# *Vulnerability Assessment of a Historical City Center –The Case of Nafplio*

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E.P.P.O.
Earthquake Planning & Protection Organization

European Council of Civil Engineers

European Council of Engineers Chambers

COUNCIL OF EUROPE ATHENS
EUROPEAN CENTRE ON PREVENTATION AND FORECASTING OF EARTHQUAKES

BEF 2021
**Building Engineering Forum**
20-21 October 2021, Sofia, Bulgaria
**International Conference on Earthquake Engineering**
Turning seismic hazard awareness into risk mitigation
Seismic risk reduction through integrated design
VISIT www.bef2021.uceb.eu

Council of Europe

- **EUR-OPA Major Hazards Agreement of the Council of Europe is a platform for co-operation in the field of major natural and technological disasters between Europe and the South of the Mediterranean. Its field of competence covers the major natural and technological disasters - knowledge, prevention, risk management, post-crisis analysis and rehabilitation.In our Country this Agreement was ratified by the Greek Law , in 1992.**

https://www.coe.int/en/web/europarisks/home

- **The European Center on Prevention of Earthquakes (E.C.P.F.E.) operates within the Framework of EUR-OPA .It belongs to the Network of 27Specialized Centers of the Agreement and it is based in Athens , Greece .The Center has a close cooperation with Earthquake Planning and Protection Organization of Greece (E.P.P.O.).**

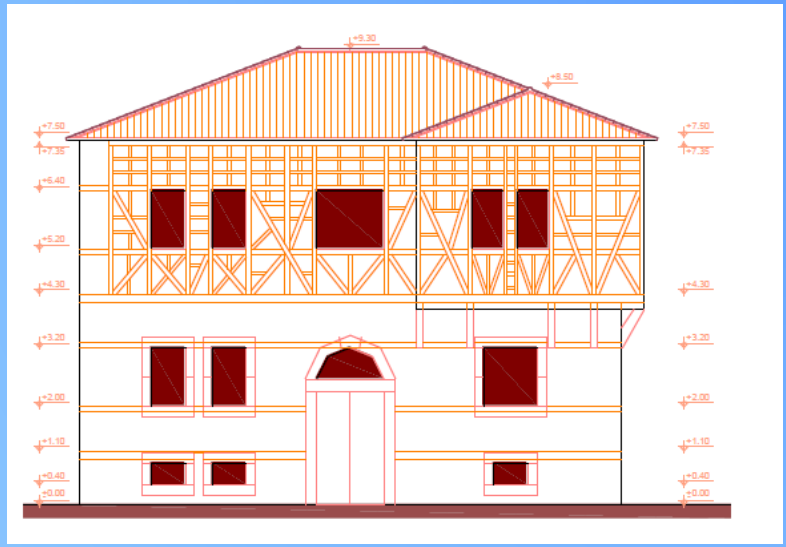
https://ecpfe.oasp.gr/

# AXIS OF POLICY

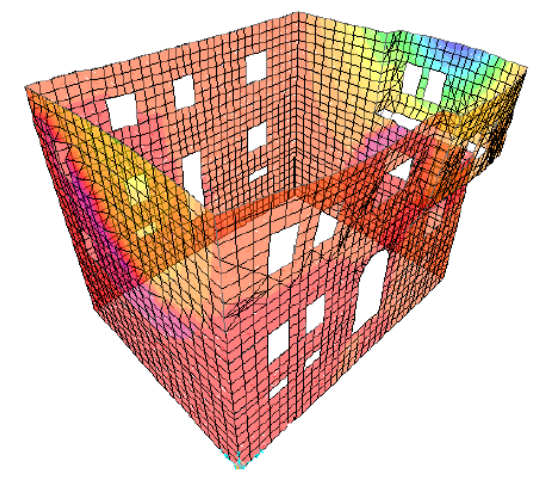
- EARTHQUAKE PROTECTION OF MONUMENTS & HISTORICAL CENTERS
- REDUCTION OF THE VULNERABILITY OF STRUCTURES
- EARTHQUAKE –DEVELOPMENT OF INFORMATIVE MATERIAL FOR INDIVIDUALS WITH DISABILITIES
- EDUCATION-INFORMATION
- EARLY WARNING SYSTEMS

# High vulnerability of bearing masonry buildings due to the following factors:

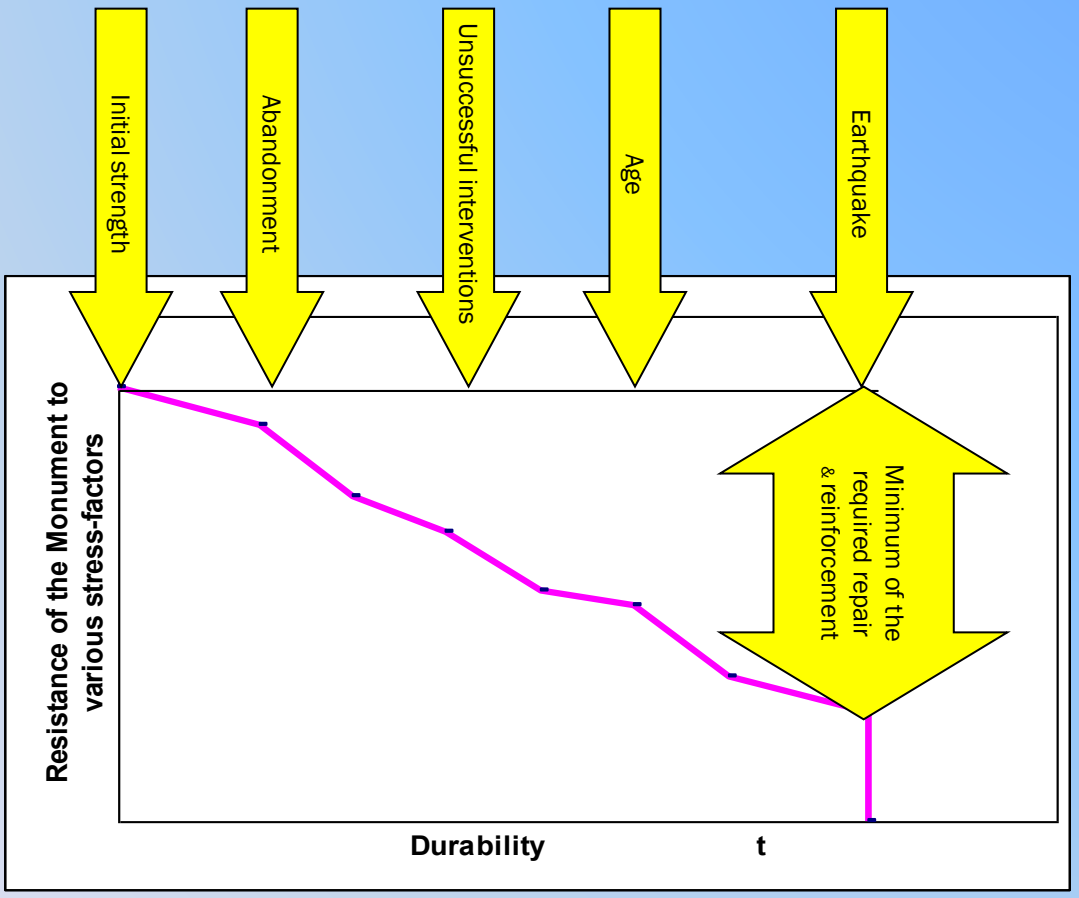
- The brittleness of unreinforced masonry
- The insufficient diaphragmatic action of the floor and roof
- Inadequate connection of the vertical and horizontal elements of the supporting structure
- All kinds of imperfections
- Interventions, modifications and additions from time to time
- Poor maintenance and ageing of the materials
- The complete absence or failure of the design, if any
- Soil alteration eg liquefaction , subsidence, underground water etc
- Previous Earthquakes
- Fire
- Climate change



**The materials and types of older masonry structures generally do not meet the requirements of EC6**



## Some of the causes leading to the weakness of the Masonry Buildings




Weakness chart during time of a Masonry Structure

**Addressing the problem requires an initial inventory and hierarchical evaluation of the building stock in order that financial resources are optimally mobilized for the seismic strengthening of the buildings.**
**The hierarchical evaluation of the existing building stock is performed through a three level assessment. The corresponding methodologies are developing by special scientific committees of E.P.P.O. In this presentation we focus in the implementation of the second level of pre-earthquake assessment in selected masonry buildings, in order to evaluate the method and propose improvements, if necessary.**

## The proposed framework of E.P.P.O., for Pre-earthquake Assessment of Masonry Buildings

### First Level Pre-earthquake Inspection

Rapid Visual Screening Procedure

The First Level of pre-earthquake assessment was implemented in 2001. It is performed to public buildings to identify those which present inefficient earthquake performance and might pose a risk of loss or injury, or severe interruption of community services in the event of a damaging earthquake.
The inspection of each building is carried out by the authority that is responsible for the operation and the safety of the building.
The inspection forms sent to E.P.P.O. are entered into a data base and are classified in three categories **A, B, C.** Lower scores correspond to an expected better seismic performance. The results determine the priority for the second degree inspection and are sent from E.P.P.O. to the Regions.

### Second Level Pre-earthquake Inspection

E.P.P.O., in 2012, developed the Second Level pre-earthquake assessment for masonry buildings (S. Dritsos, C. Ignatakis, D. Panagiotopoulou, A. Spiliopoulos). The developed methodology was based on the procedure described in: "Measuring of the relative seismic risk of historic masonry buildings" by Th. Tassios and E. Vintzilaiou.
The assessment is directed at masonry buildings that have received a score from the first level pre-earthquake assessment that is below a certain threshold value.
The aim of the procedure is to re-evaluate the ranking of identified vulnerable buildings. This evaluation goes into more detail and requires access to all parts of the building, and basic calculations without performing an analysis of the structure.

### Third Level Pre-earthquake Inspection

Detailed assessment of seismic performance

The Third Level pre-earthquake assessment is performed to buildings with local or general inefficient seismic performance. Detailed assessment studies and redesigns (strengthening) are required.
E.P.P.O. assigned to a scientific committee the development of a Code of Interventions for Masonry Buildings (KADET). The scope of the Code is the enactment of criteria for the assessment of the structural capacity of existing masonry buildings. The Code is going to be evaluated by several technical offices and external evaluators.

# *"Vulnerability assessment of Historical City Centers"*

**This proposed empirical Methodology, was carried out in the framework of the activities of E.C.P.F.E. 2014, it is the process of a second level pre-earthquake assessment , where the end result of such an assessment, is a "score" called the " relative seismic risk index I" of the building. The " relative seismic risk index I" follows from the expression :**

$$I = V(H/R - 1)$$

**Where:**

**H:The seismic action on the building (Hazard) "H"**
**R: The seismic resistance (Resistance) "R"**
**V: Building's importance index (Value )**

**Each FORM of the Secondary Assessment includes 3 Parts :**

# APPENDIX A

## APPENDIX A
## INFORMATION

Table A1: Ground type (Table 3.1 of EC 8)

| Ground type | Description of stratigraphic profile | Parameters | | |
|---|---|---|---|---|
| | | $v_{s,30}$ (m/s) | $N_{SPT}$ (blows/30 cm) | $c_u$(kPa) |
| A | Rock or other rock-like geological formation, including at most 5 m of weaker material at the surface. | > 800 | - | - |
| B | Deposits of very dense sand, gravel or very stiff clay, at least several tens of metres in thickness, characterised by a gradual increase of mechanical properties with depth. | 360-800 | > 50 | > 250 |
| C | Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of metres. | 180-360 | 15-50 | 70-250 |
| D | Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers), or of predominantly soft-to-firm cohesive soil. | < 180 | < 15 | < 70 |
| E | A soil profile consisting of a surface alluvium layer with vs values of type C or D and thickness varying between about 5 m and 20 m, underlain by stiffer material with $v_s$ > 800 m/s. | | | |
| $S_1$ | Deposits consisting, or containing a layer at least 10 m thick, of soft clays/silts with a high plasticity index (PI > 40) and high water content | < 100 (indicative) | - | 10-20 |
| $S_2$ | Deposits of liquefiable soils, of sensitive clays, or any other soil profile not included in types A to E or $S_1$. | | | |

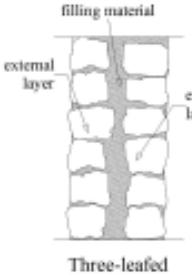
*The site should be classified according to the value of the average shear wave velocity, $v_{s,30}$, if this is available. Otherwise, the value of NSPT should be used.*

Table A2: Estimated values for the seismic action (H)

| Seismic hazard zone | Adjacent building category | Ground type | | | |
|---|---|---|---|---|---|
| | | A | B, C | D | E |
| Z1 | 1 | 1.02 | 1.20 | 1.38 | 1.50 |
| | 2 | 1.10 | 1.28 | 1.46 | 1.58 |
| | 3 | 1.15 | 1.33 | 1.51 | 1.63 |
| | 4 | 1.22 | 1.40 | 1.58 | 1.70 |
| | 5 | 1.27 | 1.45 | 1.63 | 1.75 |
| | 6 | 1.32 | 1.50 | 1.68 | 1.80 |
| Z2 | 1 | 1.53 | 1.80 | 2.07 | 2.25 |
| | 2 | 1.61 | 1.88 | 2.15 | 2.33 |
| | 3 | 1.66 | 1.93 | 2.20 | 2.38 |
| | 4 | 1.73 | 2.00 | 2.27 | 2.45 |
| | 5 | 1.78 | 2.05 | 2.32 | 2.50 |
| | 6 | 1.83 | 2.10 | 2.37 | 2.55 |
| Z3 | 1 | 2.30 | 2.70 | 3.11 | 3.38 |
| | 2 | 2.37 | 2.77 | 3.18 | 3.45 |
| | 3 | 2.42 | 2.82 | 3.23 | 3.50 |
| | 4 | 2.50 | 2.90 | 3.31 | 3.58 |
| | 5 | 2.55 | 2.95 | 3.36 | 3.63 |
| | 6 | 2.60 | 3.00 | 3.41 | 3.68 |

Table A3: Typical types of masonry

| Rubble stone | | Flat rubble stone and semi dressed cornerstones | | Semi dressed, dressed rectangular stones | |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| (a) Rubble stone of irregular shape | (b) Flat rubble stone | (c) Flat rubble stone Semi dressed cornerstones | (d) Semi dressed flat stones | (e) Semi dressed rectangular stone | (f) Fully dressed stone |




Three-leafed

Particular care is needed in cases (e) and (f) as most construction is three leafed masonry with an elaborate exterior and a poor interlock of masonry units

Table A4: Characterisation of the administrative and/or the social significance of buildings

| | |
|---|---|
| Low | Buildings of minor importance to the safety of the public, such as farm buildings and barns, stables, cow sheds, pigsties, chicken farms, etc. |
| Normal | Typical buildings such as houses and offices, industrial – light industrial buildings, hotels (which do not include conference rooms), hostels, boarding houses, exhibition spaces, catering and entertainment areas (saloons, cafes, bowling, billiards, video games, restaurants, bars, etc.), banks, clinics, markets, supermarkets, malls, shops, chemists, hairdressers, salons, fitness institutes, libraries, factories, garages and car repair/maintenance shops, paint factories, wood factories, research laboratories, synthesised food factories, cleaners, data centres, warehouses, car parks, petrol stations, wind generators, public service agencies and local government that do not fall under the category "special", etc. |
| Important | Buildings which house facilities of great economic importance, as well as public gathering buildings where many people are for all the 24 hours such as airport halls, conference rooms, buildings that house computer centres, special industries, educational buildings, classrooms, schools, nursery schools, concert halls, courtrooms, churches, sports facility complexes, theatres, cinemas, nightclubs, passenger lounges, psychiatric hospitals, disables institutions, chronically ill institutions, nursing homes, crèches, nurseries, kindergartens, playgrounds, reformatories, prisons, sewage and waste water treatment plants, etc. |
| Special | Buildings whose operation is vital during and after an earthquake such as telecommunications, energy production, hospitals, clinics, community centres, medical stations, health centres, refineries, power stations, fire and police stations, public service buildings of strategic services for earthquake emergency needs.<br>Buildings that house unique works of art such as museums, museum stores, etc. |

# APPENDIX B

## APPENDIX B
## FIELD INFORMATION DATA COLLECTION FORM

**Identifying the building**

| No. | Identifying the technical characteristics of the building | |
|---|---|---|
| 1 | Region/Province | |
| 2 | Town | |
| 3 | Address | |
| 4 | Telephone number | |
| 5 | Building's name | |
| 6 | Building's use | |
| 7 | Owner's details | |
| 8 | User's details | |
| 9 | Number of storeys | |
| 10 | Number of basements | |
| 11 | Year of construction | |
| 12 | Number of users | ≤10[ ], 11-50[ ], 51-100[ ], 101-200[ ], >200[ ] |
| 13 | Has another level been added at a later date? | |
| 14 | Is the building a listed building? | |
| 15 | Has the building been repaired/strengthened? | |

**ADDITIONAL INFORMATION:**

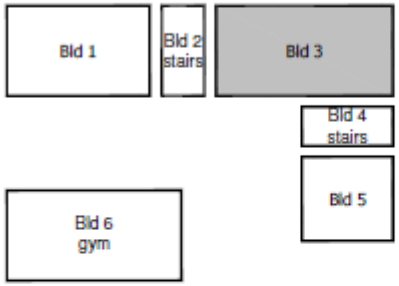
**CLARIFICATION NOTES**

*5: Building's name*
*Enter the name of the building. If the building is part of a complex of buildings, specify which building it is (e.g. Building B Sotiria Hospital or Building 1 of the 3rd City Council School, Athens).*
*6: Buildings use*
*Indicate the use of the building (e.g. hospital, education, housing, etc.). If the building has more than one use, indicate its main use for this inspection.*
*9-10: Number of storeys/basements*
*Enter the number of floors and basements. Do not count the small roof above the top of the stairs.*
*11: Year of construction*
*Note the date that the building was designed (if the plans exist) or constructed (if the plans do not exist). If it is not possible to find information concerning the date of design or construction, it is sufficient to determine the construction period (before 1959, between 1960 and 1985, between 1985 and 1995, after 1995) based on information or the buildings structural characteristics.*
*12: Number of users*
*Mark the appropriate box with a + to indicate the maximum number of people that may congregate in the building.*
*13-15: Indicate YES or NO and consider writing a short comment.*



**SKETCH OF BUILDING COMPLEX**

When the address is the same or the property contains more than one structurally independent buildings, a sketch of the buildings' general layout is required indication Bld 1, Bld 2, etc. and hatch the building under investigation. The general layout should satisfactorily reflect the existing situation to a reasonable degree of accuracy.




**SKETCH OF THE BASEMENT PLAN**
(Separate page)

**SKETCH OF THE GROUND FLOOR PLAN**
(Separate page)

**SKETCH OF THE 1ST STOREY PLAN**
(Separate page)

**SKETCH OF THE 2ND STOREY PLAN**
(Separate page)

etc.

**Assessment of the seismic action on the building (Hazard: H)**

**Data to classify the seismic action (H1)**

| No. | Factors that may locally increase the seismic action | |
|---|---|---|
| 1 | Building on or near an unstable natural slope | |
| 2 | Shallow foundation on loose fill | |

**Data to classify the effect of adjacent buildings (H2)**

| No. | Features of adjacent buildings | |
|---|---|---|
| 1 | Free building or adequate seismic gap between buildings | |
| 2 | Same floor height and significant stiffness difference | |
| 3 | Difference of one floor in height without a pounding risk | |
| 4 | Same number of floors but difference in floor heights (pounding risk) | |
| 5 | Height difference in two or more floors without pounding risk | |
| 6 | Height difference in one or more floors with pounding risk | |
| 7 | In contact with several adjacent buildings | |

*The width of the seismic separation joint should be considered at the highest point of contact between two adjacent buildings and is considered sufficient if more than 2 cm is provided for the first 3.0 m of height with an additional 1.0 cm provided for further any 2.0 m of height.*

**Assessment of the seismic resistance of a building (Resistance: R)**

**Data to classify the shear resistance (R1)**

| No. | Type of masonry unit and construction | Type of mortar | | |
|---|---|---|---|---|
| | | Cement-lime mortar | Lime mortar | Clay mortar |
| 1 | Semi dressed or fully dressed stone | | | |
| 2 | Flat stone masonry | | | |
| 3 | Rubble stone | | | |
| 4 | Cobble stone | | | |
| 5 | Whole brick masonry | | | |
| 6 | Hollow brick masonry | | | |
| 7 | Concrete block | | | |
| 8 | Mud bricks (adobe) | | | |

| In the case of three-leafed masonry, mark a + | |
|---|---|
| Description of how the three-leafed masonry is constructed[1]: | |

| In the case that the masonry is strengthened, mark a + | |
|---|---|
| Description of how the masonry is strengthened[2]: | |

In the case that there is a change of type of masonry from floor to floor[3]:

1. *e.g. The construction of walls includes two single lines of brickwork linked together with reinforced concrete. The total thickness of the walls is 28 cm and incorporates 8 cm hollow bricks and 12 cm intermediate concrete*
2. *e.g. Deep mortar, grout and internally reinforced jacket of shotcrete on one or both sides of the wall*
3. *e.g. The ground floor is type 3 masonry with a lime mortar while the first floor is type 6 masonry with a cement-lime mortar*

**Data to classify the ring beam (R3)**

| Position of the ring beam | |
|---|---|
| Absence of ring beam or ring beam discontinuous | |
| Ring beams at the level of the lintels | |
| Ring beams at the level of the floors but not below the roof | |
| Ring beams at the level of the floors and below the roof | |
| Ring beams at the level of the floors, lintels and below the roof | |
| Single storey building with ring beam at the top | |
| Multi-storey building with a single ring beam under the roof | |

| Type of ring beam | |
|---|---|
| Wood | |
| Metal | |
| Concrete | |

| In the case of a wooden or metallic ring beam | YES | NO |
|---|---|---|
| The wooden or metallic beam supporting the floor or the roof is only seated on the inside part of the wall? | | |
| The ring beam covers the perimeter walls and all major internal load bearing walls? | | |
| The longitudinal elements of wood or metal have ensured continuity (splices) and connect the corners and intersections of walls? | | |
| There are loose or corroded connections or severe damage? | | |

**DESCRIPTION – COMMENTS ON THE RING BEAMS:**

**Data to classify the diaphragms (R4)**

**The characterization of the layout of the walls in plan refers to their worst, in terms of layout, building arrangement.*

| No. | Arrangement of bearing walls in plan | |
|---|---|---|
| 1 | Symmetric | |
| 2 | Partially symmetric | |
| 3 | Asymmetric | |

| No. | Type of floor and roof | |
|---|---|---|
| 1 | Wooden floor with single floorboards | |
| 2 | Wooden floor with double floorboards | |
| 3 | Metal beams with flat brick filling | |
| 4 | Metal beams with vaulted masonry filling | |
| 5 | Reinforced concrete slab | |
| 6 | Vaulted floors of single or double curvature | |
| 7 | Roof without bracing without roofing boards | |
| 8 | Roof without clear bracing but with roofing boards | |
| 9 | Roof with a clear bracing without roofing boards | |
| 10 | Roof with a clear bracing and roofing boards | |
| 11 | Other type | |

**DESCRIPTION-COMMENTS:**

| No. | Connection type of floors or roof to the underlying walls | |
|---|---|---|
| 1 | Wooden rafters or metal beams directly on the walls | |
| 2 | Wooden rafters or metal beams on continuous wall mounted beam | |
| 3 | Wooden rafters or metal beams on ring beams | |
| 4 | Reinforced concrete slab only seated at certain points | |
| 5 | Reinforced concrete slab continuously seated partially in the thickness of the wall | |
| 6 | Reinforced concrete slab continuously seated on the whole thickness of the wall | |
| 7 | Vaulted floors | |

**DESCRIPTION-COMMENTS:**



**Data to classify the damage to the masonry (R6).**

| No. | Type of masonry damage | |
|---|---|---|
| 1 | No damage | |
| 2 | Light scattered damage | |
| 3 | Light extensive damage or medium scattered damage | |
| 4 | Severe damage | |

**DESCRIPTION-COMMENTS:**

*Light damage is cracks up to 1.0 mm wide. Moderate damage is cracks up to 2.0 mm wide without material crushing under compression and without significant residual deformation.*

**Data to classify the connection between transverse walls (R7)**

| No. | Characterisation of the connection between transverse walls | |
|---|---|---|
| 1 | Sufficient connection at all intersections | |
| 2 | The external walls are sufficiently connected but are not connected to the internal walls | |
| 3 | Poor connection at all intersections | |

**DESCRIPTION-COMMENTS:**

*Investigating a connection requires the localised removal of the wall coating for the full height in the corner where walls connect. An adequate connection is where the masonry units are interlocked together. The existence of sufficient steel brackets anchored in the corners of intersecting walls ensures an adequate connection. In the case where extensions have been added or local rebuilding has occurred, it is unlikely that there is any connection with the rest of the building's walls.*

# APPENDIX C

**SECOND LEVEL DATA COLLECTION FORM FOR THE**

**PRE-EARTHQUAKE ASSESSMENT OF MASONRY BUILDINGS**

**EARTHQUAKE PLANNING AND PROTECTION ORGANISATION**

**SECOND LEVEL PRE-EARTHQUAKE ASSESSMENT FORM**

**MASONRY BUILDINGS** [1st Edition 2012]

## A. IDENTITY OF THE BUILDING

1. REGION/PROVINCE:
2. TOWN:
3. ADDRESS:
   POSTCODE: TEL :
4. BUILDING'S NAME:
5. BUILDING'S USE:
6. OWNER'S DETAILS:
7. USER'S DETAILS:

## B. TECHNICAL CHARACTERISTICS OF THE BUILDING

1. NUMBER OF LEVELS: BASEMENTS :
2. FLOOR AREA:
3. TOTAL FLOOR AREA :
4. YEAR OF CONSTRUCTION:
5. YEAR OF LAST ADDITION:
6. DETAILS OF ADDITION:
7. IS IT A LISTED BUILDING? YES ☐ NO ☐
8. HAS THE BUILDING BEEN REPAIRED/STRENGTHENED? YES ☐ NO ☐
9. IF YES, FOR WHAT REASON AND WHEN?
10. ADDITIONAL GENERAL INFORMATION:

## C. SEISMIC AND GEOTECHNICAL DATA FOR THE REGION

1. SEISMIC HAZARD ZONE (from EC 8): Z1 ☐ Z2 ☐ Z3 ☐
2. GROUND TYPE (from EC 8): A ☐ B ☐ C ☐ D ☐ E ☐ S ☐
3. POTENTIAL INCREASE IN THE RISK OF SEISMIC ACTION: YES ☐ NO ☐

## D. ASSESSMENT OF THE SEISMIC ACTION ON THE BUILDING (Hazard: H)

1. SEISMIC ACTION INDEX (H1) : ☐
2. INFLUENCE OF ADJACENT BUILDINGS INDEX (H2) : ☐
3. ESTIMATE OF THE SEISMIC ACTION (H) : $H = 0.75H1+0.25H2$ H= ☐

## E. ASSESSMENT OF THE SEISMIC RESISTANCE OF A BUILDING (Resistance: R)

1. GROUND FLOOR SHEAR RESISTANCE INDEX (R1) : ☐
2. LOAD BEARING WALL OPENINGS INDEX (R2) : ☐
3. RING BEAM INDEX (R3) : ☐
4. DIAPHRAGM INDEX (R4) : ☐
5. OPENINGS NEAR CORNERS INDEX (R5) : ☐
6. MASONRY DAMAGE INDEX (R6) : ☐
7. CONNECTION BETWEEN TRANSVERSE WALLS INDEX (R7) : ☐
8. PERIMETER WALL OUT OF PLANE STRESS INDEX (R8): ☐
9. GROUND FLOOR PLAN REGULARITY INDEX (R9) : ☐
10. HEIGHT REGULARITY INDEX (R10) : ☐
11. BUILDING'S EARTHQUAKE RESISTANCE ESTIMATE (R) :
    $R = 0.20R1+0.15(R3+R5)+0.10(R4+R7+R8)+0.05(R2+R6+R9+R10)$ R= ☐

## F. BUILDING'S IMPORTANCE (Value: V)

1. NUMBER OF USERS *(Mark the appropriate box with +)*
   X≤10 ☐ 10<X≤50 ☐ 50<X≤100 ☐ 100<X≤200 ☐ >200 ☐
2. TOTAL FLOOR AREA ($m^2$) *(Mark the appropriate box with +)*
   A≤100 ☐ 100<A≤500 ☐ 500<A≤1000 ☐ A>1000 ☐
3. ADMINISTRATIVE AND/OR SOCIAL IMPORTANCE *(Mark the appropriate box with +)*
   LOW ☐ NORMAL ☐ IMPORTANT ☐ SPECIAL ☐
4. MONUMENTAL VALUE *(Mark the appropriate box with +)*
   NONE ☐ MEDIUM ☐ HIGH ☐
5. V1 = ☐ V2 = ☐ V3 = ☐ V4 = ☐
6. BUILDING'S IMPORTANCE ESTIMATE $V = 0.30(V1+V2)+0.20(V3+V4)$ V= ☐

## G. BUILDING'S SEISMIC RISK ESTIMATE (Indicator: I)

BUILDING'S SEISMIC RISK ESTIMATE $I=V[(H/R)-1]$ I= ☐

## H. INSPECTING ENGINEERS' DETAILS

1. NAME: 2. NAME
   PROFESSION: PROFESSION:

SIGNATURE SIGNATURE

DATE OF INSPECTION:

- The selected Historical Center for the implementation of the proposed Methodology was Nafplio.

- Nafplio was the first Capital of Greece after the 1821 revolution, is a sea port situated on the Argolic Gulf in northeast Peloponnese in Greece , rich in Monumental Stock.

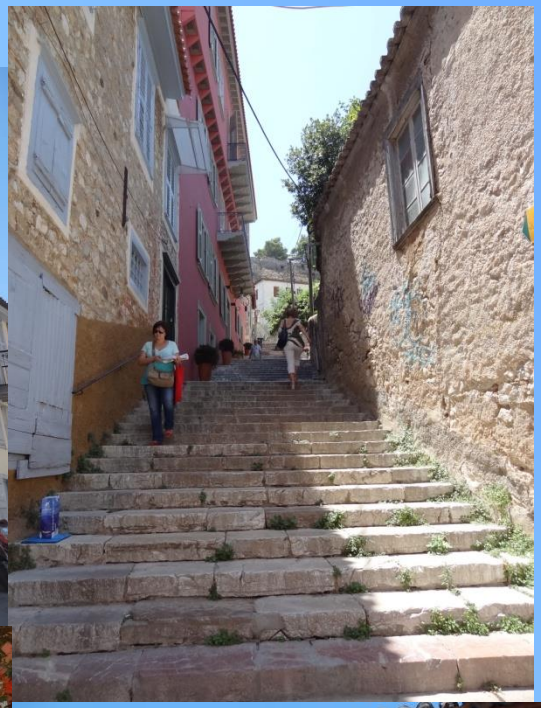
- Nafplio maintains a traditional architectural style with many traditional-style colorful buildings and houses, partly influenced by the Venetians, because of the domination of 1338-1540. In addition, modern-era neoclassical buildings are also preserved.

- The project is focusing on the assessment of the Vulnerability of the neoclassical bearing masonry buildings of the Historical Center of Nafplio, based on the proposed empirical Methodology.

**The Working Group, that carried out the activity consisted of the following members:**

**Merit Prof.S.Dritsos, as President**
**Prof.Ch.Ignatakis**
**A.Spiliopoulos, Civ.Eng., Building Infrastructure, s.a.**
**Dr. E.Pelli, Civ.Eng, Msc, Phd Dep.Dir.of E.P.P.O. & E.C.P.F.E.**
**D.Panagiotopoulou,Civ.Eng, Msc, chief of the Antis.Technology Dep,of E.P.P.O.**
**M.Panoutsopoulou, Civ.Eng, Msc, chief of the Programming ,Dep, of E.P.P.O.**
**M,Fotopoulou, Civ.Eng, Msc, chief of the Emergency Planning , Dep, of E.P.P.O.**
**M.Podimata, , Civ.Eng, Msc, chief in Ministry of Infrastructure, Transport and Networks**

# The Historical City of Nafpilo



# PART OF THE DATA BASE

| *Picture* | *Address* | *Number of levels* | Type of masonry unit and construction Type of mortar | Values for the masonry damage index | Openings near corners | Height regularity | Ground floor plan regularity | Features of adjacent buildings |
|---|---|---|---|---|---|---|---|---|
|  | Queen Olga 29 | 3 |  Semi dressed or fully dressed stone/ Clay mortar | Light extensive damage or medium scattered damage | Yes | Yes | Yes | Height difference in one or more floors with pounding risk |
|  | Queen Olga 24 | 3 |  Semi dressed or fully dressed stone/ Cement-lime Mortar | No damage | Yes | Yes | Yes | Height difference in one or more floors with pounding risk |

# PART OF THE DATA BASE

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
|  | Queen Olga 5 | 2 with loft |  Rubble stone / Lime mortar | Light scattered damage | Yes | Yes | Yes | Height difference in one or more floors with pounding risk |
|  | Queen Olga 3 | 3 |  Semi dressed or fully dressed stone / Cement-lime mortar | Light scattered damage | No | Yes | Yes | Height difference in one or more floors with pounding risk |
|  | Bouboulinas 49 & Em. Sofroni | 3 |  Semi dressed or fully dressed stone / Cement-lime mortar | No damage | No | Yes | Yes | Free building or adequate seismic gap between buildings |

# PART OF THE DATA BASE

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
|  | Georges Square 10 | 3 |   Ground Floor: Semi dressed or fully dressed stone /Cement-lime mortar Second & Third floor: Wood | Light extensive damage or medium scattered damage | Yes | Yes | No | Height difference in one or more floors with pounding risk |
|  | Georges Square 12 | 2 & 3 |   Ground Floor: / Semi | Light extensive damage or medium scattered damage | Yes | No | No | Height difference in one or more floors with pounding risk |

# BUILDING No 4

## ΝΑΥΠΛΙΟ - ΚΤΙΡΙΟ 4

**Α. ΤΑΥΤΟΤΗΤΑ ΚΤΙΡΙΟΥ**

1. ΠΕΡΙΦΕΡΕΙΑΚΗ ΕΝΟΤΗΤΑ: ΑΡΓΟΛΙΔΑΣ
2. ΔΗΜΟΤΙΚΗ ΕΝΟΤΗΤΑ:ΝΑΥΠΛΙΟΥ
3. ΔΙΕΥΘΥΝΣΗ:ΚΑΠΟΔΙΣΤΡΙΟΥ 28 & ΠΟΤΑΜΙΑΝΟΥ 2
   ΤΚ: ΤΗΛ :
4. ΟΝΟΜΑ ΚΤΙΡΙΟΥ :
5. ΧΡΗΣΗ ΚΤΙΡΙΟΥ : Ισόγειο Οινοπαντοπωλείο – Α΄ όροφος κατοικία
6. ΣΤΟΙΧΕΙΑ ΙΔΙΟΚΤΗΤΗ:
7. ΣΤΟΙΧΕΙΑ ΧΡΗΣΤΗ:

**Β. ΤΕΧΝΙΚΑ ΧΑΡΑΚΤΗΡΙΣΤΙΚΑ ΚΤΙΡΙΟΥ**

1. ΑΡΙΘΜΟΣ ΟΡΟΦΩΝ: 2 ΥΠΟΓΕΙΩΝ : 0
2. ΕΠΙΦΑΝΕΙΑ ΚΑΤΟΨΗΣ: 85,05 τ.μ.
3. ΟΛΙΚΗ ΔΟΜΗΜΕΝΗ ΕΠΙΦΑΝΕΙΑ : 170,10 τ.μ.
4. ΕΤΟΣ ΚΑΤΑΣΚΕΥΗΣ : Προ 1955
5. ΕΤΟΣ ΤΕΛΕΥΤΑΙΑΣ ΠΡΟΣΘΗΚΗΣ :
6. ΠΛΗΡΟΦΟΡΙΕΣ ΓΙΑ ΠΡΟΣΘΗΚΗ :
7. ΕΧΕΙ ΧΑΡΑΚΤΗΡΙΣΤΕΙ ΔΙΑΤΗΡΗΤΕΟ ; ΝΑΙ [√ *] ΟΧΙ [ ]
8. ΕΧΕΙ ΕΠΙΣΚΕΥΑΣΘΕΙ/ΕΝΙΣΧΥΘΕΙ ΤΟ ΚΤΙΡΙΟ ; ΝΑΙ [ ] ΟΧΙ [√ *]
9. ΑΝ ΝΑΙ ΓΙΑ ΠΟΙΑ ΑΙΤΙΑ ΚΑΙ ΠΟΤΕ :
10. ΓΕΝΙΚΕΣ ΠΡΟΣΘΕΤΕΣ ΠΛΗΡΟΦΟΡΙΕΣ :

**Γ. ΣΕΙΣΜΟΛΟΓΙΚΑ ΚΑΙ ΓΕΩΤΕΧΝΙΚΑ ΣΤΟΙΧΕΙΑ ΠΕΡΙΟΧΗΣ**

1. ΖΩΝΗ ΣΕΙΣΜΙΚΗΣ ΕΠΙΚΙΝΔΥΝΟΤΗΤΑΣ (κατά ΕΚ-8): Ζ1 [√] Ζ2 [ ] Ζ3 [ ]
2. ΚΑΤΗΓΟΡΙΑ ΕΔΑΦΟΥΣ (κατά ΕΚ-8): Α [ ] Β [ ] C [√] D [ ] Ε [ ] S [ ]
3. ΠΙΘΑΝΟΣ ΚΙΝΔΥΝΟΣ ΤΟΠΙΚΗΣ ΜΕΓΕΘΥΝΣΗΣ ΣΕΙΣΜΙΚΗΣ ΔΡΑΣΗΣ : ΝΑΙ [ ] ΟΧΙ [√]

**Δ. ΕΚΤΙΜΗΣΗ ΣΕΙΣΜΙΚΗΣ ΕΠΙΒΑΡΥΝΣΗΣ ΚΤΙΡΙΟΥ (Hazard: H)**

| | | |
|---|---|---|
| 1. | ΔΕΙΚΤΗΣ ΣΕΙΣΜΙΚΗΣ ΔΡΑΣΗΣ (H1) : | 1.6 |
| 2. | ΔΕΙΚΤΗΣ ΕΠΙΡΡΟΗΣ ΓΕΙΤΟΝΙΚΩΝ ΚΤΙΡΙΩΝ (H2) : | 1.2 |
| 3. | ΕΚΤΙΜΗΤΡΙΑ ΣΕΙΣΜΙΚΗΣ ΕΠΙΒΑΡΥΝΣΗΣ (H) : $H=0,75H1+0,25H2$ | H= 1.50 |

**Ε. ΕΚΤΙΜΗΣΗ ΣΕΙΣΜΙΚΗΣ ΑΝΤΙΣΤΑΣΗΣ ΚΤΙΡΙΟΥ (Resistance: R)**

| | | |
|---|---|---|
| 1. | ΔΕΙΚΤΗΣ ΣΕΙΣΜΙΚΗΣ ΑΝΤΙΣΤΑΣΗΣ ΙΣΟΓΕΙΟΥ (R1) : | 0.2 |
| 2. | ΔΕΙΚΤΗΣ ΑΝΟΙΓΜΑΤΩΝ ΦΕΡΟΝΤΩΝ ΤΟΙΧΩΝ (R2) : | 0.89 |
| 3. | ΔΕΙΚΤΗΣ ΔΙΑΣΩΜΑΤΩΝ (R3) : | 0.4 |
| 4. | ΔΕΙΚΤΗΣ ΔΙΑΦΡΑΓΜΑΤΩΝ (R4) : | 0.8 |
| 5. | ΔΕΙΚΤΗΣ ΑΝΟΙΓΜΑΤΩΝ ΚΟΝΤΑ ΣΕ ΓΩΝΙΕΣ (R5) : | 0 |
| 6. | ΔΕΙΚΤΗΣ ΠΑΘΟΛΟΠΑΣ ΦΕΡΟΥΣΩΝ ΤΟΙΧΟΠΟΙΙΩΝ (R6) : | 0.5 |
| 7. | ΔΕΙΚΤΗΣ ΣΥΝΔΕΣΗΣ ΜΕΤΑΞΥ ΕΓΚΑΡΣΙΩΝ ΤΟΙΧΩΝ (R7) : | 0.9 |
| 8. | ΔΕΙΚΤΗΣ ΚΑΤΑΠΟΝΗΣΗΣ ΠΕΡΙΜΕΤΡΙΚΩΝ ΤΟΙΧΩΝ ΕΚΤΟΣ ΕΠΙΠΕΔΟΥ (R8): | 0.44 |
| 9. | ΔΕΙΚΤΗΣ ΚΑΝΟΝΙΚΟΤΗΤΑΣ ΚΑΤΟΨΗΣ ΙΣΟΓΕΙΟΥ (R9) : | 1 |
| 10. | ΔΕΙΚΤΗΣ ΚΑΝΟΝΙΚΟΤΗΤΑΣ ΚΑΘ' ΥΨΟΣ (R10) : | 1 |
| 11. | ΕΚΤΙΜΗΤΡΙΑ ΣΕΙΣΜΙΚΗΣ ΑΝΤΙΣΤΑΣΗΣ ΚΤΙΡΙΟΥ (R) : $R=0,20R1+0,15(R3+R5)+0,10(R4+R7+R8)+0,05(R2+R6+R9+R10)$ | R= 0.48 |

**ΣΤ. ΣΠΟΥΔΑΙΟΤΗΤΑ ΚΤΙΡΙΟΥ (Value: V)**

1. ΠΛΗΘΟΣ ΑΤΟΜΩΝ *(Σημειώνεται με + το αντίστοιχο τετράγωνο)*
   Χ≤10 [ ] 10<Χ≤50 [√] 50<Χ≤100 [ ] 100<Χ≤200 [ ] >200 [ ]
2. ΣΥΝΟΛΙΚΟ ΕΜΒΑΔΟΝ ΟΡΟΦΩΝ ($m^2$) *(Σημειώνεται με + το αντίστοιχο τετράγωνο)*
   Ε≤100 [ ] 100<Ε≤500 [√] 500<Ε≤1000 [ ] Ε>1000 [ ]
3. ΔΙΟΙΚΗΤΙΚΗ/ή ΚΟΙΝΩΝΙΚΗ ΣΗΜΑΣΙΑ *(Σημειώνεται με + το αντίστοιχο τετράγωνο)*
   ΧΑΜΗΛΗ [ ] ΣΥΝΗΘΗΣ [√] ΣΗΜΑΝΤΙΚΗ [ ] ΙΔΙΑΙΤΕΡΗ [ ]
4. ΜΝΗΜΕΙΑΚΗ ΑΞΙΑ *(Σημειώνεται με + το αντίστοιχο τετράγωνο)*
   ΚΑΜΙΑ [ ] ΜΕΤΡΙΑ [√] ΣΠΟΥΔΑΙΑ [ ]
5. V1= 1.50 V2= 1.50 V3= 1.00 V4= 1.50
6. ΕΚΤΙΜΗΤΡΙΑ ΣΠΟΥΔΑΙΟΤΗΤΑΣ ΚΤΙΡΙΟΥ $V=0,30(V1+V2)+0,20(V3+V4)$ V= 1.40

**Ζ. ΔΕΙΚΤΗΣ ΣΕΙΣΜΙΚΗΣ ΔΙΑΚΙΝΔΥΝΕΥΣΗΣ ΚΤΙΡΙΟΥ (Indicator: I)**

ΔΕΙΚΤΗΣ ΣΕΙΣΜΙΚΗΣ ΔΙΑΚΙΝΔΥΝΕΥΣΗΣ ΚΤΙΡΙΟΥ $I=V[H:R)-1]$ I= 2.94

**Η. ΣΤΟΙΧΕΙΑ ΕΛΕΓΚΤΩΝ ΜΗΧΑΝΙΚΩΝ**

1. ΟΝ/ΜΟ: ΟΜΑΔΑ ΜΕΛΕΤΗΣ ΟΑΣΠ 2. ΟΝ/ΜΟ:
   ΕΙΔΙΚΟΤΗΤΑ: ΕΙΔΙΚΟΤΗΤΑ:
   ΤΗΛΕΦΩΝΟ: ΤΗΛΕΦΩΝΟ:

ΥΠΟΓΡΑΦΗ ΥΠΟΓΡΑΦΗ

**ΠΑΡΑΡΤΗΜΑ Β**
**ΔΕΛΤΙΟ ΣΥΓΚΕΝΤΡΩΣΗΣ ΣΤΟΙΧΕΙΩΝ ΠΕΔΙΟΥ**

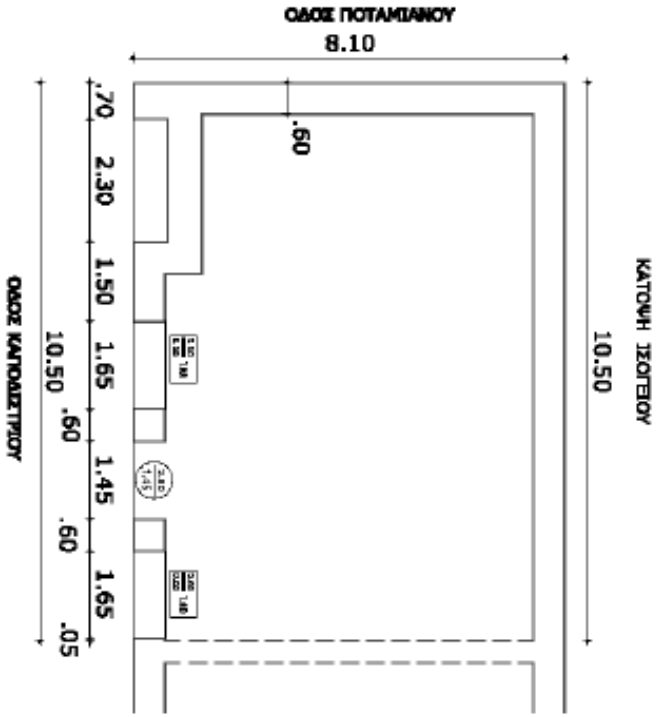
**Στοιχεία Ταυτότητας Κτιρίου**

| α/α | Ταυτότητα – Τεχνικά Χαρακτηριστικά Κτιρίου | |
|---|---|---|
| 1 | Περιφερειακή Ενότητα | ΑΡΓΟΛΙΔΑΣ |
| 2 | Δημοτική Ενότητα | ΝΑΥΠΛΙΟΥ |
| 3 | Διεύθυνση | ΚΑΠΟΔΙΣΤΡΙΟΥ 28 & ΠΟΤΑΜΙΑΝΟΥ 2 |
| 4 | Τηλέφωνο | |
| 5 | Όνομα Κτιρίου | |
| 6 | Χρήση Κτιρίου | Ισόγειο Οινοπαντοπωλείο – Α΄ όροφος κατοικία |
| 7 | Στοιχεία ιδιοκτήτη | |
| 8 | Στοιχεία Χρήστη | |
| 9 | Αριθμός Ορόφων | 2 |
| 10 | Αριθμός Υπογείων | 0 |
| 11 | Έτος Κατασκευής | Προ 1955 |
| 12 | Αριθμός Χρηστών | ≤10[ ], 11÷50[ X ], 51÷100[ ], 101÷200[ ], >200[ ] |
| 13 | Έχει κατασκευασθεί προσθήκη καθ' ύψος; ΟΧΙ | |
| 14 | Έχει χαρακτηριστεί διατηρητέο; ΝΑΙ * | |
| 15 | Έχει επισκευασθεί / ενισχυθεί το κτίριο; ΟΧΙ | |

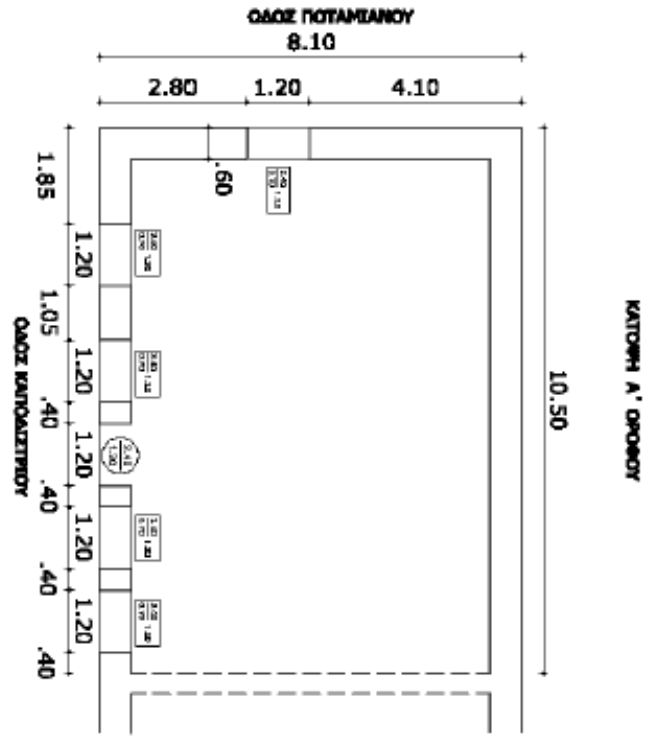
**ΠΡΟΣΘΕΤΕΣ ΠΛΗΡΟΦΟΡΙΕΣ**

**ΣΚΑΡΙΦΗΜΑ ΚΤΙΡΙΑΚΟΥ ΣΥΓΚΡΟΤΗΜΑΤΟΣ**

**ΣΚΑΡΙΦΗΜΑ ΚΑΤΟΨΗΣ ΙΣΟΓΕΙΟΥ**



**ΣΚΑΡΙΦΗΜΑ ΚΑΤΟΨΗΣ 1ΟΥ ΟΡΟΦΟΥ**






**Στοιχεία για τον δείκτη σεισμικής δράσης**

| α/α | Αιτίες πιθανού κινδύνου τοπικής μεγέθυνσης της σεισμικής δράσης | |
|---|---|---|
| 1 | Κτίριο κοντά ή πάνω σε επισφαλές φυσικό πρανές | |
| 2 | Επιφανειακή θεμελίωση σε χαλαρές επιχωματώσεις | |

**Στοιχεία για τον δείκτη επιρροής γειτονικών κτιρίων**

| α/α | Χαρακτηριστικά όμορων κτιρίων | |
|---|---|---|
| 1 | Ελεύθερο κτίριο ή όμορα με επαρκείς αρμούς ή κτίρια σε επαφή με ισοϋψία χωρίς σημαντική διαφορά δυσκαμψίας | |
| 2 | Ισοϋψία αλλά με σημαντική διαφορά δυσκαμψίας | |
| 3 | Διαφορά ενός ορόφου χωρίς κίνδυνο εμβολισμού | |
| 4 | Κοινό πλήθος αλλά ανισοϋψία ορόφων (κίνδυνος εμβολισμού) | |
| 5 | Διαφορά δύο ή περισσοτέρων ορόφων χωρίς κίνδυνο εμβολισμού | |
| 6 | Διαφορά ενός ή περισσοτέρων ορόφων και κίνδυνος εμβολισμού | √ |
| 7 | Περίπτωση επαφής με περισσότερα του ενός όμορα κτίρια | |

*Το εύρος του αντισεισμικού αρμού αναφέρεται στην ανώτατη στάθμη επαφής μεταξύ των όμορων κτιρίων και θεωρείται επαρκές εάν υπερβαίνει τα 2.0cm για ύψος 3.0m με προσαύξηση 1.0cm ανά 2.0m επιπλέον ύψους.*

**Στοιχεία για τον δείκτη διατμητικής αντίστασης**

| α/α | Τύπος Λιθοσωμάτων και Τύπος Δόμησης | Τύπος κονιάματος δόμησης | | |
|---|---|---|---|---|
| | | Ασβεστοτσιμεντοκονίαμα | Ασβεστοκονίαμα | Πηλοκονίαμα |
| 1 | Ημιλαξευτή ή λαξευτή λιθοδομή | | | |
| 2 | Λιθοδομή Πλακοειδών λίθων | | | |
| 3 | Αργολιθοδομή | | | √ |
| 4 | Κροκαλοδομή | | | |
| 5 | Πλινθοδομή πλήρων πλίνθων | | | |
| 6 | Πλινθοδομή διάτρητων πλίνθων | | | |
| 7 | Τσιμεντολιθοδομή | | | |
| 8 | Ωμοπλινθοδομή | | | |

| Σε περίπτωση τρίστρωτης τοιχοποιίας σημειώστε + | |
|---|---|
| Περιγραφή τρόπου δόμησης της τρίστρωτης τοιχοποιίας[1]: | |

| Σε περίπτωση ενίσχυσης της τοιχοποιίας σημειώστε + | |
|---|---|
| Περιγραφή τρόπου ενίσχυσης της τοιχοποιίας[2]: *(π.χ. Βαθύ αρμολόγημα, ενέμπαστο και εσωτερικά οπλισμένο επίχρισμα ή αμφίπλευρος μανδύας από εκτοξευόμενο σκυρόδεμα)* | |

| Σε περίπτωση αλλαγής τύπου δόμησης ανά όροφο[3]: |
|---|

1. *(π.χ. Ο τρόπος δόμησης της τοιχοποιίας περιλαμβάνει δύο σειρές δρομικής οπτοπλινθοδομής οι οποίες συνδέονται μεταξύ τους με οπλισμένο σκυρόδεμα. Το συνολικό πάχος της τοιχοποιίας είναι 28 εκατ. καθώς έχουν χρησιμοποιηθεί οπτόπλινθοι με οπές, πλάτους 8 εκατ. και το πάχος της ενδιάμεσης στρώσης σκυροδέματος είναι 12 εκατ.)*
2. *(π.χ. Βαθύ αρμολόγημα, ενέμπαστο και εσωτερικά οπλισμένο επίχρισμα ή αμφίπλευρος μανδύας από εκτοξευόμενο σκυρόδεμα)*
3. *(π.χ. Το κοάγεο τύπου 3 με ασβεστοκονίαμα, ό όροφος τύπου 6 με ασβεστοτσιμεντοκονίαμα)*



**Στοιχεία για τον δείκτη διαζωμάτων (R3).**

| Θέση διαζωμάτων | |
|---|---|
| Απουσία διαζωμάτων ή διαζώματα ασύνδετα μεταξύ τους | |
| Διαζώματα στις στάθμες των υπερθύρων | √ |
| Διαζώματα στις στάθμες των πατωμάτων πλην της στέγης | |
| Διαζώματα στις στάθμες πατωμάτων και στέγης | |
| Διαζώματα στις στάθμες υπερθύρων, πατωμάτων και στέγης | |
| Μονώροφο κτίριο με κορυφαίο διάζωμα | |
| Πολυώροφο κτίριο με διάζωμα μόνο στη στέγη | |

| Είδος διαζωμάτων | |
|---|---|
| Ξύλινα | √ |
| Μεταλλικά | |
| Σκυρόδεμα | |

| Σε περίπτωση ξύλινων ή μεταλλικών διαζωμάτων | ΝΑΙ | ΟΧΙ |
|---|---|---|
| Η ξύλινη ή μεταλλική δοκός έδρασης πατώματος ή στέγης (ποταμός), έχει τοποθετηθεί μόνο στην εσωτερική παρειά της στέψης των τοίχων; | | √ |
| Το διάζωμα διήκει σε όλο το μήκος των περιμετρικών και των κυριότερων εσωτερικών φερόντων τοίχων; | | √ |
| Οι διαμήκεις ράβδοι των ξύλινων ή μεταλλικών διαζωμάτων έχουν εξασφαλισμένη συνέχεια (ματίσεις) και σύνδεση στις γωνίες ή διασταυρώσεις τοίχων; | | √ |
| Υπάρχουν χαλαρές ή διαβρωμένες συνδέσεις ή σοβαρή παθολογία του υλικού; | √ | |

| ΠΕΡΙΓΡΑΦΗ – ΠΑΡΑΤΗΡΗΣΕΙΣ ΓΙΑ ΤΑ ΔΙΑΖΩΜΑΤΑ: |
|---|

**Στοιχεία για τον δείκτη διαφραγμάτων**

| α/α | Διάταξη φερόντων τοίχων σε κάτοψη | |
|---|---|---|
| 1 | Συμμετρική | √ |
| 2 | Μερικώς συμμετρική | |
| 3 | Ασύμμετρη | |

*Ο χαρακτηρισμός της διάταξης των τοίχων σε κάτοψη αναφέρεται στη δυσμενέστερη, από άποψη διάταξής τους, διεύθυνση του κτιρίου.*

| α/α | Τύποι πατωμάτων και στέγης | |
|---|---|---|
| 1 | Ξύλινο πάτωμα με μονό σανίδωμα | √ |
| 2 | Ξύλινο πάτωμα με διπλό σανίδωμα | |
| 3 | Σιδηροδοκοί με επίπεδη πλινθοπλήρωση | |
| 4 | Σιδηροδοκοί με θολίσκους πλινθοπλήρωσης | |
| 5 | Πλάκα οπλισμένου σκυροδέματος | |
| 6 | Κτιστά θολωτά πατώματα μονής ή διπλής καμπυλότητας | |
| 7 | Στέγη χωρίς σαφή δικτύωση, χωρίς σανίδωμα | √ |
| 8 | Στέγης χωρίς σαφή δικτύωση, αλλά με σανίδωμα | |
| 9 | Στέγη με σαφή δικτύωση, χωρίς σανίδωμα | |
| 10 | Στέγη με σαφή δικτύωση και σανίδωμα | |
| 11 | Άλλο είδος | |

*Μονοκλινείς στέγες με καμπτόμενες ξύλινες δοκούς ή σιδηροδοκούς αντιμετωπίζονται όπως τα αντίστοιχα πατώματα.*

**ΠΕΡΙΓΡΑΦΗ-ΠΑΡΑΤΗΡΗΣΕΙΣ:**

| α/α | Τύπος σύνδεσης πατωμάτων ή στεγών με τους υποκείμενους τοίχους | |
|---|---|---|
| 1 | Πατόξυλα ή σιδηροδοκοί απευθείας επί του τοίχου | √ |
| 2 | Πατόξυλα ή σιδηροδοκοί επί ποταμού | |
| 3 | Πατόξυλα ή σιδηροδοκοί επί διαζώματος | |
| 4 | Πλάκα Ο/Σ με σημειακές χανδρώσεις | |
| 5 | Πλάκα Ο/Σ με συνεχή έδραση σε τμήμα του πάχους του τοίχου | |
| 6 | Πλάκα Ο/Σ με συνεχή έδραση σε όλο το πάχος του τοίχου | |
| 7 | Κτιστά θολωτά πατώματα | |

**ΠΕΡΙΓΡΑΦΗ-ΠΑΡΑΤΗΡΗΣΕΙΣ:**



**Στοιχεία για τον δείκτη παθολογίας φερουσών τοιχοποιιών (R6).**

| α/α | Τύπος βλαβών φερουσών τοιχοποιών | |
|---|---|---|
| 1 | Απουσία βλαβών | |
| 2 | Ελαφρές διάσπαρτες βλάβες | |
| 3 | Ελαφρές εκτεταμένες ή μέτριες διάσπαρτες βλάβες | √ |
| 4 | Βαριές βλάβες | |

**ΠΕΡΙΓΡΑΦΗ-ΠΑΡΑΤΗΡΗΣΕΙΣ:**
Ρωγμές κάτω από τις πλευρές των παραθύρων και στους πεσσούς
Διαγώνιες ρωγμές μεταξύ των ανοιγμάτων

*Ως ελαφρές βλάβες νοούνται ρηγματώσεις εύρους έως 1.0mm. Ως μέτριες βλάβες νοούνται ρηγματώσεις εύρους έως 2.0mm χωρίς θραύσεις από θλίψη και χωρίς σημαντικές παραμένουσες παραμορφώσεις.*

**Στοιχεία για τον δείκτη σύνδεσης μεταξύ εγκάρσιων τοίχων (R7).**

| α/α | Χαρακτηρισμός σύνδεσης μεταξύ εγκάρσιων τοιχοποιιών | |
|---|---|---|
| 1 | Υπάρχει επαρκής σύνδεση σε όλες τις διασταυρώσεις | √ |
| 2 | Οι περιμετρικοί τοίχοι είναι επαρκώς συνδεδεμένοι μεταξύ τους, όχι όμως με τους εσωτερικούς | |
| 3 | Ανεπαρκής σύνδεση σε όλες τις διασταυρώσεις | |

**ΠΕΡΙΓΡΑΦΗ-ΠΑΡΑΤΗΡΗΣΕΙΣ:**
τα λιθοσώματα των δύο τοίχων είναι πλεγμένα μεταξύ τους (πάχος πεσσών 60 εκ.)

*Η διαπίστωση της σύνδεσης απαιτεί τοπικές καθαιρέσεις επιχρίσματος καθ' ύψος της ακμής συνάντησης των τοίχων. Επαρκής θεωρείται η σύνδεση όταν τα λιθοσώματα των δύο τοίχων είναι πλεγμένα μεταξύ τους. Η ύπαρξη μεταλλικών ελκυστήρων που αγκυρώνονται στις γωνίες ή τις διασταυρώσεις τοίχων εξασφαλίζει επαρκή σύνδεση. Σε περίπτωση προσθηκών κατ' επέκταση, η τοπικών ανακατασκευών, είναι πολύ πιθανή η απουσία σύνδεσης με τις τοιχοποιίες του υπόλοιπου κτηρίου.*

# VALIDATION OF THE METHODOLOGY

| Type of the Building | $L_1$ (m) | $L_2$ (m) | A/A | Seismic Zone | Number of Storeys | Width of the Wall (m) |
|---|---|---|---|---|---|---|
| A | 3,5 | 1,68 | A1 | II | 1 | 0,25 |
| | | | A2 | II | 2 | 0,25 |
| | | | A3 | II | 3 | 0,25 |
| | | | A5 | II | 5 | 0,25 |
| B | 5,50 | 2,68 | B1 | II | 1 | 0,25 |
| | | | B2 | II | 2 | 0,25 |
| | | | B3 | II | 3 | 0,25 |
| | | | B5 | II | 5 | 0,25 |
| Γ | 10,50 | 5,18 | Γ1 | II | 1 | 0,25 |
| | | | Γ2 | II | 2 | 0,25 |
| | | | Γ3 | II | 3 | 0,25 |
| | | | Γ5 | II | 5 | 0,25 |
| Δ | 3,5 | 1,68 | Δ1 | II | 1 | 0,20 |
| | | | Δ2 | II | 2 | 0,20 |
| | | | Δ3 | II | 3 | 0,20 |
| | | | Δ5 | II | 5 | 0,20 |

Height of story :3 m
Seismic Zone II
Ground Type B

Critical Parameters :

-The presence of diaphragms

- The number of stories

-The length of bearing wall openings

# CONCLUSIONS

✓ The number of stories , in combination with the presence of diaphragms or not, in case of Elastic Analyses play a crucial role, in contrast to EPPO's Methodology where the contribution of these parameters to the index(I),is trivial.

✓ The proposed values of the Diaphragm Index (R4),when altered according to the stiffness of diaphragm and connection to the underlying wall (peak values of R4=1 (STRONG) and R4=0.8 (WEAK)) have very little effect to the final resistance of the building . The opposite occurs in the elastic analyses.

## SUMMING UP

✓ The implemented empirical Methodology for Pre-earthquake Assessment of masonry buildings can be an adequate guide to prioritizing buildings in terms of vulnerability. The Seismic risk index (I) of the vast majority of buildings, is a positive decimal number. This index does not have an ultimate objective significance, but indicates the priority order for the third part of the process (third level pre-earthquake assessment), that is the preparation of assessment studies and redesigns (strengthening) of a limited number of buildings, depending on the economic capabilities of each public body.

- ✓ **It is more elaborated than a “rapid visual screening “**

- ✓ **The Second Level methodology for Pre-earthquake inspection of masonry buildings can be updated, taking into account the conclusions from the pilot application.**
- ✓ **It is easier to apply comparing to methods based on objective calculations**
- ✓ **The Second Level methodology can be harmonized with the relevant method for reinforced concrete buildings.**
- ✓ **-The E.P.P.O. methodology is proposed to be adapted by the State and extended to other types of masonry buildings (more complex).**

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# THANK YOU FOR YOUR ATTENTION

E.P.P.O.
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