Reinforced Masonry Pier Construction

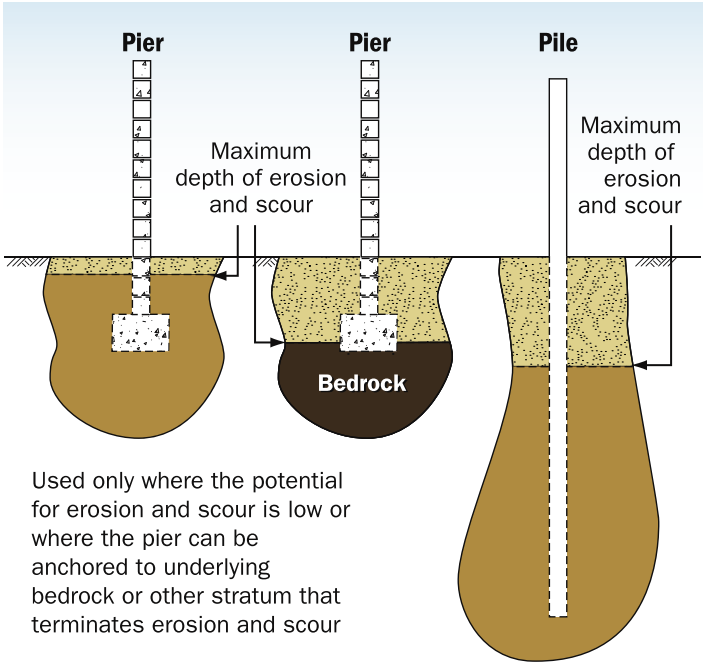
HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION FEMA 499/August 2005 Technical Fact Sheet No. 14

Purpose: To provide an alternative to piles in V zones and A zones in coastal areas where soil properties preclude pile installation, yet the need for an "open foundation system" still exists. Examples of appropriate conditions for the use of piers are where rock is at or near the surface or where the potential for erosion and scour is low.

Key Issues

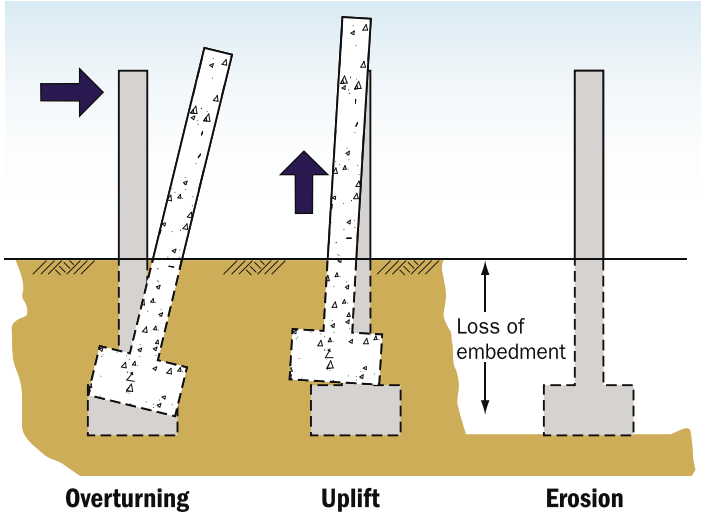
- The footing must be designed for the soil conditions present. Pier foundations are generally not recommended in V zones or in A zones in coastal areas.
- The connection between the pier and its footing must be properly designed and constructed to resist separation of the pier from the footing and rotation to due to lateral (flood, wind, debris) forces.
- The top of the footing must be below the anticipated erosion and scour depth.
- The piers must be reinforced with steel and fully grouted.
- There must be a positive connection to the floor beam at the top of the pier.
- Special attention must be given to the application of mortar in order to prevent saltwater intrusion into the core, where the steel can be corroded.

Piers vs. Piles



Used only where the potential for erosion and scour is low or where the pier can be anchored to underlying bedrock or other stratum that terminates erosion and scour

Used where the potential for erosion and scour is high



Piers are subject to upward, downward, and horizontal loads. Pier reinforcement and footing size are critical to resisting these loads; therefore, pier and footing design must be verified by an engineer.

In coastal areas, masonry pier foundations are not recommended in V zones with erodible soils, or in A zones subject to waves and erosion — use pile foundations in these areas.

Pier foundations are most appropriate in areas where:

- erosion and scour potential are low,
- flood depths and lateral forces are low, and
- soil can help resist overturning of pier.

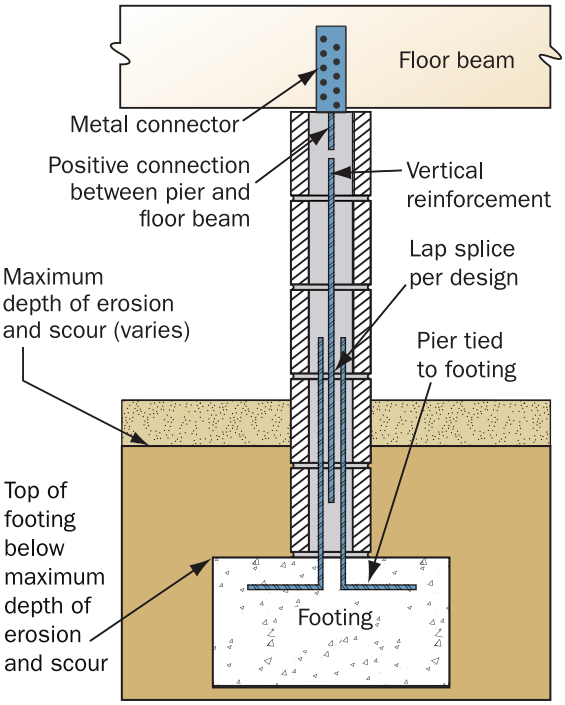
The small footings on the piers in this photograph did not prevent these piers from overturning during Hurricane Iniki.

The combination of high winds and moist (sometimes salt-laden) air can have a damaging effect on masonry construction by forcing moisture into even the smallest of cracks or openings in the masonry joints. The entry of moisture into reinforced masonry construction can lead to corrosion of the reinforcement steel and subsequent cracking and spalling of the masonry. Moisture resistance is highly influenced by the quality of the materials and the quality of the masonry construction at the site.

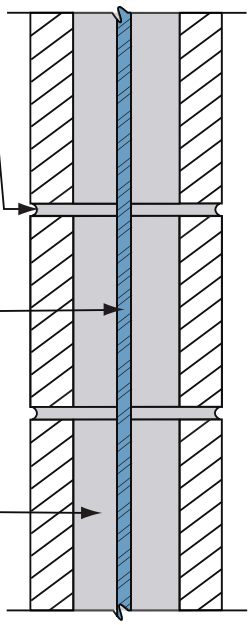
Good Masonry Practice

- Masonry units and packaged mortar and grout materials should be stored off the ground and covered.
- Masonry work in progress must be well protected.
- Mortar and grouts must be carefully batched and mixed. The 2003 International Building Code (IBC 2003) specifies grout proportions by volume for masonry construction.

Recommendations for Masonry Piers in Coastal Regions



Head and bed joints must be well mortared and tooled to prevent water intrusion. Type S mortar for below grade is recommended. Concave joints and V-joints provide the best moisture resistance.

Reinforcing bars must be protected from saltwater to prevent corrosion. Good grout practice will normally protect reinforcing. Galvanized or epoxy-coated bars may enhance pier performance, but holidays and chipped coatings must be painted, and lap splice lengths must be increased by 50 percent for epoxy-coated bars.

Grout should be in conformance with the requirements of the IBC 2003. Cleanouts should be placed at the bottom of fully grouted cells to ensure that the grout completely fills the cells from top to bottom.