Chapter 5 – Description of the building

5.1 General Description

The building used for the study of seismic response seismic loadings near-field is an eight-storey building of reinforced concrete. The building is located in the municipality of Athens, on N.Smirni, street Plastiras Street 118.
The building consists of eight floors, of which the first is ground floor. It has a total height of 21,8 m and the dimensions of the floor plan is 16,7 * 16,02 m^2. The ground floor has a height of 2,75 m and the remaining floors are 2,55 m. Also there is a basement dimensions 32.1 * 16.22 m. Here are the top view (Figure 5.1) and the section of the building (Figure 5.2)

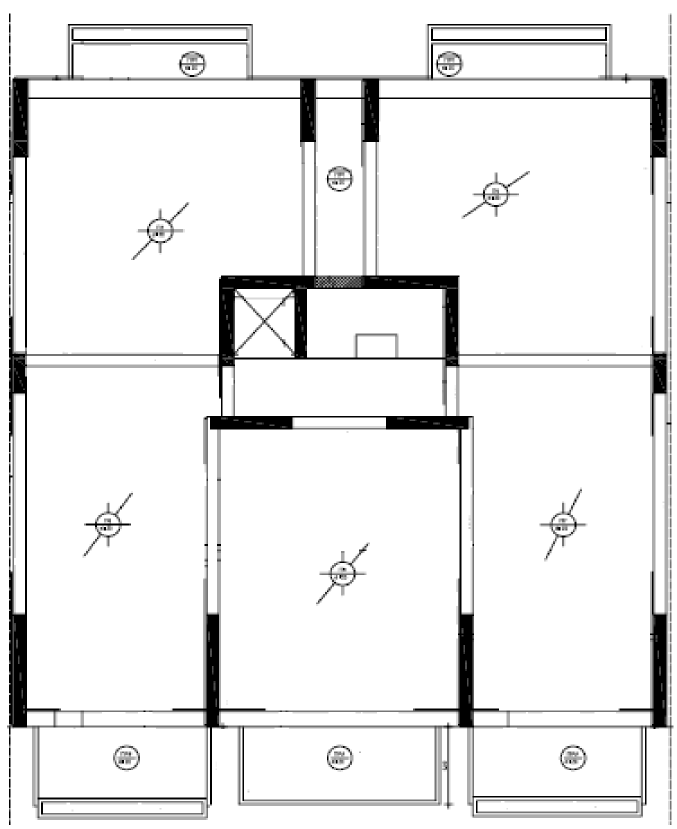

Fig 5.1 Plane view of the building

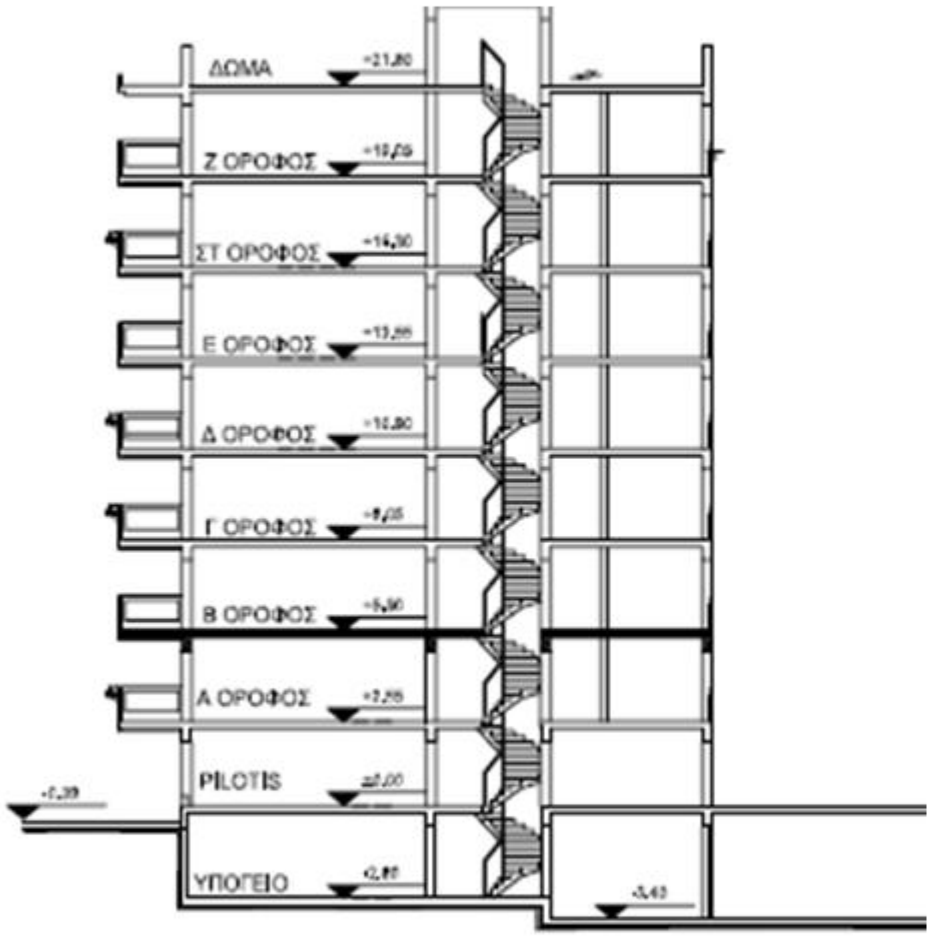

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Fig 5.2 Sectional view of the building

5.2 Assumptions study

The building is located in an area with seismic hazard zone I, which has ground acceleration a = 0,16 g. The building's seismic class design is II, when the importance factor is $\gamma 1$ = 1.00. The construction is based on soil class B. The building is made of reinforced concrete when the seismic behavior factor is $_{qd}$= 3,5. The damping of the building is ζ = 5%

5.3 Materials

Concrete

The concrete used for construction of the building is C20/25 (with fck = 20 MPa)

Steel reinforcement

The reinforcing steel used was quality S500 (fyk = 500 MPa)

5.4 Members Construction

5.4.1 Beams

The cross section of a beam of the structure is shown in Figure 5.3 and the side view in the Figure 5.4. Here are given the dimensions of the beam, and the provision of longitudinal and transverse reinforcement.

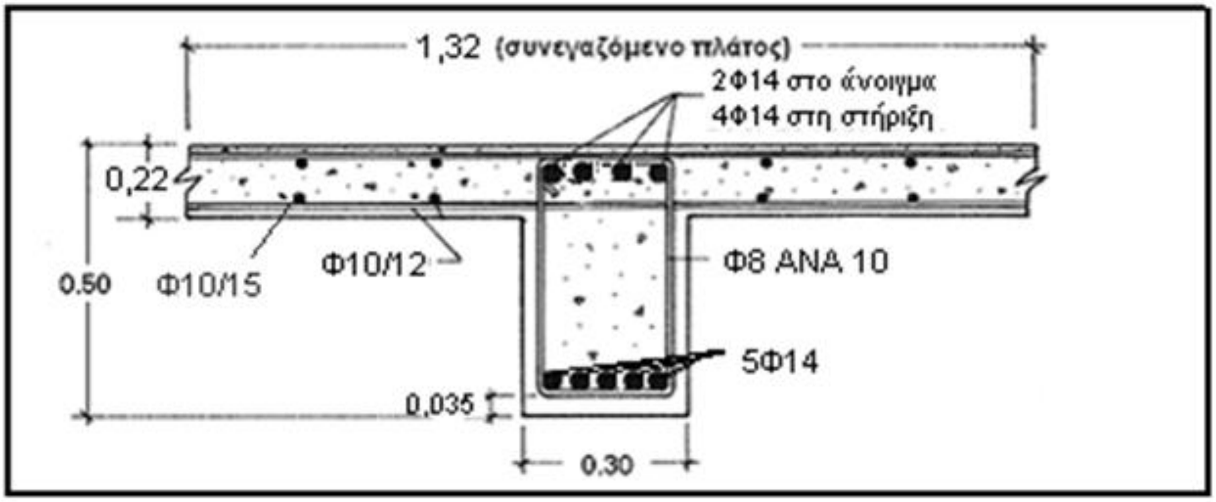

Fig5.3 Cross section of the beam

The layout of the main reinforcement, as shown in Figures 5.3 satisfies all the requirements of the codes, including the requirement that the compression reinforcement of a section to be at least 50 percent of the tension. The intersection is considered as T section with effective width equal to 1.32 m which is less than the distance from the center of a plate to the other.

5.4.2 Walls

A cross section of the wall of the structure shown below.

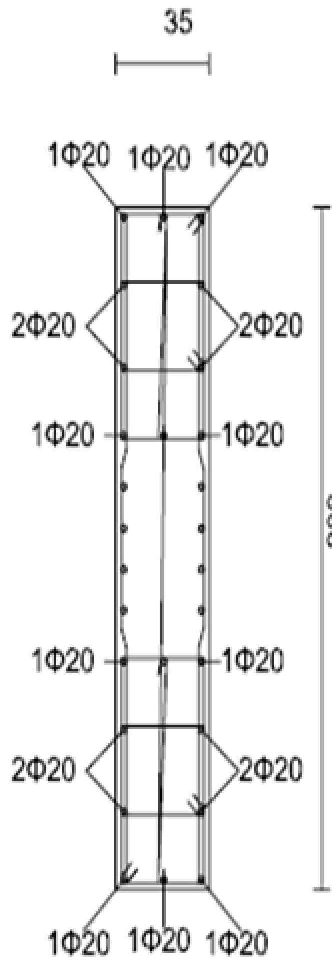

Fig 5.4 Cross section of the wall

The details of stirrups for shear walls vary between members of the construction. There are three different types of transverse reinforcement. For all the walls of the second floor and all floors supernatants as the last, fasteners consist of bars D10 diameter, square-shaped ring, spaced 100 mm height of the wall. The walls of the first floor fasteners placed every 100mm and consist of bars diameter D10 or D12, square-shaped ring.

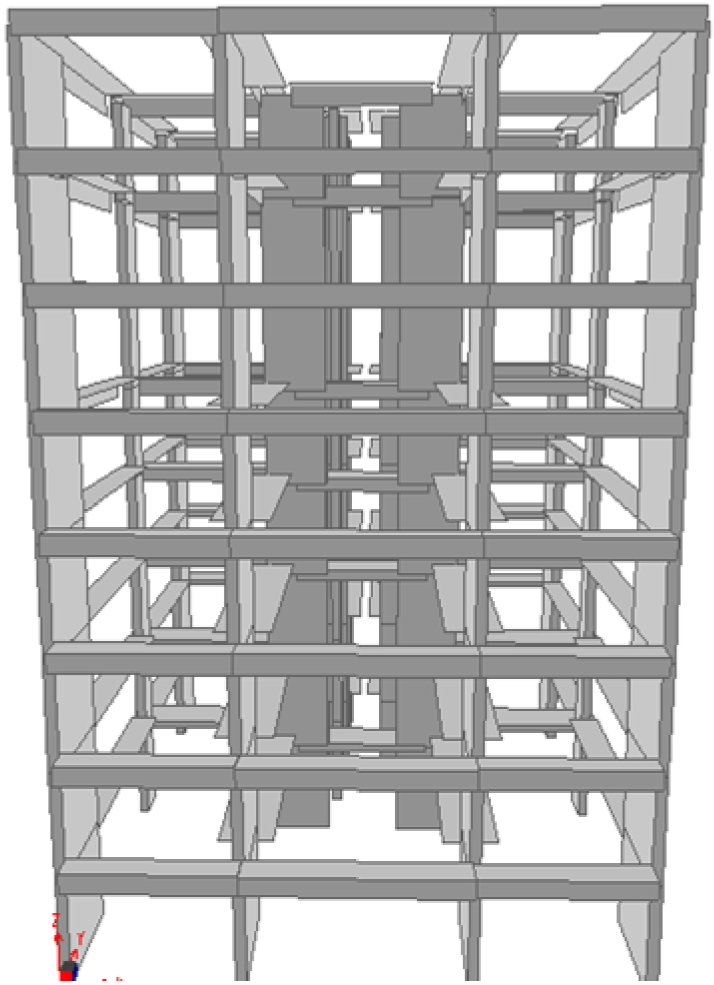

Fig 5.5 3D model of the building using SAP2000

The interior beams of the building to simulate linear elements of T shape while the perimeter beams with angular sections (C). The walls simulate linear rectangular elements. The carrier materials are considered weightless. The loads are distributed to the rafters, These loads arising from the same weights of the beams, permanent (dead) loads plates, coatings, masonry loads and live loads. The distribution of the loads of the plates in the beams is as follows:

Eventually the loads applied to the data is the same on each floor and in the table below:

Beam	F3 (kN/m)	F3 (kN/m)
	Dead	Live
1	23.1	6.7
3	23.1	6.7
4	23.96	5.42
5	23.96	5.42
6	24.21	15.15
7	24.21	15.15
8	24.21	15.15
9	27.8	5.37
10	24.7	4.48
11	36.95	9.13
12	8.24	0.93
13	13.86	2.53
14	13.86	2.53
15	36.95	9.13
16	8.24	0.93
17	27.8	5.37
18	24.7	4.48
19	25.85	5.96

Walls	F3 (kN/m)	F3 (kN/m)
	Dead	Live
A	-129.01	-36.86
B	-145.39	-41.54

Table 5.1 The loads

An important parameter of the construction components is obtained yp'opsin stiffness in structural analysis. The program has the ability to calculate and take in analyzing the cracked section stiffness, instead uses the initial stiffness of the entire section where user input initially. Therefore had to calculate and introduce the properties of the stiffness of the cracked section. The U.S. regulation FEMA 356 provides:

The stiffness of data must be calculated considering the shear behavior, flexural behavior, behavior and axial sliding of the reinforcement. Also to be taken into consideration the stress distribution in the element due to volumetric changes in the effects of temperature and shrinkage, the age of the building and the deflection of gravity loads and the earthquake. Table 6.5 of Regulation FEMA 356 states that the stiffness of the cracked section of the beam is half of the corresponding uncracked and similarly for the walls.

Finally, to complete the simulation of the introduced the locations of potential plastic hinges in the . For beams while the positions of plastic hinges is the beginning and end of each beam. For particular walls, possible positions of plastic hinges placed at the base of the shear walls.

5.5 Mode Shapes of the building

A modal analysis of the test building is also carried out using the same software SAP 2000. The resulting elastic periods and mode shapes have been determined in the Y-direction. The fundamental mode shape has a period of:

Period (sec)
1.40
0.83
0.59
0.37
0.22
0.21
0.12
0.105
0.103
0.097335
0.097322
0.0941

Table 5.2 Modal periods of the building