Analyzing a Section of Ahmadu Bello University's Electrical Grid Using Geometric Network Analysis and Trace Function

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SUMMARY

The electrical grid constitutes a complex electrical power system network, encompassing generating plants, transmission lines, substations, transformers, distribution lines, and consumers. In Nigeria, these grids often rely on electric poles. However, the efficiency of electric poles is susceptible to factors such as strong winds and erosion, which can lead to pole failures and, subsequently, unplanned power outages. This study addresses various issues, one of which is the delayed response of electric utility companies to distribution network faults. The research focused on the main feeder of Ahmadu Bello University's (ABU) electricity grid and employed a Garmin ETrex20 GPS receiver to obtain coordinates (latitude and longitude) of features within the area. Attribute data pertaining to these features were collected through interviews and organized in a geodatabase. ArcGIS v10.5 Software was utilized to map the distribution of facilities, and the geodatabase's spatial attributes were analyzed. The network featured 201 poles, accounting for 88.16% of the infrastructure, 9 Ring Main Units (RMU) at 3.49%, and 18 transformers at 6.98%. This disproportion between transformers and RMUs is attributed to certain RMUs serving multiple transformers within the network. Geometric network-based flow analysis visually highlighted the features responsible for power distribution within the grid. Trace analysis using the geometric network demonstrated its effectiveness in identifying and analyzing network paths. The study also examined the value of utilizing spatial data within the utility industry and proposed potential improvements for such applications.

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