FLOATING TIRE BREAKWATERS (FTBs)

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Louisiana State University Center for Wetland Resources, Baton Rouge, LA 70803

An inexpensive way to fight erosion.

An effective way to make calm water areas for mooring boats.

Contents

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The concept of building breakwaters out of scrap tires was developed by the Goodyear Tire and Rubber Company and the University of Rhode Island Sea Grant Program.

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Why an FTB?

Controlling erosion is expensive. Until about five years ago, anyone with a shoreline to protect had two choices, both costly: replace the material removed by erosion or invest in a permanent stone or concrete breakwater at a cost of about $1,500 per linear foot.

Now there is another, less expensive alternative: a breakwater made out of scrap tires bound together in clusters and floated parallel to the shore to protect it from wave erosion. Such breakwaters also effectively create calm water areas where boats can be moored. FTBs, as they are called, are effective, economical, and can be built by small groups of people who have never built one before. The cost of an FTB is about $150 per linear foot.

Researchers at the University of Rhode Island Sea Grant Program took up the idea about seven years ago in response to several marina owners who expressed a need for protective breakwaters but couldn't afford the permanent kind. They tested and refined a modular FTB system that had been developed by the Goodyear Tire and Rubber Company.

The FTB idea has caught on fast. Floating breakwaters protect harbors along the Great Lakes, the Atlantic Coast, and Florida. So far there's only one in Louisiana—at the south shore of Lake Pontchartrain, but with so much maintenance required to control shoreline and riverbank erosion, Louisiana could no doubt use FTBs for many erosion control projects.

Creating calm water basins for mooring boats is just one use for floating tire breakwaters. FTBs are also used to protect shorelines from wave erosion.

What they are

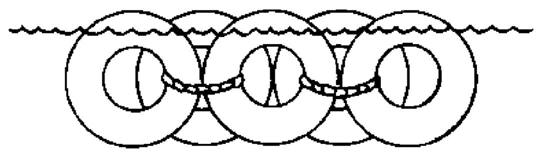
The main ingredient in an FTB is tires—old tires, and there are plenty of them around. They are available from gas stations, tire sales companies, and dumps. Some two billion accumulate every year. In the case of the breakwater on Lake Pontchartrain, all 16,000 tires were donated to the project by the Goodyear Tire and Rubber Company.

The tires are belted together in clusters, 18 tires to a cluster. The clusters are then joined to form a large mat whose length and width depends on the area to be protected, the size of the waves common to the area, the depth of the water, and a number of other factors. An engineering firm can be hired to work out the specifics, or dimensions can be worked out with the help of a guide to building FTBs published by the New York Sea Grant Program.

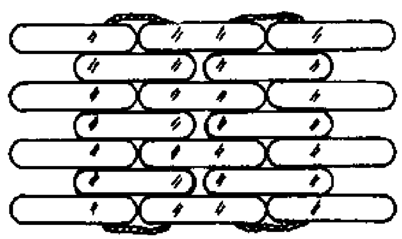
The clusters are easy to assemble. In five or ten minutes two workers can construct an 18-tire cluster, and no special equipment is needed. The job can easily be done by volunteer workers who have never built an FTB before.

The material for binding the tires together can be conveyor belt edging, stainless or galvanized steel wire, nylon line, or steel chain. Research at the Rhode Island Sea Grant Program on belting materials indicates conveyor belting as the longest lasting and least expensive binding material available. It is actually a scrap material from the manufacture of conveyor belts.

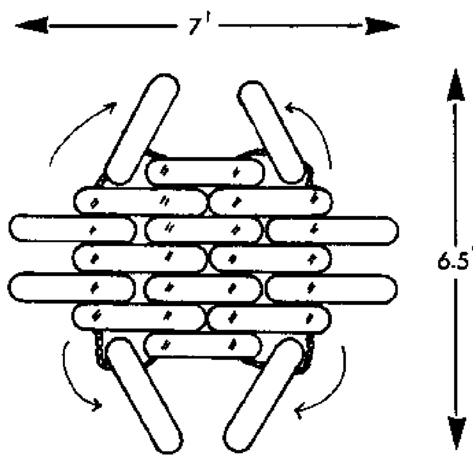
Before the tires are assembled in clusters, a quarter of each tire must be filled with a flotant such as polyurethane foam or gallon plastic containers. Without this flotation, the tires would eventually lose the air trapped in their crowns and sink.



Side view of bundle of 18 tires in the water.



Top view of the same bundle as it is constructed on land.



Top view of the same bundle before other modules are attached.

Drawings courtesy of the Rhode Island Sea Grant Program.

Once the clusters have been joined, the mat is launched and towed to the site where it is to be anchored. The size of the moorings and the anchoring system will vary depending on the type of bottom (sand, rock, or mud), local currents, as well as exposure to wind and waves. Local experience in mooring larger craft (more than 30 feet in length) is a good guide to follow. The length and weight of the mooring line are vital to its effectiveness. Past experience has shown a mooring line length of 6 feet for each 1 foot of water depth. Anchors such as concrete blocks and mushroom, stockless, and Danforth anchors, heavy enough to resist drag, have proved to be effective. Such anchors placed 50 feet apart on the windward (front) side and 100 feet apart on the leeward side have been utilized in a number of FTBs.

FTBs in Louisiana

A 900-foot FTB was launched and anchored off the south shore of Lake Pontchartrain in the spring of 1979. It is about two miles from the New Orleans city harbor, 400 feet from shore.

The mat of tires is L-shaped, one side facing waves coming from the northwest and the other side facing waves coming from the northeast. The side facing northeast is 33 feet wide; the northwest side is 65 feet wide because the waves from that direction are stronger.

The Pontchartrain FTB was built for erosion control by the Orleans Levee

Erosion along the seawall on the south shore of Lake Pontchartrain is an expensive maintenance problem for the Orleans Levee Board. An FTB has been placed 400 feet offshore to protect the bank from erosion like this. So far it is the only FTB in Louisiana, but with so much shoreline and riverbank to protect, other areas could no doubt make effective use of FTBs for erosion control.

Board, which maintains the levees around the lake and is responsible for safety in the area. When big storms blow out of the north, waves wash over the levees and erode deep holes in them. Waves also undercut the concrete sea wall that lines the levee, and large holes have washed behind it. Swimmers, unaware of the potential hazard, can get caught under the seawall and drown.

The FTB was built under a one-year Army Corps of Engineers permit, and if it is successful in helping to control erosion the Levee Board will likely vote to keep it and perhaps extend it. There's also the possibility that boat slips will be built in the calm water area behind the breakwater.

Cost

Assuming that the tires are free, the cost of an FTB can be broken down into thirds: one-third for tying material, one-third for labor, and one-third for mooring material. Just how much each third costs depends on individual cases: how long and wide the FTB must be to effectively reduce the waves in the area and how much of the labor is volunteered.

Square feet and not linear feet should be used in estimating the cost of an FTB. The square foot measurement will allow for the fact that the mat of tires will most likely not be of uniform width but will vary with the intensity of waves from different directions. Floating tire breakwaters built to date have cost between \$.60 and \$9.28 per square foot (at 1977 prices). The breakwater on Lake Pontchartrain cost about \$1.22 per square foot.

Of the total cost

⅓ binding
⅓ labor
⅓ mooring

Permits

Two permits are required to build an FTB in Louisiana: an Army Corps of Engineers permit and a coastal use permit pursuant to Louisiana's Coastal Resources Program. A single application has been established for both permits and may be submitted either through the Corps of Engineers or through the Coastal Resources Program. Once an application is made it is sent to other governmental agencies for review and comment.

Application forms and more complete details on the permitting process are available from either of the following:

District Engineer
U.S. Army Corps of Engineers
Box 60267
New Orleans, LA 70160
504/865-1121

Coastal Resources Program
Department of Transportation and Development
Box 44245
Baton Rouge, LA 70804
504/342-7898

In addition to a permit, it will normally be necessary to obtain a lease from the Department of Natural Resources. As a general rule, the bottoms of navigable water bodies in Louisiana are owned by the state, and an FTB must be anchored to a water bottom. Application for a lease should be made to the following:

Office of State Lands
Department of Natural Resources
Box 44124
Baton Rouge, LA 70804

Other clearances may be necessary in order to build an FTB, depending on local jurisdictions in the parish involved. You may need to consult with your local port commission or levee board to make sure no other clearances are needed.

Determining the size

Length, or the dimension parallel to the oncoming wave crests, is determined by the size of the area to be protected. Both length and shape depend on the physical characteristics of the area to be protected as well as possible consequences of wave diffraction around the ends of the unit. To control diffracted waves, a longer breakwater or an L-shaped one may be needed.

Beam, or width, is determined by the predominant wave length in the area to be protected. Increasing this dimension increases the suppression of wave height. The rule of thumb is that the beam must be greater than half of the significant wave length.

To determine the significant wave length, watch and record the characteristics of the waves damaging your land or facilities. Make your recordings on several days when your typical wave problem is occurring. First determine the period (T) of oncoming waves by measuring the average time in seconds between two successive wave crests passing a given point (such as a piling or a buoy) during an interval of about five minutes. Then calculate the significant wave length (L) using this formula: $L=5T^2$. This formula applies to deep-water waves or those where the depth of water is greater than half of the wave length (L). In shallow water, the calculation is not that simple. For this design, however, the above formula is more than adequate.

Draft, or immersed depth, is determined by the height of significant waves occurring in the area. Again a rule of thumb: draft should be greater than half of the height of the significant wave. Breakwaters built of standard automobile tires are effective in seas of up to five feet. Such breakwaters will suppress about 70 to 80 percent of the incoming wave height. Larger truck or tractor tires will increase the depth of the breakwater and control higher waves.

Advantages

- Less expensive than fixed breakwaters.
- Volunteers with no previous experience can build them.
- No special equipment is needed other than a boat to tow an FTB into position.
- Make use of what would otherwise be trash or refuse: scrap tires.
- Can be built where fixed breakwaters are not feasible because of soft bottoms, deep water, or sand and silt transport problems.
- Can be moved from one site to another as needed. They may be moved against a dock in the winter to give it maximum protection, and then moved out in the spring to provide a sheltered mooring area.
- Provide wave suppression without impeding tidal and current flow, a definite environmental plus.
- Attract marine life and actually become floating fishing reefs.

Disadvantages

- The design used commonly today does not effectively damp long period waves. It is limited to reducing relatively small waves—3 to 4 feet—with short periods of time between them.
- As of this writing, FTBs have been used only for shore protection primarily on lakes, embayments, or within natural harbor areas. They haven't been used in open water.
- Can be seen as an eyesore by the public.
- Can be a hazard to navigation unless effectively marked.
- Do not provide the degree of wave protection fixed breakwaters do. FTBs reduce surface wave motion, but not all subsurface motion.
- Collect debris. Some maintenance is required that would be unnecessary with a conventional breakwater.

Possible uses

- Protecting boat marinas. A number of FTBs have been built around the country for this purpose. Some have been built by local governments, others by owners of boats moored in an area. An FTB is well suited for this task as it can be moved from one site to another as needed.
- Fighting shoreline erosion. The Lake Pontchartrain breakwater was built for this reason, as have many others. The main advantage of FTBs over conventional, fixed breakwaters is cost. A public agency looking for a way to cut down on maintenance costs for repairing erosion damage can find a relatively inexpensive solution in an FTB.
- Protecting a temporary work area. In Beaumont, Texas, a ship building company built an FTB opposite the site where the ships were launched to protect the opposite shoreline from wave erosion.
- Extending permanent breakwaters.

A how-to manual

For detailed instructions for constructing an FTB, send for an easy-to-follow manual available from the New York Sea Grant Program. Cost of the publication is $1.50. Mail requests to the following:
Enhancing Wave Protection with FTBs
Mailing Room
7 Research Park
Cornell University
Ithaca, NY 14853.