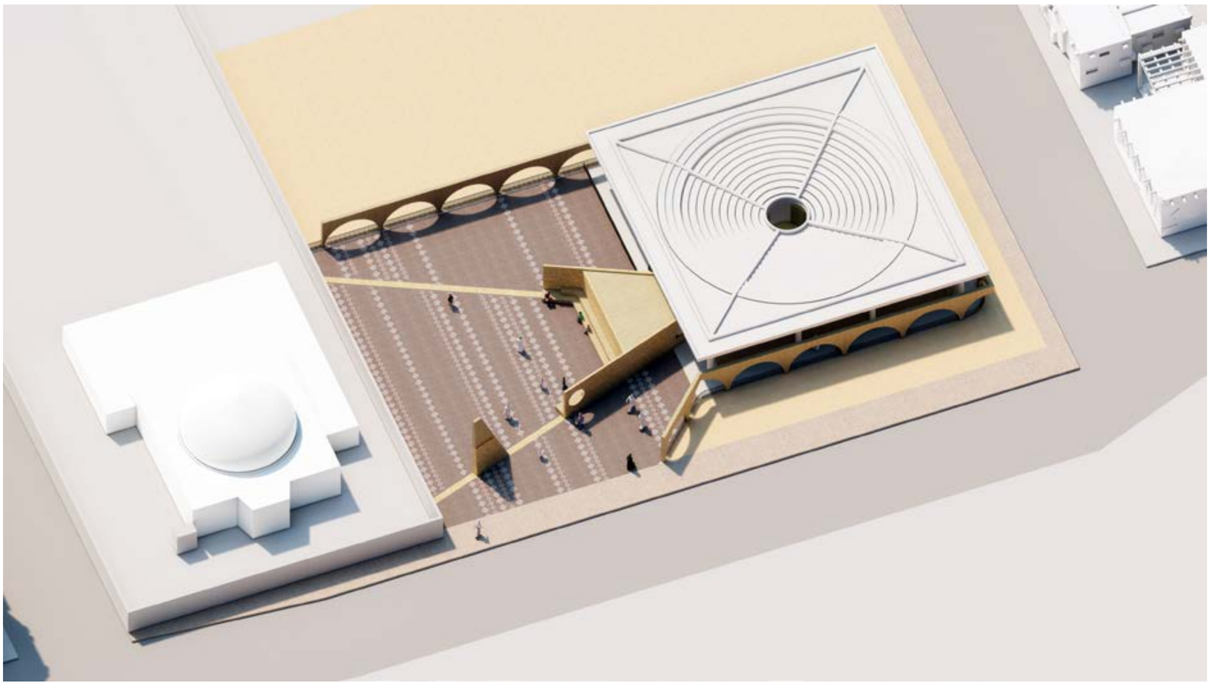
FARMERS' MARKET IN THE MUNICIPALITY OF AL- EMARAH, MISSAN

STRUCTURAL REPORT

MUNICIPALITY OF AL-EMARAH, MISSAN



Contents

1. Description of the object

Geographical position of the project area

The total height of the building is 4.75 m. The function of the object will be a market.

The market will be located in the municipality of Al-Emarah, the proposed land is located in the center of the city and can be easily reached thanks to access to the main road. The site is surrounded by a main public road in front and residential buildings from other sides, which will help in providing service to the groups surrounding the market Security control points are available to protect the market.

For the assessment of structural stability and before judging about the bearing capacity of the structure it is necessary to have a comprehensive knowledge of it, typology or type of structure, materials, strengths of the materials, technology used at the time of construction, construction condition, history of object interventions, restorations or reinforcements performed during lifespan.

2. Codes and references

The structural analysis was done in accordance with EUROCODES as follows.

Eurocode 1. Actions on structures

Eurocode 2 Design of concrete structures

Eurocode 8 Design of structures for earthquake resistance

3. Materials

In accordance with the Eurocodes, the calculations are made in the ULS of a project.
The materials used and their characteristics and design stregths are:

Concrete

Concrete- Class C25/30 per for the frame and slab

-For all concrete structures:

Unit weight $\gamma = 2500\ kg/m^3$

Cubic compressive strength $R_{ck} = 300\ daN/cm^2$

Cylindrical compressive strength $f_{ck} = 250\ daN/cm^2$

Modulus $E_c = 315000\ daN/cm^2$

Design strength $f_{cd} = 156.3\ daN/cm^2$ $f_{ctm} = 25.6\ daN/cm^2$ $f_{ctk\ 0.05} = 18.0\ daN/cm^2$

Where:

$f_{ctm} = 0.3 \times f_{ctk}$ ^(2/3)

$f_{ctk\ 0.05} = 0.7x\ f_{ctm}$

Poisson ratio $\nu = 0.1$

Safety partial factor $\gamma_C = 1.5$

Reinforcement

Steel reinforcement S-500s has the following characteristics

Tensile strengh $f_{tk} = 5500\ daN/cm^2$

Yield tensile strength $f_{yk} = 4380\ daN/cm^2$

Elasticity modulus $E_c = 2100000\ daN/cm^2$

Relative deformation coefficent > 12% $A_5 = 12\%$ $(f_t / f_y)_k = 1.256$

Partial factor $\gamma_S = 1.15$

Design resistance $f_{yd} = 3700$ daN/cm^2

4. Seismic activity

Based on the works on the report of various research studies for seismicity and seismic risk assessment for Iraq, and for the necessary seismic parameters for the analysis of the structure have been determined.

1. The construction site in the study is accepted as classified as Class C according to EC-8, (EC-8, 2004).

2. According to Eurocode 8, the elastic reaction spectrum for the basement layer of the foundation of the studied object, can be considered as follows: For probability 10% / 50 years for category B of the ground according to EC-8 result parameters: maximum acceleration ao = 0.4g and maximum spectral acceleration Se (T) =0.46g, S = 1.15, $T_B = 0.20$ sec, Tc = 0.6 sec, and $T_D = 2.0$ sec.

4. For the design and control analysis of the structure under consideration, the elastic response spectrum according to Eurocode 8 with the above parameters was used, for the probability 10% / 50 years.

5. Modelling and seismic performance

This object for the purpose of this study is modeled in the program ETABS v18.1 The mathematical model represents an idealization of a certain number of elements such as shell, frame, link, tendon and joint. These objects within programs are used to represent walls, slabs, columns, beams, and other physical objects. Constructive systems are represented by a three-dimensional grid. Extremely complex real systems can be represented by more simplified mathematical models. Using the finite element calculation method, very accurate results are obtained with respect to external and internal foci. Outcomes include twisted or out-of-plan behavior. The solution of the three-dimensional model enables a maximum inclusion of the real conditions in which the object works in reality.

The analysis enables the study of the action of horizontal and vertical loads on the structure. The programs follow the load decomposition method where the loads distributed in the soles are automatically decomposed into nodal loads which are transmitted to the beam joints and then to the columns and retaining walls being discharged to the base. As temporary loads it is accepted that = 1.5 kN / m2, based on the recommendations of the European standard EC-Programs automatically generate seismic loads which comply with the design codes.

Design Loads

The following loads are used for this design

<u>Dead Loads</u>

In accordance with EC-1, the dead loads used in this project are those due to the self-weight of the structural elements; slabs, beams, columns and foundations.

Live Loads

In accordance with EC-1 live loads are taken as follows:

Slabs	(Ec1-Cat A)	150	Kg/m^2
Cantilevers	(Ec1-Cat A)	200	Kg/m^2

Load combination

The structure is checked for ultimate limit states (ULS), serviceable limit state (SLS) and permissible state of deformation (destruction) (DLS)
The loads are combined as shown below, where IE is the Seismic action for the allowed state under examination, Gt is the characteristic value of the temporary action, Q1k is the characteristic value of the variable action of the situation created by the loads, Qik is the characteristic value of the situation variable i:; γg, γp and γq are partial security factors, ψ0i is the combination coefficient which gives 95% of the value of the variable share i, ψ2i is the combination coefficient which gives the approximate value of the temporary variable action i.

Desing Situation	Load combination
ULS	
Permanent	$\gamma_g G_k + \gamma_q [Q_{1k} + \Sigma i(\psi_{0i} Q_{ik})]$
Seismic	$IE + G_k + \Sigma_i(\Psi_{2i} Q_{ik})$
SLS	
Rarely	$G_k + Q_{1k} + \Sigma i(\psi_{0i} Q_{ik})$
Frequent	$G_k + \psi_{11} Q_{1k} + \Sigma i(\psi_{2i} Q_{ik})$
Quasi permanent	$G_k + \Sigma_i(\psi_{2i} Q_{ik})$
DLS	
Seismic	$IE + G_k + \Sigma_i(\Psi_{0i} Q_{ik})$

The values of the combination coefficients are taken into consideration as follows::

γ_g = 1.4 (or 1 if the contribution gives a greater safety)

γ_q = 1.5 (or 1 if the contribution gives a greater safety))

ψ_{oi} = 0.7

ψ_{1i} = 0.6

ψ_{2i} = 0.3 / 0.6 / 0.8

Seismic action is taken into account with its two orthogonal components, designated Ex and Ey; where the two respective actions of the components represent the same reaction spectrum and complement the quadratic combination (CQC), a method which has been used as a combination of both components.Dy kombinimet e mundeshme jane si vijon

Ex "+" 0,3*Ey

0,3*Ex "+" Ey

Where "+" means "to be combined with"

Ex are the effects of forces due to seismic action along the selected horizontal axis x in the structure

Ey are the effects of forces due to the action of the same seismic load along the selected orthogonal axis y in the structure

The inertial effects of the cast seismic loads will be evaluated taking into account the associated masses and all the gravity loads that appear in the following combination.

$Gk + \Sigma_i(\psi_{Ei}\, Q_{ik})$

Where the combination coefficient ψE takes into account the probability of ψEiQik loads that can not be present throughout the structure at the moment of seismic load action.

Residential (Ec1-Cat A) $\psi_{Ei} = \psi_{2i} x \ \phi = 0{,}3$ x 0,5 = 0,15

Covering (Ec1-Cat I) $\psi_{Ei} = \psi_{2i} x \ \phi = 0{,}3$ x 1,0 = 0,30

Restaurants (Ec1-Cat C1) $\psi_{Ei} = \psi_{2i} x \ \phi = 0{,}6$ x 0,8 = 0,48

Shops (Ec1-Cat D) $\psi_{Ei} = \psi_{2i} x \ \phi = 0{,}6$ x 0,8 =0.48

Stairs (Ec1-Cat E) $\psi_{Ei} = \psi_{2i} x \ \phi = 0{,}8$ x 1,0 =0,80

Parking (Ec1-Cat F1) $\psi_{Ei} = \psi_{2i} x \ \phi = 0{,}6$ x 1,0 = 0,60

Importance factor of buildings.

Buildings are categorized into different classes according to importance, starting from the consequences of a collapse for human life and their importance in public and civil security, immediate protection during a seismic oscillation, as well as the social and economic consequences of a collapse.

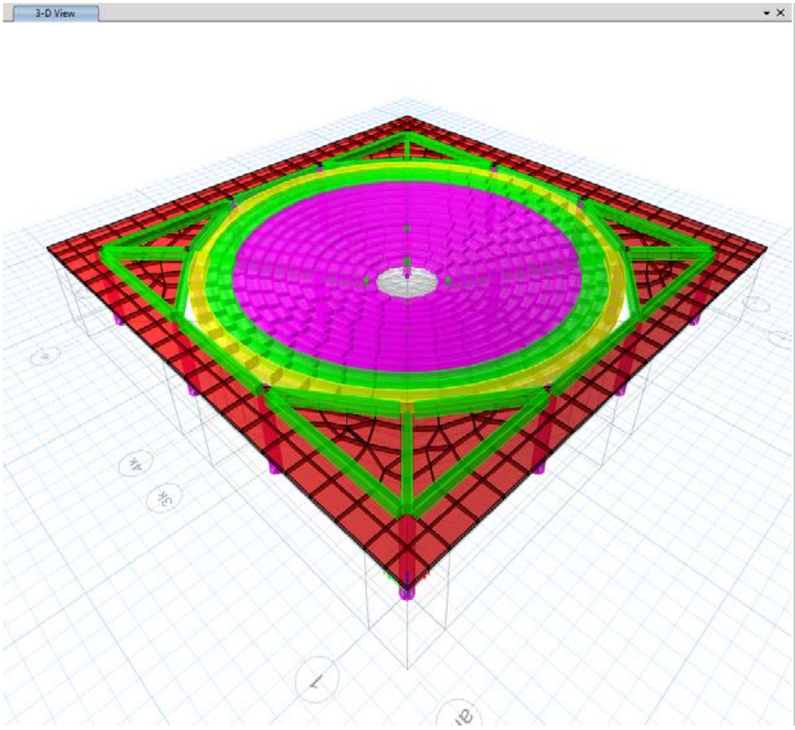
The importance classes of an object are characterized by a series of different factors which are related to the consequences and failures of a structure.

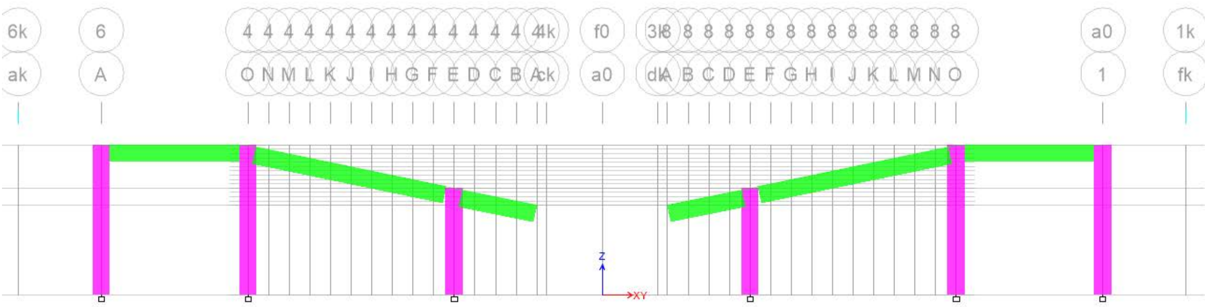
Importance factor γ_i = 1,2 is taken into account.

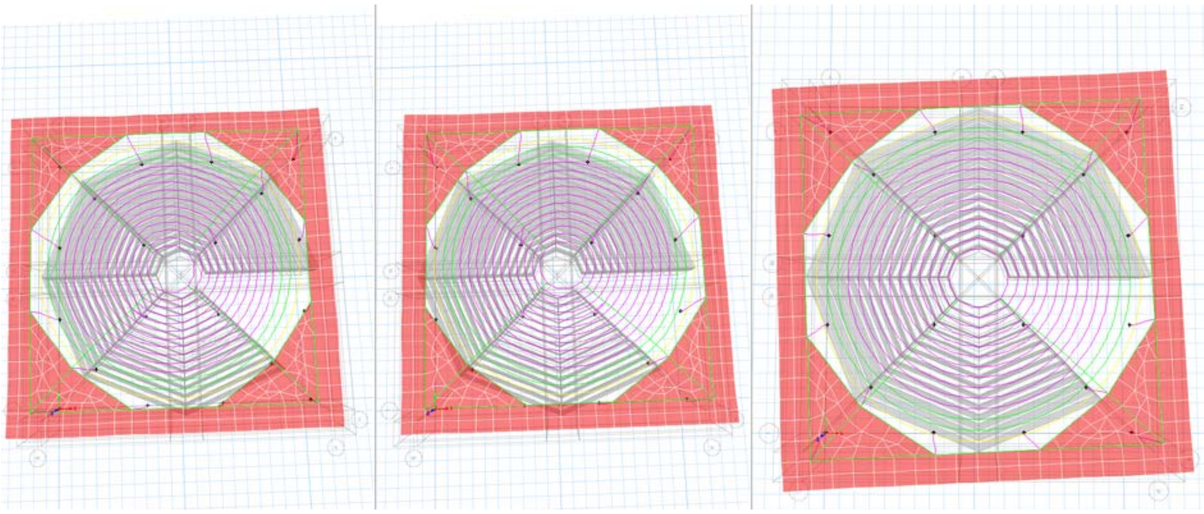
Modelling

The market structure is modeled in the ETABS V18.1 program as a frame with beam, column and slab elements. The materials and loads used for modeling are discussed extensively above.

Static and dynamic analysis of the object in the program gives us the values of drifts and periods according to the models as follows, accompanied by illustrative photos of the 3D model:







Modal periods

The first two modes show translative movements, while the third mode has torsion. And the values of the first three period are according to EC-8.

TABLE: Modal Periods And Frequencies					
Case	Mode	Period	Frequency	CircFreq	Eigenvalue
		sec	cyc/sec	rad/sec	rad^2/sec^2
Modal	1	0.255	3.926	24.6655	608.3876
Modal	2	0.255	3.929	24.6875	609.4721
Modal	3	0.255	3.929	24.6876	609.4797
Modal	4	0.105	9.529	59.8726	3584.7267
Modal	5	0.097	10.266	64.504	4160.7682
Modal	6	0.096	10.364	65.1203	4240.6561
Modal	7	0.056	17.784	111.7399	12485.8142
Modal	8	0.056	17.787	111.7599	12490.2841
Modal	9	0.05	19.811	124.4731	15493.5438
Modal	10	0.05	19.811	124.4745	15493.9101
Modal	11	0.05	19.828	124.5831	15520.9541
Modal	12	0.047	21.349	134.1421	17994.0999

The result of the twelve first modes.

6. Structural elements; columns, beams, slabs, foundation

Columns have a cicrluar uniform section throughout the entire height of the building. The diameter is 50 cm and the required reinforcement area is around 28-50 cm^2 which is covered using bars of 14-16 bars of φ16, φ18, φ20 mm. The stirrups have a diameter of 8mm according to national and European codes

Beams. For the objects are used (30x5) cm beams. Following the analysis the required longitudinal reinforcement area have beams used bars of φ14, φ16, φ18 and φ20 mm and the stirrups used are φ8 mm, with spacing based on the critical length as recommended by codes and standards.

Secondary Beams. For the objects are used (60x25) cm and (60x30) secondary beams. Following the analysis, the required longitudinal reinforcement area has beams used bars of φ12, φ14, φ16, φ18 mm and the stirrups used are φ8 mm, with spacing based on the critical length as recommended by codes and standards

Slabs have been modeled as a monolith slab, with height of 20 cm**, and for reinforcement steel have been used for bars of** φ8 mm and φ10.

For the foundation, a **stepped footing** was used with a height of 80 cm. The step footings with plan maximum dimension of 200x200 (150x150) cm and 130x130 (100x100) cm, with depths of each step of 40 cm. The bars used for the pad footing are 8 φ12mm and 6 φ12mm every one linear meter. Also, strap beams of 30x40 cm have been used to connect the columns at -0.05 m. Longitudinal bars used for the foundation beam are of ϕ12, ϕ14 and for stirrups ϕ8 every 20 cm have been used.