAL TOPICS FOR ANCHORS

### GENERAL

#### G1. Base Materials

"Base material" is a generic industry term that refers to the element or substrate to be anchored to. Base materials include concrete, brick, concrete block (CMU) and structural tile, to name a few. The base material will determine the type of fastener for the application. The most common type of base material where adhesive and mechanical anchors are used is concrete.

**Concrete** – Concrete can be cast in place or precast concrete. Concrete has excellent compressive strength, but relatively low tensile strength. Cast-in-place (or sometimes called "poured in place") concrete is placed in forms erected on the building site. Cast-in-place concrete can be either normal-weight or lightweight concrete. Lightweight concrete is specified when it is desirable to reduce the weight of the building structure.

Lightweight concrete differs from normal-weight concrete by the weight of aggregate used in the mixture. Normal-weight concrete has a unit weight of approximately 150 pounds per cubic foot compared to approximately 115 pounds per cubic foot for lightweight concrete.

The type of aggregate used in concrete can affect the tension capacity of an adhesive anchor. Presently, the relationship between aggregate properties and anchor performance is not well understood. A recent study based on a limited test program has shown that in relative terms, concrete with harder and more dense aggregates tend to yield greater anchor tension capacities. Conversely, use of softer, less dense aggregates tends to result in lower anchor tension capacities. Research in this area is ongoing. Test results should not be assumed to be representative of expected performance in all types of concrete aggregate.