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# Structural Analysis and Design of a Commercial Building

# Abstract

This project is mainly a static analysis and design for a commercial building located in Nablus city "A'al Al-Namer Al-Thari Mall" or "Al-Awkaf Mall" which is lie in "Sufian Street" and consists of eleven floors, two of them are basement floors.  
 The design were accomplished according to ACI-318-08 code and using the structural analysis program "SAP2000" with hand calculations used for verifications and preliminary design.

The project includes detailed design of slabs, beams, columns and footings. In addition, it will include a 3D- designed model for the whole building.

In the final part, a dynamic analysis for the building were done in order to know and study the behavior of structure under earthquake loads through specific types of analysis.

The following pages is a summary for the project content:

**Chapter one: Slabs**

**One –way slabs:**

In this system of slabs, the load were distributed along one of the two

directions, and then the main slab reinforcement were in that direction.

Using of this system is effective when the slab to be designed is supported at

two edges only, or at four edges with ratio of slab length L to width B is greater

than 2.

**Two –way slabs:**

In this system of slabs, the load were distributed in both directions, then the

main slab reinforcement were in the two directions.

When the slab to be designed is supported at four edges with ratio of slab

length L to width B is less than or equal to 2, using of such system becomes

effective.

**Floor systems:**

Two way and one way ribbed slab systems were used in each floor of this

structure. The slab is divided by main beams in both directions, this division

results in many unsymmetrical panels.

**Chapter two: Beams**

Beams in this part of the project were designed using tributary area method,

Hidden, multi span and large space beams are used in all floors.

**Chapter three: columns**

In this chapter an important structural elements were designed which are the

columns, the building has a Nineteen columns, all are of a rectangular section.

Columns in this part of project were classified into groups depending on the

ultimate axial load carried by each, intervals of 1500 kN were used in

classification, then each group were designed considering the highest

ultimate axial load on it, that means columns of each group have the same

steel reinforcement.

**Chapter four: footings**

In this chapter, footings of the building were designed, it important always to

use the most economical and efficient system that achieve the required

strength and stiffness.

After preliminary calculations and check, it’s founded that mat foundation

system is the most suitable system for the building loads and soil bearing

capacity.

**Chapter five: Dynamic Analysis**

In this chapter a seismic analysis were done on the building using SAP2000 in

order to study the behavior of this structure under dynamic loads which

represented by earthquakes.

Response spectrum method were used for seismic analysis as provided in

Uniform Building Code for year 97 (UBC 97), then the results were compared

to that from gravitational (static) loads.

**Seismic Analysis Conditions**

The following are the location conditions that used through the analysis:

Seismic zone is Nablus City which has a seismic zone number = 2B, then

the seismic zone factor = z = 0.20

Occupancy of the structure is commercial, then it can be considered as

hazardous facility, then importance factor = I = 1.25

Soil properties are not known, so it can be considered as a stiff soil, then

the soil profile type is SD

Response factor = R = 5.5, assuming immediate frame system.

From the previous conditions:

Seismic coefficients Ca = 0.28,

Seismic coefficients Cv = 0.4,

Scale factor =

=

= 2.23

So, the seismic load of these properties were applied on the structure.