

**OUTPUT 2.2:
ACTION PLAN
FOR BAČKA REGION**

WPT2 – Establishing the ADRISEISMIC methodology for the reduction of seismic vulnerability

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Description of the deliverable (3-5 lines)	The output includes the description of the methodology adopted for the design and adoption of the Action Plans. The Action plan for the Region of Bačka is presented.
Key words	Action plan; seismic vulnerability reduction; cultural heritage monuments; historic urban centres

Document history

NAME	DATE	VERSION	DESCRIPTION
Action Plan – deliverable template	20/12/2021	0.1	Table of Contents drafted and explained to PPs
First draft	15/07/2022	0.2	Draft of the action plan submitted to the LP for review
Advanced draft	15/10/2022	0.3	Updated draft prepared based on the received comments
Final version	05/12/2022	1.0	Final version of the deliverable

Definitions & Acronyms

Acronym	Full name
CA	Consortium Agreement
PP	Project Partner
LP	Lead Partner
WPT	Technical Work Package
PSK	Provincial Secretariat for Culture, Public Information and Relations with Religious Communities, Government of AP Vojvodina
PZZZSK	Provincial Institute for the protection of cultural monuments for Vojvodina in Novi Sad
SUZI-SAEE	Serbian Association for Earthquake Engineering
ZZSKGNS	Institute for the protection of cultural monuments of the City of Novi Sad

Executive summary

Earthquakes severely threaten the Adriatic-Ionian region. Each nation has created policies, guidelines, tools, and knowledge to address earthquake risks and lessen the built environment's seismic vulnerability. However, they continue to be high in metropolitan regions, especially in historical centers.

An earthquake is a natural disaster brought on by a natural occurrence and is likely the main factor in human fatalities and material object destruction. Disasters with a swift onset, frequent occurrence, and no previous warning are brought on by earthquakes. The preservation of cultural heritage and the sustainable development of the historical-socio-economic core of the settlements, therefore, suggest that the protection of cultural assets of historic urban centers is required and essential.

The Regional Action Plan is the result of the effort done to share information with local stakeholders and highlight best practices through four rounds of local workshops. Based on their knowledge, the participants engaged in a thorough conversation and offered helpful comments, proposals, and counsel. Additionally, workshop attendees acknowledged a high level of satisfaction with the demonstrated techniques and newly given material. All of the feedback will be used as motivation to improve methods for addressing and securing the decrease of seismic vulnerability of the Region of Crete's historic centers and historic settlements

The goal of this Regional Action Plan is to compile information already available and feedback from community workshops into concrete steps that will effectively protect, and conserve cultural items located in the Region of Bačka ancient urban areas. To address the protection and preservation of cultural heritage in times of crisis through an integrated approach, it is crucial that all stakeholders continuously communicate with one another and work together during the activities' definition, implementation, and subsequent monitoring of implementation.

The Regional Action Plan is the outcome of the work done on transferring the knowledge and highlighting good practices to local stakeholders achieved through four series of local workshops. Based on their expertise, the stakeholders engaged in a substantive discussion providing invaluable suggestions, proposals and advice. Stakeholders expressed their satisfaction about the displayed methods and presented content of the workshop.

1 Introduction and methodology

The ADRION area is heavily subject to natural hazards and Europe, in particular, is the area with the highest seismic vulnerability. It is due not only to the severity of earthquake events, but also to the high level of exposure and to the important value of the Cultural and Natural Heritage, confirmed by a large number of UNESCO World Heritage Sites and UNESCO Geoparks. When it comes to the seismic vulnerability assessment and risk management, the area lacks homogeneous and comparable normative and policies as well as shared methods for the expeditious assessment of buildings. In addition, the skills and knowledge of all the actors involved in the seismic retrofitting process are not enough detailed and comprehensive to face the complexity of the thematic. Facing all these challenges is in general important in order to tackle seismic vulnerability, but it is especially urgent if the focus is about cultural heritage and historic centres since these areas are particularly prone to seismic risk and, at the same time, they are the socio-economic cores and symbols of identity of the ADRION area.

Given all the considerations above, ADRISEISMIC project aims at developing new integrated approaches to innovate and harmonize the normative, technical and training frameworks in the ADRION area, providing ready-to-use methods, tools and procedures that will be integrated into the existing policies and practices, thus strengthening local responses and reducing vulnerability to natural hazards.

Within WPT1, relevant seismic norms, urban planning laws, building regulations, incentives, post-earthquake planning, and insurances policies have been collected in the six countries partner of the project and analysed in depth (Activity T1.1). The detailed knowledge has been systematized in order to identify good practices for reducing seismic vulnerability and enhancing resilience of historic areas. Good practices have been described through a factsheet with the aim to describe it in detail and let all the partners understand whether and how it is possible to replicate the good practices in their countries.

Besides the work carried out in WPT1, in the second WPT (Activity T2.2) the ADRISEISMIC expeditious assessment methodology has been developed for both masonry and reinforced concrete buildings. The two factsheets have been conceived to be compiled by a technician in less than ten minutes after the collection of the basic information necessary for the assessment of the building.

In WPT3 efforts have been made to improve the knowledge and skills of all the actors involved in the seismic retrofitting process and three training packages have been developed addressing the target groups of practitioners, building workers and civil servants. A toolkit for volunteers has been also conceived and developed. In fact, in the initial part of the project a lack of targeted training courses has been detected in all the project partners countries.

All the above-mentioned activities generate knowledge at project level. A first step towards the tailorization of the general knowledge to the various local context is represented by the roadmaps. These are strategic documents conceived within the activity T1.2.2 as a step-by-step procedure to undertake in order to improve the seismic norms, urban planning laws, building regulations, post-earthquake planning documents and procedures, incentives and insurance framework in respect to seismic vulnerability of the built environment and historical centres. Each country involved in the project has drafted its own roadmap, besides the institutional role of the representing partners (e.g. public authorities, higher education, private companies) aiming at identifying a strategic pathway to increase its resilience towards the seismic risk.

A further step is then undertaken by local and regional authorities involved in the consortium. They have the role to embed it in their policy instruments some of the project results, establishing priorities among the possible actions and based on the specific territorial needs. To this aim, the Municipality of Gjirokastrer and the City of Kaštela developed a local action plan, while the Region of Crete and the RDA Bačka are responsible for the action plan at regional scale.

Action plans represent instruments for public authorities to clearly define and explain the way to integrate and adapt some of the promising good practices and/or the new expeditious seismic vulnerability assessment methodology into the current local practices, thus enhancing their replicability and scalability in the Countries involved in the project but also beyond. The structure of the action plans reflects a process to be followed by municipalities and regions in order to identify priorities among all the possible strategies identified at project level to increase the resilience of the historical areas and provide as much details as possible in this regard. In this way it is possible to verify the effective concreteness and feasibility of the actions selected by the authorities in charge of the implementation. The methodology also foresees a series of local workshops to involve key stakeholders to take decisions on what to insert in the action plan.

The process starts from the identification of the territorial context and the specific needs of the region/municipality, followed by the presentation of the overall and specific objectives of the plan. A specific chapter has been then dedicated to the identification of the key stakeholders that was involved in the above-mentioned workshops and their specific role in the process. The last part of the document is about the description of the specific actions identified as priority to improve resilience of historical areas while reducing the vulnerability of the existing assets, together with the timeframe of implementation and the identification of possible risks and the corresponding mitigation actions to undertake. Each measure is described in detail, starting from the identification of specific objectives and specific activities foreseen for the implementation, the timeframe, main stakeholders to involve and beneficiaries of the action. Attention is also paid to the means for monitoring of the implementation phase.

In the following chapters the action plan for the Bačka Region is presented.

2 Territorial context

Bačka is a geographical and historical area located within the Pannonian Plain bordering the Danube River to the west and south, and the river Tisa (Tisza in Hungarian) to the east. The territory of Bačka is divided between Serbia and Hungary. Most of the area is located within the Vojvodina region in Serbia. The smaller northern part of the geographical area is located within Bács-Kiskun County in Hungary. Novi Sad, the capital of the Autonomous Province of Vojvodina, is located on the banks of the Danube, at the border between Bačka and Syrmia. According to the 2011 Census of Serbia¹, the population of Serbia was 7.186.862, while the total population of Bačka was 1.025.315 (approximately 14.3% of the total population of Serbia). The Bačka region has been divided into South Bačka, West Bačka, and North Bačka. The total area of Bačka is 8.218 km², that is, approximately 10.6% of the territory of the Republic of Serbia (equal to 77.474 km² – excluding Kosovo). Agricultural land within the Bačka region, particularly in its southern part, is considered among the most fertile in Europe. The population is primarily engaged in agriculture. Figure 1 shows a map of Serbia, showing Vojvodina (shaded in orange) and the Danube and Tisa rivers. Note that the Bačka region is located in the north-west part of Vojvodina.

¹ <https://www.stat.gov.rs>



Figure 1: Map of the Republic of Serbia and neighbouring countries, including Hungary²

2.1 Region factsheet

Geography, economy, and demographics

Most of the territory and a vast majority of the population of Bačka is part of Serbia's Autonomous Province of Vojvodina. It should be noted that the Republic of Serbia has been divided into 25 administrative districts, out of which 7 districts are located in Vojvodina, including South Bačka, West Bačka, and North Bačka. According to the 2011 Census of Serbia, the total population of South Bačka (capital Novi Sad), West Bačka (capital Sombor), and North Bačka (capital Subotica) was 1.025.315. Ethnic structure of the population is diverse and includes Serbs (56.59%), Hungarians (18.83%), Croats (3.21%), and other ethnic groups. Figure 2 shows a map of the Republic of Serbia and its administrative districts, including South Bačka, West Bačka, and North Bačka.

² <https://geology.com/world/serbia-satellite-image.shtml>



Figure 2: Map of Serbia showing administrative districts (Bačka’s border shown in blue)³

South Bačka administrative district includes 12 local self-governments (City of Novi Sad, Bač, Bačka Palanka, Bački Petrovac, Beočin, Bečej, Sremski Karlovci, Srbobran, Vrbas, Žabalj, Titel, and Temerin), and its population was 639.833 (based on the 2011 Census). West Bačka includes 4 local self-governments (City of Sombor, Apatin, Kula and Odžaci) and has the population of 193.467, while the North Bačka administrative district includes 3 local self-governments (City of Subotica, Mali Idoš and Bačka Topola) and has the population of 192.337. Novi Sad, the capital of Vojvodina, is located at the border between Bačka and Syrmia, on the banks of the Danube. Based on the 2011 Census, largest cities in the Serbian part of Bačka are Novi Sad (population 250.439), Subotica (population 97.910), and Sombor (population 47.623).

Bačka is considered as one of the most fertile agricultural regions in Europe⁴. The population is primarily engaged in agriculture – production of all sorts of crops, especially wheat and maize. It should be noted that cattle breeding was the main occupation of the local population until the 19th century. At the present time,

³ <https://www.mapsofworld.com/serbia/serbia-political-map.html>

⁴ <https://www.rda-backa.rs/en/backa-region/>

the population is mostly engaged in agriculture and cattle breeding, and to some extent in crafts, trade and industry. Pig farming is a very important activity, but poultry husbandry, fishery, sericulture and hunting are also represented. About 44% of the population of Serbia is settled in rural areas (with a population density below 150 inhabitants per km²). By and large, the territory of Bačka, except for the City of Novi Sad, is considered either as a rural or a semi-rural area.

Cultural Heritage

Cultural heritage in the Bačka region includes secular buildings (museums, schools, townhalls, etc.), buildings typologically linked with urban centres and featuring dominant architectural styles characteristic for the epochs during which they were built, as well as fortifications and religious buildings (churches, chapels and monasteries)⁵. The distribution of cultural monuments within the region is irregular - it is mostly concentrated in urban centres, especially Novi Sad, Sremski Karlovci, Subotica, and Sombor. Although there is a significant number of religious monuments (churches and monasteries) as well as castles and forts, they will not be discussed in this document since the main focus of the project is on urban heritage. An interactive online information system of cultural heritage monuments in Serbia (ISNKD), including those located in Bačka, was developed by Institute for the Protection of Cultural Monuments of Serbia - Belgrade⁶.

The Provincial Institute for the Protection of Cultural Monuments for Vojvodina in Novi Sad⁷ (PZZZSK) was founded in 1951 and currently has around 50 staff members, including 35 conservators. The Institute is responsible for preserving cultural heritage in the entire province, including Bačka. Many years of archive and field research have resulted in placing significant heritage buildings and sites in Vojvodina under legal protection (65 monuments of exceptional importance, 354 of great importance, and 331 important cultural assets). An extensive work was completed on the protection of valuable urban areas in the largest towns in Vojvodina (Sombor, Vršac, Zrenjanin, Bečej, Apatin and Sremski Karlovci). For more information related to the Institute and its activities refer to Dobrić and Stajić (2021).

A significant number of cultural heritage monuments of special importance (around 80) are located in Novi Sad and the surrounding areas. Cultural heritage in Novi Sad, as well as other neighbouring settlements, in larger part belongs to recent ages, 19th and 20th century. Remains of the antique fortification Castellum Onagrinum near Begeč (built in the early 4th century, during the rule of Emperor Diocletian), the church and the fortification of Klis, near Stari Ledinci (13th/14th century) and the Monastery of Kovilj (16th/17th century) belong to the oldest, partially preserved period of construction. A certain number of religious buildings and a very few secular buildings dating back to the 18th century were completely preserved. The Petrovaradin Fortress and the Lower Town in Novi Sad (constructed in the period 1692-1780) are unique examples of preserved baroque fortifications and civil architecture.

A sizeable portfolio of heritage landmarks in Novi Sad, associated with its cultural and historical development, prompted a need for an organized system of preservation. After the World War II, national and provincial institutions were responsible for protection of most valuable heritage monuments. In 1983, the City of Novi Sad founded the Institute for the Protection of Cultural Monuments of the City of Novi Sad⁸. Functions of the

⁵ <http://www.zzskgns.rs/galerija-spomenici-kulture/>

⁶ <https://nasledje.gov.rs/index.cfm?jezik=Engleski>

⁷ <http://eng.pzzzsk.rs/>

⁸ <http://www.zzskgns.rs/>

Institute include research, valorisation and categorization of immovable cultural heritage and monuments that are already under protection, as well as maintaining documentation related to cultural heritage within its territory. Furthermore, the Institute determines the technical protection measures, manages conservation projects, and supervises the works associated with the protection of building heritage. One of the most important services is professional assistance to the owners and users of the buildings, as well as the care for presentation and adequate use of the heritage.

2.2 Description of the need(s) to be addressed

Serbia is located in a region of moderate seismic activity; however, its territory is close to regions of high seismic hazard which triggered major earthquakes in recent history, e.g. the 1979 Montenegro earthquake (M 6.9) and the 1977 Vrancea, Romania earthquake (M 7.2). In the last 100 years more than 10 earthquakes with magnitude (M) 5.0 or higher were recorded in Serbia. The strongest earthquake that hit Serbia in the 20th century (M 6.0) occurred in 1922 with the epicentre close to Lazarevac (at 50 km distance from the national capital Belgrade). The most damaging earthquake in the 21st century to date was the 2010 Kraljevo earthquake (M_L 5.4), which caused 2 fatalities and more than \$US 100 million in damages (World Bank, 2016). Several other earthquakes affected rural areas, e.g. Rudnik, 1927 (M 5.9), Kopaonik, 1980 (M 5.8), and Mionica, 1998 (M_L 5.7). The World Bank has estimated that national annualized capital losses in Serbia resulting from earthquakes are \$40 million; this is an average value - actual earthquake losses are concentrated into specific catastrophic events. The country risk profile reports that an infrequent but intense earthquake event (a 250-year return period) could result in nearly \$1 billion of capital losses in Serbia (about 3 % of the country's GDP in 2015 – estimated at \$36.4 billion). Figure 3 presents the official seismic hazard map for Serbia and shows Peak Ground Acceleration (PGA) values which are required for seismic design and assessment according to Eurocode 8 (PGK, 2019; SRPS EN 1998-1/NA:2018). It can be seen from the map that the territory of Bačka is characterized by a lower seismic hazard compared to some other sites in Serbia.

There are currently no published studies related to seismic vulnerability of existing buildings in Serbia which would be relevant for the current project. However, seismic safety of schools in Serbia has been assessed within the ongoing project “Serbia National Disaster Risk Management Program: Scaling Up Resilient Infrastructure Project”⁹ managed by the Public Investment Management Office of Serbia. **There is a need to perform a comprehensive survey of cultural heritage monuments in Serbia to assess the risk of damage and/or collapse due to seismic actions.**

⁹ <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/863191614943769186/serbian-national-disaster-risk-management-program-concept-note>

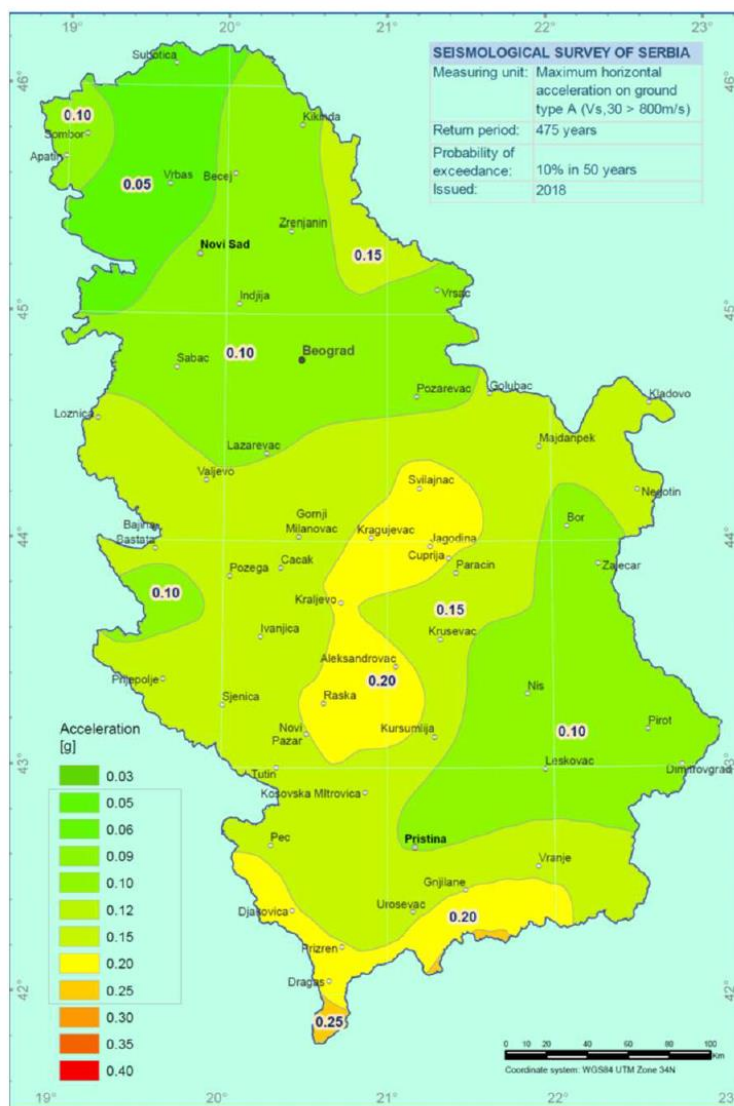


Figure 3: Seismic hazard map for the Republic of Serbia showing the Peak Ground Acceleration (PGA) values for design earthquake with 10% probability of exceedance in 50 years (475 year return period earthquake) (Seismological Survey of Serbia, 2018)

Given the current situation in Serbia, there are **both financial and technical needs** related to the reduction of seismic vulnerability associated with cultural heritage monuments in urban centres of Bačka. Although these needs are interconnected, it is important to first identify technical needs and actions because the required funding will be determined based on the initial technical activities which will need to be performed in the framework of the proposed action plan. Current government funding associated with preservation of culture in Vojvodina (including cultural heritage) is limited. In 2021 the total budget of the Government of Autonomous Province of Vojvodina was 75.2 billion RSD (approximately 642.96 million euros)¹⁰. Out of the total budget, the Provincial Secretariat for Culture, Public Information and Relations with Religious Communities, Government of AP Vojvodina (PSK), which is in charge of the PZZZSK, was allocated the annual budget of 3.66 billion RSD (approximately 31.30 million euros) for funding various projects and activities. For example, an ongoing project focused on the rehabilitation and protection of cultural heritage in Sremski

¹⁰ <https://www.021.rs/story/Novi-Sad/Vesti/260345/Budzet-Vojvodine-za-2021-Ko-ima-manje-a-ko-vise-novca-na-raspodaganju.html>

Karlovci, a major heritage town in Bačka, received funding of 64.5 million RSD (approx. 551.500 euros) for 2021. **Current funding allocated to preservation of cultural heritage in Vojvodina, including Bačka, is modest.** Additional funding is required to ensure protection of high-risk cultural heritage monuments from earthquake actions, and needs to be allocated in future.

Due to a relatively few seismic events in the last century in Serbia there is **a limited focus on seismic vulnerability of existing building stock and cultural monuments and enhancing their seismic safety through seismic retrofitting interventions.** As a result, technical expertise and experience are limited and insufficient for implementing an initiative to reduce seismic vulnerability of cultural heritage monuments. There is a need for capacity building of various stakeholders engaged in the protection of cultural heritage, including the PZZZSK staff, engineers and architects, construction workers, etc. The objective of capacity building is to raise the level of knowledge related to seismic risk assessment and retrofitting of cultural heritage monuments in urban centres, primarily unreinforced masonry buildings.

Seismic design codes are available and enforced in Serbia, including Eurocode 8 (parts 1 and 3) which contain provisions for seismic design and retrofitting of existing buildings (PGK, 2019). However, **current codes do not provide adequate guidance related to conservation and seismic retrofitting of earthen structures,** which are very common among cultural heritage buildings in Bačka. There is a need for developing a guideline for seismic risk assessment and retrofitting of earthen structures.

In spite of rich cultural heritage in Serbia in general and specifically in Bačka, there is a limited visibility of the activities of PZZZSK, as reported in their strategic plan (PZZZSK, 2019). **There is a need for an awareness campaign related to the importance of preservation of cultural heritage in general, including the protection from earthquake effects.**

The proposed action plan will outline both the technical methodology for reducing seismic vulnerability of cultural heritage monuments for Bačka and the implementation process. It is proposed that the Provincial Institute for the Protection of Cultural Monuments, Novi Sad (PZZZSK) leads the development and implementation of the action plan, since the activities contained in the action plan align with the mission and mandate of the Institute.

2.3 Overall and specific objectives of the plan

Awareness related to risk of earthquake damage or collapse of building structures due to earthquakes in Serbia is very limited. Local technical experience and expertise related to the seismic assessment and interventions related to building structures in general, including the cultural heritage monuments, is also limited. In many instances, maintenance of buildings in urban areas is inadequate, hence many older existing buildings are in dilapidated condition, mostly due to economic constraints of building owners and limited government funding. The following four specific objectives of the action plan are:

1. To develop a technical framework for identifying selected cultural heritage monuments in major urban centres of Bačka and assessing their seismic vulnerability,
2. To develop a policy framework for implementation of the action plan through government organizations (e.g. PZZZSK),
3. To organize and implement capacity building for technical staff of the PZZZSK and other similar institutions related to seismic assessment and seismic interventions of cultural heritage monuments in Bačka, and

4. To raise awareness regarding the importance of protecting cultural heritage monuments in urban areas from earthquake effects.

3 Stakeholders involved through the workshops

Since the beginning of the project, four local workshops were organized with the objective to engage relevant stakeholders and obtain their feedback related to different project components. The workshops were focused on discussing the progress related to the main technical working packages WPT1, WPT2, and WPT3. The main purpose of the workshops related to WPT1 was to acquaint the stakeholders with the need to establish a common reference framework concerning regulative, operational and economic-financial instruments of seismic vulnerability and its reduction in the Adriatic and Ionian area, by harmonizing the different instruments and approaches. The workshops related to WPT2 presented techniques for seismic strengthening/interventions and expeditious seismic assessment, and the action plan presented in this document. The workshops related to the WPT3 was focused on training tools and resources for different target groups, ranging from engineers and architects to volunteers.

A wide variety of stakeholders (39 in total) have been involved in the workshops, including the public sector (education and administration), as well as the private sector (engineering and architectural consulting firms, contractors, manufacturers of seismic retrofitting technologies), see Table 1. These stakeholders were invited to participate in the workshops because of their potential role in implementing the action plan. They provided feedback during the workshops by answering specific questions which were related to the material presented and discussed at the workshop. It is expected that these stakeholders are going to play an important role in the implementation of action plan in their respective sectors. Stakeholders 13 to 16 are owners and/or managers of cultural heritage buildings and they are expected to lead implementation of the action plan. Stakeholders 1 to 13 are government organizations or municipalities, and it is expected that they are also going to be engaged in all actions. Stakeholders 17 to 21 are expected to be involved in assisting cultural heritage managers to obtain local and international funding for implementation of the action plan. Stakeholders 13-21 are expected to participate in implementation of action no. 5. Stakeholders 22-29 include technical experts who will be working along with the government organizations on action no. 1, and will play leading role in implementing actions no. 2, 3 and 4. Stakeholders 32-39 are engineering and construction firms who are also going to be engaged in actions no. 2, 3 and 4. Stakeholder 32 is responsible for the development of technical regulations in Serbia and is going to play an important role in approving deliverable of action no. 3 for wider application in the country.

Table 1 Stakeholders involved in the ADRISEISMIC workshops in Serbia

1	Provincial Secretariat for Culture, Public Information and Relations with Religious
2	Communities
3	The City of Novi Sad Council in charge for Culture
4	Municipality of Bač
5	Municipality of Odžaci
6	Municipality of Srbobran
7	Municipality of Temerin
8	Municipality of Bačka Palanka
9	Municipality of Kula

10	Municipality of Novi Kneževac
11	Municipality of Senta
12	Municipality of Sečanj
13	Museum of the City of Novi Sad
14	Provincial Institute for the Protection of Cultural Monuments Vojvodina
15	Institute for the Protection of Cultural Monuments of the City of Belgrade
16	Institute for the Protection of Cultural Monuments of the City of Novi Sad
17	Public Investment Management Office of Serbia
18	RDA Panonreg - Subotica
19	RDA Srem - Ruma
20	Regional Centre for Socio-Economic Development Banat
21	RDA Bačka
22	Serbian Association for Earthquake Engineering SUZI-SAEE
23	University of Belgrade - Faculty of Architecture
24	University of Belgrade - Faculty of Civil Engineering
25	University of Novi Sad – Faculty of Technical Sciences
26	University of Niš - Faculty of Civil Engineering and Architecture
27	University of Belgrade - Faculty of Mining and Geology
28	Faculty of Technical Sciences Kosovska Mitrovica
29	Jaroslav Černi Water Research Institute
30	Association of Firefighters of Vojvodina
31	Association of Firefighters of the City of Novi Sad
32	Institute for Standardization of Serbia
33	MAPEI SRB DOO (specialised manufacturer/supplier)
34	Sika Srbija (specialised manufacturer/supplier)
35	SDA-engineering RS (consulting firm)
36	KMZ contractor (contractor)
37	VMS Belgrade (consulting firm)
38	ASMEC Consultants (consulting firm)
39	Inobačka Novi Sad (construction, design & engineering company)

4 Actions and timeframe

4.1 Actions

4.1.1 Action no. 1

Action name	Review of information related to the existing inventory of cultural heritage buildings in historic urban centers of Bačka
Specific objective of the action	Specific objective of the action is to identify urban localities and cultural heritage buildings in Bačka to identify the localities of high priority for seismic risk assessment.
Brief description of the action	This action will be focused on selected urban centres (cities and towns) in the Bačka region. As a part of the action it is required to first develop a policy

	<p>paper, which will outline criteria for the selection of urban centres and cultural heritage monuments which will be the scope of the action plan. It is anticipated that the main criteria will include seismic hazard level at the localities under consideration, as well as the number and importance of cultural heritage monuments at a specific location. A hierarchical multiple-factor classification of heritage monuments will be developed based on, among other features, their uniqueness, scarcity of structural materials, exposure (number of occupants), etc.</p> <p>Currently available information related to cultural heritage monuments which has been compiled by the PZZZSK is a valuable resource. For the selected cultural monuments the existing information will be expanded by including information related to construction typology, construction technology (masonry or reinforced concrete), evidence of previous structural interventions, etc. All relevant information related to cultural heritage buildings will be made available in electronic form. Due to limited financial and human resources it is not possible to consider all cultural heritage monuments and all urban centres in the Bačka region, however a policy paper developed as a part of this action and the proposed action plan could be applied at other localities in the Bačka region and the Republic of Serbia in general.</p>
<p>Specific activities foreseen for the implementation of the action</p>	<ul style="list-style-type: none"> i) Development of a policy document to set up criteria for the selection of cultural heritage monuments that have priority due to potentially higher seismic risk, ii) Review of the available technical documents and current database of recognized cultural heritage monuments in Bačka, iii) Selection of cities/towns to be considered in the action plan based on the criteria established in the policy document, iv) Identification of most vulnerable cultural heritage buildings according to the criteria established in the policy document, v) Compilation of available historic, architectural and construction information related to the selected buildings, which will be used as a reference for subsequent actions.
<p>Reference to the policy instruments in WPT1</p>	<p>Cultural Heritage Law (Zakon o kulturnim dobrima), Službeni Glasnik RS, No. 71/94, 52/2011, 99/2011, 6/2020 (in Serbian).</p>
<p>Reference to the Good Practice in WPT1</p>	<p>Analysis of the local seismic risk as part of the Urban Plan Baseline Framework (GP_09-UPR_4.1a_IT.pptx) Framework for pre-earthquake monitoring of public utility buildings (GP_12-SIF_5.1_GR.pptx)</p>
<p>Implementation timeframe</p>	<p>January-December 2023</p>
<p>Means for monitoring the implementation</p>	<p>Presentation of the proposed policy document to the stakeholders Meetings to present progress at the mid-term and the end of the survey</p>
<p>Main stakeholders involved and their roles and contribution</p>	<p>- Managers and owners of cultural heritage buildings to manage the action and provide input to the technical experts</p>

	- Selected structural and architectural engineering experts from academia and/or design practice to implement the action
Beneficiaries	Cultural heritage managers, citizens of the Republic of Serbia
Indicative funding sources	Government of the Republic of Serbia, EU funds

4.1.2 Action no. 2

Action name	Expeditious seismic risk assessment of cultural heritage buildings at selected urban localities in Bačka
Specific objective of the action	Specific objective of the action is to perform expeditious seismic assessment of cultural heritage buildings in selected urban centres in order to identify buildings which are at high risk of damage or collapse due to future earthquakes.
Brief description of the action	This action consists of surveying selected areas (building blocks) within the urban centres of Bačka, in order to estimate seismic risk associated with cultural heritage buildings. The ADRISEISMIC methodology for expeditious seismic assessment offers a means of assessing unreinforced masonry and reinforced concrete buildings, based on their structural characteristics, height, and seismic hazard level. The survey is expected to be fast/expeditious (a walkthrough visit to the building), and will not require neither non-destructive/destructive material testing nor engineering calculations. An important objective of the assessment will be to create a comprehensive photographic archive for each cultural heritage building, which may be required for reconstruction purposes after an earthquake. The main outcome of the assessment is to identify cultural heritage buildings which are at highest risk of severe damage or collapse due to earthquake actions, according to the national seismic hazard maps and technical regulations (codes). Due to high importance of cultural heritage buildings, seismic performance objectives for the retrofit should be set to minimize chances of the structural damage and also damage to building contents. The buildings which are characterized by high seismic risk will be recommended for future seismic retrofitting interventions. The buildings will be prioritized by the seismic risk level, cultural value, exposure (number of occupants for public buildings), etc. The training of surveyors is of critical importance and needs to be organized with the assistance of civil and architectural engineering faculty members from local universities. The surveyors need to have technical (either civil or architectural engineering) background.
Specific activities foreseen for the implementation of the action	<ul style="list-style-type: none"> i) Development of a technical guideline for expeditious seismic risk assessment based on the ADRISEISMIC project methodology (in Serbian language), ii) Development of a 1-day training programme for the technicians (engineers/architects) who are going to perform expeditious assessment, iii) Assessment at various locations by multiple teams of technicians (3 members per team),

	<p>iv) Processing of the survey results and arranging for a review by a panel comprised of experts in the field of earthquake engineering and conservation of heritage monuments, and</p> <p>v) Preparing a set of reports which will contain completed survey forms and a summary of the results for each location and each urban centre.</p>
Reference to the policy instruments in WPT1	<p>i) Pravilnik za građevinske konstrukcije (Technical regulations for building structures). Institute for Standardization of Serbia, Official Gazette of Republic of Serbia No. 89/2019, 52/2020, 122/2020, Serbia, 2019 (in Serbian).</p> <p>ii) SRPS EN 1998-1/NA:2018. Evrokod 8 - Projektovanje seizmički otpornih konstrukcija, Deo 1: opšta pravila, seizmička dejstva i pravila za zgrade (Eurocode 8 - Design of structures for earthquake resistance-Part 1: General rules, seismic actions and rules for buildings). Institute for Standardization of Serbia, Serbia, 2018 (in Serbian).</p> <p>iii) SRPS EN 1998-3/NA:2018. Evrokod 8 - Projektovanje seizmički otpornih konstrukcija, Deo 3: procena stanja i ojačanje zgrada (Eurocode 8 - Design of structures for earthquake resistance-Part 3: Assessment and retrofit of buildings). Institute for Standardization of Serbia, Serbia, 2018 (in Serbian).</p>
Reference to the Good Practice in WPT1	<p>POTROG applications (apps. regarding seismic assessment of buildings, earthquake scenarios...) (GP_19-SIF_5.1_SLO.pptx)</p> <p>Guidelines for assessment and structural interventions on masonry buildings (GP_04-SN_2.5_GR.pptx)</p>
Implementation timeframe	January 2023-June 2024
Means for monitoring the implementation	Internal meetings to present the progress (number of assessed buildings) at the mid-term and the end of the project
Main stakeholders involved and their roles and contribution	<ul style="list-style-type: none"> - Cultural heritage managers (PZZZSK and ZZSKGNS staff) to manage the action - Owners of cultural heritage buildings to facilitate the assessment - Selected structural and architectural engineering experts from academia and/or design practice, university students to implement the action
Beneficiaries	Cultural heritage managers, PSK
Indicative funding sources	Government of the Republic of Serbia, EU funds

4.1.3 Action no. 3

Action name	Development of technical guidelines for detailed seismic evaluation and retrofitting of high-risk and high importance cultural heritage buildings in Bačka
Specific objective of the action	The objective of this action is to develop technical guidelines for detailed seismic assessment and seismic retrofitting techniques for cultural heritage buildings which will be applied in future seismic retrofitting projects in Bačka.
Brief description of the action	This action will be focused on developing technical guidelines for seismic assessment and retrofitting of cultural heritage buildings with high cultural importance and heritage value which are at risk of damage or collapse due to

	<p>future earthquakes. Technical guidelines for seismic assessment and retrofitting of cultural heritage buildings are currently not available in Serbia. The guidelines will outline a methodology for performing detailed seismic assessment of buildings, based on guidelines/codes from countries with extensive experience in this area, such as Italy, Greece, New Zealand, USA, etc. The guidelines for seismic retrofitting will address both design and construction aspects of seismic retrofitting. The focus will be on seismic retrofitting approaches which are feasible for cultural heritage buildings and take into account conservation requirements. Guiding principles related to the conservation of heritage structures, as recommended by the UNESCO and other relevant organizations, will be considered while developing technical solutions for seismic retrofitting (European Union, 2018; UNESCO, 2013; Stovel, 1998). The guidelines will outline traditional seismic retrofitting techniques, which involve the use of reinforced concrete, steel, etc., as well as novel technologies, e.g. Fibre Reinforced Composites (FRCs). The guidelines will be focused on unreinforced masonry structures, which constitute majority of cultural heritage buildings in Serbia and are considered to be most vulnerable to earthquake effects.</p>
<p>Specific activities foreseen for the implementation of the action</p>	<ul style="list-style-type: none"> i) Review of relevant resources and best practices from Serbia and other countries ii) Developing guidelines for detailed seismic assessment of cultural heritage buildings, including material testing, site-specific seismic hazard study, and performance-based seismic analysis, iii) Developing a guideline for seismic retrofitting interventions of cultural heritage buildings, which will address relevant seismic/structural design and construction aspects, as well as case study design examples, and iv) Organize a seminar to present completed guidelines to all stakeholders in Serbia - by the Serbian Association for Earthquake Engineering (SUZI-SAEE)
<p>Reference to the policy instruments in WPT1</p>	<ul style="list-style-type: none"> i) Pravilnik za građevinske konstrukcije (Technical regulations for building structures). Institute for Standardization of Serbia, Official Gazette of Republic of Serbia No. 89/2019, 52/2020, 122/2020, Serbia, 2019 (in Serbian). ii) SRPS EN 1998-1/NA:2018. Evrokod 8 - Projektovanje seizmički otpornih konstrukcija, Deo 1: opšta pravila, seizmička dejstva i pravila za zgrade (Eurocode 8 - Design of structures for earthquake resistance-Part 1: General rules, seismic actions and rules for buildings). Institute for Standardization of Serbia, Serbia, 2018 (in Serbian). iii) SRPS EN 1998-3/NA:2018. Evrokod 8 - Projektovanje seizmički otpornih konstrukcija, Deo 3: procena stanja i ojačanje zgrada (Eurocode 8 - Design of structures for earthquake resistance-Part 3: Assessment and retrofit of buildings). Institute for Standardization of Serbia, Serbia, 2018 (in Serbian).
<p>Reference to the Good Practice in WPT1</p>	<p>Guidelines for the evaluation of seismic vulnerability of buildings (GP_14-SIF_5.2_IT.pptx)</p> <p>Evaluation and reduction of seismic risk for cultural heritage (GP_05-SN_2.3_IT.pptx)</p>

Implementation timeframe	January 2023-December 2024
Means for monitoring the implementation	Consultation meetings, both at the initial stage and at the end (when draft guidelines are completed); participants will include co-authors of the guidelines and cultural heritage managers
Main stakeholders involved and their roles and contribution	<ul style="list-style-type: none"> - Selected structural and architectural engineering experts from academia and design practice – to develop the guidelines - Cultural heritage managers (PZZZSK and ZZSKGNS staff) – to provide input and guidance during the development stage, and use the guidelines in future projects - Civil engineers and architects in Serbia – as users of the guidelines - Serbian Association for Earthquake Engineering (SUZI-SAEE) – to assist with the dissemination
Beneficiaries	Cultural heritage managers, academics and design engineers
Indicative funding sources	Government of the Republic of Serbia, EU funds

4.1.4 Action no. 4

Action name	Capacity building (training) related to seismic risk assessment and retrofitting of cultural heritage buildings
Specific objective of the action	Specific objective of the action is to develop and implement training programmes for stakeholders related to seismic risk assessment and retrofitting of cultural heritage buildings.
Brief description of the action	<p>This action is focused on enhancing the level of knowledge as related to seismic risk assessment and retrofitting of cultural heritage buildings. While seismic risk assessment needs to be performed before an earthquake, seismic retrofitting could be performed either before or after an earthquake. Training activities need to be delivered at different levels, keeping in mind stakeholders with different educational background, skills, and experience. It is expected that majority of stakeholders have limited background regarding the topic of the training. The following stakeholders will be targeted for this action: engineers, construction workers, and civil servants (administrators). Training materials developed by the ADRISEISMIC project team are going to serve as the main resource for this action (ADRISEISMIC Moodle Platform¹¹). Technical guidelines developed in Action no. 3 will also be included. Training activities will include seminars, short courses, and online learning modules. The participants will need to successfully complete evaluation (quiz, test) in order to be eligible to obtain a certificate of completion.</p> <p>It is expected that training activities will need to be delivered by professionals with adequate knowledge of earthquake engineering, including civil and</p>

¹¹ <https://adriseismic.nhmc.uoc.gr/>

	architectural engineering faculty from institutions of higher education, and members of professional organizations, such as the Serbian Association for Earthquake Engineering (SUZI-SAE). In order to ensure long-term sustainability of this action, it is important to set up a “Train the trainers” program, with an objective to identify a pool of competent trainers for future training activities. It is expected that the training will need to be periodically repeated (e.g. every 3 years).
Specific activities foreseen for the implementation of the action	i) Developing a long-term training programme, based on the review of available resources, both human (potential trainers) and training materials, ii) Developing training materials for different training activities, iii) Identifying organizations that are going to be in charge of delivering training, and will arrange for trainers/instructors, venues, advertisement, course/seminar fees, etc., and iv) Delivering training programmes for different stakeholders: engineers, construction workers, and civil servants (administrators).
Reference to the policy instruments in WPT1	N/A
Reference to the Good Practice in WPT1	N/A
Implementation timeframe	January 2023-December 2025
Means for monitoring the implementation	Summary reports after training activities by the trainers; surveys of the training participants
Main stakeholders involved and their roles and contribution	- Cultural heritage managers (PZZZSK and ZZSKGNS staff) to provide input regarding the training curriculum - Educational institutions (SUZI-SAE, university faculty, practicing engineers) and cultural heritage managers to implement the training - Engineers, architects, construction workers, administrators (including owners and managers of cultural heritage buildings) to receive the training
Beneficiaries	Cultural heritage managers and owners, academics and design engineers, citizens of the Republic of Serbia
Indicative funding sources	Government of the Republic of Serbia, EU funds

4.1.5 Action no. 5

Action name	Raising public awareness related to the need for protection of cultural heritage from the effects of natural disasters
Specific objective of the action	Specific objective of the action is to raise awareness among general public (citizens) regarding the importance of cultural heritage and its protection from the effects of earthquakes and other natural disasters.
Brief description of the action	This action is focused on raising awareness related to the importance of cultural heritage and its protection from the effects of natural disasters. Given the limited experience related to raising awareness related to importance of cultural heritage in Serbia, it is critical to build on best

	<p>practices from other countries, especially countries with frequent earthquakes, e.g. Italy, Greece, etc. The action needs to cover, among other topics, awareness of potential risks of structural and non-structural damage in a heritage structure during an earthquake, which could cause a loss of cultural heritage and potential injuries/fatalities. It is also important to include awareness of and familiarity with emergency procedures during and after an earthquake, which are critical for the survival of occupants in an earthquake. Finally, it is important to use the awareness campaign as an opportunity to emphasize the importance of preservation of cultural heritage in Serbia, irrespective of earthquakes and other disasters. The awareness campaign should target citizens of all ages, ranging from school children to senior citizens. It is critical to ensure long-term sustainability of the action, because some of the activities need to be repeated on annual basis. It is important to engage local primary and secondary schools in the action and raise awareness among the school children.</p>
Specific activities foreseen for the implementation of the action	<p>i) Planning of a public awareness campaign, based on the review of successful examples from other countries in the region (e.g. Italy),</p> <p>ii) Development of educational/awareness materials, such as brochures, manuals, videos, etc.,</p> <p>iii) Dissemination of the materials through Internet, social media, news (TV, newspapers), and</p> <p>iv) Organization of public lectures at various municipalities in Bačka.</p>
Reference to the policy instruments in WPT1	N/A
Reference to the Good Practice in WPT1	<p>“EDURISK” - increasing knowledge and awareness of seismic risk in schools (GP_17-SIF_5.5_IT.pptx)</p> <p>“I don’t take risks” - national awareness campaign for risk prevention and preparedness (GP_15-SIF_5.3_IT.pptx)</p> <p>Guidelines for planning and execution of civil protection drills (2nd edition) (GP_21-PEP_6.5_GR.pptx)</p>
Implementation timeframe	January 2024-December 2025
Means for monitoring the implementation	Summary reports after the awareness activities by the implementing agencies; surveys of the awareness campaign participants
Main stakeholders involved and their roles and contribution	<ul style="list-style-type: none"> - Cultural heritage managers (PZZZSK and ZZSKGNS staff) and earthquake engineering experts – to provide input regarding the content - Public relations firms - to develop the content implement the action
Beneficiaries	Cultural heritage managers, civil protection, citizens of the Republic of Serbia
Indicative funding sources	Government of the Republic of Serbia, EU funds

4.2 Risks and mitigation actions

Risk action no.	Actions involved	Description of the risk	Mitigation actions proposed
1	Actions 1 and 3	Lack of funding, lack of interest	Seek alternative funding sources (role of the PZK and PZZZSK)
2	Action 2	Incompetent surveyors	make effort to provide adequate training and assess competence of the surveyors before the start of survey
4	Action 4	Lack of interest in training	Ensure advertising of usefulness/benefit of the training for future projects
5	Actions 4 and 5	Lack of interest in the awareness campaign	Ensure that materials are interesting, brief, and relevant

References

Dobrić, K. and Stajić, M. (2021). Pokrajinski zavod za zaštitu spomenika kulture – prvih 70 godina (Provincial Institute for the protection of cultural monuments for Vojvodina – first 70 years), Provincial Institute for the protection of cultural monuments for Vojvodina in Novi Sad (in Serbian).

European Union (2018). Safeguarding Cultural Heritage from Natural and Man-Made Disasters. Publications Office of the European Union, Luxembourg.

ISNKD. Information System of Immovable Cultural Property. The Provincial Institute for the Protection of Cultural Monuments, Novi Sad, Serbia < <https://nasledje.gov.rs/index.cfm?jezik=Engleski>>

PGK (2019). Pravilnik za građevinske konstrukcije (Building regulations). Institute for Standardization of Serbia, Official Gazette of Republic of Serbia No. 89/2019, 52/2020, 122/2020, Serbia (in Serbian).

PZZZSK (2021). Strateski plan Pokrajinskog zavoda za zaštitu spomenika kulture, Petrovaradin 2020-2024 – (Strategic plan of the Provincial Institute for the protection of cultural monuments for Vojvodina, Petrovaradin 2020-2024), Provincial Institute for the protection of cultural monuments for Vojvodina in Novi Sad (in Serbian).

Seismological Survey of Serbia (2018). Seismic hazard maps for Serbia. Seismological Survey of Serbia, Belgrade, Serbia <http://www.seismo.gov.rs/Seizmicnost/Karte_hazarda_e.htm>

SORS (2011). The Census of Population, Households and Dwellings. Statistical Office of the Republic of Serbia. < <https://www.stat.gov.rs> >

SRPS EN 1998-1/NA:2018. Evrokod 8 - Projektovanje seizmički otpornih konstrukcija, Deo 1: opšta pravila, seizmička dejstva i pravila za zgrade (Eurocode 8 - Design of structures for earthquake resistance-Part 1: General rules, seismic actions and rules for buildings). Institute for Standardization of Serbia, Serbia, 2018 (in Serbian).

SRPS EN 1998-3/NA:2018. Evrokod 8 - Projektovanje seizmički otpornih konstrukcija, Deo 3: procena stanja i ojačanje zgrada (Eurocode 8 - Design of structures for earthquake resistance-Part 3: Assessment and retrofit of buildings). Institute for Standardization of Serbia, Serbia, 2018 (in Serbian).

Stovel, H. (1998). Risk Preparedness: A Management Manual for World Cultural Heritage. ICCROM/UNESCO/ICOMOS/WHC, Rome, Italy, 145 p.

UNESCO (2013). Managing Cultural World Heritage. UNESCO/ICCROM/ICOMOS/IUCN, Paris, France, 152 p.

ZZSKGNS (2014). Kulturna dobra online (Cultural heritage online). Institute for the protection of cultural monuments of the City of Novi Sad, Serbia (in Serbian) < <http://www.zzskgns.rs/kulturna-dobra-online/> >