

CIDH Concrete Piling – Materials

The following provides information and instructions for review and authorization of materials used to construct Cast-In-Drilled Hole (CIDH) concrete piling.

1 - Slurry Testing for CIDH Piling

Testing requirements for each of the authorized drilling slurries are listed in the contract documents. If the Contractor proposes to use slurry admixtures, discuss the type, concentration and mixing with the Structure Construction (SC) Substructure Engineer. All questions regarding the use of slurries can be directed to the SC Substructure Engineer.

SC has slurry test kits for use in the field. Witness the Contractor's quality control testing of slurry and then randomly perform quality assurance testing using the kit. If your field office does not have a kit, contact your Bridge Construction Engineer.

The slurry test kits include equipment for testing density, sand content, marsh funnel viscosity, and pH. The test procedures for density, marsh funnel viscosity, and sand content can be found in the *Recommended Practice for Field Testing Water-based Drilling Slurry* by the American Petroleum Institute, accessed through the Caltrans account on the [IHS Markit](#) website, which requires the user to create a user account, then search for (API RP 13B-1).

Extensive background and commentary on slurry (including the reasons for testing slurry) are in the *Foundation Manual*, [Chapter 9](#), *Slurry Displacement Piles*.

Key inspection considerations are summarized as follows:

- Before the slurry operation starts, verify that the Contractor's sampling and testing equipment is adequate.
- Verify the Contractor is proportioning, mixing, agitating (or circulating) per the [Contract Specifications](#). Sand can quickly settle out, especially with synthetic slurries. Mixing or agitating ensures accurate test results.
- Verify the Contractor takes slurry samples at the correct elevations.
- Slurry test results from the same hole (but different elevations) may vary, but each test result must conform to the requirements of the contract documents.

For synthetic slurry (not mineral slurries), occasionally take a sample and send it in to Materials Engineering and Testing Services (METS) to verify that the chemistry still matches the pre-approved product chemistry. On the sample testing ticket request that a copy of the results be sent to the Division of Engineering Services (DES) Pile Mitigation Committee Chair. Send about 8 ounces (200 ml) of the mixed slurry to:

Caltrans
Transportation Laboratory, Chemical Testing Branch
5900 Folsom Boulevard, Mail Station 5
Sacramento, CA 95819-4612

2 - Use of Plastic Spacers in CIP Concrete Piles

Plastic spacers are used to ensure concentric spacing for the entire reinforcing steel cage in Cast-In-Place (CIP) concrete piles. It allows travel of the cage along the wall of the drilled shaft excavation minimizing dislodging soils and accumulation of loose material in the bottom of the excavation. It provides for adequate clearance for fresh concrete to flow up the annular space between the cage and the side of the excavation as well as to maintain a minimum concrete cover. The main concern for usage of plastic spacers for CIP concrete piles is the difference in the coefficient of thermal expansion between the plastic and concrete.

To address this concern, the industry standards and the Concrete Reinforcing Steel Institute (CRSI) recommend that all plastic-side-form spacers should have at least 25% of their gross plane area perforated to compensate for the difference in the coefficient of thermal expansion between the plastic and concrete.

Plastic spacers used in CIP concrete piles between the outside of the pile bar reinforcing cage and the side of the drilled hole must meet the following criteria:

- Spacers must be used near the bottom, the top, and at intervals not exceeding 10 feet vertically or per manufacturer's recommendation, whichever is less.
- The spacers must be of sufficient size, composition, and durability to support the lateral loads placed by the reinforcing cage upon the sidewall of the shaft. The spacers must also be capable of withstanding impacts during the construction process.
- A minimum of 3 spacers are required at each level or per manufacturer's recommendation, whichever is greater.
- The spacers must be of adequate dimension to ensure an annular space of not less than 3 inches between the outside of the pile bar reinforcing cage and the side of the excavation along the entire length of the CIP concrete pile.
- Plastic spacers must conform to the provisions in Section 3.4, *All-Plastic Bar Supports*, and Section 3.5, *Side-Form Spacers*, of the *Concrete Reinforcing Steel Institute Manual of Standard Practice*, attached below.
- Plastic spacers must be commercially manufactured. Examples of commercially manufactured plastic spacers are shown below.

3 - Sections 3.4. and 3.5. of the CRSI, *Manual of Standard Practice*, 28th Edition

3.4. All-Plastic Bar Supports

The industry practices presented in this section are intended to serve as a guide for the selection and utilization of all-plastic bar supports used to position reinforcing bars in reinforced concrete.

All-plastic bar supports may have a snap-on action or other method of attachment. All-plastic supports are lightweight, non-porous and chemically inert in concrete. Properly designed, all-plastic bar supports should have rounded seating to avoid punching holes in the formwork and should not deform under load when subjected to normal temperatures encountered in use nor should they shatter or severely crack under impact loading when used in cold weather.

All-plastic bar supports will not rust, therefore eliminating blemishes on the surface of the concrete. These supports are particularly suitable in situations of moderate to severe exposure or when grinding of the concrete is necessary. All plastic bar supports may be used to support epoxy-coated reinforcing bars (see Section 3.6). These bar supports provide maximum rust protection, i.e., Class 1.

3.5. Side-Form Spacers

A side-form spacer is a type of bar support which is used to maintain side concrete cover on the reinforcing bars against a vertical form, such as for walls and columns. Spacers can also be used to align a reinforcing bar cage in a drilled shaft. Spacers can be made of steel wire, precast concrete, or plastic. Examples of side-form spacers are SBC wire bar supports, DSSS and DSWS precast concrete bar supports, and WS, DSWS and VLWS all-plastic bar supports.

Typically, these supports are not shown on the design or contract drawings. There are numerous variations in the placer's requirements making it difficult for the supplier to estimate. Estimating, detailing or furnishing these materials is not a normal industry practice unless by special arrangement with the General Contractor or placer. Unless agreed to between the buyer and the seller, these materials will not normally be included in the supplier's bid.

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Figure 1. Sample of Commercially Manufactured Plastic Spacers