EVALUATION OF GEOPHYSICAL AND GEOTECHNICAL PARAMETERS OF RECLAIMED LAND FOR CONSTRUCTION PURPOSES: A CASE STUDY OF BADORE, AJAH, LAGOS STATE, NIGERIA

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CERTIFICATION

This is to certify that this work was carried out by ADEWOYIN, Olusegun Oladotun in partial fulfillment of the requirements for the award of Doctor of Philosophy (Ph.D) degree in Physics (Applied Geophysics) of Covenant University, Ota, Ogun State, Nigeria.

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DEDICATION

This thesis (research work) is dedicated to God the Father, the Son and the Holy Spirit.

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ABSTRACT

Oftentimes, when a building collapses, it is usually attributed to substandard building materials, poor building practices, lack of experience of the contractors and the age of the building. The rarely mentioned contributing factor is the condition of the land on which the building lies. Hence, this study was conducted at Badore Model College (Site 1) and Greenville Estate (Site 2) in Ajah, Lagos State to evaluate the subsurface structures of a reclaimed land for construction purposes using geophysical and geotechnical methods. The geophysical method comprised the resistivity and the seismic methods while geotechnical method is composed of the percussion drilling, cone penetration and standard penetration tests. Resistivity methods revealed the second and the third geoelectric layers as the most competent layers in Site 1 and Site 2, with resistivity values ranging between 23.3 and 951.7 Ωm at depth of about 8 m to 54 m. The seismic refraction method delineated three layers at Site 1 and two layers at Site 2 with the last layers being the most competent at a depth range of about 7 m and 18 m. The Young modulus of the competent layer at Site 1 ranged from 1.558 to 25.106 GPa and bulk modulus ranged from 0.999 to 16.093 GPa whereas at Site 2, the Young modulus ranged between 0.514 and 7.018 GPa, for bulk modulus, the value varied between 0.330 and 4.499 GPa. At Site 1, it was noted that the shear modulus ranged between 0.638 and 10.123 GPa, whereas Lame’s constant ranged between 0.580 and 9.345 GPa. This is in contrast with the values obtained for shear modulus and Lame’s constant at Site 2, which varied between 0.207 and 2.830 GPa and 0.191 and 2.612 GPa respectively. The parameters measured in Site 1 were higher than Site 2 by factors of 3.082 and 3.580 respectively. Geotechnically, this layer had the lowest Poisson’s ratio of about $0.24 \pm 1.1 \times 10^{-5}$ which could indicate the competent zone within the subsurface at depth range of about 7 m and 18 m below the ground level. The Poisson’s ratio found at Site 2 is distinctly lower than that of Site 1 but within the same depth range of 7.5 m and 16 m respectively. The percussion drilling tests showed that at a depth range of 1 m to 7.5 m, the formation that constituted the topsoil was loose and relatively compressible. The SPT-N value for the material within the depth of competence ranged between 13 and 35 at both sites. In the same vein, the results of the cone penetrometer test revealed that the formation from the topsoil to a depth of about 6 m and 7 m into the subsurface, at both sites were characterised by relatively compressible formation. Significantly, this study suggested that civil engineering structure should be founded on competent formation of about 7.5 m and 18 m below the ground level in the study area.

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