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the European Union

Union Civil Protection
Mechanism

Earthquake Resilient Schools

Building Cooperation and Community resilience against Earthquakes in the Greek-Turkish CBA

European Commission

EReS project presentation by

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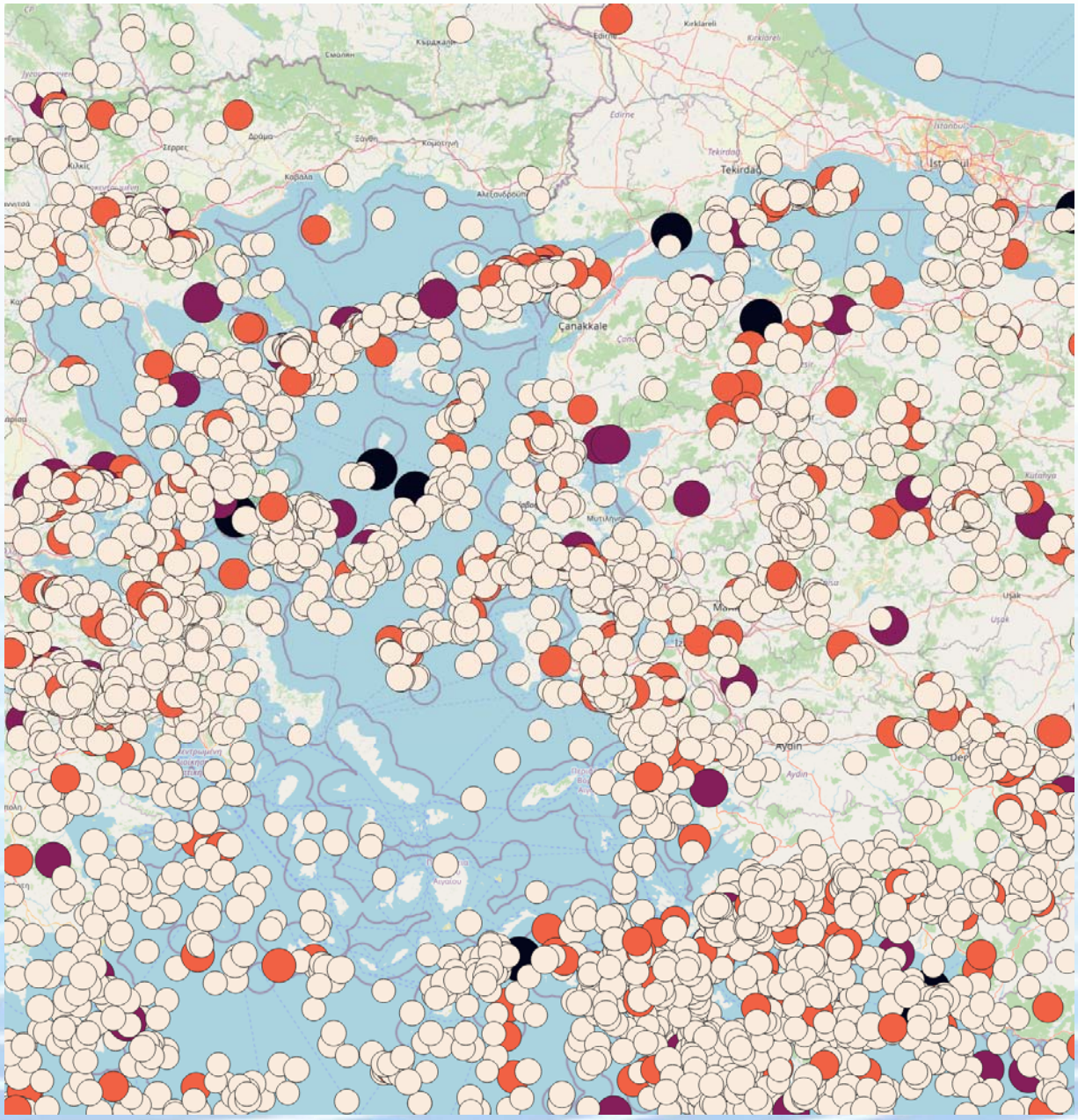
EReS Project Coordinator

01 March 2023, Serres, Greece

Earthquake pose a real problem in the GR/TR CBA

1990-2020 Earthquake Data M≥4, USGS



- ✓ A common problem posing common challenges to all people living in the Greece/Türkiye Cross Border Area (CBA)

Requires….

- ✓ Cooperation
- ✓ Exchanging ideas
- ✓ Joining forces, competencies and efforts
- ✓ Joint development of tools & methods to mitigate Earthquake Risks

Basic project info

Programme	Work programme part
Union Civil Protection Mechanism (UCPM)	UCPM-2022

Call	Work programme year
Prevention and Preparedness Projects on Civil Protection and Marine Pollution (UCPM-2022-PP)	UCPM-2022

Type of action	Type of MGA
UCPM-PJG UCPM Project Grants	UCPM Action Grant Budget-Based [UCPM-AG]

European Commission

Project info

Total Costs (proposal): **923,784.50 €**

Maximum Grant Amount (award decision):

785,215.92 €

Area of implementation: **Greece – Türkiye CBA**

Starting date: **March the 1st , 2023**

Duration: **two (2) years**

Consortium

INTERNATIONAL HELLENIC UNIVERSITY

GEBZE TEKNİK ÜNİVERSİTESİ

AFAD
T.C. İÇİŞLERİ BAKANLIĞI
AFET VE ACİL DURUM YÖNETİMİ BAŞKANLIĞI

ITΣAK

Background

2020-23

BSB JOP 2014-20

Rapid Earthquake Damage Assessment Consortium-REDACt

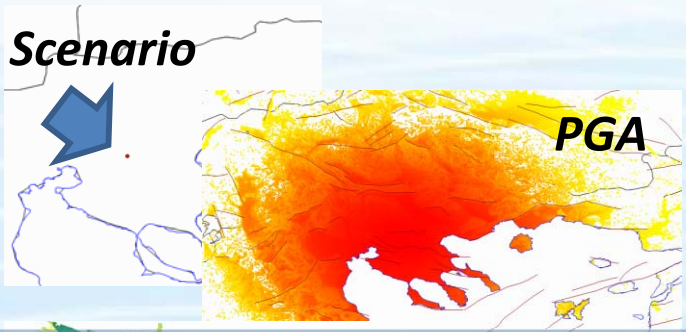
REDACt
Rapid Earthquake Damage Assessment ConsorTium

2023-25

Union Civil Protection Mechanism-UCPM 2022

ERes
EARTHQUAKE RESILIENT SCHOOLS

The Rapid Earthquake Damage Assessment platform



Earthquake Damage Assessment

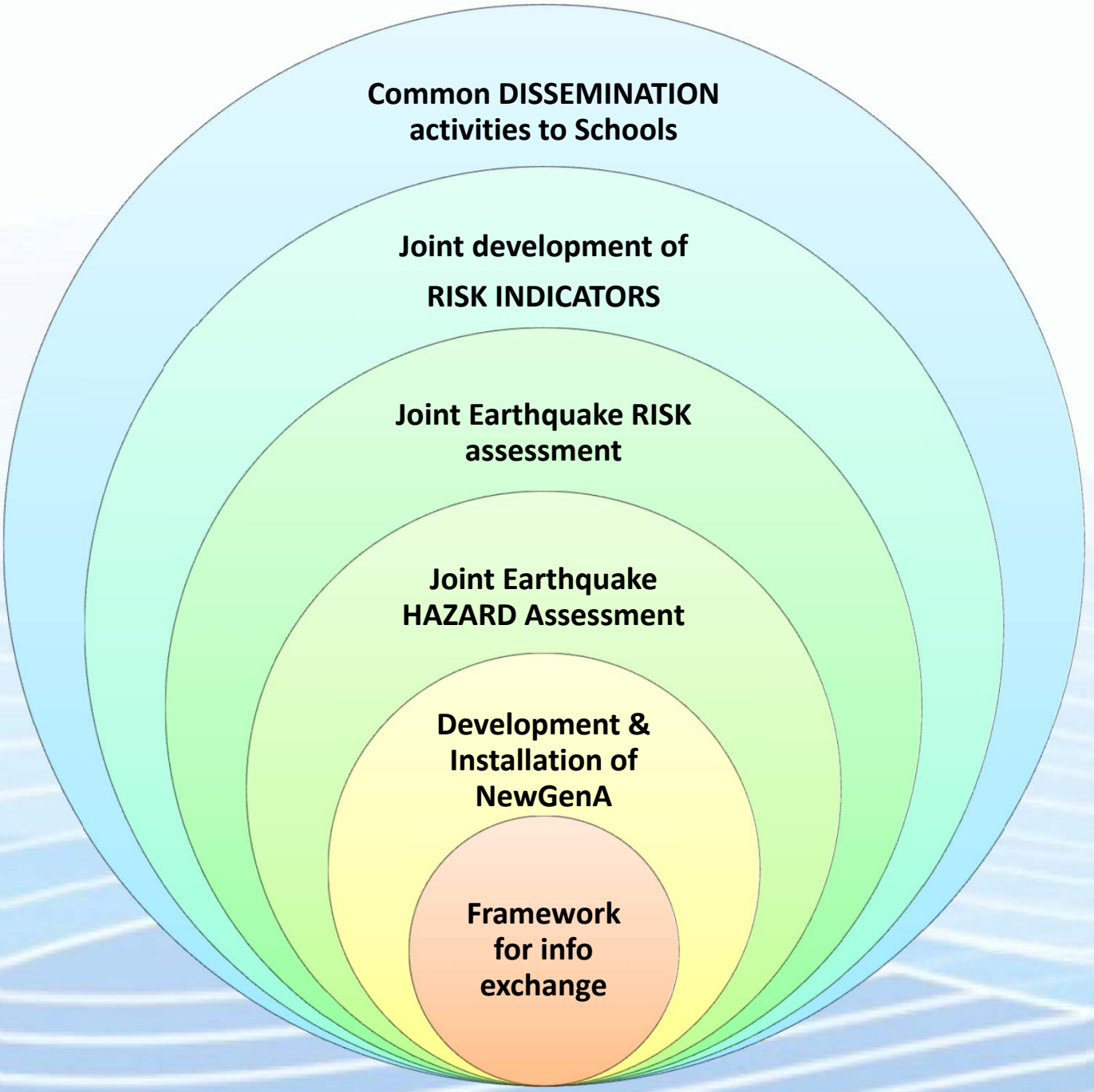
- Scenario based and
- Near Real-Time

https://www.redact-project.eu/

The Educational Hub

Solutions to problems related to Public Response

Activities & Outputs



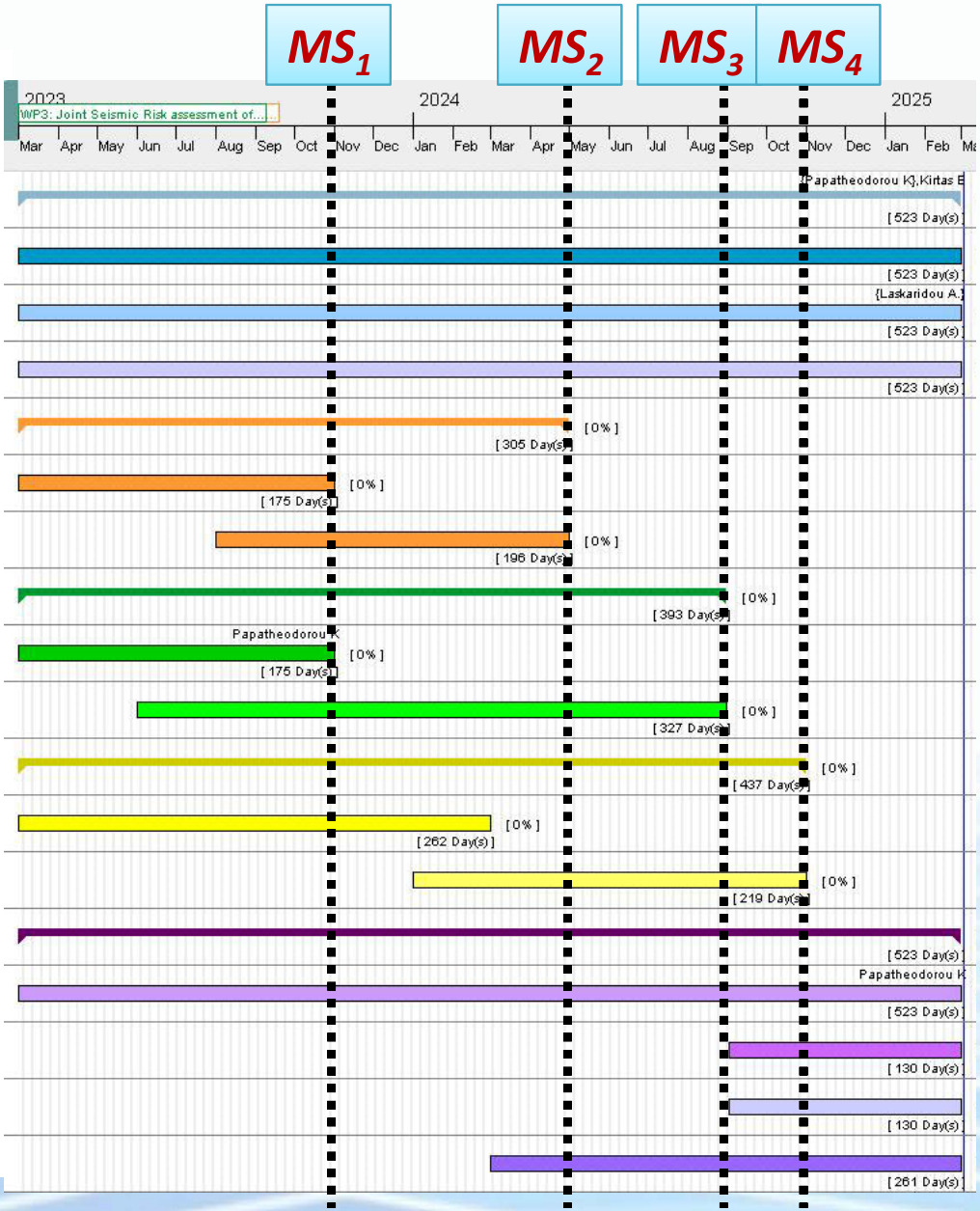
- ✓ Development of a **Framework for information exchange**
- ✓ Development of **New Generation Accelerometers (NGAc)**
- ✓ **NGAc Installation** to selected School buildings of various representative typologies within the Pilot Implementation Areas
- ✓ **Joint Earthquake Hazard Assessment**
- ✓ **Joint Earthquake Risk Assessment**
- ✓ **Joint development of EQuake RISK indicators**
- ✓ Common Communication/ Dissemination activities (development and dissemination of Educational Material to the school community and to Authorities, Workshops)

Project Structure & Activities

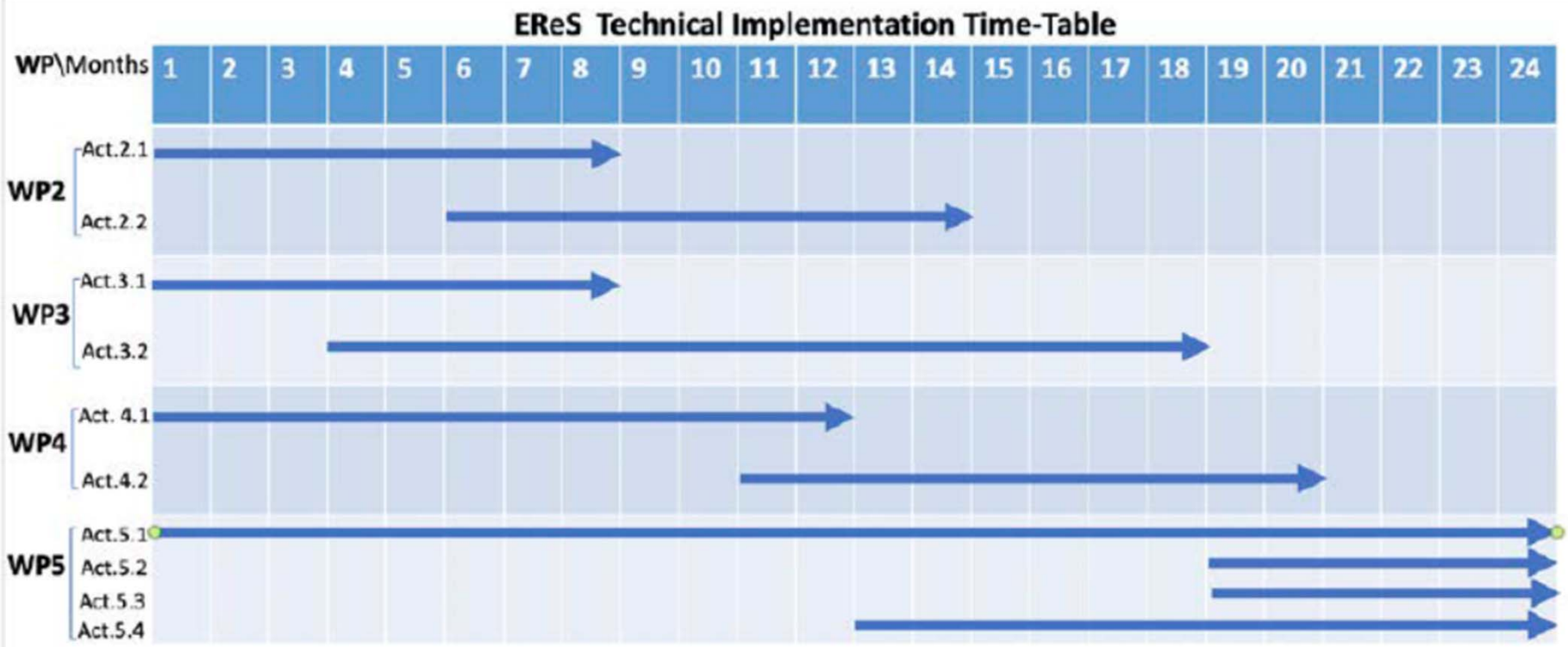
EReS Feb 2, 2023

Tasks 2

Name	Begin date	End date	Coordinator
WP1: Project Coordination & management	01/03/2023	28/02/2025	
T1.1. Project Coordination & Management	01/03/2023	28/02/2025	
T1.2: Financial Management	01/03/2023	28/02/2025	
T1.3: Project Meetings	01/03/2023	28/02/2025	
WP2: A framework for seismic hazard assessment in the Greece-Türkiye CBA	01/03/2023	30/04/2024	ITSAK
T2.1: A framework for information exchange for seismic hazard harmonization	01/03/2023	31/10/2023	
T2.2: Joint assessment of seismic hazard in the pilot sites of the Greece-Türkiye CBA	01/08/2023	30/04/2024	
WP3: Joint Seismic Risk assessment of school buildings	01/03/2023	30/08/2024	GTU
T3.1: A framework for information exchange for seismic risk harmonization in the Greece-Türkiye CBA	01/03/2023	31/10/2023	
T3.2: Joint assessment of seismic risk in the Greece-Türkiye CBA (school buildings in the pilot sites)	01/06/2023	30/08/2024	
WP4: Joint investigation of seismic risk indicators based on instrumentation of school buildings (pilot sites in the CBA)	01/03/2023	31/10/2024	ITSAK
T4.1: Design and Manufacture of Next Generation Accelerometers	01/03/2023	29/02/2024	
T4.1: Deployment of Next Generation Accelerometers in selected schools of the pilot sites	01/01/2024	31/10/2024	
WP5: Communication & Dissemination	01/03/2023	28/02/2025	AFAD
T5.1: Dissemination activities	01/03/2023	28/02/2025	
T5.2: Dissemination of project's results to end users & critical stakeholders	02/09/2024	28/02/2025	
T5.3: Training of school community aiming at earthquake resilient schools	02/09/2024	28/02/2025	
T5.4: Scientific Publications/Presentations	01/03/2023	28/02/2025	



Project Structure & Activities



Act.2.1 A framework for information exchange for seismic hazard harmonization
Act.2.2 Joint assessment of seismic hazard in the pilot sites of the Greece-Türkiye CBA
Act.3.1 A framework for information exchange for seismic risk harmonization in the Greece-Türkiye CBA
Act.3.2 Joint assessment of seismic risk in the Greece-Türkiye CBA (school buildings in the pilot sites)
Act.4.1 Design and Manufacture of Next Generation Accelerometers
Act.4.2 Deployment of Next Generation Accelerometers in selected schools of the pilot sites
Act.5.1 Dissemination activities
Act.5.2 Dissemination of project's results to end users & critical stakeholders
Act.5.3 Training of school community aiming at earthquake resilient schools
Act.5.4 Scientific Publications/Presentations

WP.2: A framework for seismic hazard assessment in the Greece-Türkiye CBA

In-kind contributions: In-kind contributions for free are cost-neutral, i.e. cannot be declared as cost. Please indicate the in-kind contributions that are provided in the context of this work package.
The Coordinator remains fully responsible for the coordination tasks, even if they are delegated to someone else. Coordinator tasks cannot be subcontracted.
If there is subcontracting, please also complete the table below.

Task No (continuous numbering linked to WP)	Task Name	Description of the task and expected result	Participants		In-kind Contributions and Subcontracting (Yes/No and which)
			Name	Role (COO, BEN, AE, AP, OTHER)	
T2.1	A framework for information exchange for seismic hazard harmonization	It is well known that both Greece and Türkiye are earthquake prone countries and in the past both have paid a high toll in damage and losses due to earthquake disasters. Additionally, based on historical and recent instrumental period data, in their Cross Border Area (CBA) high seismicity is observed leading to high seismic hazard (e.g. PGA>0.4g for mean return period of 475years; SHARE European Seismic Hazard Map, 2013). Only within the last 8 years, 4 strong events hit the CBA (Samothraki-Canakkale 2014 (M6.9); Lesvos-Denizkoy 2017 (M6.3); Kos-Bodrum 2017 (M6.6); Samos – Kusadasi & Izmir 2020 (M7.0), see Figure below) and caused damage in the CBA of both countries. Among other infrastructures, schools are unanimously considered as a critical one in the earthquake prone CBA, and undoubtedly being elements at risk for which requirement of earthquake resilience is imperative (OECD booklet, Keeping Schools Safe in Earthquakes (2004)). A basic first step towards a jointly developed harmonized seismic hazard assessment is the generation of a joint framework for earthquake information exchange for seismic hazard assessment. Then, compilation of all up to date available geological, geophysical and seismological information around the pilot sites of the CBA is planned. The geological information will use national maps with at least 1:50.000 scale and the topographic data from Digital Elevation Model with an accuracy of less or equal to 30 arc-sec. As for the seismic sources and faults all historical information and instrumental period seismicity will be the basis for determining the joint seismic source model around the pilot sites of the CBA. Generation of the final source/faults model will be jointly proposed assuring thus harmonization of its parameters to be used in seismic	IHU ITSAK/EPPO, GTU, AFAD	COO BEN	No
		hazard analysis. Harmonization of Ground Motion Prediction Models and of a Logic Tree will be jointly elaborated and validated for the pilot sites of the CBA.  			

WP.2: A framework for seismic hazard assessment in the Greece-Türkiye CBA

Task T2.2 Joint assess Joint assessment of seismic hazard in the pilot sites of the Greece-Türkiye CBA

Harmonized Seismic Hazard assessment in the pilot sites is twofold. (a) In probabilistic sense, on "rock" conditions, for various mean return periods (T=100, 475, 950 years), for various intensity. measures (PGA, PGV, PSA {T=0.3s, 0.6s, 1.0s}), to be provided in respective maps and tables for a grid of point of the Pilot Implementation Areas and (b) In real time assessment (Shakemaps) in case of an earthquake with M≥4.0 in the broader examined area. For the shake of accuracy of the Shakemap, installation of in-house manufactured low cost Next Generation Accelerometers (NGA-LC) will be deployed in various geologic conditions in the pilot study sites of the CBA. and beyond (see Fig. 1) within selected school buildings. Amplification of seismic motion on "rock" for both real time Shakemaps and probabilistic maps will be based on Vs30 proxy distribution. Processed information from the National Accelerometers Network of Greece (ITSAK) and Türkiye (AFAD) along with data from the NGA networks within the CBA pilot sites will be exchanged in real time among Greece and Türkiye and utilizing the Rapid Earthquake Damage Assessment System (REDASystem: to be developed in REDACt project), a harmonized Shakemap as well as DamageAssessment Distribution of school buildings in pilot sites will be available to all involved authorities of both countries.ment of seismic hazard in the pilot sites of the Greece-Türkiye CBA.

WP. 3: Joint Seismic Risk assessment of school buildings

Task No (continuous numbering linked to WP)	Task Name	Description of the task and expected result	Participants		In-kind Contributions and Subcontracting (Yes/No and which)
			Name	Role (COO, BEN, AE, AP, OTHER)	
T3.1	A framework for information exchange for seismic risk harmonization in the Greece-Türkiye CBA	A reliable seismic assessment of building structures strongly depends on the availability, as well as the quality, of the information regarding the structural characteristics that determine their seismic performance. Several properties such as the structural material (e.g. masonry, reinforced concrete, steel, etc.), the construction year (directly corresponding to the applied codes and regulations), the height (i.e. number of storeys), the structural system (moment frame, dual, etc.), potential structural irregularities (in plan and/or elevation), affect the seismic response and the vulnerability of existing buildings. Regarding populations of school buildings, it is practically impossible to perform thorough seismic assessment studies (including detailed depiction, potential laboratory results and analyses of enhanced numerical models) for each school. All available information regarding the structural properties mentioned in the previous paragraph will be gathered for school buildings in the pilot areas and then used in order to classify them into broader structural typologies with common characteristics. Taxonomy schemes proposed in the literature (e.g. GEM, HAZUS, WHE-PAGER, RiskUE etc.) will be examined for their ability to reliably describe the school building stock in the Greek-Türkiye CBA. Similarities, as well as differences due to local construction practices, regarding school building typologies in Greece and Türkiye will be identified and investigated, targeting to a harmonized framework/platform that will be developed for the CBA.	IHU ITSAK/EPPO, GTU, AFAD	COO BEN	No

WP. 3: Joint Seismic Risk assessment of school buildings

T3.2 Joint assessment of seismic risk in the Greece-Türkiye CBA (school buildings in the pilot sites).

For the harmonized implementation of the risk assessment methodology of school buildings in the pilot sites, appropriate existing sets of available, widely accepted, fragility curves for typical building classes (e.g. Martins & Silva (2020), ESRM2020 (2019), Kappos and Panagopoulos (2010) and others) will be investigated and adopted after critical evaluation. This would lead to the use of a unified framework for the seismic vulnerability assessment (with common damage state definitions) in the CBA. It should be emphasized that use of vulnerability functions developed for other regions (e.g. utilizing fragility curves proposed for USA building typologies, for risk scenarios in European areas) should be treated with caution since variations in local construction practices as well as the corresponding codes and regulations could result in significantly different seismic performance. Combining the seismic hazard maps developed in WP2, the inventory of the school buildings and the adopted vulnerability functions, seismic risk assessment scenarios can be carried out targeting to estimate the damage robability of the existing school building stock within the broader pilot study sites.

Furthermore, in case of an earthquake event, near real-time seismic risk assessment for the pilot sites will be possible, having already developed the NGA network that monitors the seismic motion, and the software tools to estimate seismic damage. As a result of the present WP, a joint dataset of school building typologies and a harmonized methodology for risk assessment of school buildings will be implemented and adopted by the respective national authorities. Provided that data for damage of school buildings due to past earthquake events will be available for the pilot study sites, the ability of the proposed procedures to adequately describe the actually observed damage will be investigated, by developing appropriate seismic risk scenarios and estimating the damage state of the existing school building stock.

WP. 4: Joint investigation of seismic risk indicators based on instrumentation of school buildings (pilot sites in the CBA)

Task No (continuous numbering linked to WP)	Task Name	Description of the task and expected result	Participants		In-kind Contributions and Subcontracting (Yes/No and which)
			Name	Role (COO, BEN, AE, AP, OTHER)	
T4.1	Design and Manufacture of Next Generation Accelerometers	The design & development of Next Generation Accelerometers has been started 10 years ago at ITSAK) as a stand-alone 14bits MEMS accelerometer, known as "SeismoBug" low cost unit (https://tracxn.com/d/companies/seismobug.com). Technology advancements in telecommunication and electronic materials opened the path for designing and manufacturing more versatile devices for data transferring fast and reliably. Under these conditions, new design and development of Next Generation Accelerometer is made possible and will be attempted. About fourty (40) such devices of high resolution (20 bits) and capability of real time continuous data streaming from the installation site to the Computing Center for further elaboration, will be manufactured within the project duration.	ITSAK / EPPO	BEN	Yes (GTU, next gen accelerometers design and production)

WP. 4: Joint investigation of seismic risk indicators based on instrumentation of school buildings (pilot sites in the CBA)

Description
T4.1 Design and Manufacture of Next Generation Accelerometers. The design & development of Next Generation Accelerometers has been started 10 years ago at ITSAK) as a

Associated with document Ref. Ares(2022)8262283 - 29/11/2022

stand-alone 14bits MEMS accelerometer, known as "SeismoBug" low cost unit (https://tracxn.com/d/companies/seismobug.com). Technology advancements in telecommunication and electronic materials opened the path for designing and manufacturing more versatile devices for data transferring fast and reliably. Under these conditions, new design and development of Next Generation Accelerometer is made possible and will be attempted. About fourty (40) such devices of high resolution (20 bits) and capability of real time continuous data streaming from the installation site to the Computing Center for further elaboration, will be manufactured within the project duration.

T4.2 Deployment of Next Generation Accelerometers in selected schools of the pilot sites.
After the Next Generation Low Cost Accelerometers are successfully tested in-lab and pass all required conditions, they will be installed at the school buildings of the pilot sites. Their capability of in-situ ambient noise recording to reveal basic dynamic response properties of the respective building (e.g. first eigenmode etc.) will be investigated using high resolution temporary array of high resolution 24bits seismographs. Continuous data streaming will be sent to the remote Computing Center in 24/7. This data will be used Shakemaps generation within urban environment and in case of a strong event to investigating possible damage indicators by using both units on the building (ground floor and top-roof).

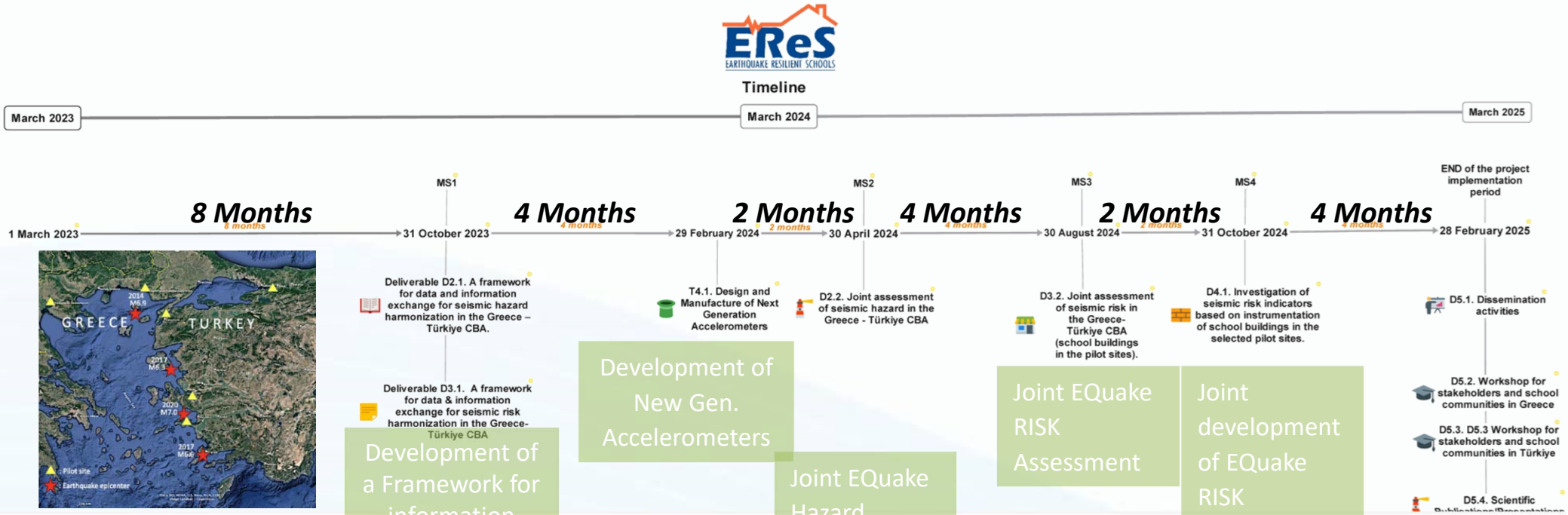
WP. 5: Communication & Dissemination

Task No (continuous numbering linked to WP)	Task Name	Description of the task and expected result	Participants		In-kind Contributions and Subcontracting (Yes/No and which)
			Name	Role (COO, BEN, AE, AP, OTHER)	
T5.1	Dissemination activities	Dissemination of project implementation activities goals and results can be achieved through a combination of communication	IHU ITSAK/EPPO,	COO	No
		approaches from all beneficiaries participating the project. Partners' websites and social media accounts will be used to reach a larger audience, based on the existing extended network of friends, followers and visitors of the involved institutions and researchers participating the project, many of which belong to the scientific communities of Greece and Türkiye with obvious advantages for the effectiveness of the dissemination process.	GTU, AFAD	BEN	
T5.2	Dissemination of project's results to end users & critical stakeholders	Since this task is devoted to the dissemination of scientific and technological implementation activities, the targeted audience will focus on project stakeholders that will benefit from the project outputs, such as employees of the civil protection and municipality technical services. Through the deliverables linked to this task, the project partners intend to transfer knowledge and train the stakeholders on new methodological approaches and tools, to enhance preparedness and response towards earthquake events. To this end, workshops in the framework of the project will inform and train people in the competent civil protection agencies of the CBA. Furthermore, the project partners will produce material (presentations, electronic material) to facilitate the multiplication of the results to other regions of the involved countries.	IHU ITSAK/EPPO, GTU, AFAD	COO BEN	Yes (AFAD subcontracting for workshop organization)
T5.3	Training of school community aiming at earthquake resilient schools	a. Needs and Best Practices Analyses in Schools The objectives of the Needs and Best Practices Analyses are to identify: a) needs, weaknesses, challenges and opportunities, b) the status of preparedness of school community in participating countries, c) best practices, tools and methodologies that could adapted d) communication channels with school community. b. Design and Production of Training Package The main objective of this sub-activity is to develop joint intervention and prevention protocols for schools. From this point of view, it is important to develop an effective, targeted and users-friendly Training Package of activities, videos, guidelines and theoretical background on earthquake protection issues, in order to be used for training and dissemination actions.	IHU ITSAK/EPPO, GTU, AFAD	COO BEN	Yes (AFAD subcontracting for workshop organization)

12.01.2024 meeting AGENDA (indicative)

1. "**Task 4.1 - Design and Manufacture of Next Generation Accelerometers**". Current status, next steps, timeline for delivering the NGAc.
2. "Task 4.2 - Deployment of Next Generation Accelerometers in selected schools of the pilot sites". Current status, next steps, timeline for delivering the NGAc.
3. "**D2.2 Joint assessment of seismic hazard in the Greece- Türkiye CBA**". Current status, next steps, timeline for delivering the deliverable.
4. "D3.2 Joint assessment of seismic risk in the Greece- Türkiye CBA (school buildings in the pilot sites)." Current status, next steps, timeline for delivering the deliverable.
5. "Task 5.3 - Training of school community aiming at earthquake resilient schools". Current status, next steps, timeline for preparing the educational material. Dissemination means (printed, website etc).
6. Any subject proposed by partners

Timeline - Milestones - Major events – End Users



Milestones

Number		Name	Lead Beneficiary	Due Date (in months)
M1	✓	MS1 Framework for data & information exchange (Har	AFAD	8
M2	✓	MS2 Joint Hazard Assessment	ITSAK/EPPO	14
M3	✓	MS3 Joint Risk Assessment	GTU	18
M4	✓	MS4 Joint Investigation of seismic risk indicators of sc	ITSAK/EPPO	20

- ✓ Stakeholders: **State Authorities, Civil Protection Authorities, school communities**
- ✓ **Workshop for major stakeholders & school communities in Greece and in Türkiye (end of the project (23-24th month)**

European Commission

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Programme	Work programme part
Union Civil Protection Mechanism (UCPM)	UCPM-2022

Call	Work programme year
Prevention and Preparedness Projects on Civil Protection and Marine Pollution (UCPM-2022-PP)	UCPM-2022

Type of action	Type of MGA
UCPM-PJG UCPM Project Grants	UCPM Action Grant Budget-Based [UCPM-AG]

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Thank you!

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ITSAK