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# Engineers Point to Flaws in Flood Walls' Design as Probable Cause of Collapse

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NEW ORLEANS, Oct. 23 - When the Army Corps of Engineers started to design a flood wall on the 17th Street Canal here in the early 1980's, deep probes found what geologists viewed as a potentially weak layer of peat soil about 15 feet below sea level in the area where the wall collapsed during Hurricane Katrina.

Yet in building the wall, corps officials acknowledge, they did not drive the steel pilings - the main anchors for the structure - any deeper than 17 feet.

Several outside engineers who have examined the designs say the decision not to hammer the pilings deeper and into firmer ground left the support for the flood wall dangerously dependent on soil that could easily have given

way under the immense pressure from floodwaters.

And members of a team of experts from the National Science Foundation say it now seems that this simple failure probably led to the collapse of the walls on both the 17th Street and London Avenue canals, which flooded many residential neighborhoods and surrounded the Superdome with several feet of water.

Corps officials say it is possible their engineers made a mistake, and in rebuilding the broken sections they are planning to hammer the new pilings three to four times as deep. They also say their original design team may have seen other data suggesting that the soil was stronger, or taken measures to compensate for any weakness in it.

Corps investigators say they have just started going through 235 boxes of the agency's records that could shed more light on why the engineers believed the design was safe. And some outside investigators caution that they would like to examine more of the records before deciding what caused the break.

Herbert J. Roussel Jr., a consulting engineer who worked for the contractor that built the flood walls to the corps's design, said the peat layer seemed to extend 15 feet to 20 feet below sea level where the breach occurred on the 17th Street Canal. He said that if the original pilings "had gone through the peat layer, I don't think we would have had a problem."

He added that driving the pilings just 10 feet deeper might have prevented the collapse.

Robert G. Bea, an engineering professor at the University of California, Berkeley, who has examined the soil data for the National Science Foundation, said the decision not to drive the piling deeper was "a design flaw."

Dr. Bea said he and others in his group believed it was the most likely reason that the floodwaters broke through, shoving parts of the walls and the earthen levees beneath them as far as 35 feet into nearby neighborhoods.

He also said that even if the strength of the soil initially met the corps's standards, the designers might have underestimated how it would deteriorate to what he called "thick pancake batter" once it got pummeled by the water surging into the canals from Lake Pontchartrain.

Walter Baummy, the chief engineer for the corps's New Orleans district, said, however, that the problem was "a little more complicated than just saying that there's a five-foot-deep layer of peat in there."

"What's probably more important is, How did we account for it in the design?" Mr. Baummy said. "Or did we properly address it?"

He added, "We need to step back and review our design and see if it was done properly at that time."

Peter Nicholson, an engineering professor at the University of Hawaii who heads a review team from the American Society of Civil Engineers, also said it was too early to "say conclusively that the weak soil caused the failure."

Dr. Nicholson said the significance of the depth of the pilings also remained "a question that needs to be answered."

Still, some of the engineers say the new information about the peat soil could also be significant in terms of what the corps will have to do, and how much money it will need to spend, to ensure that the 17th Street and London Avenue flood walls hold up in future storms.

Mr. Roussel said tests of the soil conducted before the walls were built showed that the layer of peat soil stretched under large expanses of the wall on the 17th Street Canal. He said this could mean that instead of just replacing the 400-foot section that broke, the corps might have to tear up much of the three-mile wall and the earthen levee beneath it.

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