

Evaluation on Applicability of GPR to Explore Underground Utilities in Old Downtown Areas for Application of Micro-Trenching Method in South Korea

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In the past, Aerial cables were indiscriminately installed due to rapid urban development in South Korea. As a result, aerial cables in old downtown areas had negative impacts on urban fine view and frequently hindered the safety of pedestrians. In particular, damaged telegraph poles or fallen of aerial cables due to natural disasters such as typhoons, earthquakes, and torrential rains caused a great amount of danger to the safety of citizens.

In recent years, the South Korean Government has established and executed the “Total Plan of Aerial cables Arrangement” as a government policy project to resolve the problems associated with overcrowded aerial cables. However, the Road Act in Korea states that when electric and telecommunication cables are buried, 1.2m of excavation width and 0.8m of excavation depth should be arranged. Due to this compliance the cost of underground work for aerial cable increases and underground work has not progressed as expected.

To resolve this problem, a micro-trenching method that has been applied in the cables laying at a low depth in overseas has been introduced to Korea. When the micro-trenching method is applied, more than 70% of the cost can be reduced as compared to that of existing laying method of electric and telecommunication cables, which will be a significant help to the aerial cables arrangement plan. So, the studies have been conducted on the development of safe backfill materials for trenching sections and the evaluations on the resistance against ground vehicle loads considering the Korean geological features have been conducted as well.

When the micro-trenching method is applied, the first thing to do is accurately survey underground utilities in the construction area. the most important step in the micro-trenching is the design of the optimal route, where trenching can be possible after accurate survey for underground utilities.

This study used GPR(Ground Penetrating Radar) in the survey, which has been widely utilized in underground cavity surveys in Korea recently, and has been investigated as a measure to survey underground utilities accurately in the trenching area. To do this, the GPR applicability was investigated through the analyses on current technology and application cases in Korea and overseas. GPR explorations with various frequencies were conducted to find arbitrarily laid cables in the test-bed site, and the survey accuracy by frequency and the effective analysis depth were evaluated in this study. In addition, this study performed GPR surveys in old downtown roads that existing aerial cables were present, thereby investigating underground utilities in various environments and conditions. The underground utilities were surveyed by using vehicle-assembled multi-channel GPR equipment with various frequencies and the results were compared with existing underground utilities map of the government department. The micro-trenching applied in Korea is planned to have 0.3m maximum excavation depth and 0.3m maximum excavation width. In this study, the optimal path and design of micro-trenching were proposed by the GPR survey results considering the micro-trenching characteristics and underground situation in Korea.