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GEOFIZIČKA ISTRAŽIVANJA TONJENJA LESA U ZEMUNU

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Ključne reči: refraktivna seizmometrija, oštećenje objekata, prodor vode

Istražni prostor obuhvata periferni deo Zemunskog lesnog platoa, koji čini značajni deo Zemuna. U prirodnim uslovima teren je okarakterisan kao stabilan, ali se usled prodora veće količine vode u tlo, naročito u dužem vremenskom periodu ili sa većim hidrauličkim pritiskom vode, mogu očekivati naknadna diferencijalna sleganja i deformacije prašinasto-peskovitih lesnih naslaga. Usled kolapsa lesnog tla u Novogradskoj ulici u Zemunu, potpuno se urušio jedan prizemni stambeni objekat, oštećenja na dečjem obdaništu su bila tolika da je morao biti srušen, za dva veoma oštećena objekta su projektovane sanacione mere, a deformacije su registrovane na još 10 stambenih objekata, kao i na samoj saobraćajnici. Istraživano područje obuhvata 0,8 ha urbanog područja, gde su registrovane prsline, pukotine i ulegnuća na površini terena koja ukazuju na nejednako sleganje i tonjenje tla i pojavu procesa mehaničke sufozije u centralnom delu istražnog područja.

Cilj geofizičkih istraživanja je bio da se registruju potencijalna prisustva podzemnih prostorija, tj. laguma, kao i degradiranih zona sa slabijim fizičko-mehaničkim svojstvima, koje su pretpostavljeni uzrok nestabilnosti tla i oštećenja stambenih objekata. Korišćena je refraktivna seizmometrijska metoda duž dva profila, pri čemu je akvizicija podataka vršena instrumentom RAS-24. Pozicije profila i njihove dužine su odabrane tako da se obuhvati i stabilna i nestabilna zona. Procena stabilnosti navednih zona vršena je na osnovu evidentiranja nastalih oštećenja na objektima u široj zoni profila. Obrada i modelovanje na osnovu podataka dobijenih terenskim merenjima postupkom seizmometrijske refrakcije, izvedene su programskim paketima RAS-24 (System Software i Rayfract), dok je optimizacija i vizuelizacija izvedena programskim paketom Golden Software (Surfer & Grapher). Za oba merena profila generisani su 2D modeli distribucije brzina longitudinalnih seizmoakustičkih talasa, u domenu konačnih elemenata.

Analizom dobijenih 2D modela može se zaključiti da duž dva izvedena profila ne postoje indicije o postojanju većih zona smanjenja brzine primarnih talasa (V_p) koje su karakteristične za prisustvo šupljina, odnosno laguma. Međutim, moguće je uočiti razlike u distribuciji V_p na profilima. Na jednom od profila, koji je pozicioniran na strani ulice gde je dokumentovano i vizuelno uočljivo sleganje objekata, pojavljuje se veća debljina sredine sa smanjenom brzinom V_p . Navedeno može ukazivati na prisustvo zone sa izmenjenim i slabijim fizičko-mehaničkim svojstvima tla. Za potvrdu takvih pretpostavki neophodno je izvesti dodatna geotehnička i inženjersko-geološka ispitivanja.

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GEOPHYSICAL INVESTIGATION OF COLLAPSING LOESS IN ZEMUN

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Key words: seismic refraction, building damage, wetting

The exploration area includes peripheral part of the "Zemun loess plateau", which covers a large area of Zemun. In natural conditions the terrain is characterized as stable, but due to the infiltration of larger amounts of groundwater into the soil, especially in the long-term period or with higher hydraulic pressure of water, significant differential settlements and deformation of dust-sand loess sediments can occur. As a result of loess collapse in Novogradska street in Zemun, one ground floor residential building was completely demolished, the damage to the kindergarten was so great that it has to be demolished, measures were designed for two damaged buildings, and deformations were registered in 10 other residential buildings as well as on the road. The investigated area covers 0.8 ha of urban part of the research area, where cracks, fissures, and shallow depressions on the surface of the terrain were registered that indicate subsidence and sinking of the terrain, as well as the mechanical suffusion in the central part of the investigation area.

The goal of the performed geophysical investigation was to determine the possible presence of larger underground facilities, i.e., dungeons, as well as weakened zones with loose physical and mechanical properties, which are presumed to be the cause of instability and endangerment of proximate residential buildings. Seismic refraction data was recorded using a Seistronix RAS-24 24-channel seismograph along two profiles. The positions of the profile as well as their length were chosen to include both the stable and unstable zone, estimated based on damage to the buildings in the zone of profile. Collected data was processed and analyzed using the RAS-24 System Software and Rayfract, while optimization and visualization were performed in Golden Software (Surfer & Grapher). 2D models of distribution of longitudinal seismoacoustic waves velocity, in the domain of finite elements, were generated for both measured profiles.

By analyzing the obtained 2D models, it was concluded that along the two derived profiles there were no indications of the existence of larger zones of V_p reduction, which is characteristic for the underground facilities or cavities. However, there were differences in the distribution of V_p along the profiles. The one profile, performed on the side of the street where sinking of buildings was documented and visually noticeable, had a greater thickness with reduced V_p speed. This can indicate the presence of a zone with altered and loose physical and mechanical soil properties. Additional geotechnical and engineering geological investigations are needed to confirm such assumptions.

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