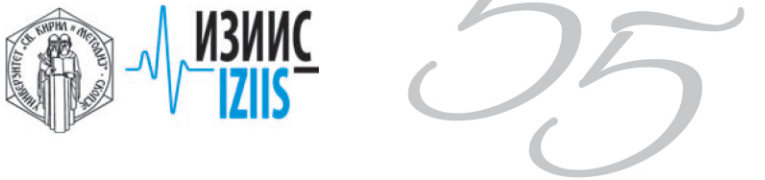
55 years
1965-2020

ИЗИИС 1965
IZIIS 2020

„Ss. Cyril and Methodius“ University in Skopje
Institute of Earthquake Engineering and Engineering Seismology (IZIIS)



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„Ss. Cyril and Methodius" University in Skopje

Institute of Earthquake Engineering and Engineering Seismology (IZIIS)

1965-2020

55 YEARS CONTINUOUS BUILDOUT OF SEISMIC RESILIENT SOCIETY

Prof. Dr. Vlatko Sesov

PREFACE

55 years of existence! A number, which is the synonym of excellence, perfection, the dream of every child, every student, every man. This year, these two digits mark the 55th anniversary of IZIIS. Lots of fives, many great people, many outstanding careers, many excellent Master of Science, many distinguished Doctor of Science, a lot of magnificent scientific projects, many excellent missions have been interwoven in these 55 years of existence of IZIIS. It is not immodest if I say that everything has been marked by excellence.

It is really a great privilege to be Director of IZIIS during such a jubilee. No matter what I write, or how I address this jubilee, it will not be as great as the IZIIS portfolio. In such moments, we need to look through the past that teaches us to understand the present and, what is more important, how to build the future. The beginnings of IZIIS are inseparably linked to the Skopje 1963 earthquake. The tragedy that struck the city of Skopje meant the beginning of one of the most prestigious scientific institutions in European and world frames. On 27 May 1965, in the aftermath of the Skopje earthquake, the University Council of the University in Skopje made a decision on establishment of an Institute for General and Engineering Seismology. The Institute started to develop with limited human resources, but with national and, mainly, international support provided by experts. Despite the modest beginnings, the vision of the first generations of professors, engineers and scientific collaborators contributed, within a very short time, to the growth of IZIIS into a recognizable centre for earthquake engineering and engineering seismology even beyond the boundaries of the then existing country. Then, there followed years of dedicated work, building of own scientific staff, education of generations of Masters and Doctor of Science, building of own capacities representing an excellent basis for successful functioning and further advancement of the Institute. It is this strenuously achieved legacy that represents a great responsibility for all of us that are currently part of IZIIS, to pre-

serve it and enrich it for the future generations. This is an exceptional challenge that we can overcome, in the conditions of our existence, only through joint and team work of the entire collective. In fact, this has been one of the secrets of success in these 55 years, the team morale, the team work of the Institute and the maximum commitment of all employees. The close connection between the scientific investigations and the applicative activities as well as the application of the most recent knowledge in the educational activities are specificities of IZIIS that have been cherished since its establishment and will continue to be upgraded with new contents and ideas.

The complex social conditions, the distorted system of values, the globalization, the climate changes, create daily challenges that we must solve and overcome although they are not our professional priority. We are celebrating this jubilee in conditions of world COVID-19 pandemics that has completely changed not only our living but also working habits. I am sure that we will overcome this crisis with joint efforts and will come out stronger and more determined in building the future of our IZIIS.

The objective of this brief monograph is to mark the 55-th anniversary of IZIIS by presentation of the most recent achievements within the main activities of the Institute, namely the scientific-research, the applicative and the educational activity.

Finally, I would like to express my deepest respect and gratitude to all generations of IZIIS employees who have contributed, throughout these 55 years, to what IZIIS is today – a symbol of science in Macedonia.

Thank you IZIIS

Yours truly,

Prof. Dr. Vlatko Sesov

BEGINNING

The Institute of Earthquake Engineering and Engineering Seismology (formerly, Institute of General and Engineering Seismology) was established within the frames of the University in Skopje (presently, „Ss. Cyril and Methodius" University (UKIM) in Skopje), on 27 May 1965, based on the decision made by the University Council (Decision no. 01-2/1), the recommendation of the International Consultation Board, the decisions of the Government of the Republic of Macedonia and the City of Skopje with UNESCO support.

The initial mandate of the Institute was to supervise and assist the reconstruction and the renewal of the City of Skopje after the catastrophic earthquake of 1963. Long-term goals were continuous investigations in the field of seismology and earthquake engineering, permanent collection and updating of seismological and other relevant data and their implementation in the process of design and planning of the City. The Institute was the first higher education and scientific institution that enabled organized training of civil engineers, architects and planners for the purpose of advancement of planning, design and construction by application of the most recent knowledge in the field of earthquake engineering. It was in this direction that the first regular master and doctoral studies started with considerable support given by foreign professors and experts.

MANDATE

Since its establishment in 1965, the activities of the Institute of Earthquake Engineering and Engineering Seismology (IZIIS) have been directed to disaster risk reduction, i.e., protection of population and material goods, reduction of physical and economic damages and protection of socio-economic systems against earthquakes and other natural disasters. All activities of IZIIS have been in the domain of system preparedness, preparation of a consistent legislation, creation of highly professional human resources and building capacities for a seismic resilient society.

In accordance with the strategic orientation and the mandate of the Institute, its principal spheres of work can be summed up into the following categories:

- **Scientific-research, educational, applicative, developmental and publishing activity in the following fields:**
  - Earthquake engineering;
  - Engineering seismology;
  - Design of seismically resistant structures;
  - Diagnosis, repair, strengthening, reconstruction of existing or earthquake-damaged structures and systems;
  - Development, physical and urban plans for creation of an environment with an acceptable level of seismic risk and special site surveys for detailed urban planning and capital investments;

- Assessment of risks due to the occurrence of geotechnical hazards;
- Dynamic resistance of mechanical, electrical and other technological elements and systems;
- Prevention of earthquake disasters, planning measures for their mitigation and preparedness for their occurrence;
- Development of programmes and strategies for building a seismically resilient society.

- **Assistance to governments and organizations in mitigation of earthquake consequences and recovery process, involving assessment of post-earthquake needs, damage assessments, assessments of physical, functional and economic losses and social effects as well as planning measures and activities for initial response, reconstruction and seismic protection of regions affected by earthquakes.**

- **Development and improvement of technical regulations, standards and procedures for design with a leading role or participation in elaboration of:**
  - Seismic zoning and microzoning studies;
  - Development and improvement of seismic regulations for newly designed structures, repair and strengthening protocols for buildings and engineering structures damaged by earthquakes and related standards, including the European regulations for design of seismically resistant structures;
  - Assistance to the construction industry in the domain of seismic safe design, construction, revision and supervision of important structures and capital investments;
  - Continuous participation, through own experts in different fields (concrete, masonry, steel structures, geotechnics, earthquake engineering) in the work of technical committees in the frames of the Institute for Standardization for the purpose of providing strong support to the process of adoption and implementation of the Eurocodes as national design standards.

- **Laboratory and field investigations aimed at definition of the technical basis for mitigation of the seismic risk referring to application and development of experimental methods and techniques for testing the behaviour of structures exposed to earthquakes, explosions, wind and other static and dynamic loads; field and laboratory experimental testing of structural elements and seismic shaking table tests on physical models of structures and tests on geomodels.**

- **Seismic monitoring and probabilistic assessment:**
  - Strong motion network;
  - Integrated 3D strong motion network;
  - Deterministic and probabilistic seismic hazard, vulnerability and risk assessment.

- **Raising public awareness and improvement of preparedness of the population for action in the case of earthquakes and other disasters through organization of international conferences, numerous training courses and workshops.**

VISION

The future activities of IZIIS will continuously be dedicated to mitigation of risks related to natural disasters through protection of human lives and material goods and reduction of possible damages to social-economic systems caused by earthquakes and other disasters, with the only goal of contributing to building of a seismically resilient society. IZIIS realizes its strategic goals by:

1. Advancement of scientific, educational and applicative activities in the field of earthquake engineering and engineering seismology through integration of knowledge and experience in higher education study programmes for the second and the third cycle of studies as well as through realization of scientific and applicative projects.

2. Contribution to creation of a society ready to manage disasters and mitigate their consequences as well as promotion of policies for building capacities in the field of science, technology and innovations, direct raising of the preparedness level of the population for natural disasters and creation of an environment in which legal regulations will be developed, adopted and implemented to prevent and mitigate the risks reducing them to acceptable ones at national and regional level.

3. Development of cooperation with international academic and scientific communities and organizations, crises management institutions as well as media that will contribute significantly to building a culture of efficient management of natural disasters and their consequences.

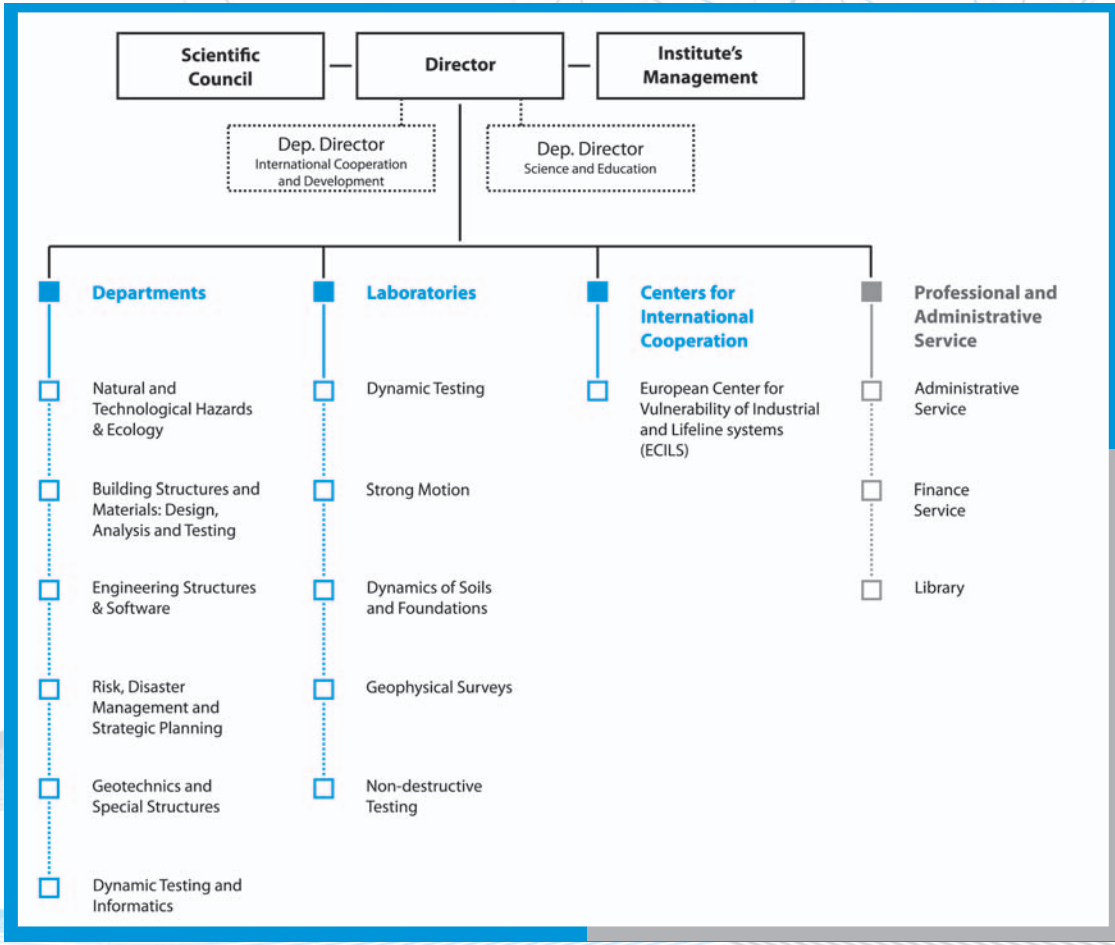
4. Establishment of regional and international partnerships and networks for collection and exchange of data on natural hazards and their direct application in reduction and control of risks.

5. Establishment of regional and international partnerships with the construction industry for direct application of the results from the investigations in the construction sector.

6. Exchange of knowledge and experience among academic and scientific institutions, organization of training courses for researchers and engineers in the field of earthquake engineering and engineering seismology as well as creation of interdisciplinary platforms for advancement of management of disaster risks by participation of researchers dealing with natural, social and other sciences.

ORGANIZATION

The Institute of Earthquake Engineering and Engineering Seismology (IZIIS) is a scientific-research, higher education institution, constitutional unit of the „Ss. Cyril and Methodius" University in Skopje (www.iziis.ukim.edu.mk). It performs higher education activity related to the second and the third cycle of studies, scientific-research and applicative activities in the scientific-research fields of earthquake engineering and engineering seismology as well as in all other scientific fields related to the basic activities of the Institute.



Professional Profile/ Educational Level	Dr.	M.Sc.	B.Sc.	Sec. Edu.	Total	IZIIS Activity
Professors	11				11	Education (20) / Science, application and development (48)
Assoc. Professors	4				4	
Asst. Professors	4				4	
Assistants		12			12	
Scientific Advisors	1				1	
Professional associates		3	3		6	
Professional associates on contractual basis		6	3	1	10	
Administrative and general-technical support		1	3	11	15	Administrative and general-technical activity (25)
Administrative and general-technical support on contractual basis			3	7	10	
Total	20	22	12	19	**73**	Status 28.04.2020

In accordance with the IZIIS' Statute, the basic activity of the Institute is organized through 6 departments, 5 laboratories and 1 centre for international cooperation. The realization of the main activities is supported by the professional and administrative services of the Institute. The Institute is headed by a Director and two deputy Directors through the Institute's bodies: the Scientific Council and the Institute's Management.

IZIIS has 73 employees out of whom 20 represent teaching-scientific staff, 18 account for the collaborators, 15 represent administrative and assisting-technical staff and 20 account for administrative and assisting-technical collaborators engaged on a contractual basis.

DEPARTMENTS

The main activities of the Institute are realized through 6 departments, involving all segments of earthquake engineering and engineering seismology, with development of innovative approaches, methodologies and software solutions:

- **Natural and Technological Hazards & Ecology**

  Domain: Natural and technological hazards, engineering seismology, geophysics and ecology with realization of advanced analytical and experimental investigations.

- **Building Structures and Materials: Design, Analysis and Testing**

  Domain: Design, diagnosis, repair, strengthening and reconstruction of high rises resistant to earthquakes by realization of advanced analytical and experimental investigations.

- **Engineering Structures & Software**

  Domain: Design of earthquake resistant engineering structures by realization of advanced analytical and experimental investigations as well as development of original software packages.

Risk, Disaster Management and Strategic Planning

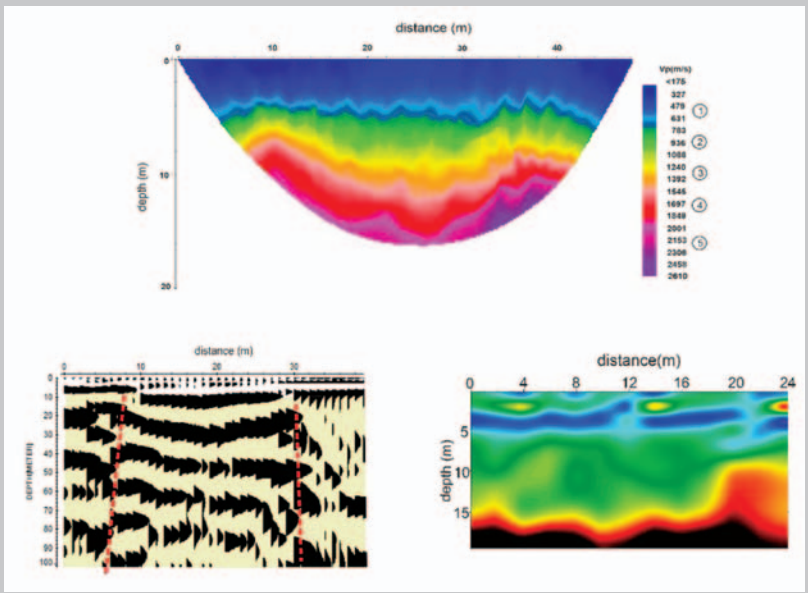
Domain: Seismic hazard and risk, damage and loss assessment, measures for disaster management and strategic planning by realization of advanced analytical and experimental investigations.

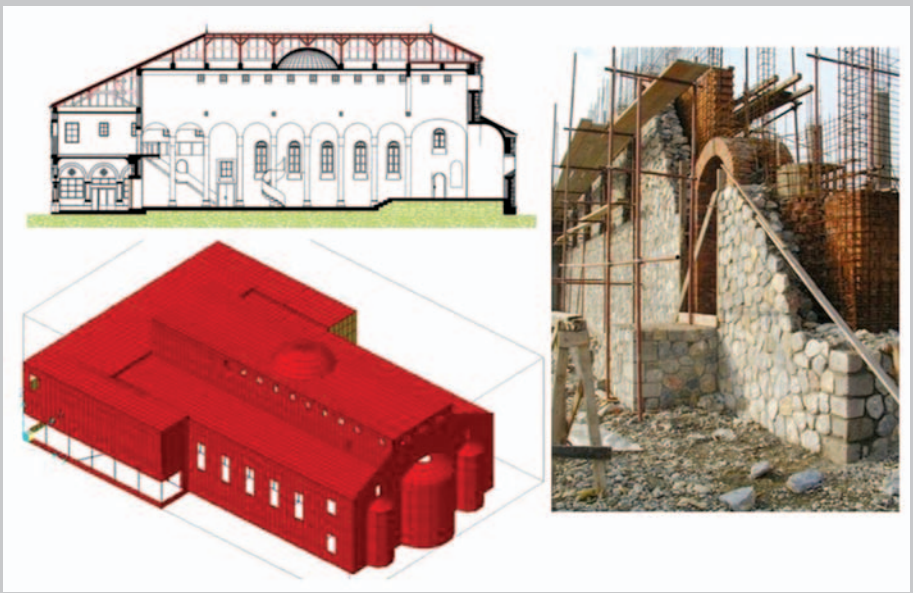
Dynamic Testing and Informatics

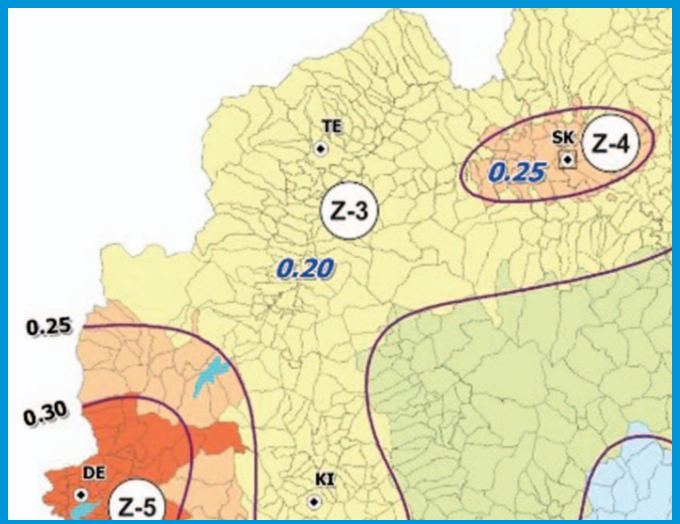
Domain: Dynamics of structures, experimental tests, design of systems for control and monitoring of structures by realization of advanced analytical and experimental investigations as well as development of original software packages.

Geotechnics and Special Structures

Domain: Geotechnical earthquake engineering and design of special structures by realization of advanced analytical and experimental investigations.



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LABORATORIES

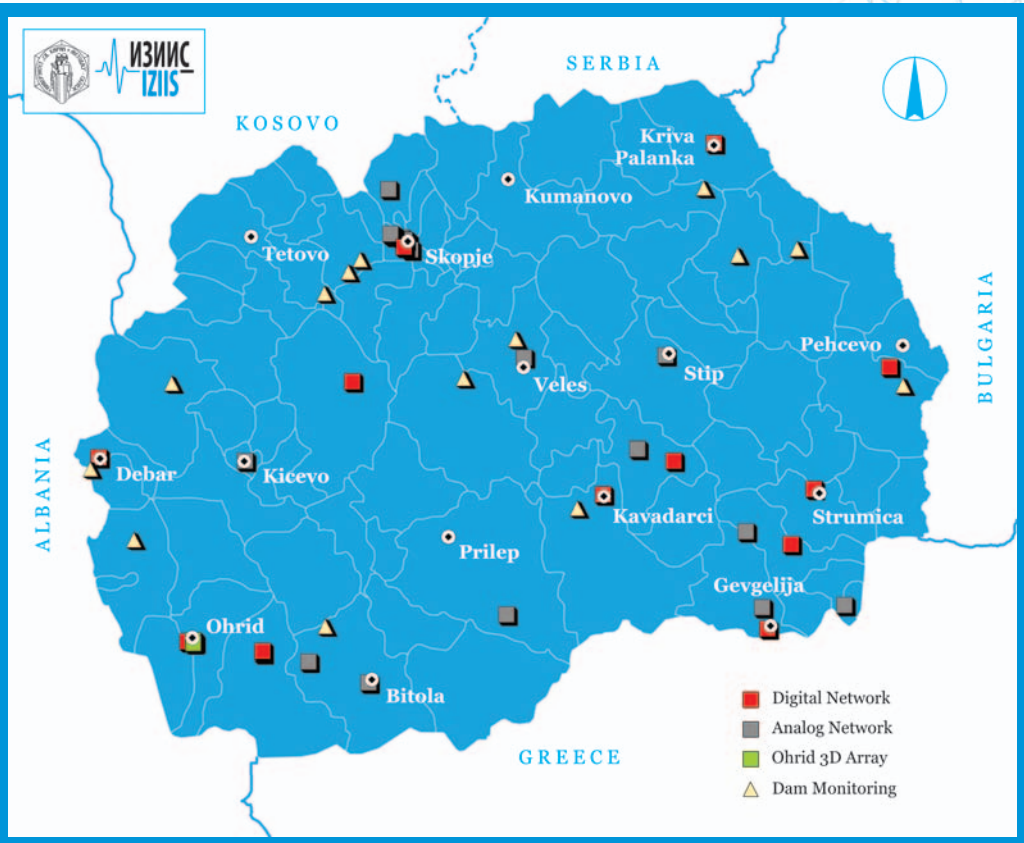
Within the frames of the Institute, there are 5 laboratories in which specific experimental tests and studies are realized in a number of domains of earthquake engineering and engineering seismology:

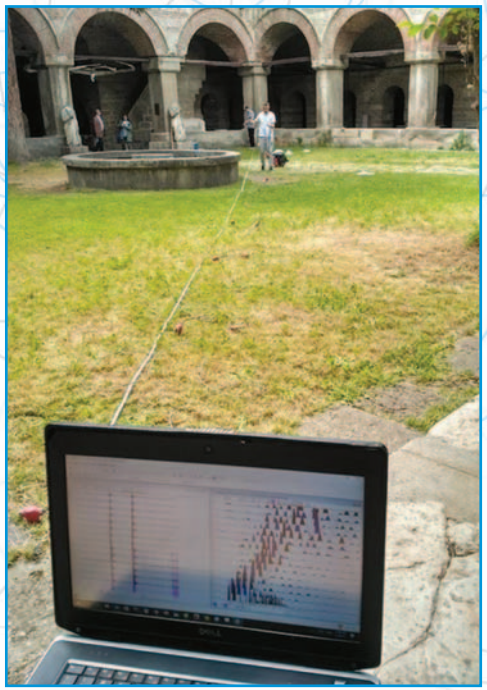
- **Dynamic Testing Laboratory**

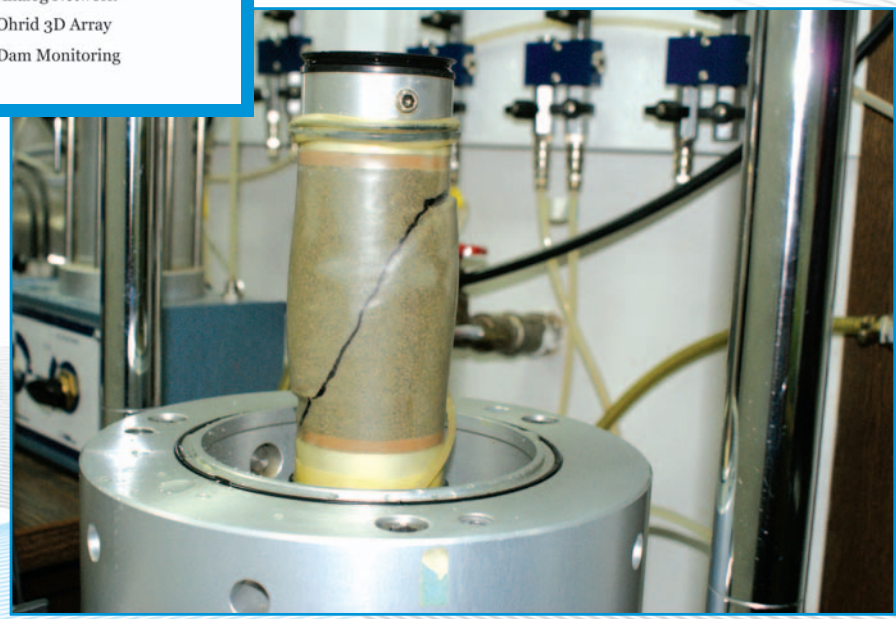
  A five-component seismic shaking table (5x5m); a single-component shaking table; a multi-component system for quasi-static tests of elements, joints, parts of structures and different devices; a material testing frame; equipment for dynamic testing of full scale structures in both ambient vibration conditions and conditions of forced vibrations applied by use of two synchronized generators of harmonic force; sophisticated, modular, digital systems for acquisition and storage of measured physical quantities in laboratory conditions and on field.

- **Strong Motion Laboratory**

  A strong motion network consisting of 126 active accelerometers: 12 digital stations (with 12 accelerometers on bedrock and characteristic soil), 21 analogue stations (with 28 accelerometers on bedrock, characteristic soil and structures), a 3D network in Ohrid (with 16 digital accelerometers placed on selected locations of characteristic soil, structures and in boreholes) and seismic monitoring of dams (by 32 digital and 38 analogue accelerometers on bedrock, characteristic soil and dam bodies).







- **Laboratory for Dynamics of Soils and Foundations**

  A three-axial system for static and dynamic testing; a dynamic cyclic shear testing device; a laminar container for shaking table tests of geo-models.

- **Laboratory for Geophysical Surveys**

  A multi-channel digital system for active and passive seismic surveys; equipment for microtremors, a geo-radar.

- **Laboratory for Non-destructive Testing**

  Equipment for definition of compressive strength of concrete, light concrete, gypsum, mortar and brick; equipment for location of position and diameter of reinforcement and thickness of protective layer; equipment for definition of position and size of fine cracks in concrete and other materials; mobile equipment for microtremors and ambient vibrations; equipment for definition of inclination of structures; equipment for definition of vertical load at specific levels.

CENTRES

In March 1997, a centre entitled European Centre for Vulnerability of Industrial and Lifeline systems (ECILS) was established within IZIIS by a decision made by the Council of the Institute of Earthquake Engineering and Engineering Seismology (IZIIS) (21-891/1 dated 06.03.1997) and support given by the Ministry of Foreign Affairs, the Ministry of Education and Science and the Government of the Republic of Macedonia. By the decision made by the permanent correspondents of the countries-members of EUR-OPA Major Hazard Agreement (23-24.05.1997, Potenza, Italy), ECILS was included in the network of specialized Euro-Mediterranean centres under the Council of Europe's Open Partial Agreement (OPA) for prevention and protection against disasters and assistance in conditions of severe natural and technological hazards (www.coe.int).

The mandate of ECILS complies with the scientific and development policy of IZIIS and also the strategic goals of the EUR-OPA Major Hazard Agreement. Since its existence to date, ECILS has realized numerous activities and projects in the domain of urban risk and vulnerability, natural and technological hazards, improvement of preparedness and response capacities as well as numerous consulting and professional missions and activities.

55 years 1965-2020

MAIN ACTIVITIES

Science

The scientific-research activities of IZIIS are oriented toward finding solutions and definition of bases for seismic risk reduction and the risk pertaining to other natural disasters. In the course of its existence, the Institute has realized a large number of international, bilateral and national scientific-research projects, contributing vastly to building and strengthening of institutional capacities for management of natural risks. During its 55 years of growth, the Institute has been developing and has permanently been maintaining intensive cooperation at international level. IZIIS is one of the leading scientific institutions in the country that has participated in the framework programmes financed by the European Commission since their beginning. As a result of this active participation, the Institute is one of the few members of UKIM that takes the role of coordinator of projects within the programmes of the European Commission. For the last decade, the Institute, as an institution from a partner country, has participated in the realization of 5 projects financed by the European Commission. Noteworthy is also the participation of the Institute in a number of projects financed by NATO within the Science for Peace programme.

So far, IZIIS has successfully realized 6 such projects (3 for the last decade) in cooperation with NATO member countries and partner countries. A large number of bilateral projects with the USA, China, Germany, Turkey, Austria, Bulgaria, Albania, Slovenia, Croatia etc. and a large number of national scientific-research projects financed by the Ministry of Education and Science of the Republic of N. Macedonia and the „Ss. Cyril and Methodius" University in Skopje have also been realized.

List of referent scientific-research projects realized in the period 2010-2020:

Projects financed by the European Commission:

- *Transnational Network of National Contact Points (NCP_WIDENET); 2015-2020 (H2020, WIDESPREAD programme).*
- *Increased Resilience of Critical Infrastructure to Natural and Human-induced Hazards (INFRA-NAT); 2018-2019 (EC DG-ECHO programme).*
- *Seismology and Earthquake Engineering Research Infrastructure Alliance for Europe – SERA: WP14, TA7: Access to DYNLAB Shaking Table at IZIIS; 2016-2017 (H2020 programme).*
- *Seismic Engineering Research Infrastructures for European Synergies (SERIES); 2009-2013 (FP7 programme).*
- *Upgrading of Research Equipment for Dynamic Testing of Large-scale Models (UREDITEME), 2009-2011 (FP7 programme).*

Projects financed within the NATO „Science for Peace" programme:

- *Improvements of the Harmonized Seismic Hazard Maps for the Western Balkan Countries (BSHAP-2), NATO SpS 984374; 2012-2015.*
- *Seismic Upgrading of Bridges in South East Europe by Innovative Technologies, NATO SpS-983828; 2010-2013.*
- *Harmonization of Seismic Hazard Maps for the Western Balkan Countries (BSHAP-1), NATO SpS-983054; 2007-2011.*

Projects financed within the COST programme:

- *Advancing Effective Institutional Models towards Cohesive Teaching, Learning, Research and Writing Development, no15221; 2016-2020.*
- *Underground Built Heritage as Catalyzer for Community Valorization, no 18110; 2019-2023.*
- *The Soil Science & Archaeo-Geophysics Alliance: Going Beyond Prospection, Action SAGA-CA 17131; 2018-2022.*
- *Smart Energy Regions (ESF Project), TU_1104; 2012-2016.*
- *Impact of Climate Change on Engineered Slopes for Infrastructure, Action TU1202; 2013-2016.*
- *Assessment, Reinforcement and Monitoring of Timber Structures (FP1101); 2011-2016.*
- *Urban Habitat Constructions under Catastrophic Events; 2007-2010.*

Bilateral projects financed by the Ministry of Education and Science of the Republic of N. Macedonia:

- *Development of New Methodology for Assessment of Natural Catastrophes such as Liquefaction Risk Mitigation; 2018-2020 (Bilateral project with Austria).*
- *Study on Supporting Structures for Earthquake Emergency Rescue; 2018-2019 (Bilateral project with P.R. China).*
- *Development of Seismic Resilient Precast Cladding Systems; 2017-2018 (Bilateral project with Slovenia).*
- *Study on Strong Ground Motion Simulation for Structural Seismic Analysis; 2016-2017 (Bilateral project with P. R. China).*
- *Behavior of Tall Buildings under Seismic and Wind Force; 2016-2017 (Bilateral project with P. R. China).*
- *Vulnerability Assessment of RC Structures Including Soil Flexibility; 2014-2015 (Bilateral project with P. R. China).*
- *Neo-deterministic Seismic Hazard Analysis; 2011-2013 (Bilateral project with P. R. China).*
- *Seismic Resistance of Timber-Structural Glass Systems with Optimal Energy Dissipation; 2010-2012 (Bilateral project with Croatia).*
- *Development and Application of Seismic Base-Isolation System for Reservoirs and Buildings Based on the Concept of »Floating-Sliding« Structure (ALSC); 2010-2012 (Bilateral project with Slovenia).*
- *Seismic Safety of Precast Industrial Buildings; 2010-2011 (Bilateral project with Slovenia).*
- *Harmonization of the Shaking Table Testing Procedure for Medium and Large Scale Models; 2009-2012 (Bilateral project with Turkey).*
- *Reduction of Liquefaction Hazard in Urban Areas - New Developments; 2009–2011 (Bilateral project with P. R. China).*

Scientific projects financed by the „Ss. Cyril and Methodius" University in Skopje:

- *Methodology for Prediction of Behavior of Reinforced Concrete Bridges under Serviceability and Seismic Loads Using Experimental and Analytical Approach; 2020.*
- *Method for Using of Experimentally Defined Sets of Modal Parameters for the Prediction of the Response of Building Structures under Seismic Excitation and Potential for Damage Detection; 2019.*

- *Conceptualization and Establishment of an Integrated Harmonized Database of Accelerograms Recorded in the Period 1975-2016 of the Analogue (SMA-1) and the Digital (GURALP CMG-5TD /TC) UKIM - IZIIS Strong Motion Networks; 2018.*
- *Advanced Methods for Liquefaction Hazard; 2017.*
- *Definition of Unified Approach for Processing of Strong Ground Motion Records and Suitable Corrective Techniques; 2016.*
- *Optimal Damper Placement in Steel Frame Structures; 2015.*
- *Development of Constitutive Model for Vertical Construction Joints at Arch Dams; 2014.*
- *Displacement Calculation Based on Real-time Recorded Accelerations; 2013.*
- *Methodology and Experiences in Repair and Strengthening of Buildings in Republic of Macedonia According to the Requirements of EUROCODE8; 2012.*

Scientific-research projects financed by other sources:

- *Experimental Verification of Innovative Technique for Seismic Retrofitting of Masonry with Mortar Repointing (STREP); 2019-2020 (financed by UKIM-IZIIS, UKIM-GF and ADING).*
- *Development of Numerical Models for Reinforced-Concrete and Stone Masonry Structures under Seismic Loading Based on Discrete Cracks; 2015-2018 (financed by the Croatian Science Foundation).*
- *Frame – Masonry Composites for Modeling and Standardizations (Framed – Masonry- FRAMA); 2014-2015 (financed by the Croatian Ministry of Science).*
- *Experimental Verification of Innovative Technique for Seismic Retrofitting of Traditional Masonry Buildings; 2012-2013 (financed by RÖFIX AG, member of FIXIT GRUPPE, Austria).*
- *Unified Seismic Hazard Mapping for the Territory of Romania, Bulgaria, Serbia and Republic of Macedonia; 2009-2010 (financed by CEI).*

For the period since 2010, the IZIIS scientific staff can boast about a fruitful publishing activity with over 50 papers published in journals with an impact factor, more than 120 papers published in other scientific journals, over 1000 papers published and presented at international and national conferences as well as published books and chapters in books.

Education

It has been already for 55 years that the Institute of Earthquake Engineering and Engineering Seismology (IZIIS) as a unit within the „Ss. Cyril and Methodius" University in Skopje has been educating staff from the country and abroad in the fields connected with development and advancement of a modern technology for control and reduction of the seismic risk. Today, IZIIS can rightfully be proud of the fact that the first master studies in the Republic of N. Macedonia were organized and realized exactly by IZIIS in 1965. The studies of this type were the first in Europe.

Today, the Institute represents an internationally recognized and respected scientific institution that is unique in this field in the region. An institution in which young scientific staff is continuously educated in specific and complex fields as are earthquake engineering and engineering seismology. These scientific fields integrate within themselves a wide spectrum of engineering sub-fields as are structural engineering, design of seismically safe and stable structures (buildings, bridges, dams, infrastructural systems, special structures), specific problems in geotechnical engineering, seismic hazard assessment, preparedness for management of earthquake disasters and alike. The study programmes for the second and the third cycle of studies that are realized by IZIIS are designed based on own experience and the experience of other universities worldwide, particularly the experi-

ence of the countries with developed earthquake engineering and offer to the young scientific-research staff responses and solutions in these complex areas, creating at the same time the basis for their future advancement.

The master and doctoral studies at IZIIS are accredited and are completely realized in Macedonian and English language.

The Institute of Earthquake Engineering and Engineering Seismology also continuously holds training courses, seminars and other training courses adapted to various target groups.

Master Studies (Second Cycle)

The accredited master studies cover two fields:

- Structural Engineering and Seismic Design
- Earthquake Engineering

The study programmes of the second cycle (a total of six) are completely harmonized with the provisions of the Bologna declaration and the ECTS rules and consist of obligatory and optional subjects. The time duration of the study is different, namely, two, three and four semesters for the purpose of responding to the needs of students that come with different number of credits acquired during their previous education. Upon accomplishment of the studies, the students acquire the title of Master of Science in Earthquake Engineering and, depending on the time duration of the studies, they acquire 60, 90 or 120 credits, respectively. Within the frames of the educative activities related to the second cycle of studies, the title of master of science has so far been conferred upon 208 students.

Doctoral Studies (Third Cycle)

The accredited doctoral studies are in the field of earthquake engineering and are realized under the mentorship of accredited university professors, proved experts in their field.

The programme of the doctoral studies is compliant with the Bologna declaration and the ECTS rules and is carried out within the frames of the integrated School of Doctoral Studies at "Ss. Cyril and Methodius" University. Doctoral studies at IZIIS last 3 years (6 semesters) as follows: I year – attendance and passing of lecturing subjects; II and III year – preparation and application for doctoral dissertation – research, publication of results, writing and defense of doctoral thesis, accompanied by participation in doctoral seminars, annual conferences and workshops. Upon accomplishment of the studies, the student is conferred the title of Doctor of Technical Sciences in Earthquake Engineering and acquires 180 credits. Within the frames of the educational activity related to the third cycle, 55 students have acquired this title so far.

In addition to the lecturing process, the students are also actively involved in ongoing scientific-research projects and are motivated for realization of international mobility, participation in summer schools, training courses, workshops and alike. For the purpose of providing continuous support and creating new staff in the earthquake engineering field, it has been for years that the Institute has been awarding fellowships to the best enrolled students in the form of exemption from payment of the prescribed tuition fee.

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Training Courses and Training

In 1982, within the frames of the bilateral scientific and technological cooperation between the government of the former Yugoslavia and the government of the Royal Netherlands, IZIIS started the first international course intended for upgrading of the professional knowledge of civil engineers from the developing countries recognizable on a world scale under the abbreviated title CADAC (Course on Aseismic Design and Construction). This course was supported by the Department for International Education at the Ministry of Foreign Affairs of the Royal Netherlands, the Ministry of Education and Science of the Republic of Macedonia, IZIIS and the Council of Europe. During 26 years of its existence, 520 participants from 72 developing countries from South America, Asia, Africa and Europe were trained. In this way, the participants in the CADAC programme became part of the world network of missionaries contributing to the increase of the seismic stability and development of their countries. Today, most of them are eminent members of the academic society, highly respected professionals and national authorities and ambassadors of IZIIS throughout the world. The UNDP office in Skopje understood the importance of this programme and accorded recognition to the CADAC course as extraordinary, efficient and internationally recognized instrument that promoted the culture of prevention of risks, reduction and mitigation of consequences of disasters in developing countries.

In addition to the courses lasting several months, IZIIS also organizes other different training programmes, education and training courses intended for interested groups, in thematic areas of the earthquake engineering and engineering seismology field.

Applicative Activity

The Institute has continuously been applying knowledge from its scientific-research activity in the professional engineering practice of design and construction of modern earthquake resistant structures. With its engagements, expert and consulting services, IZIIS has considerably been present in our country and on the international market (The United Arab Emirates, Canada, Turkey, Austria, Germany, Great Britain, etc.). The engagements are most frequently related to the following fields:

- Regional and micro seismic hazard studies;
- Studies for analysis and processing of strong motion records, design and maintenance of networks;
- Geophysical surveys for soil characterization by application of different methods;
- Microzoning and definition of the seismic potential of sites with definition of seismic design parameters;
- Analysis of geotechnical hazards, landslides, excavations, underground water level variations, liquefaction susceptibility, etc.;
- Design of new structures of special importance, seismic safety and security, rehabilitation, re-use of a structures for other purposes, building of additional storeys, reconstruction or strengthening of existing structures that necessitates a number of previous experimental, laboratory and field studies and subsequent profound analyses of their behaviour during earthquakes;
- Design and analysis of RC and steel structures: bridges, dams, industrial halls, silos, chimneys, different energetic structures, specific tall structures, etc.;
- Investigations of seismic isolation systems applicable for seismic isolation of new and revitalization of existing bridge structures;
- Testing of bridge structures by trial loads;
- Diagnosis, strengthening and reconstruction of engineering structures;
- Experimental studies for seismic qualification, testing of new materials and methodologies for seismic strengthening of structures;
- Experimental investigations for verification and calibration of newly developed sophisticated numerical models for different types of structures;
- Testing and engineering application of new technologies for management of structural response to earthquakes and other dynamic effects for the purpose of construction of modern and safer structures;
- Integration of protection of cultural heritage in national and regional programmes within policies for reduction of consequences of natural disasters;
- Seismic monitoring of structures (dams, bridges, tall buildings, etc.) for providing data on structural response and verification of seismic parameters;
- Regional and detailed studies of seismic vulnerability and risk;
- Recommendations for planning, design and construction in seismically active regions, protection against natural and technological disasters, preparation and improvement of technical regulations, standards and codes for seismic design of structures.

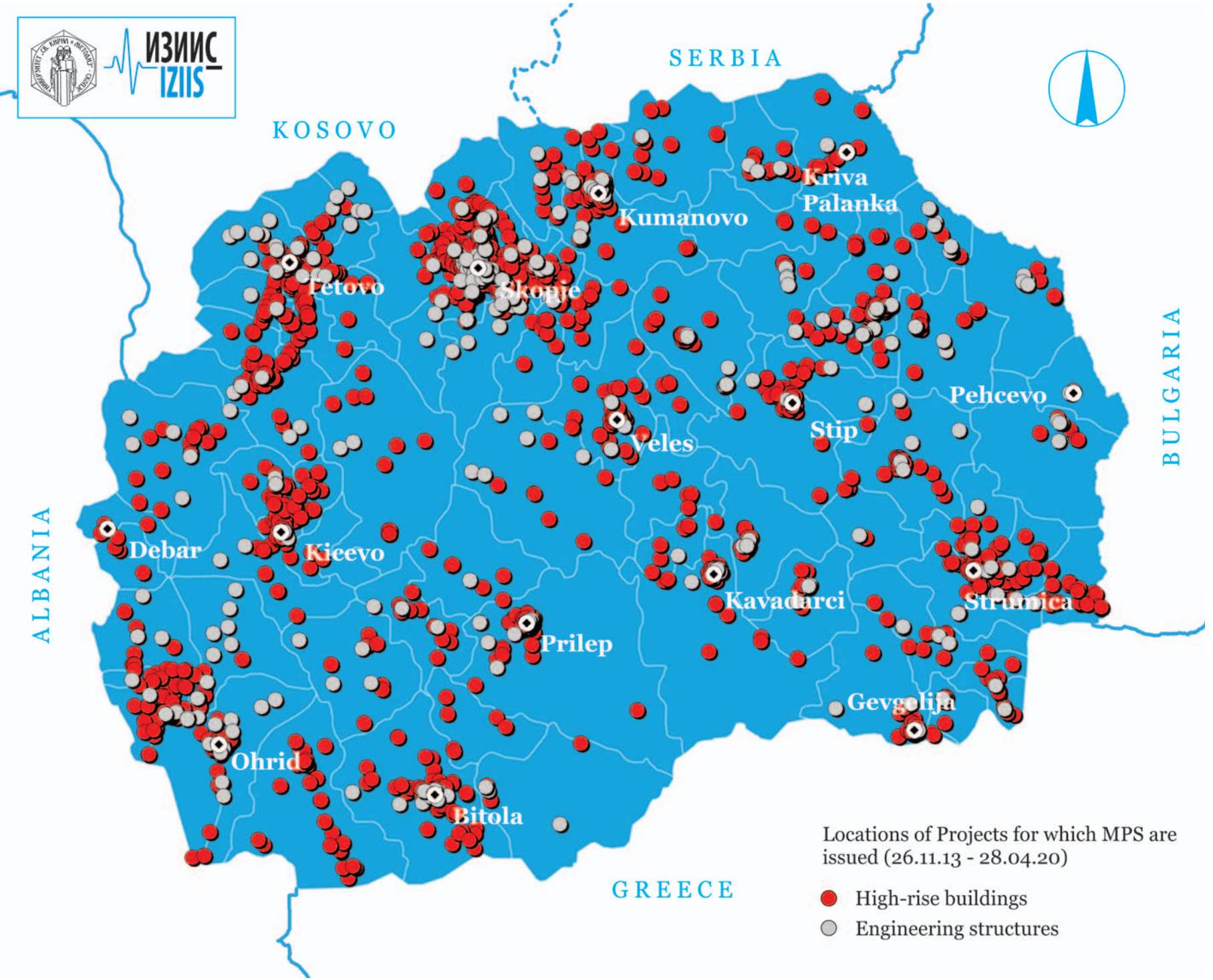
Since 2010, IZIIS has realized over 600 applicative projects, a large number of which representing engineering challenges at national, regional and international level. The fruitful cooperation with domestic and in particular with large international companies like *Limak, Max Aicher, Cevahir, Lindner, Siemens, Kinemetrics, Rade Koncar, TAV, Put Inzenjering, Irgo, Arup, Gerb, Rofix, Johnson Matthey, IDOM,* etc. confirms the international reputation of IZIIS as a proven and respectable partner.

55 years 1965-2020

LEGISLATIVE COMPETENCES

In accordance with the Law on Modification and Amendment of the Law on Construction (Official Gazette of RM no. 163 dated 26.11.2013), each structure in the Republic of N. Macedonia should be designed and constructed in such a way that it will suffer no disturbance of its mechanical resistance, stability and seismic protection in the course of its serviceability (Article 4).

As a confirmation of its continuous commitments to develop a seismic resilient society, IZIIS acquired a legal competence to control structures in the phase of design and in the course of construction of their bearing structures. Based on these modifications of the Law on Construction dating back to the end of 2013, IZIIS has continuously been receiving requirements, has been controlling submitted design documentation, has been performing field inspection and inspection of built structures, has been defining whether the constructed structures are compliant with the submitted design documentation and has been issuing Opinions on designed and as-built level of mechanical resistance and seismic protection. This complex process is realized through an integrated web-based system tailored by own staff that is the first of this kind in the region and beyond (www.msz.iziis.ukim.edu.mk). From the beginning of effectiveness of this Law until May 2020, IZIIS issued over 17.000 opinions, being one of the key actors of control of the national seismic risk.


ИЗИИС
IZIIS
SERBIA
KOSOVO
ALBANIA
BULGARIA
GREECE
Kriva Palanka
Kumanovo
Tetovo
Skopje
Pehcevo
Stip
Veles
Debar
Kicevo
Kavadarci
Strumica
Prilep
Gevgelija
Ohrid
Bitola
Locations of Projects for which MPS are issued (26.11.13 - 28.04.20)
High-rise buildings
Engineering structures

COOPERATION

In the course of the past 55 years, the Institute has continuously been cooperating with numerous institutions and universities at national and international level. This has confirmed one of the basic principles of IZIIS regarding permanent promotion and upgrading of the scientific-research and educational capacities. IZIIS is part of the programmes for exchange and mobility of academic staff and students (ERASMUS, TEMPUS, DAAD), realizing cooperation involving multi-disciplinary contents with the only goal of building a seismically resilient society for the present and future generations.

It is only for the period since 2016 that 16 new memorandums of cooperation have been concluded with:

- Faculty of Geotechnical Engineering in Varazdin, University of Zagreb, Croatia (2016).
- Faculty of Civil Engineering, University of Montenegro, Podgorica, Montenegro (2017).
- Macedonian Association for Geotechnics (2017).
- Construction Chamber of Commerce within the Macedonian Chambers of Commerce (2018).
- Faculty of Technical Sciences, University in Novi Sad, Serbia (2018).
- Max Aicher Engineering GmbH, Freilassing, Germany (2018).
- Institute for Geodynamics, National Observatory in Athens, Greece (2018).
- Civil Engineering Faculty, University of Architecture, Civil Engineering and Geodesy – Sofia, Bulgaria (2018).
- Geological Survey of the R. N. Macedonia (2019).
- Public Enterprise for State Roads (2019).
- Faculty of Civil Engineering, University of Mostar, Bosnia and Herzegovina (2019).
- Faculty of Civil Engineering, Architecture and Geodesy, University of Split, Croatia (2019).
- Public Enterprise Kumanovo Plan, Kumanovo municipality (2020).
- Within the frames of the ERASMUS programme, memorandums for cooperation were concluded with:

- University of Pavia, Italy (2016)
- University of Bari, Italy (2019)
- Patras University, Greece (2019)

IZIIS initiated the signing of an agreement for cooperation between the University of Pavia, Italy and the „Ss. Cyril and Methodius" University in Skopje.

The Institute is currently in the last phase of officialization of the high recognition awarded by UNESCO, namely designation of IZIIS as category 2 Institute under the auspices of UNESCO.

MEMBERSHIPS

In the course of its existence and today, the Institute has been and is member of a large number of bodies, organizations and associations, contributing to the strengthening of capacities in different segments of science and practice at national and world level. At the moment, the Institute is member or is actively contributing to the work of:

- *Crises Management Centre, Government of the R. N. Macedonia*
- *Protection and Rescue Directorate, Government of the R. N. Macedonia*
- *Standardization Institute of the R. N. Macedonia*
- *Macedonian Association for Earthquake Engineering (member of the European and World Association for Earthquake Engineering)*
- *Macedonian Association of Structural Engineers*
- *Macedonian Association for Geotechnics*
- *Macedonian Committee on Large Dams (MACOLD)*
- *National Committee of ICOMOS - Macedonia*
- *European Facilities for Earthquake Hazard and Risk (EFEHR)*
- *CEN TC250 Structural Eurocodes (national delegate from IZIIS)*

SOCIAL RESPONSIBILITY AND PROMOTIONAL ACTIVITIES FOR RAISING PUBLIC AWARENESS

The concept of social responsibility and raising of public awareness has been an imperative for the Institute in the course of its long years of existence. Education and raising of public awareness about the devastating consequences and management of earthquakes are cross-linked components whose key elements have rested upon existence of a common approach and mutual cooperation of many institutions over the past years. For that purpose, with its experience and knowledge, IZIIS has realized activities and training courses within the frames of primary and secondary schools in the country as one of the most important target categories. Numerous training courses have also been realized for the employees of different organizations and diplomatic representative offices.

IZIIS has continuously supported the exchange of knowledge and experience by organization of national and international conferences. Noteworthy among the international conferences that have been held for the last 10 years with large participation of international renowned and reputed European and world experts in the field are:

- **14ECEE – 14th** European Conference on Earthquake Engineering (30.08-03.09, 2010, Ohrid)
- **SE-50EEE** – International Conference on Earthquake Engineering to mark 50 years since the catastrophic Skopje earthquake of 1963 (29-31.05.2013, Skopje)
- **IZIIS-50** – International Conference on Earthquake Engineering and Engineering Seismology on the occasion of 50 years since the establishment of IZIIS (12-16.05.2015)

With its teams for expert assistance for damage assessments after strong earthquakes, the Institute has participated in many missions after earthquakes that have occurred worldwide, contributing to the overcoming of the consequences with its proved preparedness and expertise. In the course of existence of the Institute, such expert missions were realized in former Yugoslavia (Banja Luka 1969, Montenegro 1979, Kopaonik 1980, Knin 1986), in Macedonia (Gevgelija 1990, Bitola 1994, Skopje 2016, Ohrid 2017) and also beyond the country (Algeria 1980, Mexico 1985, Armenia 1988, Iran 1996, Turkey 1999, Pakistan 2005, Italy 2009 and 2016, Albania 2019).

REWARDS AND RECOGNITIONS

For its achievements and efforts toward developing of a seismic resilient society and successful cooperation with different institutions, organizations and companies in the course of its existence, the Institute has received numerous awards, recognitions and certificates of merit noteworthy among which are the following:

- November award of the city of Skopje for results achieved in reconstruction of Skopje (1968);
- 11 October award as the highest social recognition for particularly important achievements in the sciences of interest for the country (1974);
- The Anti-Fascist Council for the National Liberation of Yugoslavia (AVNOJ) award as an extraordinary social recognition for creation and work of general importance for the development of technical sciences in the country (1982);
- National award „19 September" awarded to the Institute by Mexico for its contribution to solidarity after the earthquakes of 19 and 20 September 1985 (1985);
- Order of merit for Macedonia (2015).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