

A heavy-duty Rixö Model 850 wave attenuator battles 65 mph winds.

MARKING 10 YEARS OF “TESTED BY THE NORTH SEA” RIXÖ SYSTEM

BY ANNA OSSANNA

Ten years ago, ShoreMaster introduced its “Tested by the North Sea” Rixö floating concrete dock and wave attenuator systems to the United States. Dock manufacturer Rixö-Bryggan had honed this post-tensioned design for more than 20 years in Sweden’s coastal waters. In the decade since its North American debut, the Rixö system has been further tested by the sea—and by lakes, rivers, bays, and inlets across the continent.

“Not every site needs this level of strength,” said ShoreMaster President Erik Ahlgren, who added that the company also offers conventional concrete, aluminum, and galvanized steel dock systems. “But for those sites that need a tough, durable dock system,” Ahlgren said, “there is nothing better.”

Modeled after suspension bridges, ShoreMaster’s Rixö design connects 50-foot concrete pontoons with four hydraulically post-tensioned high strength steel strands running through the length of the dock system. Post-tensioning has

long been used in the construction industry as a way to combine steel’s tensile strength with concrete’s compressive resistance to improve a structure’s overall performance.

In ShoreMaster’s Rixö concrete floats, PVC tubes molded inside the concrete protect the plastic-sheathed steel strand or cable. When the cables are hydraulically post-tensioned, polyurethane spacers between the sections compress to seal out air and water. Stainless steel end caps are then installed to prevent corrosion. According to ShoreMaster Chief Engineer and Vice President Dennis Tuel, Jr., P.E., this connection system minimizes the transfer of potentially damaging stress to the concrete.

Each 50-foot pontoon is comprised of a concrete outer shell with an expanded polystyrene (EPS) core. The concrete’s broom-finished surface and corner walkways provide a non-slip walking surface, while matching wood walers refine the system’s appearance.

ShoreMaster applies a proprietary polyurethane coating to the bottom of

each float to protect the pontoon’s EPS core. According to ShoreMaster, this spray elastomer’s poly-based molecular structure fuses to the polystyrene core to form a thick, durable shell similar to a truck bed liner. ShoreMaster applies a coating of 90–150 mils, as determined by Army Corps of Engineers standards and a site’s specific conditions.

One System, Multiple Applications

ShoreMaster manufactures three models of Rixö floating concrete pontoons that vary in height, mass, and shape. Depending on the pontoon model used and the application, ShoreMaster’s Rixö post-tensioned design can function as a heavy-duty dock system or as a medium- to heavy-duty wave attenuator, as four recent installations demonstrate.

Antigua Cove Marina at Little Harbor

In Ruskin, Fla., three deepwater marinas provide access to Tampa Bay and beyond to the Gulf of Mexico from the Anglo-Caribbean style “seaside village” of Little Harbor, a resort commu-

nity under development by Earthmark companies. Earthmark designed these three harbors to offer various dock styles, as well as 200 dry storage units for lease or sale.

Tucked away in a system of canals, Antigua Cove Marina is protected by mangroves and a point of land, eliminating the need for wave attenuation. To accommodate 2½-foot tidal fluctuations, Antigua Cove Marina's Rixö Model 400 floating concrete dock system attaches to concrete piles with UHMW (ultra high molecular weight polyethylene) pile guides that allow the float to rise and fall with the water level.

According to Little Harbor Project Manager Cynthia Pride, Earthmark specifically sought a concrete dock system for Antigua Cove Marina's 40'-60' slips. "The advantages of ShoreMaster's state of the art post-tensioned system sold us," Pride said. "No doubt it was the best system out there."

Harborage Yacht Club and Marina

On the St. Lucie River in Stuart, Fla., the Harborage Yacht Club and Marina connect boaters to the Atlantic Ocean, the Intracoastal, and Okeechobee Water-

ways. Luxury condominium cottages and a three-story clubhouse accompany two 150-slip harbors, the Harborage Marina, and the Yacht Club Marina, accommodating 30' to 120' yachts.

When The Altman Companies designed the Harborage Marina, project managers wanted to optimize the moorage within the footprint of the yacht club's submerged land lease, explained Marina General Manager Bill Hill. Harborage Marina needed a wave attenuator to tame wakes generated as boats enter a slow zone. Project engineers attached finger piers to ShoreMaster's Rixö Model 450 medium duty wave attenuator to deflect wave action while creating an additional 21 slips that are projected to net \$26,625 per month at full capacity.

Standing 4' 3" high and weighing 37,000 pounds, Rixö Model 450 pontoons add wave-dissipating mass to the basic construction of the Model 400. ShoreMaster typically recommends attaching finger piers to the Model 450 only in moderately exposed sites. While the Harborage's fetch extends about two miles, most wind waves come from the east and are therefore

deflected by the adjacent Yacht Club Marina's attenuator. "When you look out at the wakes and the white caps, you can see that it's calming the basin inside the wave attenuator," Hill said.

King's Pointe

In northwest Iowa, 15-20 mph winds generate power in fields of turbines. These gusts then plow across the shallow, 3,000-acre Storm Lake before reaching King's Pointe, a 100-room hotel, restaurant, and conference center complete with an 18-slip galvanized steel dock system where hotel guests and Regatta Grille diners moor their boats.

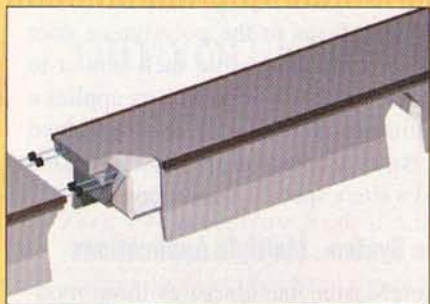
King's Pointe is the centerpiece of Project Awaysis, a plan to invigorate economic activity by establishing the city of Storm Lake as a first-class destination. When complete, this lakeside development will include family-friendly amenities, such as a new public beach and playground, as well as an indoor/outdoor water park, and a remodeled marina.

"[King's Pointe's] dock is on the northeast shore of the lake, and prevailing winds in the summertime come from the south and southwest, so we knew we needed an attenuator system to make it easier to get in and out of the docks," said Project Manager and Community Development Director for the City of Storm Lake, Mike Wilson. The city solicited bids according to strict specifications, Wilson said, and with its proposed Rixö Model 450 wave attenuator, "ShoreMaster not only met the specifications, but did so at the lowest cost."

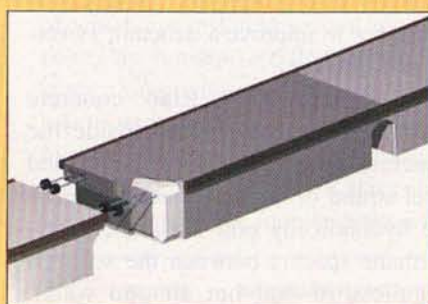
Landscape Architect and Project Manager Craig Larson of Omaha-based architecture firm BCDM explained that Storm Lake experiences significant wind waves, but is also quite shallow. A larger attenuator with a deep draft "would have been overkill," Larson explained. According to ShoreMaster, the Rixö Model 450's smaller draft effectively reduces shorter period waves, such as those on Storm Lake.

Charlottetown Harbour

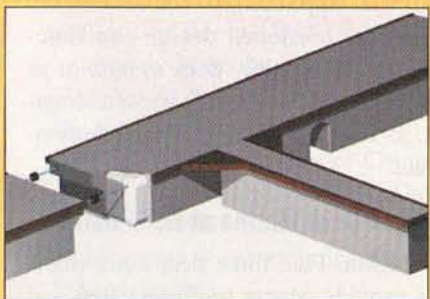
Taller and heavier than the 450, the Rixö Model 850 increases the pontoon's proportions to amplify its wave



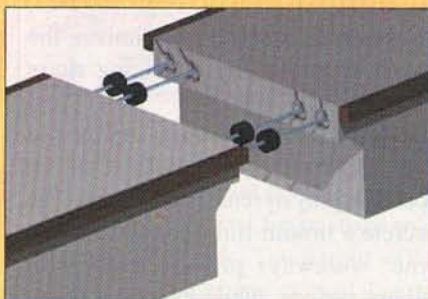
Increased mass and draft amplify the Rixö Model 850's ability to dissipate wave energy.



The Rixö Model 450 medium-duty wave attenuator is designed with a smaller draft to combat short-period waves.



Designed as a commercial dock system, the Rixö Model 400 provides a stable walking surface and durable moorage in rough waters, according to ShoreMaster.



Hydraulically post-tensioned cables absorb much of the stress wave action places on the floating dock system's concrete pontoons.



Left: Antigua Cove Marina, one of three deepwater facilities under development at resort community Little Harbor, offers moorage in a Rixö post-tensioned floating concrete dock system.

Courtesy of City of Storm Lake



Below: A newly-installed Rixö Model 850 wave attenuator helps pave the way for a new marina in Charlottetown, Prince Edward Island.

dampening effect. Six feet, six inches in height and weighing 58,000 pounds, the Model 850 adds concrete “legs” to trap water, further augmenting the pontoon’s mass. According to Tuel, “the deeper the wave attenuator and the greater its mass, the better it can interrupt the wave energy traveling under the water’s surface.”

On Prince Edward Island, the Charlottetown Harbour Authority Inc. (CHAI) is improving its harbor to increase commercial shipping capacity and to lay the groundwork for a new marina facility. Toward this end, CHAI recently expanded the existing marine terminal and installed a Rixö 850 wave attenuator in Hillsborough Bay.

“The original proposal anticipated the construction of a new rubble mound breakwater,” explained Nazmi Lawen, P.E., of engineering and architectural firm Coles Associates Ltd. High costs and poor soil conditions made this plan unfeasible. Project engineers were asked to recommend an alternative that would meet “environmental conditions, performance criteria, and budget,” Lawen said.

Coles Associates commissioned a wind and wave study and determined through wave modeling that a ShoreMaster Rixö 850 floating wave attenuator would effectively reduce maximum wave heights to “an acceptable level” of 1 to 1.3 feet (0.3 to 0.4m).

The harbor’s loose, silty soil conditions made gravity anchors unsuitable, so project engineers selected helical

anchors embedded 45-55 feet below the harbor bottom. To accommodate extreme tidal fluctuations, ShoreMaster proposed a SuperFlex® pontoon mooring system, which stretches to allow for significant variances in depth. According to SuperFlex® manufacturer Supflex Pontoon Mooring Systems, Inc., this system combines “Multi-component rubber rope with KEVLAR® or UHMWPE fabric materials to maximize flexibility, stability, and durability.”

According to Lawen, since the wave attenuator’s installation in summer 2007, CHAI monitored the Rixö wave attenuator during a storm with 55 mph (90 km/hr) southwest winds blowing across the harbor’s long fetch. “Wave transmission was less than 20 percent during this event,” Lawen explained. “The water behind the breakwater was very calm.”

Ahlgren said that since the Rixö system’s 1998 introduction to the North

American market, it has been an impetus for the company’s growth. “The need for a product to handle rough locations was a driving force behind ShoreMaster’s decision to build production facilities in California and Florida, making us a truly national company,” he said. Over the next decade Ahlgren projects, “the Rixö system and the need for a premium-strength product will likely lead ShoreMaster into international markets as well.”

Built to withstand Sweden’s cold, wave-battered shores, ShoreMaster’s “Tested by the North Sea” post-tensioned Rixö dock and wave attenuation systems seem equally at home in rough waters from the Canadian maritime to Florida’s sunny coast. ⚓

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