

ABSTRACT

This project work was carried out at Ireukpen-Ozalla Road Axis Ekpoma, Esan-West Local Government Area Edo State. Using seismic refraction prospecting method to examine the cause(s) of the persistent failure of the road. An ABEM TERRALOC MARK-6 Seismometer was used as the recording instrument and twelve geophones as wave detectors in series with one another. The geophones were spread at predetermined distances and the impact of a sledge hammer on a flat plate served as the source of generating seismic waves. The "SERCOM1" software was employed in the interpretation of the field result for the forward and reversed shooting respectively. From which the subsurface reveals two layers of velocities, which are 980ms^{-1} and 1283ms^{-1} for the forward shooting, 851ms^{-1} and 1276ms^{-1} for the reversed shooting respectively. The investigation also shows that at twenty three metres (23 m) from the surface of the forward shooting, clay deposit could be discovered. And even at thirteen metres (13 m) from the surface of the reversed shooting clay deposit could also be encountered. The form of road failure identified in this study is due to subsidence associated with clayey material and the delineated clayey water absorbing sections which are major geologic factors responsible for road failure in the area.

CHAPTER ONE

MEANING AND BASIC APPLICATION OF GEOPHYSICS

1.1 INTRODUCTION

It is to be noted that the geophysical method of prospecting and delineation of anomalous zone in the subsurface extend its wide application to buried material (both of economic and non economic values) (Ozejin, K.O. et al., 2007). Also geological factors are not often considered as precipitators of road failure even though the highway pavement is founded on the geology (Momoh et al., 2008).

Seismic method has successfully helped in the search and exploitation of the subsurface. In particular, seismic refraction method is commonly used to get detailed information of the subsurface lithology, geologic setting (mapping), locating refracting interfaces separating

layers of different seismic velocity, subsurface mapping, lithological boundary differentiation, engineering geophysics and static correction.

It is sad to note, that, the perennial or incessant failure and poor rehabilitation work on these roads has become a very common phenomena and a source of concern. Generally, in seismic refraction surveying technique, the method uses seismic energy that returns to the surface of the Earth after travelling through the ground along refracted ray paths. The vast majority of refraction surveying is carried out along profile lines which are arranged to be sufficiently long to ensure that refracted arrivals from target layers are recorded as first arrivals for at least half the length of the line. It involves putting the first geophone relatively far away from the shot point, and the shot and detector are on the same line. Consequently, the ABEM TERRALOC MARK-6 were used. And a hand held hammer was used to generate the source energy.

Many factors causes road failure, these include;

Geological, geomorphological/geotechnical, road usage, poor or bad construction practices and maintenances. The influence of geology and geomorphology in the design and construction phases may not have been adequately considered. The problem could also be as a result of inadequate knowledge of the characteristics and behavior of residual soils and not putting the bearing capacity of rocks in relation to vehicular traffic into consideration. Furthermore, the geological factors in road failure covers the nature of soils (i.e. laterite) the near surface geological sequence, existence of geological structure like cavities, ancient stress, channels and shear zones, near surface geological sequence. Sometimes there is the presence of some concealed subsurface geological structure as well as rock weakness or deficiency. One or more of the aforementioned factors has been noticed to have contributed in some of our highway and rail track

failure. For the purpose of information, geomorphological factors are concerned or related to topography and surface/subsurface drainage systems. Also, subsurface geologic sequence and concealed geological structure can be mapped by geophysical method, hence its relevance (Ozegin et al., 2007).

1.2 LOCATION OF STUDY AREA

The study area lies along the Iruokpen-Ozalla Road, in Esan-West Local Government Area,

Ekpoma, Edo State, Nigeria. It has its headquarters in the town of Ekpoma, with an area of 502km² and a population of 125,842 people, according to the 2006 national census. The study area is located on 6¹44¹12¹1¹N, 6⁰8¹36¹1¹E as obtained from a reliable geographical positioning system (GPS) meter. The Local Government Area is bounded on the South by Orhionmwon Local Government Area, on the East, by Esan Central Local Government Area (L.G.A), on the West by Uhumwonde and on the North by Owan West L.G.A. The people of the local government are basically subsistent farmers and petty traders. It is thickly forested with a moderate temperature between 20⁰C to 30⁰C and a climate which is predominately rainforest characteristics by two seasons, that is, dry and wet season. Its topography is generally undulating (Ewanlen, T.A., 2010).

A GEOPHYSICAL INVESTIGATION USING SEISMIC REFRACTION METHOD TO DETERMINE THE CAUSES OF ROAD FAILURE, A CASE STUDY OF IRUEKPEN-OZALLA ROAD AXIS

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