European Council of Civil Engineers

ECCE POSITION PAPER:
The need for Structural / Seismic Rehabilitation of Existing Buildings, in parallel with Energy Efficiency Improvements

Eur. Ing. Platonas Stylianou
B.Eng. (Hons), MSc, MCS, CEng, FICE, FCIArb.
Chartered Civil Engineer • Arbitrator • Mediator

European Council of Civil Engineers

Aging European Building stock and Infrastructure

- The majority of the existing building stock in many European countries built in the 80s, 70s or earlier lacks of modern design standards and the basic requirements for seismic safety and energy efficiency.

- Thus, based on their date of construction, the vast majority are deficient both in terms of energy and seismic resistance. This creates the need for the society (government, public and engineers) to take actions to keep and maintain the building stock in operational, reliable and resilient state, in order to ensure primarily the safety of the users.

- In civil engineering this ongoing process is achieved by updating the design codes to incorporate aspects studied after extensive research, laboratory work or identified through shortcomings in real hazard situations. In addition to safety, nowadays the comfort of the users is of prime importance. To satisfy the required comfort levels, the user should consume energy, in the form of heating, cooling etc.

- Therefore, this ongoing trend to satisfy these conditions, results in new buildings which are safer, more economic to operate, more secure and more sustainable **(satisfy the three S approach).**

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

- However, **the current building stock of Europe** comprises of structures that have been designed and constructed over a long period of years, spanning some decades ago. For traditional masonry buildings this can be more than 100 years.

- A BPIE (Buildings Performance Institute Europe) survey [BPIE, 2011] revealed that a significant amount, more than 60% of the existing building stock in EU was build before 1980 (only around 17% is constructed after 1991), firstly exceeding their design life and secondly **are constructed during a period that Seismic knowledge and standards were very limited and energy performance guidelines were non-existent.**

- The structural performance of buildings is related to their stiffness and strength as well as their ability to undergo non-linear (ductile) deformations. The extent to which a building can resist loads depends mainly on the characteristics of its lateral load resisting structure L.L.R.S. (i.e. columns, beams and walls). Most existing buildings do not pose significant lateral load resistance and require upgrading to increase the efficiency of one or more of the above.

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

- In the case of the aging existing buildings, the lack of consideration at the design and construction stage, for the seismic effect means this building stock is more vulnerable to earthquakes. In addition, as it is exceeding its design life of 50 years, it means that along with strengthening interventions to improve the seismic performance, durability and structural assessments should also be carried-out to ensure functionality and thus safety and comfort for the users.

- In addition to safety, in the last decade the importance on the energy front has been highlighted; increased energy consumption lead to adverse environmental impact (e.g. climate change). Therefore, for the building sector the energy efficiency term is introduced, which is highlighted by the Europe's aim to reduce by 2020 the Greenhouse emissions by 20% and achieve 20% energy savings [EPBD recast, 2010/31/EU].

- Therefore, it is evident that there is a big portion of the existing EU building block that is under-designed, both regarding their seismic capacity and also their energy performance, since is well below the national minimum requirements set in the last fifteen years and therefore in need of structural and energy renovation to remain operational and safe.

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

- To improve the seismic performance/capacity of existing buildings that have not been designed according to the earthquake standards of Eurocode EC8, a variety of techniques based on the typology of the building and the level of the required strengthening are currently used.
- For RC structures, the seismic retrofit techniques are generally divided to local and global methods [JRC 2014a]:
- Local methods are concentrated in improving the performance of particular structural members and most commonly include the strengthening of the column-to-beam joints, column and beam jacketing and column and beam strengthening with advance materials such as fibre reinforced polymers (FRP) or combined with new technology such as the textile reinforced mortar (TRM) technique, or with traditional R.C. jacketing.
- Global methods may be provided with the addition of shear walls and foundations strengthening, which will also lead to the change of the structural system.
- Regarding the energy performance level of buildings, it is influenced by a number of factors including the installed heating/cooling systems, the climatic conditions and the building envelope. The energy demand of buildings can be reduced by improving the insulation of the envelope, increasing the thermal capacity of the building and by using energy efficient systems in the building's operating processes (e.g. heating). Therefore, any potential energy saving measures are inter-related with these factors, with greatest focus on aging/ "old" existing buildings which have the largest energy consumption due to insufficient insulation.

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

- The insulation of the envelope can be drastically improved by reducing the energy loss from windows and doors and by insulating the walls and the roof. For the latter, the level of improvement depends on the thickness of the provided insulation and the properties of the insulating material, although thick insulating layers are unfavorable due to limitations in space, aesthetics reasons and other technical constraints [JRC 2014a].

- Currently, from a sustainability perspective, emphasis is placed on developing an integrated structural and energy design methodology for new buildings that should be preferred over individual actions, to ensure a **Sustainable Structural Design (SSD). Such approaches like the SSD methodology will ensure that new buildings satisfy both structural safety and energy efficiency targets.**

- However, for existing buildings, especially of a certain construction age, the problem of seismic and energy inefficiency is of primary importance and a similar in concept approach is required to provide upgrading on both fronts. Only the last few years it is acknowledged that independent retrofit actions should be integrated to enhance the overall performance.

- Unfortunately, the current practice prescribes and promotes upgrading solutions that isolate each deficiency and proposes solutions to enhance/upgrade any of the two items (either energy efficiency improvement or structural seismic upgrade) separately.

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

- Given that buildings in many European regions experience frequent seismic activity and high temperature variations, it becomes a necessity to proceed with upgrading or retrofitting measures as part of a major refurbishment process.
- These measures are expected to improve the resilience of the existing building stock in an economically feasible way, reduce the operational expenses and contribute to the sustainability of the society and the environment and offer safer buildings to people (**Home**).
- As it is well known to all Engineers, if old buildings are cladded and insulated, **then they may look new, but their underlying structural issues remain, hidden, unseen and unassessed and may become life-threatening, especially in case of a major seismic or dynamic event and may lead to a collapse or failure.**
- If that occurs, all EU money spent for energy Upgrades and refurbishment would be lost. However, the economic risk is redundant compared to the potential injury and loss of life.

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

2020 3S SAFE SOUND SUSTAINABLE

Seismic Risk Chart

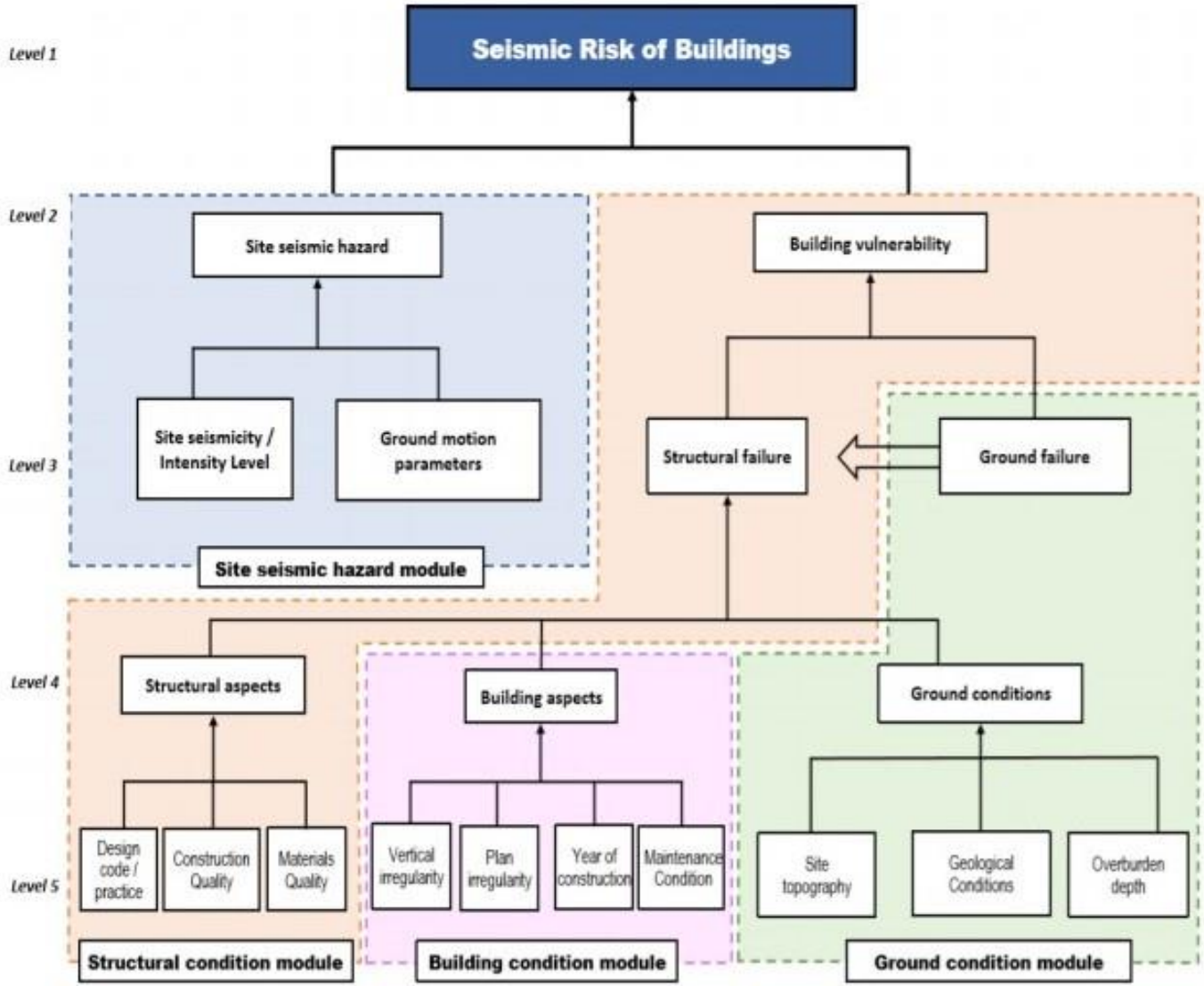


Figure1 – Hierarchical Earthquake Risk Assessment of Buildings (Platonas Stylianou 2020)

European Council of Civil Engineers

Sustainable Structural Upgrade

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

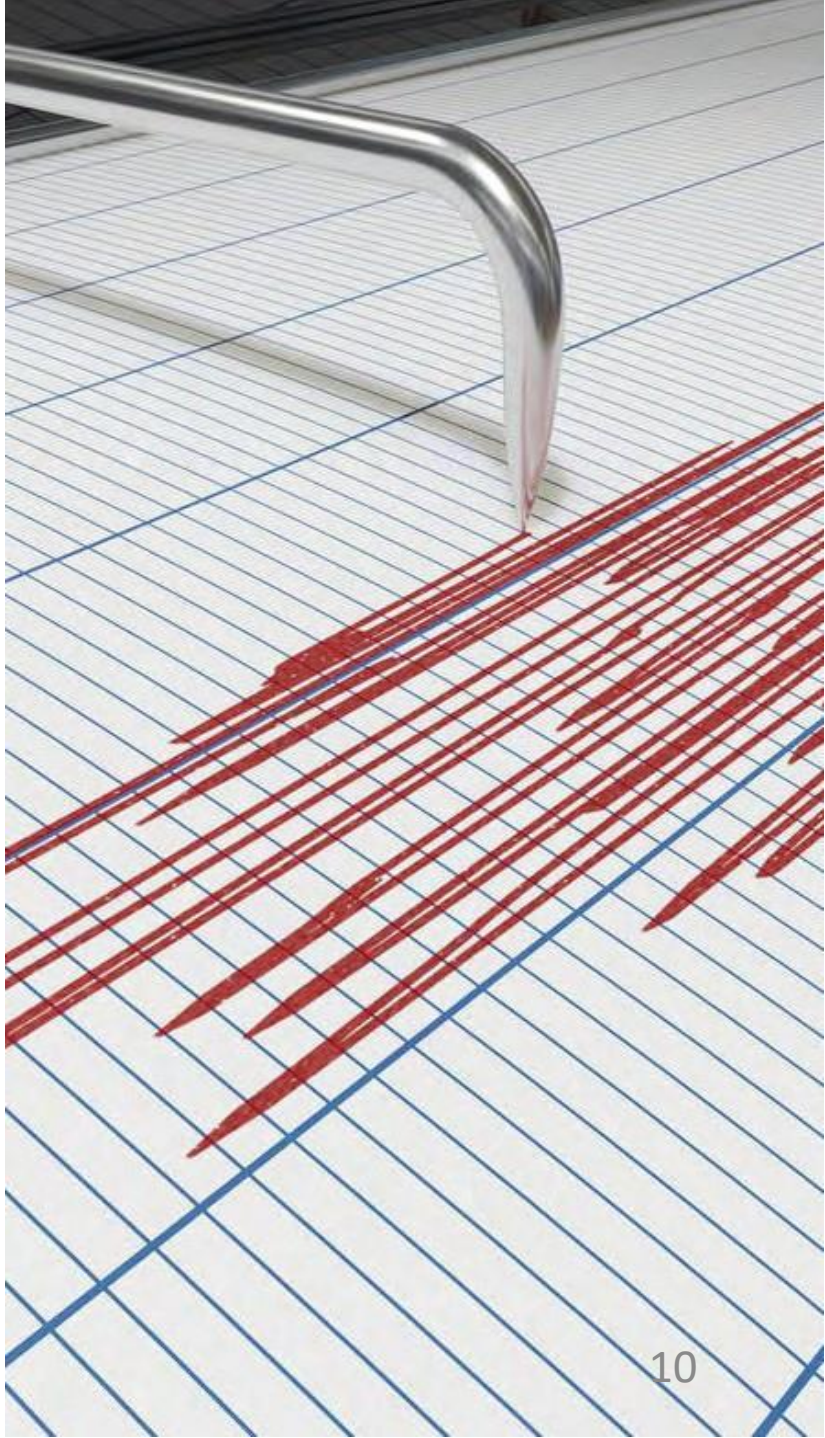
2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

Economic Aspect

- The need for investing on the upgrade of existing buildings and infrastructure is not only a humanistic duty is mainly respecting the value of life.
- Demolition and reconstruction programs are economically unaffordable.
- It is also of great economic importance. We have reliable data on the economic loses provoked by major earthquakes.
- In a rather small earthquake in the island of Samos/ Greece the estimated cost was about of 100 million Euros.

But the economic risk is redundant compared to the potential injury and loss of life.



2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

The need for a new approach is urgent!!

- We need a common European policy on vulnerability assessment and retrofitting measures.

- A solution needs to be found so that funding can be given for scientific work on structural assessment, strengthening and upgrade as well as energy efficiency work. Decision-makers need to comprehend the huge responsibility undertaken when ruling that energy efficiency measures only, would be funded by the EU.

The new trend is smart financing for smart buildings.

But, a building can only be called smart when it is Safe, Sound and Sustainable, (the 3S Approach).

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

Sustainable Structural Design

- The construction sector needs to develop a new way to conceive structures, aiming to achieve a competitive sustainable building market.
- In order to achieve this European objective, a new design methodology is needed, focusing on a multi-performance and life-cycle oriented approach.
- Sustainable Structural Design (SSD) methodology addresses the possibility to include environmental aspects from the very beginning of the project in structural design, so that proper decisions, with regard to design options, can be made in the most influential stages of design.
- The approach for sustainable structural design complies with the design rules and reliability provisions of the European standards for structural design (Eurocodes), thus enabling harmonization between structural safety and sustainability in the design process, thus complying with the basic requirements for construction works of the Construction Products Regulation.

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

Basic Aspects of SSD

- **Design optimization:** The design of structures is made according to structural requirements prescribed by structural Eurocodes or other codes. Furthermore, design optimization should take into account the optimization of the building performance over the complete life cycle of the building, minimizing the need of maintenance and maximizing the recovery of materials in the end of life.

- **Reduction of construction and demolition waste:** The waste produced during construction and demolition processes shall be reduced to a minimum and the residues that are unavoidable should be recycled or reused.

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

Basic Aspects of SSD

- **Design for flexibility and adaptability:** Buildings have a long life span and thus, the eventual change of use or requirements should be considered in the design process

- **Durability of materials and components:** The durability of the materials should be taken into account to minimize maintenance needs and avoid the need for replacement

- **Robustness:** The ability of a structure to withstand unforeseen events, without being damaged to an extent disproportionate to the original cause

2020 3S
SAFE SOUND SUSTAINABLE

ECCE Working Team

European Council of Civil Engineers

ECCE scope is to raise Awareness and to highlight the problem regarding the safety of the existing buildings and infrastructure stock. Safety is one of the six essential requirements stated in the Eurocodes and probably the most important one.

Decision-makers need to comprehend the huge responsibility undertaken when ruling that energy efficiency measures only, would be funded by the EU.

ECCE working team was:

a) Mr. Aris Chatzidakis Greece, (A.C.)

b) Mr. Andreas Brandner Austria, (A.B.)

c) Mr. Paul Coughlan United Kingdom, (P.C.)

d) Mr. Andreas Theodotou Cyprus, (A.T.)

e) Dr. Branko Zadnik Slovenia, (B.Z.)

f) Mr. Ivan Paska Croatia (I.P.)

g) Dr. Nicolas Kyriakides Cyprus, (N.K.)

h) Eur. Ing. Platonas Stylianou Cyprus (P.S.), Coordinator of the working team

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

Some first measures

- EU has to encourage the new approach, making some simple additions to legal texts to allow to grant funding for the Structural and / or Seismic Upgrade of the buildings, before, or at least together with, the grants given for the upgrade of the energy performance of buildings, under Directive 2010/31/EM, of the European Parliament and of the Council of 19th of May 2010.

- The starting point for legally binding rules on the structural upgrade in case of major renovation projects should be for all state/government owned buildings and buildings of high importance (as categorized in the Eurocodes). That needs to be done by each country immediately.

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

Seismic Performance Classification

ECCE will continue their work and research on the aspect and will contribute to the effort of defining a common method for the Seismic Classification of Buildings. This could be combined with the electronic identity of structures, provided in many countries, and could be something similar to the Energy Performance Classification of Buildings and become the basis for the Seismic Risk Classification.

Finally financial aid should be provided, similar to that given for energy efficiency upgrading, based on the minimization of expected annual loses (EAL), which is the economic justification for this prevention strategy.

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

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

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

So...the starting point must be ***all State/Government Buildings and all Buildings of High Importance,***

categorized as such in the Eurocodes.

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

QUESTIONNAIRE

2020 3S SAFE SOUND SUSTAINABLE

Ref: 151.GE.V05.2018

QUESTIONNAIRE

Title: "The need for integrating Structural / Seismic Upgrade of Existing Buildings, with Energy Efficiency Improvements"

Dear Colleague, please complete the following questionnaire and give us all details available.

Name and Surname:

Email:

A/A	QUESTIONS
I.	General
1	Does your Country suffer from earthquake or other dynamic loading problem or other combination of dynamic loadings and if yes approximately how frequently –Please attach historical records, if possible. ☐ Yes ☐ No If yes give details. .....
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? ☐ Yes ☐ No If yes give details. .....
4	Please briefly explain what damages does it causes (with regard to buildings, roads, bridges, etc.) .....
5	Where there any fatalities or serious injuries? ☐ Yes ☐ No If yes give data. .....

Ref: 151.GE.V05.2018

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? ☐ Yes ☐ No If yes give details. .....
II.	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? ☐ Yes ☐ No If yes give details (attach as well the Regulation or legislation). .....
9	Are there any legal or technical regulations/codes related to Seismic or Structural strengthening or upgrades in your Country? ☐Yes ☐ No If yes give details (please also attach the Regulation or legislation). .....
10	Are the Eurocodes applied for seismic assessments and seismic/structural strengthening of existing buildings in your country? ☐Yes ☐ No If yes give details .....
11	Are there incentives provided by the government, to individuals, for structural upgrades / renovations / seismic upgrades in your Country? ☐Yes ☐ No If yes give details. .....

Ref: 151.GE.V05.2018

12	Have you received any training related to seismic and energy efficiency upgrading? ☐Yes ☐ No If yes give details. .....
13	Have you partic pated in a workshop/conference on the above topics? ☐Yes ☐ No If yes give details. .....
III.	From practice
14	What are the most common building categories in your Country, regarding existing buildings build 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? ☐ Yes ☐ No If yes can you please give us numbers or percentage with regard to the total? .....

European Council of Civil Engineers

The questionnaire contributed significantly to the elaboration of the Position Paper. Also the results provided by each country are a valuable source of data for ECCE records.

The questionnaire was divided in three parts:

Part one, was the General part with 7 questions,

Part two, was the State Regulation/ legislation part with 6 questions, and

Part three, was the Practice experience and includes 5 questions.

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

Expected Benefit

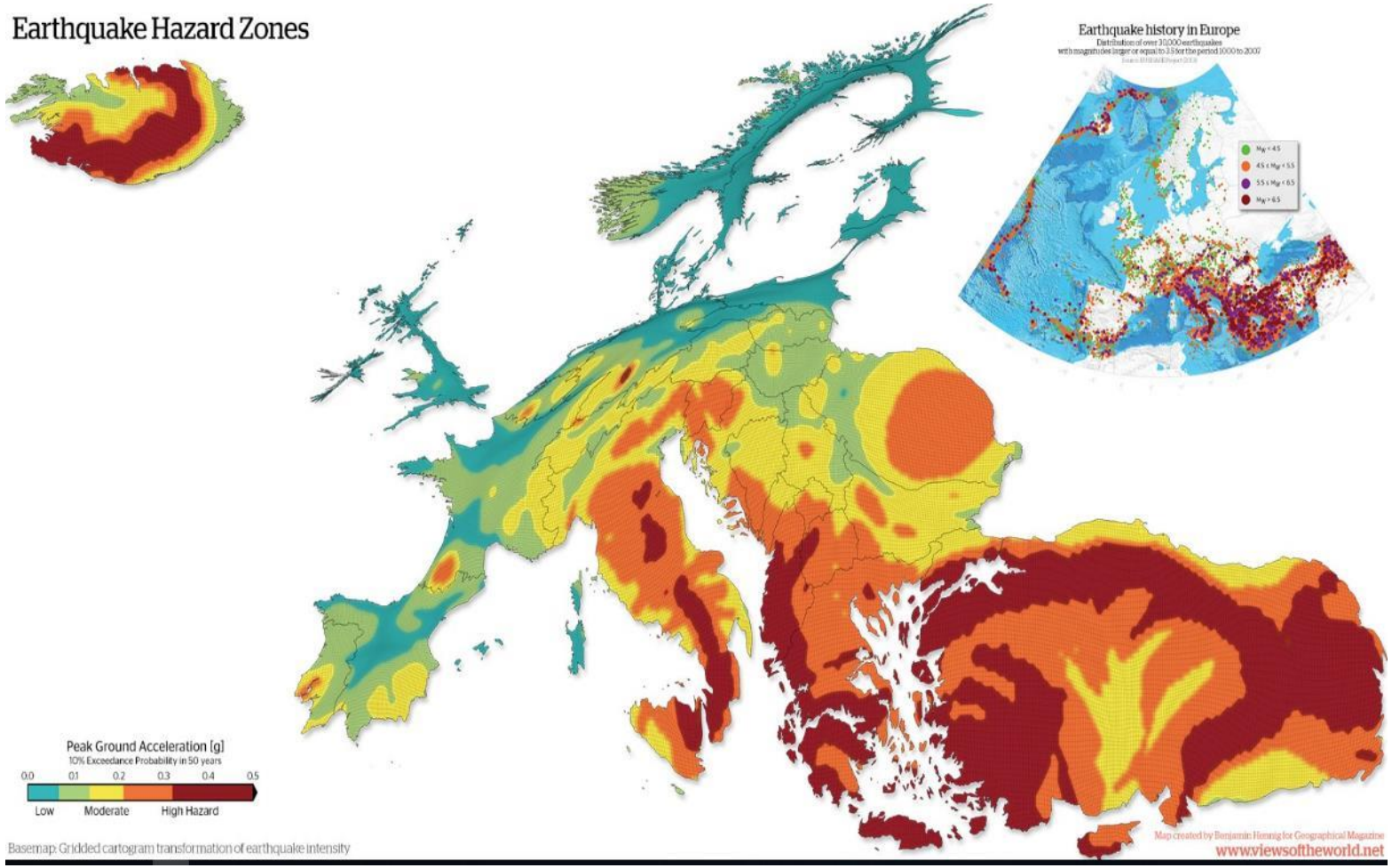
1. **Raise awareness** and demand for better and structurally sound buildings among stakeholders, governments, owners, operators and all citizens.
2. **Improve knowledge** and information regarding assessment and design for structural and/or seismic upgrading of existing buildings.
3. **Increase funding opportunities** from EU.
4. **Offer a significant contribution to the community**, as the need to protect the homes and build property, is one of the basic Human Rights that originates from antiquity.

By applying the idea expressed in the position paper, countries that possess abandoned, deteriorated or ill-maintained buildings, especially those subject to seismic hazard, can assess, evaluate and if necessary, structurally strengthen tand energy upgradeheir buildings, in order to obtain the same or better structural capacity than what was mandated by the building codes and allowed by the construction practices at the time of the original construction.

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

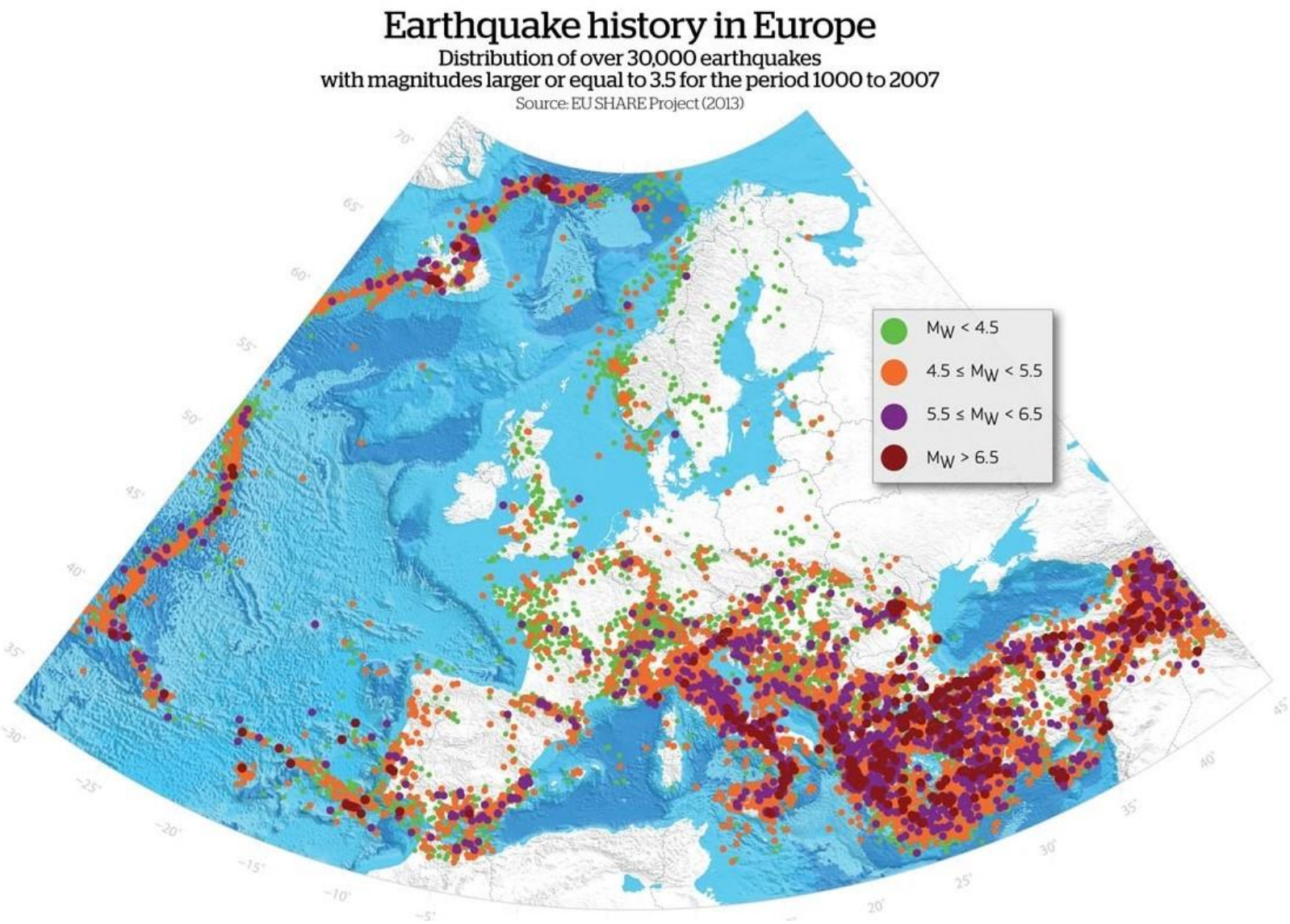
The biggest Earthquakes in Europe the last 20 years.



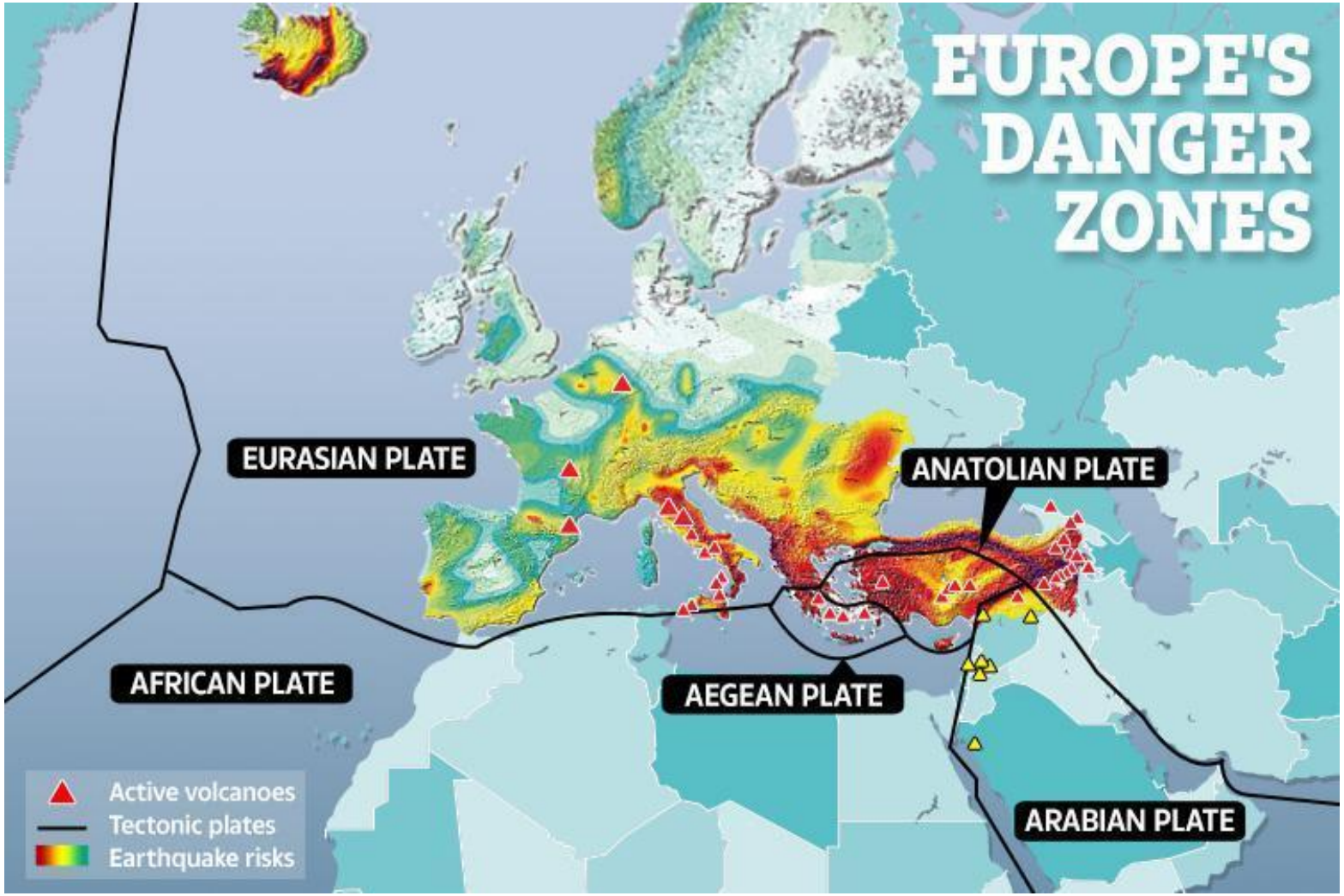
2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

2020 3S
SAFE SOUND SUSTAINABLE



European Council of Civil Engineers



2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

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.

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

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, Mw = 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.

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

Earthquake in the city of Laquila (Italy)

- On April 6, 2009, a strong earthquake excitation Mw = 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 of the damage or collapse of several buildings and monument.

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

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..

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

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.
- The cultural impact was dramatic.

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

Earthquake of Albania 2019

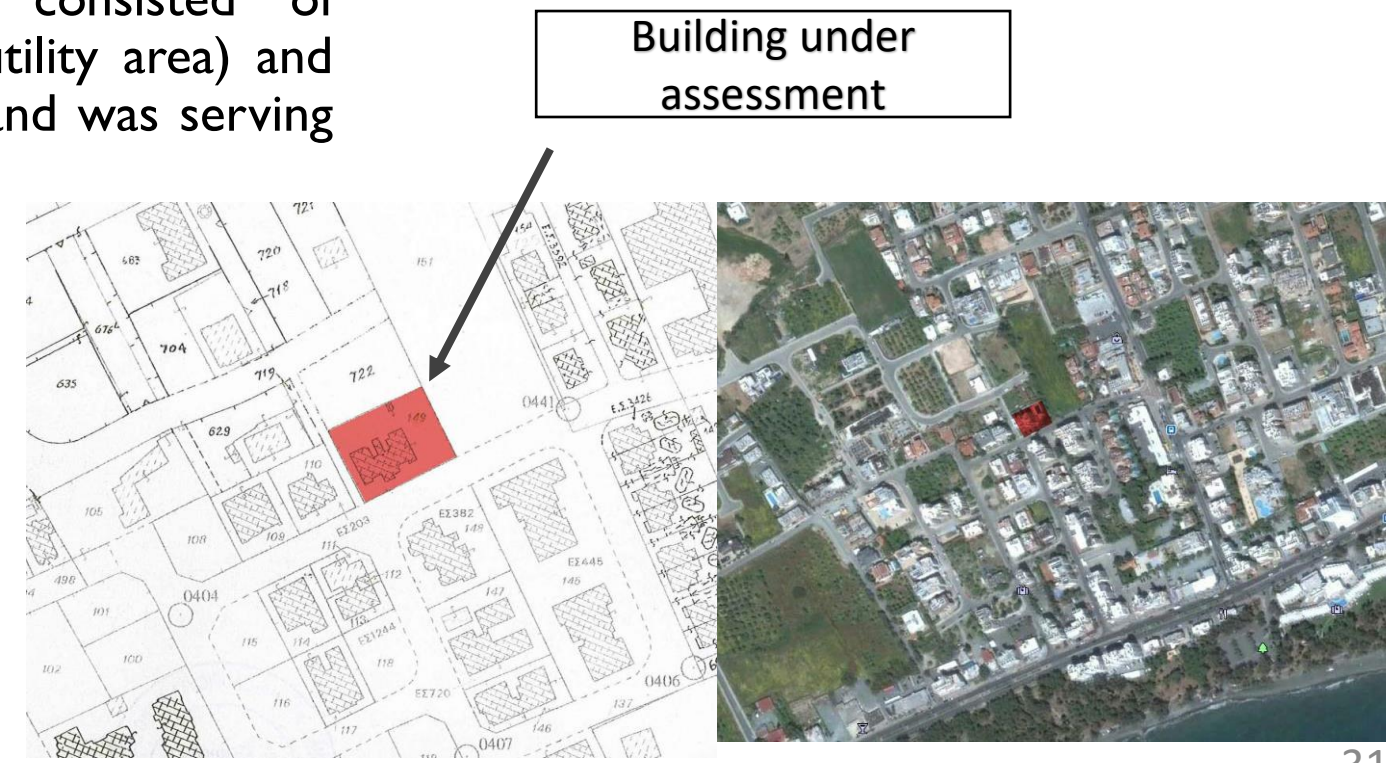
- On November 26, 2019 there was a strong earthquake excitation, M = 6,4 on the Richter Scale.
- The impacts of the earthquake were dramatic, 51 people lost their live, more than 900 were injured and 10.000 were left homeless.
- The cultural impact was dramatic.
- The financial impact was huge…and still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

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

Typical Example of Seismic/Structural Upgrade of an existing building.

- The building is situated in Germasogeia Limassol, Cyprus.
- Building was constructed around 1980.
- The existing building consisted of ground floor (used as utility area) and five more floors above and was serving as a small business hotel.



2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

- Photos of the building (before upgrade).

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

- More photos

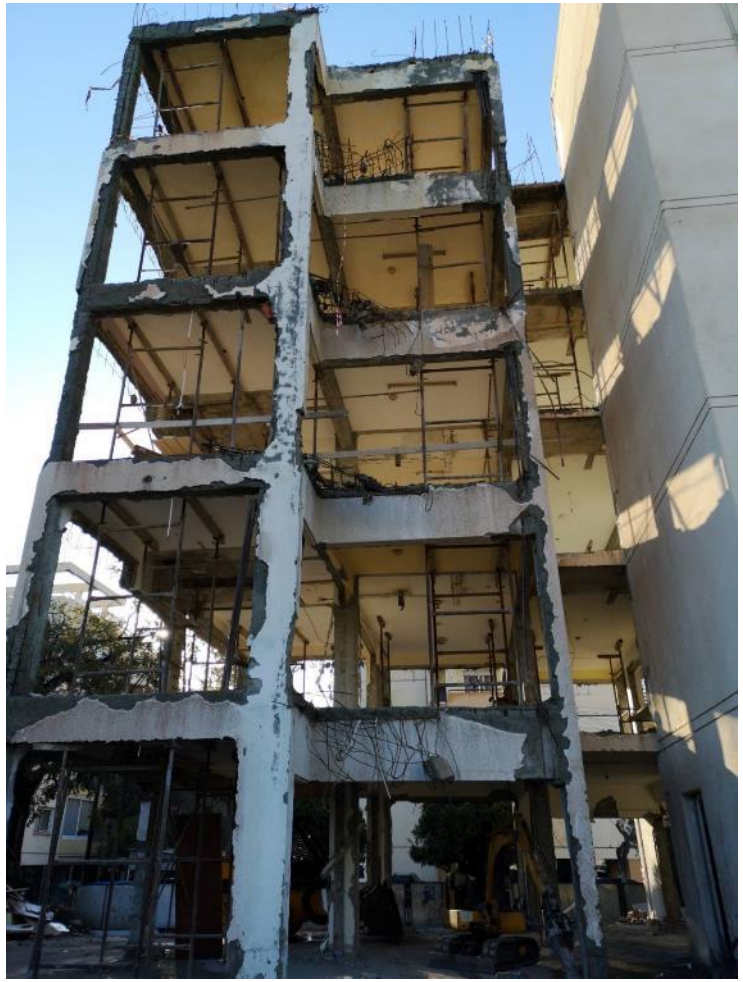





2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

- Existing Structure before strengthening



2020 3S

SAFE SOUND SUSTAINABLE

European Council
of
Civil Engineers

2020
3S
SAFE SOUND
SUSTAINABLE

European Council of Civil Engineers

The new need was for a luxury apartment building, with almost zero energy consumption:

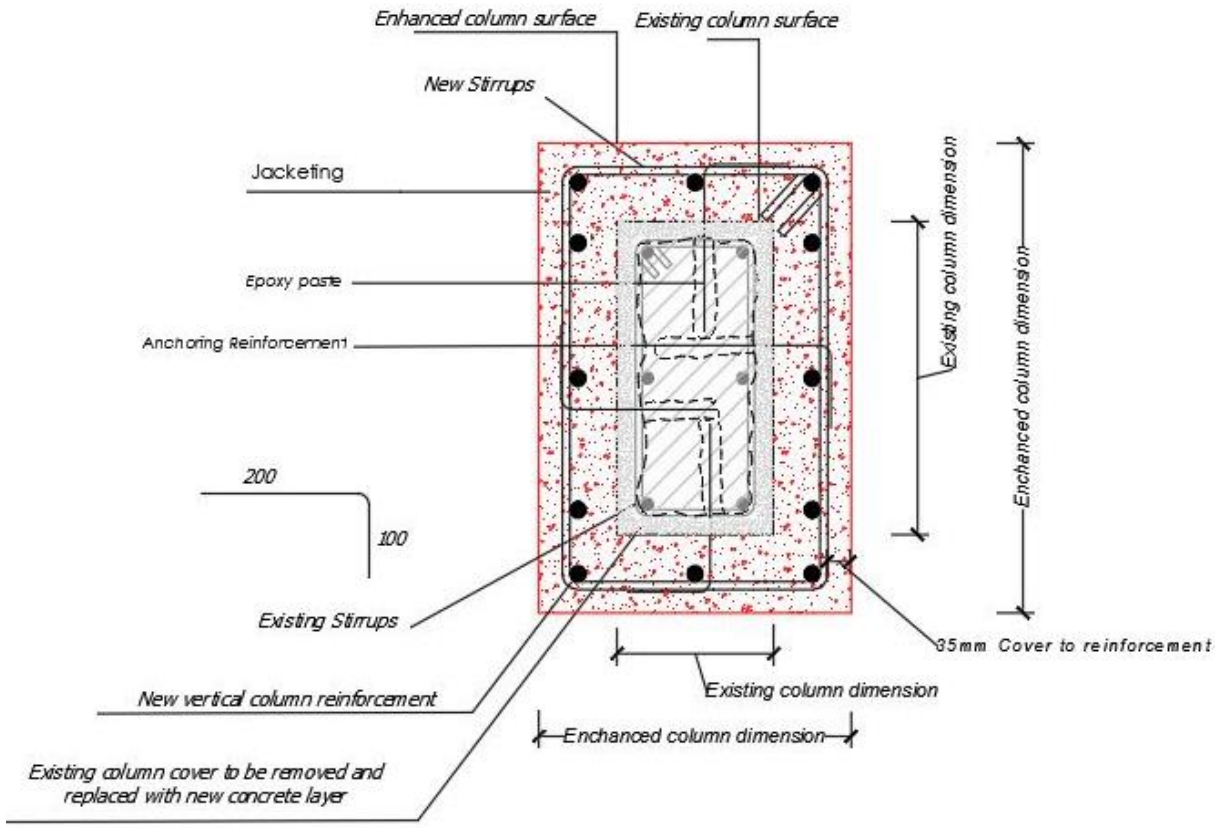
- 3D Drawings of the proposed renovated building, energy upgraded and with the addition of one extra floor.

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

STRENGTHENING OF THE EXISTING BUILDING

(Jacketing Detail of existing columns and foundation strengthening)

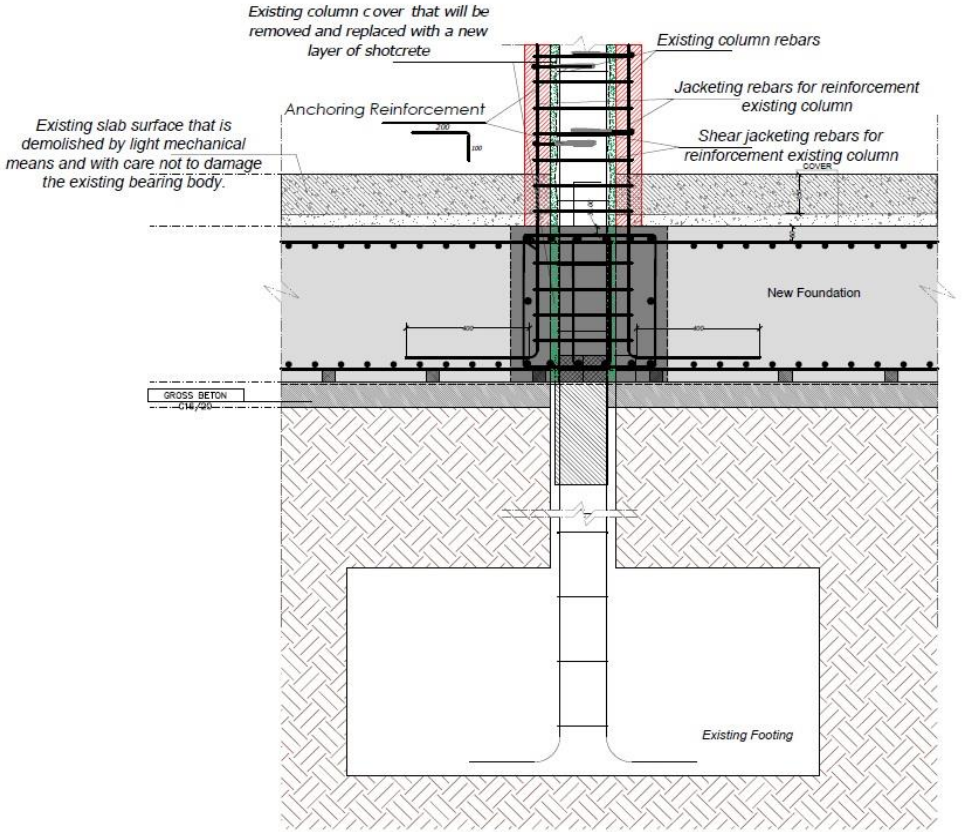


2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

STRENGTHENING OF THE EXISTING BUILDING

(new mat foundation which encased existing ground beams)



2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

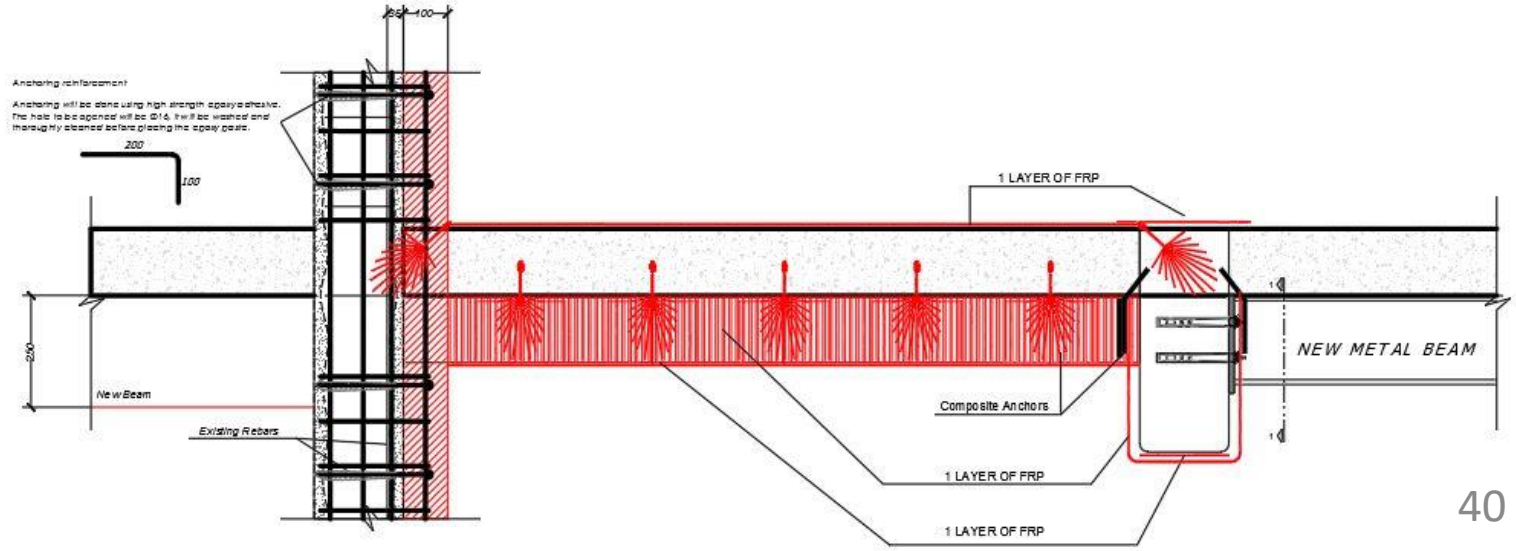
STRENGTHENING OF THE FOUNDATIONS OF THE EXISTING BUILDING

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

STRENGTHENING OF THE EXISTING BUILDING

(Fibre Reinforced Polymers (FRP) - strengthening of beams /slabs)

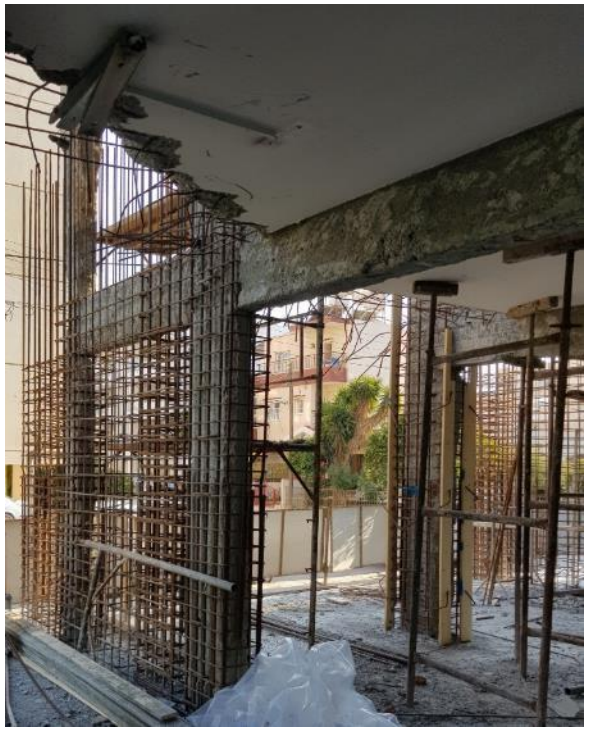


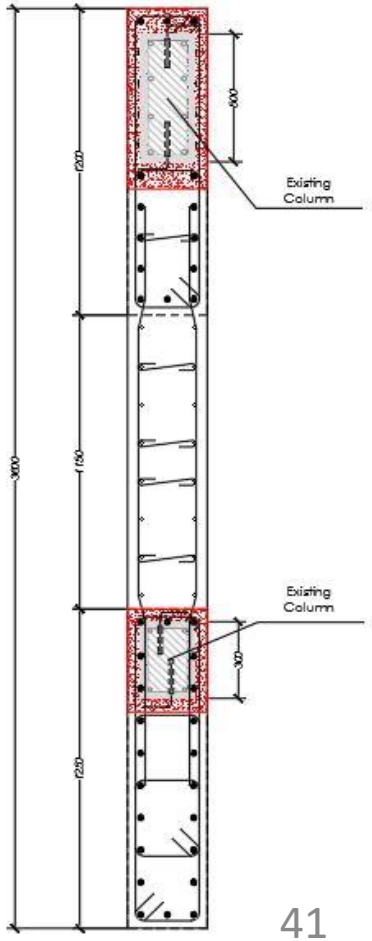
2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

STRENGTHENING OF THE EXISTING BUILDING

(formation of Shear Walls, incorporating existing columns)





2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

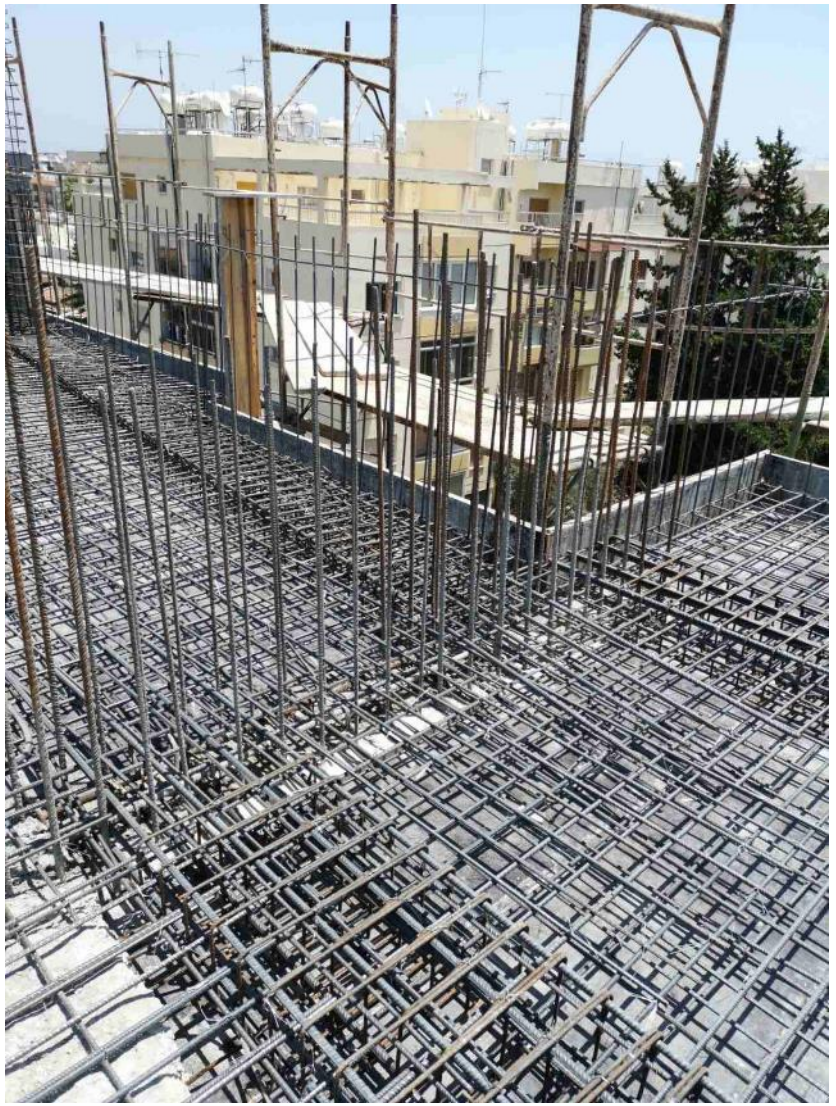
STRENGTHENING OF THE EXISTING BUILDING

(Jacketing Detail of existing columns)

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

- New RC Slabs



2020 3S

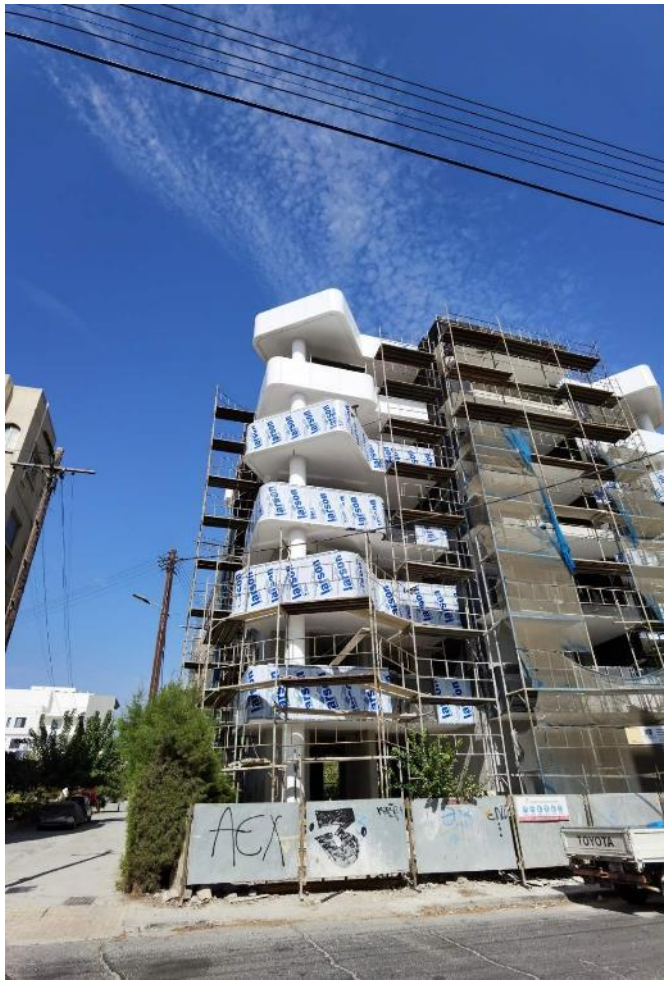
SAFE SOUND SUSTAINABLE

European Council
of
Civil Engineers

2020
3S
SAFE SOUND
SUSTAINABLE

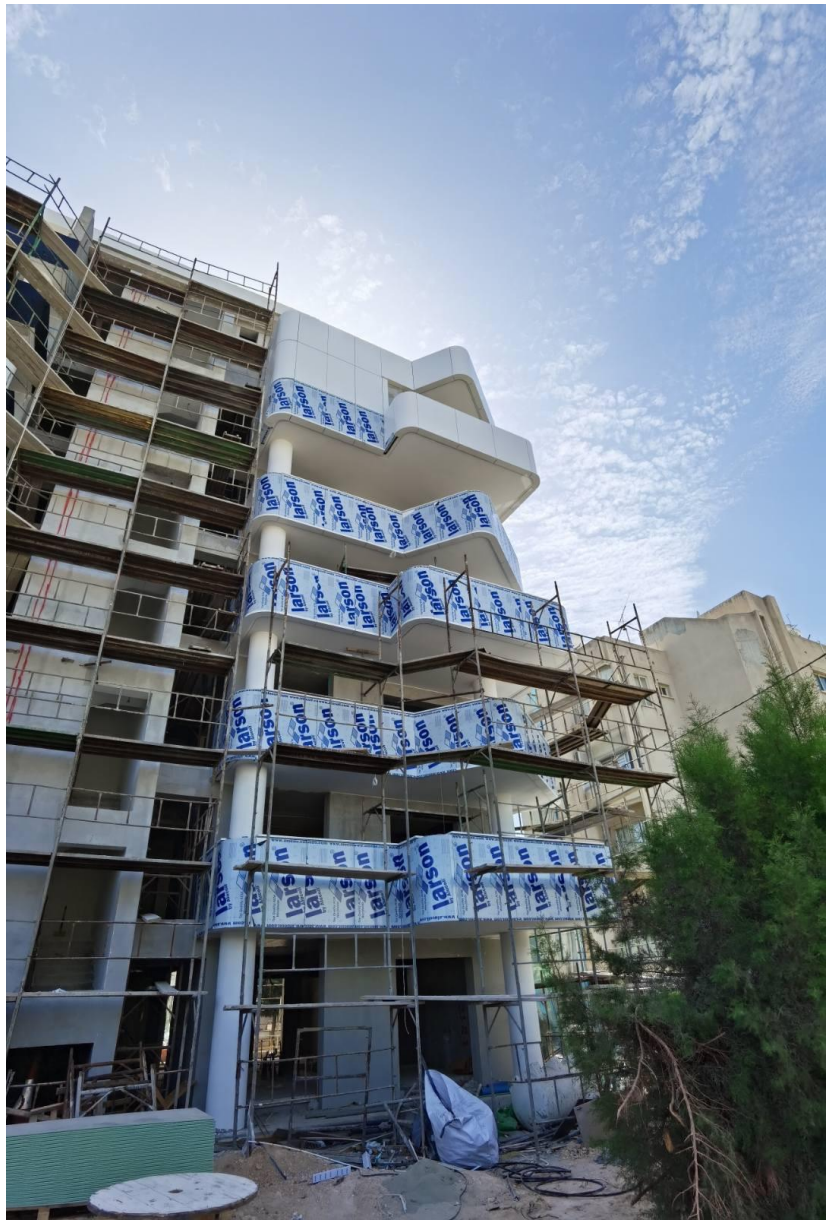
European Council of Civil Engineers

- Photos after the structural/seismic strengthening and energy upgrading.



2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers



2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

SAFETY MUST COME FIRST

- So we can conclude that, it is reasonable to state that in countries with high seismic risk it is economically "foolish" to **invest on energy efficiency measures on unsafe buildings.** ….We put a new skin on an old and unsafe structure…..

- As it is well known if buildings are cladded and insulated, then they may look new but their underlying structural issues remain, hidden, unseen and unassessed **and may become life-threatening, especially in case of a major seismic event, leading possibly to a collapse.**

2020 3S SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

WE NEED A NEW APPROACH

- We need a new common European policy on vulnerability assessment and on retrofitting measures.

- A solution needs to be found so that funding can be given for work on structural assessment, strengthening and upgrade as well as energy efficiency work. Decision-makers need to comprehend the huge responsibility undertaken **when ruling that energy efficiency measures only,** would be funded by the EU. The new trend is smart financing for smart buildings. But, a building can only be called smart when it is safe and secure.

2020 3S
SAFE SOUND SUSTAINABLE

European Council of Civil Engineers

The new trend nowdays 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".

So, as ECCE we did declare the year 2020 as…
The Year of the **3S** Approach and we have also officially launch our Position Paper.

2020
3S
SAFE SOUND
SUSTAINABLE

ECCE Moto for 2020

European Council of Civil Engineers

ECCE Manifesto

2020
3S
SAFE SOUND SUSTAINABLE

The need for integrating Structural / Seismic Upgrade of Existing Buildings, with Energy Efficiency Improvements

The majority of the existing building stock in most European countries built in the 80s, 70s or earlier, lack modern design standards, including the requirements for seismic safety and energy efficiency. One of the most important Human rights is to possess Safe, Sound and Sustainable **buildings** (3S).

Thus, based on their date of construction, the vast majority of buildings are deficient both in terms of energy efficiency and seismic resistance. This creates the need for the society (public and engineers) to take actions to keep and maintain **the building stock in operational, reliable and resilient state, in order to ensure primarily the safety of the users.**

The extent to which a building can resist loads depends mainly on its columns, beams and walls, its load resisting system – LRS. Most existing buildings do not pose significant Lateral load Resistance and require upgrading to increase the efficiency of one or more of the above. In the case of aging existing buildings, **the lack of consideration for any dynamic effect means that the building stock is more vulnerable to earthquakes and other dynamic effects.**

In addition, as it is exceeding its design life of 50 years, it means that along with strengthening interventions to improve the building's seismic performance, **durability and structural assessments procedures to ensure functionality should also be carried-out, bringing safety and comfort for the users.**

In the last decade, **the importance on the energy front has been highlighted enough; increased energy consumption lead to adverse environmental impact** (e.g. climate change). Therefore, the building sector introduced the energy efficiency concept, highlighted by Europe's goal to reduce the Greenhouse gas emissions by 20% and achieve 20% energy savings by 2020. **The building sector accounts for large energy consumption in EU** with the European households consuming nearly the 70% of the energy demand in the form of electrical energy. Unfortunately, the importance of safety has not been highlighted or considered likewise.

Currently, from a sustainability perspective, emphasis has been placed on developing an integrated structural and energy design methodology for new buildings to override individual actions to ensure a Sustainable Structural Design (SSD).

However, in older existing buildings, the issue of structural, seismic and energy inefficiency becomes of primary importance and a similar overarching concept approach is required to provide upgrading on both fronts and if possible, in an integrated common holistic approach.

The new trend nowdays is...
smart financing for smart buildings.
But a building can only be called smart...
once it fulfills the **3S** approach
"safe, sound and sustainable".

So, as ECCE we declare year 2020 as...
The Year of the **3S** Approach

ECCE Moto for 2020

European Council of Civil Engineers

THANK YOU FOR YOUR ATTENTION!