

GPR signal analysis according to the type of pipe and the overlapping form of buried pipe

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GPR (Ground Penetrating Radar), is a non-destructive testing method using electromagnetic waves. It is an exploration method that uses reflected waves returned from reflectors after radiating electromagnetic waves underground or ground. The GPR signal is propagated through the medium, and the signal propagated in the medium is reflected where the difference between the medium and the dielectric constant occurs. At this time, the larger the difference between the dielectric constant of the medium and the reflector, the larger the amplitude of the reflected signal. The velocity of the GPR signal is determined by the dielectric constant of the propagating medium, and the depth of the buried material can be estimated by calculating the arrival time and velocity of the reflected signal. GPR exploration is used for non-destructive testing and ground exploration of concrete. The frequency should be selected appropriately according to the object or depth to be explored. Currently, GPR exploration is widely used in various industries. Especially, there are frequent cases of damage to gas pipes, water pipes, sewer pipes, and telecommunication pipes without knowing the location of underground buried groundwork in civil engineering and construction sites. In addition, damage and leakage caused by age-deterioration of long-term operation nuclear power plant buried pipelines is one of the important issues facing the nuclear power industry. In this study, we analyzed the GPR signal by fabricating a jig that can simulate various buried types of pipe in air. For the signal analysis according to the type of pipe, pipes of metal and non-metallic materials were used in the experiment. In addition, GPR signals were acquired and analyzed for the possibility of distinguishing each pipe by simulating pipes overlapping in various forms. In order to confirm whether these test results are similar even in the situation where the actual pipe is buried, a burial pipe simulation test site was constructed to carry out an empirical test. As a result of using jig in the air, Moreover, it was confirmed that the metal pipe shows a clearer reflection signal than the non-metal pipe. In addition, it was confirmed that the GPR signal is relatively well distinguished even when the buried piping is overlapped in various forms. In the buried pipe simulation test site, it was possible to distinguish the signal between the metal pipe and the non-metallic pipe, and the signal for each pipe was well distinguished even when the pipe overlapped. These results may be helpful for the future GPR signal analysis studies on the types of buried piping and various overlapping situations.