10.7 PILES AND SHAFTS

10.7.1 GENERAL

This policy addresses applications and limitations of driven piles and drilled shafts, also called Cast-In-Drilled-Hole (CIDH) concrete piles, that support bridges and earth retaining systems. Driven piles include Cast-In-Steel Shell (CISS) concrete piles, steel pipe and H piles, and precast-prestressed concrete piles.

10.7.2 TERMINOLOGY

Corrugated Metal Pipe (CMP) Casing — facilitates the construction of CIDH concrete piles. The contribution to the geotechnical or structural resistance of the pile is usually disregarded.

Permanent Steel Casing — contributes to the structural resistance of the pile and must be smooth-walled. The geotechnical resistance is typically disregarded.

Steel Shell — contributes to the structural and geotechnical resistances of the pile and must be smooth-walled and driven with an impact hammer.

10.7.3 DESIGN REQUIREMENTS

When evaluating the resistance of pile groups supporting piers/bents, the passive resistance provided by the embedded pile cap backfill shall be ignored for Service and Strength Limit State evaluations. A column's seismic over-strength moment and associated shear force shall be applied to the top of the pile cap in 15-degree increments to determine the maximum pile forces.

10.7.4 LIMITATIONS AND CONSTRAINTS

Standard Plan piles (Classes 90, 140, and 200) shall not be used as pile extensions. Steel pile anchorage reinforcement that is required at the pile-to-cap connection of steel piles shall resist the applied factored tension and shall be epoxy-coated.

The length of a CIDH concrete pile measured from the cut-off elevation shall be limited to 30 times the smallest diameter of the pile. When the wet construction method is anticipated, the diameter of CIDH concrete piles must be at least 24 inches. The inspection pipes must be shown on the plans.

For partially cased CIDH concrete piles, the inside diameter of the permanent casing shall be at least 6 inches larger than the CIDH diameter below the casing. For CIDH piles drilled below the CMP casing, the clearance is measured from the point on the surface of the CMP that is closest to the drilled hole below the casing. Where internal shear connectors are specified for permanent steel casing, the steel casing diameter shall be increased to

fully account for the projection of shear connectors. Corrosion resistance in steel shells and permanent steel casings shall be provided through the addition of sacrificial steel thickness.

For Type II shafts that are 5 feet in diameter or larger, the plans shall show a construction joint at the tip of the embedded column reinforcement. For CISS and CIDH concrete piles less than or equal to 36 inches in diameter, steel shell or permanent steel casing without internal shear connectors may be assumed to act compositely with concrete. For larger piles, full composite action may be utilized only through the addition of shear rings or other internal shear connectors.

10.7.5 REFERENCES

1. AASHTO. (2017). *AASHTO LRFD Bridge Design Specifications*, 8th Edition, American Association of State Highway and Transportation Officials, Washington, DC.
2. Caltrans. (2019). *California Amendments to AASHTO LRFD Bridge Design Specifications*, 8th Edition, California Department of Transportation, Sacramento, CA.
3. Caltrans. (2025). *Seismic Design Criteria 2.1*, California Department of Transportation, Sacramento, CA.