



A tethered breakwater is a type of floating coastal protection that reduces wave energy primarily through drag. It consists of numerous smaller, buoyant floats—often tubes, spheres, or screens—that are secured to the seabed with tethers. When waves pass through, the movement of the floats and tethers creates turbulence that dissipates the wave energy.

How it works

Unlike solid breakwaters that rely on mass and reflection, tethered float breakwaters use drag to calm the water.

- **Drag dissipation:** As waves pass through the array, the floats and tethers move and agitate the water. This motion creates significant drag, which converts the wave energy into turbulence and heat.
- **Minimal reflection:** Because tethered breakwaters are designed to allow water to pass through, they produce very little wave reflection. This prevents the buildup of higher-energy waves that can disrupt marine habitats and cause erosion elsewhere along the coast.
- **Tether system:** The mooring system restricts the movement of the floats and transfers some of the wave energy directly to the sea floor.

Advantages

- **Environmentally friendly:** This type of breakwater minimizes disruption to natural water circulation, sediment transport, and fish migration. Some variants, like those made from recycled tires, also promote the use of reclaimed materials.
- **Cost-effective:** Tethered breakwaters are often less expensive than fixed, bottom-mounted structures, especially in deep water where traditional construction is more difficult and costly.
- **Adaptable:** Since they are not dependent on seabed conditions, they can be used in areas with poor or muddy soil. Their design allows them to adjust to changing water levels caused by tides or storms.

- **Easy to deploy and remove:** With minimal anchoring requirements, tethered breakwaters are easy to install, move, or remove for seasonal storage, such as in areas where ice formation is a problem.
- **Flexible layout:** The modular nature of floating breakwaters allows for easy rearrangement of their configuration with minimal effort.

Disadvantages

- **Limited effectiveness:** Tethered float breakwaters are most effective in semi-sheltered areas with shorter-period waves, such as lakes and bays. They are less effective against high-energy or long-period swell waves, which can lift the structure.
- **Maintenance costs:** Due to their dynamic response to waves, the floats and mooring system require regular maintenance to prevent component failure. Replacing parts can be labor-intensive and costly.
- **Subject to failure in storms:** Extreme storm conditions can cause the structures to fail. If they become detached from their moorings, they can become a hazard to navigation.
- **Not multi-purpose:** Unlike some other types of floating breakwaters that offer a solid surface, tethered breakwaters cannot be used for walking or mooring boats.

Applications

- **Marina and harbor protection:** Providing calm water within marinas and harbors for safer mooring and boarding of boats.
- **Shoreline erosion control:** Minimizing shoreline erosion by reducing wave impact.
- **Construction and salvage operations:** Providing temporary wave abatement for marine construction, salvage, or diving activities.
- **Aquaculture sites:** Protecting sensitive aquaculture sites or allowing for the expansion of aquaculture operations in harsher conditions.
- **Living shorelines:** Supporting "living shoreline" projects by providing calm water for establishing vegetation like mangrove seedlings