

10.5 COMPOSITE CASED PILES

10.5.1 GENERAL

This BDM provides guidance related to the load transfer mechanism from concrete pile core to permanent steel shell or casing used in cast-in-steel shell (CISS) or cast-in-drilled hole (CIDH) concrete piles. According to STP 10.7, for CISS and CIDH concrete piles greater than 36 inches in diameter, full composite action may be utilized only through the addition of shear rings or other internal shear connectors. This BDM provides guidance on how to achieve full composite action for such piles.

The design recommendations are based on Caltrans' research conducted by the University of California, San Diego (UCSD). The UCSD Structural Systems Research Project (SSRP) 06/16 contains findings that recognize two main components contributing to this load transfer capacity: chemical surface bond and mechanical bond. Laboratory tests demonstrated substantial capacity due to chemical surface bond; however, given the unpredictability of construction environment, Caltrans does not allow reliance on it to provide composite action in cased piles greater than 36 inches in diameter. Variances in construction environment such as use of slurry displacement method of placing concrete reduce the chemical surface bond resistance inside the pile. As such, Caltrans requires internal shear connectors such as shear rings to provide full composite action for larger cased piles. In addition, exclusion of chemical surface bond capacity recognizes the absence of redundancy in single column supports.

10.5.2 SHEAR RINGS

Laboratory tests have shown that when shear rings are used as prescribed herein, full composite action can be attained. The number of shear rings per pile is shown in Table 10.5.2.1. Shear ring details are shown in Figures 10.5.2.1 and 10.5.2.2, and shear ring types and sizes are shown in Table 10.5.2.2.

Table 10.5.2.1 Shear Ring Quantity

Foundation Type	Number of Shear Rings Required when Pile Diameter \geq 5 feet	Number of Shear Rings Required when 3 feet < Pile Diameter < 5 feet
CISS Concrete Pile	2	1
CIDH Concrete Pile with Permanent Steel Casing	2	1

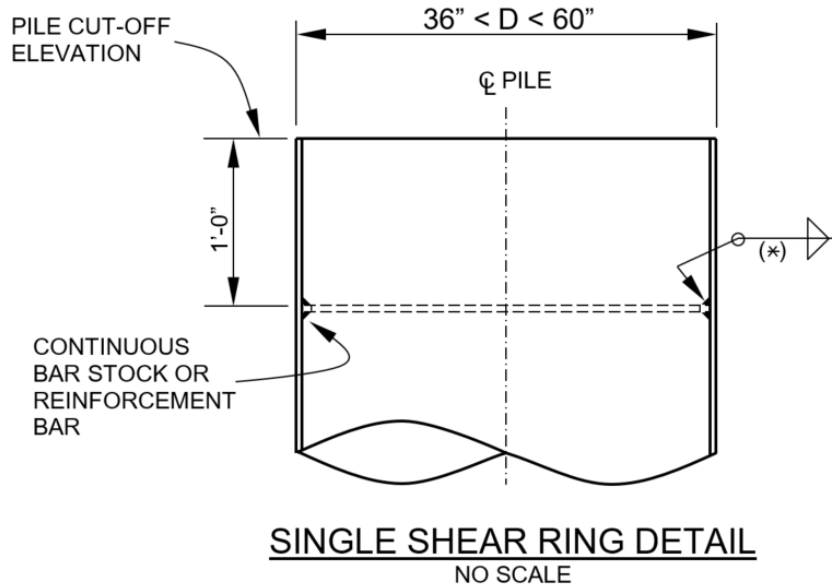


Figure 10.5.2.1 Shear Ring Details

Note: * For fillet weld size refer to Table 10.5.2.2

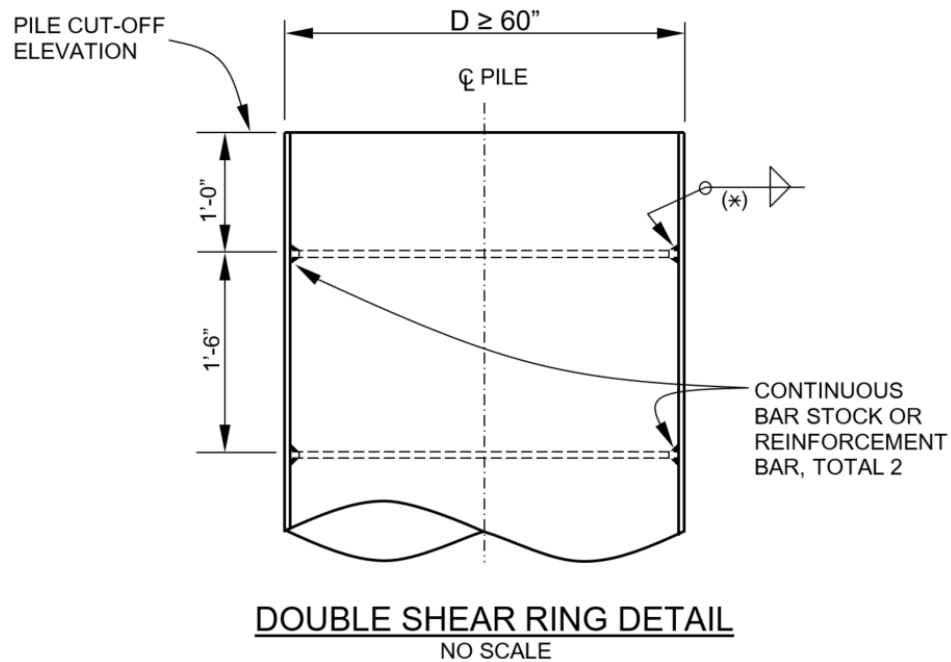


Figure 10.5.2.2: Shear Ring Details

Note: * For fillet weld size refer to Table 10.5.2.2

Table 10.5.2.2 Shear Ring Design

Pile Diameter	Shear Ring Options		Fillet Weld Size [in]	
	Reinforcing Bar Size	Bar Stock Size	Reinforcing Bar	Bar Stock
< 6 ft	#4	1/2 in x 1/2 in	1/2	3/8
6 ft to 10 ft	#6	5/8 in x 5/8 in	5/8	1/2
> 10 ft	#8	1 in x 1 in	3/4	5/8

10.5.3 REFERENCES

1. Gebman, M., Ashford, S., and Restrepo, J. (2006). "Investigation of the Axial Load Transfer through Shear Rings in Cast-In-Steel-Shell Piles." *Structural Systems Research Project No. SSRP-06/16*. Department of Structural Engineering, University of California, San Diego.
2. Caltrans. (2022). *Structural Technical Policy 10.7, Deep Foundations*, California Department of Transportation, Sacramento, CA.