STATE OF CALIFORNIA—CALIFORNIA STATE TRANSPORTATION AGENCY

DEPARTMENT OF TRANSPORTATION
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METHOD OF TEST FOR DETERMINING THE ULTIMATE TENSILE STRENGTH OF CAST-IN-PLACE CONCRETE INSERTS

Withdrawn

A. SCOPE

This test method describes the procedure to be followed in determining the ultimate tensile strength of cast-in-place concrete inserts.

B. REFERENCES

ASTM A 563 - Carbons and Alloy Steel Nuts
Caltrans Standard Specifications - Section 75, "Miscellaneous Metal"
Caltrans Standard Specifications - Section 90, "Concrete"

CT 682 has been withdrawn. It is no longer maintained by Caltrans.

C. APPARATUS

The following apparatus are required:

1. Testing apparatus, similar to that shown in Figure 1 that is capable of applying a tension load to the cast-in-place (CIP) insert system. The base of the testing apparatus should make contact with the concrete surface outside the expected concrete failure zone, so that is does not affect test results. A base-bearing ring with a radius of 1.75 times the embedment depth (ED), measured from the center of the insert should be sufficient for this purpose. The testing apparatus shall be of sufficient size to prevent failure of any of its components and of proper design to ensure that the tension loads are always applied along the longitudinal axis of the CIP insert system.

2. Two shackles, a chain, or a multi-directional swivel assembly connecting the CIP insert assembly to the pull rod to eliminate the transfer of bending moment to the system. The pull rod and the various parts of the connector

shall be of sufficient size to develop the ultimate strength of the CIP insert with minimal elongation.

3. A hydraulic ram and pump, or suitable device that is capable of providing a constant load rate and with an ultimate capacity exceeding the expected ultimate load of the CIP insert system.

4. A load cell or load-monitoring device that is capable of measuring the ultimate tensile force applied to the pull rod, accurate to within ± 1 % of the applied load.

5. Two dial indicators, linear variable differential transformers (LVDTs), or other suitable displacement gages that is capable of measuring linear displacement with an accuracy of ± 0.001 inches.

6. An XY recorder, a data logger, or another suitable type of data acquisition system that is capable of plotting or recording load and displacement versus time at a rate greater than ten samplings per second.

D. PREPARATION OF TEST SPECIMENS

1. Installation of cast-in-place inserts:

   a. Position and secure the CIP inserts to the bottom form of the concrete test slab form using plastic setting plugs. [Setting plugs are used to achieve a ¼ inch cover from the concrete surface]. Provide adequate edge distance (minimum of 1.75ED) and spacing between inserts (minimum of 3.5ED).

   b. Prior to screwing the insert onto the setting plug, lubricate the internal threads of the insert with grease.

2. Concrete for test slabs:

   a. Fabricate an unreinforced, concrete test slab large enough to provide adequate edge distance and sufficient spacing between inserts to be tested. (See Section D.1.a) Slab thickness shall not be less than:

      i. 8 inches or the overall insert length plus 2 inches for inserts with stud diameters of ¾ inch or less.

ii. 12 inches or the overall insert length plus 2 inches for inserts with stud diameters greater than ¾ inch and less than or equal to1½ inches.

b. Concrete used for the test slab shall contain a minimum of 505 lbs/cu. yd. of cementitious material and shall conform to the requirements in Section 90 of the Caltrans Standard Specifications. The aggregate used for the test slab shall be considered non- innocuous. The aggregate shall be rounded, or crushed gravel, or crushed rock and conform to the 1-inch maximum combined aggregate grading. Admixtures shall not be used. Concrete shall be cured by either the water method or the curing compound method. At the beginning of each sustained direct tension test, the concrete shall have an age of not less than 21 days and the associated compressive strength shall not be greater than 4750 psi. Anchorage systems to be used in early age or lightweight concrete, or concrete having compressive strength requiring special ingredients shall be evaluated using concrete having a similar composition.

E. PROCEDURE

1. Calibrate the load cell. If an insert with female threads is being tested, screw a threaded rod into the insert so that the minimum depth of thread engagement is at least one stud diameter. Note: If zinc-coated (hot-dip galvanized or mechanically deposited) studs are required, inserts must be tapped oversize in accordance with ASTM A563.

2. Slide the load collar over the anchorage stud and secure to the concrete using a washer and nut. Tighten the nut according to the manufacturer's installation torque requirement. If the manufacturer of the CIP insert has not specified an installation torque value, then the torque values listed in Section 75 of the Standard Specifications must be used.

   For an insert size not listed in Section 75, the installation torque may be calculated from the formula:

$$T = (0.2 * d * P_y) /12$$

   Where:

   T = installation torque in foot * pounds

   D = nominal diameter of the anchorage stud or bolt in inches

P_Y = yield load of an ASTM A307 bolt in pounds

3. Bond two small flat metal bearing plates to the surface of the concrete at an appropriate distance from the CIP insert so as to provide smooth surfaces for the contacts of the dial indicators or LVDTs.

4. Assemble the tension apparatus and center directly over the CIP insert.

5. Install two displacement indicators (LVDTs or dial indicators), one on each end of a rigid arm that is securely fastened to the load collar of the testing apparatus, and position the indicators so as to measure displacements normal to the concrete surface. Tips of the indicators shall rest on bearing plates previously bonded to the concrete surface. Mount these indicators so that their shafts are equidistant from the center of the CIP insert and are outside the zone of concrete cone failure.

6. Remove slack from the test assembly by applying a tension load of about 5% of the estimated ultimate load of the CIP insert system.

7. Record each indicator reading and average the two readings to obtain the initial mean indicator measurement.

8. Apply the tension load at a rate of about 100 to 300 lbs/s until the CIP insert system fails. The load rate should be determined based on the stud size of the CIP insert system such that it takes over 60 seconds to reach the ultimate load.

9. Record load and displacement versus time throughout the test.

F. SAMPLING

1. Test at least three CIP inserts per anchor/insert diameter. Satisfactory performance is obtained when all tests pass. Retesting is permitted only if no more than one CIP insert of the group tested failed. When retesting is performed, six samples of the same type of CIP insert device shall be tested under the same conditions. A satisfactory performance is obtained when all six CIP insert devices pass. Should any of the tests fail, no further retesting is allowed, unless the manufacturer alters the design of the CIP insert system.

2. Any future change in CIP insert design or materials will require retesting.

G. REPORTING OF RESULTS

Results of all tests performed shall be reported

The report of test results shall include the following minimum information:

- Test sponsor and test agency.
- Dates of testing and report preparation.
- A list of observers who witnessed the qualification test with the signature and title of the person responsible for testing.
- Identification of the CIP insert system including manufacturer, type and model number, dimensions, type of steel, type and thickness of corrosion-protective coating, and other pertinent information.
- The number of test specimens tested.
- The concrete mix design, the type and gradation of aggregates used in the concrete, and unit weight.
- The compressive strength of the concrete and age of the test slab on the date of anchorage installation and testing.
- A physical description of the test slab including dimensions, locations of anchorage devices, and method of curing.
- Photographs of test specimens.
- Illustration/photographs of testing equipment.
- Description of the procedure followed to install the anchorage device, including installation tools, materials used to install the anchorage system, and installation torque used.
- The actual depths of embedment of each anchorage system.
- The length of time from initial installation of the anchorage system to application of the tensile load.
- A plot of load and displacement versus time for each test specimen.
- The ultimate load for each individual test specimen, and the mean displacement at that load.

H. SAFETY AND HEALTH

It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Prior to handling, testing, or disposing of any materials, testers must be knowledgeable about safe laboratory practices, hazards and exposure, chemical procurement and storage, and personal protective apparel and equipment.

The Caltrans Laboratory Safety Manual is available at:
http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf

End of Text
(California Test 682 contains 7 pages)

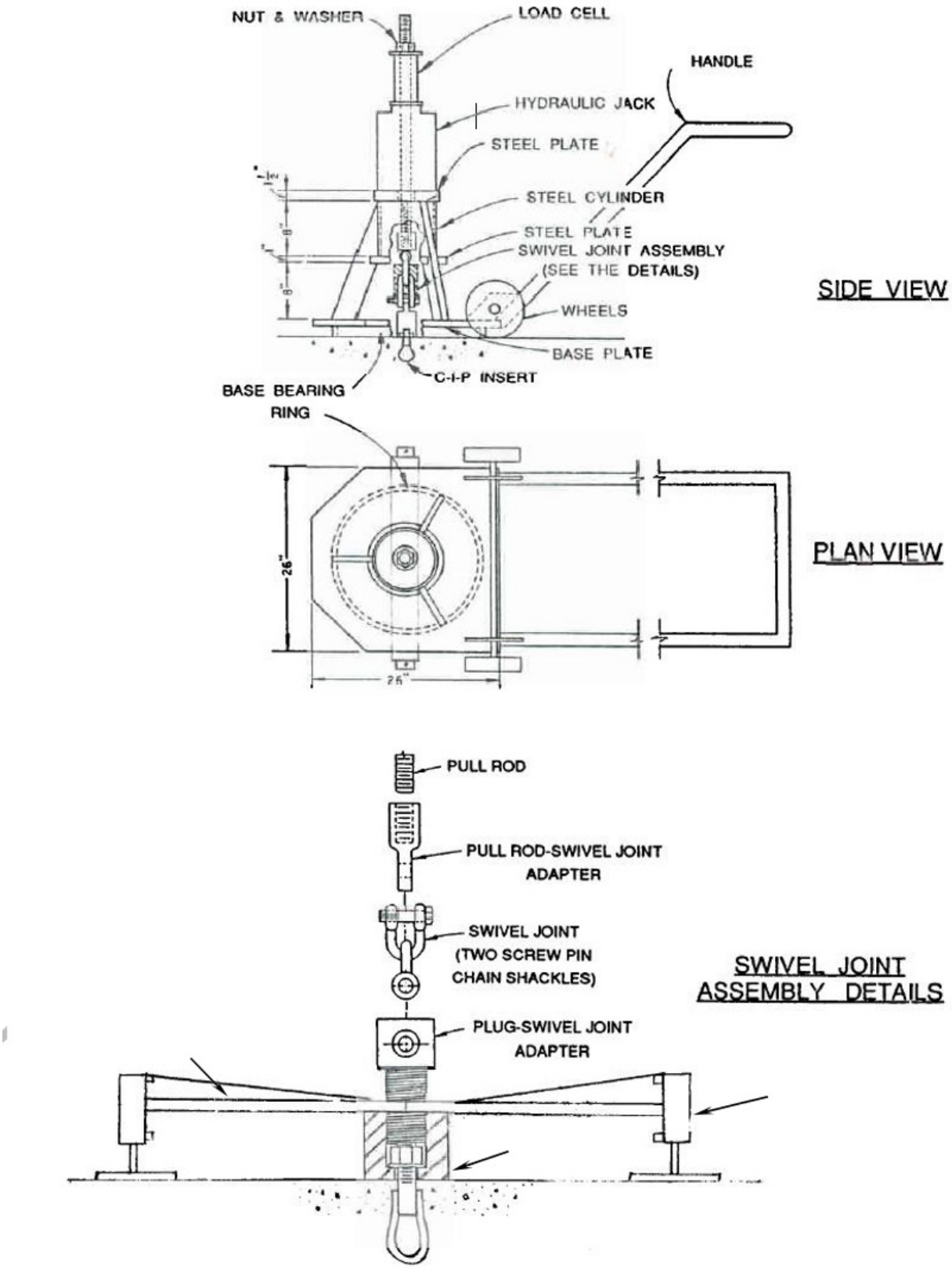

Figure 1. SCHEMATIC OF A TENSION TESTING APPARATUS