Ain Shams University
Faculty of Science
Department of Geology

Slope Stability Study of the North Scarps at Gebel El Mokattam Area, Cairo, Egypt.

A THESIS
Submitted In Partial Fulfillment Of The Requirements For The Degree Of Master of Science In Geology.
By

Mohamed Mostafa Ahmed Abd El Kader

B.Sc. (Hons.) 2013

Supervised by

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Note

The present thesis is submitted to the Faculty of Science, Ain Shams University, in partial fulfillment of the requirements for the degree of Master of Science in Geology.

In addition to the research work materialized in this thesis, the candidate has attended the following post-graduate courses for one year in the following topics:

1. **Advanced Structural Geology**
2. **Geotectonic**
3. **Advanced Lithostratigraphy**
4. **Biostratigraphy**
5. **Geomorphology**
6. **Remote Sensing**
7. **Sedimentation**
8. **Sedimentary Petrology**
9. **Field Geology**
10. **Geostatistics**

He successfully passed the final examination in these courses.

In fulfillment of language requirement of the degree, he also passed the final examination of course in the English language.

Head of Geology Department

Prof. Dr. Ashraf Roshdy Baghdady

Key Words

1. **Slope Stability**
2. **Rock slopes**
3. **Mokattam**
4. **Geotechnical of Soil**
5. **Rock properties**
6. **Manshiet Nasser**
7. **Duwika**

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Abstract

The present study is addressed mainly to analysis the stability of rock slopes and related geo-hazards in the northern part of Gebel El-Mokattam area (Manshiet Nasser and Duwaiqa unplanned population areas), East Cairo. The rock slopes in the study area are mainly composed of the Middle Eocene white argillaceous limestone and the Upper Eocene claystones, marls, and sandy dolomitic limestone. Physical, geotechnical, mechanical and mineralogical characteristics of these rocks are investigated to evaluate the geo-hazards at the foundation levels and slope faces. The physical and geological parameters were determined in terms of water content, bulk density, porosity, water absorption and insoluble residue. Detailed geological mapping for the rock masses distribution and the faults and fractures affecting these masses were investigated to predict the slope instability areas through the study area.

The evaluation of the physical and swelling characteristics of the claystone beds indicating that the claystone in the study area is classified as medium to high swelling potentiality. So, the occurrence of these claystone at the foundation levels, require some engineering treatments before the constraction. On the other side, the mechanical properties of carbonate rocks in terms of uniaxial compressive strength (UCS), point load strength and slake durability index pointing to these rocks have weak to medium rock strengths, with medium to high durability. The study revealed that the physical and geological properties controlled these carbonate strengths. The bulk density has positive effect on the UCS values, on the other hand the porosity, water content and water absorption have negative effect on the UCS values. The carbonate content and clastic content have no noticeable effect on the UCS values that strongly support the influences of the carbonate texture and structures on these values rather than the lithologic components.

Slope stability analysis done by measuring the slope profiles, rock slope properties and affecting fractures, in addition to define the geometrical relation between the fracture and slope attitudes. This relationship in association with the field investigation identify different types of rock slope failures (Instability problems) that have been occurred and will continue. These failure types depending on the steepens of slope profiles and rock slope types of Middle Eocene and Upper Eocene slopes. The studied slopes have several

weakly attached, weathered and instable blocks with different sizes that can fall down from the slope beds, particularly Ain Musa Bed. Previous studies had defined many mechanisms where these blocks separated from the slope beds. Site investigation and study the occurred block failures revealed that some of these fallen blocks reached down into the toe area of the slopes. So, the rockfall modeling and simulation were analysed for both two rock slope types, followed with the assessment of rockfall risk analysis as well as rated its impacts on the residents' buildings, and then suggesting many of protection and supporting measures. The Middle Eocene rock cut slopes resulted during the past quarrying operations are caharcterized by vertical quarry walls, undercutting, and protruding ridges. While, the rockfall through the Upper Eocene slopes occur due to lateral clay flow, weakly attached blocks and the formation of undercuttings.

Finally, the present work provides some significant recommendations that are suggested to be considered during the further development in the study area and in other parts in El-Mokattam Plateau.

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