



# The Battleship of Keystone Dam

• 7 feet wide  
 • 48 feet long  
 • 24 feet tall

• 80,000 pounds with no ballast  
 • 182,000 pounds with ballast  
 • \$492,000

*Left: Two cranes -- a 300 ton and a 200 ton -- were attached to the bulkhead to launch it into the water.*

by Edward Engelke, Michael Mills and Mary Beth Hudson

## New Bulkhead Design Key to Keystone Lake Tainter Gate Repairs

Last fall, work began near Keystone Dam which had onlookers and passers by curious. Some did double takes as they drove by, others stopped to look, and several called to ask, "Hey, what's the deal?"

The 'deal' was a floating bulkhead being prepared to allow tainter gate repairs to occur more rapidly, more safely, and without removing water from the lake.

The bulkhead looks every bit like its unofficial title, "The Battleship of Keystone Dam." The name comes from the design and construction techniques used to build it. It looks and floats like a battleship, which added to the confusion of the curious who wanted to know, "What's that you're building out at the lake?"

"It's our 182,000 pound, 48-foot long water safety patrol boat," we wanted to reply. "We're gonna stop reckless jet skiers with this baby!"

Instead, we gave them the facts. "It's a 182,000-pound floating bulkhead which will be used for repairs and maintenance on the dam's gates." The bulkhead was specifically designed to fit the curved face of the weir which extends from the face of the tainter gates at Keystone Dam. It will be used during the next two years to allow dewatering and overhaul of the flood gates. Using the floating bulkhead allows this maintenance to proceed without having to lower the lake's water level. In fact, the level was temporarily raised to prepare for the bulkhead's initial placement in the water. Using the bulkhead maintains the

hydropower, water supply, and fish and wildlife purposes of the lake and helps maintain safe water levels for boating and skiing.

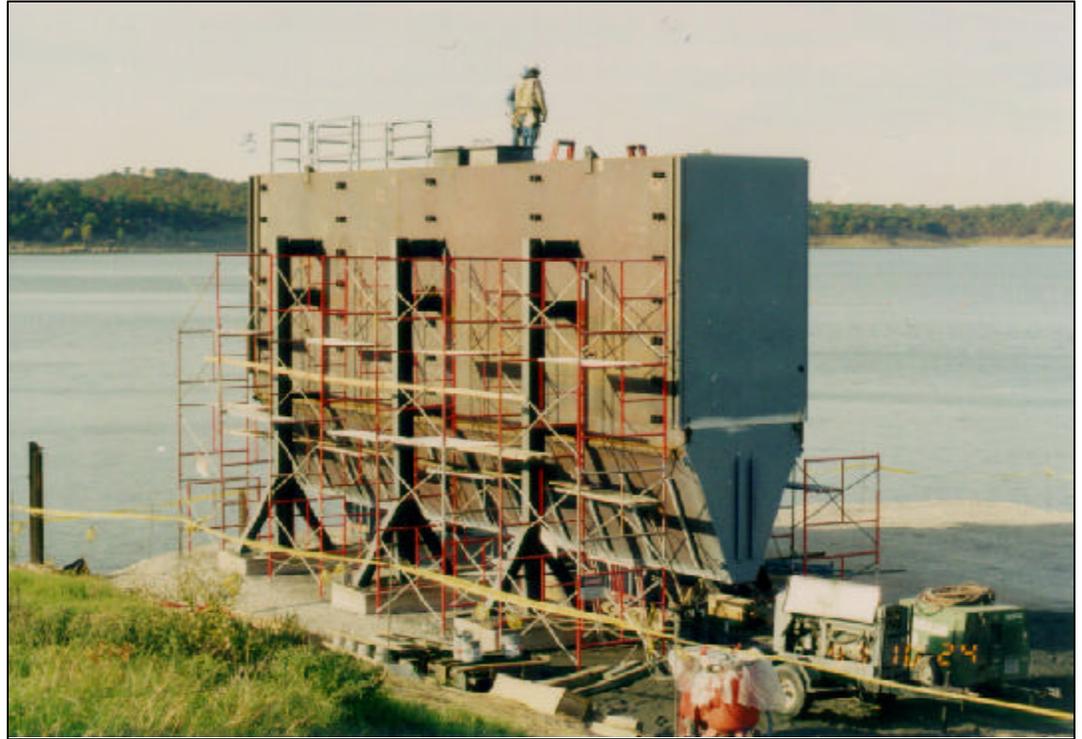
Tulsa District has patented a floating bulkhead system which lies horizontal until floated into a vertical position and placed in front of the tainter gate. That bulkhead was used for repairs at Broken Bow Lake in southeast Okla. But the Keystone Lake bulkhead is different. It is designed like a battleship to fit the gates at Keystone Dam.

### About The Bulkhead

The contract for construction and setting of the bulkhead was awarded to Alltech Engineering Corp. of Mendota Heights, Minn. The notice to proceed was given on April 19, 1999. Alltech subcontracted the fabrication to Superior Steel Inc. of Duluth, Minn., the painting and sand blasting to Coatings Unlimited of Bridgeton, Mo.; and all crane activities to Bennett Steel of Sapulpa, Okla.

The contractor selected the site where the bulkhead would be constructed and determined how the bulkhead would be set in the water. Site preparation began on August 24, 1999. The bulkhead was constructed in two sections. The sections were delivered by truck to Keystone from Duluth, Minn. The lower section was delivered Sept. 24th. The upper section was delivered on Oct. 21st. The halves were welded together.

The final product was tested on Dec. 6th. It was lifted by two cranes and was placed in the water. Once in the water, it



was moved into position in front of the first tainter gate. The bulkhead was lowered into position by opening a valve to let water flow into the bulkhead. Once the bulkhead reached the concrete seats on the gate, the tainter gate was opened; water poured from the gatewell area thereby sealing the bulkhead against the upstream side of the dam. The test concluded by removing the bulkhead and transporting it to a cove near the dam where it is moored awaiting its official use repairing Keystone Lake's 18 flood control gates. Those repairs will take about two years.

*Top Left: The bulkhead being placed into the lake. The lake's level had to be raised to allow it to clear the bottom.*

*Top Right: Construction of the bulkhead looked like a ship in dry-dock.*

*Right: Looking inside the "battleship" bulkhead shows its construction. The bottom section is ballasted with steel and concrete to keep the bulkhead upright.*

*Bottom: This photo shows the bottom of the gate and the ripples as the last remaining water on the weir crest flows from the gatewell.*



See the District's website for more on the floating bulkhead.  
<http://www.swt.usace.army.mil/invent/invent.htm>