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### Exploration of underground utilities for electric field analysis in jointed rock mass with anomaly

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Rapid urbanization and industrialization have caused increased demand for underground structures such as cable, and other utility tunnels. Recently, it has become very difficult to construct new underground structures in downtown areas because of civil complaints, and engineering problems related to insufficient information about existing underground structures, cable tunnels in particular. This lack of information about the location and direction-of-travel of cable tunnels is causing many problems. To solve these problems, this study was focused on the use of geophysical exploration of the ground in a way that is theoretically, different from previous electrical resistivity surveys. An electric field analysis was performed on the ground with cable tunnels using Gauss' law and the Laplace equation. The electrical resistivity equation, which is a function of the cable tunnel direction, the cable tunnel location, and the electrical conductivity of the cable tunnel, can be obtained through electrical field analysis. A field test was performed for the verification of this theoretical approach. A field test results provided meaningful data.