Data Required For GPR Calculations
Ground Potential Rise Studies

Background
Ground Potential Rise (GPR) studies are performed when telecommunications sites are to be installed in the high voltage (HV) environments found in the power distribution systems and substations. Due to the potential of a high voltage short to ground, this environment represents a significant risk to personnel and cellular equipment. Under short conditions, thousands of amps will flow until circuit protection activates. The GPR study determines how the site must be designed and constructed so that personnel and equipment are protected under the conditions of a short.

Performing the engineering analysis for GPR studies requires a significant amount of data that often requires some effort by the utility to provide. As everyone would agree, the integrity of any engineering/computer/modeling output is dependent on the integrity of the data used. The output of the study is the 300-volt line, recommendations to make the site safe from a step and touch potential and the recommendations for the grounding system that will satisfy the telecom carrier's requirement.

The purpose of this paper is to define the data generally required and how the information is utilized. The data can be divided into three categories as outlined below. Subsequent paragraphs detail the information.

Summary of Data Required
I. Site Plan
II. Soil Resistivity Data
III. Fault Current Data

Site Plan
The site plan should include the following information:
- Dimensions of the lease area
- Dimensions of equipment pads or shelters
- Dimensions of the site tower and any adjacent towers
- Distance between equipment and towers

The site plan should show the tower on which the GPR is being performed and other towers or substations within 500 feet. Sometimes data for surrounding towers and substations is required. They are sometimes more of a problem then the tower on which the telecom equipment is being installed.

Soil Resistivity Data
Soil resistivity is the measure of the conductivity or resistivity the soil. The units of measure are ohms-meter or ohms-centimeters and it is generally collected on site by performing a 4-Point Wenner or comparable method of testing.

Accurate soil data is absolutely necessary for the grounding system and safety calculations for the sites under discussion. Testing is performed in three different directions at the site out to a probe spacing of 100 feet, minimum. This provides resistivity data down to a depth of 100 feet. Typically probe spacing's are 5, 10, 15, 20, 30, 40, 60, 80 and 100 feet.

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Fault Current Data

The utility will be asked to provide the following information:

- Phase-To-Ground Fault Current
- Clearing Time (Number of Cycles)
- Zero Sequence Impedance and Positive Sequence Impedance (Or X/R Ratio If Calculated)

The Fault Current is the maximum that will flow under fault conditions. The current will flow until the circuit protection devises open to stop the flow. The clearing time is the number of cycles that occur until this device activates. Obviously, the longer this takes, the more difficult it will be to make the site safe.

Additional data is required if the HV structure carries overhead grounding wires (neutral conductors). When neutral conductors are present, they will carry a portion of the fault current. This will significantly impact (make easier) the GPR calculations and actions required to meet the safety requirements for the site. The additional information is:

- Fault Current Contribution of Each Terminal
- Distance from the HV Tower to Each Terminal
- Average Span Length
- Average Height of Neutral Conductors (AGL)
- Number of Neutral Conductors
- Relative Distance Between Neutral Conductors (if >1)
- Average Coordinates of Phase Conductors: X and Y (AGL)
- Type of Neutral Conductors (ACRS336, Steel 1/2HS-AG, etc.)

This information allows Lyncole to determine the amount of fault current that will enter the ground at the tower under study and the amount that will return through other paths which will reduce the hazard and also the expense of making the site safe.

Contact Us Today to Learn More!
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