Stability of I-Walls in New Orleans during Hurricane Katrina

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Failures of I-walls during Hurricane Katrina were responsible for many breaches in the flood protection system in New Orleans. Six breaches were examined in detail by Task Group 7 of the Interagency Performance Evaluation Taskforce. Four of these failures and breaches, which occurred before the water levels reached the top of the wall, were not caused by overtopping erosion. The failure of the I-wall at the 17th Street Canal resulted from shear through the weak foundation clay. The south failure of the London Avenue I-wall was caused by subsurface erosion, which carried massive amounts of sand inland, and removed support for the wall, leading to catastrophic instability. At the north breach on London Avenue, the failure was caused by high pore pressures, combined with a lower friction angle in the loose sand, which resulted in gross instability of the I-wall under the water pressure load from the storm surge. Looking back, with the benefit of 20-20 hindsight, these stability and erosion failures can be explained in terms of modern soil mechanics, exploration techniques, laboratory test procedures, and analysis methods. An important factor in all of the cases investigated was development of a gap behind the wall as the water rose against the wall and caused it to deflect. Formation of the gap increased the load on the wall, because the water pressures in

the gap were higher than the earth pressures that had acted on the wall before the gap formed. Where the foundation soil was clay, formation of a gap eliminated the shearing resistance of the soil on the flood side of the wall, because the slip surface stopped at the gap. Where the foundation soil was sand, formation of the gap opened a direct hydraulic connection between the water in the canal and the sand beneath the levee. This hydraulic short circuit made seepage conditions worse, and erosion due to underseepage more likely. It also increased the uplift pressures on the base of the levee and marsh layer landward of the levee, reducing stability. Because gap formation has such important effects on I-wall stability, and because gaps behind I-walls were found in many locations after the storm surge receded, the presence of the gap should always be assumed in I-wall design studies.

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