Oceaneering Pile Driving Infrastructure Technology: Mitigating Anthropogenic Underwater Noise Impacts on Coastal Marine Life

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After observing the devastating effect of natural disasters, such as super storms, flooding, and rising sea levels; an engineered pile driving design was created as a noise control acoustic barrier for coastal marine construction needed to facilitate infrastructure while reducing the harmful underwater sounds causing behavioral disturbances in marine mammals' zone of influence. Testing focused on the coastal shallow water with sedimentary rock in the Gulf of Mexico. The simple design changes may reduce environmental permitting and increase construction ability as well as accommodating the marine life. The design included an outer pile to encapsulate the sound and a threaded inner pile which makes it reusable. A cone was welded to the bottom of the outer pipe for drivability and to protect from sediment or water entering the pile, Rubber sound dampeners were placed in the cone. The double wall pile and hydrophone arrays were set at 3m, 10m, 20m, 40m, and 80m. The pile was struck using a top strike method on the inner pile as well as the designed impact hammer which directed energy into the bottom of the pile, sending energy into the rubber sound dampeners located in the cone and into the seabed floor. Hydrophone recordings determined the new design mitigated noise in the air as well as underwater.The engineered design of an outer pile, weighted rod hammer and rubber dampeners mitigated underwater acoustic sounds by an average of 17 dB ref 1uPa per hammer strike in the shallow coastal waters in the Gulf of Mexico. The test also showed a decrease in sound produced above water by 44 dB ref 20uPa and in silt, the distance driven was increased by about 3 centimeters. Hydrophone recordings determined the new design mitigated noise in the air as well as underwater.