Inspection Method for Internal State of Quay Wall Under Water Using Acoustic Device

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Recently, deterioration of infrastructure has become a prominent problem in Japan. According to a document of the Ministry of Land, Infrastructure, Transport and Tourism, the percentage of quay walls over 50 years old was 8% in 2013, will be 32% in the next 10 years and 58% in the next 20 years approximately, and it is estimated that those facilities will require repair works or improvement works at nearly the same time. The implementation of preventive maintenance such as the early damage detection and repair is essential to secure the safety of port and harbor facilities, and to maintain them economically. In an aged quay wall which is one of major facilities in ports and harbors, the infill sand behind the wall escapes into the sea. This phenomenon causes formation of holes inside the quay wall, and sometimes subsidence or collapse of top surface of quay wall can occur. Ground-Penetrating Radar (GPR) is a popular method to investigate subsurface structure of road, and it is also used for quay walls. GPR uses electromagnetic radiation and detects the reflected signals from subsurface structures. However the penetration depth of electromagnetic wave is limited by soil moisture, and it makes difficult to investigate the internal state of submerged portion of quay walls by GPR. Against these background, we have studied an inspection method for internal state of quay wall under water using the parametric acoustic transmission technology. A parametric acoustic probe transmits two signals of slightly different high frequencies (primary wave) at high pressures simultaneously. Non-linear interactions generate the difference frequency (secondary

wave) that is low enough to penetrate the sea floor. The beam-width for the secondary wave is nearly the same as for the primary wave. This technology is used to clarify the sub-seabed geological structure. In order to apply this technology to inspection of quay walls, we implemented water channel experiments and field experiments of the parametric acoustic probe. As the results, it was found that the parametric acoustic probe can measure the distance to a target placed behind a sheet pile and the depth of a cavity made behind a sheet piled wall.