Journal of Geology & Geophysics
ISSN: 2381-8719
OPEN ACCESS Freely available online
Opinion Article

Geotechnical-Geological Integrated Approach to Stiff Jointed Clay Formations

Mohamed Hassan Bahnassy*

Department of Soil and Water Sciences, Alexandria University, Alexandria, Egypt

DESCRIPTION

The Mediterranean region is generally characterized by complicated and weak formations as a result of its geological evolution. Many Mediterranean countries' regions are become unstable and prone to landslides by these formations, which expose crucial infrastructures like the transportation network and lifelines to inescapable dangers. The primary characteristics of this broad class of materials, such as mélanges, hard soils, and structurally complicated formations, have been well described by recent advances in the geological field. However, when it comes to creating a Geotechnical Design Model (GDM) that can accurately represent the design situation and the geotechnical characteristics of complicated formations as relevant for design, the translation of many geological features into engineering terms is still quite limited.

The geology of the area in which a geotechnical structure or infrastructure is to be erected has a significant impact on the design of that structure or infrastructure. This is especially true in geological settings that feature complicated and fragile formations, a large class of materials whose behavior cannot be simply understood or predicted by using the fundamental rules of either rock mechanics or soil mechanics. This term is extremely consistent with Croce's "geotechnical oriented" definition of "structurally complex formations," which he established as geological formations that are too complex to be modeled as a continuous system. Due to the tectonic processes that have contributed to determining the current conformation of the territories, these formations are frequently found in the Mediterranean region. The fact that they are prone to landslides has a significant impact on the safety and development of geotechnical works and infrastructure.

The DG21 and DG22 are two new double carriageways road segments being built in Italy as part of European Route E90. They are located in the Calabria region of southern Italy, close to the Ionian coast, and interact primarily with the over consolidated stiff jointed marine clay sedimentary formation from the Plio-Pleistocene epoch.

The region is a part of the Calabrian Arc, which was created when the remnants of the Alpine-Betic back-thrust belt were superimposed on the Apennine Chain during the Tyrrhenian Sea opening. The Calabrian Arc was fragmented and two narrow straits connecting the Ionian and Tyrrhenian Seas were formed as a result of strike-slip deformation and extensional tectonics that occurred in the back-arc zone from the late Pliocene to the Pleistocene. Tidally-dominated sedimentation was present in the two straits, known as the Catanzaro and Siderno palaeostraits.

As a result of the region's mountainous topography, several bridges, tunnels, embankments, and excavations are needed to meet the geometric requirements of high-speed roadways. Such extensive labour resulted in the triggering or re-triggering of landslides, as well as the activation of many soil movements that occasionally advanced to real instabilities and the displacement of soil volumes ranging from tens to thousands of cubic meters. The back examination of the events made it possible to separate them into two major categories: shallow instabilities, including colluvial-eluvial coverings, and deep mass movements, in which the surface of the rupture occurs inside the formation. The clay/silt planar slide is responsible for the shallow instabilities, and the transition from the eluvial-colluvial cover to the intact formation corresponds to the sliding surface.

A previously stable soil block of unbroken material was "unlocked" by the excavation face and the pattern of discontinuities in contrast to the deep mass-movements, which involved the jointed stiff clay formation. In other words, as is typically the case in rock mechanics instabilities, the pattern of discontinuities contributes significantly to the failure. Although it is still possible to have a compound failure surface that is mostly controlled by the existing discontinuities but locally extends into the intact soil, the strength of the intact SJC formation is still within the realm of soil mechanics.

Large portions of the Mediterranean region are vulnerable to landslides due to the existence of stiff joined clay formation, making the creation of trustworthy technical solutions difficult and requiring a great deal of experience. This is typical for the planning and construction of infrastructural networks, which necessitate substantial earthworks, such as embankments on naturally occurring slopes and underground excavations, due to their rigorous geometrical requirements.

Correspondence to: Mohamed Hassan Bahnassy, Department of Soil and Water Sciences, Alexandria University, Alexandria, Egypt, E-mail: hassanmd.bahn@gmail.com

Received: 01-Sep-2022; Manuscript No. JGG-22-20480; **Editor assigned:** 05-Sep-2022; PreQC. No. JGG-22-20480 (PQ); **Reviewed:** 19-Sep-2022; QC. No. JGG-22-20480; **Revised:** 26-Sep-2022; Manuscript No. JGG-22-20480 (R); **Published:** 03-Oct-2022, DOI: 10.35248/2381-8719.22.S5.003.

Citation: Bahnassy MH (2022) Geotechnical-Geological Integrated Approach to Stiff Jointed Clay Formations. J Geol Geophys. S5.003.

To comprehend the causes of the profound mass movements that occurred during the construction of the road, a thorough investigation of the Stiff Jointed Clay (SJC) formation has been carried. The examination comprised laboratory tests, Piezocone (CPTu) and Pressumeter (PMT) site tests, and boreholes. The study of the geotechnical characteristics of both intact soil and discontinuities proved to be vital to the application of the proposed approach in order to comprehend the behavior of SJC formation.

Numerous discontinuities, mostly connected to the tectonic context of the SJC formation, were exhumed during the road construction excavations. From an engineering standpoint, the main problem was the shear strength along such discontinuities. Numerous direct shear studies on natural materials collected from excavation faces and containing discontinuities have been conducted to look into this behavior. In particular, the discontinuity was positioned as closely as feasible along the sliding plane of the shear test device during the experiments. Other direct shear tests at residual were performed for comparison, commencing with samples that had not been altered and with samples that had artificially smoothed surfaces. A significant portion of the findings are consistent with a Mohr-Coulomb failure envelope with a friction angle of $\varphi'r$=18-22°. For this formation, a single typical residual friction angle of 20° was deemed suitable.