GEOTECHNICAL AND STRUCTURAL STUDIES ON SOME NEW CITIES AROUND CAIRO

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ABSTRACT

15th of May and the Qattamiya cities are located to the southeast and east of Cairo city, respectively. Both cities are built on bedrock consisting of limestones intercalated with marls and clays of Middle and Upper Eocene age. These cities are facing serious problems in the building and constructions due to the lack of geological, structural and geotechnical studies on their foundation bedrocks. Accordingly, the Scope of this thesis deals with the geological, structural, geotechnical studies on the foundation bedrocks in the sites of both cities and their environs, which are delimited between latitudes 29° 46` and 30° 02` N and longitudes 31° 16`and 31° 30`E, to throw the light on these problems and hazards affecting them.

Stratigraphically, the exposed rocks in the area are of Middle, Upper Eocene, Oligocene, Pliocene and Quaternary ages. They could be distinguished into nine rock units, Gabal Hof Formation (Middle Eocene), Observatory Formation (Middle Eocene) , El Qurn Formation (Upper Eocene), Wadi Garawi Formation (Upper Eocene), Wadi Hof Formation (Upper Eocene), Anqabiya Formation (Upper Eocene), Gabal Ahmar Formation (Oligocene), Pliocene Deposits and Wadi Deposits (Quaternary).

Geomorphologicaly, the area under consideration is characterized by the presence of conspicuous land forms. Its topography and geology are intimately related, where the lithology and stratigraphic position of the different beds greatly influence the type of weathering and contribute much to the general shape of the landscape.

Topographically, the area has two plateaus separated by a topographically low area. Gabal Mokattam forms the northern plateau while the southern plateau is marked by a relatively high escarpment on its northern side called here the Tura –Hof -Observatory plateau. The latter is dissected by several deeply incised wadies such as Wadi Degla, Wadi Hof, and Wadi Gibbu. Some topographic lows exist within this plateau representing grabens. Also some topographic heights can be recognized on top of this plateau; e.g. El Qurn Height, El Halawana Height, the Ochsen Ridge, G. Hamadel, etc... Some of the highs and the plateau escarpments are also structurally controlled.

Detailed geological and structural maps has been constructed to show the effect of the faults on the site of the cities. Structural analysis defined several major trends of faults and fractures affecting the study area. The main fault sets have NW-SE and E-W trends. The formeris the most dominant and gives rise to a sequence of horsts and grabens.

The GPR studies have been applied on 26 chosen locations within the sites of the cities. Sixteen sites within the 15th of May city in addition to 10 profiles collected from the Qattamiya city. These sites were chosen to represent the different districts of the cities as possible and to cover sectors of special interest where subsurface structures or some problems are expected. The main subsurface features recorded are the presence of vertical and inclined fractures, a considerable number of caves at several locations and at different depths. Also, sewage water is encountered in the subsurface of some locations of the Qattamiya city site.

The geotechnical studies on 74 limestone rock samples collected from 15th of May city revealed that the foundation bedrocks forming the site of the city are

physically and mechanically heterogeneous (anisotropic) and fall within the weak to medium strong range of the limestones, while their mode of failure is almost of brittle type developing extension, wedge type and single shear fractures. The mechanical properties are controlled by their physical properties, as well as their composition. Statistical relations between the physical and mechanical properties are studied and expressed by empirical equations.

Laboratory tests were performed in accordance on 42 samples collected from the Qattamiya city and its extensions. Analysis of physical properties of the studied Qattamiya soil samples indicates that they have high to very high swelling potentiality. The engineering classification of the studied soil samples is inorganic clay of high to extremely high plasticity.

Based on the detailed structural and geotechnical studies on the area under consideration, some environmental and geologic hazards are encountered and can be grouped as: geotechnical hazards, structural hazards, dissolution hazards, quarry blasting hazards, subsidence hazards, seismicity hazards and air pollution hazards. These hazards are intimately related and mutually affect each other.

Such hazards may also be taken into consideration in the future extension of the cities where necessary.

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