

**Srpsko geološko društvo**

**Zbornik apstrakata  
XVIII Kongres geologa Srbije**



**18 КОНГРЕС  
ГЕОЛОГА СРБИЈЕ**

**Book of abstracts  
of the XVIII Serbian Geological Congress**

**GEOLOGIJA REŠAVA PROBLEME  
GEOLOGY SOLVES THE PROBLEMS**

**Divčibare, 01-04. jun 2022.**

# **XVIII Kongres geologa Srbije: Zbornik apstrakata**

(Nacionalni kongres sa međunarodnim učešćem)

# **XVIII Serbian Geological Congress: Book of abstracts**

(National Congress with International Participation)

**Divčibare, 01-04.06.2022.**

## **Organizator / Organised by**

Srpsko geološko društvo / Serbian Geological Society

## **Suorganizator / Co-organised by**

Univerzitet u Beogradu – Rudarsko-geološki fakultet /  
University of Belgrade, Faculty of Mining and Geology

## **Za izdavača / For the Publisher**

Vladimir Simić

Predsednik Srpskog geološkog društva / President of the Serbian Geological Society

## **Glavni urednik / Editor-in-chief**

Bojan Kostić

## **Uređivački odbor / Editorial Board**

Danica Srećković-Batočanin, Nevenka Đerić, Dragoljub Bajić

## **Tehnička priprema / Technical Preparation**

Bojan Kostić, Zoran Miladinović, Ana Zeković, Marija Petrović

## **Izdavač / Publisher**

Srpsko geološko društvo / Serbian Geological Society

Kamenička 6, P.Box 227, 11001, Belgrade, Serbia

<http://www.sgd.rs>; e-mail: [office@sgd.rs](mailto:office@sgd.rs)

**ISBN-978-86-86053-23-7**

**Napomena:** *Autori su odgovorni za sadržaj i kvalitet svojih saopštenja*

**Note:** *The authors are responsible for the content and quality of their contributions*

## **Organizacioni odbor / Organizing Committee**

Vladimir Simić (predsednik), Danica Srećković-Batočanin (potpredsednik), Dragoljub Bajić (sekretar), Zoran Miladinović (sekretar), Nevenka Đerić, Nenad Marić, Predrag Cvijić, Danijela Božić, Sonja Đokanović, Bojan Kostić, Nikoleta Aleksić, Stefan Petrović, Nemanja Krstekanić, Maja Maleš, Marija Vuletić, Natalija Batočanin

## **Naučni odbor / Scientific Committee**

Vladimir Simić, Danica Srećković Batočanin, Nevenka Đerić, Dragana Životić, Rade Jelenković, Aleksandar Kostić, Uroš Đurić, Miloš Marjanović, Alena Zdravković, Suzana Erić, Meri Ganić, Uroš Stojadinović, Katarina Bogičević, Dejan Prelević, Jana Štrbački, Vesna Ristić-Vakanjac, Dušan Polomčić, Vesna Cvetkov, Nevena Andrić-Tomašević, Spomenko Mihajlović, Aleksandra Maran-Stevanović, Darko Spahić, Slobodan Radusinović, Lidija Galović, Kristina Šarić, Vesna Matović

## **Volonteri studenti / Students volunteers**

Marija Petrović, Filip Arnaut

## **Sponzori / Sponsors**

Ministarstvo prosvete, nauke i tehnološkog razvoja  
Univerzitet u Beogradu – Rudarsko-geološki fakultet  
"Jelen Do" Lime & Aggregates - Carmeuse Group  
Rudarski institut d.o.o. Beograd  
IBIS-INŽENJERING d.o.o. Banja Luka  
Geoing Group  
GeoProspect d.o.o.  
VODAVODA  
Knjaz Miloš  
Kompanija Simex

## GEOFIZIČKA ISTRAŽIVANJA TONJENJA LESA U ZEMUNU

**Dragana Đurić<sup>1</sup>, Branislav Sretković<sup>1</sup>, Uroš Đurić<sup>2</sup>, Zoran Radić<sup>2</sup>, Dejan Vučković<sup>1</sup>**

<sup>1</sup>Univerzitet u Beogradu - Rudarsko-geološki fakultet, Beograd, Srbija, <sup>2</sup> Univerzitet u Beogradu – Građevinski fakultet, Beograd, Srbija  
E-mail: dragana.djuric@rgf.bg.ac.rs

### **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.

Ovaj rad finansiran je po „Ugovoru o realizaciji i finansiranju naučnoistraživačkog rada NIO u 2022. godini“, br. 451-03-68/2022-14/ 200126.

## GEOPHYSICAL INVESTIGATION OF COLLAPSING LOESS IN ZEMUN

**Dragana Đurić<sup>1</sup>, Branislav Sretković<sup>1</sup>, Uroš Đurić<sup>2</sup>, Zoran Radić<sup>2</sup>, Dejan Vučković<sup>1</sup>**

<sup>1</sup>University of Belgrade, Faculty of Mining and Geology, Belgrade, Serbia, <sup>2</sup>University of Belgrade, Faculty of Civil engineering, Belgrade, Serbia  
E-mail: dragana.djuric@rgf.bg.ac.rs

**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<sub>p</sub> reduction, which is characteristic for the underground facilities or cavities. However, there were differences in the distribution of V<sub>p</sub> 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<sub>p</sub> 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.

This paper has been financed by the „Contract on realisation and financing of scientific research of SRI in 2022“, Nr. 451-03-68/2022-14/ 200126