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## Louisiana's Levee Inquiry Faults Army Corps

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The devastation of New Orleans was a disaster waiting to happen because of a significant flaw in levee design by the Army Corps of Engineers, according to preliminary findings from the official Louisiana team investigating the Hurricane Katrina flooding.

The findings are included in a draft report prepared by engineers on the team. They mirror the conclusion of many outside experts: that the levee that toppled at the 17th Street Canal was built with too little regard for the inherent weakness of the soil under the canal banks. Similar conditions, the experts say, existed at the sites of the two other major levee breaches in metropolitan New Orleans.

"It should have been obvious," said the deputy director of the Louisiana State University Hurricane Center, Ivor van Heerden, the leader of the investigative group, known as Team Louisiana.

Billy R. Prochaska, an engineering consultant to the team, said, "That's our question: how could this be?"

The puzzlement is especially acute, Mr. Prochaska said, because the levee design "was gone over by everyone" up and down the Corps of Engineers organization, from the local level to Washington, before the levees were upgraded with flood walls in the 1980's and 90's.

The Louisiana team's investigation of the levee breaches shows that the sheet piles, the interlocking sheets of steel that are driven into soil

to anchor the levees and prevent a flow of water underneath them, were too shallow to prevent that flow. Tests by the Louisiana group found that sheet piles reached only 10 feet below sea level in some spots, far less than would protect the city. Corps documents dating from the time of construction show that the design was for a depth of 17½ feet, but even that, the investigators say, would have been too shallow. By comparison, in spots where the levees are now being repaired, the Corps of Engineers is calling for sheet piles to be driven to a depth of 51 to 65 feet.

The state manager for the Team Louisiana project, Edmond J. Preau Jr., assistant secretary of the Louisiana Department of Transportation and Development, said the levees had failed at water levels that would have been predicted had the soil problem been recognized. The walls should never have been toppled by water levels of 11 or 12 feet, Mr. Preau said.

"You had a wall that was supposed to protect to water levels up to 14, 14½ feet," he said. "Water didn't get that high. The wall fell down. We want to know why."

A spokesman for the corps acknowledged yesterday that its own sonar tests had confirmed the state's findings of 10-foot sheet pile depths, and said piles would be pulled from the ground at the 17th Street Canal within the next 10 days to measure them directly. But the spokesman, James Taylor, noted that pile depth was only one factor contributing to the strength of a levee, along with others like the levee's height and width.

Another corps spokesman, Wayne Stroupe, said it was still too early to know exactly why the levees of New Orleans failed. The corps, Mr. Stroupe said, is conducting its own investigation, with a report expected at the beginning of June. He said the report would include detailed analyses of the forces that the storm actually brought to bear on the city's flood control systems.

Engineers typically build structures with somewhat greater strength than is necessary for expected challenges. A design standard set by the Corps of Engineers calls for levees to be built at 130 percent of the strength needed to withstand a Category 3 hurricane, and design documents from the corps stated that the New Orleans levees would meet the standard.

But the preliminary calculations by Team Louisiana suggest that the 17th Street Canal levee was actually built at 93 percent to 98 percent of that strength near the breached area - substantially weaker than the forces of a Category 3 storm.

Mr. Preau, the state manager of the team, declined to comment in detail about its draft, which was described yesterday in The Times-Picayune of New Orleans and the Baton Rouge daily, The Advocate. The draft itself was not officially released because data are still being collected and analyzed, he said.

"We don't want to release any of this until we have all of our background data completely documented," he said. But he also said that the final determinations, which will be released early next year, were likely to be similar to those in the draft.

Another member of Team Louisiana, G. Paul Kemp, an associate professor at L.S.U. and director of the Natural Systems Modeling Group at the university's Center for Coastal, Energy and Environmental Resources, said outsiders might interpret the findings as an effort to foist blame for Louisiana's problems onto the federal government and avoid responsibility for local lapses in levee maintenance.

But, Dr. Kemp argued, "the design and construction is a process that is overseen by federal people at every step." He added that the ultimate goal was to find out precisely what went wrong, for the sake of future guidance.

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