An-Najah national university

Faculty of Engineering

Building Engineering Department



Graduation Project.2

***Redesign of An-Najah National University Engineering College***

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# The Project Idea

The main idea of this project was to check the architectural, structural, safety and environmental design of the Engineering College Building and to find the problems inside the building as well as to make a new design for the college taking in consideration solve of that problems and make the Building more environmentally friendly (green building).

The building consist of 3 part each one consist of 5 floors with an area of (4300 m2) for the ground, first and second, (3018 m2) for Basement.1, (1760 m2) for Basement.2, (3026 m2) for the third floor and (1900m2) for the fourth floor.

# Architectural design.

## 1.2 Element of Educational Buildings:

* COR***RI***DORS: The corridors have been enlarged up to 3.5 instead of 2.75.
* Stairs: The position of the stairs has been moved to north side of the building and the width of the trade has been modified into 2.35 instead of 1.55 according to Neufert 3rdedition, and the natural day lighting was existed in the stairs.

### Entrance: In order to make the entrance to the engineering college visible for everybody, the back entrance has been moved to the middle of the building with 4m wide door according to IBC 2009 code.

* CLASSROOMS: The classrooms have been enlarged to 80m2 instead of 53m2 according to Nuefert 3rdedition,. With the same height which is3m, with a capacity of 42 students in all classrooms.
* LECTURE theaters: The location of the theater has been changed and its capacity increased up to 250 students with an addition of 30 students.
* ***Handicapped Students:*** Regarding the handicapped students, the following changes and modification were taken into consideration:
1. Two new toilets.
2. Two More elevators.
3. Provides ramps at entrances.
* Offices: Department heads and instructors offices have been modified according to the Nuefert code.
* ***Water closet:*** W.C’s have been moved to the north side of the building and 6 W.C’s instead of 3 have been established.
* ***Science Laboratories:*** The number of the science laboratories has been kept the same but the labs were enlarged. However, the number of the computer labs has been increased.
* ***Drawing studio:*** The drawing studios have been enlarged to 150 m2in average instead of 120 m2.

# Environmental Design

**Natural Day Lighting and Ventilation:** A new court has been established and the others were modified.

**Acoustical and Thermal Insulation:**

* + - The acoustic requirements of Building Bulletin 93 - BB93 code
		- In the Previous Design 52 STC used for sound insulation for all partitions.
		- In the previous Design no thermal insulations used.
		- In This Design perfect insulations put for this building depending on :
			* Building Bulletin 93 - BB93 code for Acoustical requirements.
			* Mechanical Equipment' code for building and ASHREE code for thermal requirement.

**Solar Design:** Double glazing was used for this project since it reduces Energy Transfer.

**Shading:** The aim of good shading design is to utilize these characteristics (Ventilation, Light, and View) to best advantage, usually complete exclusion in summer and maximum exposure in winter.

# Structural design.

The structural system of the new design will be discussed in this chapter, but first the specifications of the new design should be mention:

1. Live load is equal to 400 kg/m² for all spaces in the new design whereas it is equal to 500 kg/m² for the whole building except offices which is equal to 300 kg/m².
2. Super imposed dead load was assumed to be 300 kg/m².
3. Required minimum compressive characteristic 28 days cube strength is equal to B300 for all elements in the current design and B150 for blinding concrete, whereas in the new design it is equal to the following :

Figure 59

1. B350 for slabs and footings (ƒ`c = 280 kg/cm²)
2. B400 for beams (ƒ`c = 320 kg/cm²)
3. B450 for columns (ƒ`c = 360 kg/cm²)
4. The clear cover for reinforcement is equal to the following:
5. Footing: 5 cm top/bottom in the current design where it is 7 cm in the new one.
6. Shear wall: 4 cm in the current design where it is 5 cm in the new one.
7. Slaps: 2 cm in the current design where it is 4 cm in the new one.
8. Beams: 2 cm in the current design where it is 6 cm in the new one
9. Columns: 2.5 cm in the current design where it is 5 cm in the new one
10. All reinforcement bars is a deformed bars and has a minimum characteristic strength (fy), of 4200

kg\ cm² in both designs.

1. A blocks of (30X40 cm) extrude polystyrene were been used with unit weight of 40 kg/m³

# MECHANICAL DESIGN.

* + - Sanitary Drainage System: **Flush valve** is used for Water Closets.
		- Drainage fixture values for plumbing fixture:

|  |  |
| --- | --- |
| Drainage fixture unit | Plumbing fixture |
|
| 6 | Water closet |
|
| 4 | Urinal |
|
| 1 | Lavatories |
|
| 2 | Service sink |

Water supply: One of the designer’s first concerns is to match the quality of the water to the task it performs.

* To get a good water supply we must to have:
1. Good water Pressure.
2. Good water Flow.
3. Good water Quantity.
4. Good water Quality.

Elevators Design: **The Codes and Standards used in elevators design is:**

1. American Society of Mechanical Engineers ASME Standard.
2. National Fire Protection Association (NFPA).
3. American National Standards Institute (ANSI).

**Sliding Door is used for this building with 1.07m min. wide.**

# Safety and fire design.

* Fire system design: Fire hose and fire extinguisher are used in this building to protect from fire, since it's the best choice for Educational building.

Fire exits: In the Previous design there was 2 fire exits in the building, But in this project design 4 fire exits used related to safety code requirements, since the building have more than 4000 population.

# Refrences:

* Time Saver Standards for Building Types.
* ACI 318M-08 Building Code Requirements for Structural Concrete.
* Mechanical and Electrical Equipment for buildings.
* International Building Code 2009.
* Neufert Architects Data 3rd Edition.
* Educational Facilities Specifications High Schools.
* Building bulletin 90 lighting design for educational building.
* Building bulletin 90 acoustical design for educational building.
* Engineering design guidelines for high performance school (by the US renewable energy laboratory).