Earthquake Planning
and Protection Organization

European Centre on Prevention
and Forecasting of Earthquakes

Preseismic Assessment of the Traditional Dwellings and Vulnerability Assesment of the Old town of Rhodes

Ottoman Period

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FIRST DEGREE PRE-EARTHQUAKE ASSESSMENT

OF THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN PERIOD IN THE

OLD TOWN OF RHODES

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PILOT APPLICATIONS

1. INTRODUCTION

The old town of Rhodes includes buildings of the successive historical periods of its development, with the main feature being the bearing masonry consisting of carved local brown-yellow limestone, known as poros stone ("porolithos"). Throughout the 24 centuries of its history, the city of Rhodes has become a meeting place, development and clash of civilizations, due to its position as a crossroads of the Middle East, Asia Minor, Africa and the West.

Urban development is divided into 6 major categories, according to the respective historical periods:

1. Hellenistic 408 B.C. – 515 A.D.
2. Byzantine 516 A.D. – 1309 A.D.
3. Knights of the Order of St John. 1309 A.D. – 1522 A.D.
4. Ottoman 1522 A.D. – 1912 A.D.
5. Itallian 1912 A.D.– 1945 A.D.
6. Modern 1947 A.D. – Today

In the following sections, a summary of the 4th Historical Period (Ottoman - Period of Ottoman rule) and the corresponding typology of constructions are presented.

1.1 Ottoman Period (1522 A.D. – 1912 A.D.)

The occupation of the knightly capital by the Ottomans in 1522 and its integration into the great Ottoman Empire decisively determined the further development of the city and its structures. The Byzantine fortification of Rhodes divided the city into three parts: the Acropolis (later the Palace of the Grand Master), Collachium and the Burgh.. Parts of this fortification are preserved today incorporated in later buildings, mainly in the area of Collachium.

In the first period (16th century), the Ottomans engaged in minimal interventions, mainly maintenance, both in the private and public sector, according to their own needs and customs. The orthodox churches were transformed into mosques and new ones were built inside the city. The hospital of the knights became a barracks and the palace a prison.

In the second period (17th - mid 19th century) new mosques were built with imposing domes and minarets, a library, baths and the characteristic introverted Turkish houses.

The third period is characterized by the construction of the large mosques of Suleiman and Ibrahim Pasha, while in the private and public sector the neoclassical rhythm appears with the characteristics of the Muslim school and the house on Pythagoras Street.

The second half of the 19th century was devastating for the monuments of the medieval city. The earthquake of 1856 destroyed a large part of the city, which in combination with the explosion of gunpowder in the basement of the bell tower of St. Ioannis of Collachium completed the destruction. The strong seismic sequence of the late

19th century and especially the earthquake of 1863, resulted in the destruction of the Naillac tower on the east pier of the port

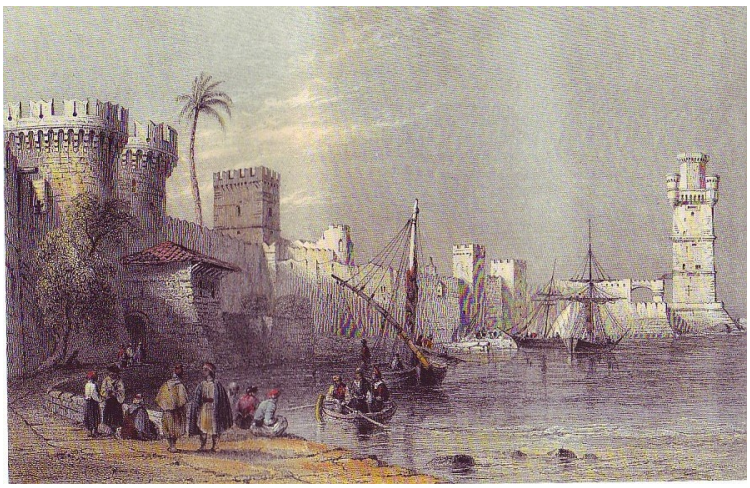


Figure 1. The port of Rhodes and the Naillac tower in the 19th century.

The city has extensive bombed areas of World War II in which the ruined buildings have not been systematically restored, while about 300 properties belong to the Greek state and are managed by the Archaeological Resources Fund of the Ministry of Culture. It is noted that several of them are in very poor condition.

1.2 General description of typology of buildings of the Old Town of Rhodes

The simple structures in residential areas and in the commercial areas of the city resulted from the evolution of medieval types and construction methods. These structures belong to the following three categories.

- Two-storey buildings with vaulting on the ground floor, bearing masonry walls and wooden horizontal roofs. Their original construction usually dates back to the knightly period (1309 -1522 AD) and they have undergone extensive interventions or reconstruction of the floor.
- Buildings (mainly two-storey) with masonry walls, wooden load-bearing floors and horizontal roofs, the construction of which usually dates back to the period of Ottoman rule (1523-1912). At the end of the 18th century, the characteristic type of the Ottoman mansions of the Balkans appears with stone bearing walls on the ground floor and stone or wooden framed bearing walls on the first floor and wooden horizontal roofs.
- Two-storey buildings of Neoclassical type (after 1912) with masonry walls, wooden floors and wooden pitched or quadruped roofs.

1.3 Building typology of the Ottoman period

The building typology during the Ottoman Period has been selected for further investigation, due to the significant percentage of the existing buildings of the old city of Rhodes. In addition, structures had the least new interventions-reconstructions

compared with other historical periods and therefore, it can be assumed that they retain the original architecture and the seismic behavior follows the original structural system.

A decisive factor in the design of the house was the Muslim tradition and religion that significantly influenced the daily life of the Ottomans. For example, the introversion of the house and the obligation for women to stay in the house led to the removal of windows of the former knight's house on the ground floor, the creation of high fencing in the case of houses with a courtyard to the street and the addition of Ottoman enclosed wooden balconies called the "sahnisi".

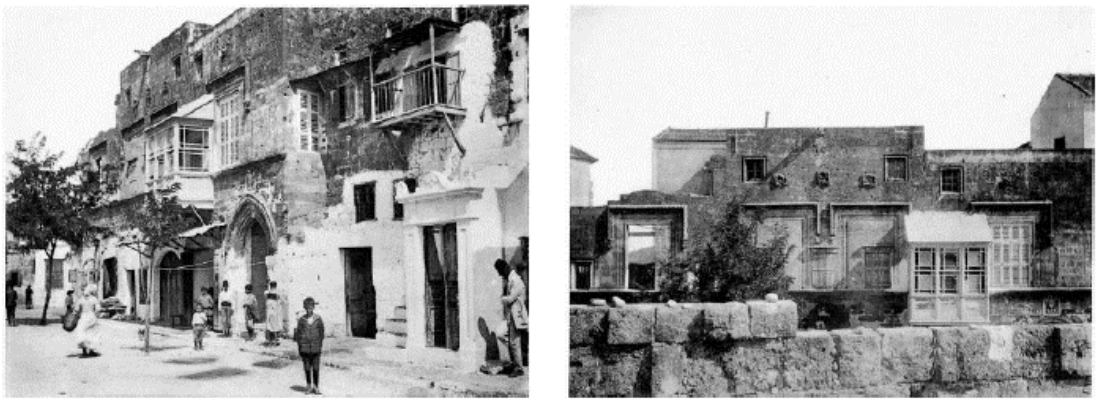


Figure 2. Photos of the late 19th century in the center of the old Town La cité de Rhodes, Architecture civile et religieuse

The reused knightly houses had direct access from the street, but there were also houses with entrance from the courtyard. In both cases, there was a clear attempt to separate the interior from the exterior. The houses were two-storey buildings with the floor being the important part of the house and the ground floor the connection to the outside. The shape of the floor plan was a Γ. The ground floor was an open space and was used as a storage room and stable, while the first floor was used as a living space.

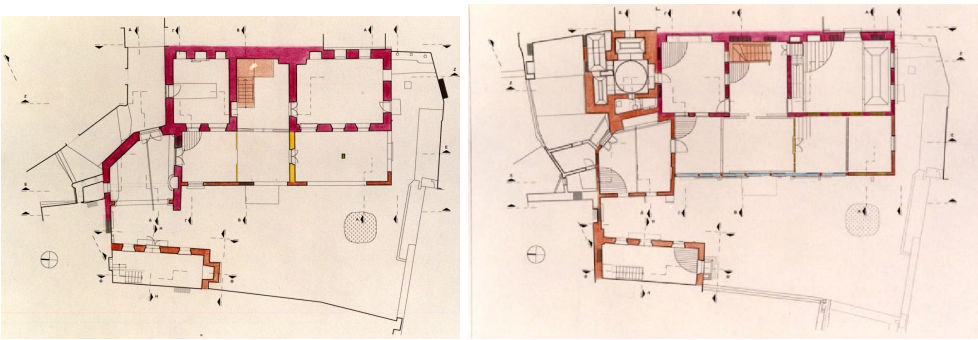


Figure 3. Ground floor plan and 1st floor views of Ierokleous street mansion

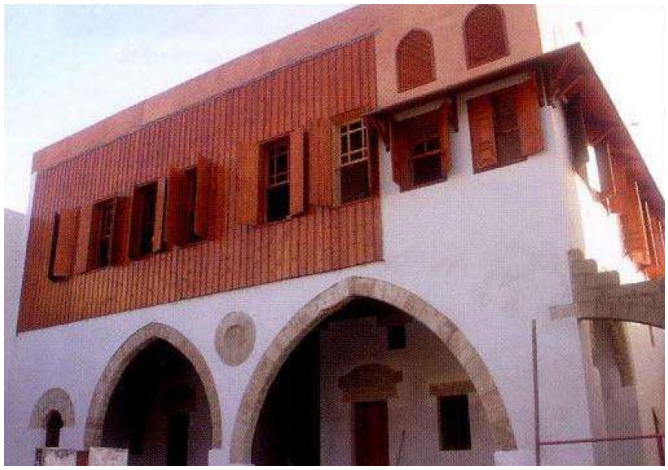


Figure 4. Exterior view of Ierokleous Street mansion after the restoration works

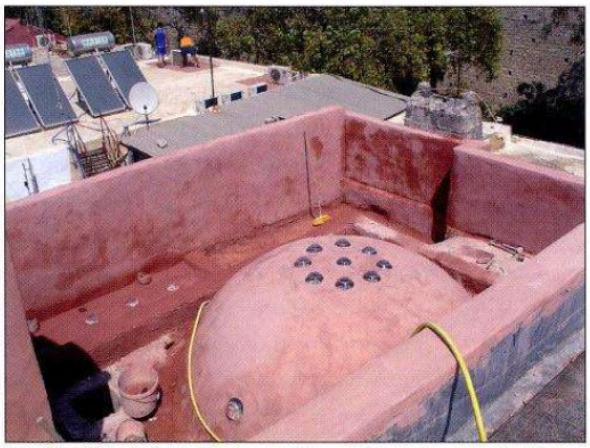


Figure 5. Exterior view of the dome of the hammam room

The height of the ground flour was 4.50-5.50 m, while the upper floor almost reached 4.50 m. The ground floor had a limited number of openings at a high height from the floor, covered with wooden or metal grilles to achieve safety and introversion. On the contrary, the facade of the floor was structured by several openings at short distances between them arranged in two rows, with the upper row always consisting of smaller windows. The whole construction obviously conveys in stone the solution of the thin wooden walls and the chimneys of the houses of the East. In general, the new Ottoman dwellings maintained the construction technique and structure of the knighthood buildings. The houses remained stone-built, with an obvious isodomic stone structure on the first floor and a wide strip of kurasani around the roof for protection from moisture.

Concluding, the buildings of the Ottoman Empire are mainly two-storey buildings with stone bearing walls of poros stone ("porolithos"), reinforced with wooden elements mainly on the first floor. The load-bearing floors and the horizontal roof are wooden. (16th-20th century). It is pointed out that the two-storey stone building with wooden or vaulted roof can belong to the construction categories A, AB and B depending on the size, use and type of the structure.

1.4 Formulation and completion of pre-earthquake assessment data sheets

The existing pre-earthquake assessment data sheets for contemporary masonry buildings (Structural Category A) have to undergo certain modifications in order to offer sufficient and credible information about historical buildings of the Ottoman Period. This is a first approach to the effort of assessment and preliminary rating of historical buildings in the old town of Rhodes, according to their seismic behaviour and vulnerability.

It is necessary that at least one of the two engineers who undertake the in situ assessment of a historical building has relative experience in repair and restoration of monuments, in order to avoid either over or under-estimation of the seismic risk.

Before visiting the historical building on site, in order to complete the Pre-earthquake assessment data-sheet, it is recommended to have visited the responsible Services and gathered all possible information about the monument such as historical data, the legal status of its protection and ownership, details about the seismicity of the area, existing former documentation and possible design restoration projects. This information may be very helpful to understand and evaluate the present condition of the building.

Before the completion of the 3leaf Pre-earthquake assessment data-sheet, the engineers carrying out the assessment will complete the 3 accompanying documentation sheets. The guidelines presented herein are instructions for the completion of these 3 sheets and then transfer this information to the pre-earthquake assessment data sheet.

There are also the rating sheet and instructions on how to complete it.

It is also pointed out that the rating procedure following this assessment, provides an administrative tool for a comparative classification of historical buildings in order to help the state authorities set the priorities for the design of interventions. It is not, and should not serve as, a substitute for the complete scientific diagnosis of the problems of each monument, an in all cases, a restoration design project should follow.

Annex I,II and III contain helpful information (with photos, sketches and descriptions) about the types of buildings existing in Rhodes and specific details for the understanding of the structural types, pathology, terminology etc.

Finally, three historical buildings are chosen as examples, and the completion of their sheets is presented.

2. DOCUMENTATION SHEET No. 1: "field survey – design and photographic documentation"

with instructions (in italics)

AVAILABLE FORMER SURVEY

Type of survey and documentation	**scale/list of plans**	**Author and date of survey**
Topographic survey		
Architectural survey and documentation		
Structural survey and documentation		
Pathology		

In case that design projects are already available, this table is completed with the relevant information, and photocopies are used for the in-situ assessment and are attached to this sheet.

FORMER INTERVENTIONS

Former interventions-construction phases*	
Last restoration**	
I don't know	

** Short information about former interventions (alterations, additions, repairs, etc.) The source of information should be mentioned (archive- files, bibliography, old Photos, gravures etc.)*
*** Short information about the date and aim of the most recent restoration, description of main interventions and who did them (if known).*

IN SITU GRAPHIC SURVEY AND DOCUMENTATION

In case of lack of former designs, simple rough drawings (sketches) of the ground plan, the most characteristic sections, and the exterior elevations must be drawn in situ. The basic dimensions (concerning thickness, length, height of all structure's walls and additional height of any existing pediment or other structures) must be measured as precise as possible. All openings and other characteristic architectural elements (arches etc.) should be sketched too. It is also recommended to add the information gathered in situ about pathology, former interventions, etc. to these sketches.

PHOTOGRAPHIC DOCUMENTATION

During the visit to the structure, general photographs and details of the damaged areas or existing characteristic structural elements of the building and its surroundings should be taken. These photographs are attached in electronic or printed archives with the necessary references.

3. DOCUMENTATION SHEET No. 2: "Seismicity-environment"
with instructions (in italics)

ENVIRONMENTAL DATA

LOCATION

Sketch of the broader area around the building, showing adjacent or neighbouring buildings or other structures, and general characteristics of the structure's location (soil-inclination etc.) should be made. A geological map would be also useful, if available.

INFLUENCE OF GEOMORFOLOGICAL AND ENVIRONMENTAL CONDITIONS
THE BUILDING IS CONSTRUCTED**:**

Conditions	**YES**	**NO**	**DON'T KNOW**
With shallow foundation on loose embankment or silt			
Near or on unstable natural or artificial slope			
In area with high water level (rising humidity)			
In area with floods			
In area with polluted atmosphere			
Near the sea (salt exposure)			

INFLUENCE OF NEIGHBOURING BUILDINGS

Existence of	**YES**	**NO**	**DON'T KNOW**
Adequate joint*			
inadequate or non-continuous joint			
Without joint			

**An adequate joint (gap between buildings) is 2 cm broad to a height of 3 meters, and 1 more cm needs to be added for every 1 additional m of height. It is counted on the upper edge of the common area between neighbouring buildings.*
The next table is completed when no joint exists.

Conditions of neighbourhood	**DANGER OF STROKE**	
With other 1storey building of different height	**YES**	**NO**
With building of different rigidity	**YES**	**NO**
With different floor levels	**YES**	**NO**
In contact with other voluminous or high structures	**YES**	**NO**

OTHER INFLUENCES

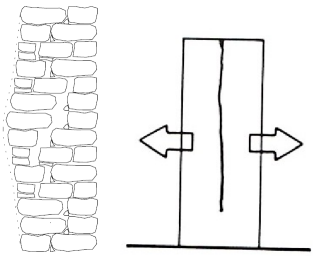
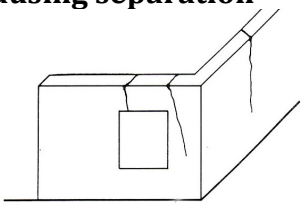
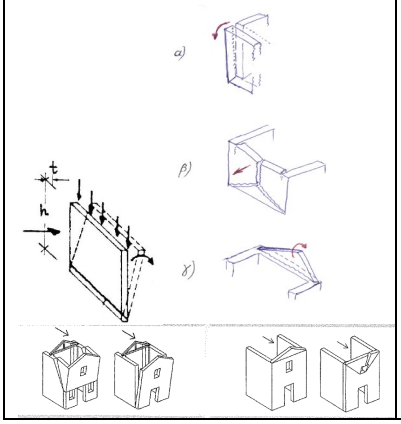
Free text about: -NEARBY SOURCE OF VIBRATIONS (AUTOROUTE ETC) -RECENT EARTHQUAKES AND REPORTS ABOUT DAMAGES -HISTORICAL EARTHQUAKES AND INFORMATION ABOUT DAMAGES

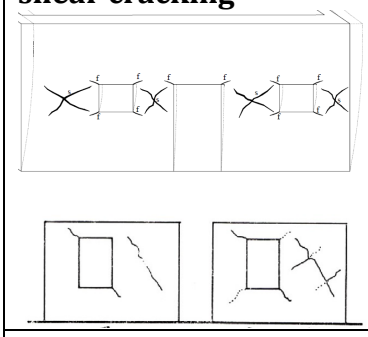
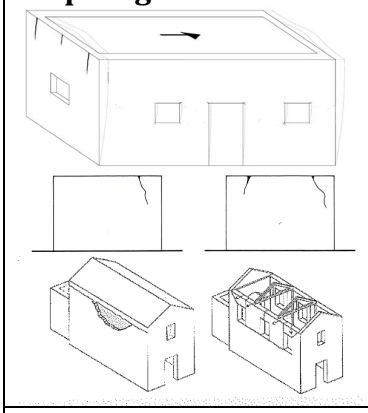
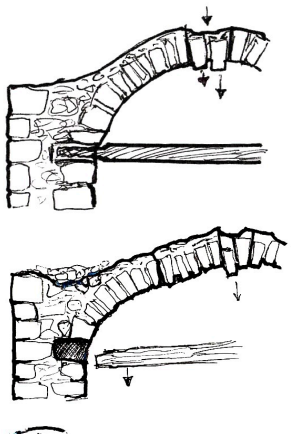
Any reference to existing information concerning bibliographical data or information derived from the monument's archive should be included.

DATA FROM MICROZONATION STUDY
Reference to the results of the survey, if it exists.

4. DOCUMENTATION SHEET No. 3: "Pathology"

In order to enable the evaluation of the pathology criteria contained in the pre-earthquake assessment data sheet, one may go through the following typical descriptions of characteristic damages usually observed in historical buildings

	C	B	A
Vertical cracks inside the masonry core with swelling of the wall surfaces, indicating separation of masonry leaves 	Serious swelling of both masonry leaves	Small area of swelling, with few vertical cracks	Non-existent
Cracks near the corners of intersecting walls causing separation 	Disconnection of walls near the corners. Broad and long cracks through the wall	Thin and short cracks on one side of the intersecting walls	Non-existent
Horizontal cracks at the base of wall or pillars or pediments or over openings (out of plane flexural cracking) 	Very serious cracks, even if thin	X	Non-existent

Diagonal or X-shaped shear cracking 	Many long cracks over openings and in the area of piers	Few and short cracks over and under openings.	Non-existent
Cracks at the base of diaphragms (roofs, floors indicating poor or inexistent connection of diaphragms and walls 	Many long and broad cracks, sometimes accompanied by sliding of the roof or local collapses at the edges of walls	Small and few cracks	Non-existent
Damages in domes, apses and arches 	Cracking and sliding of many voussoirs or keystones. Deformation of the original curve, clearly visible from the intrados or the extrados of the structure. Local disintegration of apse or dome in areas of compressive failure, local collapses	Sliding of many voussoirs or keystones. Cracks parallel to the keystones and inclined cracks near the edges, Local decollation of plastering mortars.	Inexistent damages or only fissures parallel to the keystones. Few slides decollations of mortar joints.
Masonry wall inclination	Always serious, with or without cracks	X	Non-existent

FIRST DEGREE PRE-EARTHQUAKE ASSESSMENT OF THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN PERIOD IN THE OLD TOWN OF RHODES

IDENDITY DATA

1	Name	Main name	
2		Other	
3	Location	Municipality	
4		Town	
5		Address	
6		Name of local spot	
7		Geodetic coordinates	
8		Code number registered in the archaeological archive	
9	Description	Number of storeys	
10		Area (m2)	
11		Typology according to use	
12	Use and ownership	Present owner	
13		Initial use	
14		Current use	
15		Number of users	
16		Frequency of use	
17	Age	Monument's age according to the period of construction	
18	Protection	Issue protected	
19		Legal status of protection	
20		Responsible protection Service	
21		Responsible restoration Service	

IDENTIFICATION OF ENGINEERS CARRYING OUT THE ASSESSMENT

22	NAME:		
	SPECIALI-ZATION:		
	TEL. /E-MAIL:		

TECHNICAL DATA

23	STRUCTURAL CATEGORY	A	AB	B	C	D	E	F	Don't know
24	Description of the structural system elements								

METHOD OF COSTRUCTION

a) vertical bearing elements

Evaluation		C	B	A
25	Interconnection of stone or brick elements			
26	Type of stone or brick elements			
27	Binding mortar of the outer leaves			
28	Core filling material if it can be identified (it refers to three leaf masonry only)			
29	Vertical Ribs (buttresses, pilasters)			
30	Corners and edges with chiseled stones			
31	Chainages (placement)			
32	Chainages (type)			
33	Chainages (number of horizontal layers)			
34	Connections between chainage elements (mortices, joints)			
35	Chainage (condition of building materials: wood, reinforced concrete, steel)			
36	One sided reinforced concrete coating		----	---
37	Double sided reinforced concrete coating			---
38	Timber Framed Masonry wall (condition of wooden columns, beams, tsatmas)			
39	Exterior steel masonry braces			

B) Horizontal or inclined bearing elements

	Evaluation	C	B	A
40	Timber or steel trusses (condition of materials and connections between the elements)			
41	Bearing elements of horizontal roof (condition of materials and connections between the elements)			
42	Connection with vertical walls			
43	Chainage at the connection area			
44	Domes or arches			
45	Arched ribs			
46	Tendons, ties			

GEOMETRICAL CHARACTERISTICS

	Evaluation	C	B	A
47	Ratio of wall length to wall thickness			
48	Ratio of wall height to wall thickness			
49	Additional height of pediment or bell tower (vertical cantilever)			
50	Arrangement of openings			
51	Openings near the corners			

C: SEISMIC ACTION

52	SEISMIC ZONE ACCORDING TO EC-8 and National Annex	I	II	III
53	Data from microzonation study (if elaborated)			

	Ground type	A	B	C	D	E	S1 S2
54	Based on scientific data/survey						
55	Estimation (not certain)						

ADDITIONAL DATA INFLUENCING SEISMIC ACTION

	Evaluation of influence	Influence coefficient
56	Negative impact of geomorphological or environmental conditions	
57	Danger of stroke by neighbouring buildings	

D: PATHOLOGY

GENERAL CONDITION OF DAMAGES

	Evaluation	C	B	A
58	General condition of masonry damages			
59	Damages in domes, apses, arches			
60	Damages on roofs and floors			

SERIOUS LOCAL DAMAGE:
Description of the problem:

61	

Proposed urgent measures:

62	

Proposed urgent investigations/surveys:

63	

6. INSTRUCTIONS FOR THE COMPLETION OF THE PRE-EARTHQUAKE ASSESMENT DATA SHEET FOR THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN PERIOD IN THE OLD TOWN OF RHODES

IDENTITY DATA

1	Name	Main name	
2		Other	
3	Location	Municipality	
4		Town	
5		Address	
6		Name of local spot	
7		Geodetic coordinates	
8		Code number in the archaeological archive *	
9	Description	Number of storeys	
10		Area (m2)	
11		Typology according to use**	
12	Use and ownership	Present owner	
13		Initial use	
14		Current use	
15		Number of users	
16		Frequency of use	
17	Age	Monument's age according to the period of construction ***	
18	Protection	Issue protected****	
19		Legal status of protection*****	
20		Responsible protection Service	
21		Responsible restoration Service	

Notes:
**This refers to the code number given to the monument by the archaeological Archive.*

***in accordance to the archaeological archive classification, the types of monuments according to their use are:*

- *Worship places (temple, monastery, sanctum, Mosque etc.)*
- *Housing*
- *Fortification, military installations*
- *Welfare centers (e.g. hospital)*
- *Administrative installations*
- *Educational, athletic installations*
- *Recreational, touristic installations*
- *Industrial or Manufacturing installations*
- *Other*

**** The age refers to basic historical periods such as:*

1. Hellenistic 408 B.C. – 515 A.D.

2. Byzantine 516 A.D. – 1309 A.D.
3. Knights of the Order of St John. 1309 A.D. – 1522 A.D.
4. Ottoman 1522 A.D. – 1912 A.D.
5. Italian 1912 A.D.– 1945 A.D.
6. Modern 1947 A.D. – Today

If the exact date of construction is known, it is also written in parenthesis. The buildings examined in this research concern the 4th Historical Period, however, the data sheet could be used also for other historical period with slight modifications.

*****The protected elements of the monument are pointed out, such as:*

- *The building as a whole*
- *A part of the building*
- *The facade*
- *The outer shell of the building*
- *Decoration elements (sculpture, murals etc.)*
- *The surroundings- historical location*

******The legal framework of monument characterization may be:*

- *International monument*
- *Monument characterized by specific governmental document*
- *Monument protected by general archaeological legislation*
- *Inside protected area (archaeological site, protected zone, traditional village etc.)*

TECHNICAL DATA

23	**STRUCTURAL CATEGORY (according to e-monuments)**	**A**	**AB**	**B**	**C**	**D**	**E**	**F**	**Don't know**
24	**Description of the structural system elements**								

For details about the structural categories see annex 1
For the description of the structural elements see annex 2 and the following descriptions

Vertical bearing elements (stone or brick masonry)
A) TYPES ACCORDING TO THE BUILDING TECHNIQUE
• *Masonry with worked polygonal and corner stones* • *Rubble masonry with carefully selected stones* • *Random rubble masonry* • *Reticulated masonry (isodomum)* • *Banded masonry* • *Cloisonné* • *Dry stone masonry* • *Slaty stone masonry* • *Fired brick masonry* • *unfired brick masonry*

B) TYPES ACCORDING TO THE THICKNESS OF WALL
• *One leaf masonry (10-30 cm) by bricks, artificial stones and chiseled stones* • *Two leaf masonry (20-55 cm) by bricks and stones* • *Three leaf masonry* a) *55-80 cm (estimated thickness of leaves>core with filling material with or without throughstones (parpens)* b) *80-100 cm (estimated thickness of leaves<core with filling material without transversal throughstones (parpens)* c) *.100cm (very thick inner filling, without throughstones(parpens)*
C) TYPES ACCORDING TO ENCORPORATED REINFORCEMENTS
• *Un-reinforced* • *With horizontal frames of timber or steel beams, or concrete chainages* • *Reinforced with both horizontal and vertical frames of timber or steel or concrete beams and columns*
Horizontal or inclined bearing elements
• *Domes* • *Roofs with Timber or steel trusses* • *Horizontal or inclined roofs with timber or steel beams or reinforced concrete plates*

It must be pointed out that the vulnerability of the various types of masonry in historical buildings cannot be rated considering only the building techniques, or the wall thickness. In order to evaluate their seismic resistance one has to take under consideration more other factors such as the building materials, the percentage of inner discontinuities and voids, the way the leaves are transversally connected with throughstones etc.
It has also been proven that the strength of the mortars is not always the best criterion for the strength of the masonry, since other characteristics such as porosity, plasticity etc. are more responsible for the durability of the structure.
Also, due to the monuments' long period of life, very critical factors for the condition of building materials are the long-lasting environmental influences e.g. humidity (decay, corrosion), biological or chemical factors (fungi, pollution, salts, carbonization etc.) and human interventions.
In the following tables one can evaluate the quality of the vertical and horizontal bearing elements considering some of those factors

EVALUATION OF STRUCTURAL SYSTEM

A) VERTICAL BEARING ELEMENTS

EVALUATION		C	B	A
25	**Interconnection of stone or brick elements**	Bad or inexistent	Adequate	Very carefully constructed
26	**Type of stone or brick elements**	Small sized, random rubble material, of low quality corroded, decayed, with cracks	Well sized, in good condition, with adequate strength (of medium strength)	Chiseled, good quality stones (of significant strength), with polygonal or rectangular size
27	**Binding mortar of the external leaves***	Thick, of low strength or decayed, non-porous with many small stones and bricks	Medium thickness, with adequate strength and porosity	Not thick, porous with adequate strength
28	**Core filling material if it can be identified (it refers to three leaf masonry only)**	Clay or lime-clay mortars, small gravels or pebbles, washed out mortars. high percentage of void	Relatively thick lime mortar and small gravels. Few voids	Concrete mixture of lime or lime-hydraulic mortar and small stones. Very few voids
29	**Vertical Ribs (buttresses, pilasters)**	Inexistent (critical in cases of long walls)	Existing, due to later interventions, unconnected to the main walls	Existing from the initial construction phase, with good connection with the wall
30	**Corners and edges with chiseled stones**	Without	Only in the wall corners	Both in the wall corners and around openings
31	**Chainages (placement)**	In no place	Only to the long walls	In all perimetric and lateral walls
32	**Chainages (type)**	Only to the inner leaf	Only to the outer leaf or in the center	To both masonry leaves
33	**Chainages (number of horizontal layers)**	If they are rotten the more layers the worst (due to the remaining voids)	One layer (e.g. in lintels)	Dense layers
34	**Connections between chainage elements (mortices, joints.)**	Un connected or disconnected due to damages	With few unconnected spots	Continuous and well connected

35	**Chainage (condition of building materials: wood, reinforced concrete, steel)**	Mostly damaged (rotten, corroded, decayed) creating voids inside the walls	Local damages only (rot, corrosion, decay)	In good condition
36	**One sided reinforced concrete coating**	Always negative factor for the seismic resistance of the masonry wall		
37	**Double sided reinforced concrete coating**	Corroded steel, carbonated concrete, without Through connections	In good condition with through connections	
38	**Timber Framed Masonry wall (condition of wooden columns, beams,tsatmas)**	Mostly damaged (rotten, corroded, decayed) creating voids inside the walls	Local damages only (rot, corrosion, decay)	In good condition
39	**Exterior steel masonry braces**	Corroded, decayed, broken, not working	Continuity joints not working properly	In good condition

** The binding mortar is usually different from the external plastering mortar of the joints, which most of the times is in better condition due to repairs. It is necessary to try to find the original binding mortar (in areas of cracks or by partly removing the external plastering).*

B) HORIZONTAL OR INCLINED BEARING ELEMENTS

Evaluation		C	B	A
40	**Timber or steel trusses (condition of materials and connections between the elements)**	Distorted, with poor quality connections, no lattice work, rotten or corroded	Undistorted, simple lattice work and one way timber grid, medium quality connections	Trusses without distortions with good lattice work and connections, with two-way timber grid and planks

41	**Bearing elements of horizontal roof (condition of materials and connections between the elements)**	Distorted ore seriously cracked, with rotten or corroded elements	With subtle distortions, local damages, fissures	Good condition, no damages, no distortions
42	**Connection with vertical walls**	Bearing elements simply supported at the edges of long walls	Well-connected only to the long walls anchored on a proper chainage	Well connected on the whole perimeter of walls, anchored on a well-constructed chainage.
43	**Chainage at the connection area**	No continuous chainage, only local niches for the truss beams, or damaged (corroded concrete or rotten timber) chainage only to the inner masonry leaf	Simple mounting of truss beams on a timber or concrete chainage, that extends deeper than the inner masonry leaf	Truss beams well anchored on an adequately large concrete chainage with proper dimensions, or connected to a double frame of timber or steel beams
44	**Domes or arches**	Unperfect curve, loose construction with small stones and thick mortar	Normal curve, with properly chosen trapezoid stones and thin mortar joints	Perfect curve with chiseled stones or bricks and good quality of mortar joints
45	**Arched ribs**	Not existing, (critical, especially in case of a large and long dome	Existing, but not well connected to dome, usually built afterwards as a strengthening measure	Existing as part of the initial construction of the dome, with good contact to it
46	**Tendons, ties**	Initially existing but damaged (rotten, corroded or cut off)	Not existing	Existing as part of the initial construction or new after additional repair

GEOMETRICAL CHARACTERISTICS

Evaluation		C	B	A
47	Ratio of wall length to wall thickness	<1/12	1/12-1/8	>1/8
48	Ratio of wall height to wall thickness	<1/9	1/9-1/7	>1/7
49	Additional height of pediment or bell tower (vertical cantilever)	YES	--------	--------
50	Arrangement of openings	Irregular arrangement creating disorder to the vertical pier-zones	Partly irregular arrangement, local disorder to some pier zones	Regular arrangement with well-ordered pier zones between them
51	Openings near the corners (distance from corners)	< 1,2m	1,2-2,0 m	>2,0m

C: SEISMIC ACTION

52	SEISMIC ZONE ACCORDING TO EC-8 and National Annex	I	II	III
53	Data from microzonation study (if elaborated)			

SOIL CATEGORY

	Ground type *	A	B	C	D	E	S1 S2
54	Based on scientific data/survey						
55	Estimation (not certain)						

For soil categorization see Annex III. If there is not adequate information about the soil condition, the engineers give their personal estimation (not certain).

ADDITIONAL DATA INFLUENCING SEISMIC ACTION

	Evaluation of influence	Influence coefficient
56	Negative impact of geomorphological or environmental conditions	
57	Danger of stroke by neighbouring buildings	

For the estimation of the influence coefficient, all information of documentation data sheet 2 is taken into consideration.

D: PATHOLOGY
GENERAL CONDITION OF DAMAGES

In order to evaluate the following main categories of pathology, one must take into consideration all information gathered in documentation data sheet No 3

		C	B	A
58	**General condition of masonry damages**	Long and broad cracks on most walls, with possible slide along cracks. Deterioration of building materials leading to local distortions and discontinuities. Local cracks due to compression or in positions of compressive failure. Failure of various non-bearing elements Inclination or swelling of walls, local collapses	Diagonal shear cracks on many walls, without sliding along them, many thin cracks (<2,5 mm) due to in plane flexural cracking at the corners, local destruction and decollation of large pieces of plaster	No cracks or only fissures, in few walls. Possible local destruction and decollation of little pieces of plaster.
59	**Damages in domes, apses, arches**	Cracking and sliding of many voussoirs or keystones. Deformation of the original curve, clearly visible from the intrados or the extrados of the structure. Local disintegration of apse or dome in areas of compressive failure, local collapses	Sliding of many voussoirs or keystones. Cracks parallel to the keystones, and inclined cracks near the edges, Local decollation of plastering mortars.	Inexistent damages or only fissures parallel to the keystones. Few slides decollations of mortar joints.
60	**Pathology of roofs and floors**	Deformation and/or Partial failure of roofs and floors, sliding of roof tiles		No damages

SERIOUS LOCAL DAMAGE:
Description of the problem:

61	

Serious problems of possible collapse or destruction of important elements of the monument are pointed out.

Proposed urgent measures:

62	

Proposals for the necessary urgent measures to be taken by the responsible authorities (e.g. evacuation, scaffolding, special measures for the protection of neighbours, protection from theft etc.)

Proposed urgent survey or design projects:

63	

In case of great danger of immediate destruction of very important elements of the protected monument, the most urgent surveys and design projects are proposed.

FIRST DEGREE PRE-EARTHQUAKE ASSESSMENT OF THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN PERIOD IN THE OLD TOWN OF RHODES number of Data sheet:			Rating	Number of completed questions	Calculation of the Vulnerability Index
SECTION A: IDENDITY DATA					
Name	Main name				
	Other				
Location	Municipality				
	Town				
	Address				
	Name of local spot				
	Geodetic coordinates				
	Code number registered in the archaeological archive				
Description	Number of storeys				
	Area (m2)				
	Typology according to use				
Use and ownership	Present owner				
	Initial use				
	Current use				
	Number of users				
	Frequency of use				
Age	Monument's age according to the period of construction				
Protection	Issue protected				
	Legal status of protection				
	Responsible protection Service				
	Responsible restoration Service				

IDENTIFICATION OF ENGINEERS CARRYING OUT THE ASSESSMENT	
NAME:	
SPECIALI-ZATION:	
Tel./E-MAIL:	
NAME:	
SPECIALI-ZATION:	
Tel./E-MAIL:	
Date of assessment:	

Section B : METHOD OF COSTRUCTION

(the completion of the cells should be made with english letter x)

STRUCTURAL CATEGORY	**A**	**AB**	**B**	**C**	**D**	**E**	**F**	**Don't know**
Description of the structural system elements								

METHOD OF COSTRUCTION

A) Vertical bearing elements

Evaluation	**C**	**B**	**A**		**Total number of rated questions of the Method of Construction Section**
Interconnection of stone or brick elements				**Not completed**	**25**
Type of stone or brick elements				**Not completed**	
Binding mortar of the outer leaves				**Not completed**	
Core filling material if it can be identified (it refers to three leaf masonry only)				**Not completed**	
Vertical Ribs (buttresses, pilasters)				**Not completed**	
Corners and edges with chiseled stones				**Not completed**	
Chainages (placement)				**Not completed**	
Chainages (type)				**Not completed**	
Chainages (number of horizontal layers)				**Not completed**	

Connections between chainage elements (mortices, joints)				Not completed	Number of completed questions of section A	
Chainage (condition of building materials: wood, reinforced concrete, steel)				Not completed		
One sided reinforced concrete coating				Not completed		
Double sided reinforced concrete coating				Not completed		
Timber Frame Masonry wall (condition of wooden columns, beams,tsatmas)				Not completed		
Exterior steel masonry braces				Not completed		
B) Horizontal or inclined bearing elements					0	
Evaluation	**C**	**B**	**A**			
Timber or steel trusses (condition of materials and connections between the elements)				Not completed	Number of completed questions of section B	
Bearing elements of horizontal roof (condition of materials and connections between the elements)				Not completed		
Connection with vertical walls				Not completed		
Chainage at the connection area				Not completed		
Domes or arches				Not completed		
Arched ribs				Not completed		
Tendons, ties				Not completed	0	
Γ) Geometrical Characteristics						
Evaluation	**C**	**B**	**A**			
Ratio of wall length to wall thickness				Not completed	Number of completed questions of section Γ	Vulnerability Index of the Method of Construction Section
Ratio of wall height to wall thickness				Not completed		
Additional height of pediment or bell tower (vertical cantilever)				Not completed		
Arrangement of openings				Not completed		
Openings near the corners				Not completed	0	#ΔΙΑΙΡ/0!

Section C: SEISMIC ACTION

(the completion of the cells should be made with english letter x)

SEISMIC ZONE ACCORDING TO EC-8 and National Annex	I	II	III

Not completed

Data from microzonation study (if elaborated)						
Ground type	**A**	**B**	**C**	**D**	**E**	**S1 S2**
Based on scientific data/survey						
Estimation (not certain)						

0

0

The questions of Seismic Action should always be completed

ADDITIONAL DATA INFLUENCING SEISMIC ACTION

Evaluation of influence	**Influence coefficient**	Influence coefficient of Additional Data
Negative impact of geomorfological or environmental conditions		1
Danger of stroke by neighbouring buildings		1

Vulnerability Index of the Seismic Action Section

#TIMH!

Section D: PATHOLOGY

(the completion of the cells should be made with english letter x)

GENERAL CONDITION OF DAMAGES

Evaluation	**C**	**B**	**A**	
General condition of masonry damages				0
Damages in domes, apses, arches				0
Damages on roofs and floors				0

Vulnerability Index of the Pathology Section

0.00

SERIOUS LOCAL DAMAGE:

Description of the problem:

Proposed urgent measures:

Proposed urgent investigations/surveys:

Final Vulnerability Index

#TIMH!

PRE-EARTHQUAKE ASSESMENT DATA SHEET FOR THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN RULE IN THE OLD TOWN OF RHODES

RATING INSTRUCTIONS

After the in-situ completion of the pre-earthquake assessment data sheets, the responsible Service goes on to the rating procedure in order to estimate the vulnerability index of the historical building visited.

SECTION B: TECHNICAL CHARACTERISTICS

In the following tables one can see the grades from 1-3 given according to the evaluation C to A for section B (technical method of construction and the geometrical characteristics

METHOD OF COSTRUCTION
a) vertical bearing elements

Evaluation		C	B	A
25	Interconnection of stone or brick elements	1	2	3
26	Type of stone or brick elements	1	2	3
27	Binding mortar of the outer leaves	1	2	3
28	Core filling material if it can be identified (it refers to three leaf masonry only)	1	2	3
29	Vertical Ribs (buttresses, pilasters)	1	2	3
30	Corners and edges with chiseled stones	1	2	3
31	Chainages (placement)	1	2	3
32	Chainages (type)	1	2	3
33	Chainages (number of horizontal layers)	1	2	3
34	Connections between chainage elements (mortices, joints)	1	2	3
35	Chainage (condition of building materials: wood, reinforced concrete, steel)	1	2	3
36	One sided reinforced concrete coating	1	----	---
37	Double sided reinforced concrete coating	1	2	---
38	Timber Frame Masonry wall (condition of wooden columns, beams,tsatmas)	1	2	3
39	Exterior steel masonry braces	1	2	3

B) Horizontal or inclined bearing elements

	Evaluation	C	B	A
40	Timber or steel trusses (condition of materials and connections between the elements)	1	2	3
41	Bearing elements of horizontal roof (condition of materials and connections between the elements)	1	2	3
42	Connection with vertical walls	1	2	3
43	Chainage at the connection area	1	2	3

44	**Domes or apses**	1	2	3
45	**Arched ribs**	1	2	3
46	**Tendons, ties**	1	2	3

GEOMETRICAL CHARACTERISTICS

	Evaluation	**C**	**B**	**A**
45	**Ratio of wall length to wall thickness**	1	2	3
46	**Ratio of wall height to wall thickness**	1	2	3
47	**Additional height of pediment or bell tower (vertical cantilever)**	1	2	3
48	**Arrangement of openings**	1	2	3
49	**Openings near the corners**	1	2	3

SECTION C: SEISMIC ACTION

For the rating of the seismic action the following tables are used in order to estimate the coefficient s

Seismic Zones	Coefficient Values	Ground Types / Coefficient values				
		A	B,C	D	E	S1, S2*
	a	0.85	1.00	1.15	1.25	-
Z1	1.60	1.36	1.60	1.84	2.00	-
Z2	2.40	2.04	2.40	2.76	3.00	-
Z3	3.60	3.06	3.60	4.14	4.50	-

ADDITIONAL DATA INFLUENCING SEISMIC ACTION

	Evaluation of influence	**Influence coefficient**
56	**Negative impact of geomorphological or environmental conditions**	-10%
57	**Danger of stroke by neighbouring buildings**	-10%

SECTION D: PATHOLOGY

Rating of pathology responds to evaluations C to A with rates from 75 to 25.

GENERAL CONDITION OF DAMAGES

	Evaluation	C	B	A
58	**General condition of masonry damages**	25	50	75
59	**Damages in domes, apses, arches**	25	50	75
60	**Damages on roofs and floors**	25	50	75

Final estimation of the seismic vulnerability index

The proposed estimation of the influence of Section B: "structural and geometrical characteristics" to the vulnerability index responds to the equation:

$$B = \frac{total\ number\ of\ questions}{total\ number\ of\ complete\ questions} \cdot total\ rating\ of\ method\ of\ construction\ section$$

The proposed estimation of the influence of Section C: "seismic action" to the vulnerability index corresponds to the following equation:

$$C = \frac{Most\ Favorable \cdot Seismic \cdot Zone \cdot Most\ Favorable \cdot Ground\ Type}{Existing\ Seismic\ Zone \cdot Existing\ Ground\ Type} \cdot Additional\ Influence\ coefficient \cdot 75$$

The proposed estimation of the influence of Section D: "Pathology" to the vulnerability index responds to the worst (smallest) rating of the 3 subcategories 58, 59 and 60 of this section.
So, the influence of this section (D) can be is either 75 or 50 or 25 where the worst case is represented by rate 25.

The final vulnerability index is expressed as the sum of B+C+D.

It is of course understandable that this "vulnerability index" is only a relative number that can serve as an administrative tool for a comparative classification of historical buildings in order to help the state authorities to set the priorities for the design of restoration interventions on monuments at a large scale.
It is not and should not serve as a substitute for the complete scientific diagnosis of the problems of each monument, an in all cases, a restoration design project should always follow.
Pilot applications will be applied as examples, by experimentally completing the data and rating sheets of four monuments in different states of vulnerability.

ANNEX I
INFORMATION ON
CHARACTERISTIC BUILDINGS OF THE OTTOMAN PERIOD
IN THE OLD TOWN OF RHODES
INTRODUCTION TO PILOT APPLICATIONS

The completion of the pre-earthquake assessment data sheet will be applied on three historical buildings constructed during the Ottoman Rule. This typology of buildings collects masonry structures (mainly two-story) with two main bearing structural elements: vertical masonry walls and horizontal floors or roofs. If they are properly connected, mutual cooperation between the structural elements allows the building to behave as a box or a number of boxes.

This structural type, with many variations, refers to a great number of buildings constructed during the Ottoman Period. A lot of them have been classified as monuments, some because of their interesting structural type and some due to their historic role.

The selected pilot applications refer to buildings of different uses and more specifically to an Ottoman Mansion on Ierokleous Street, to the Neoclassical Building of The Ottoman Courthouse and the Neoclassical School of Panaitios street.

1st case sudy: Ottoman Mansion on Ierokleous Street

The mansion on Ierokleous street exhibits typical characteristics of similar mansions in the Balkans of the 18th-19th c. It is a two-storey building of Rhodian poros stone and timber elements, located next to the monastery of St George. It also features a small two-storey ancillary building in the courtyard.

The bearing system of the building consists of masonry walls 60-70 cm thick at the odas of the ground floor and the east wall of the upper floor, walls 25 cm thick at the hayat, the sofa and the odas of the upper floor, and a timber-framed wall at the west façade of the upper floor hayat . The mezzanine floor and the flat roof are timber structures. The masonry of the mansion at the upper floor is reinforced at its perimeter with timber frames at its base, above the lintels and the crowning of the walls. The timber frames are joined together with specific cross-sections and are anchored to the walls with metal joints.

A significant difference in relation to similar mansions in Rhodes lies in the existence of large openings (windows, light-holes) of the same phase at the first floor.

Pathology

The structural cross-walls of the upper floor suffered from cracks with significant width and almost all the pillars as well as on the rest of the areas between the openings were heavily cracked. In addition, the east wall was almost detached. The wooden support beams and the secondary features were in bad condition due to humidity and dereliction.

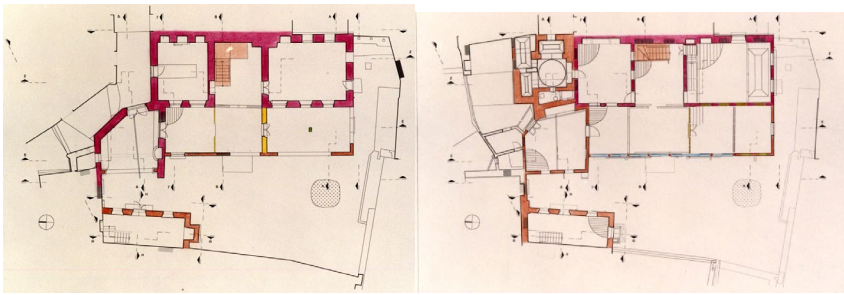


Figure I.1. Ground plan view and upper floor1

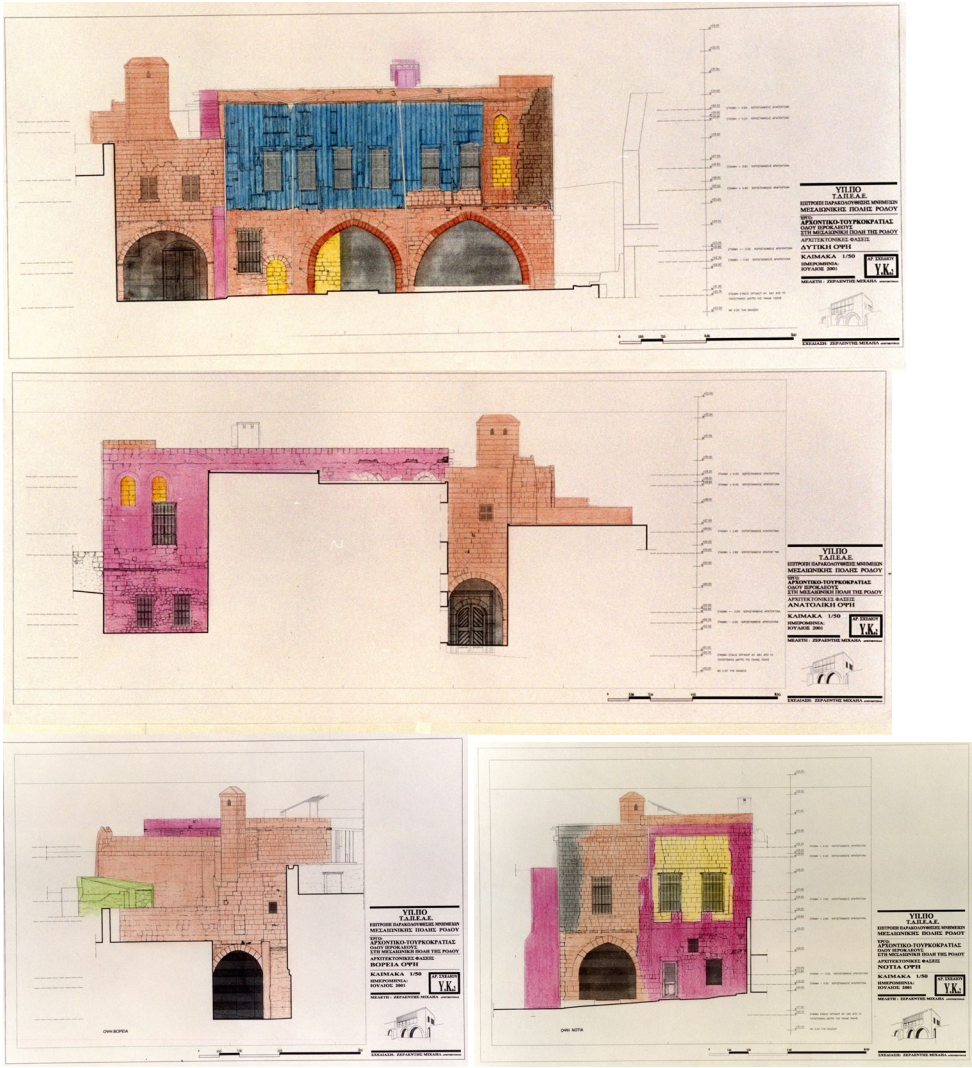
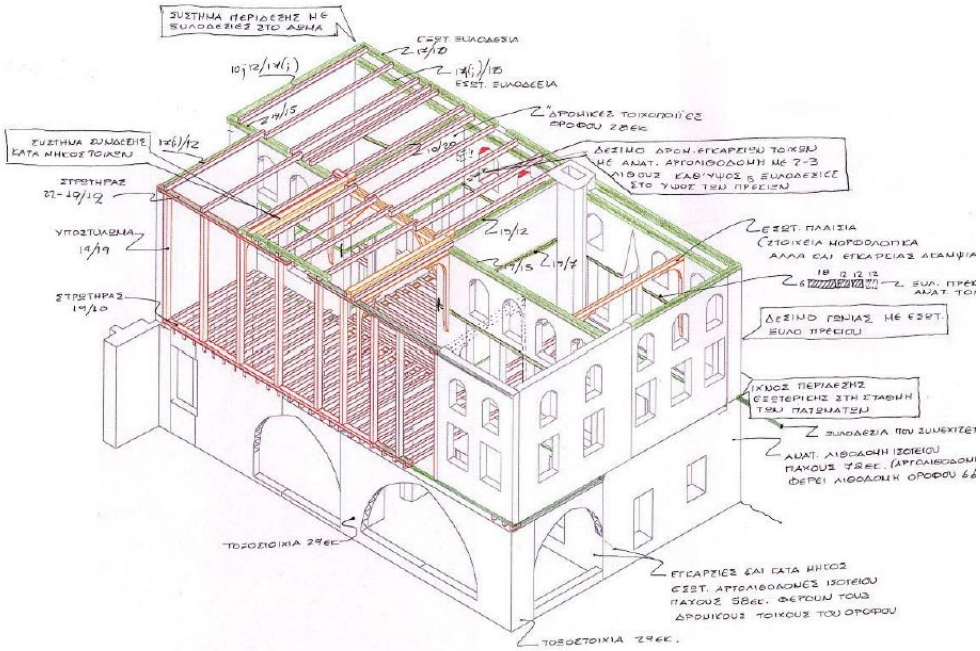


Figure I.2. Views of the structure[1]

[1] Architectural Study G.Dellas and M.Zerlenti



Εικόνα Ι.3. Analysis of structural system

2nd case study: Neoclassical Building of The Ottoman Courthouse

The Neoclassical Building of the Ottoman Courthouse is a two storey building and was used by the last qadi (Muslim judge) of Rhodes, on Theophiliskou street. It was erected upon the fourth Byzantine tower on the south wall of the Byzantine Castle (Collachium) in 1907. The central door leads to a small antechamber, which then leads to the hayat overlooking the backyard, arranged above the Byzantine fortification wall. The typology of the building presents particular interest in architectural terms, as it combines features of Ottoman mansions of the 18th – 19th c. and Neoclassical buildings. The two corner rooms, a small intervening space and the lavatory at the northeast corner are all accessed through the hayat.

The floor is covered by a four-pitched wooden roof with French tiles. The south main face is completely symmetrical, it has six vertical rectangular protrusions in the plaster, one horizontal in the mezzanine and another in the crown accompanied by cornices and a protruding cornice where the end of the roof rests.

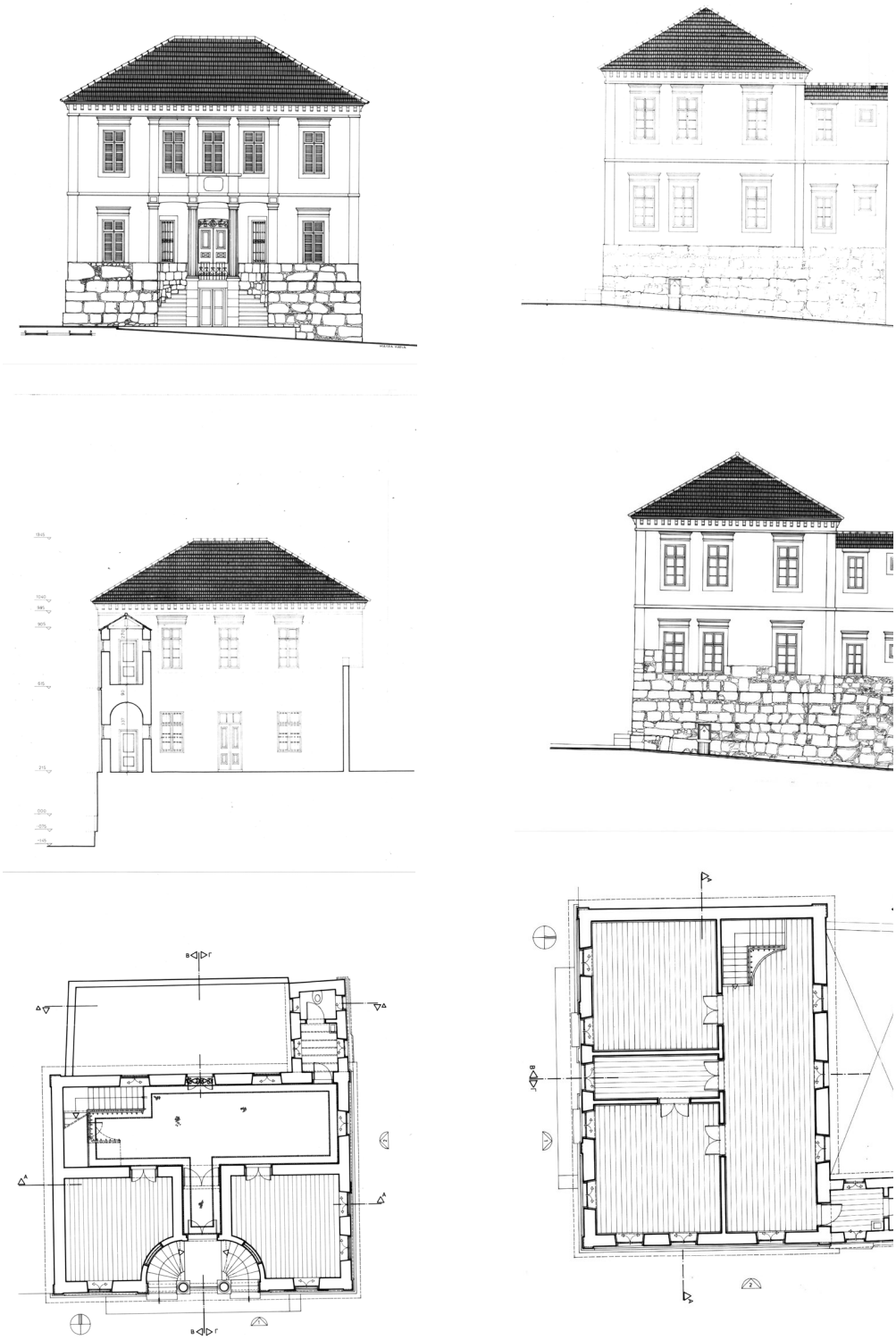
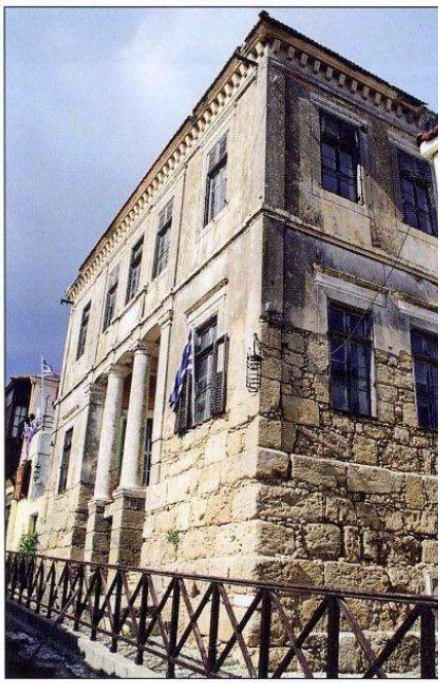


Figure I.4. Side and plan views of the Ottoman Courtyard[2]

[2] A.Angelopoulos and Partners, Project: Centre for renewable energy sources

Pathology

Before the restoration works at the fourth Byzantine tower with the old Ottoman court, numerous cracks appeared in masonry. After removing the loose coatings, the initial condition of the walls was restored by blocking and stapling the cracks. In addition, it was deemed necessary to strengthen the four-pitched wooden roof. The frames also showed structural problems as well as the the first floor and the rooms on the ground floor. Small cracks were also observed in the stone structures of the surviving part of the second from the west Byzantine tower.



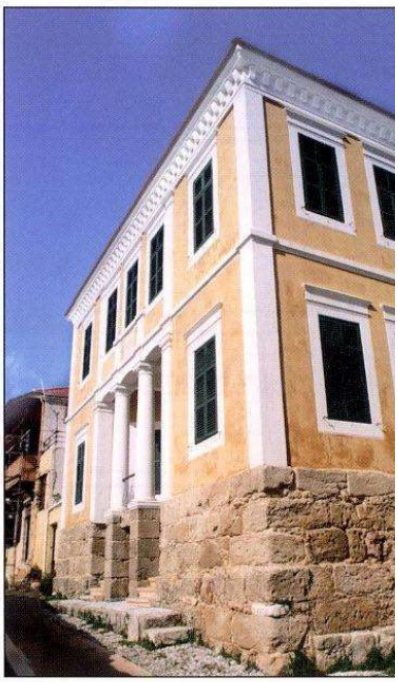


Figure I.5. View from the street before and after the restoration works

3rd case study: Neoclassical School in Panaitios street

The Neoclassical School was built in 1898 on the ruins of the catholic church of Agios Ioannis of the Knights of Rhodes, later known as the Great Mosque, which was blown up in 1856. It, is a typical example of a monument of Ottoman rule with a timeless development in the medieval city of Rhodes. In 1876 a two-storey school was built on the same site, with a cross-shaped plan, but it was destroyed and gave way to the current Neoclassical ground floor building.

The current building is an elevated ground floor of masonry, almost square (31.70m x 32.60m), with an internal rectangular patio and perimeter gallery, from where the twelve smaller or larger rooms have access (total built-up area of 912 sq.m.). The four wings are housed with wooden gabled roofs with French tiles, while in the center there is the atrium which is accessed by two gates east and west and corresponding entrances.

The only difference in the structural system of the building is the partition wall in the south hall of the eastern side, which was an addition to the initial structure and was made of lath and plaster (the so-called bagdati). This method of

constructing walls or ceilings was a common construction during the Ottoman period.

The exteriors are dominated by symmetry. On either side of the entrances, on the east and west sides, are four large windows, while the north and south have nine windows. The facades are with plastered stone structures, while the bases below the floor height have an obvious stone structure made of rectangular stones and kyphosis.

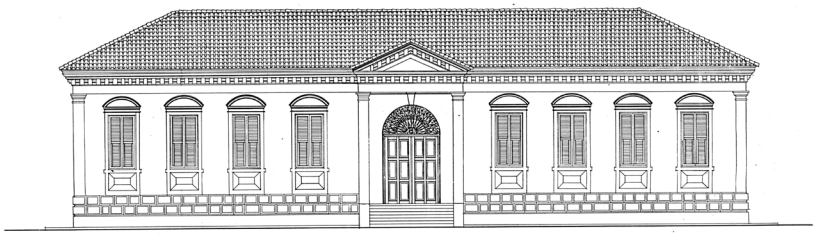
The load bearing system of the structure consists of vertical walls, made of local poros stone, with height about 5.68m and thicknesses ranging from 31cm in interior to 54cm in the perimeter. It is easily noticed that the material of walls has a low strength in general, and there is a great variety in the dimensions of the stones used. Moreover, the construction of the façade is not so meticulous.

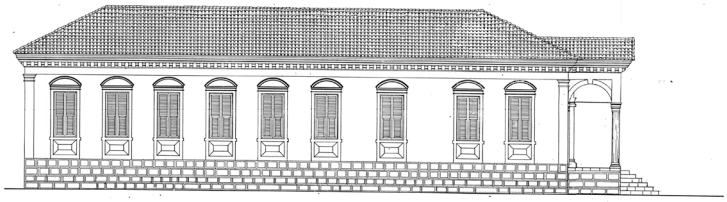
It should also be mentioned the complete absence of timber throughout the height of the masonry and throughout their thickness, a technique that is found in older Ottoman constructions, even in masonry walls with small height. This fact may testify to the poor economic situation that prevailed in Rhodes at the end of the 19th century after the successive natural disasters from earthquakes and fires that occurred from 1856 onwards, as well as the need for rapid construction of the school after the destruction of A. phase. All the walls are connected at the intersections with involved poros stones in 2-3 rows of stones, with the exception of the two transverse dividers.

The joints are uneven with rich mortar in a large part of their thickness (and with a large percentage of gaps as well) and with usually embedded small stones and ceramics (chips) to cover the gaps or to reduce the width of the joints and the amount of mortars. Mortars are plasters with the possible presence of pozzolans, aggregates of natural origin with angular edges, pieces of wood and coal grains.

In the arches and the porch there are metal tractors and reinforced concrete frames that were integrated into the mass of masonry on the north, west and south sides. The metal tractors connect the arches on both sides, the arch with the opposite walls, as well as the arches of the porch with the exterior masonry of the east side. These are solid rods of circular and square cross-section, dimensions Φ32 and 30/30mm, respectively.

During the interventions in the end of the 1970s, reinforced concrete frames were integrated in the mass of the masonry of the north, west and south side. The height of the frames reaches to the arches of the windows and visibly runs through the openings, at the same time reducing their height.





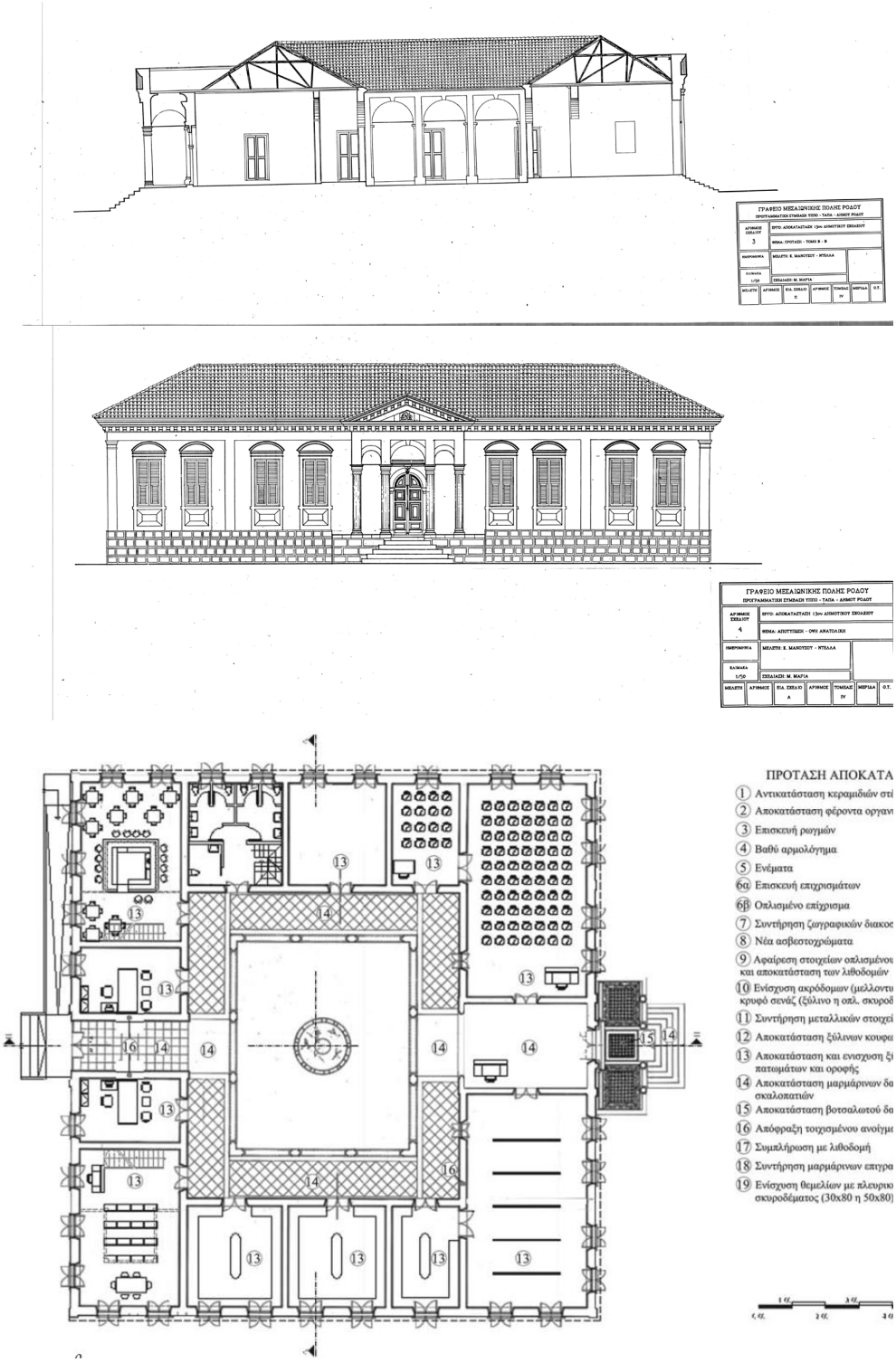


Figure I.6. 3d view, facades and plan view of the structure according to the restoration study[3]

[3] Restoration of neoclassical school of medieval town of Rhodes G.Ntellas, K.Sxinoritis, G.Papamichael, P.Nikolaidou. Pr.Papanikolaou. Internationsl Scientific Conference Rhodes 27/11-01/12 2013.

Pathology

The west wing of the building was reinforced during the 1970s with reinforced concrete elements after the appearance of very severe cracks which, however, continued to expand to the other wings, despite the implementation of this reinforcement measure. The cause of these landslides, as it turned out, was the foundation of the building on rubble placed in the crater of the eruption of 1856 that destroyed the catholic church of Agios Ioannis and which came from the firing of the forgotten powder magazine in its bell tower.

If we take into account the fact of the high height of the stone structures (7.5m from the ground of the yard) in combination with their small thickness (0.30m-0.50m) and the quality of the stones with the weak mortars, the deterioration is fully justified, regarding the size and number of cracks.

Most of the pathology is found in cracks in the masonry due to out of plane or in-palne bending of the walls resulting from the differentiation of the characteristics of the foundation soil, the different materials used in the various construction phases and the corrosion oxidation of steel elements used.

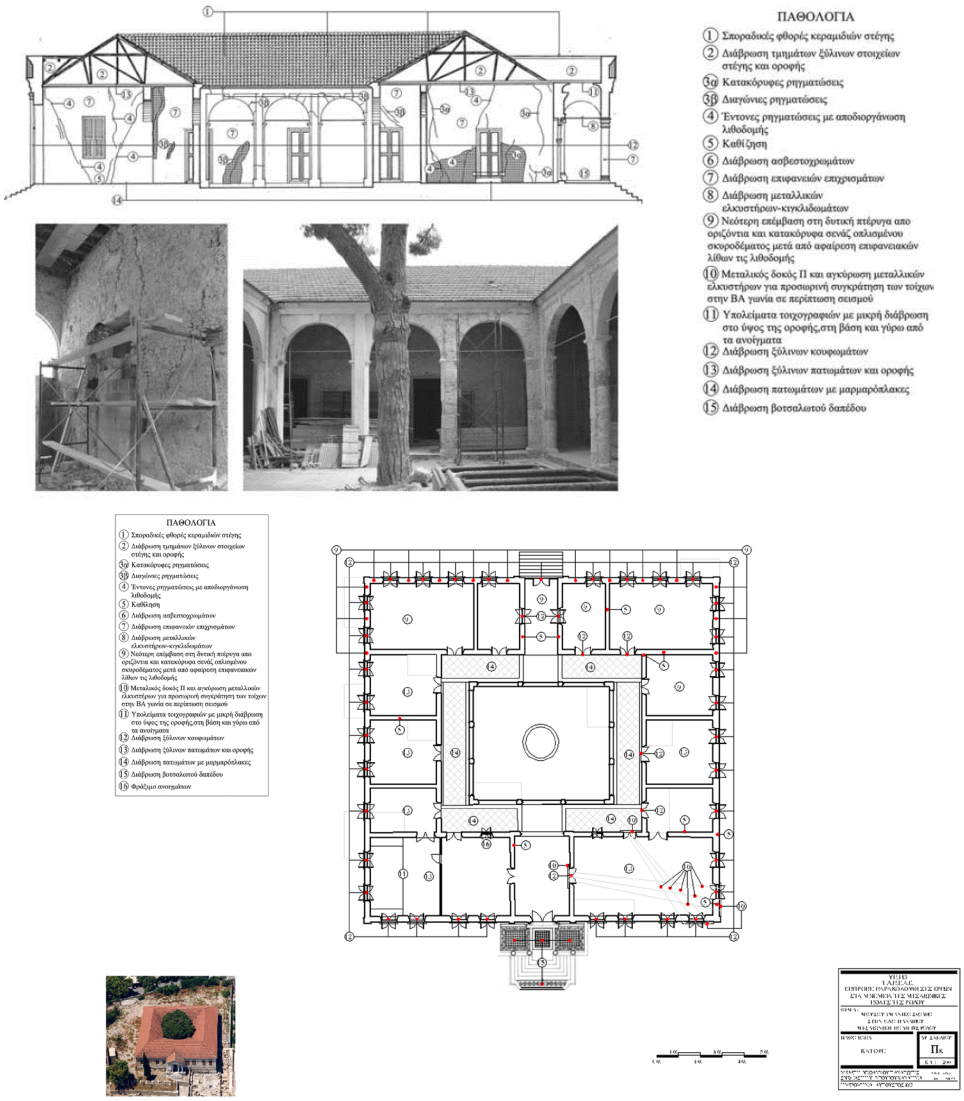


Figure I.7. Pathology of the structure before the restoration works.

INDEX II

NUMERICAL ANALYSES

The importance of the parameters included in the pre-earthquake assessment data sheets can be demonstrated by applying numerical simulations that examine the seismic response of buildings with the specific typology. As mentioned, the typology of the Ottoman Period includes masonry buildings (mainly two-storey) with stone load-bearing walls, wooden load-bearing floors and horizontal roofs. The main feature of the differentiation of the buildings of the period was the use of either wood masonry (tsatmades) on the upper floor (wooden pillars and beams), or systematic timber at various levels of the building. which was an indication of the financial situation of the owner. It is noted that this typology of constructions is observed mainly in Mansions of the specific period, as described in Annex I (mansion on Ierokleous Street). In public houses, on the other hand, most of the times, no timber frames are found is in the masonry of the upper floor.

In the presented assessment data sheets, the effect of timber framed masonry on the seismic response of the building is included in parameter 38. This effect is further examined in terms of stresses in masonry and displacements of the upper floor. Moreover, the ratio of width to the height of the masonry walls is also examined since most of the buildings, constructed during the Ottoman period, have significant height in ground floor and could reach even 5.5m

Parameter 38 (timber framed masonry walls)

Based on the geometry of the Ierokleous street mansion, a two storey building with bearing masonry walls was created. On the ground floor, the facades are distinguished for the arched openings, while on the first floor the openings are smaller and larger. The floor plan of the simulation is rectangular, measuring 15m x 10m, with a wall thickness of 0.50m. The load-bearing structure of the mezzanine and the roof is wooden, while the heights of each level are 4.50m and 9.0m, respectively. The beams of the horizontal diaphragms run through the building in the small dimension and are rigidly connected to the masonry. The following figure shows the two models with the only difference being the use of a wooden frame in the masonry of the floor (wooden elements are shown in white).

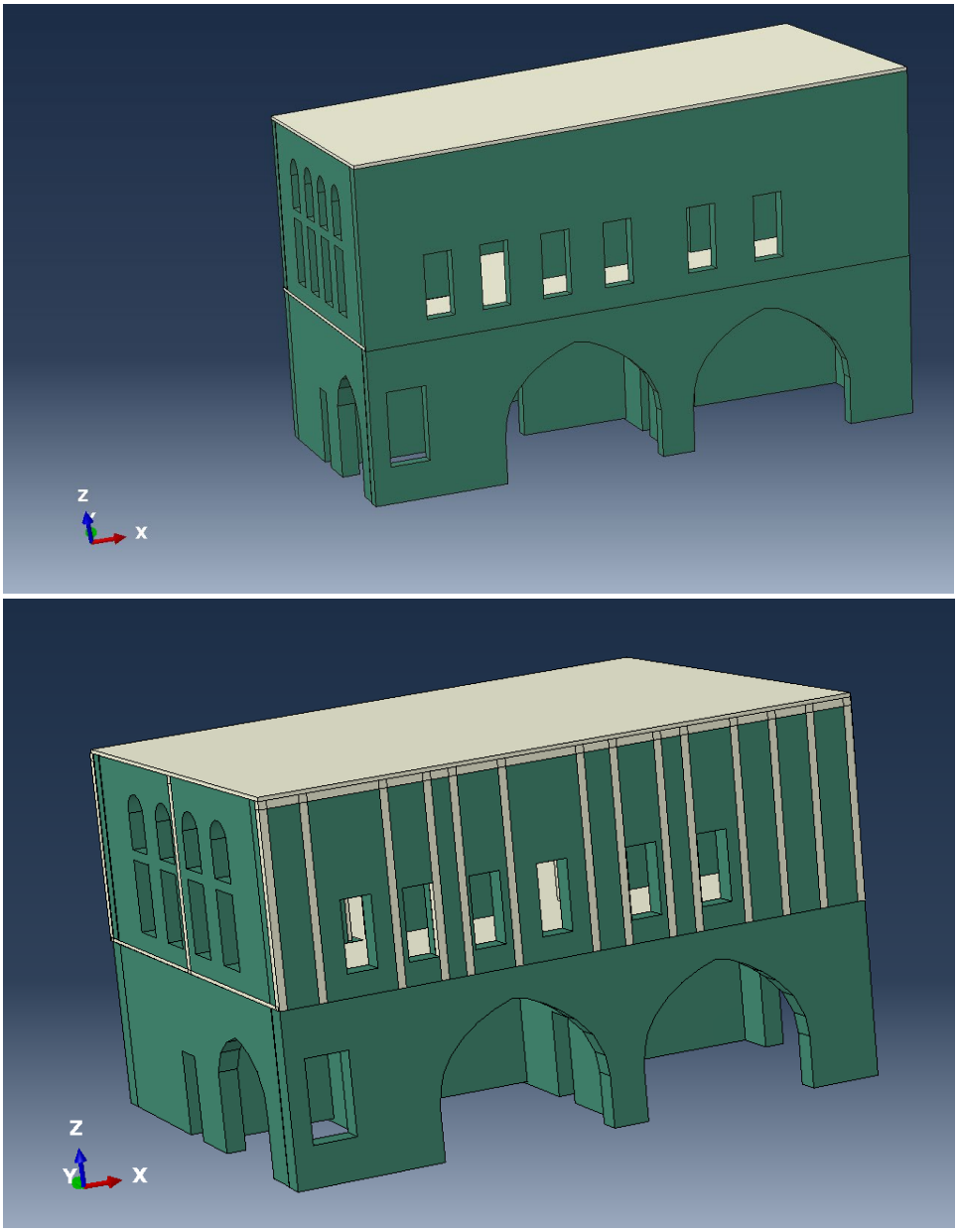


Figure II.1 Three dimensional view of the two-storey model.

The investigation of the seismic response of the model was implemented using dynamic spectral analysis, employing the first 100 eigenvectors and the spectrum resulting from Eurocode 8 for ground foundation category B and ground acceleration 0.12g. The seismic excitation was imposed in the x direction, ie the direction to which the large side of the building corresponds. The aim of the elastic analysis was to compare the results between the two simulations and therefore the conclusions presented below are independent of the seismic loads imposed. Besides, for better overview of the results, the imposition of a lower ground acceleration than the maximum expected for the area (0.24g) defined by the seismic hazard zones, was chosen.

In terms of intensity, the principal tensile stresses developed in the masonry, due to seismic excitation, are presented in the following figures. The principal tensile stresses are used to identify the structure's most vulnerable areas and places of possible cracks in the masonry. It is obvious that the tensile strength of the masonry is more critical than the compressive one and the largest percentage of damage after an earthquake comes from the specific weakness.

The color gradation, used in figures, is representative of the magnitude of the main tensile stresses developed in the masonry. The upper grade value was set at 200kPa, a value that can be considered as the tensile strength of masonry consisting of carved poros stone with medium strength plaster. The areas painted in gray correspond to the areas exceeding the tensile strength of the masonry

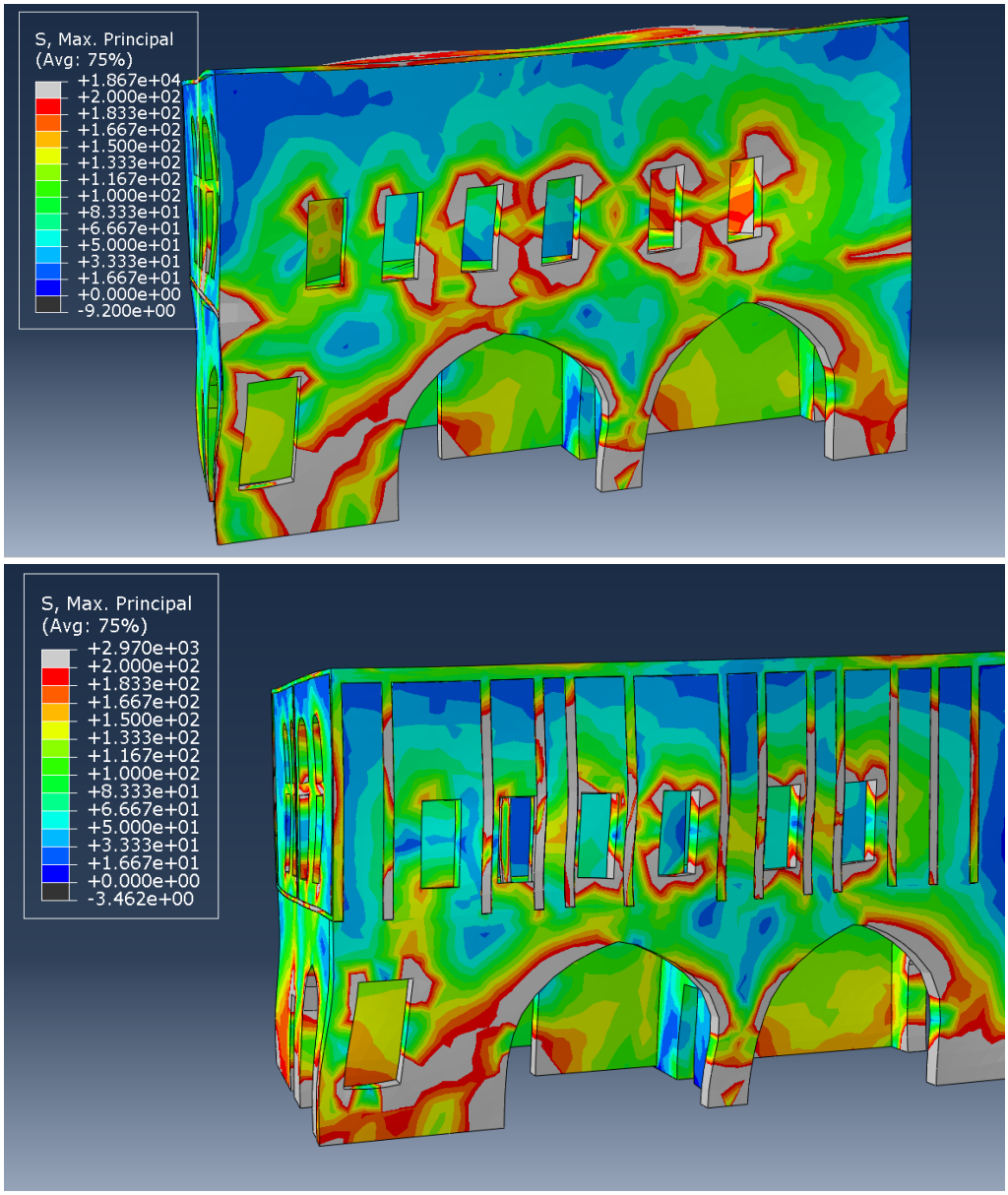


Figure II.2. Principal tensile stresses without and with timber framed masonry wall in upper floor.

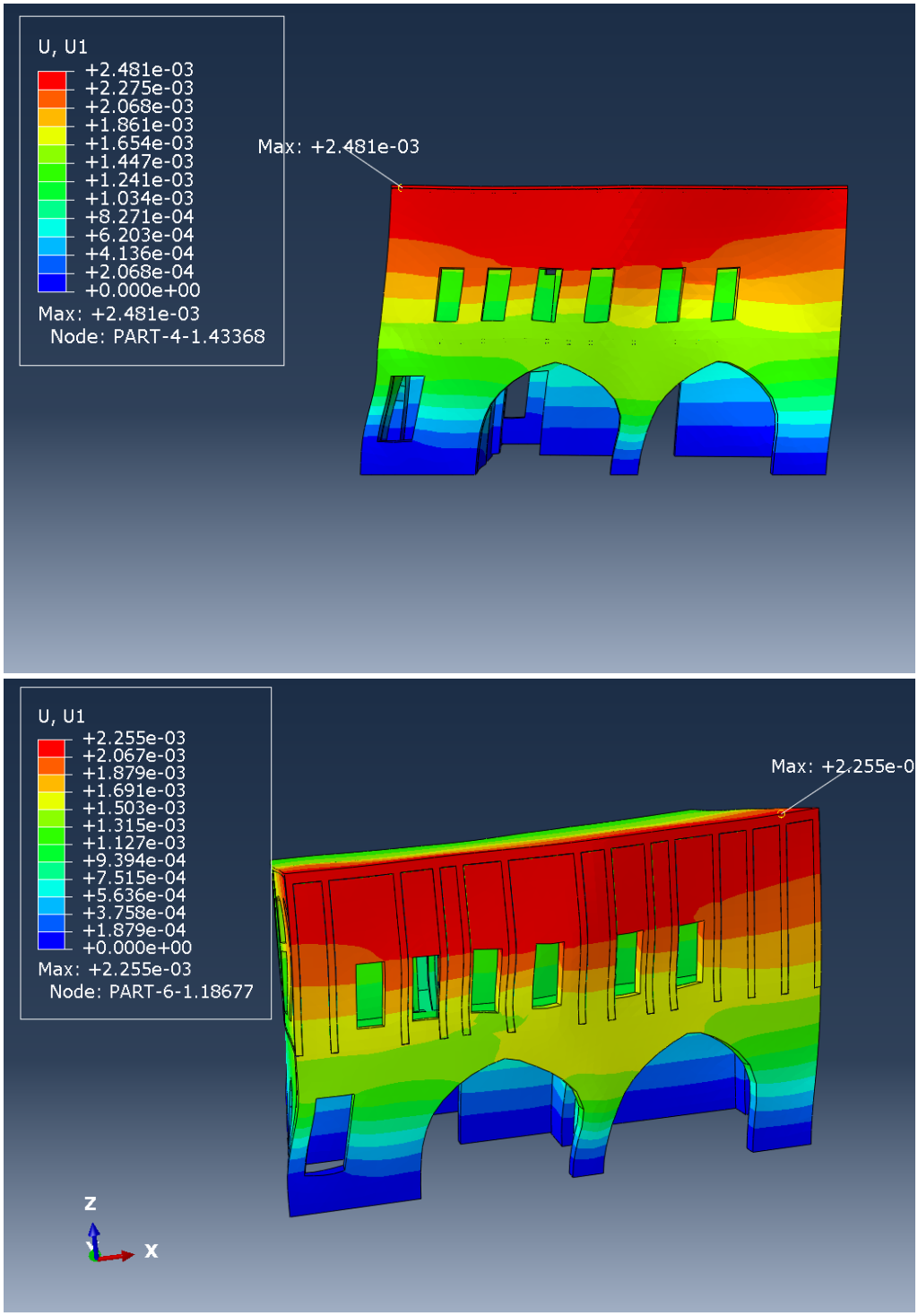


Figure II.3. Horizontal elastic displacements without and with timber framed masonry wall in upper floor.

From Figure II.2. it is easily concluded that the total area of the upper walls, where the tensile strength is exceeded, is smaller in the case of timber framed masonry walls. Therefore, it can be concluded that both the stresses and the displacements of the masonry of the upper floor are reduced due to the addition of wooden elements, a fact that enhances the seismic response of the construction.

Parameter 48 (ratio width to height of masonry walls)

In this paragraph, the influence of the ratio of the wall thickness to floor height is further examined. Therefore, the height of the ground floor of the model presented, is reduced from 4.5m to 3.5m., As a result, the ratio changes from 0.11 to 0.14, which means that the value of parameter 48 changes from category B to A.

In accordance with the previous paragraph, the main tensile stresses and the horizontal displacements along the larger side of the building are studied and the results are compared with those computed in the cease where only masonry is used for the walls of the upper floor.

The comparison of the pictures leads to the conclusion that the tensile stresses as well as the displacements are obviously reduced, a fact that justifies the differentiation in the categories of parameter 48 in the pre-earthquake assessment data sheet.

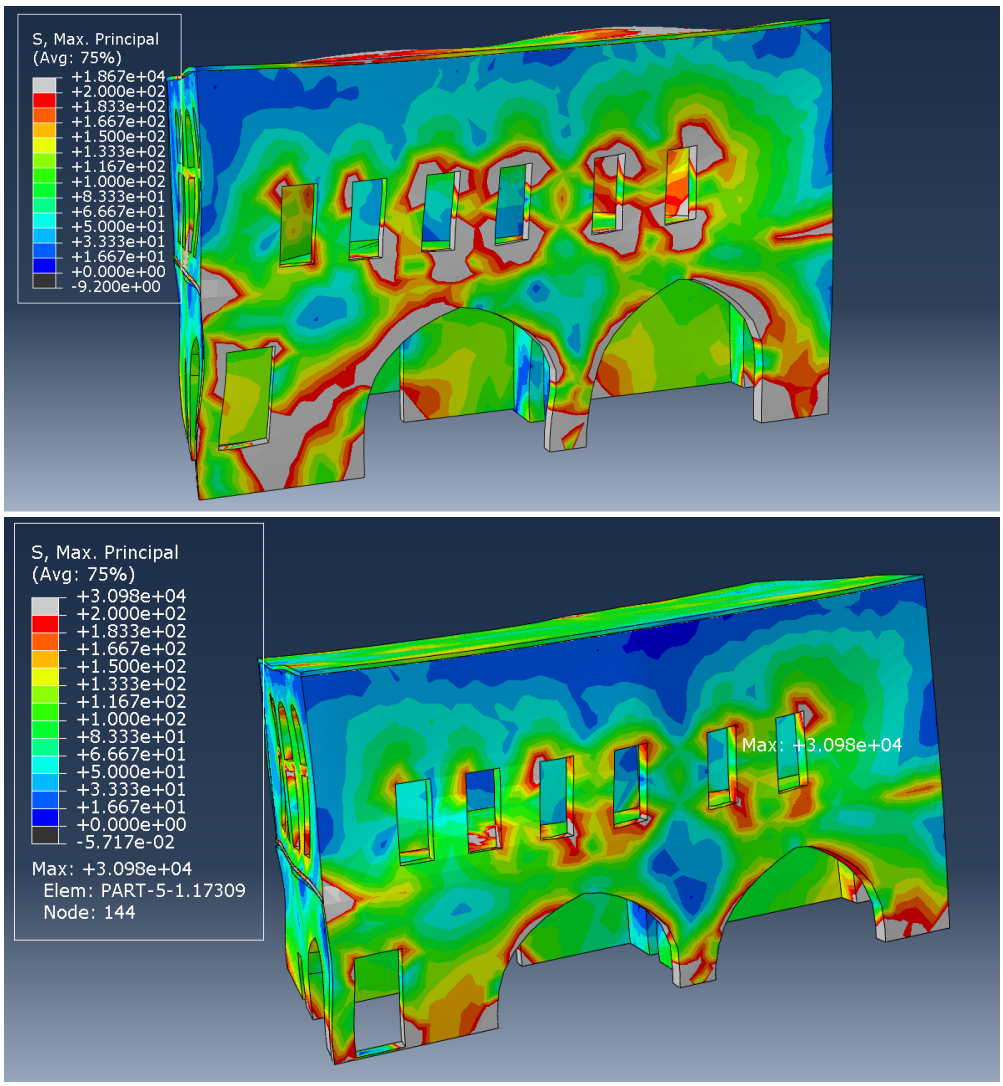


Figure II.4. Principal tensile stresses for the cases of 4.5m (a) and 3.5m (b) height of ground floor.

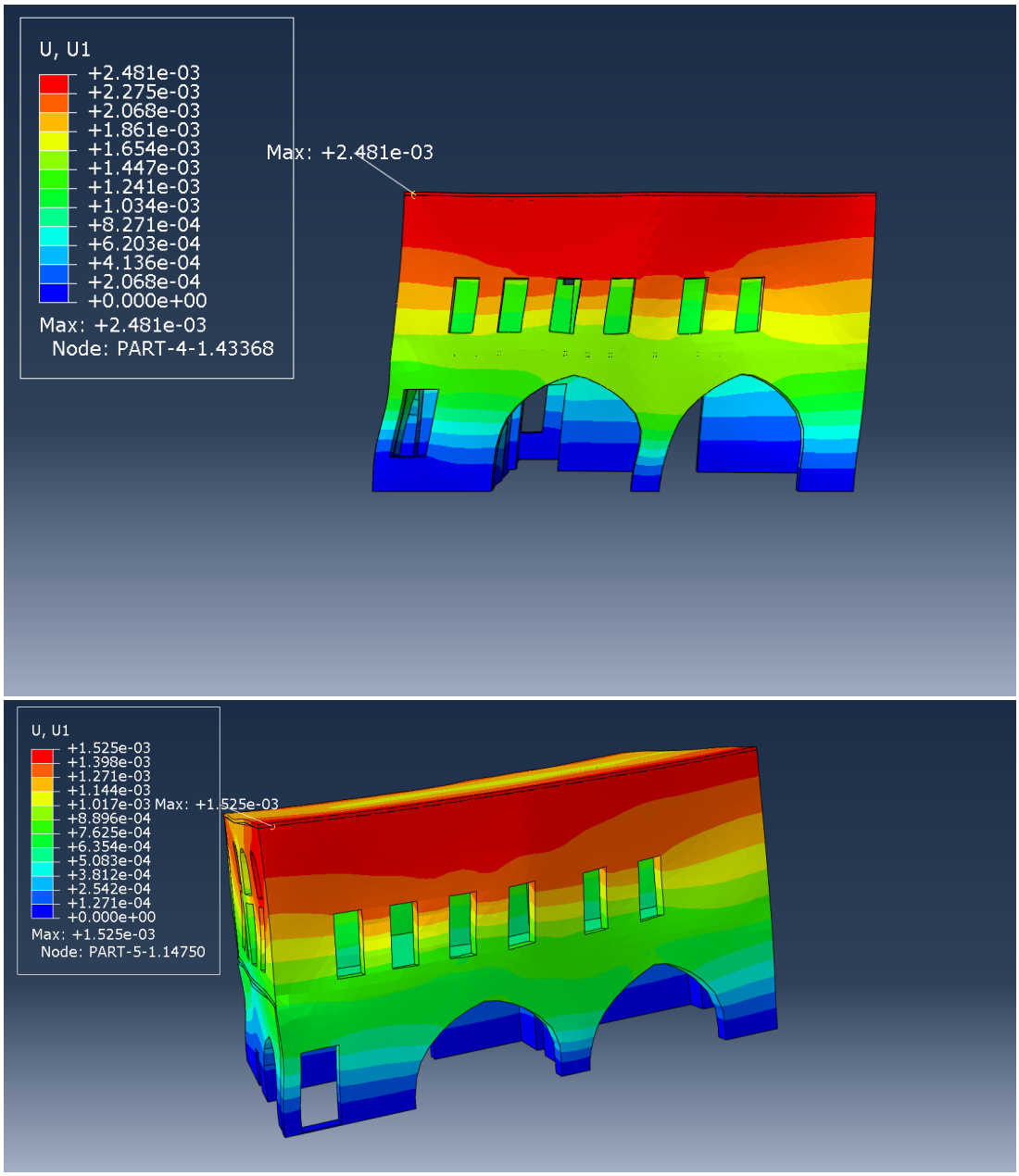


Figure II.5. Horizontal elastic displacements for the cases of 4.5m (a) and 3.5m (b) height of ground floor, respectively.

Annex III

ADDITIONAL INFORMATION

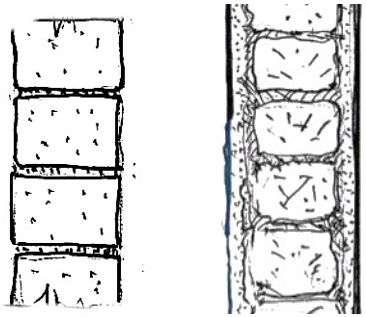
STRUCTURAL CATEGORIES

A	This category collects architectonic assets with two main bearing structural elements: **vertical walls** and **horizontal floors or roofs**. If they are properly connected, mutual cooperation between the structural elements allows the building to **behave as a box**, or a number of boxes
AB	This category collects **complex** architectonic assets which are characterized by **wide spaces with** few inner walls, with or without colonnades, connected to the perimetric walls with **intermediate floors or roofs, or with additional box structures around the main wide space**
B	This category collects architectonic assets which are characterized by **wide spaces without intermediate floors** and few inner walls. Independent damage mechanisms occurs in the different parts of the building, and it is often possible to recognize **specific structural macroelements** (façade, triumphal arch, apse, dome, transept, ...). It refers mainly to large scale structures
C	This category collects architectonic assets in which the **vertical dimension prevails** on the other ones. Since usually, these buildings are characterized by significant slenderness, their seismic response may be assumed as a **global flexural behavior**.
D	This category collects architectonic assets with long free standing **columns** / piers / walls with or without **beams** / arches / vaults / buttresses forming mainly a plane structural element. Their seismic response may be assumed as an out of plane flexural behaviour
E	This category collects massive constructions in which the wide thickness of walls, if compared to other dimensions, doesn't allow the idealization as plane structural element. Local failure occurs as, for example, the detachment of external leaf. Geotechnical aspects play as well important role.
F	This category collects single isolated architectonic assets, which do not delimit an interior space.
G	This category refers to historical centers, or other clusters of buildings made of ordinary buildings' aggregates, which assume the relevance of cultural heritage asset as whole in the urban context. The seismic response must consider the interaction among adjacent buildings.
H	This category refers to archaeological sites consisting of ordinary masonry remains of small height which are mainly vulnerable to environmental threats other than earthquakes
I	This category refers to underground structures, often constructed with the cut-and-cover procedure, or structures carved in soft bedrock or caves. In these particular structures the geotechnical aspect is of main importance.

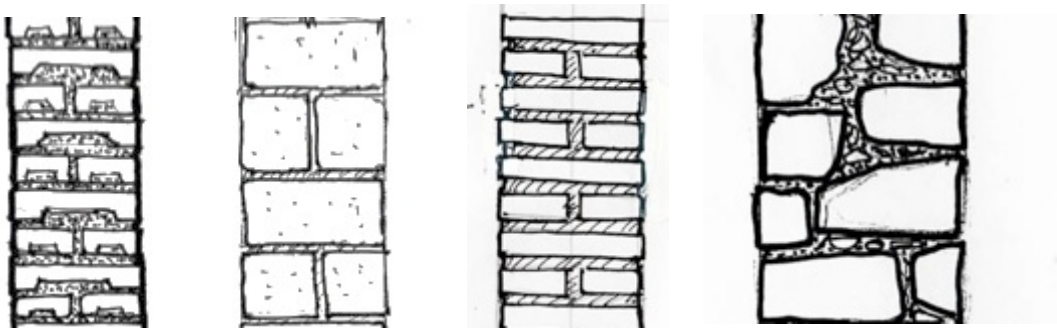
GROUND TYPES

Ground type	Description of stratigraphic profile	Parameters		
		$v_{s,30}$ (m/s)	N_{SPT} (blows/30cm)	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 v_s 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 – E or S_1			

MASONRY STRUCTURAL TYPES

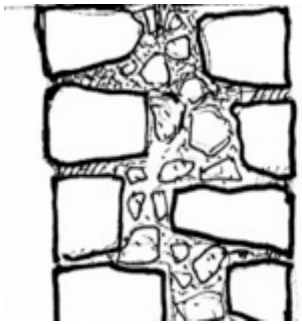


STRETCHER UP TO 0,25 M OF THICKNESS
STONE AND BRICK MASONRY.

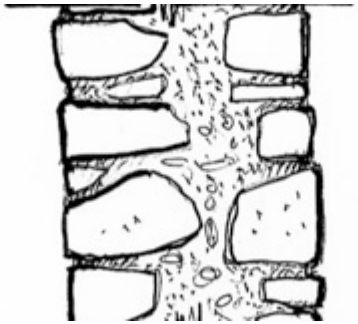


HEADER UP TO 0,55 M OF THICKNESS
STONE AND BRICK MASONRY

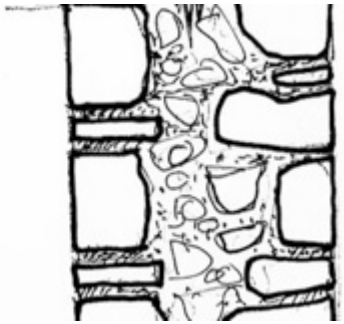
TRHEE LEAF MASONRY 0,55-0,80 M. THICK



COMPACT FILLING MATERIALS

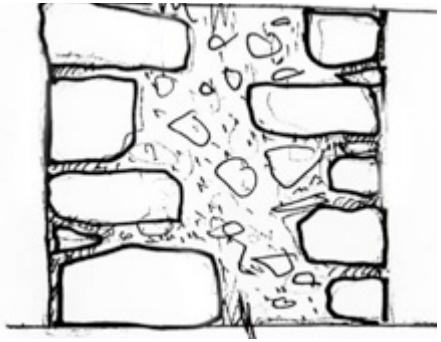


LOOSE FILLING MATERIALS

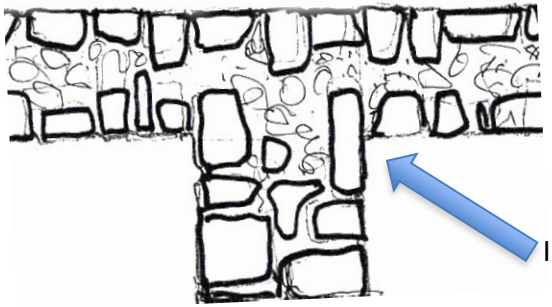


CLOISONNE' MASONRY

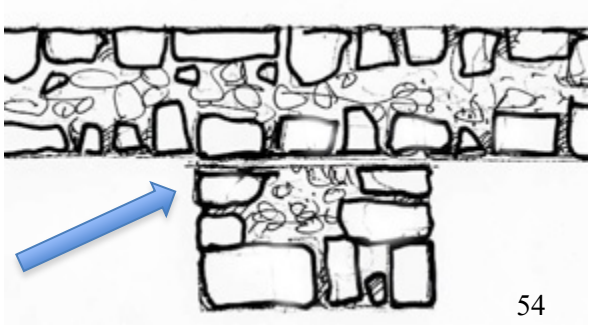
TRHEE LEAF MASONRY >0,80 M



LOOSE FILLING MATERIALS-VOIDS.

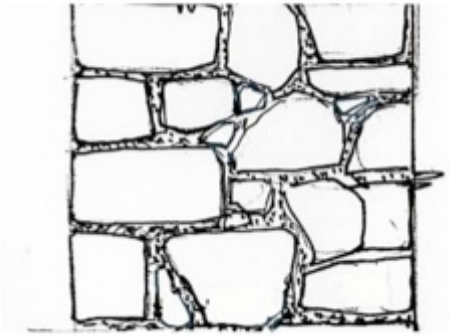


LATERAL RIBS IN MASONRY
WELL CONNECTED UNCONNECTED
INITIAL STRUCTURE ADDITIONAL

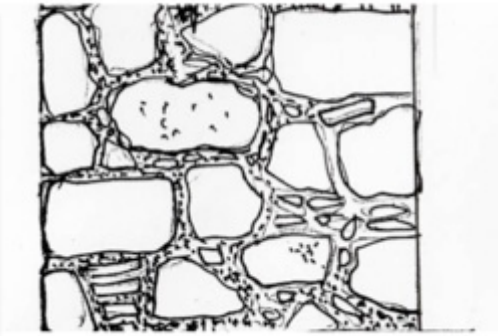


OPUS ISODOMUM

THREE LEAF MASONRY WITH WORKED RECTANGULAR STONES IN OUTER LEAF



MASONRY WITH WORKED POLYGONAL AND CORNER STONES



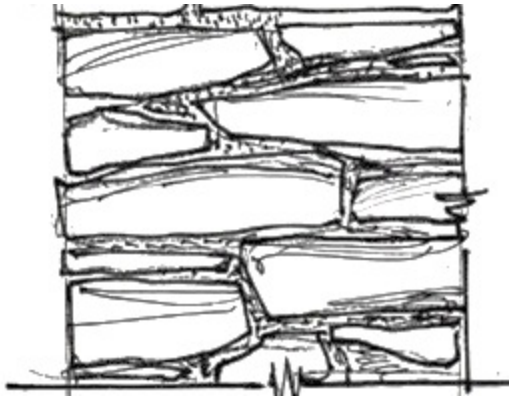
RUBBLE MASONRY WITH CAREFULLY SELECTED STONES

RANDOM RUBBLE MASONRY

CLOISONNE' STRUCTURAL SYSTEM

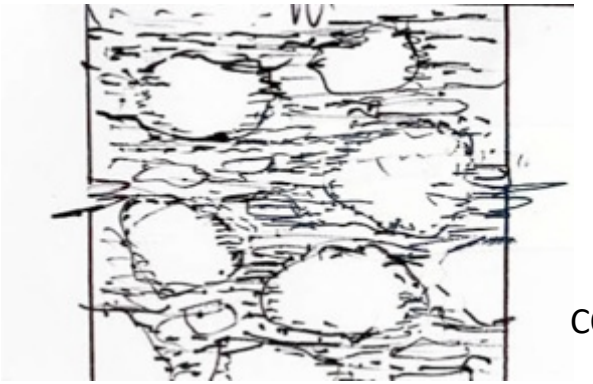
PSEUDO CLOISONNE' STRUCTURAL SYSTEM

PSEUDOCUFIC ORNAMENTS IN CLOISONNE' MASONRY



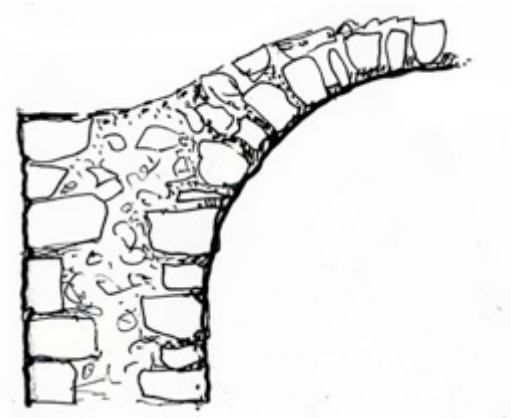
SLATY STONE MASONRY

UNFIRED BRICK MASONRY
WITH CLAY AND STRAW
AND EXTERIOR PLASTERING

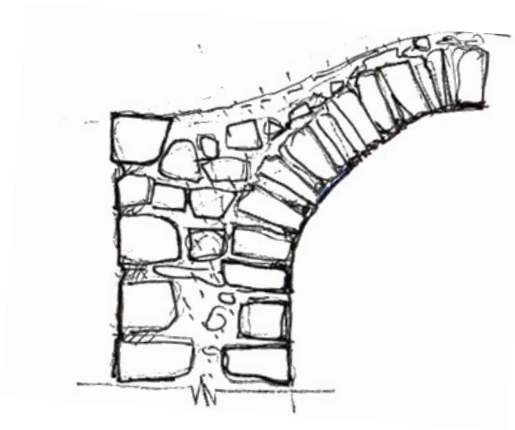


RUBBLE MASONRY
WITH THICK
PLASTERING
COVERING THE JOINTS

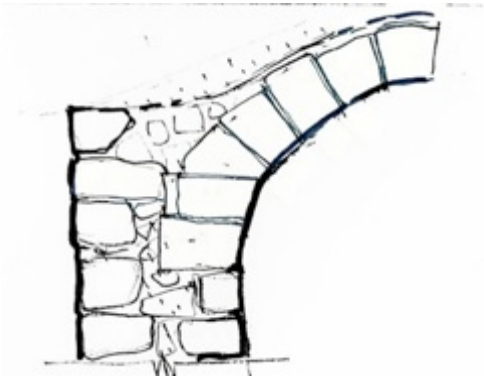
TYPES OF CYLINDRICAL DOMES ACCORDING TO THEIR STRUCTURAL ELEMENTS



WITH SMALL RUBBLE STONES AND THICK MORTAR

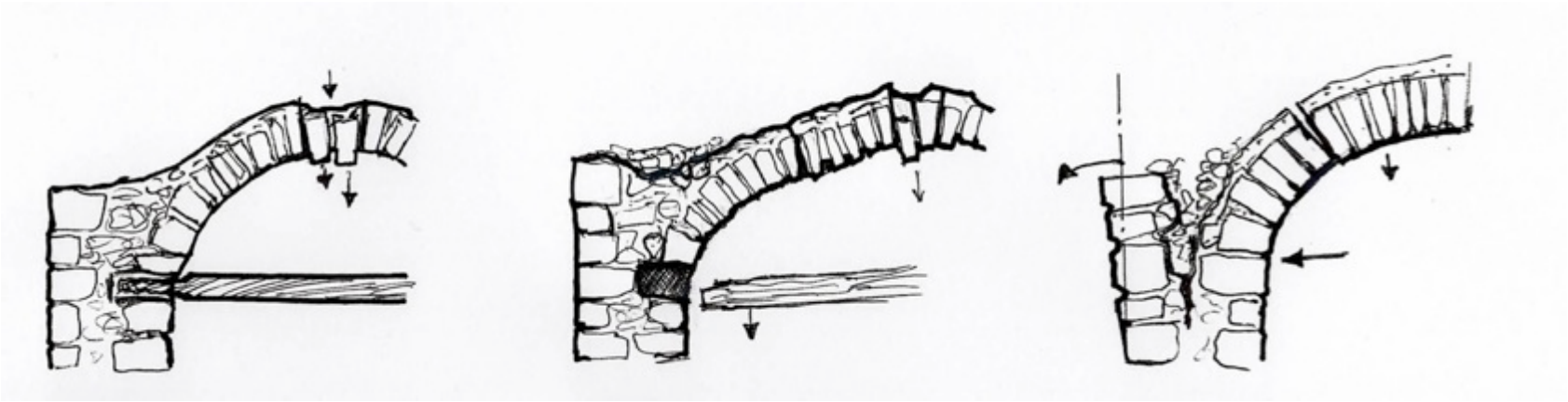


WITH PROPERLY CHOSEN TRAPEZOID STONES



WITH CHISELLED STONES

PATHOLOGY OF DOMED BUILDINGS

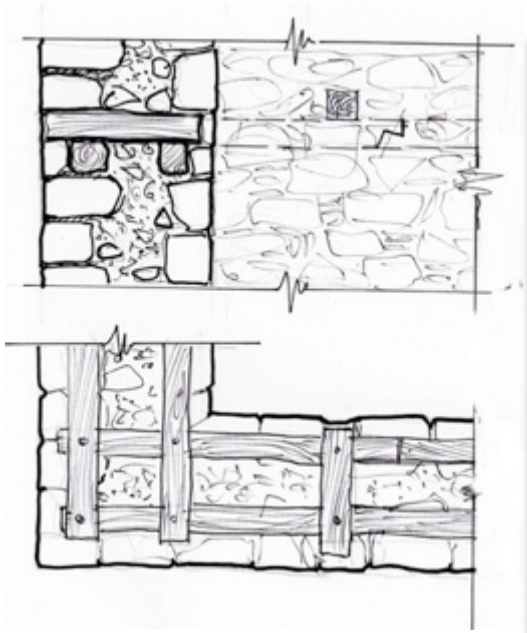


ROTTEN WOOD TIE AND LOCAL SLIDING OF KEY STONE AND FEW VOUSSOIRS

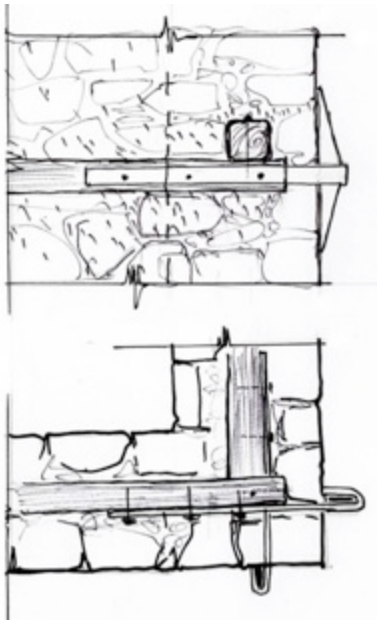
DESTRUCTION OF TIE AND COMPLETE DEFORMATION OF DOME'S CURVE

HORIZONTAL STROKE CAUSING INCLINATION AND DEFORMATION OF OUTER WALL LEAF

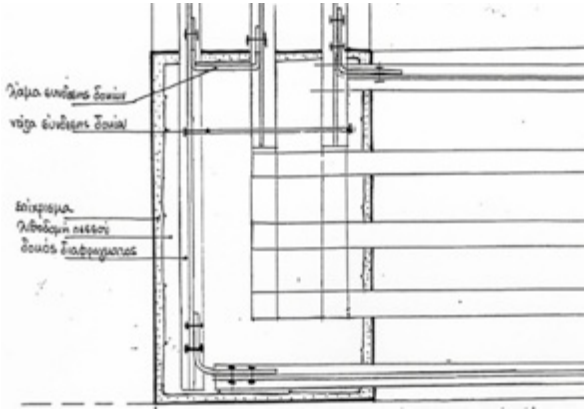
CHAINNAGE TYPES



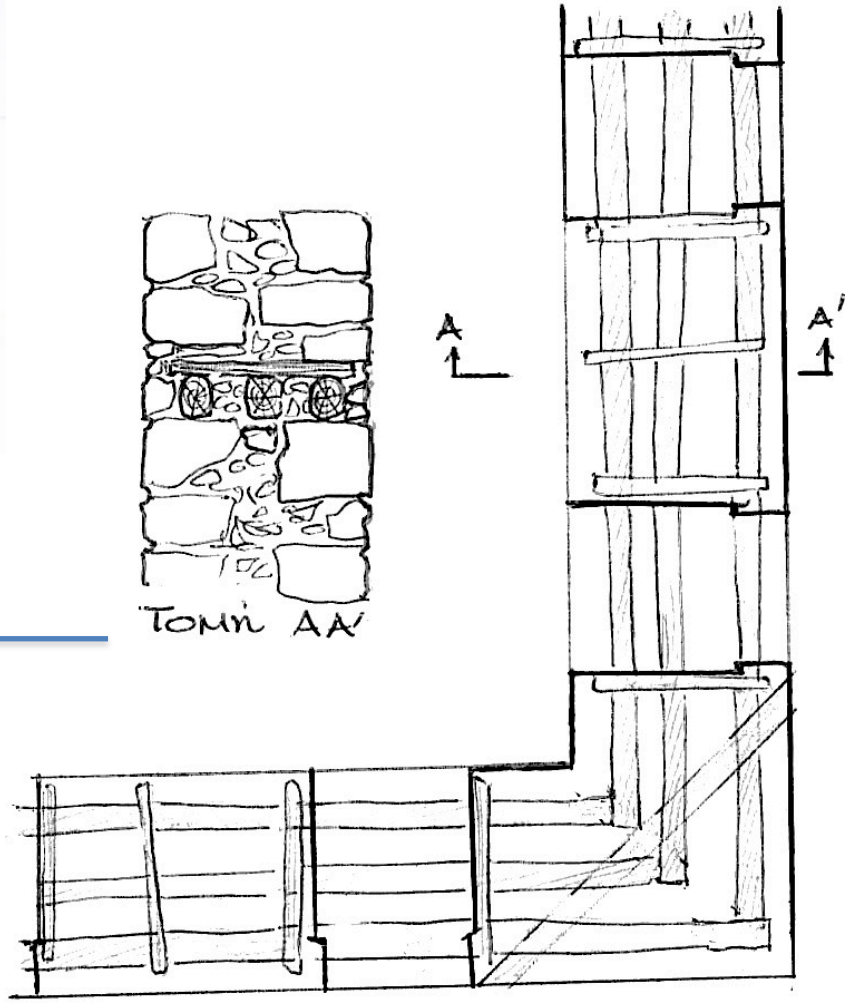
DOUBLE TIMBER REINFORCEMENT INSIDE THREE LEAF MASONRY.



SINGLE TIMBER REINFORCEMENT WITH STEEL ANCHORAGES IN THE CORNERS

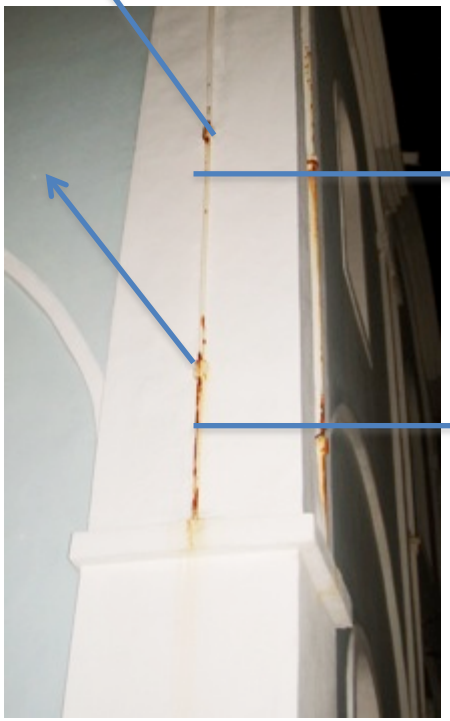


MULTIPLE STEEL REINFORCEMENT IN STONE MASONRY WALL



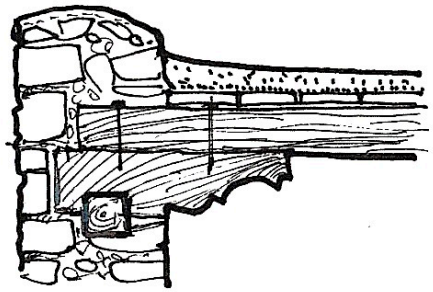
TRIPLE TIMBER REINFORCEMENT INSIDE THREE LEAF MASONRY, WITH DIAGONAL CONNECTIONS IN CORNERS

SIGNS OF
EXISTENCE
OF HORIZONTAL
REINFORCED
TIMBER
FRAMES
INSIDE MASONRY

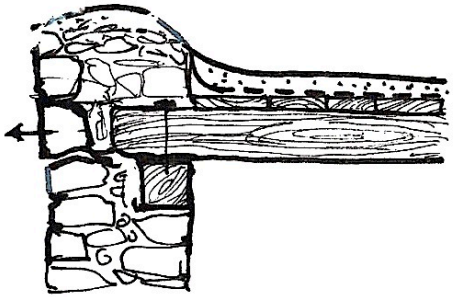


STEEL ANCHORAGES
OF INNER
HORIZONTAL
TIMBER OR STEEL
REINFORCEMENTS

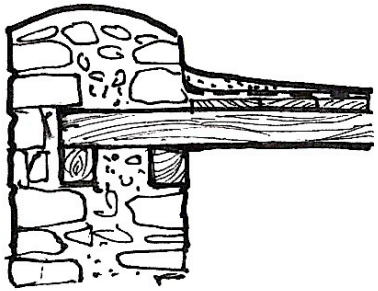
PATHOLOGY OF HORIZONTAL TERRACES



SAFE MOUNTING OF TIMBER BEAMS ANCHORED ON TIMBER CORBELS AND SINGLE TIMBER CHAINAGE

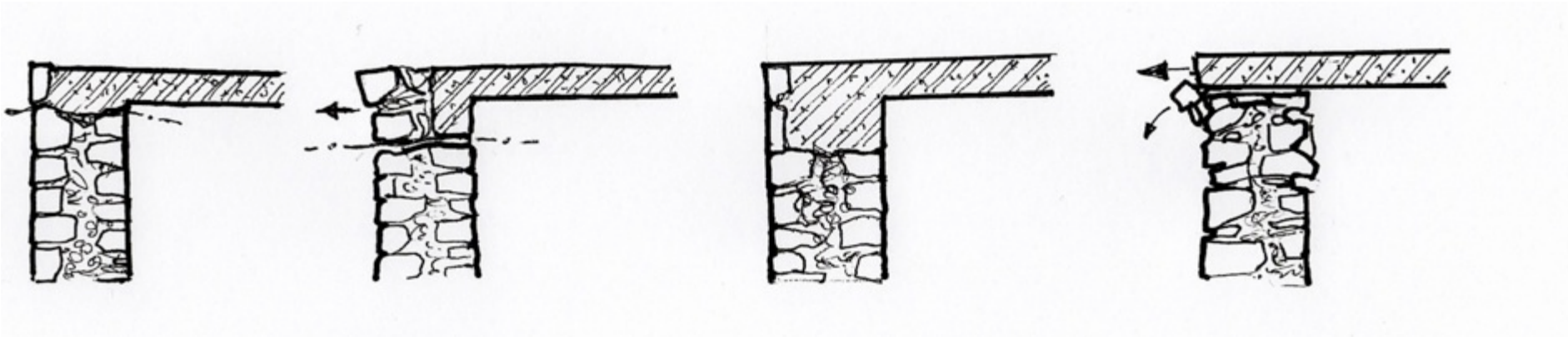


UNSAFE MOUNTING OF WOODEN BEAMS ON INNER TIMBER CHAINAGE



SAFE MOUNTING OF WOODEN BEAMS ON DOUBLE TIMBER BEAM REINFORCEMENT (CHAINAGE)

PATHOLOGY OF CONCRETE PLATE TERRACES ON MASONRY WALLS



SIMPLE MOUNTING ON WALL ONE SIDED MOUNTING MOUNTING ON ADEQUATE CHAINNAGE HORIZONTAL STROKE TO WALL

FIRST DEGREE PRE-EARTHQUAKE ASSESSMENT OF THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN PERIOD IN THE OLD TOWN OF RHODES

IDENDITY DATA

The Mansion in Ierokleous Street, before the restoration works, is examined

1	Name	Main name	Mansion in Ierokleous Street
2		Other	Mansion of Ottoman Period
3	Location	Municipality	Rhodes
4		Town	Old Town of Rhodes
5		Address	Ierokleous Street, next to St.George Monastery
6		Name of local spot	Old Town of Rhodes
7		Geodetic coordinates	
8		Code number registered in the archaeological archive	
9	Description	Number of storeys	Two-storey building (Ground and 1st floor)
10		Area (m2)	200sq.m+200sq.m
11		Typology according to use	Residence
12	Use and ownership	Present owner	Ministry of Culture
13		Initial use	Residence
14		Current use	Historical Building
15		Number of users	20-30 (max. 50)
16		Frequency of use	Random
17	Age	Monument's age according to the period of construction	Ottoman Period (18th-19th century)
18	Protection	Issue protected	Architecture
19		Legal status of protection	Document of Characterization
20		Responsible protection Service	EFA OF RHODES
21		Responsible restoration Service	DABMM

IDENTIFICATION OF ENGINEERS CARRYING OUT THE ASSESSMENT

22	NAME:		
	SPECIALI-ZATION:		
	TEL. /E-MAIL:		

TECHNICAL DATA

23	STRUCTURAL CATEGORY	A	AB X	B	C	D	E	F	Don't know
24	Description of the structural system elements	It is a two-storey building of Rhodian poros stone and timber elements, located next to the monastery of St George. It also features a small two-storey ancillary building in the courtyard. The bearing system of the building consists of masonry walls 60-70 cm thick at the odas of the ground floor and the east wall of the upper floor, walls 25 cm thick at the hayat, the sofa and the odas of the upper floor, and a timber-framed wall at the west façade of the upper floor hayat . The mezzanine floor and the flat roof are timber structures. The masonry of the mansion at the upper floor is reinforced at its perimeter with timber frames at its base, above the lintels and the crowning of the walls. The timber frames are joined together with specific cross-sections and are anchored to the walls with metal joints.							

METHOD OF COSTRUCTION
a) vertical bearing elements

Evaluation		C	B	A
25	Interconnection of stone or brick elements		X	
26	Type of stone or brick elements		X	
27	Binding mortar of the outer leaves			X
28	Core filling material if it can be identified (it refers to three leaf masonry only)		X	
~~29~~	~~Vertical Ribs (buttresses, pilasters)~~			
30	Corners and edges with chiseled stones			X
31	Chainages (placement)			X
32	Chainages (type)			X
33	Chainages (number of horizontal layers)			X
34	Connections between chainage elements (mortices, joints)			X
35	Chainage (condition of building materials: wood, reinforced concrete, steel)	X		
~~36~~	~~One sided reinforced concrete coating~~		----	---
~~37~~	~~Double sided reinforced concrete coating~~			---
38	Timber Framed Masonry wall (condition of wooden columns, beams, tsatmas)	X		
~~39~~	~~Exterior steel masonry braces~~			

B) Horizontal or inclined bearing elements

	Evaluation	C	B	A
40	Timber or steel trusses (condition of materials and connections between the elements)		X	
41	Bearing elements of horizontal roof (condition of materials and connections between the elements)	X		
42	Connection with vertical walls	X		
~~43~~	~~Chainage at the connection area~~			
~~44~~	~~Domes or arches~~			
~~45~~	~~Arched ribs~~			
~~46~~	~~Tendons, ties~~			

GEOMETRICAL CHARACTERISTICS

	Evaluation	C	B	A
47	Ratio of wall length to wall thickness	X (0.05)		
48	Ratio of wall height to wall thickness	X (0.06)		
49	Additional height of pediment or bell tower (vertical cantilever)			
50	Arrangement of openings		X	
51	Openings near the corners	X (1.00)		

C: SEISMIC ACTION

52	SEISMIC ZONE ACCORDING TO EC-8 and National Annex	I	II X	III
53	Data from microzonation study (if elaborated)			

	Ground type	A	B	C	D	E	S1 S2
54	Based on scientific data/survey						
55	Estimation (not certain)		X				

ADDITIONAL DATA INFLUENCING SEISMIC ACTION

	Evaluation of influence	Influence coefficient
56	Negative impact of geomorphological or environmental conditions	
57	Danger of stroke by neighbouring buildings	

D: PATHOLOGY

GENERAL CONDITION OF DAMAGES

	Evaluation	C	B	A
58	General condition of masonry damages	X		
59	Damages in domes, apses, arches			X
60	Damages on roofs and floors	X		

SERIOUS LOCAL DAMAGE:

Description of the problem:

61	

Proposed urgent measures:

62	

Proposed urgent investigations/surveys:

63	

DOCUMENTATION SHEET No. 1: "field survey – design and photographic documentation"
with instructions (in italics)

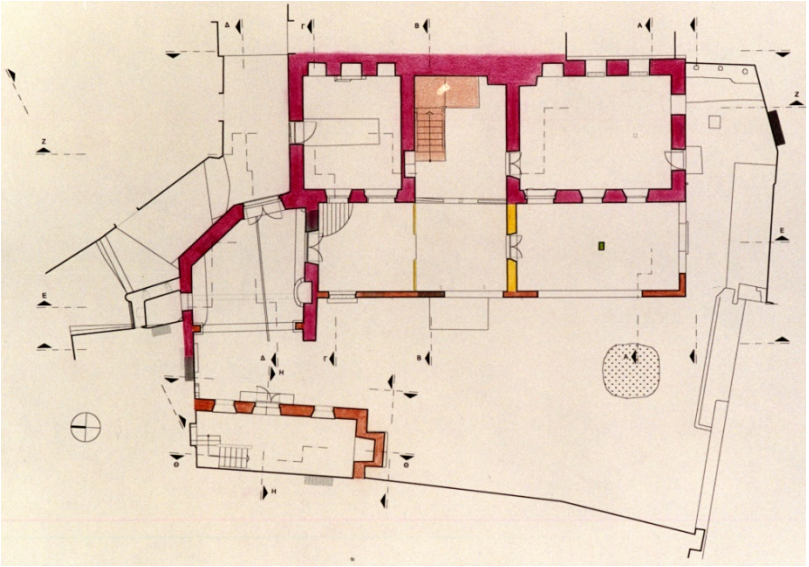
AVAILABLE FORMER SURVEY

Type of survey and documentation	**climax/list of plans**	**Author and date of survey**
Topographic survey		
Architectural survey and documentation	YES	G.Dellas & M.Zerlenti (2001)
Structural survey and documentation	YES	E.Tsakanika & K.Athanasiadi
Pathology		

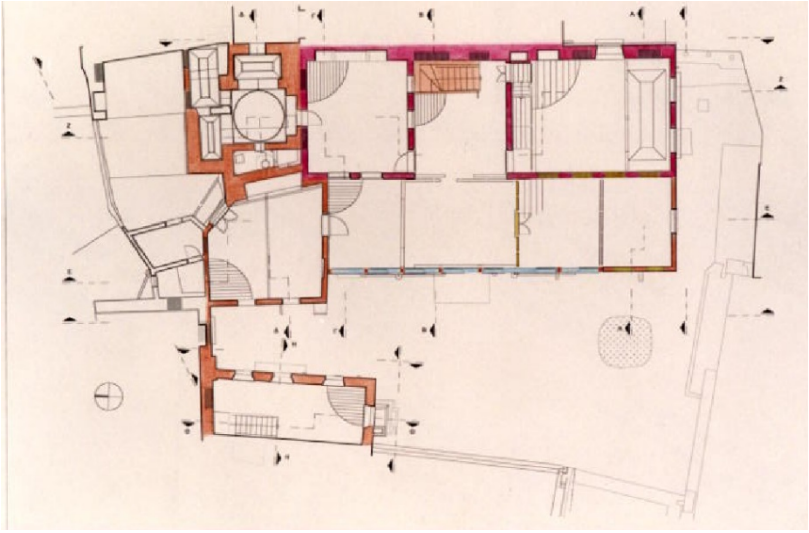
FORMER INTERVENTIONS

FORMER INTERVENTIONS	
Last restoration**	*The above assessment data sheets refer to the condition of the building before the restoration works started after the architectural study of 2001. The restoration works included the strengthening of the foundations by completing the stone structure of the foundation, the missing arch of the loggia (hagiati) room and its connection with the foundations of the foundations at a depth of 1.5 m. The fixing and restoration of the load-bearing structure of the stone structures of the ground floor and the floor was completed with replacements of loose stones and stone staples. The surfaces of the masonry were cleaned from the remains of loose coatings and newer cement mortars, the joints were thoroughly cleaned and deep jointed with a special plaster with granulated quartz sand. At the level of the crown, the bearings were replaced and great attention was paid to their connection with the underlying stonework with wooden studs. The mezzanine and the roof were restored by reusing old pieces of beams and filling them with new wood*
I don't know	

GRAPHIC SURVEY AND DOCUMENTATION



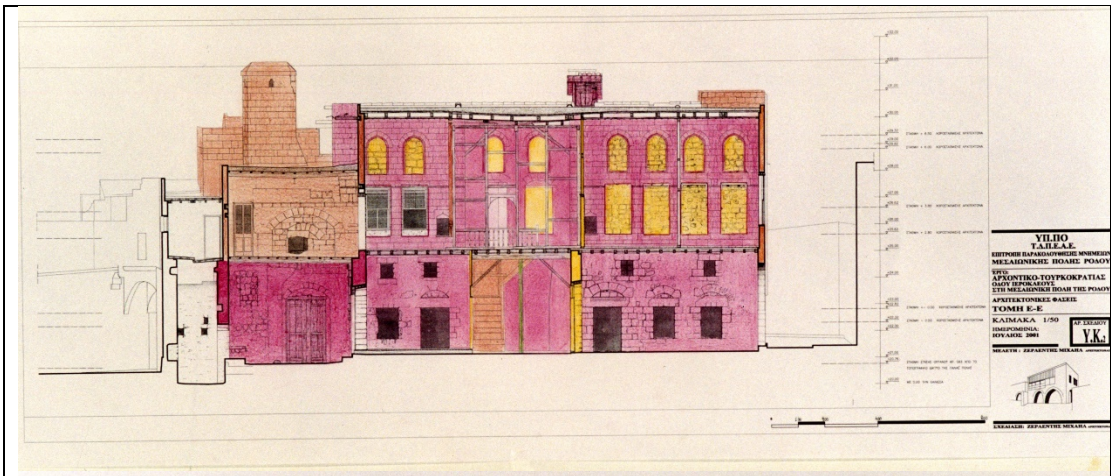
Ground plan view

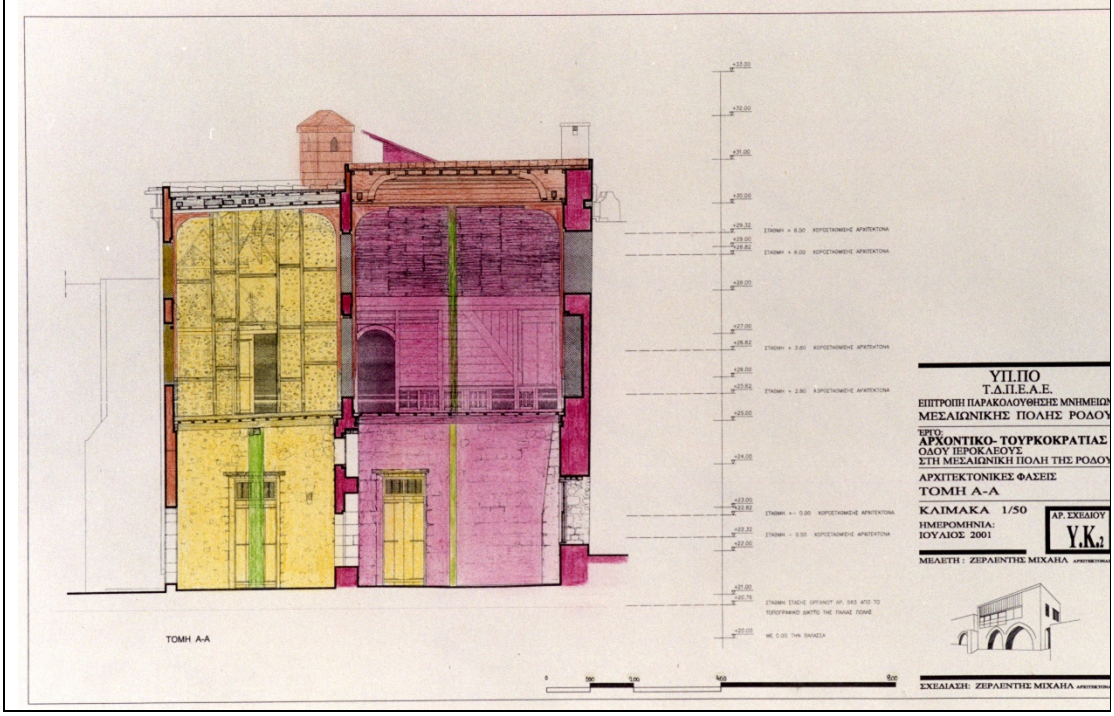


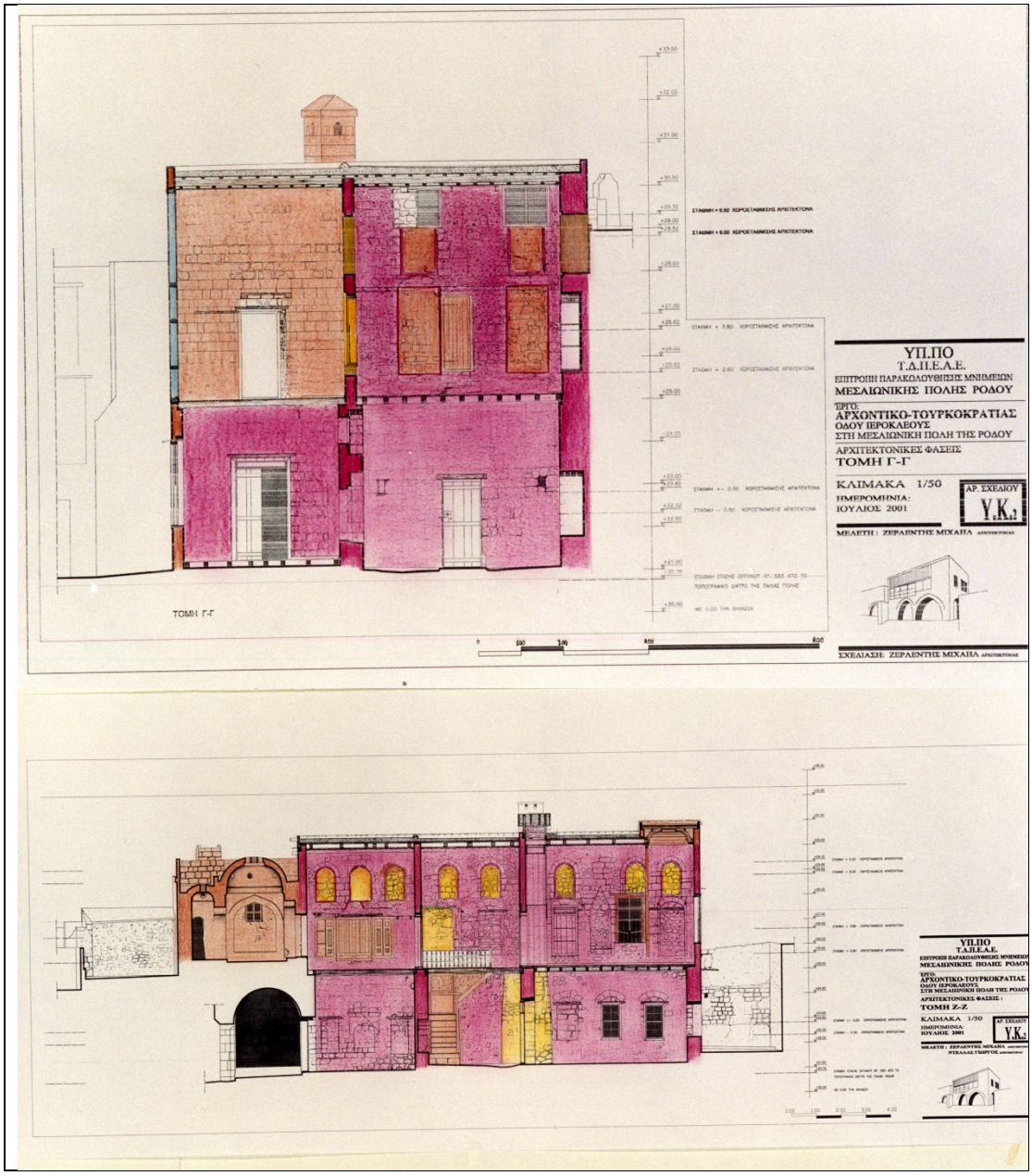
Floor plan View

Building dimensions: (length 16.30 m. X width 9.70 m) and wall thickness 60-70 cm. Except for the east of the floor which is 20 cm.

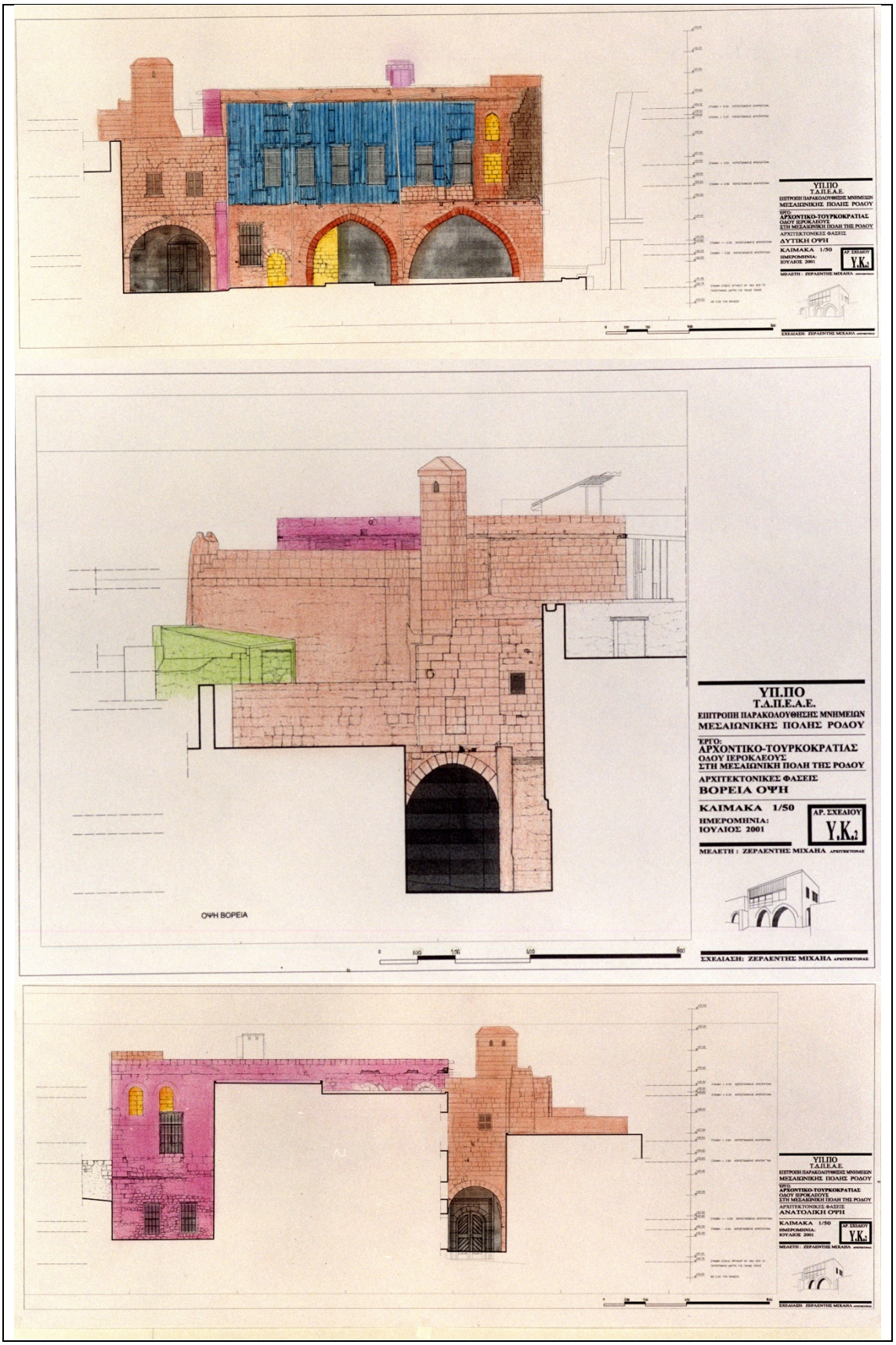
CHARACTERISTIC SECTIONS:

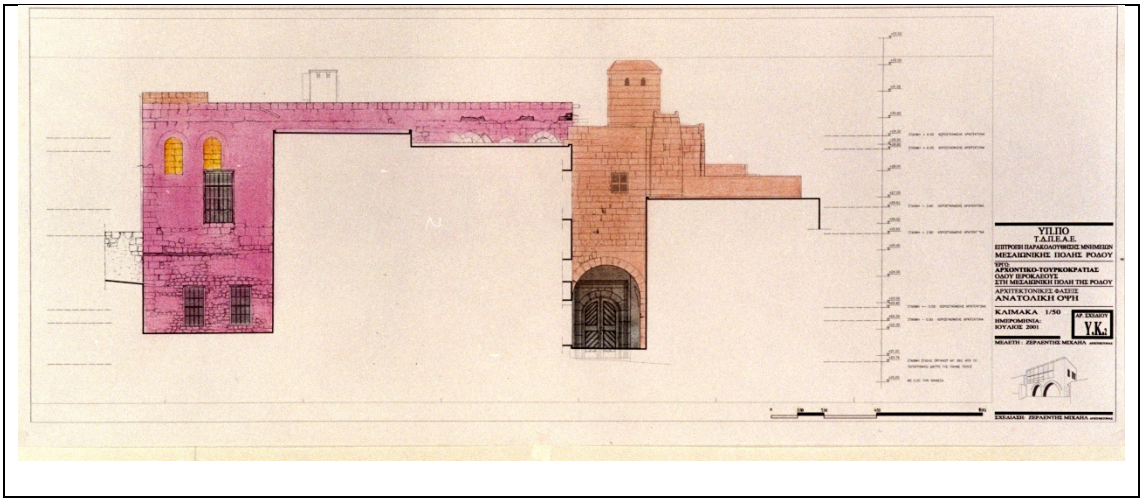





ΤΟΜΗ Γ-Γ
ΥΠ.ΠΟ
Τ.Δ.Π.Ε.Α.Ε.
ΕΠΙΤΡΟΠΗ ΠΑΡΑΚΟΛΟΥΘΗΣΗΣ ΜΝΗΜΕΙΩΝ
ΜΕΣΑΙΩΝΙΚΗΣ ΠΟΛΗΣ ΡΟΔΟΥ
ΕΡΓΟ:
ΑΡΧΟΝΤΙΚΟ-ΤΟΥΡΚΟΚΡΑΤΙΑΣ
ΟΔΟΥ ΙΕΡΟΚΛΕΟΥΣ
ΣΤΗ ΜΕΣΑΙΩΝΙΚΗ ΠΟΛΗ ΤΗΣ ΡΟΔΟΥ
ΑΡΧΙΤΕΚΤΟΝΙΚΕΣ ΦΑΣΕΙΣ
ΤΟΜΗ Γ-Γ
ΚΛΙΜΑΚΑ 1/50
ΗΜΕΡΟΜΗΝΙΑ:
ΙΟΥΛΙΟΣ 2001
ΑΡ. ΣΧΕΔΙΟΥ
Υ.Κ.1
ΜΕΛΕΤΗ : ΖΕΡΛΕΝΤΗΣ ΜΙΧΑΗΛ
ΣΧΕΔΙΑΣΗ: ΖΕΡΛΕΝΤΗΣ ΜΙΧΑΗΛ

CHARACTERISTIC VIEWS





PHOTOGRAPHIC DOCUMENTATION

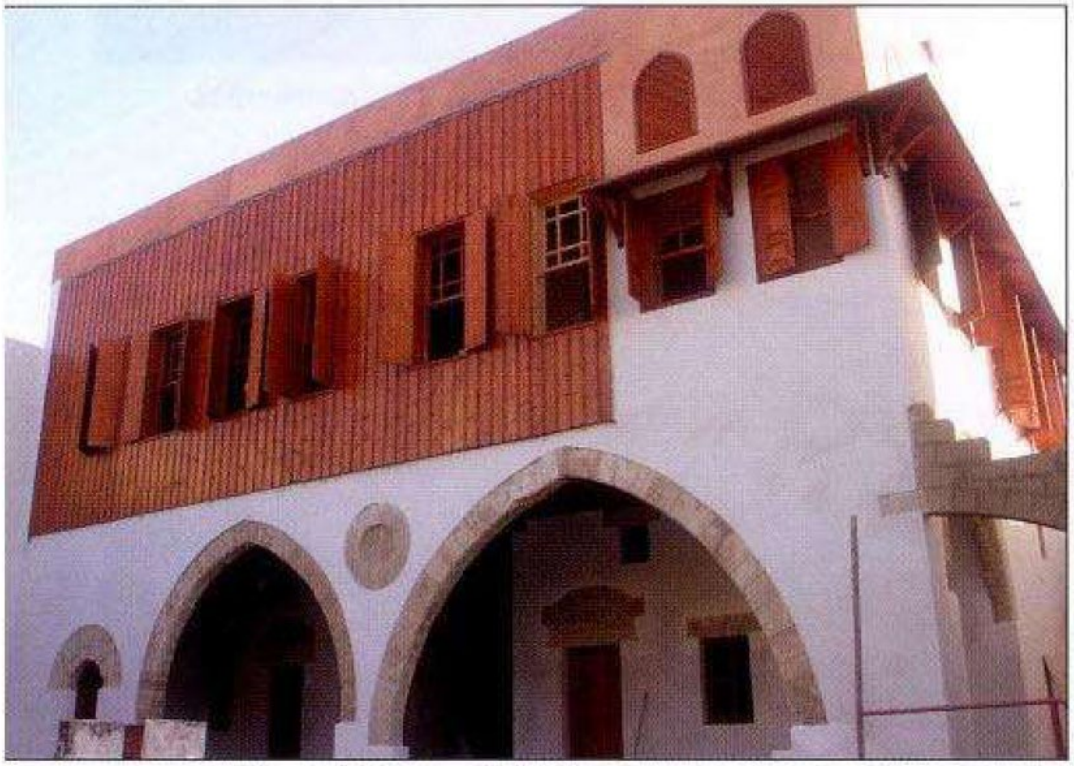


Figure shows the conditions of the building before and after the restoration works applied after 2001.

DOCUMENTATION SHEET No. 2: "Seismicity-environment"
with instructions (in italics)

ENVIRONMENTAL DATA

LOCATION

PENDING

INFLUENCE OF GEOMORFOLOGICAL AND ENVIRONMENTAL CONDITIONS

THE BUILDING is CONSTRUCTED**:**

Conditions	**YES**	**NO**	**DON'T KNOW**
With shallow foundation on loose embankment or silt			**X**
Near or on unstable natural or artificial slope		**NO**	
In area with high water level (rising humidity)			**X**
In area with floods		**NO**	
In area with polluted atmosphere		**NO**	
Near the sea (salt exposure)	**YES**		

INFLUENCE OF NEIGHBOURING BUILDINGS

THE CHURCH IS IN CONTACT WITH BELLTOWER

Existence of	**YES**	**NO**	**DON'T KNOW**
Adequate joint*			
inadequate or non-continuous joint			
Without joint			

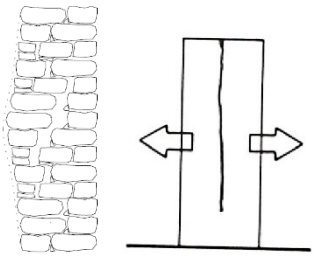
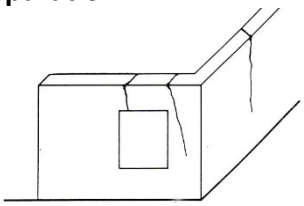
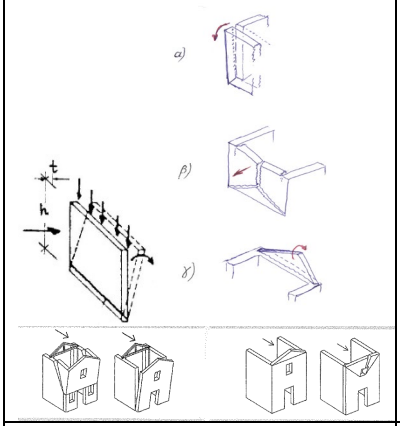
Conditions of neighbourhood	**DANGER OF STROKE**	
With other 1storey building of different height		**NO**
With building of different rigidity		**NO**
With different floor levels		**NO**
In contact with other volumnous or high structures		**NO**

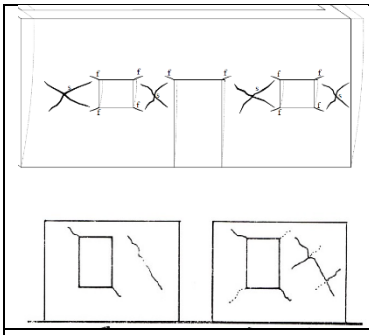
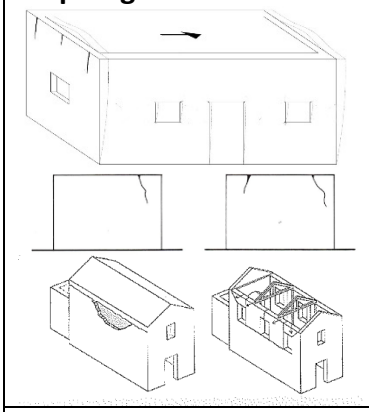
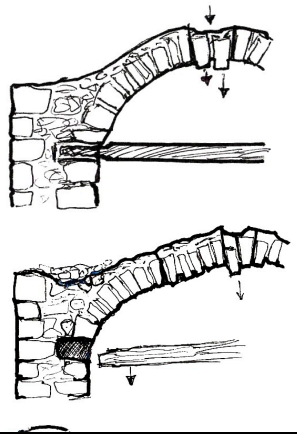
OTHER INFLUENCES

Free text about:
-NEARBY SOURCE OF VIBRATIONS (AUTOROUTE ETC) -RECENT EARTHQUAKES AND REPORTS ABOUT DAMAGES -HISTORICAL EARTHQUAKES AND INFORMATION ABOUT DAMAGES

DATA FROM MICROZONATION STUDY **NOT EXISTING**

DOCUMENTATION SHEET No. 3: “Pathology”

	Г	В	А
Vertical cracks inside the masonry core with swelling of the wall surfaces, indicating separation of masonry leaves 			Non-existent
Cracks near the corners of intersecting walls causing separation 	Disconnection of walls near the corners. Broad and long cracks through the walls		
Horizontal cracks at the base of wall or pillars or pediments or over openings (out of plane flexural cracking) 			Non-existent
Diagonal or X-shaped shear cracking			Non-existent

			
Cracks at the base of diaphragms (roofs, floors indicating poor or inexistent connection of diaphragms and walls 	Many long and broad cracks, sometimes accompanied by sliding of the roof or local collapses at the edges of walls		
Damages in domes, apses and arches 			Non-existent
Masonry wall inclination			Non-existent

FIRST DEGREE PRE-EARTHQUAKE ASSESSMENT OF THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN PERIOD IN THE OLD TOWN OF RHODES number of Data sheet:			Rating	Number of completed questions	Calculation of the Vulnerability Index
SECTION A: IDENDITY DATA					
Name	Main name	**Mansion in Ierokleous Street**			
	Other	**Mansion of Ottoman Period**			
Location	Municipality	**Rhodes**			
	Town	**Old Town of Rhodes**			
	Address	**Ierokleous Street, next to St.George Monastery**			
	Name of local spot	**Old Town of Rhodes**			
	Geodetic coordinates				
	Code number registered in the archaeological archive				
Description	Number of storeys	**Two-storey building (Ground and 1st floor)**			
	Area (m2)	**200sq.m+200sq.m**			
	Typology according to use	**Residence**			
Use and ownership	Present owner	**Ministry of Culture**			
	Initial use	**Residence**			
	Current use	**Historical Building**			
	Number of users	**20-30 (max. 50)**			
	Frequency of use	**Random**			
Age	Monument's age according to the period of construction	**Ottoman Period (18th-19th century)**			
Protection	Issue protected	**Architecture**			
	Legal status of protection	**Document of Characterization**			
	Responsible protection Service	**EFA OF RHODES**			
	Responsible restoration Service	**DABMM**			

IDENTIFICATION OF ENGINEERS CARRYING OUT THE ASSESSMENT	
NAME:	
SPECIALI-ZATION:	
Tel./E-MAIL:	
NAME:	
SPECIALI-ZATION:	
Tel./E-MAIL:	
Date of assessment:	

Section B : METHOD OF COSTRUCTION

(the completion of the cells should be made with english letter x)

STRUCTURAL CATEGORY	A	AB	B	C	D	E	F	Don't know
		X						

Description of the structural system elements	It is a two-storey building of Rhodian poros stone and timber elements, located next to the monastery of St George. It also features a small two-storey ancillary building in the courtyard. The bearing system of the building consists of masonry walls 60-70 cm thick at the odas of the ground floor and the east wall of the upper floor, walls 25 cm thick at the hayat, the sofa and the odas of the upper floor, and a timber-framed wall at the west façade of the upper floor hayat . The mezzanine floor and the flat roof are timber structures. The masonry of the mansion at the upper floor is reinforced at its perimeter with timber frames at its base, above the lintels and the crowning of the walls. The timber frames are joined together with specific cross-sections and are anchored to the walls with metal joints.

METHOD OF COSTRUCTION

A) Vertical bearing elements

Evaluation	C	B	A		Total number of rated questions of the Method of Construction Section
Interconnection of stone or brick elements		X		2	25
Type of stone or brick elements		X		2	
Binding mortar of the outer leaves			X	3	
Core filling material if it can be identified (it refers to three leaf masonry only)		X		2	
Vertical Ribs (buttresses, pilasters)				Not completed	

Corners and edges with chiseled stones			X	3	Number of completed questions of section A	
Chainages (placement)			X	3		
Chainages (type)			X	3		
Chainages (number of horizontal layers)			X	3		
Connections between chainage elements (mortices, joints)			X	3		
Chainage (condition of building materials: wood, reinforced concrete, steel)	X			1		
One sided reinforced concrete coating				Not completed		
Double sided reinforced concrete coating				Not completed		
Timber Frame Masonry wall (condition of wooden columns, beams,tsatmas)	X			1		
Exterior steel masonry braces				Not completed		
B) Horizontal or inclined bearing elements					11	
Evaluation	**C**	**B**	**A**			
Timber or steel trusses (condition of materials and connections between the elements)		X		2	Number of completed questions of section B	
Bearing elements of horizontal roof (condition of materials and connections between the elements)	X			1		
Connection with vertical walls	X			1		
Chainage at the connection area				Not completed		
Domes or arches				Not completed		
Arched ribs				Not completed		
Tendons, ties				Not completed	3	
Γ) Geometrical Characteristics						
Evaluation	**C**	**B**	**A**			
Ratio of wall length to wall thickness	X			1	umber of completed uestions of section Γ	rability Index of the od of Construction Section
Ratio of wall height to wall thickness	X			1		
Additional height of pediment or bell tower (vertical cantilever)				Not completed		

Arrangement of openings			X				2	
Openings near the corners	X						1	4
Section C: SEISMIC ACTION (the completion of the cells should be made with english letter x)								
SEISMIC ZONE ACCORDING TO EC-8 and National Annex	I		II		III			
			X				2.4	
Data from microzonation study (if elaborated)								
Ground type	A	B	C	D	E	S1 S2		
Based on scientific data/survey							0	
Estimation (not certain)		X					1	
ADDITIONAL DATA INFLUENCING SEISMIC ACTION								
Evaluation of influence	**Influence coefficient**						Influence coefficient of Additional Data	
Negative impact of geomorfological or environmental conditions							1	
Danger of stroke by neighbouring buildings							1	
Section D: PATHOLOGY (the completion of the cells should be made with english letter x)								
GENERAL CONDITION OF DAMAGES								
Evaluation	C		B		A			
General condition of masonry damages	X						25	
Damages in domes, apses, arches					X		75	
Damages on roofs and floors	X						25	
SERIOUS LOCAL DAMAGE:								
Description of the problem:								
Proposed urgent measures:								
Proposed urgent investigations/surveys:								

The questions of Seismic Action should always be completed

Vulnerability Method

48.61

Vulnerability Index of the Seismic Action Section

42.50

Vulnerability Index of the Pathology Section

25.00

Final Vulnerability Index

116.11

FIRST DEGREE PRE-EARTHQUAKE ASSESSMENT OF THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN PERIOD IN THE OLD TOWN OF RHODES

IDENDITY DATA

In the present assessment sheets, the Neoclassical Building of The Ottoman Courthouse, is examined, before the restoration works.

1	Name	Main name	Neoclassical Building of The Ottoman Courthouse
2		Other	Vakouf Offices
3	Location	Municipality	Rhodes
4		Town	Old Town of Rhodes
5		Address	Theofiliskou street
6		Name of local spot	Old Town of Rhodes
7		Geodetic coordinates	
8		Code number registered in the archaeological archive	
9	Description	Number of storeys	Two-storey building with basement
10		Area (m2)	180sq.m+180sq.m+180sq.m
11		Typology according to use	The seat of the Muslim judge of Rhodes - Administrative building
12	Use and ownership	Present owner	Ministry of Culture
13		Initial use	Administrative building
14		Current use	Historical Building
15		Number of users	20-30 (max. 50)
16		Frequency of use	Random
17	Age	Monument's age according to the period of construction	Ottoman Period (18th-19th century)
18	Protection	Issue protected	Architecture
19		Legal status of protection	Document of Characterization
20		Responsible protection Service	EFA of Rhodes
21		Responsible restoration Service	DABMM

IDENTIFICATION OF ENGINEERS CARRYING OUT THE ASSESSMENT

22	NAME:		
	SPECIALI-ZATION:		
	TEL. /E-MAIL:		

TECHNICAL DATA

23	STRUCTURAL CATEGORY	A	AB X	B	C	D	E	F	Don't know
24	Description of the structural system elements	The court is a two-storey neoclassical building built on the fourth from the west Byzantine tower of the Byzantine castle of Rhodes. Therefore, the basement of the building belongs to the original square Byzantine tower which consists of a dome with massive walls 4m thick. The ground floor and the first floor consist of stone structures 50-60cm thick. which hold the four-pitched wooden roof at the upper height of the building. Most of the building is plastered except for the lower parts which are connected to the surviving part of the tower.							

METHOD OF COSTRUCTION

a) vertical bearing elements

Evaluation		C	B	A
25	Interconnection of stone or brick elements		X	
26	Type of stone or brick elements		X	
27	Binding mortar of the outer leaves			X
28	Core filling material if it can be identified (it refers to three leaf masonry only)		X	
~~29~~	~~Vertical Ribs (buttresses, pilasters)~~			
30	Corners and edges with chiseled stones			X
31	Chainages (placement)			X
32	Chainages (type)			X
33	Chainages (number of horizontal layers)			X
34	Connections between chainage elements (mortices, joints)			X
35	Chainage (condition of building materials: wood, reinforced concrete, steel)			X
~~36~~	~~One sided reinforced concrete coating~~		----	---
~~37~~	~~Double sided reinforced concrete coating~~			---
38	Timber Framed Masonry wall (condition of wooden columns, beams, tsatmas)			
~~39~~	~~Exterior steel masonry braces~~			

B) Horizontal or inclined bearing elements

	Evaluation	C	B	A

40	Timber or steel trusses (condition of materials and connections between the elements)		X	
41	Bearing elements of horizontal roof (condition of materials and connections between the elements)	X		
42	Connection with vertical walls	X		
~~43~~	~~Chainage at the connection area~~			
~~44~~	~~Domes or arches~~			
~~45~~	~~Arched ribs~~			
~~46~~	~~Tendons, ties~~			

GEOMETRICAL CHARACTERISTICS

	Evaluation	C	B	A
47	Ratio of wall length to wall thickness	X (0.06)		
48	Ratio of wall height to wall thickness	X (0.06)		
49	Additional height of pediment or bell tower (vertical cantilever)			
50	Arrangement of openings			X
51	Openings near the corners	X (1.00)		

C: SEISMIC ACTION

52	SEISMIC ZONE ACCORDING TO EC-8 and National Annex	I	II X	III
53	Data from microzonation study (if elaborated)			

	Ground type	A	B	C	D	E	S1 S2
54	Based on scientific data/survey						
55	Estimation (not certain)		X				

ADDITIONAL DATA INFLUENCING SEISMIC ACTION

	Evaluation of influence	Influence coefficient
56	Negative impact of geomorphological or environmental conditions	
57	Danger of stroke by neighbouring buildings	

D: PATHOLOGY

GENERAL CONDITION OF DAMAGES

	Evaluation	C	B	A
58	General condition of masonry damages			X
59	Damages in domes, apses, arches			X
60	Damages on roofs and floors		X	

SERIOUS LOCAL DAMAGE:
Description of the problem:

61	

Proposed urgent measures:

62	

Proposed urgent investigations/surveys:

63	

DOCUMENTATION SHEET No. 1: "field survey – design and photographic documentation"
with instructions (in italics)

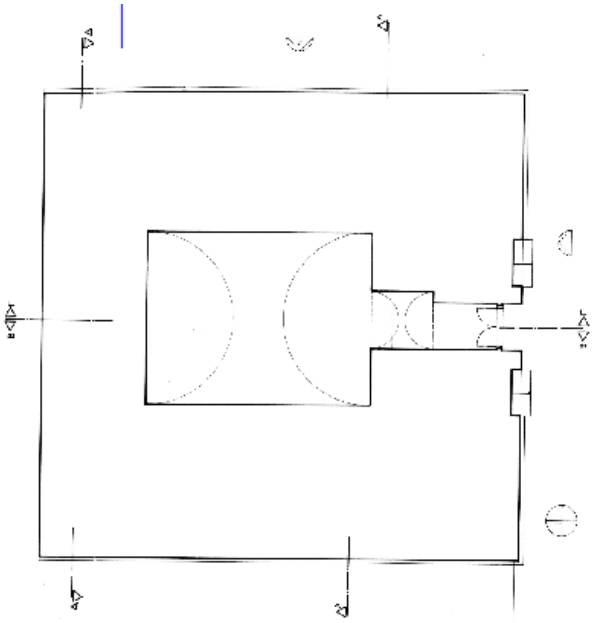
AVAILABLE FORMER SURVEY

Type of survey and documentation	**climax/list of plans**	**Author and date of survey**
Topographic survey		
Architectural survey and documentation	YES	G.Dellas & M.Zerlenti (2001)
Structural survey and documentation	YES	E.Tsakanika & K.Athanasiadi
Pathology		

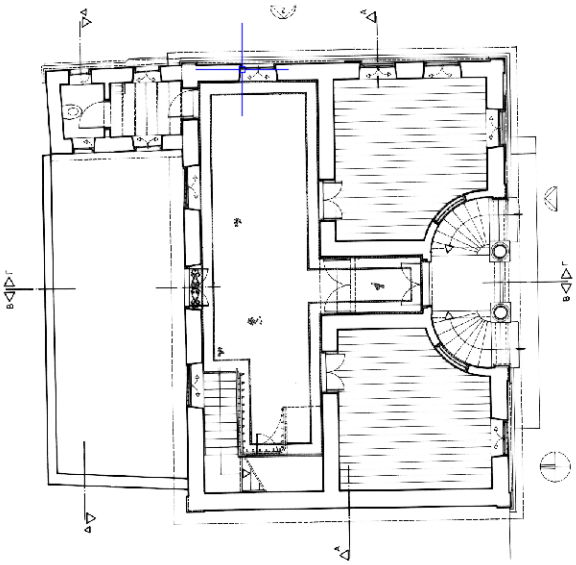
FORMER INTERVENTIONS

FORMER INTERVENTIONS	
Last restoration**	*The above registration sheets refer to the condition of the building before the restoration works started after the architectural study of 2001.* *The restoration work included the demolition of the loose coatings and the completion of the repair and reinforcement of the four-pitched wooden roof. The roof was covered with French tiles, the stone structures were repaired by blocking and stitching the cracks, the worn wooden frames were replaced and the old ones were preserved. All the coatings of the facades were restored first and the interior space afterwards.*
I don't know	

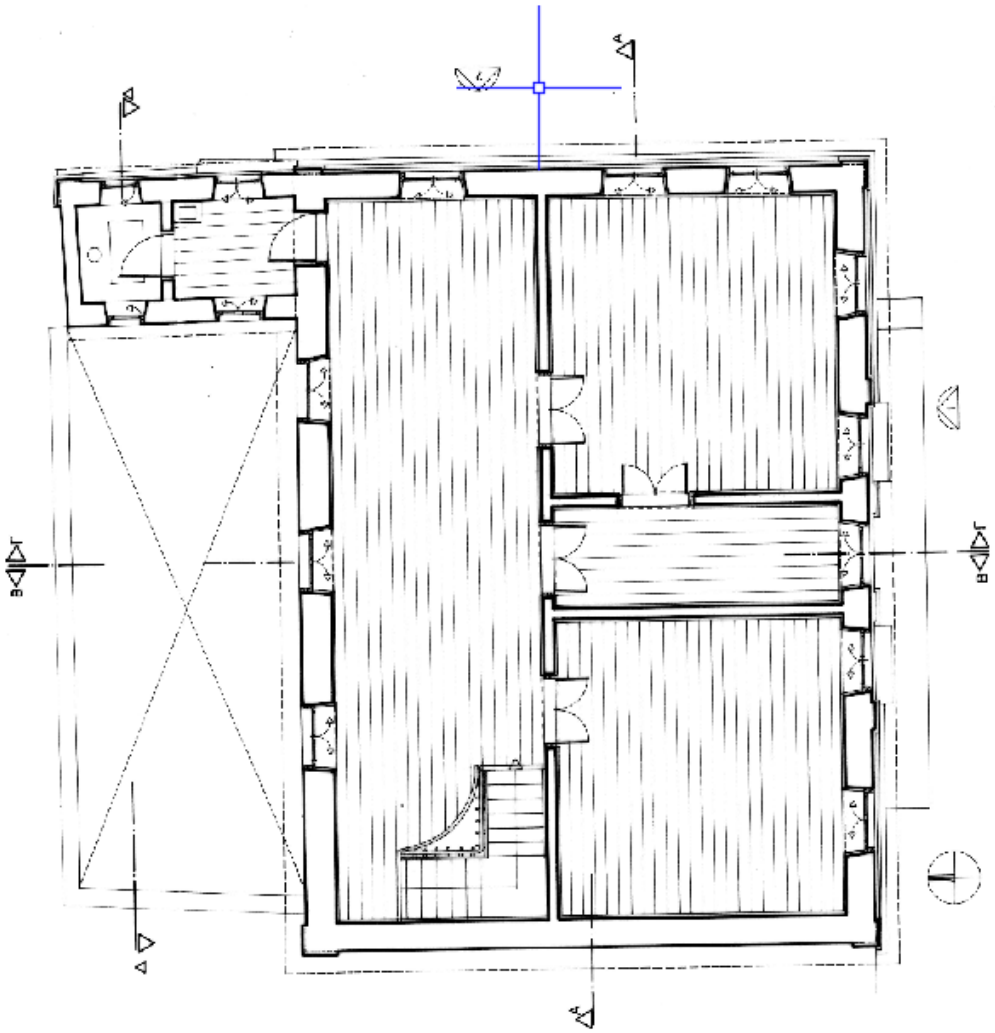
GRAPHIC SURVEY AND DOCUMENTATION



Basement plan view



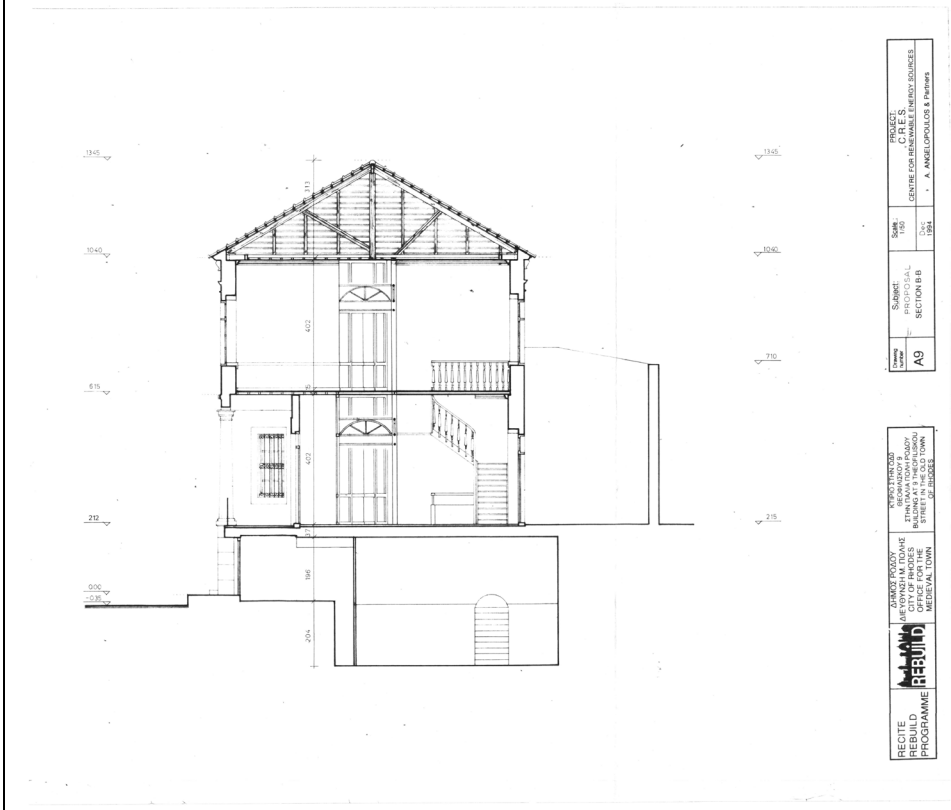
Ground plan view.

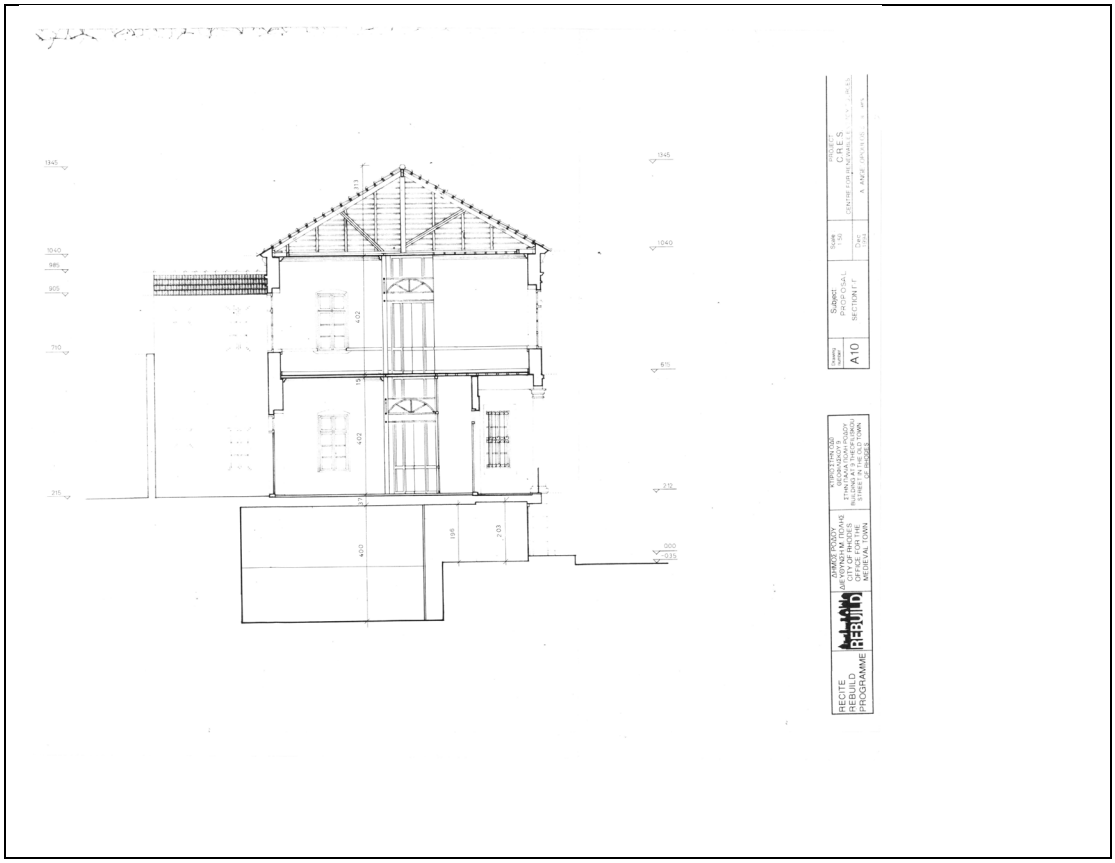


1st Floor plan View

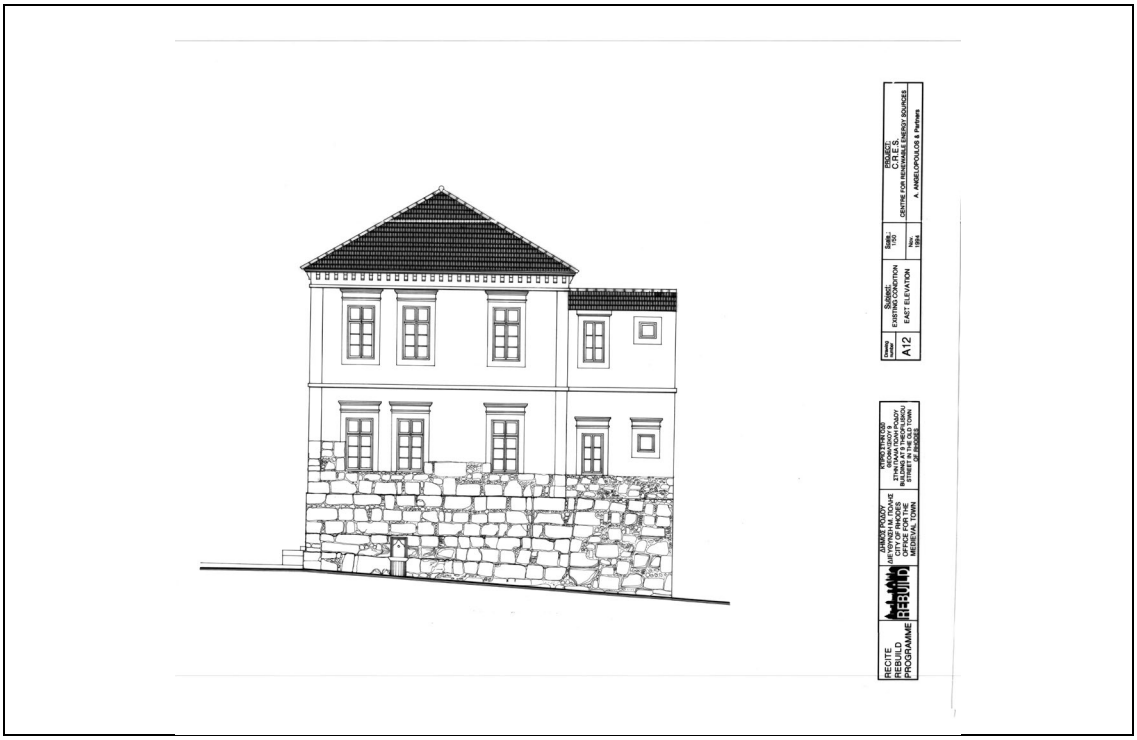
Building dimensions: length 13.6 m. Width 13.6 m and wall thickness 50-60 cm. except for the basement whose walls are 4 m thick

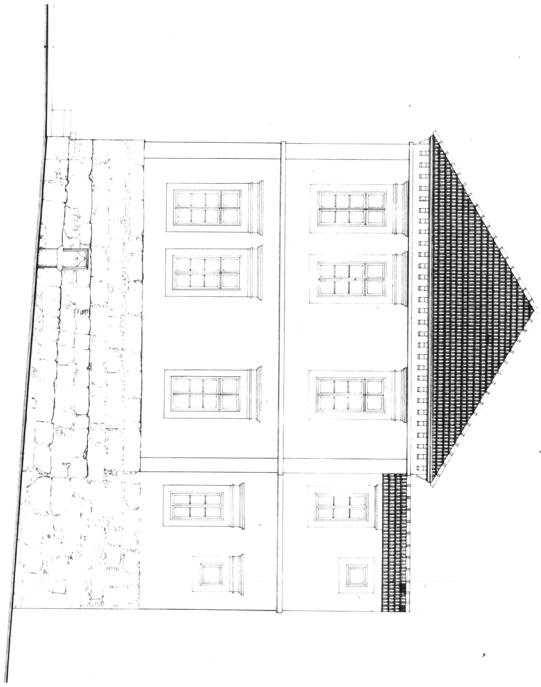
CHARACTERISTIC SECTIONS:





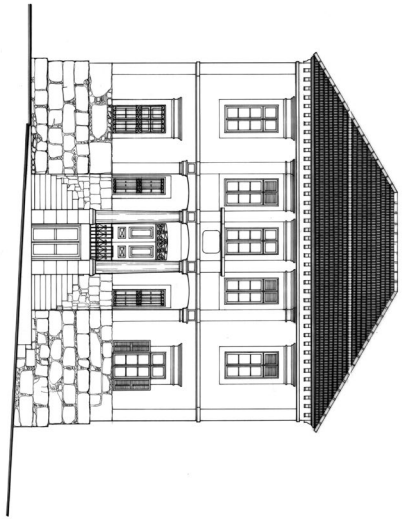
CHARACTERISTIC VIEWS





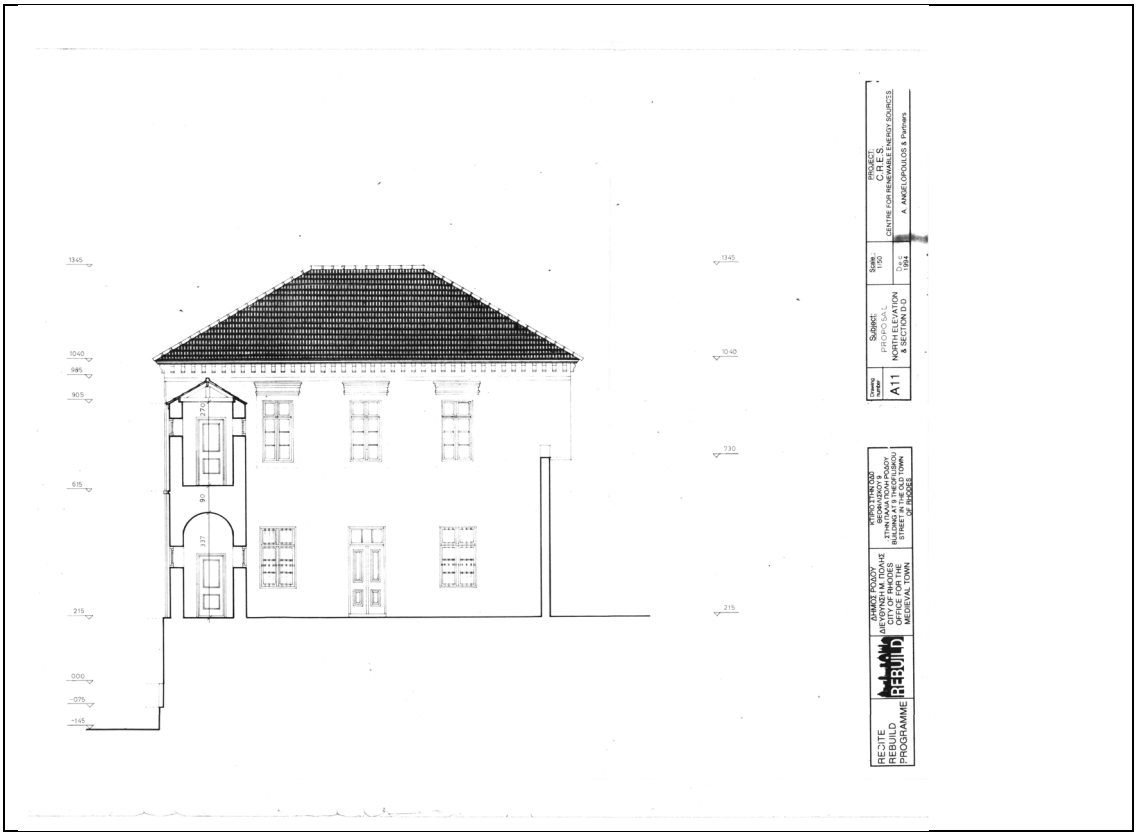
RECITE REBUILD PROGRAMME	REBUILD	ΔΗΜΟΣ ΡΟΔΟΥ ΔΙΕΥΘΥΝΣΗ Η.Μ. ΠΟΛΗΣ CITY OF RHODES OFFICE FOR THE MEDIEVAL TOWN	ΚΤΙΡΙΟ ΣΤΗΝ ΟΔΟ ΘΕΟΦΙΛΙΣΚΟΥ 9 ΣΤΗΝ ΠΑΛΑΙΑ ΠΟΛΗ ΡΟΔΟΥ BUILDING AT 9 THEOFILISKOU STREET IN THE OLD TOWN OF RHODES

Drawing number	Subject: PROPOSAL	Scale: 1:50	PROJECT: C.R.E.S. CENTRE FOR RENEWABLE ENERGY SOURCES
A12	EAST ELEVATION	Dec 1994	A. ANGELOPOULOS & Partners



RECITE REBUILD PROGRAMME	REBUILD	ΔΗΜΟΣ ΡΟΔΟΥ ΔΙΕΥΘΥΝΣΗ Η.Μ. ΠΟΛΗΣ CITY OF RHODES OFFICE FOR THE MEDIEVAL TOWN	ΚΤΙΡΙΟ ΣΤΗΝ ΟΔΟ ΘΕΟΦΙΛΙΣΚΟΥ 9 ΣΤΗΝ ΠΑΛΑΙΑ ΠΟΛΗ ΡΟΔΟΥ BUILDING AT 9 THEOFILISKOU STREET IN THE OLD TOWN OF RHODES

Drawing number	Subject: EXISTING CONDITION	Scale: 1:50	PROJECT: C.R.E.S. CENTRE FOR RENEWABLE ENERGY SOURCES
A13	SOUTH ELEVATION	Nov 1994	A. ANGELOPOULOS & Partners



PHOTOGRAPHIC DOCUMENTATION

The condition of the building before and after the restoration work is presented in the attached photos.

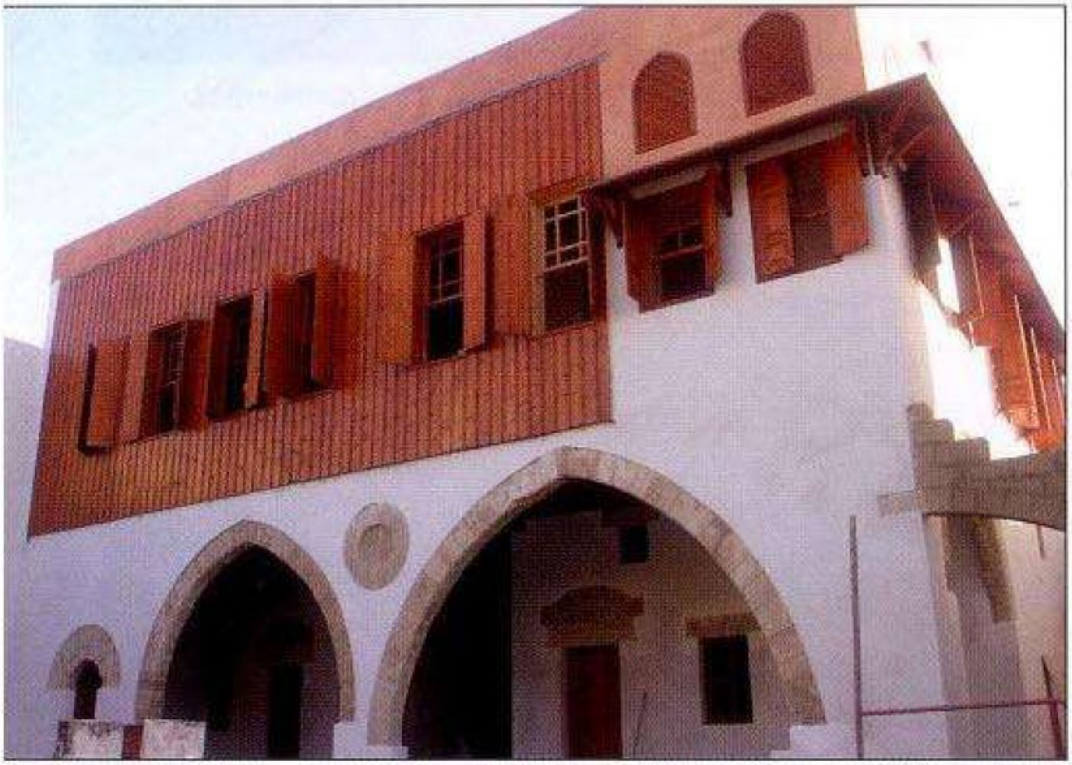


Figure shows the conditions of the building before and after the restoration works applied after 2001.

DOCUMENTATION SHEET No. 2: "Seismicity-environment"
with instructions (in italics)

ENVIRONMENTAL DATA

LOCATION

PENDING

INFLUENCE OF GEOMORFOLOGICAL AND ENVIRONMENTAL CONDITIONS

THE BUILDING is CONSTRUCTED**:**

Conditions	**YES**	**NO**	**DON'T KNOW**
With shallow foundation on loose embankment or silt			**X**
Near or on unstable natural or artificial slope		**NO**	
In area with high water level (rising humidity)			**X**
In area with floods		**NO**	
In area with polluted atmosphere		**NO**	
Near the sea (salt exposure)	**YES**		

INFLUENCE OF NEIGHBOURING BUILDINGS

THE CHURCH IS IN CONTACT WITH BELLTOWER

Existence of	**YES**	**NO**	**DON'T KNOW**
Adequate joint*			
inadequate or non-continuous joint			
Without joint			

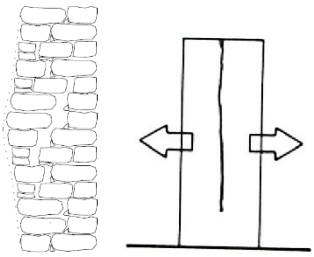
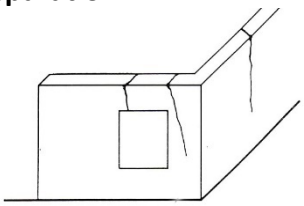
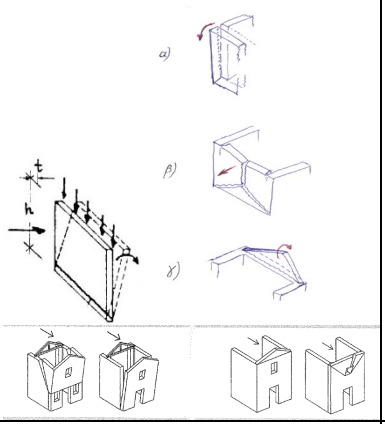
Conditions of neighbourhood	**DANGER OF STROKE**	
With other 1storey building of different height		**NO**
With building of different rigidity		**NO**
With different floor levels		**NO**
In contact with other volumnous or high structures		**NO**

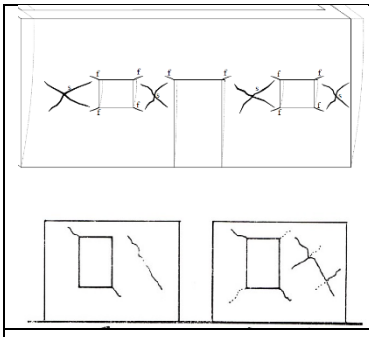
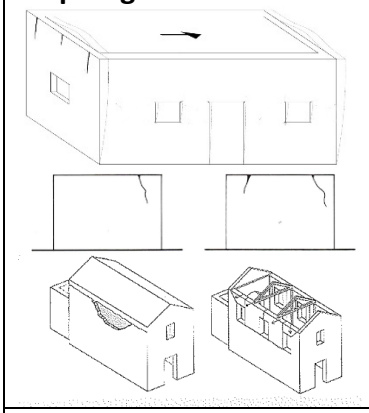
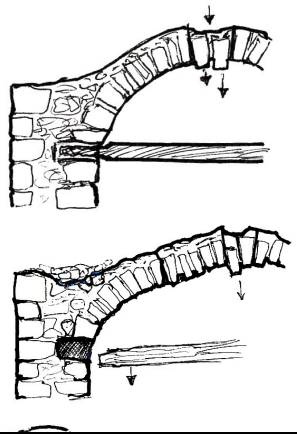
OTHER INFLUENCES

Free text about:
-NEARBY SOURCE OF VIBRATIONS (AUTOROUTE ETC) -RECENT EARTHQUAKES AND REPORTS ABOUT DAMAGES -HISTORICAL EARTHQUAKES AND INFORMATION ABOUT DAMAGES

DATA FROM MICROZONATION STUDY **NOT EXISTING**

DOCUMENTATION SHEET No. 3: “Pathology”

	Γ	B	A
Vertical cracks inside the masonry core with swelling of the wall surfaces, indicating separation of masonry leaves 			Non-existent
Cracks near the corners of intersecting walls causing separation 			Non-existent
Horizontal cracks at the base of wall or pillars or pediments or over openings (out of plane flexural cracking) 			Non-existent
Diagonal or X-shaped shear cracking			Non-existent

			
Cracks at the base of diaphragms (roofs, floors indicating poor or inexistent connection of diaphragms and walls 		Small and few cracks	
Damages in domes, apses and arches 			Non-existent
Masonry wall inclination			Non-existent

FIRST DEGREE PRE-EARTHQUAKE ASSESSMENT OF THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN PERIOD IN THE OLD TOWN OF RHODES number of Data sheet:			Rating	Number of completed questions	Calculation of the Vulnerability Index
SECTION A: IDENDITY DATA					
Name	Main name	**Neoclassical Building of The Ottoman Courthouse**			
	Other	**Vakouf Offices**			
Location	Municipality	**Rhodes**			
	Town	**Old Town of Rhodes**			
	Address	**Theofiliskou street**			
	Name of local spot	**Old Town of Rhodes**			
	Geodetic coordinates				
	Code number registered in the archaeological archive				
Description	Number of storeys	**Two-storey building with basement**			
	Area (m2)	**180sq.m+180sq.m+180sq.m**			
	Typology according to use	**The seat of the Muslim judge of Rhodes - Administrative building**			
Use and ownership	Present owner	**Ministry of Culture**			
	Initial use	**Administrative building**			
	Current use	**Historical Building**			
	Number of users	**20-30 (max. 50)**			
	Frequency of use	**Random**			
Age	Monument's age according to the period of construction	**Ottoman Period (18th-19th century)**			
Protection	Issue protected	**Architecture**			
	Legal status of protection	**Document of Characterization**			
	Responsible protection Service	**EFA of Rhodes**			
	Responsible restoration Service	**DABMM**			

IDENTIFICATION OF ENGINEERS CARRYING OUT THE ASSESSMENT	
NAME:	
SPECIALI-ZATION:	
Tel./E-MAIL:	
NAME:	
SPECIALI-ZATION:	
Tel./E-MAIL:	
Date of assessment:	

Section B : METHOD OF COSTRUCTION

(the completion of the cells should be made with english letter x)

STRUCTURAL CATEGORY	A	AB X	B	C	D	E	F	Don't know
Description of the structural system elements	The court is a two-storey neoclassical building built on the fourth from the west Byzantine tower of the Byzantine castle of Rhodes. Therefore, the basement of the building belongs to the original square Byzantine tower which consists of a dome with massive walls 4m thick. The ground floor and the first floor consist of stone structures 50-60cm thick. which hold the four-pitched wooden roof at the upper height of the building. Most of the building is plastered except for the lower parts which are connected to the surviving part of the tower.							

METHOD OF COSTRUCTION

A) Vertical bearing elements

Evaluation	C	B	A		Total number of rated questions of the Method of Construction Section
Interconnection of stone or brick elements		X		2	25
Type of stone or brick elements		X		2	
Binding mortar of the outer leaves			X	3	
Core filling material if it can be identified (it refers to three leaf masonry only)		X		2	
Vertical Ribs (buttresses, pilasters)				Not completed	
Corners and edges with chiseled stones			X	3	
Chainages (placement)			X	3	

Chainages (type)			X	3	Number of completed questions of section A	
Chainages (number of horizontal layers)			X	3		
Connections between chainage elements (mortices, joints)			X	3		
Chainage (condition of building materials: wood, reinforced concrete, steel)			X	3		
One sided reinforced concrete coating				Not completed		
Double sided reinforced concrete coating				Not completed		
Timber Frame Masonry wall (condition of wooden columns, beams,tsatmas)				Not completed		
Exterior steel masonry braces				Not completed		
B) Horizontal or inclined bearing elements					10	
Evaluation	**C**	**B**	**A**			
Timber or steel trusses (condition of materials and connections between the elements)		X		2	Number of completed questions of section B	
Bearing elements of horizontal roof (condition of materials and connections between the elements)	X			1		
Connection with vertical walls	X			1		
Chainage at the connection area				Not completed		
Domes or arches				Not completed		
Arched ribs				Not completed		
Tendons, ties				Not completed	3	
Γ) Geometrical Characteristics						
Evaluation	**C**	**B**	**A**			
Ratio of wall length to wall thickness	X			1	Number of completed questions of section Γ	Vulnerability Index of the Method of Construction Section
Ratio of wall height to wall thickness	X			1		
Additional height of pediment or bell tower (vertical cantilever)				Not completed		
Arrangement of openings			X	3		

Openings near the corners	X						1	4	54.41
Section C: SEISMIC ACTION (the completion of the cells should be made with english letter x)								The questions of Seismic Action should always be completed	
SEISMIC ZONE ACCORDING TO EC-8 and National Annex	I		II		III				
			X				2.4		
Data from microzonation study (if elaborated)									
Ground type	A	B	C	D	E	S1 S2			
Based on scientific data/survey							0		
Estimation (not certain)		X					1		
ADDITIONAL DATA INFLUENCING SEISMIC ACTION									
Evaluation of influence	**Influence coefficient**						Influence coefficient of Additional Data		
Negative impact of geomorfological or environmental conditions							1		Vulnerability Index of the Seismic Action Section 42.50
Danger of stroke by neighbouring buildings							1		
Section D: PATHOLOGY (the completion of the cells should be made with english letter x)									
GENERAL CONDITION OF DAMAGES									
Evaluation	C		B		A				
General condition of masonry damages					X		75		Vulnerability Index of the Pathology Section 50.00
Damages in domes, apses, arches					X		75		
Damages on roofs and floors			X				50		
SERIOUS LOCAL DAMAGE:									
Description of the problem:									
Proposed urgent measures:									
Proposed urgent investigations/surveys:									
									Final Vulnerability Index 146.91

FIRST DEGREE PRE-EARTHQUAKE ASSESSMENT OF THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN PERIOD IN THE OLD TOWN OF RHODES

IDENDITY DATA

In the present assessment sheets, the Neoclassical School in Panaitios street is examined, before the restoration works.

1	Name	Main name	Neoclassical School in Panaitios street
2		Other	Catholic church of Agios Ioannis of the Knights of Rhodes
3	Location	Municipality	Rhodes
4		Town	Old Town of Rhodes
5		Address	Panaitios street
6		Name of local spot	Old Town of Rhodes
7		Geodetic coordinates	
8		Code number registered in the archaeological archive	
9	Description	Number of storeys	Ground floor construction
10		Area (m2)	900sq.m. - almost square (31.70m x 32.60m), with an internal rectangular patio
11		Typology according to use	School – Educational Use
12	Use and ownership	Present owner	Ministry of Culture
13		Initial use	Catholic church of Agios Ioannis of the Knights of Rhodes
14		Current use	Historical Building
15		Number of users	30-40 (max. 50)
16		Frequency of use	Random
17	Age	Monument's age according to the period of construction	1898 - Ottoman Period (18th-19th century)
18	Protection	Issue protected	Architecture
19		Legal status of protection	Document of Characterization
20		Responsible protection Service	EFA of Rhodes
21		Responsible restoration Service	DABMM

IDENTIFICATION OF ENGINEERS CARRYING OUT THE ASSESSMENT

22	**NAME:**		
	SPECIALI-ZATION:		
	TEL. /E-MAIL:		

TECHNICAL DATA

23	**STRUCTURAL CATEGORY**	**A**	**AB** X	**B**	**C**	**D**	**E**	**F**	**Don't know**
24	**Description of the structural system elements**	The current building is an elevated ground floor of masonry, almost square (31.70m x 32.60m), with an internal rectangular patio and perimeter gallery, from where the twelve smaller or larger rooms have access (total built-up area of 912 sq.m.). The four wings are housed with wooden gabled roofs with French tiles, while in the center there is the atrium which is accessed by two gates east and west and corresponding entrances. The only difference in the structural system of the building is the partition wall in the south hall of the eastern side, which was an addition to the initial structure and was made of lath and plaster (the so-called bagdati). This method of constructing walls or ceilings was a common construction during the Ottoman period. The exteriors are dominated by symmetry. On either side of the entrances, on the east and west sides, are four large windows, while the north and south have nine windows. The facades are with plastered stone structures, while the bases below the floor height have an obvious stone structure made of rectangular stones and kyphosis. The load bearing system of the structure consists of vertical walls, made of local poros stone, with height about 5.68m and thicknesses ranging from 31cm in interior to 54cm in the perimeter. It is easily noticed that the material of walls has a low strength in general, and there is a great variety in the dimensions of the stones used. Moreover, the construction of the façade is not so meticulous.							

		It should also be mentioned the complete absence of timber throughout the height of the masonry and throughout their thickness, a technique that is found in older Ottoman constructions, even in masonry walls with small height. This fact may testify to the poor economic situation that prevailed in Rhodes at the end of the 19th century after the successive natural disasters from earthquakes and fires that occurred from 1856 onwards, as well as the need for rapid construction of the school after the destruction of A. phase. All the walls are connected at the intersections with involved poros stones in 2-3 rows of stones, with the exception of the two transverse dividers. The joints are uneven with rich mortar in a large part of their thickness (and with a large percentage of gaps as well) and with usually embedded small stones and ceramics (chips) to cover the gaps or to reduce the width of the joints and the amount of mortars. Mortars are plasters with the possible presence of pozzolans, aggregates of natural origin with angular edges, pieces of wood and coal grains.

METHOD OF COSTRUCTION

a) vertical bearing elements

Evaluation		C	B	A
25	Interconnection of stone or brick elements		X	
26	Type of stone or brick elements	X		
27	Binding mortar of the outer leaves	X		
28	Core filling material if it can be identified (it refers to three leaf masonry only)			
~~29~~	~~Vertical Ribs (buttresses, pilasters)~~			
30	Corners and edges with chiseled stones		X	
31	Chainages (placement)	X		
32	Chainages (type)	X		
33	Chainages (number of horizontal layers)	X		
34	Connections between chainage elements (mortices, joints)	X		
35	Chainage (condition of building materials: wood, reinforced concrete, steel)	X		
~~36~~	~~One sided reinforced concrete coating~~		----	---

~~37~~	~~Double sided reinforced concrete coating~~			---
38	Timber Framed Masonry wall (condition of wooden columns, beams, tsatmas)			
~~39~~	~~Exterior steel masonry braces~~			

B) Horizontal or inclined bearing elements

	Evaluation	C	B	A
40	Timber or steel trusses (condition of materials and connections between the elements)		X	
41	Bearing elements of horizontal roof (condition of materials and connections between the elements)	X		
42	Connection with vertical walls	X		
~~43~~	~~Chainage at the connection area~~			
~~44~~	~~Domes or arches~~			
~~45~~	~~Arched ribs~~			
~~46~~	~~Tendons, ties~~			

GEOMETRICAL CHARACTERISTICS

	Evaluation	C	B	A
47	Ratio of wall length to wall thickness	X (0.06)		
48	Ratio of wall height to wall thickness	X (0.06)		
49	Additional height of pediment or bell tower (vertical cantilever)			
50	Arrangement of openings			X
51	Openings near the corners	X (1.00)		

C: SEISMIC ACTION

52	SEISMIC ZONE ACCORDING TO EC-8 and National Annex	I	II X	III
53	Data from microzonation study (if elaborated)			

	Ground type	A	B	C	D	E	S1 S2
54	Based on scientific data/survey						
55	Estimation (not certain)		X				

ADDITIONAL DATA INFLUENCING SEISMIC ACTION

	Evaluation of influence	Influence coefficient

56	Negative impact of geomorphological or environmental conditions	
57	Danger of stroke by neighbouring buildings	

D: PATHOLOGY

GENERAL CONDITION OF DAMAGES

	Evaluation	C	B	A
58	General condition of masonry damages	X		
59	Damages in domes, apses, arches	X		
60	Damages on roofs and floors	X		

SERIOUS LOCAL DAMAGE:

Description of the problem:

61	

Proposed urgent measures:

62	

Proposed urgent investigations/surveys:

63	

DOCUMENTATION SHEET No. 1: "field survey – design and photographic documentation"
with instructions (in italics)

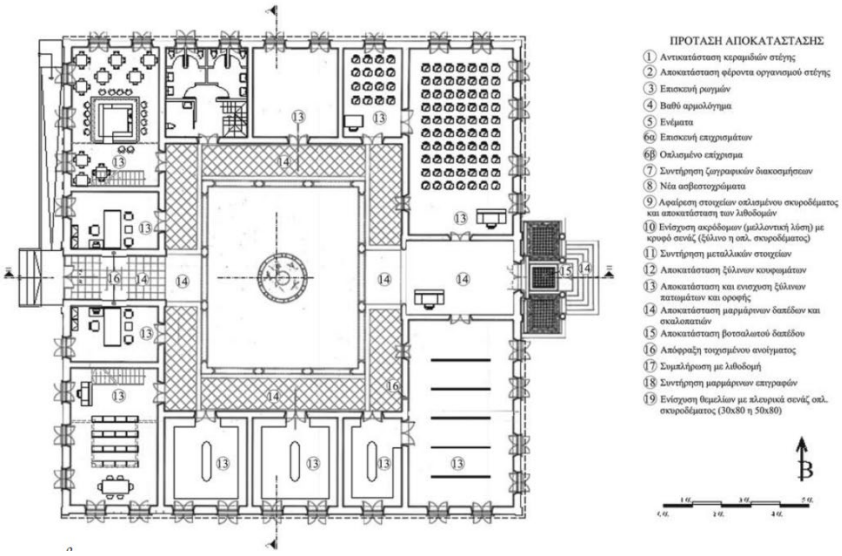
AVAILABLE FORMER SURVEY

Type of survey and documentation	**climax/list of plans**	**Author and date of survey**
Topographic survey		
Architectural survey and documentation	YES	K.Manoussou-Della
Structural survey and documentation	YES	M.Callioudakis Civil ENgineer
Pathology		T.D.P .E.A.E.

FORMER INTERVENTIONS

FORMER INTERVENTIONS	The west wing of the building was reinforced during the 1970s with reinforced concrete elements after the appearance of very severe cracks which, however, continued to expand to the other wings, despite the implementation of this reinforcement measure. The cause of these landslides, as it turned out, was the foundation of the building on rubble placed in the crater of the eruption of 1856 that destroyed the catholic church of Agios Ioannis and which came from the firing of the forgotten powder magazine in its bell tower.
Last restoration**	
I don't know	

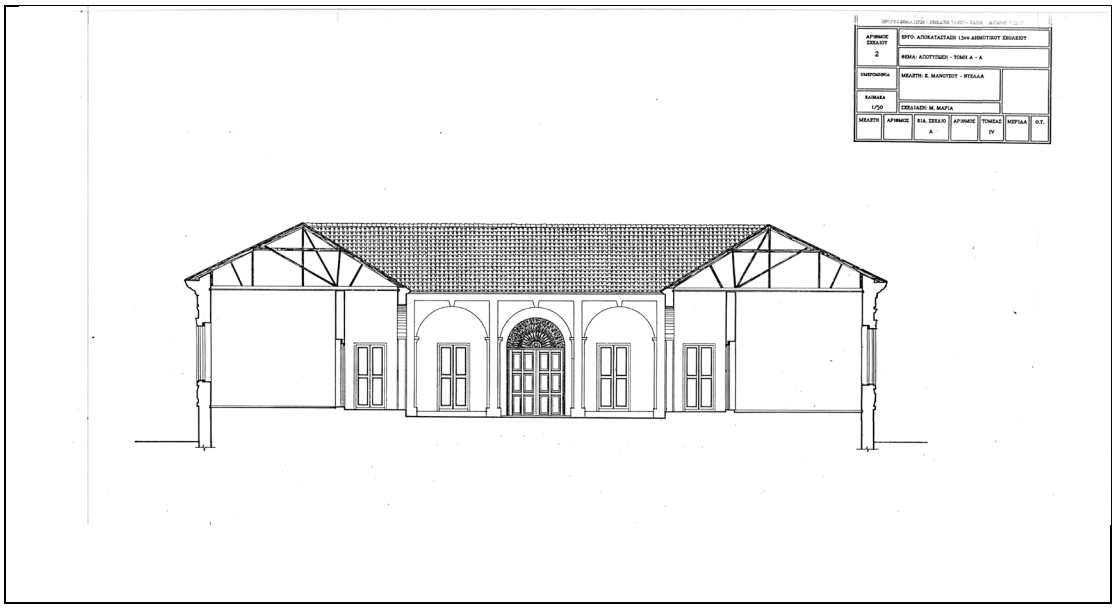
GRAPHIC SURVEY AND DOCUMENTATION



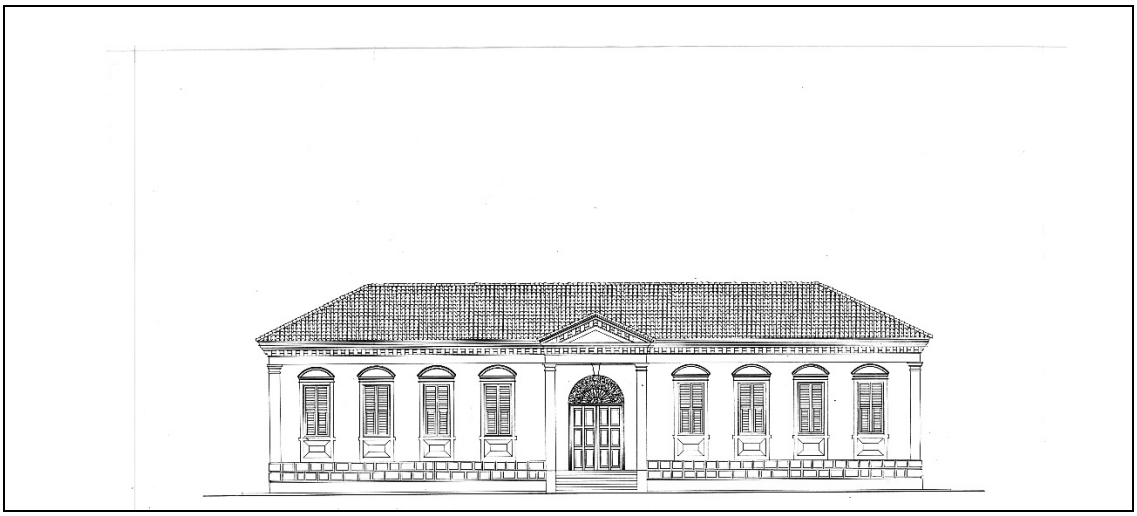
ground floor plan

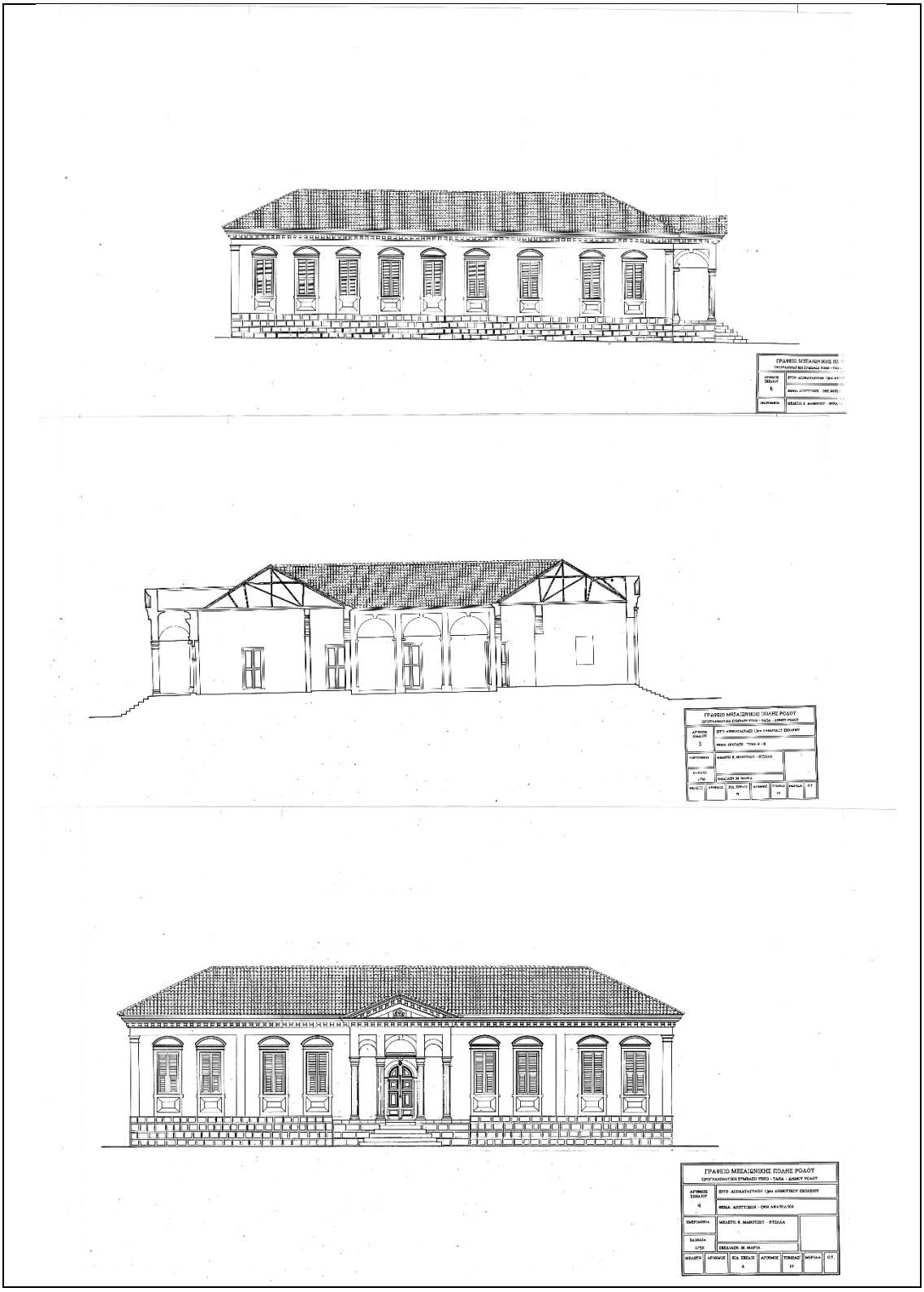
The current building is an elevated ground floor, almost square (31.70m x 32.60m), with an internal rectangular patio and perimeter gallery, from where the twelve smaller or larger rooms have access (total built-up area of 912 sq.m.)

CHARACTERISTIC SECTIONS:



CHARACTERISTIC VIEWS





PHOTOGRAPHIC DOCUMENTATION

Aerial View of the school

North side of the school

The entrance of the school with the ladder, the porch and the arch

DOCUMENTATION SHEET No. 2: "Seismicity-environment"
with instructions (in italics)

ENVIRONMENTAL DATA

LOCATION

PENDING

INFLUENCE OF GEOMORFOLOGICAL AND ENVIRONMENTAL CONDITIONS

THE BUILDING is CONSTRUCTED**:**

Conditions	**YES**	**NO**	**DON'T KNOW**
With shallow foundation on loose embankment or silt			**X**
Near or on unstable natural or artificial slope		**NO**	
In area with high water level (rising humidity)		**NO**	**X**
In area with floods		**NO**	
In area with polluted atmosphere		**NO**	
Near the sea (salt exposure)	**YES**		

INFLUENCE OF NEIGHBOURING BUILDINGS

THE CHURCH IS IN CONTACT WITH BELLTOWER

Existence of	**YES**	**NO**	**DON'T KNOW**
Adequate joint*			
inadequate or non-continuous joint			
Without joint			

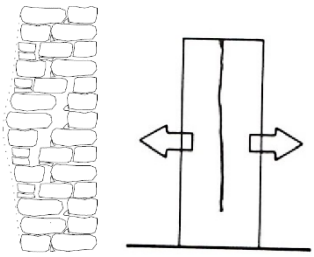
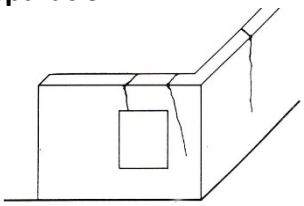
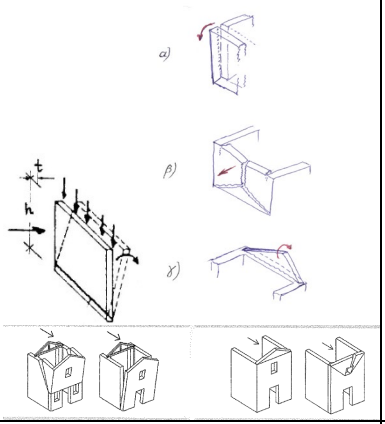
Conditions of neighbourhood	**DANGER OF STROKE**	
With other 1storey building of different height		**NO**
With building of different rigidity		**NO**
With different floor levels		**NO**
In contact with other volumnous or high structures		**NO**

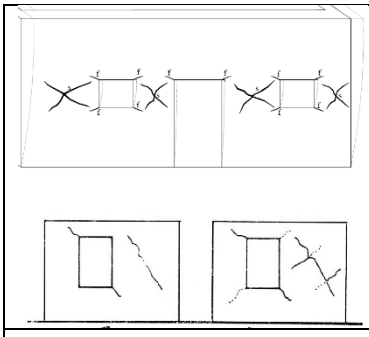
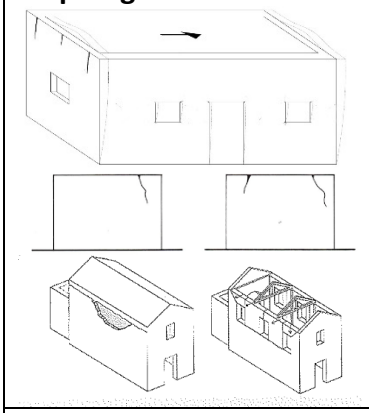
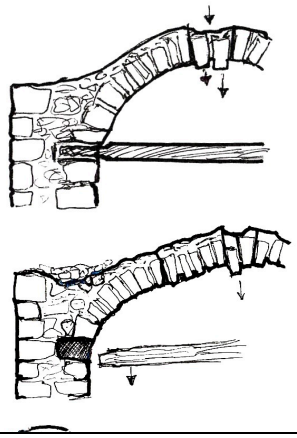
OTHER INFLUENCES

Free text about:
-NEARBY SOURCE OF VIBRATIONS (AUTOROUTE ETC) -RECENT EARTHQUAKES AND REPORTS ABOUT DAMAGES -HISTORICAL EARTHQUAKES AND INFORMATION ABOUT DAMAGES

DATA FROM MICROZONATION STUDY **NOT EXISTING**

DOCUMENTATION SHEET No. 3: “Pathology”

	Г	В	А
Vertical cracks inside the masonry core with swelling of the wall surfaces, indicating separation of masonry leaves 	Serious swelling of both masonry leaves		
Cracks near the corners of intersecting walls causing separation 	Disconnection of walls near the corners. Broad and long cracks through the wall		
Horizontal cracks at the base of wall or pillars or pediments or over openings (out of plane flexural cracking) 	Very serious cracks, even if thin		
Diagonal or X-shaped shear cracking	Many long cracks over		

	openings and in the area of piers		
Cracks at the base of diaphragms (roofs, floors indicating poor or inexistent connection of diaphragms and walls 		Small and few cracks	
Damages in domes, apses and arches 			Non-existent
Masonry wall inclination			Non-existent

FIRST DEGREE PRE-EARTHQUAKE ASSESSMENT OF THE BUILDINGS CONSTRUCTED DURING THE OTTOMAN PERIOD IN THE OLD TOWN OF RHODES number of Data sheet:			Rating	Number of completed questions	Calculation of the Vulnerability Index
SECTION A: IDENDITY DATA					
Name	Main name	**Neoclassical School in Panaitios street**			
	Other	**Catholic church of Agios Ioannis of the Knights of Rhodes**			
Location	Municipality	**Rhodes**			
	Town	**Old Town of Rhodes**			
	Address	**Panaitios street**			
	Name of local spot	**Old Town of Rhodes**			
	Geodetic coordinates				
	Code number registered in the archaeological archive				
Description	Number of storeys	**Ground floor construction**			
	Area (m2)	**900sq.m. - almost square (31.70m x 32.60m), with an internal rectangular patio**			
	Typology according to use	**School – Educational Use**			
Use and ownership	Present owner	**Ministry of Culture**			
	Initial use	**Catholic church of Agios Ioannis of the Knights of Rhodes**			
	Current use	**Historical Building**			
	Number of users	**30-40 (max. 50)**			
	Frequency of use	**Random**			
Age	Monument's age according to the period of construction	**1898 - Ottoman Period (18th-19th century)**			
Protection	Issue protected	**Architecture**			
	Legal status of protection	**Document of Characterization**			
	Responsible protection Service	**EFA of Rhodes**			

	Responsible restoration Service	**DABMM**
IDENTIFICATION OF ENGINEERS CARRYING OUT THE ASSESSMENT		
NAME:		
SPECIALI-ZATION:		
Tel./E-MAIL:		
NAME:		
SPECIALI-ZATION:		
Tel./E-MAIL:		
Date of assessment:		

Section B : METHOD OF COSTRUCTION

(the completion of the cells should be made with english letter x)

STRUCTURAL CATEGORY	**A**	**AB X**	**B**	**C**	**D**	**E**	**F**	**Don't know**
	he current building is an elevated ground floor of masonry, almost square (31.70m x 32.60m), with an internal rectangular patio and perimeter gallery, from where the twelve smaller or larger rooms have access (total built-up area of 912 sq.m.). The four wings are housed with wooden gabled roofs with French tiles, while in the center there is the atrium which is accessed by two gates east and west and corresponding entrances. The only difference in the structural system of the building is the partition wall in the south hall of the eastern side, which was an addition to the initial structure and was made of lath and plaster (the so-called bagdati). This method of							

Description of the structural system elements	constructing walls or ceilings was a common construction during the Ottoman period. The exteriors are dominated by symmetry. On either side of the entrances, on the east and west sides, are four large windows, while the north and south have nine windows. The facades are with plastered stone structures, while the bases below the floor height have an obvious stone structure made of rectangular stones and kyphosis. The load bearing system of the structure consists of vertical walls, made of local poros stone, with height about 5.68m and thicknesses ranging from 31cm in interior to 54cm in the perimeter. It is easily noticed that the material of walls has a low strength in general, and there is a great variety in the dimensions of the stones used. Moreover, the construction of the façade is not so meticulous. It should also be mentioned the complete absence of timber throughout the height of the masonry and throughout their thickness, a technique that is found in older Ottoman constructions, even in masonry walls with small height. This fact may testify to the poor economic situation that prevailed in Rhodes at the end of the 19th century after the successive natural disasters from earthquakes and fires that occurred from 1856 onwards, as well as the need for rapid construction of the school after the destruction of A. phase. All the walls are connected at the intersections with involved poros stones in 2-3 rows of stones, with the exception of the two transverse dividers. The joints are uneven with rich mortar in a large part of their thickness (and with a large percentage of gaps as well) and with usually embedded small stones and ceramics (chips) to cover the gaps or to reduce the width of the joints and the amount of mortars. Mortars are plasters with the possible presence of pozzolans, aggregates of natural origin with angular edges, pieces of wood and coal grains.					Total number of rated questions of the Method of Construction Section
METHOD OF COSTRUCTION						
A) Vertical bearing elements						
Evaluation	**C**	**B**	**A**			
Interconnection of stone or brick elements		X		2	25	
Type of stone or brick elements	X			1		
Binding mortar of the outer leaves	X			1		
Core filling material if it can be identified (it refers to three leaf masonry only)				Not completed		

Vertical Ribs (buttresses, pilasters)				Not completed	Number of completed questions of section A	
Corners and edges with chiseled stones		X		2		
Chainages (placement)	X			1		
Chainages (type)	X			1		
Chainages (number of horizontal layers)	X			1		
Connections between chainage elements (mortices, joints)	X			1		
Chainage (condition of building materials: wood, reinforced concrete, steel)	X			1		
One sided reinforced concrete coating				Not completed		
Double sided reinforced concrete coating				Not completed		
Timber Frame Masonry wall (condition of wooden columns, beams,tsatmas)				Not completed		
Exterior steel masonry braces				Not completed		
B) Horizontal or inclined bearing elements					9	
Evaluation	**C**	**B**	**A**			
Timber or steel trusses (condition of materials and connections between the elements)		X		2	Number of completed questions of section B	
Bearing elements of horizontal roof (condition of materials and connections between the elements)	X			1		
Connection with vertical walls	X			1		
Chainage at the connection area				Not completed		
Domes or arches				Not completed		
Arched ribs				Not completed		
Tendons, ties			X	3	4	
Γ) Geometrical Characteristics						
Evaluation	**C**	**B**	**A**			
Ratio of wall length to wall thickness	X			1	ted questions n Γ	k of the uction

Ratio of wall height to wall thickness	X						1	Number of complete of sectio	Vulnerability Index Method of Constr Section
Additional height of pediment or bell tower (vertical cantilever)	X						1		
Arrangement of openings				X			3		
Openings near the corners	X						1	5	34.72
Section C: SEISMIC ACTION (the completion of the cells should be made with english letter x)								The questions of Seismic Action should always be completed	
SEISMIC ZONE ACCORDING TO EC-8 and National Annex	I		II		III				
			X				2.4		
Data from microzonation study (if elaborated)									
Ground type	A	B	C	D	E	S1 S2			
Based on scientific data/survey							0		
Estimation (not certain)		X					1		
ADDITIONAL DATA INFLUENCING SEISMIC ACTION							Influence coefficient of Additional Data		
Evaluation of influence	**Influence coefficient**								
Negative impact of geomorfological or environmental conditions							1		Vulnerability Index of the Seismic Action Section
Danger of stroke by neighbouring buildings							1		42.50
Section D: PATHOLOGY (the completion of the cells should be made with english letter x)									
GENERAL CONDITION OF DAMAGES									
Evaluation	C		B		A				
General condition of masonry damages	X						25		Vulnerability Index of the Pathology Section
Damages in domes, apses, arches	X						25		
Damages on roofs and floors	X						25		

SERIOUS LOCAL DAMAGE:			**25.00**
Description of the problem:			
			Final Vulnerability Index
Proposed urgent measures:			
Proposed urgent investigations/surveys:			
			102.22