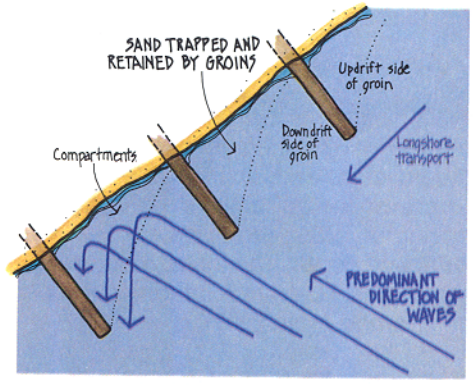
# Groins

Groin field

Groins are structures that extend, fingerlike, perpendicularly from the shore. Usually constructed in groups called groin fields, their primary purpose is to trap and retain sand, nourishing the beach compartments between them. Groins initially interrupt the longshore transport of littoral drift. They are most effective where longshore transport is predominantly in one direction, and where their action will not cause unacceptable erosion of the downdrift shore. When a well-designed groin field fills to capacity with sand, longshore transport continues at about the same rate as before the groins were built, and a stable beach is maintained.




Groins are suitable erosion control measures where a beach is desirable, and they are compatible with most recreational activities. The beach fed by the sand trapped between the groins acts as a buffer between the incoming waves and the backshore and inland areas: the waves break on the beach and expend most of their energy there. Filled groins provide this protection during normal weather conditions but offer only limited protection against storm-driven waves.

## Design Considerations and Site Characteristics

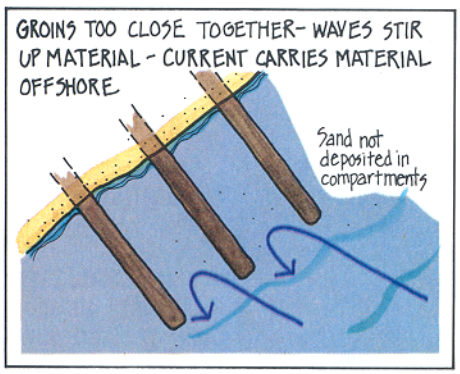
Groin design completely depends on conditions at the site. The structures are most effective in trapping sand when littoral drift is transported in a single direction. If there is no predominant direction of longshore transport, or if the littoral drift is clay or silt rather than sand, filling a groin field with sand from a nearby source may be necessary. Beach fill can also provide a beach sooner than natural action and help to minimize undesirable downdrift consequences.

Groin fields must be carefully designed with respect to height, spacing, extension (both shoreward and into the water), and porosity. The structures should be no higher than the level of a reasonable beach, so that when they are filled the sand is free to pass downdrift to neighboring beaches.

Spacing of groins depends on local wave energy and the amount of usual littoral drift. Groins should be spaced so that drift accumulates along the entire distance between the structures. If the groins are too far apart, part of each compartment will be unprotected due to lack of accumulation; too close together, and not enough littoral material will accumulate in the compartments. As a rule of thumb, groins should be spaced two to three groin lengths apart.

Groins must be built to extend far enough into the water to retain adequate amounts of sand. However, they should not be so long that rip currents develop along them, carrying sand offshore into deep water where waves cannot return it to the beach. Excessively long groins can also aggravate erosion elsewhere by trapping sand that would have been deposited on the downdrift shore by uninterrupted longshore transport. Also, groins should be built to extend far enough inland that storm waves cannot bypass them on the shoreward side, undercutting the structure and eroding the beach.

Vandalism or wave action may remove groin material, causing the structure to become ineffective. Groins that are too porous allow wave turbulence to wash too much sand through the voids, preventing material from accumulating to protect the backshore area.

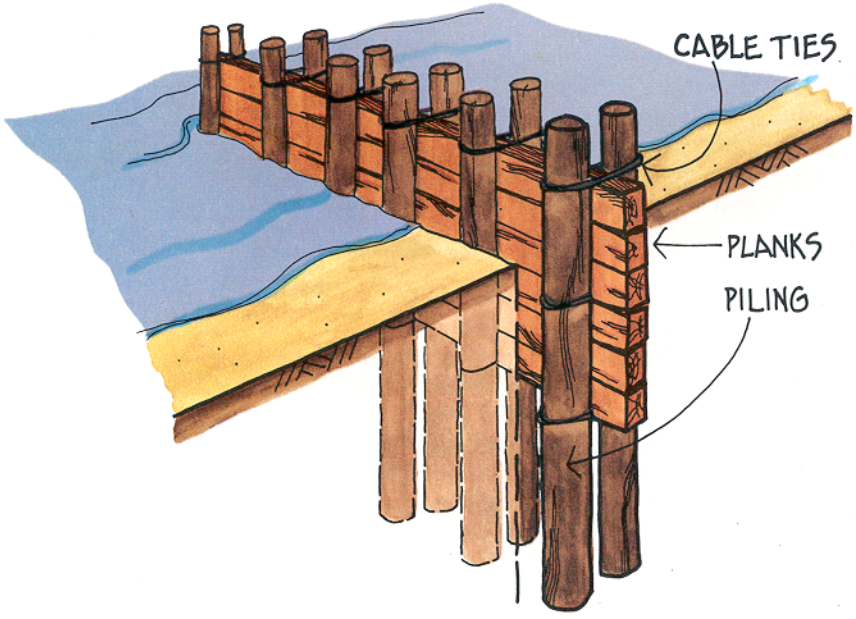


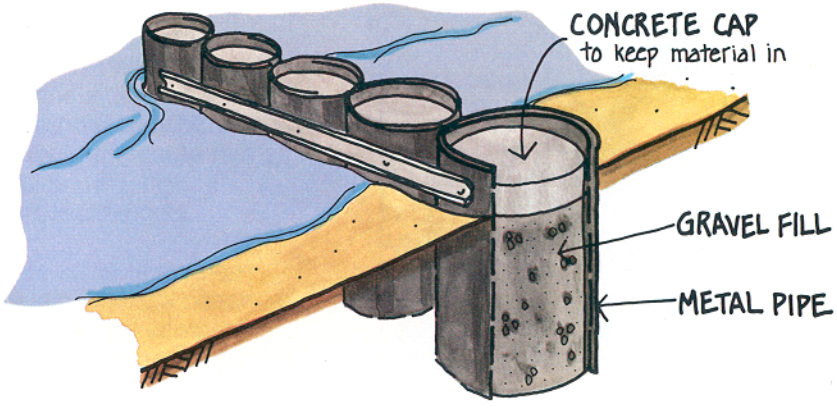
## Construction Materials

Sheet piles of treated timber, steel, or aluminum can be used to build effective and long-lasting groins in situations where they can be driven to adequate depth. Timber brace piles or mounds of rubble may be needed as reinforcement at the offshore end.

Another way to use treated timber in groins is to drive posts into the bottom in pairs, with planks sandwiched between them. Because the planks cannot be embedded deeply when working under water, this method is limited to areas of wide tidal range where work can proceed during low tide.

Where piles cannot be driven, a treated-timber framework lined with wire mesh and filled with rock can be used. This relatively light construction is suitable in moderate wave climates where the water is not deeper than about two feet.



Treated-timber and rubble groin

Rubble or quarrystone groins are sturdy but have high construction costs. The cost of rubble groins increases considerably with water depth. Either concrete rubble or quarrystone may be used, depending on local availability and cost. The smaller sizes should form the core of the structure, armored by larger pieces.

Groins can also be built of stacked bags filled with sand or lean concrete mix, corrugated pipe driven deep into the bottom and filled with gravel, or rock mounds filled with asphalt mastic. Although these materials perform very well, they may be more expensive than the types described above.

Other materials that may be suitable in special cases are gabions (wire baskets filled with rock), Longard tubes, and steel fuel drums.