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The importance of the existing engineering geological conditions during the building construction on the terrain affected by sliding

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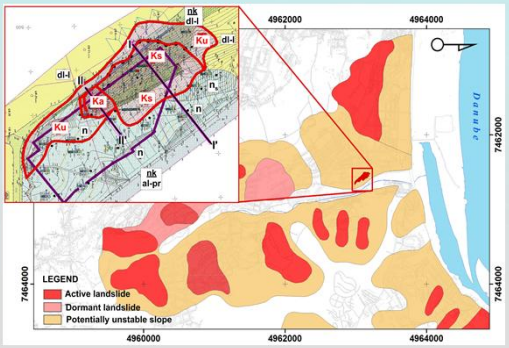
SUMMARY: In this paper the importance of knowing engineering geological conditions and history of landslide processes is highlighted with the example of the construction of a shopping mall in a densely populated area of the Serbian capital-Belgrade. The results of engineering geological and geotechnical researches are chronologically presented starting from the first landslide activation in 1970 and its reactivations in 1981 and 1992. By the latest research results, the existence of "fossil" landslide is registered for the first time in this part of the terrain. Based on that, the project for the protection of surrounding terrain was done due to the deep foundation pit excavation.

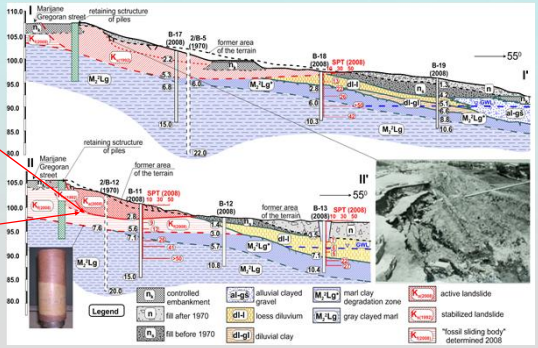
INTRODUCTION: Due to the specific conditions of performing a deep excavation such as: variation in different soil types, limited space, difficult and demanding work conditions, excavation speed etc., conditions of the natural geological environment are especially important. Therefore, the base for the deep excavations performances is the engineering geological maps which should be practical, concise, clear and with adequate graphical and numerical representation of the terrain.

Geological terrain composition and characteristics of the sliding process

The wider zone of the terrain belongs to the region that includes an area of active, dormant and stabilized landslides. The terrain basis, within the exploration area, consists of marine basin sediments which are the oldest sediment layers of Paratetis near Belgrade. They are presented with marls (Lg), which are intensively modified in the surface layer, and they formed a surface weathering zone of degraded marl clays (Lg*). Quaternary cover is formed over this complex and it is made of different lithogenetic sediments in which diluvial sediments dominate on the slope ground part and alluvial-proluvial sediments on the flat part of the terrain next to a stream.



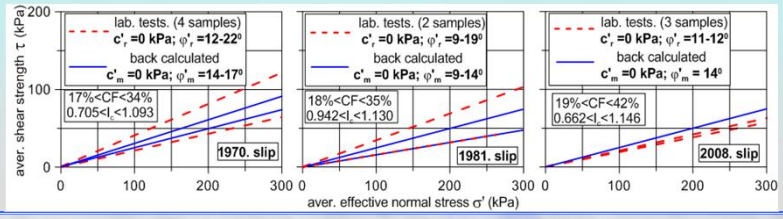
active slip surface

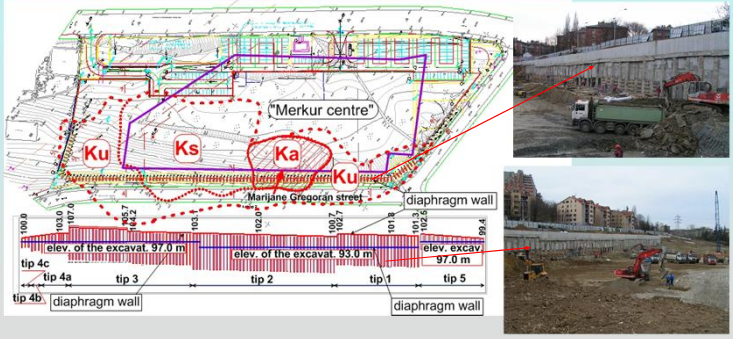


landslide - 1970.

In 1970 and later in 1981 laboratory tests were performed and gave the results of the residual internal friction angle of saturated colluvial soil samples. Also, the back-analyses were performed giving the mobilized shear strength parameters at failure along the slip surface. The latest laboratory tests have mostly yielded lower residual values for the internal friction angle φ'_r=11-12^0. The value of the conditional internal friction angle φ'_m = 14^0 was obtained by the back-analysis method, which was later used to determine the force of a potential sliding body on the retaining structure.

Residual shear strength depending on the time activity of the landslide





Remediation measures

As the basic remediation measure and the foundation pit protection measure, the reinforced concrete diaphragms were designed. Along the street of Marijana Gregoran they were placed in the so-called ''comb arrangement'' perpendicularly to the reinforced concrete structure of piles, and connected with the overhead slab at a certain depth. Groundwaters from the slope are collected by the drainage curtain, which was placed between the diaphragms, and transferred in a controlled process through drainage pipes and shafts system to the city sewage. The reinforced concrete diaphragms were designed according to deepest determined slip surfaces ("fossil" or dormant), which were defined in the contact of degraded marl clay zone and grey marl zone.