European Centre for Vulnerability of Industrial and Lifeline Systems

ECILS

North Macedonia

European and Mediterranean Major Hazard Agreement (EUR-OPA)

Joint (77TH) meeting of the Committee of Permanent Correspondents and Directors of Specialized Centres

10-11 February 2022

PROJECT IN 2021 – ECILS (COORDINATOR), ECPFE (PARTNER)

First-level Seismic Vulnerability Assessment of the Skopje Old Bazaar

- PARTIALLY REALIZED DUE TO COVID-19 PANDEMIC

PROJECT PROPOSAL FOR 2022-2023 – ECILS (COORDINATOR), ECPFE (PARTNER)

Seismic Vulnerability Assessment of the Skopje Old Bazaar

- COMPLETION AND CONTINUATION

Dr. Veronika SHENDOVA
Director
European Centre for Vulnerability of Industrial and Lifeline Systems, ECILS

2021 Project information

- Priority for action plan: Using scientific and technological knowledge to better assess evolving risks and adapt accordingly the resilience strategies
- Coordinator Centre: ECILS, Skopje, North Macedonia
- Partner Centre: ECPFE, Athens, Greece
- Title of the Project: ***First-level Seismic Vulnerability Assessment of the Skopje Old Bazaar***
- Implementation period: 1st February to 1st November 2021 (agreement signed on 2nd March)
- Grant by Council of Europe: ECILS - 5500 euro, ECPFE – 1800 euro
- Contribution by ECILS: working space, fieldworks costs, local transport, computer calculation costs, research grant for the salary of PhD/permanent staff
- Contribution by ECPFE: working space, local transport, computer calculation costs

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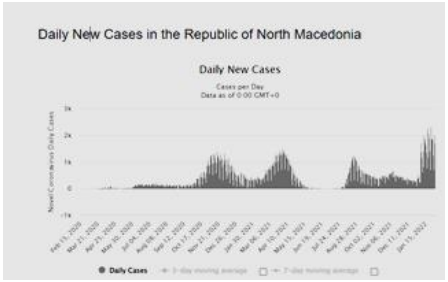
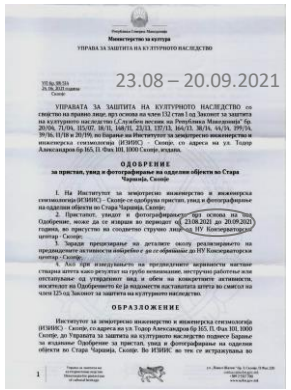
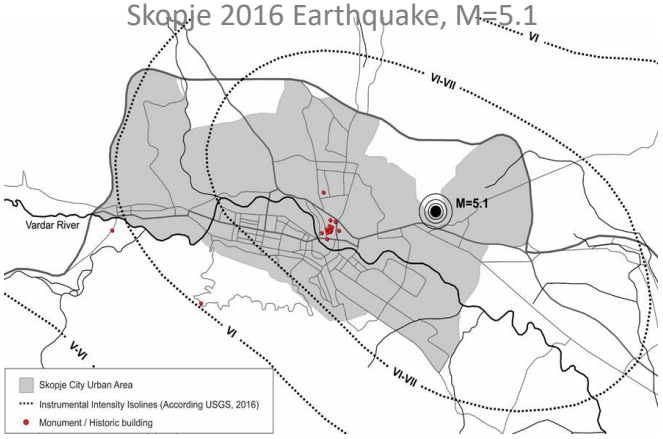
2021 Project information – global overview

- Skopje Old Bazaar - one of the oldest and largest marketplaces in the Balkans
- First-level Seismic Vulnerability Assessment - using harmonized and calibrated *Vulnerability Index Method*
- For the first time in North Macedonia – crucial ECPFE experience from similar projects
- Rapid Visual Screening of 30 selected buildings - indoor/outdoor visual building inspection and relevant photography
- permission from Office for Protection of Cultural Heritage of North Macedonia – applied in April 2021, obtained in June 2021, inspection allowed from end of tourist season
- 3rd covid-19 wave





Skopje 2016 Earthquake, M=5.1



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2021 Project information – planned activities

ECILS	ECPFE
A1: Calibration of previously harmonized seismic vulnerability index method using data form post-2016 earthquake RSVP	**A8:** Contribution to the preparing of *First_Level-Data_Form* and Manual for first-level seismic screening based on own previous experience
A2: Preparing of *First_Level_Data_Form* and Manual for first-level seismic screening	**A9:** Participation to the joint work meeting in Skopje Old Bazaar (if possible, considering pandemic)
A3: Introducing the relevant institutions to the problem to provide access to the buildings	**A10:** Providing relevant dynamic analysis for one representative building, which will serve as a pilot study in order to validate the proposed method
A4: Joint meeting in Skopje Old Bazaar with participation of the responsible institution and ECPFE representatives	
A5: Selection of 30 representative buildings for further assessment and preparation of technical documentation	
A6: Rapid visual outside/inside screening of selected 30 buildings using *First_Llvel_Data_Form*	
A7: Selection of one representative building and providing the necessary information to the partner ECPFE for the next phase of dynamic analysis	

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2021 Project information – realized activity A1

ECILS

A1: Calibration of previously harmonized seismic vulnerability index method using data form post-2016 earthquake RSVP

- ✓ setting the most important and independent parameters P1, P2 (P3, P13), P4, P5, P6, P7, P8, P9, P10, P11(P12), P14
- ✓ prescribing the vulnerability levels A, B, C, D for each of the independent parameters
- ✓ calibration of p_i (weight coefficient) using data from post-earthquake RVS

Parameter		Weight *pi*	
1. Structural building system		**original**	**calibrated**
P1	Type of resisting system	0.75	2.50
P2	Quality of resisting system	1.00	2.50
P3	Conventional strength	1.50	1.00
P4	Maximum distance between walls	0.50	0.50
P5	Number of floors	1.50	0.50
P6	Location and soil condition	0.75	0.25
2. Irregularities and interactions			
P7	Aggregate position and interaction	1.50	1.50
P8	Irregularity in plan	0.75	0.50
P9	Irregularity in height	0.75	0.75
3. Floor slabs and roofs			
P10	Alignment of openings	0.50	0.50
P11	Horizontal diaphragms	1.00	0.75
P12	Roof systems	1.00	0.50
4. Conservation status and other elements			
P13	Fragilities and conservation status	1.00	1.00
P14	Non-structural elements	0.50	0.75

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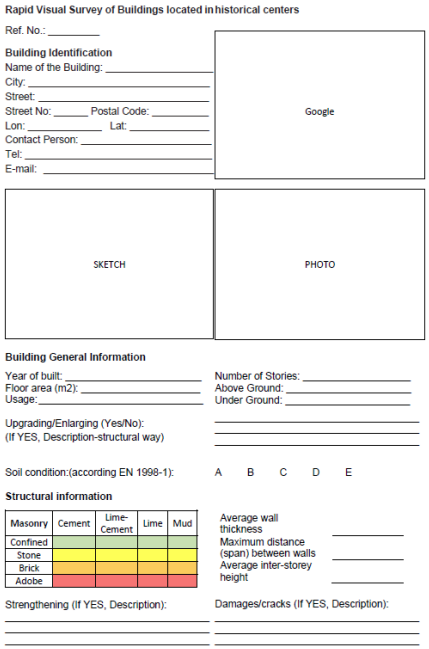
2021 Project information – realized activity A2

ECILS

A1: Calibration of previously harmonized seismic vulnerability index method using data form post-2016 earthquake RSVP

A2: Preparing of Preparing of *First_Level_Data_Record_Form* and Manual for first-level seismic screening

- ✓ preparing of the *First_Level_Data_Form* for rapid visual survey
- ✓ desk study and remote data collection on the Skopje Old Bazaar buildings



Rapid Visual Survey of Buildings located in historical centers

Ref. No.: _____

Building Identification

Name of the Building: _____
City: _____
Street: _____
Street No: _____ Postal Code: _____
Lon: _____ Lat: _____
Contact Person: _____
Tel: _____
E-mail: _____

Google

SKETCH

PHOTO

Building General Information

Year of built: _____
Floor area (m2): _____
Usage: _____

Number of Stories: _____
Above Ground: _____
Under Ground: _____

Upgrading/Enlarging (Yes/No): _____
(If YES, Description-structural way) _____

Soil condition:(according EN 1998-1): A B C D E

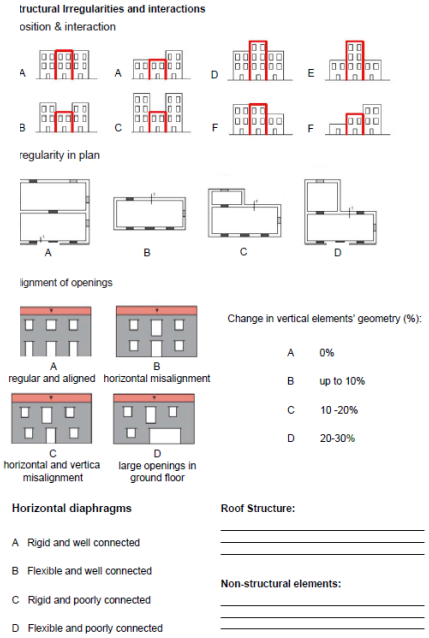
Structural information

Masonry	Cement	Lime-Cement	Lime	Mud
Confined				
Stone				
Brick				
Adobe				

Average wall thickness _____
Maximum distance (span) between walls _____
Average inter-storey height _____

Strengthening (if YES, Description): _____

Damages/cracks (If YES, Description): _____



tructural Irregularities and interactions

osition & interaction

A A D E

B C F F

regularity in plan

A B C D

lignment of openings

A regular and aligned

B horizontal misalignment

C horizontal and vertica misalignment

D large openings in ground floor

Change in vertical elements' geometry (%):

A 0%

B up to 10%

C 10 -20%

D 20-30%

Horizontal diaphragms

A Rigid and well connected

B Flexible and well connected

C Rigid and poorly connected

D Flexible and poorly connected

Roof Structure: _____

Non-structural elements: _____

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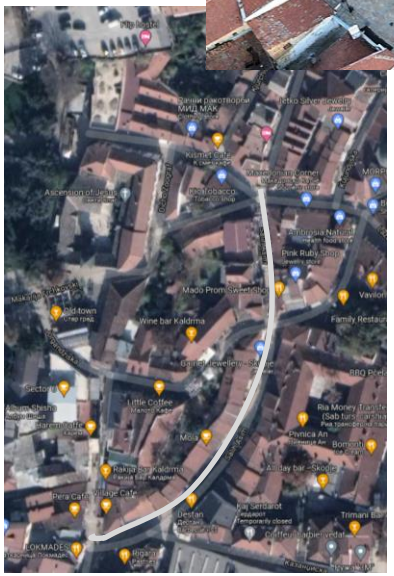
2021 Project information – realized activity A2

ECILS

A1: Calibration of previously harmonized seismic vulnerability index method using data form post-2016 earthquake RSVP

A2: Preparing of Preparing of *First_Level_Data_Record_Form* and Manual for first-level seismic screening



- ✓ preparing of the *First_Level_Data_Form* for rapid visual survey
- ✓ desk study and remote data collection on the Skopje Old Bazaar buildings
- ✓ selection of 30 buildings for RVS
- ✓ definition of the database format
- ✓ defining the work plan and staffing

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2021 Project information – realized activity A3

ECILS
A1: Calibration of previously harmonized seismic vulnerability index method using data form post-2016 earthquake RSVP
A2: Preparing of Manual for first-level seismic screening
A3: Introducing the relevant institutions to the problem to provide access to the buildings

- ✓ presentation of the project plan and goals to the Skopje Conservation Center as institution responsible protection of Skopje Old Bazaar
- ✓ short description of the project followed by a request to the Office for Protection of Cultural Heritage for issuing a permit for access, entry and photography of the buildings of the Old Skopje Bazaar

Република Северна Македонија, НУ Конзерваторски центар – Скопје
Republic of North Macedonia, NI Conservation Centre – Skopje
Republika e Maqedonishë së Veriut, IN Qendra Konzervatore - Shkup

УЗКНДРСН
УПРАВА ЗА ЗАШТИТА НА КУЛТУРНОТО НАСЛЕДСТВО
DREJTORIA PËR MBROJTJEN E TRASHËGIMISË KULTURORE
DIRECTORATE FOR PROTECTION OF CULTURAL HERITAGE

РЕПУБЛИКА СЕВЕРНА МАКЕДОНИЈА
МИНИСТЕРСТВО ЗА КУЛТУРА
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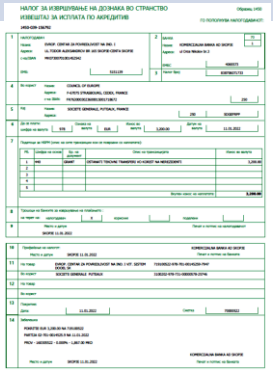
2021 Project information – realized / non-realized activities

ECILS - activities	
A1: Calibration of previously harmonized seismic vulnerability index method using data form post-2016 earthquake RSVP	+
A2: Preparing of *First_Level_Data_Form* and Manual for first-level seismic screening	+
A3: Introducing the relevant institutions to the problem to provide access to the buildings	+
A4: Joint meeting in Skopje Old Bazaar with participation of the responsible institution and ECPFE representatives	-
A5: Selection of 30 representative buildings for further assessment and preparation of technical documentation	-
A6: Rapid visual outside/inside screening of selected 30 buildings using *First_Llvel_Data_Form*	-
A7: Selection of one representative building and providing the necessary information to the partner ECPFE for the next phase of dynamic analysis	-

realized activities

non-realized activities -> continued in project proposal for 2022-2023

ECILS – financial part	
1. CoE grant	5500 euro
2. received (80%)	4400 euro
3. spent	1200 euro
4. less spent (1-2)	4300 euro
5. returned back (2-3)	3200 euro



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2022-2023 Project proposal - completion and continuation

- Priority for action plan: Using scientific and technological knowledge to better assess evolving risks and adapt accordingly the resilience strategies
- Coordinator Centre: ECILS, Skopje, North Macedonia
- Partner Centre: ECPFE, Athens, Greece
- Title of the Project: *Seismic Vulnerability Assessment of the Skopje Old Bazaar*
- Implementation period: February 2022 - November 2023
- Grant by Council of Europe: ECILS – 6000 euro (research/desk study) + 920 euro (per diem/travel ?)
  ECPFE – 2250 euro (research/desk study) + 850 euro (per diem/travel ?)
- Contribution by ECILS: working space, fieldworks costs, local transport, computer calculation costs, research grant for the salary of PhD/permanent staff
- Contribution by ECPFE: working space, local transport, computer calculation costs

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2022-2023 Project proposal – global overview

aim of the project proposal - to assess the seismic vulnerability of representative part of Skopje Old Bazaar by:

- rapid visual screening using *First_Level_Data_Form* (developed in 2021), resulting in category for each of the surveyed buildings according to its seismic risk,
- creation of Database with information from the screening,
- re-evaluation and harmonization of the ranking of identified vulnerable buildings based on evaluation of structural parameters
- performing the relevant structural analysis for one or two representative buildings to verify the proposed methodology
- defining possible key structural interventions for the buildings' seismic upgrading based on findings from relevant structural analysis

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2022-2023 Project information – planned activities for 2022

ECILS	ECPFE
A1: Preparatory work: providing mandatory permission for access to the buildings, setting up the survey teams and introducing them with seismic screening methodology, desk study and remote data collection	
A2: Hold of first joint meeting in Skopje Old Bazaar with participation of the responsible people and the representatives from ECPFE, (in case of the pandemic via videoconference)	**A3:** Participation to the first joint meeting in Skopje Old Bazaar (In case of the pandemic via videoconference)
A4: Rapid visual outside/inside screening of selected 30 buildings using *First_Level_Data_Form* followed by preliminary seismic risk rating of the buildings	
A5: Harmonization of evaluation criteria and re-evaluation of the ranking based on detailing and evaluation of structural parameters	**A6:** Contribution to the harmonization of evaluation criteria and re-evaluation of the buildings ranking, based on own expertise and previous experience
A7: Fill-in the database with the final results and create the vulnerability map of selected part of Skopje Old Bazaar	
A8: Selection of two representative buildings for further structural analysis	

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2022-2023 Project information – planned activities for 2023

ECILS	ECPFE
A9: Providing the necessary information to the partner ECPFE as the input data for the phase of dynamic analysis (if necessary, by repeated on-site inspection)	
A10: Performing *bearing and deformation capacity analysis* of the structures of the selected buildings	**A11:** Performing *relevant dynamic analysis* for one or two representative models concerning the dominant typology of the Old Bazar
A12. Participation to the second joint meeting in ECPFE premises in Athens. In case of the pandemic via video-conference	**A13:** Holding the Joint meeting in Athens. In case of the pandemic via video-conference.
A12: Comparing/commenting on the results from the dynamic and bearing and deformation capacity analyses	**A17.** Report concerning the above and Proposals for amelioration
A13: Proposing the possible key structural intervention for seismic upgrading of the buildings identified as most vulnerable	
A14: Preparing the final report	

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Why Skopje Old Bazaar?

- brick/stone/adobe plain masonry buildings, predominant Ottoman, remains from Byzantine, elements of modern architecture
- damages: 1555 earthquake, 1689 burning of the city, 1963 earthquake, during I and II World Wars, 2016 earthquake
- various rebuilding following these events

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2022-2023 Project proposal – expected results/target groups

- *Raising awareness* among the institutions, population and especially among the owners about possible earthquake consequences in the case of Skopje Old Bazaar
- Mutual acquaintance with the *characteristics and good practices* related to the old city cores of the *neighboring countries*
- Reducing post-earthquake urban and human losses by *in-time pre-earthquake structural assessment* and identification of the most vulnerable buildings

- *Architects, engineers, conservators* (both males and females) involved in the earthquake protection of structures pertaining to cultural heritage
- *Owners* of the facilities, who usually do not pay attention to the existing state of the buildings
- *Authorities*, who will support risk mitigation and management strategies for this very important urban historic centre in North Macedonia

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THANK YOU FOR YOUR ATTENTION !

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