Engineers Find New Way to Close Levees

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A team of University of South Carolina civil engineers who have studied the failure of the 17th Street canal levee in New Orleans say they have found a cost-effective and efficient way to halt flooding caused by breached levees.

The study, done by researchers in USC's College of Engineering and Information Technology, is believed to be the first to look at the hydraulics of the 17th Street canal breach and the closing procedures used in the hours after Hurricane Katrina.

Their research, funded by $25,000 from USC's Office of Research, will continue with a $100,000 grant from the National Science Foundation and could have implications for levees throughout the United States and the world. Dr. Hanif Chaudhry, chairman of USC's department of civil and environmental engineering, and his colleague, Dr. Ahmed Kassem, a civil-engineering research professor, examined the breach of the New Orleans levee and found that a concept for closing cofferdams – temporary barriers made of wood, steel or concrete that hold back water – may prevent the widespread flooding that results from levee failure.

Like millions of Americans, Chaudhry watched as engineers raced against time to close the breached levee. But he watched with a civil engineer's keen eye.

"It was apparent that the ordinary dumping of sandbags would not work and that a more systematic approach utilizing knowledge and experience gained from the closing of rivers might have been better," said

Chaudhry, who has been a consultant on a number of projects for the U.S. Army Corps of Engineers.

The attempts to close the breached levee failed because the velocity of the water flowing through the breach was too high for the size of the sandbags that were used, Chaudhry said.

“Even sandbags that weighed 10,000 pounds washed away,” he said. “Our laboratory tests confirm this and show that it would have taken sandbags weighing about 50,000 pounds to stay.”

In the hydraulics laboratory, USC’s researchers constructed a scale model of the canal, the breach and the surrounding area, which included a number of homes. One foot on the model represents about 50 feet on the levee.

They utilized “similitude relationships” to produce, to scale, the flow velocity, flow rate, and sandbags used in New Orleans to close the breached levee in New Orleans.

Then, using a concept for closing rivers, the USC researchers added stones between the homes to obstruct the water. The houses also acted as barriers to the water.
Although the obstruction didn’t stop the flow completely, it backed up water to the breach location, reducing the flow velocity and allowing the use of smaller sandbags. Researchers believe that if the same method had been used in New Orleans, the city’s flooding would have been much less.

“By doing this, we were successful in closing the breach with sandbags that weighed about 7,500 pounds,” Chaudhry said. “Our next step will be to try closing the breach with sandbags weighing as little as 5,000 pounds or less, but utilizing another concept from river closure”. These concepts

are cost effective and efficient and have been successfully used for closing large rivers," he said.

“These procedures should help to close breached levees in a shorter time, thereby reducing the extent and depth of flooded areas,” Chaudhry said.

USC’s levee research could have an impact beyond New Orleans. Levee systems throughout the United States, including those in San Diego, along the Mississippi River and the Congaree River in South Carolina, and throughout the world could be affected by the USC studies.

Chaudhry’s first grant for the levee study was one of 18 funded with $400,000 from USC’s Office of Research for studies on the societal and environmental implications of Hurricane Katrina. The new NSF grant will enable USC’s civil-engineering researchers to expand their research.

“Having this grant will greatly add to our preliminary findings,” Chaudhry said. “The flooding caused by Hurricane Katrina will never be forgotten by those who watched it on television and by those who lived through it. We want to prevent this type of disaster from occurring again.”

Source: University of South Carolina