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Standard Terminology for Anchors and Fasteners in Concrete and Masonry[1]

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1. Scope

1.1 This terminology covers standard terminology for anchors and fasteners installed in structural members made of concrete or masonry.

1.2 This terminology does not cover terms relating to the mechanical properties of the materials used for fabricating anchors, nor does it cover their use.

1.3 The terms are listed alphabetically. Compound terms appear in the natural spoken order.

2. Terminology

adhesive anchor—anchor placed into a hole in the base material, and which derives its holding strength from a chemical adhesive placed between the wall of the hole in the base material and the embedded portion of the anchor.

allowable load—capacity assigned to an anchor in accordance with allowable-stress design procedures.

anchor—cast-in-place or post-installed fastening device installed in the base material for the purpose of transferring loads to the base material.

anchor loading: axial—load applied concentrically with the anchor longitudinal axis.

anchor loading: bending—flexure induced in the anchor by application of a shear load at a distance from the surface of the base material.

anchor loading: combined—axial and shear loading applied simultaneously (oblique loading).

anchor loading: shear—load applied parallel to the surface of the base material and perpendicular to the anchor's longitudinal axis.

anchor spacing—distance between anchors measured centerline to centerline.

attachment—structural element (fixture) external to the surface of the base material, and which transmits loads to the anchor.

base material—material in which anchor is installed, such as concrete or masonry.

bond failure—failure mode characterized by loss of bond either between the anchor and adhesive or between the adhesive and the base material.

cast-in-place anchor—anchor installed in formwork prior to placement of concrete.

characteristic value—the 5 % fractile (value with a 95 % probability of being exceeded, with a confidence of 90 %).

clamping force—compression force transmitted to the base material as a result of preload in the anchor.

concrete breakout failure—anchor failure mode characterized by concrete cone failure or concrete edge failure.

connection—attachment of load-bearing element to concrete or masonry base materials using anchors.

cracked concrete—for testing purposes, a test member having one or more cracks, each of which is approximately uniform in width through the depth of the member.

DISCUSSION—Only one crack is permitted in the area of influence of the test anchor.

critical edge distance—minimum anchor edge distance, measured from the anchor centerline to the edge of the structural member, at which the full anchor capacity can be obtained without concrete edge breakout failure or splitting failure.

critical spacing—minimum anchor spacing, measured centerline to centerline of the anchors, at which the full anchor capacity can be obtained without influence from adjacent anchors.

cure time—the length of time required for a grouted anchor or an adhesive-bonded anchor to develop its specified strength.

diamond core bit—non-percussion drill bit, usually utilizing a hollow cylindrical pipe or tube with a diamond-impregnated matrix at the end that is used to drill in the base material.

displacement—movement of anchor relative to the structural member.

[1] This terminology is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.13 on Structural Performance of Connections in Building Construction.

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DISCUSSION— For tension tests, displacement is measured parallel to the anchor axis; for shear tests, displacement is measured perpendicular to the anchor axis.

displacement-controlled expansion anchor—a post-installed anchor that derives its holding strength by expansion against the side of the drilled hole through movement of an internal plug in the sleeve or through movement of the sleeve over an expansion element (plug). Once set, the anchor does not expand further under load.

drill—electric-, hydraulic-, or air-powered tool for boring holes into the base material, using rotary action, often supplemented by percussion or hammering.

drill bit—solid-shaft, carbide-tipped bit, usually with spiral flutes, used to drill holes in the base material.

edge distance—perpendicular distance from the centerline of the anchor to the edge of the structural member in which anchor is installed.

effective embedment depth—the overall depth through which the anchor transfers force to or from the surrounding base material, measured from the surface: for adhesive-bonded anchors measured to the deepest point of the anchor; for cast-in-place anchors measured to the upper surface of the direct bearing element; for undercut and sleeve anchors measured to the bottom of the expansion mechanism; for expansion anchors measured to the farthest point of contact between the expansion mechanism and surrounding material.

elongation—increase in length of the anchor under loading resulting from axial strain of the anchor material.

embedment depth—distance measured from the surface of the base material to the farthest point of anchor, measured prior to setting of anchor.

expansion anchor—post-installed anchor that derives its capacity predominately from frictional forces generated by mechanical expansion of the anchor against sides of hole.

expansion sleeve—outer part of expansion anchor, which is forced outward by its center part as a result of applied torque or impact, to bear against the sides of the predrilled hole.

failure mode—failure mechanism during load application to anchor.

fastener—see **anchor**.

fatigue test—test involving repeated loading cycles, usually in excess of 2×10^6 cycles.

fixture—see **attachment**.

flush installation—anchor that is installed so that its top is flush with the surface of the structural member and does not protrude beyond the surface.

follow-up expansion—movement of an expansion anchor during tension loading, whereby the expansion sleeve remains stationary and further expands as the anchor body moves axially in response to the load application.

gel time—the time after mixing at which an adhesive begins to increase in viscosity and becomes resistant to flow.

grout—pourable mixture of a cementitious or polymeric binder and water, possibly also containing fine aggregates, coarse aggregates, or both.

grouted anchor—anchor installed in the base material using grout.

insert—pre-designed and prefabricated cast-in-place or post-installed anchors specifically designed for the attachment of bolted or slotted connections.

installation torque—specified torque applied to an anchor during its installation.

linear variable differential transformer (LVDT)—a device for measuring movements that utilize a sliding core within a variable magnetic field.

DISCUSSION—Some units are powered with alternating current and require external modulators, while others are powered with direct current and have built-in modulators.

minimum spacing—minimum anchor spacing measured centerline to centerline, at which base material will not be damaged when multiple anchors are set.

prestressing force—axial force in anchor resulting from setting or torquing of anchor or nut.

pullout failure—a failure mode in which the entire anchor pulls out of the base material without a fracture of the anchor material, or without a concrete breakout failure at the effective embedmnet depth.

DISCUSSION—The anchor may displace toward the surface, resulting in a shallow breakout failure at a load that may not be consistently repeatable.

pull-through failure—a failure mode in which the anchor body pulls through the expansion mechanism without development of the full concrete breakout capacity.

relaxation—reduction in anchor prestress and associated clamping force over time.

screw anchor—a post-installed anchor that is an externally threaded mechanical fastener installed in a pre-drilled hole. The anchor derives its capacity from the mechanical interlock of the fastener threads with the grooves cut into the base material during the anchor installation.

seismic test—test that applies load cycles of varying magnitude and frequency to an anchorage system for the purpose of simulating a seismic event (earthquake).

shear test—application of load perpendicular to anchor or anchor axis and parallel to and at the surface of the base material.

shock test—test that simulates shock loads applied to an anchorage system using an external load of short duration.

slip—displacement of an anchor with respect to the surrounding base material.

spacing sleeve—sleeve that encases a portion of the anchor shaft but does not expand.

splitting failure—a failure mode in which the base material fractures along a plane passing through the axis of the anchor or anchors.

standoff installation—anchorage assembly in which the attachment is secured at a distance from the surface of the base material.

static load—load condition not involving significant inertial force.

static test—a test involving only static loads.

steel failure—failure mode characterized by fracture of the anchor steel.

stop-drill—drill bit equipped with a drill stop that ensures attaining a predetermined hole depth.

tensile test—application of tensile force concentric with the anchor axis.

torque-controlled adhesive-bonded anchor—an adhesive anchor employing an anchor element designed to generate expansion forces in response to tension loading.

DISCUSSION—Typically the application of torque is employed to overcome the initial adhesion between the anchor element and the adhesive at a resultant tension load significantly less than that required to disrupt the adhesive-concrete bond. Displacement of the anchor rod relative to the adhesive in response to the tension load serves to generate expansion forces normal to the hole wall, further increasing the load transfer capability of the adhesive-concrete interface. Subsequent application of external tension loads beyond the initial preload results in further displacement of the anchor element and increased expansion forces.

torque-controlled expansion anchor—a post-installed expansion anchor that derives its holding strength from the expansion of one or more sleeves or other elements against the sides of the drilled hole through the application of torque, which pulls the cone(s) into the expansion sleeve(s). After setting, tensile loading can cause additional expansion (follow-up expansion).

uncracked concrete—for testing purposes, a concrete test member having no noticeable cracks in the anchor vicinity prior to the installation and loading of anchors.

undercut anchor—a post-installed anchor that derives its holding strength by the mechanical interlock provided by undercutting of the concrete, achieved either by a special tool or by the anchor itself during installation.

3. Keywords

3.1 anchor; concrete; definition; fastener; masonry; terminology

RELATED MATERIAL

E488 Test Methods for Strength of Anchors in Concrete and Masonry Elements[2]

E631 Terminology for Building Constructions[2]

E1190 Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members[2]

E1512 Test Methods for Testing Bond Performance of Bonded Anchors[2]

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.