Málþing / *Symposium*

Jarðskjálftaáhætta á Íslandi
SERICE - Seismic Risk in Iceland

Verkfræðingahús Engjateig 9, Reykjavík
Mánudaginn 9. september 2024 – kl. 9:00 – 16:00

Málþingið er helgað SERICE rannsóknaverkefninu sem fékk þriggja ára Öndvegisstyrk frá Rannís árið 2021.

Málþingið er ókeypis en mikilvægt að tilkynna forföll.

Skráning er í viðburðadagatali á vef Verkfræðingafélags Íslands.

Athugið: Málþingið fer fram á ensku

The SERICE Research Project

Seismic hazard in Iceland, highest in North Europe, is comparable to that in South Europe. Furthermore, the geology in Iceland is young and unique due to volcanic activity and various impact form glaciers. Since 2000, three destructive earthquakes have hit South Iceland, Mw6.5 and Mw6.4 events in June 2000 and a Mw6.3 quake in May 2008. These earthquakes occurred in the middle of the South Iceland lowland, containing farms, small towns, bridges, and all infrastructure of modern society. A wealth of strong ground motion data and damage/loss data was collected during and after these earthquakes. These data are very accurate and unique in an international context. The overall aim of the SERICE project is to create scientific knowledge and provide engineering solutions for seismic risk assessment and reduction in Iceland. The project is divided into three main work packages: WP1 - Seismic site characterization, WP2 - Modelling and simulation of scenario ground motion fields, and WP3 - Seismic vulnerability assessment.

Research Group

The research group consists of three principal investigators from the Faculty of Civil and Environmental Engineering of the University of Iceland: Prof Bjarni Bessason, Prof Rajesh Rupakhety and Prof Sigurður Erlingsson. Research specialists: Dr. Ching-Yi Tasi and Dr. Elín Ásta Ólafsdóttir. Three doctoral students: Mojtaba Moosapoor, Sayed Javad Fattahi and Victor Moises Hernandez Aguirre. Several domestic and international experts are also participating in the project.

Finances

The project is finance by Grant of excellence from the Icelandic Research Fund (Rannís). Other supporting finance are from the Energy Research Fund of the National Power Company of Iceland (Landsvirkjun), the Research fund of the Icelandic Road and Coastal Administration (Vegagerðin), and from the University of Iceland Research Fund (Háskóli Íslands).

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Program for SERICE – Symposium

(see also short abstracts below)

	09:00 – 09:30	**Registration and coffee**
	Lectures by international collaborators Session chairs: Rajesh Rupakhety	
	09:30 – 09:45	**Opening and introduction of SERICE**
1	09:45 – 10:15	**Evolution of the new revision of Eurocode 8: Developments on seismic action** Dr. Roberto Paolucci, Professor of Engineering seismology - Politecnico di Milano, Italy
2	10:15 – 10:45	**Recent advances in seismic research of RC walls and their nonlinear modelling** Dr. Tatiana Isakovic, Professor, University of Ljubljana, Slovenia
	10:45 – 11:00	**Coffee**
3	11:00 – 11:30	**Geotechnical earthquake issues in transportation projects in Norway Application to seismic slope stability for a bridge foundation** Dr. Amir M. Kaynia, Emeritus Professor, NTNU and Norconsult AS, Norway
4	11:30 – 11:55	**The November 2023 Earthquake Swarm on Reykjanes Peninsula – Initial Loss Estimate** Jón Örvar Bjarnason, Head of Insurance, Natural Catastrophe Insurance of Iceland
	12:00 – 13:00	**Lunch**
	Lectures by SERICE Ph.D students Session chairs: Sigurður Erlingsson	
5	13:00 – 13:30	**Liquefaction analysis of Icelandic basaltic sand: from testing to simulating** Sayed Javad Fattahi, Ph.D. student, at University of Iceland
6	13:30 – 14:00	**3D Physics-based simulations of ground motion for the Mw6.5 South Iceland earthquake on 17 June 2000** Victor Moises Hernandez Aguirre, Ph.D. student, at University of Iceland
7	14:00 – 14:30	**Seismic vulnerability assessment of Icelandic buildings** Mojtaba Moosapoor, Ph.D. student, at University of Iceland
	14:30 – 14:50	**Coffee**
	SERICE Lectures Session chairs: Bjarni Bessason	
8	14:50 – 15:20	**Surface wave analysis for seismic characterization of soil strata in the South Iceland Seismic Zone** Dr. Elín Ásta Ólafsdóttir, Lector at University of Iceland
9	15:20 – 15:50	**Numerical Vulnerability Assessment of RC Wall Damages After Recent Earthquakes in South Iceland** Dr. Ching-Yi Tsai, Research specialist at University of Iceland
	16:00	**End of Symposium**

Mini abstracts for SERICE lectures

#1

Evolution of the new revision of Eurocode 8: Developments on seismic action

Dr. Roberto Paolucci
Professor of Engineering seismology, Politecnico di Milano, Italy

The purpose of this talk is to present the main changes introduced by CEN-TC250-SC8 concerning seismic action in the next revision of Eurocode 8, consisting principally of:

- Introducing the concept of seismic action class in place of seismicity level.
- Anchoring the standard spectrum by its plateau value, S_a, and its value at 1 s spectral period, S_b, instead of the PGA.
- Introducing, in an informative annex, two European hazard maps, one for S_a, and one for S_b, both defined for 475 years return period, based on the ESHM20 hazard model.
- Revising the site categorization by introducing the bedrock depth in addition to the shear wave velocity.
- Introducing new site amplification factors based on this site categorisation and dependent on input motion level.
- Introducing a new spatial model of input motion for bridges and pipelines.
- Providing miscellaneous specifications on conventional values of magnitude and strong motion duration, dependence of spectra to damping

#2

Recent advances in seismic research of RC walls and their nonlinear modelling

Dr. Tatiana Isakovic
Professor and the Head of the Chair of Structural and Earthquake Engineering,
University of Ljubljana, Slovenia

Reinforced concrete walls are among the most effective structural systems for resisting seismic loads. Therefore, it was surprising that some walls were severely damaged during the 2010 earthquake in Chile, exhibiting brittle failures due to shear, compression and tension. The observed damage also resulted from a lack of understanding of the basic mechanisms of their seismic response. Some experiments have indicated that these mechanisms can differ significantly from those typically considered in design. One of these experiments, a large-scale shake table test of slender walls connected only by slabs, will be presented. The results of an extensive parametric study, which identified the most important parameters providing the strong coupling of slender cantilever walls, changing considerably their response mechanism, will be overviewed. Various possibilities for modelling the nonlinear response of reinforced concrete walls will be presented, with a special emphasis on the version of the MVLEM (multiple-vertical-line-element) developed at the University of Ljubljana. This element was successfully used in several blind prediction simulations of various shake-table and cyclic experiments. The presentation will also include the latest extension of this element, which can be used to model axial-shear-flexure interaction in the nonlinear range.

#3

Geotechnical earthquake issues in transportation projects in Norway - Application to seismic slope stability for a bridge foundation

Dr. Amir M. Kaynia
Emeritus Professor, NTNU and Norconsult AS, Norway

This presentation introduces the issues and simplified solutions adopted in geotechnical seismic design of transportation-related projects in Norway. Special focus is given to selection of material parameters including small-strain shear moduli, cyclic shear strength in sand and clay together with design of foundations on slopes based on performance-based principles. These aspects are illustrated through an example for design of a railroad bridge on piles founded in sloping seabed of loose sand and soft clay layers.

#4

The November 2023 Earthquake Swarm on Reykjanes Peninsula Initial Loss Estimate

Jón Örvar Bjarnason, Head of Insurance, Natural Catastrophe Insurance of Iceland

On November 10, 2023, a 15 km magma dyke and a subsequent subsidence valley formed on the Reykjanes Peninsula. During this event, a swarm of earthquakes caused significant cracks and deformation in the town of Grindavík. In Iceland, it is mandatory to insure all properties through the Natural Catastrophe Insurance of Iceland (NTI). The institution has now received over 500 claims related to the event. The presentation will provide an overview of the ongoing damage assessment in Grindavík, which has proven to be significantly different from previous major earthquake loss events in the history of NTI.

#5

Liquefaction analysis of Icelandic basaltic sand: from testing to simulating

Sayed Javad Fattahi, Ph.D. student
Faculty of Civil and Environmental Engineering, University of Iceland

This presentation outlines our recent advancements in liquefaction assessment of Icelandic basaltic sand, using lab tests to establish liquefaction resistance curves and tune constitutive soil models. Results from the initial study guide the calibration of advanced models such as NorSand and SANISAND-MS, enhancing predictive accuracy for soil-water-structure interaction.

#6

3D Physics-based simulations of ground motion for the Mw6.5 South Iceland earthquake on 17 June 2000

Victor Moises Hernandez Aguirre, Ph.D. student
Faculty of Civil and Environmental Engineering, University of Iceland

Stimulated by the recent advances in high-performance computing, regional 3D physics-based numerical simulations (PBS) of seismic wave propagation for the 17 June 2000 Mw6.5 South Iceland earthquake are carried out. Simulated ground motions are compared with recorded data and relevant features of the ground motion field, such as near-fault effects, are discussed.

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#7

Seismic vulnerability assessment of Icelandic buildings

Mojtaba Moosapoor, Ph.D. student
Faculty of Civil and Environmental Engineering, University of Iceland

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The ongoing seismic and volcanic activity on the Reykjanes Peninsula highlights the urgent need for disaster preparedness in Iceland. This project utilizes extensive ground motion and damage data from significant past earthquakes to improve seismic risk assessment and mitigation strategies. Pioneering the use of Bayesian Markov Chain Monte Carlo (MCMC) methods, it quantifies seismic vulnerability with zero-inflated beta regression (ZIBR) models, focusing on low-rise residential buildings in the South Iceland Seismic Zone. The Bayesian analysis provides comprehensive fragility and vulnerability functions for structural and non-structural damage, addressing uncertainties and enhancing damage predictions from the 2000 and 2008 earthquakes

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#8

Surface wave analysis for seismic characterization of soil strata in the South Iceland Seimic Zone

Dr. Elín Ásta Ólafsdóttir
Lector, Faculty of Civil and Environmental Engineering, University of Iceland

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The presentation outlines recent developments in the use of surface wave analysis to characterize both simple and 'sandwiched' sediment-lava-sediment soil site stratigraphy in the South Iceland lowland, along with its use in ground response simulations for the local geological and seismic conditions

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#9

Numerical Vulnerability Assessment of RC Wall Damages After Recent Earthquakes in South Iceland

Dr. Ching-Yi Tsai
Research specialist, Faculty of Civil and Environmental Engineering, University of Iceland

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This study aims to develop numerical modelling techniques to investigate the seismic behaviours of reinforced concrete (RC) wall buildings in Iceland after the 2000 South Iceland earthquakes and the 2008 Ölfus earthquake. To validate the model, this study uses experimental data from two identical large-scale RC U-shaped walls subjected to pure flexure and pure torsion. The nonlinear finite element analysis simulations are conducted with OpenSees software

Publication of SERICE results and data

Published research results, articles and data are available at the open SERICE webpage: serice.hi.is which is currently being developed.