

# **Application Form for World Centre of Excellence on Landslide Risk Reduction**

## **2020-2023**

### **1. Name of Organization**

The Institute of Telecommunication and Global Information Space (*ITIGS*) of the National Academy of Science of Ukraine (NASU), Research Institute of Building Constructions (*RIBC*)

### **2. Name of Leader**

Oleksandr Trofymchuk (*ITIGS*)

#### **Affiliation: position**

Director, Doctor of Engineering, Prof., Corresponding Member of the NASU

#### **Contact: postal address, fax, phone, email**

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#### **Core members of the activities**

##### **Names/Affiliations: (4 individuals maximum)**

1. Iurii Kaliukh (*RIBC*), Leading Researcher, Doctor of Engineering, Prof.;
2. Oleksii Lebid (*ITIGS*), Vice Director, Doctor of Engineering;
3. Viktoriia Berchun (*ITIGS*), Researcher;
4. Iaroslav Berchun (*ITIGS*), Ph.D. student.

### **3. Date of Submission of Application**

04, October 2019

### **4. Activity scale and targeted region.**

1) Global, 2) Intercontinental, 3) Continental, **4) Regional, 5) National**

### **5. Short Title (10 words maximum) characterizing past and planned activities**

National Slope Master Plan, method of certification heritage objects in hazardous landslide sites

### **6. Objectives for the initial 3 years: (5 lines maximum; what you expect to accomplish?)**

Will be created method of certification and assessment of technical state of old heritage objects in hazardous landslide sites. The method includes: visual and vibrodynamic examination of old heritage objects within landslide hazardous sites; development of calculation model and calculations; comparative analysis of experimental and estimated data; recommendations for the repair and restoration and further operation of old heritage objects within landslide hazardous sites.

## 7. Background Justification: (10 lines maximum)

Ukraine has been a member of the "Landslides and Cultural & Natural Heritage" (LACUNHEN) thematic Network of the ICL since 2012. LACUNHEN will share and disseminate their respective experience, demonstrating how these special "objects" require approaches, techniques and solutions that go far beyond traditional civil engineering perspectives. Within this view, landslides and more generally slope instabilities are an important factor endangering cultural heritage sites and its degradation and require additional protection measures, creation of the monitoring and early warning systems, etc.

Up-to-date methods of geotechnical protection for historical monuments of architecture can provide them with reliable protection against adverse geological processes and ensure long-term reliable operation, as shown by the example of Livadia Palace, St. Andrew's Church and Swallow's Nest castle situated on the top of the 40-meters high Aurora Cliff of Cape Ai-Todor in the Black Sea, Autonomous Republic of Crimea, Ukraine (temporary occupied in 2014 by Russian Federation).

## 8. Resources available for WCoE activities

### **Personnel, Facilities, Budgets, and Affiliation and Contribution to ICL/IPL-GPC.**

**Personnel:** the project manager and four key members of the IPL projects will be represented by two scientific institutions (*ITIGS* and *RIBC*). -Two junior research scientists and three Information Technology experts who are also employees of the *ITIGS* will be engaged in projects implementation. In addition 2 – 3 local experts from the Kyiv city had been employed.

**Facilities:** the *ITIGS* and *RIBC* has provided - office premises, 10 PCs and other resources for the projects.

**Budgets:** The budget amount will be approximately up to € 6 000 - 7 000.

**Affiliation:** *ITIGS* and *RIBC*

### **Contribution to ICL/IPL-GPC:**

In recent decades, the concept of cultural heritage Migon<sup>1</sup> (2013) has evolved into one that encompasses an understanding of the history of humanity, together with scientific knowledge and intellectual attitudes. This changing concept has prompted a subsequent reevaluation of what constitutes the outstanding universal values of World Heritage sites and the operational methods for implementing the UNESCO World Heritage Convention<sup>2</sup> (1972). The scope has broadened from studying a single monument in isolation to one that values a multidimensional, multiregional, and inter-disciplinary approach and encapsulates vast spans of human history, as demonstrated by the above: Livadia Palace and St.

<sup>1</sup> Migon P (2013) Cultural heritage and natural hazards. In: Bobrovsky (ed) Encyclopedia of natural hazards. Springer Science + Business media, Dordrecht

<sup>2</sup> The World Heritage Convention (1972) URL:<http://whc.unesco.org/en/convention/>

Andrew's Church, located within active landslide systems; the Swallow's Nest castle situated on the top of the 40-meters high Aurora Cliff of Cape Ai- Todor in the Black Sea, Autonomous Republic of Crimea, Ukraine.

The obtained method of certification and assessment of technical state of old heritage objects in hazardous landslide sites may be used in boarder country regions and ICL/IPL-GPC. The training programme concerning assessment of technical state of old heritage objects in hazardous landslide sites according to the new Ukrainian State Construction Norms may be used in ICL/IPL-GPC as an example of "implementing of landslide knowledge into building practice" and allow designers from the Third World countries to certify and to asses of technical state of old heritage objects in hazardous landslide sites in future.

#### **9. Description of past activities related to risk reduction of landslides and other related earth system disasters (30 lines maximum)**

During the 2012 - 2018 period LACUNHEN Ukrainian Department has studied three Ukrainian Heritage Sites located in complicated geological and geotechnical conditions within the framework of the "Landslide protection structures and their development in the Autonomous Republic of the Crimea, Ukraine" IPL Project № 153 and a part of the research activities within the LACUNHEN. Two of the above sites are: Livadia Palace and St. Andrew's Church located within active landslide systems. The third is the Swallow's Nest castle situated on the top of the 40-meters high Aurora Cliff of Cape Ai-Todor in the Black Sea, Autonomous Republic of Crimea, Ukraine (temporary occupied in 2014 by Russian Federation), and is a subject of intensive destruction during the recent years.

Monitoring and early warning system (EWS) of Livadia Palace building constructions located within active Central Livadia Landslide system has been described in details in the articles by Trofymchuk, Kaliukh, Klimenkov<sup>3</sup> (2018) as an example of system approach for monitoring of World Heritage Sites placed on active landslides. There are also results of EWS performance.

The Swallow's Nest castle has been investigated within IPL Project № 153 and a part of the research activities within the LACUNHEN. The Swallow's Nest castle is a landmark of the whole Crimean coast. In 1927, the Swallow's Nest survived a serious earthquake. There were two shocks at night. At the end of 1950s the cracks indicating the threat of the castle collapse were detected. The castle was recognized as dangerous and was not used for a long time. It was an idea to take the castle to pieces, to number the

<sup>3</sup> Trofymchuk O, Kaliukh I, Klymenkov O, (2018) TXT-tool 2.380-1.1. Monitoring and Early Warning System of the Building Constructions of the Livadia Palace, Ukraine. Landslide Dynamnics: ISDR-ICL Landslide Interactive Teaching Tools. Volume 1. Springer, Cham. pp 491-508.

stones and slabs and assemble on a new safe place. Ukrainian ICL Department and RIBC undertook scientific and research works on the above issue and developed recommendations as for the Aurora Cliff suspension as well as reconstruction and preservation of the castle structures. The crack in the cliff is obvious (the crack width is up to 0,5 ~ 0,7 м). The huge crack separating some part of the rock from the main cliff part and a range of smaller cracks covering the whole Swallow's Nest castle base. Visual and instrumental survey of the cliff Swallow's Nest castle foundation and castle itself performed by the group of RIBC specialists under the supervision of Prof. Iurii Kaliukh has revealed that whole chalkstone rock mass has been affected by different types of destruction with perspective of cracks and cavernous porosity consolidation and extension. More detailed results of the stressed-deformed state of the rock survey, rock base and castle itself are about to be investigated as part of the research activities of Ukraine within the LACUNHEN thematic Network of the ICL and results of the new IPL Project № ??? (project proposal reported in ICL/IPL meeting 2019).

**10. Planned future activities /Expected Results: (20 lines maximum; work phases and milestones)**

Will be created method of certification and assessment of technical state of the old heritage objects in hazardous landslide sites. The method includes: visual and vibrodynamic examination of the old heritage objects within landslide hazardous sites; development of calculation model and calculations; comparative analysis of experimental and estimated data; recommendations for the repair and restoration and further operation of the old heritage objects within landslide hazardous sites.

Will be conducted certification some of religious buildings of the old heritage objects, data collection and processing, development of targeted database.

Two Ukrainian construction standards for scientific and technical monitoring of construction objects and construction for building in the areas sensitive to landslides introduced into Ukrainian building practice in 2018-2019. Ukrainian ICL Department planned training programme in 2020-2022 concerning above questions according to the new State Construction Norms for more than 1500 designers from all regions of Ukraine will allow them to correct design monitoring system of construction objects and landslides territory, in particular, to correct design of landslides protection structures (retaining walls) in the areas sensitive to landslides.

At the moment Dr Olexander Trofymchuk is the supervisor of PhD student Iaroslav Berchun, whose PhD study is devoted to landslide initiation mechanism in Neogene clay and Dr Iurii Kaliukh is the supervisor of PhD student Alexander Ischenko, whose PhD study refers to stress-deformed state of retaining walls in towns. They will be finishing their PhD thesis's to 2020-2021 years.

ITGIP with RIBC will plain to conduct annually scientific conferences from 2021 to 2023 about question of mitigation hazards landslide disasters.

**11. Beneficiaries of WCoE: (5 lines maximum; who directly benefits from the work?)**

the Autonomous Republic of the Crimea, Ukraine (ARCU) and the Kyiv local authority, ARCU and Kyiv Regional State Administration; Kyiv City State Administration; Kharkov, ARCU and Kyiv District State Administrations. Ministry of Environmental Protection, its ARCU and Kyiv Regional Branches; ITGIP and RIBC; Environmental NGOs and, finally, ICL/IPL-GPC.

**12. References: 10 lines maximum, i.e. relevant publications, international/regional/national recognition supporting items 9-10.**

Kaliukh I., Farenjuk G., Farenjuk I. (2018) Geotechnical issues of monitoring, calculation and engineering protection of landslide hazardous areas of Ukraine. In: Wu W., Yu HS. (eds) Proceedings of China-Europe Conference on Geotechnical Engineering. Springer Series in Geomechanics and Geoengineering. Springer  
TXT-tool 2.380-1.1: Monitoring and Early Warning System of the Building Constructions of the Livadia Palace, Ukraine / O. Trofymchuk. I. Kaliukh, O. Klimenkov/ In book: Landslide Dynamics: ISDR-ICL Landslide Interactive Teaching Tools. - 2018. – P. 491-508.

Vibrodinamic monitoring of pile foundation engineering on landslide hazardous site in dense urban development conditions / I. Kaliukh, O. Lebid, V. Dunin, Y. Berchun, S. Samoilenko / Ekologichna Bezpeka. – 2018. – № 2 (26). – C. 54-64.

**13. If your organization is an ongoing WCoE 2014-2017, please attach the articles reporting activities of WCoE, IPL project and ICL network published/contributed to either in *Landslides: Journal of International Consortium on Landslides* or/and the Fourth World Landslide Forum 2017.**

Attached file 1.

**14. List of published or planned reports of WCOE 2017-2020 in journal “Landslides” or “WLF5 books” for ongoing WCOE organization.**

(Those organizations with no activity report/no achievement in WCOE 2017-2020 will not be accepted as the candidate of WCOE 2020-2023 to be submitted to the Independent Panel of Experts for WCOEs.)

Attached file 2.

Note: Please fill and submit this form **by 31 October 2019** to ICL secretariat <[secretariat@iclhq.org](mailto:secretariat@iclhq.org)>