



3S - Safe, Sound & Sustainable Housing in Africa

May 10th | 16:30 Central Africa Time



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FEDERATION OF AFRICAN ENGINEERING ORGANISATIONS
FEDERATION DES ORGANISATIONS D'INGÉNIEURS EN AFRIQUE




ECCE European Council
of
Civil Engineers

**THE NEED FOR
INTEGRATING
STRUCTURAL / SEISMIC UPGRADE
OF EXISTING BUILDINGS,
TOGETHER WITH
ENERGY EFFICIENCY
IMPROVEMENTS**

Platonas Stylianou
Joint ECCE – WCCE 3S group Initiative Chair



The 3S Approach

 The European Council of Civil Engineers (ECCE) and the World Council of Civil Engineers (WCCE) are joining forces in a common initiative which aims to raise awareness on the need of "Safe - Sound - Sustainable" (3S) buildings which can be fulfilled by integrating structural/seismic upgrade of the existing buildings together with energy efficiency improvements.



 What started as an ECCE Initiative and became an ECCE statement in 2020 focusing on Europe, is now being extended together with WCCE on a Global Level.

Context for 3S 1.0 : Aging Building stock



The majority of the existing building stock in most countries was built at a time when modern design and construction standards and techniques, including the requirements for resilience, seismic safety, and energy efficiency, were not yet enforced. Thus, depending on their date of construction, the vast majority are deficient in terms of energy, durability, and seismic resistance.



One of the most important human rights is the right to possess Safe, Sound and Sustainable buildings (3S). Adequate, safe housing was recognized as part of the right to an adequate standard of living in Article 25 of the 1948 Universal Declaration of Human Rights and in Article 11.1 of the 1966 International Covenant on Economic, Social, and Cultural Rights.



Are rules and priorities in place?

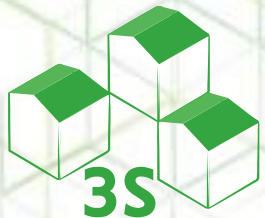


Seismic and structural risk assessment of buildings is of paramount importance in order to:

- define prioritization strategies
- quantify the required resources,
- plan investments



However, quite a lot of countries **do not have modern and enforceable regulations** for the assessment and retrofiting of buildings.



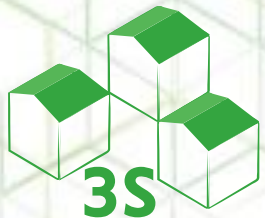
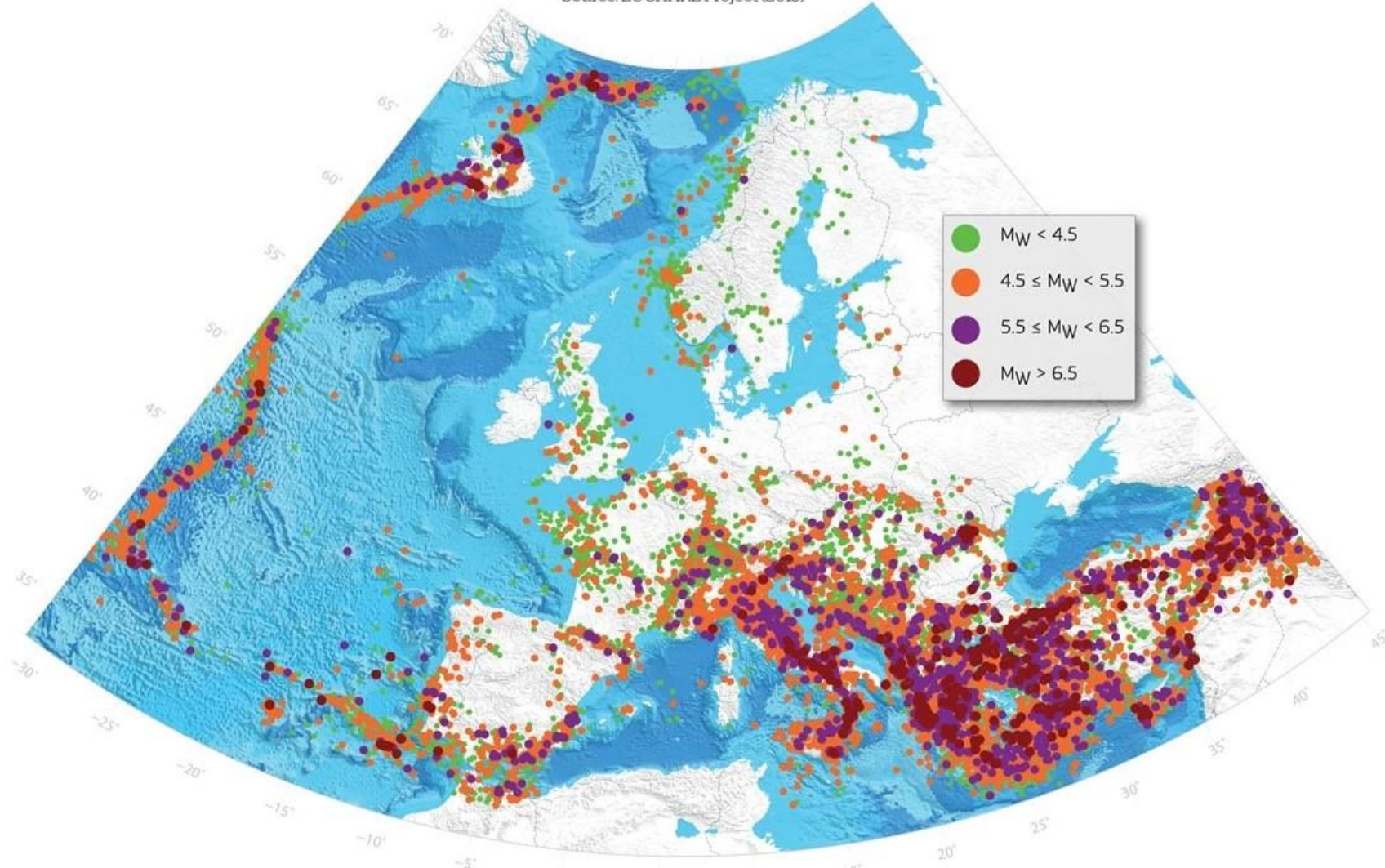
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The biggest Earthquakes in Europe

Earthquake history in Europe

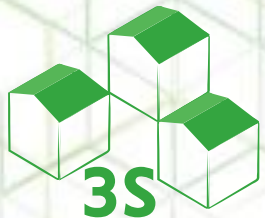
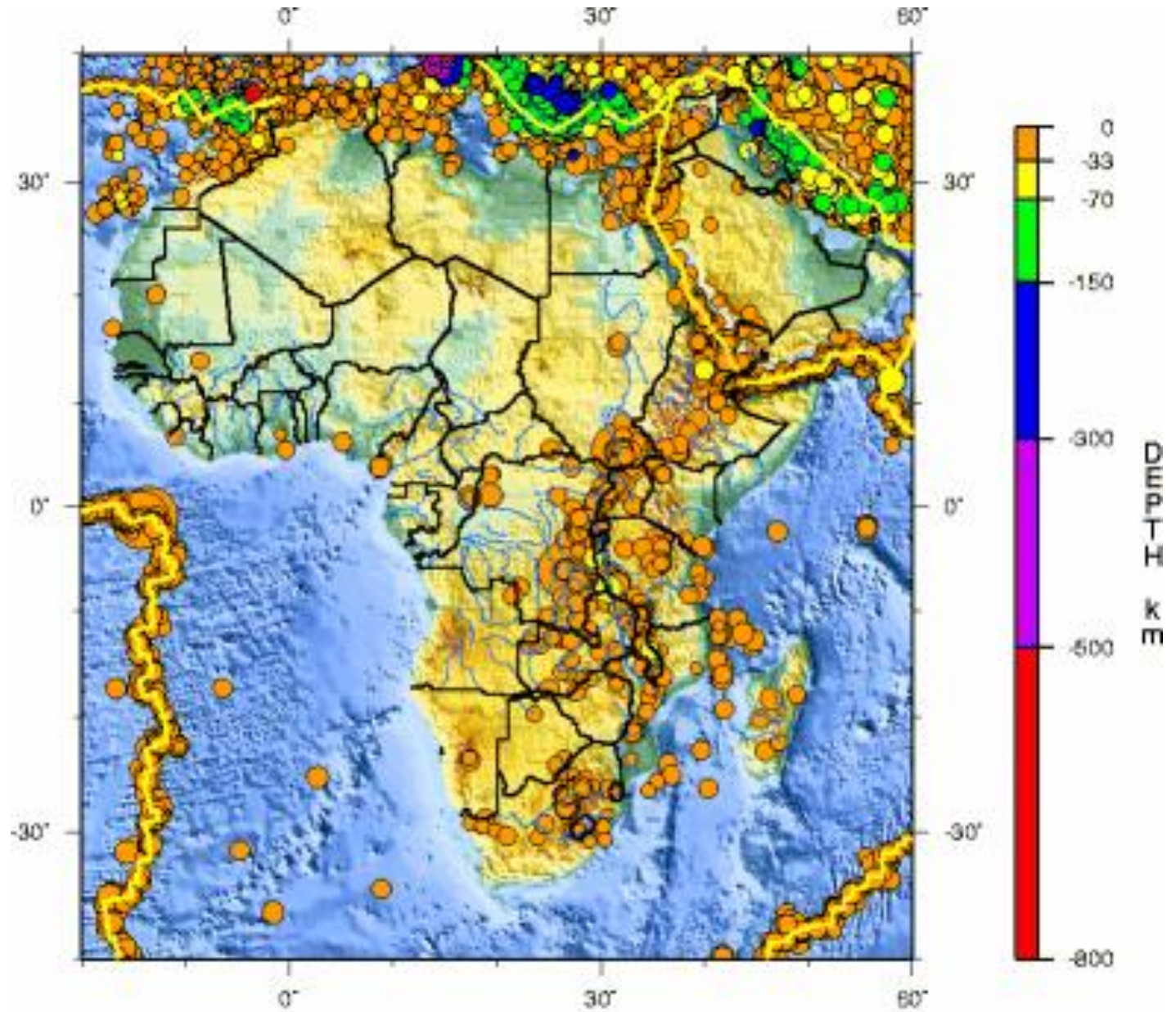
Distribution of over 30,000 earthquakes
with magnitudes larger or equal to 3.5 for the period 1000 to 2007

Source: EU SHARE Project (2013)



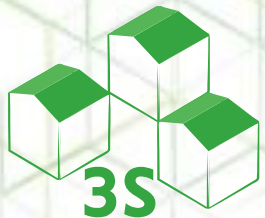
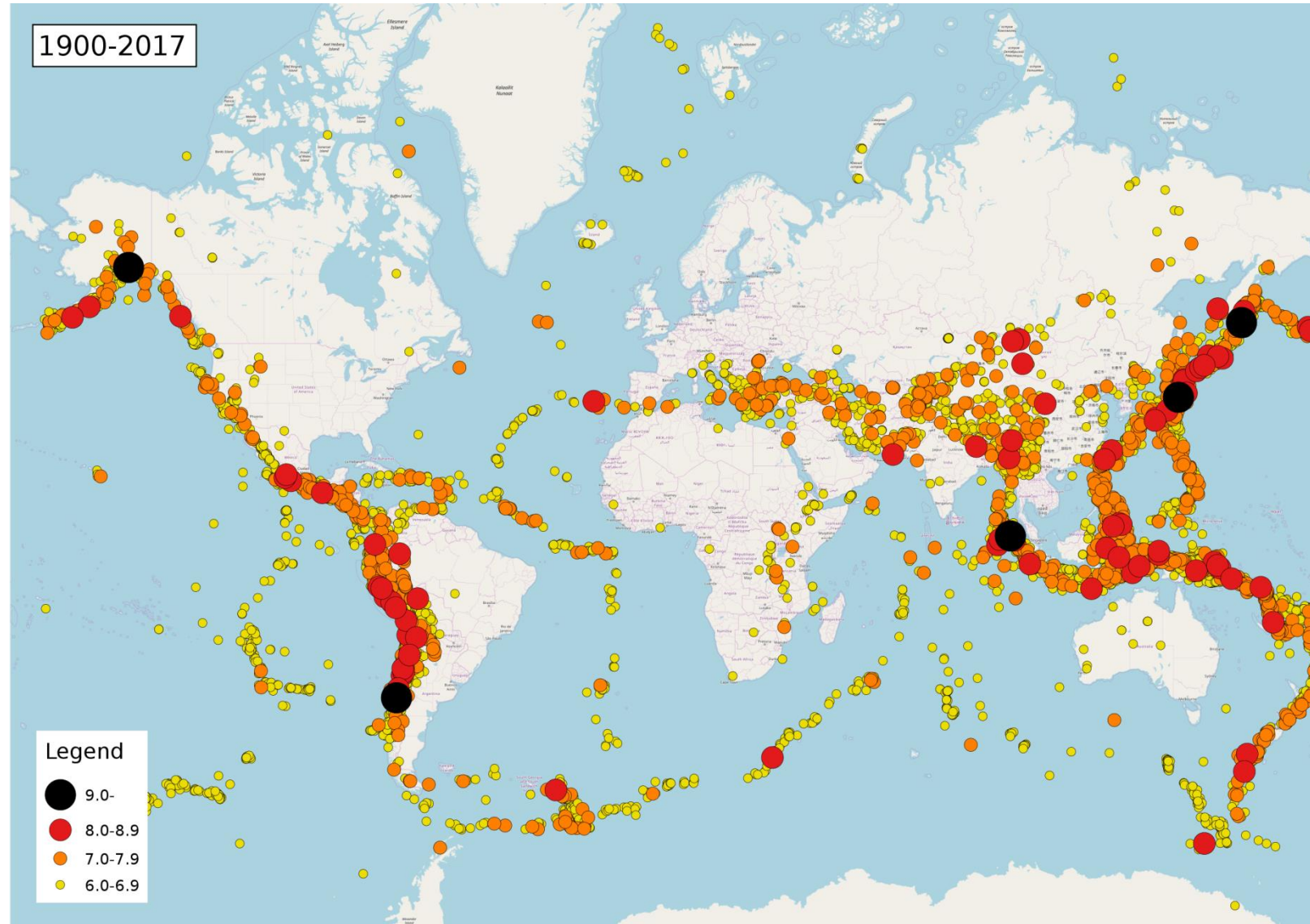
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The biggest Earthquakes in Africa



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Global map of earthquakes (1900-2017)



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Safety must come first



It is economically absurd for seismic-risk countries to invest solely in habitability measures - thermal insulation and energy upgrade – in unsafe buildings.

We simply apply makeup to an uninspected old structure, covering up everything and posing a life-threatening risk.




We bear the risk of a collapse during a strong seismic hazard event. If that happens, all of the money spent on such measures will be wasted. **However**, the economic risk pales in comparison to the potential for injury and loss of life.




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We need a new approach

 We need global, national, and regional regulations and standards on vulnerability assessment and retrofitting measures.

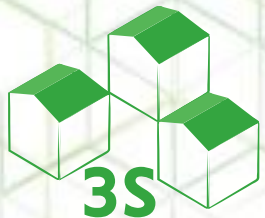
The new trend is smart financing for smart buildings.

 But a building can only be called smart when it is **Safe, Sound and Sustainable**.

 **We need to apply:**

a. **Holistic Approach on Concurrent Structural/Seismic and Energy Retrofitting on existing Buildings.**

b. **Sustainable Structural Design on new Buildings.**



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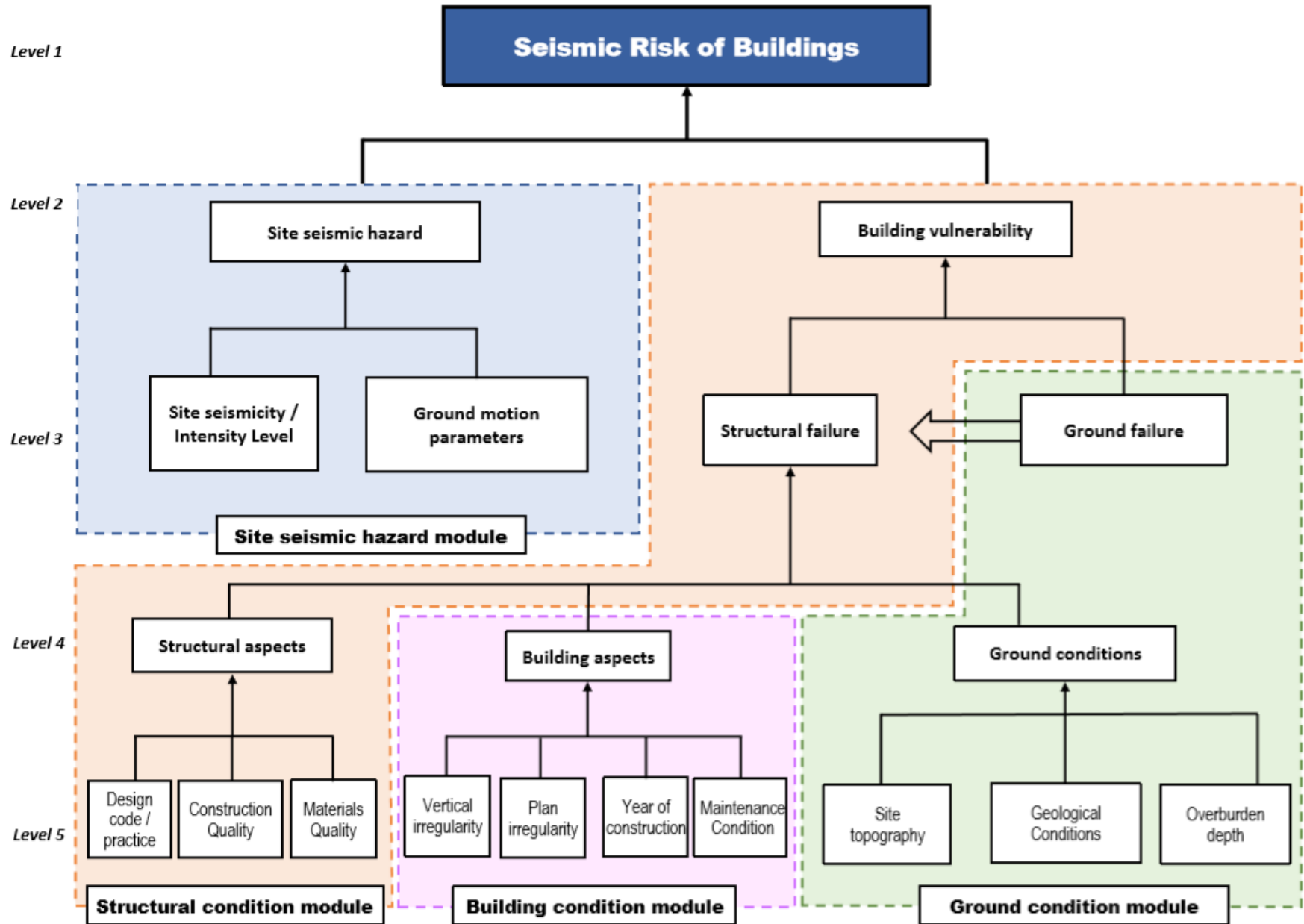


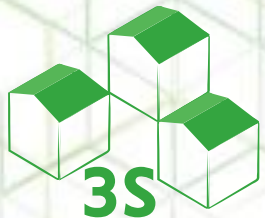
Figure 1 – Hierarchical Earthquake Risk Assessment of Buildings (Platonas Stylianou 2020)

Sustainable Structural Design (SSD)

➤ Modern Construction and Design techniques demand the use of energy and resilience associated with construction, operation and maintenance of structures to be investigated during planning and design phase.


➤ **Key features of SSD are:**

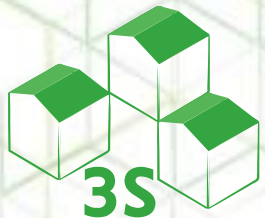
1. Life cycle design optimization
2. Safe Structural Design and execution
3. Waste Reduction / Minimization of Environmental pollution
4. Design for use flexibility
5. Durability of materials and components
6. Optimization of operational and maintenance practices
7. Reuse, reduce and recycle



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Sustainable Structural Upgrade

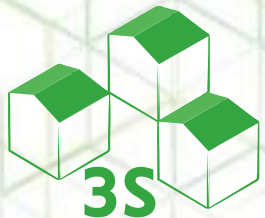
-  Existing assets need urgent maintenance and retrofitting to keep their value and meet today's functional and safety standards.
-  They need to be upgraded if the world wants to maintain its productive and humane standards.
-  This represents a huge renovation and maintenance volume that the world has to deal with during the next few years.
-  This has to be done in a sustainable and innovative way.
-  The application of advanced asset and risk management methodologies based on research is needed, in order to further increase the efficiency of interventions.



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Innovation

- A lot of scientific research has been done Globally during the last few years on seismic and other natural hazards assessment, structural vulnerability, retrofitting of existing structures with innovative materials, and sustainability.
- With this common language, comprehensive building upgrades under a sustainability framework will be possible.



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The Italian case

➤ In 2014 a work group submitted to the Italian Minister a draft of the guidelines for a new seismic performance classification framework based on expected annual losses (EAL) which was the basis for the Seismic Risk Classification introduced in Italy in February 2017.

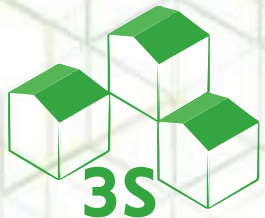
➤ The Classification has a structure similar to the Energy Performance Classification of Buildings and allows ranking the buildings in 7 classes (from A to G).

➤ To stimulate the adoption of risk mitigation measures, together with the Seismic Classification, the Italian government has introduced an interesting tax deduction scheme where the amount of deductible costs is based on the level of seismic risk reduction achieved through retrofitting works.



Izmit Earthquake (Turkey)-17 August 1999

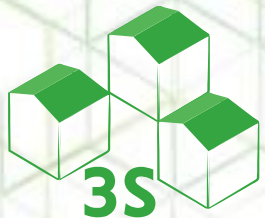
- On 17 of August, 1999 at 03:01:3 (Local Time) there was a strong earthquake, $M = 7.4$ on the Richter Scale, with its epicentre South-West of Izmit town in northern Turkey and at a depth of 15-17Km.
- The duration of seismic vibration was 37 sec. The earthquake shook the cities of the wider area such as Istanbul, Bursa, Eskishir, Duze and Bolu.
- The impact was dramatic, 17,118 civilians died, 45,000 injured, 600,000 homeless and thousands were missing.
- The financial impact of the devastating earthquake amounts to appr 50 billion. dollars without taking into account all the long-term impact.



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Earthquake in the city of Duzce, Turkey 12/11/1999

- On November 12, 1999 at 18:57:22 (local time) a strong earthquake of magnitude, $M_w = 7.2$. Acceleration reached $PGA = 1g$, as it was recorded by the accelerator in the city of Duzce.
- The deaths caused by the earthquake reached 1,000 and more than 5,000 People were injured, 55,000 were forced to leave their homes.
- The economical impact has exceeded \$ 1 billion.

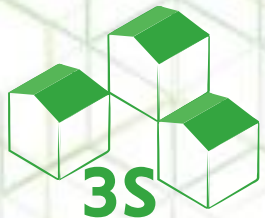


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Earthquake in the city of Laquila (Italy)

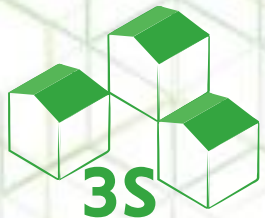
- On April 6, 2009, a strong earthquake excitation $M_w = 6.3$ or 5.9 magnitude on the Richter Scale, occurred with its epicentre 7km outside of the city of L'Aquila at a depth of 10km deep.
- The earthquake was fatal and 319 people were killed, 1,600 were injured and more than 10,000 homes were damaged, 70,000 were forced to leave their homes where 30,000 were left homeless for several months.
- The economical impact of the earthquake Exceeded \$ 15 billion and created a major Unemployment problem. But the cultural impact was also great due to the damage or collapse of several Buildings and monuments.



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Earthquake of Parnitha (Athens) 1999

- On September 7, 1999, there was a strong earthquake excitation, $M = 5.9$ on the Richter Scale with its epicentre, 18km north of downtown Athens.
- The horizontal acceleration exceeded 0.5 g in central Athens while vertical acceleration reached 1 g.
- The impacts of the earthquake were dramatic, 145 people lost their lives, 2,000 were injured and 50,000 were left homeless.
- The financial impact reached \$ 4 billion, with 110 buildings collapsing completely and more than 50,000 buildings were damaged.



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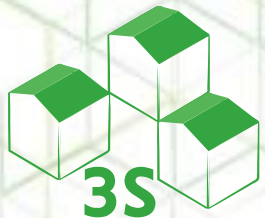
Earthquake of Central Italy

- On August 24, 2016 there was a strong earthquake excitation, $M = 6,2$ on the Richter Scale with its epicentre, Southeast of Norcia, the focal depth of the earthquake was 10km.
- The impacts of the earthquake were dramatic, 299 people lost their live, more than 400 were injured and 4.500 were left homeless.
- The financial impact was appr. \$ 11 billion.
- But the cultural impact was dramatic..



Earthquake of Albania 2019

- On November 26, 2019 there was a strong earthquake excitation, $M = 6,4$ on the Richter Scale.
- The impacts of the earthquake were dramatic, 51 people lost their live, more than 900 were injured and 10.000 were left homeless.
- The cultural impact was dramatic. The financial impact was huge... and still not exactly known.



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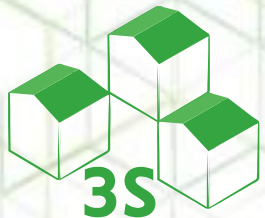
Kahramanmaraş Pazarcık and Elbistan Earthquakes (2023)



On 6 February 2023 a Mw 7.8 earthquake struck southern and central Turkey and northern and western Syria. The epicenter was 37 km west–northwest of Gaziantep. It was followed by a Mw 7.7 earthquake. This earthquake was centered 95 km north-northeast from the first one.



The Mw 7.8 earthquake is the second largest in the history of Turkey. There were more than 10,000 aftershocks in the three weeks that followed. The seismic sequence was the result of shallow strike-slip faulting.



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Kahramanmaraş Pazarcık and Elbistan Earthquakes (2023)


➤ There was widespread damage in an area of about 350,000 km² (about the size of Germany). An unofficial estimated is that about 1.5 million people were left homeless


➤ As of 20 March 2023, more than 57,300 deaths were confirmed: more than 50,000 in Turkey, and more than 7,200 in Syria. And the economic loss was also huge, estimated more than 100 billion dollars.

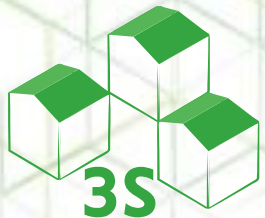


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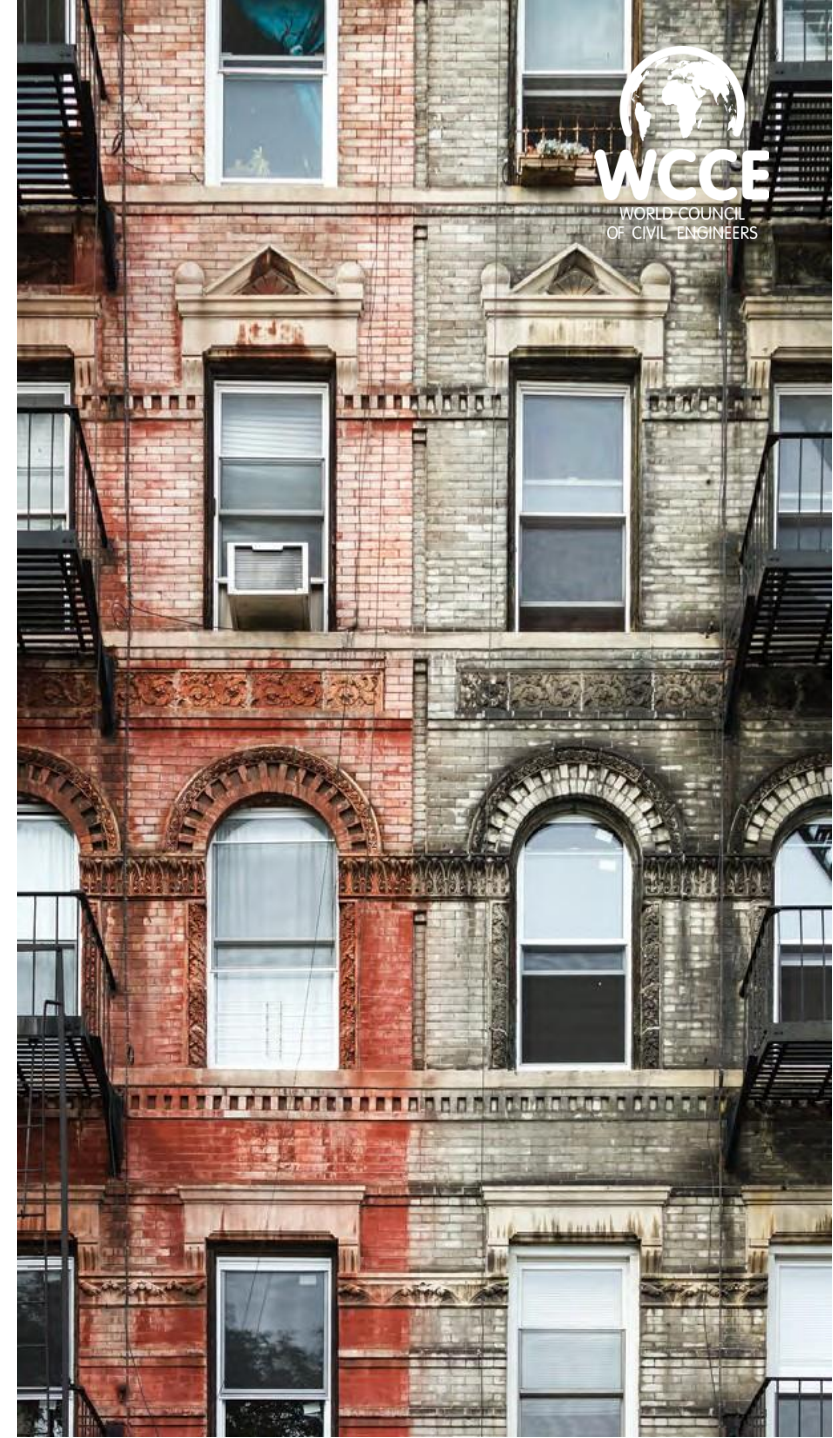
Some first measures

 A new approach must be encouraged, by making some simple changes to legal texts to allow funding for structural and/or seismic upgrades of buildings to be granted before, or at least concurrently with grants for improving building energy performance, under a global directive.

 In cases of major renovation projects, the starting point for legally binding rules on structural upgrades should be all the state/government owned buildings and buildings of high importance, as well as buildings that gather a large number of people.



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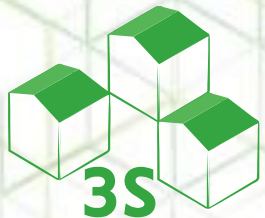
Seismic Performance Classification



ECCE and WCCE must contribute to the effort of developing a **Global common method for building seismic classification**. This could be combined with the electronic identity of structures, which is provided in many countries, and become the basis for the Seismic Risk Classification, similar to the Energy Performance Classification of Buildings.



Finally, financial measures similar to those that promote energy efficiency upgrades should be implemented, with the goal of minimizing expected annual losses (EAL), which is the economic justification for this prevention strategy.

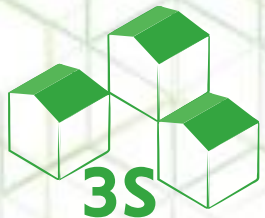


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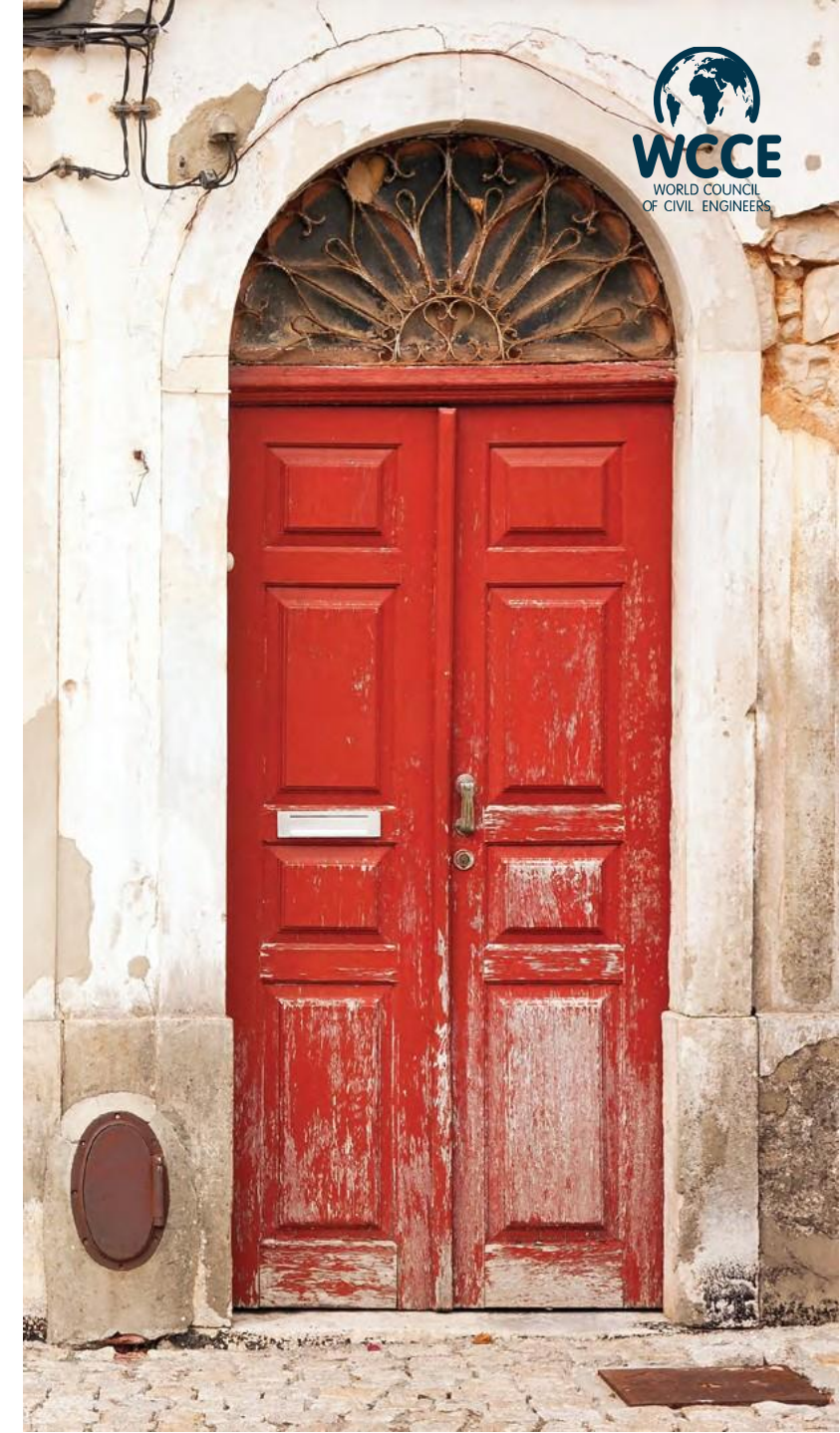


A joint ECCE – WCCE Task Force

- Both ECCE and WCCE contribute to raise Awareness for the problem of safety of the existing building and infrastructure stock.
- **Safety is one the essential features of the human right on adequate housing, and no sustainable approach can forget this.**
- Decision-makers need to comprehend this. The new trend is smart financing for smart buildings - but, a building can only be called smart once it is safe, secure and sustainable, in the order stated.
- ECCE and WCCE have created a joint working team to elaborate on all these ideas.



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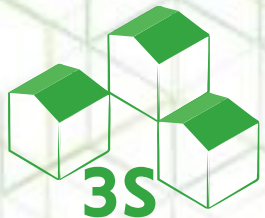


A joint ECCE – WCCE Task Force



Joint ECCE – WCCE Task Force members:

- Platonas Stylianou – Cyprus (Coordinator)
- Andreas Brandner – Austria
- Aris Chatzidakis – Greece
- Jeanette Muñoz Abela - Malta
- Nathaniel Matalanga – Kenya
- Juan Yacopino – Argentina
- Nickolas Kyriakides – Cyprus
- José Francisco Saez Rubio – WCCE Executive Director
- Maria Karanasiou – ECCE General Secretary



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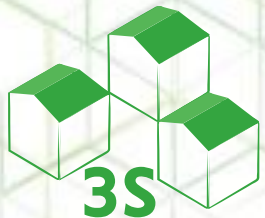
Contribute to the 3S Approach

Please respond to the Questionnaire that will provide us with valuable input.



General info

1. Does your Country suffer frequently from earthquake or other dynamic loading problem or other combination of dynamic loadings? *If yes, give details.—Please provide a link to historical records or additional info, if possible.*
2. When was the last major / serious earthquake or other dynamic event that took place in your Country that affected the stability of buildings and civil works? *What was the intensity?*
3. Were the affected buildings or civil works repaired? *Do you know what was the amount of money needed in order to repair the above? If yes, give details.*
4. Please briefly explain what damages it caused (with regard to buildings, roads, bridges, etc.)
5. Were there any fatalities or serious injuries? *If yes, give data.*
6. What was the time needed in order to fix the damages and to reinstate smoothly operation?
7. Are you aware of any special measures or others means applied, to mitigate/prepare for these events in your Country? *If yes, give details.*



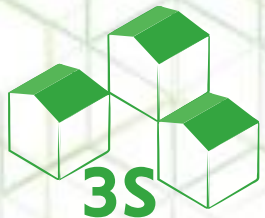
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State regulations/legislations and concrete experiences.

8. Is there a legal or technical guide/regulation on Energy Efficiency Upgrading of existing buildings in your Country? *If yes, give details.*
9. Are there any legal or technical regulations/codes related to Seismic or Structural strengthening or upgrades in your Country? *If yes, give details.*
10. Are the Eurocodes applied for seismic assessments and seismic/structural strengthening of existing buildings in your country? *If yes, give details.*
11. Are there incentives provided by the government, to individuals, for structural upgrades / renovations / seismic upgrades in your Country? *If yes, give details.*
12. Have you received any training related to seismic and energy efficiency upgrading? *If yes, give details.*
13. Have you participated in a workshop/conference on the above topics? *If yes, give details.*



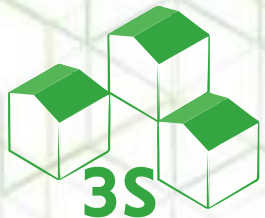
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From practice

14. What are the most common building categories in your Country, regarding existing buildings built before 2000 and how many storeys are they?
15. What is the most widely used construction material for those buildings?
16. What is the common technique/material used for energy efficiency upgrading of existing buildings?
17. What are the most widely used techniques /applications for seismic strengthening of existing buildings?
18. Do you have unmaintained, deteriorated or abandoned buildings that suffer structural deficiencies /material degradation in your country? *If yes, please give us numbers or percentage with regard to the total*



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Contribute to the 3S Approach



Complete the questionnaire online via the link

<https://forms.gle/P7zBWooMd3PmPGAZ6>



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REMEMBER:

The new trend nowadays is...
smart financing for **smart** buildings.

But a building can only be called **smart**...
once it fulfills the **3S** approach
“**S**afe, **S**ound and **S**ustainable”.



Join us!! Check our Manifesto



**THANK YOU
FOR YOUR
ATTENTION!**





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