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Multi-Criteria Decision Model for Evaluation and management of Diverting Utilities Projects in the Old Cities

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Abstract:

The construction of projects within cities with high population density is a common practice for city development, some of which can be a solution to the problem of congestion or the addition of new services to cities such as bridges, tunnels, and new service or residential buildings. To ensure the success of these projects, the existing public utilities should be studied, which in most cases require diversion or connection to link them to the newly developed projects, to avoid negative effects such as an unexpected increase in the cost of diverting them, delayed project schedule or unexpected risks. In this research paper, the previous studies and the necessary items that directly affect project management in general and the management of diverting utilities in particular were compiled and analysed to find out the main factors for different types of projects (underground, above ground and suspended) that may have an effect on utilities diversion during the construction phase. For this purpose, a multi criteria decision model has been developed to evaluate the effect of utilities diversion on projects before construction by introducing the critical parameters included under the project management triangle elements (Time - Cost - Value). A model was developed to help in evaluation of such activities and to rank the project impact on the existing infrastructure, therefore, help the decision maker to take the right/necessary action

Keywords:

Construction, Decision Support System, Management triangle, Multi-Criteria Decision model, Utilities.

Introduction :

During the implementation of engineering projects, the surrounding utilities that conflict with the project to be constructed should be studied, necessary data for the existing utilities are to be collected, and then a diverting schedule should be drawn up without affecting the area and assuring the comfort of the residents during the implementation period and after the completion of the project. It is also important to determine the diverting costs or the need of making new temporary or permanent replacements. The success of projects requires the study of the infrastructure and how to deal with them while planning the work of temporary traffic and facilities diversion .

without affecting the daily life of the population or affecting their needs for water, electricity, sanitation, or communications. Subsurface Utility Engineering (SUE) is an engineering process that combines civil engineering, geophysics, survey, and Computer-Aided Design and Geographic Information Systems CAD/GIS. Information and coordination on the location and condition of subsurface utilities are collated and assessed to reduce interference and conflict with valuable infrastructure. The importance of utility coordination for the project and utility owners, designers, engineers, and contractors can significantly benefit during the life cycle of a project to avoid:

١- Community dissatisfactory
٢- Environmental effects and drawback
٣- Unexpected costly solutions for utility conflicts or damage repair
٤- Project delays

٢- Problem Statement

Over the past few decades, project management tools and technologies have been created to improve the performance of construction projects. Despite the efforts made to enhance their performance, construction projects still suffer from low efficiency. One of the important obstacles to improving the efficiency of construction projects is the disparity between the existing theories in performance assessment and the complex and uncertain nature of modern construction projects. This knowledge gap creates the need for a paradigm shift in performance assessment approaches. In particular, better understanding and improving the ability of project systems to cope with uncertainty is an important element in enhancing performance in complex projects. To address the limitations in the existing literature and facilitate the paradigm shift, this study investigates resilience in project systems as the ability of project systems to cope with uncertainty. In this study, complex construction projects are conceptualized as complex systems. Accordingly, theoretical underpinnings from complex system science are adopted to propose an integrated framework for performance assessment in construction project systems. Another important aspect is project resilience. Resilience is an emergent property in a complex system which it hated to system thee the capability in coping with uncertainty. It arises from dynamic behaviors and interdependencies in complex systems. Understanding the determinants of resilience in project systems is essential in improving project performance under uncertainty. However, the current literature in project management and construction has a large gap related to characterizing and examining resilience in construction project systems. For this reason, the results of questionnaires of experts in the infrastructure engineering field and various previous research were used to determine the most important items affecting the management of diverting utilities during construction. (Alkhadrawy et al, ٢٠٢١).

٤- previous study :

Different researchers have tried to determine the factors that leads to a successful project. Lists of variables have abounded in the literature, however, no general agreement can be made. Many researchers tried to develop a conceptual framework on critical success factors (CSFs). Seven significant journals in the construction field are chosen to review the previous works on project success. Five major groups of independent variables, namely project-related factors, project procedures, project management actions, human-related factors, and external environment are identified as crucial to project success. Further study on the key performance indicators (KPIs) is needed to determine the causal relationships between CSFs and KPIs. The causal relationships, once identified, will be a useful piece of information to implement a project successfully. (Albert P. C. Chan; David Scott; and Ada P. L. Chan,٢٠١٣). - Factors Affecting Project Success There are many variables that have been identified for their direct impact on the success of the project, and they are called critical success factors, which are also an indicator of the success of the project. The factors affecting the success of the project can be divided into five main categories (Albert P. C. Chan; David Scott; and Ada P. L. Chan,٢٠١٣):

A -Project-Related Factors.

B -Procurement-Related Factors.

C -Project Management Factors.

D -Project Participants-Related Factors.

E -External Factors.

A- Project-Related Factors Its measurement depends on the nature of the project, its type, number of floors, size and complexity (Albert P. C. Chan; David Scott; and Ada P. L. Chan,٢٠١٣).

B- Procurement-Related Factors To measure this factor, two characteristics are used, the first is the procurement method, such as choosing the entity that will design and implement the project, and the second is tendering process (Albert P. C. Chan; David Scott; and Ada P. L. Chan,٢٠١٣).

C- Project Management Factors Project management is the path to its success. (Hubbard ١٩٩٠). Management tools must be used to plan and implement the project to increase the chances of project success. These tools include adequate communication with all parties involved in the project, access to and collection of information, control mechanisms, the ability to troubleshoot and fix errors in a timely manner, effective decision-making, continuous monitoring of the progress of work, setting and achieving time programs, and the use of expertise in Similarly related projects, attention to quality, safety and occupational health standards, business management, and subcontractors contracts, and coordinating all of the above with managerial procedures. (Albert P. C. Chan; David Scott; and Ada P. L. Chan,٢٠١٣).

D- Project Participants-Related Factors : It is summarized in the project participants as the project manager, contractor, customer, consultants, subcontractors, supplier and manufacturers. Contractor, consultants, subcontractor, supplier, and manufacturers. Walker (١٩٩٥) Construction time depends on the type of client, experience, knowledge of construction project organization, project financing and client confidence in the team. (Albert P. C. Chan; David Scott; and Ada P. L. Chan,٢٠١٣)

E- External Factors This factor includes all external influences on the construction process and includes political and social systems. This factor is measured by the economic and physical environment, the level of advanced technology, and the industrial environment. (Kaming et al. ١٩٩٧ and Songer ; Chua et al. ١٩٩٩; Walker and Vines ٢٠٠٠). ٥- Critical parameters affecting utilities diversion According to the designed questionnaire results, made for experts in the field of project management and utilities management, table (١) shows the main/critical parameters under the management triangle elements (Cost-Time-Value) that may affect the project, (Alkhadrawy et al, ٢٠٢١). Noting that the questionnaire included many influential parameters, and the most influential ones were presented.

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Table (١). Main critical parameters under the managementtriangle elements

No.	Item
١-	**Critical parameters related to Cost**
١,١.	Initial cost
١,٢.	Construction cost
١,٣.	Maintains cost
٢-	**Critical parameters related to Time**
٢,١.	Target year
٢,٢.	Construction time
٣.	**Critical parameters related to Value (Environment,Efficiency)**
٣,١.	**Environment**
٣,١,١	Noise pollution
٣,١,٢	Air pollution
٣,١,٣	Soil pollution
٣,١,٤	Heat pollution
٣,١,٥	Groundwater pollution
٣,٢.	**Efficiency**
٣,٢,١.	Performance
٣,٢,٢.	Quality
٣,٢,٣	Durability
٥,٢,٤	Ability of construction

It is worth mentioning that all experts assured that safetyparameters in all projects should be taken into consideration as a must with a high priority/stander.

Methodology

There are influencing parameters that have a direct impact on project management in general and on managing the infrastructure and utilities diversion associated with the construction activities in particular. According to the management triangle (Time - Value Cost) they are called critical parameters. There are other parameters that have an indirect impact, but they are of a great importance to the success of the project, such as attention to environmental and social factors. Experts in the field of infrastructure engineering and infrastructure project managers were questioned to determine all the influencing parameters and select the critical parameters.

The questionnaires were designed and their results were used as explained here after;

The experts in the field completed the questionnaire which was made to determine the parameters weights according to the project type and the project location or situation.

- The parameters weight is determined according to management triangle elements analyzed using the model programmed using Java scripts.
- The weight values for main parameters (Cost, Time & Value) are fixed in all structure types in the same conditions, for comparison purpose only, and may need to differ according to the project condition (i.e., urgent project, environmentally sensitive project, …etc.). While all other sub-parametersweights were adopted as resulted from the questionnaire.
- The user such as project manager entered the weight of all critical parameters according his/her detailed study of the project and different constrains/limitation

of construction process.

- The model is analyzed and evaluate the input weights with respect to the expert weights that were entered.
- The project is evaluated as percentage results. Every result is reprehensive as a percentage weight with respect to the main triangle (Cost – Time –Value).
- The previous result for project weight percentage is ranked. Rank is the standard that measure the project impact according to the total evaluation percentage according the following:

(٩٠-١٠٠) %. .... Excellent
(٨٠-٩٠) % …... Very good((٧٠-٨٠)
%. .... Good
(٦٠-٧٠) %. .... Fair
(<٦٠) %. .... Restudy

- The results can then be presented by chart for the percentage of every project triangle element to help in interpretation of results.
- The evaluation result can help to improve the parameters that have low weights and help the decision maker understating the effect of existing utilities and their management during construction on the cost, value or time of the project.

Figure (١) shows the methodology process.

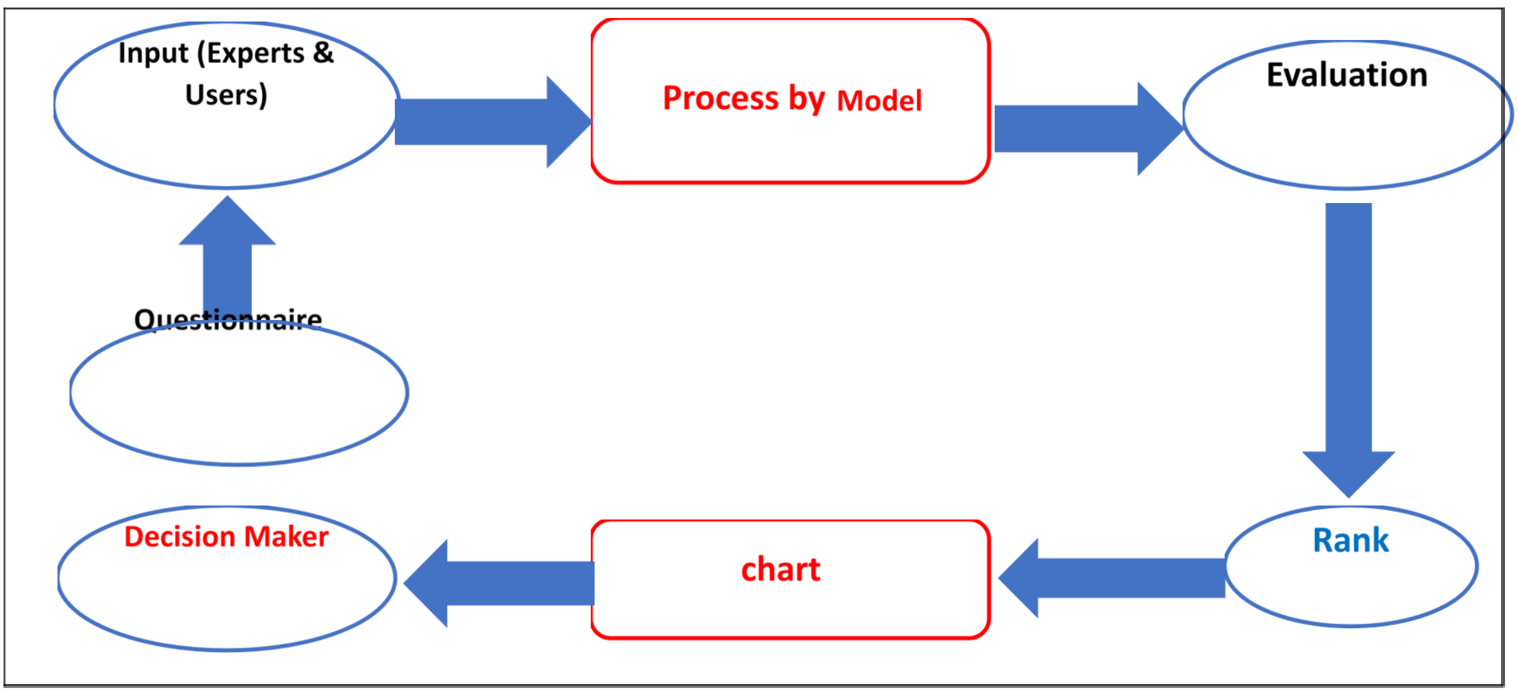


Fig. (١) The methodology of projects evaluation process

Multi criteria decision making (MCDM)

Multi-criteria decision making (MCDM) is a process ofintegrated assessment of projects, alternatives or options for ranking or selecting, priority setting among the finite set of projects, alternatives or options. It is a structured approach to determine overall preference among alternatives, where the alternatives accomplish severalobjectives. MCDM methods have been widely used in the area of environmental resources planning and management. (Alkhadrawy et al ,٢٠٢١), (Riad,٢٠١٨), and (Recio et al,١٩٩٩). The following equation was implemented in the developed model to determine the final weight of each criterion:

٦- Model Development and Implementation:

The Model was designed to be applied for utilities evaluation during the construction of any type of building in general. Figure ٢ shows the flow chart of the designed model as will be explained in this section.

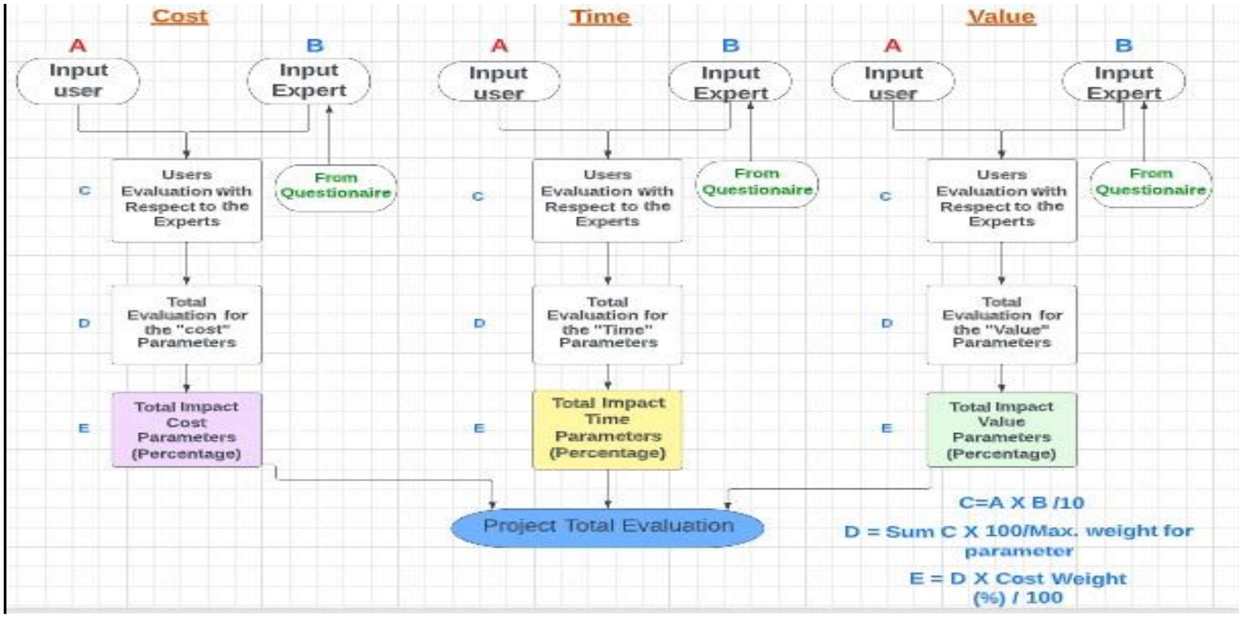


Fig. (٢) The model flow chart

The flow chart, is divided into levels (rows) and tracks (column) Under the main element of the management triangle (Cost, Time & Value). Levels (A) and (B) indicates twotypes of inputs, the first one (A) is from direct user such as project manager and the second input (B) is related tothe weights of parameters as defined from questionnaire of expert in similar projects type.

Every parameter weight from (١-١٠), (١) means that the parameter has a week influence on the project and (١٠) hasa strong influence (Alkhadrawy et al ,٢٠٢١).

For Example in the (Cost) track, Level C is where the total evaluation with respect to expert is calculated by the percentage of the user input with expert input divided bythe maximum weight. Level D is the total evaluation for the cost parameter calculated by the percentage of the total evaluation for the Cost parameter from level C divided bythe maximum total weight.

Every type of structures can be evaluated by input every item weight according to the impact of/on utilities affected by the expected construction activities and depending on structure type (underground, above ground andsuspended).

Input data:

The input data is the first step in the model that dependson the questionnaire and users as mentioned before andshould be entered carefully. The data entered are weightsof critical parameters with values ranges between (١-١٠). ١ means that the parameter has a week influence on the project and (١٠) means a strong influence. The same type of building in different condition will be given different weights An example for two buildings in same type and different places (i.e. different construction conditions) will be applied in section (٩) in order to make a comparison for the critical impact factors on the different buildings types. Yet, the same percentages for management triangle elements [Cost, Time& Value] (Tracks) will begiven for simplicity.

Model data analysis:

The input data are analyzed through the model processes byusing multi criteria decision making (MCDM) to calculate the users' evaluation of each criterion with respect to those of the experts in the project as following

Model output:

According to the previous input and model calculations, theproject evaluation grade will depend on the percentage of the project total evaluation.

$T\ etotalprojectevaluation$ = (١) + (٢) + (٣)

The total evaluation score of the project is then used torank the project as per the below ranking score;

(٩٠-١٠٠) %. ....Excellent
(٨٠-٩٠) % …... Very good
(٧٠-٨٠) %. ....Good
(٦٠-٧٠) %. ....Fair
(<٦٠) %. ....Restudy

The Model Application:

The model can be applied on any type of structure. Yet, in the current work it will be applied to the more critical structures types, to study their influences on the existing infrastructure. These structures are the rested with foundation depths less than ١٠m, where most of the utilities are located in this range and may need to be diverted before construction.

In this practical example a comparison between two projectsin different conditions will be carried out. Building (A) is an administrative building in a new urban community and the other one Building (B) is planned to be constructed in a natural protected area.

Building (A): administrative building in a new urbancommunity

This building will be constructed in the down town of Cairo, Egypt which is very crowded area and needs a lot ofdiverting utilities taking into account the effect of the daily uses of theses utilities during construction for residents in the area. So, the weight of critical parameters for input data will have high weights for both parameters related to cost and time.

Building (A) Output data:

The output data from the input weights from experts and users as mentioned is evaluated as a percentage that the time has the highest evaluation percentage according to fig. (٣) because that the time is very critical parameter for this project according to building crowded location that will be presented with the other parameters in a column chart in fig. (٥) that can help the decision makers to make the appropriate decision. The total evaluation rankfor the project is fair. This rank is classified as mentioned in section (٨,٤) that this project has high impact on diverting utilities during construction.

Cost	Time	Value	Total
40	40	20	100 %

Please Fill the Yellow Highlight By a Regular Value from 1 to 10

	Users Input	Questionnaire experts Output	Users evaluation w.r.t. the experts
Initial Cost	6	9	5.4
Construction Cost	6	8	4.8
Maintenance Cost	6	9	5.4
Total Evaluation of cost parameter			15.6
Total Evaluation % of cost parameter			52%
Total Impact Cost Parameter Percentage		20.8%	

	Users Input	Questionnaire experts Output	Users evaluation w.r.t. the experts
Target Year	7	10	7
Construction Time	8	10	8
Total Evaluation of time parameter			15
Total Evaluation % of time parameter			75%
Total Impact time Parameter Percentage		30%	

	Users Input	Questionnaire experts Output	Users evaluation w.r.t. the experts
Noise Pollution	5	5	2.5
Air Pollution	5	8	4
Soil Pollution	10	10	10
Heat Pollution	1	5	0.5
Ground Water Pollution	8	10	8

Performance	10	10	10
Quality	10	10	10
Durability	10	10	10
Ability To Construction	10	10	10
Total Evaluation of value parameter			65
Total Evaluation % of value parameter			72.22%
Total Impact value Parameter Percentage			14.44%
Project Total Evaluation			65.24%
			Fair

Fig. (٣) The output data for building (A)

٢. Building (B): administrative building in a naturalprotected area

This building will be constructed in Nabq natural protectedarea in Sharm El Sheikh city, Egypt. The building is located in an area with low density of population, so the diverting utilities during construction may have low impacts on the residents. So, the weight of critical parameters for the input data will be higher in the “value”parameter, as the environmental impact has very high weight.

Both buildings (A & B) will be applied in the modelaccording to the questionnaire results as follows:

٩,٢,١. Building (B) Output data:

The output data from the input weights from experts and users as mentioned is evaluated as a percentage that the value has the highest evaluation percentage according to fig. (٤) because that the environment (soil pollution, airpollution , heat pollution and groundwater pollution) is very critical parameter for this project according to building located in natural protected area .It will be presented with the other parameters in a column chart in fig. (٥) that can help the decision makers to make the appropriate decision. The total evaluation rank for the project is good. This rank is classified as mentioned insection (٨,٤) that this project has high impact on diverting utilities during construction.

Cost	Time	Value	Total
40	40	20	100 %

Please Fill the Yellow Highlight By a Regular Value from 1 to 10

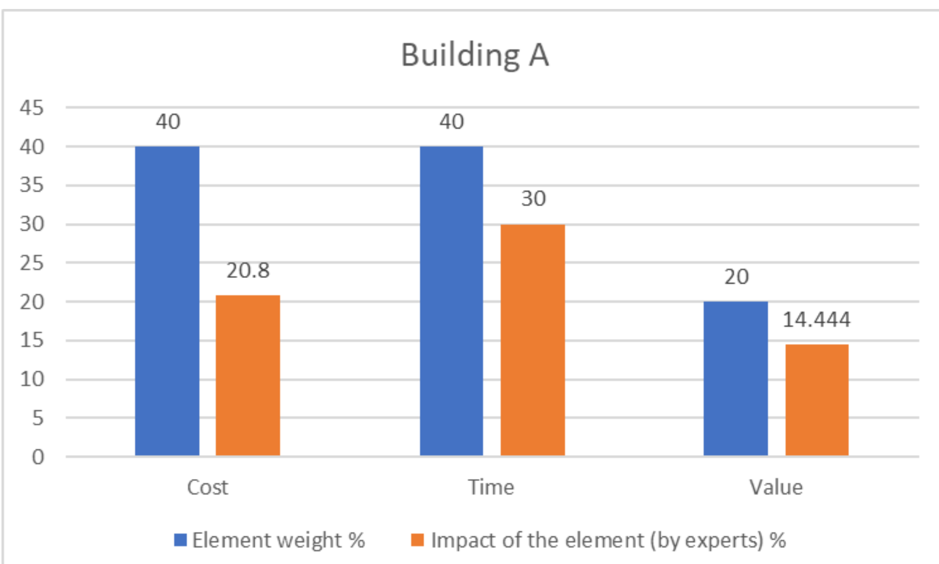
	Users Input	Questionnaire experts Output	Users evaluation w.r.t. the experts
Initial Cost	6	9	5.4
Construction Cost	6	8	4.8
Maintenance Cost	6	9	5.4
Total Evaluation of cost parameter			15.6
Total Evaluation % of cost parameter			52%
Total Impact Cost Parameter Percentage		20.8%	

	Users Input	Questionnaire experts Output	Users evaluation w.r.t. the experts
Target Year	9	10	9
Construction Time	9	10	9
Total Evaluation of time parameter			18
Total Evaluation % of time parameter			90%
Total Impact time Parameter Percentage		36%	

	Users Input	Questionnaire experts Output	Users evaluation w.r.t. the experts
Noise Pollution	5	5	2.5
Air Pollution	10	10	10
Soil Pollution	10	10	10
Heat Pollution	1	5	0.5
Ground Water Pollution	10	10	10
Performance	10	10	10
Quality	10	10	10
Durability	10	10	10
Ability To Construction	10	10	10
Total Evaluation of value parameter			73
Total Evaluation % of value parameter			81.11%
Total Impact value Parameter Percentage			16.22%
Project Total Evaluation			73.02%
			Good

Fig. (٤) The output data for building (B)

From above results between building (A & B) the building
B) has higher evaluation which means that it has less impacts on diverting utilities compared with building (A).



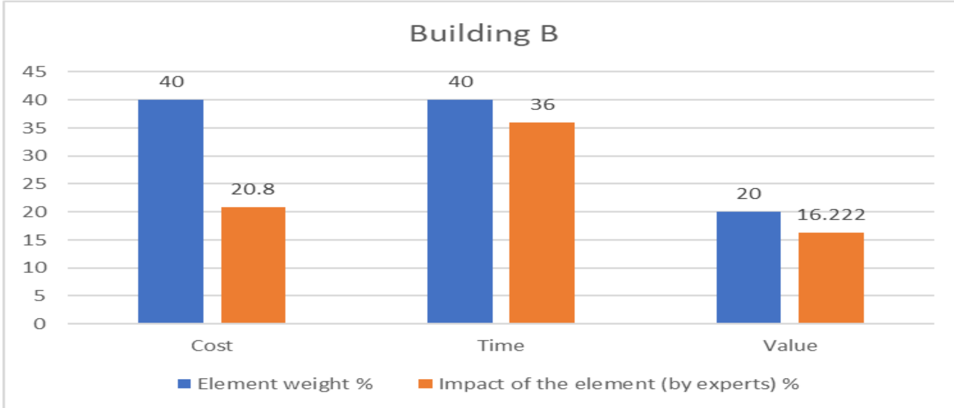


Fig. (٥) Column charts for impacts of management elementson diverting utilities in buildings (A) and (B)

The charts results shown in fig. (٥) explain the percentageof every impact value management element (Cost, Time &Value) with respect to the percentage that achieved. Thesecharts can help in identifying the weakness parameters torestudy and improve them for decision support system (DSS). The percentage of the "value" element is lowest forbuilding (A) than building (B), which is existing inprotected natural area. It can be improving the "cost"element for building (A) to increase the total rank.

<u>conclusions:</u>

According to the results of the model for evaluating the effects of constructing different types of structures on utilities diversion, conclusions can be summarized in the following points:

- A new model programmed to evaluate the impacts of the projects on diverting utilities before constructionwas built and tested.
- The expert's questionnaire is basic factor for input data that differs from a project to another accordingto its type or conditions as mentioned.
- The critical parameters factors are changed according to the structure type (suspended, Overground structures rested, Underground structures).
- The final evaluation is according to the sum of total weights and the grade of theproject impact on the diverting utilities and rank the project before constructionthat can help to improve the element weight by restudy the project again.
- The results of the model represent a guide for the way forward for restudying orimproving the shortage in any evaluation percentage for the parameters impacts.
- The model can help for decision support system (DSS) that some projects, whichhave ranks less than ٦٠٪ to be restudied.

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Estimating the Seismic Pounding Force between Adjacent Buildings and Study the Effect of Gap Distance on Seismic Pounding

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Abstract. Insufficient separation distance between adjacent buildings may lead to their pounding during strong earthquakes causing damage or local failure. Accordingly, most of the design codes specify a minimum separation or gap distance between adjacent buildings to prevent their seismic pounding. Main objectives of this study are study the seismic pounding between adjacent rein- forced concrete buildings under various ground motions and study the effect of gap distance on seismic pounding. The studied buildings are modeled as two- dimensional frames to idealize the adjacent buildings. This study considers ad- jacent frame buildings having the same number of floors as well as frames hav- ing a different number of floors. Nonlinear finite element time history analysis is performed using ETABS commercial software. Three different real earth- quake records with different characteristics are scaled and used to simulate ground motion. Nonlinear gap element is used to model pounding between buildings at their interface points. The results of the study indicate that, the maximum pounding force was investigated for each of the studied cases. Pounding does not occur between buildings having equal height. Increasing separation distance between buildings reduces the pounding force between them. Separation distance which estimated by the Egyptian code is conserva- tive.

Keywords: Separation Distance, Pounding Force, Time History, Earthquake, Adjacent Buildings.

١ Introduction

During the earthquake there are many types of failures and damage that may occur to the building. Some are due to design errors and others are due to external factors that have not be taken into account in design such as, pounding between adjacent struc- tures (Naeej et al. ٢٠١٩, Abdel Raheem et al. ٢٠١٨, Elwardany et al. ٢٠١٧). Structures with large plan dimensions, as well as those with parts of a different number of floors, might be required to be separated into two or more parts by expansion joints or sepa- ration distances. If the separation distance, during an earthquake, is not sufficient to accommodate the relative lateral deformations of the adjacent buildings, they might

come into contacts or collide with each other. This collision between adjacent build- ings during earthquake is referred to as seismic pounding (Shrestha and Hao. ٢٠١٨). This pounding may cause local damage, significant damage or even total collapse of the adjacent buildings depending on the earthquake strength such as buildings in Christchurch CBD as shown in Fig. ١ (Khatami et al. ٢٠١٩).

Fig. ١. Pounding damage observed in Christchurch CBD

٢ Background

Many analytical and experimental research works have been carried out to study the seismic pounding between adjacent buildings. Adjacent buildings that have different dynamic properties such as time period, mass, rigidity and geometry vibrate out of phase. These vibrations can be strong enough to create forces that affect the structural response of the buildings. Observations after many earthquake indicates that local damage at the interaction point is due to insufficient separation between buildings. Therefore, major efforts have been directed towards the problem of seismic analysis of buildings using different modeling techniques (Mohamed et al. ٢٠٢١).

٢.١ Different models of pounding

This section explains the different models used to simulate impact between adjacent buildings. The distance between buildings (gap) is the significant element in pounding model because it affects the pounding force and level of damage. Adjacent buildings are modeled using masses and the pounding between these mass is simulated by con- tact or gap element. This gap element is activated when masses collides and deac- tivated when masses are apart. For example of this model that discussed are a stereo- mechanical model, linear spring model, Kelvin-Voight element model, and Analyticalsolution as explained later in this section.

٢,١,١ Stereo mechanical model

Stereo mechanical model is used the final velocity of impacting bodies which is basedon their initial velocity. It also considered the effect of material properties of the masses through the coefficient of restitution as simulated by Goldsmith (١٩٦١). The coefficient of restitution value can be obtained from any material by dropping test which threw sphere formed by any material from height (h) then measure the rebound height in opposite direction to get (h*). The value of coefficient of restitution (e) ranges between ٠ and ١. When the (e) convergences to (٠) it indicates plastic collision and when it convergences to (١) it refers to elastic collision as shown in Eqs. (١), (٢), and (٣). Furthermore, for multiple degrees of freedom system when several colliding expected at various time, the application of the Stereo-mechanics based model is seen as infeasible (Jankowski, ٢٠٠٥).

٢,١,٢ Linear spring model

A linear elastic spring was used to simulate the contact element between adjacent structures this contact element called gap element when its stiffness depends on the axial stiffness of the collided elements of the structures as used by Masion and Kasai (١٩٩٠) as shown in Fig. ٢. When buildings vibrate out of phase the relative displace- ment change by their motion and the spring begins to observe the force when the ini- tial gap between the structures is less than relative gap between them. Force on con- tact or gap element can be calculated according to Eqs. (٤) and (٥). Where u١ and u٢ are the displacements of the impacting masses during oscillator (pounding), k١ is the spring stiffness constant and gp is the initial separation distance between the structures.

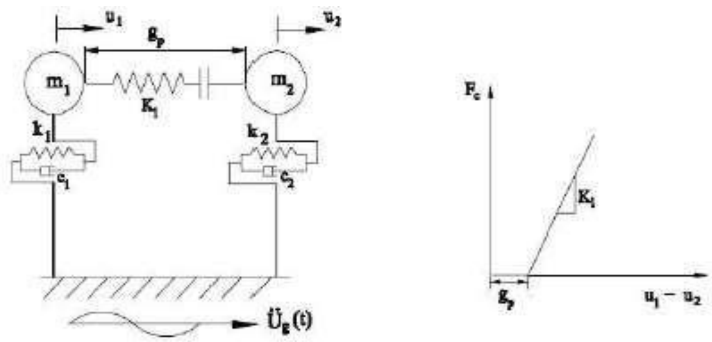

Fig. ٢. Liner spring model between two masses

١,١,١ Kelvin-Voight element model

The significant addition in this model is the damper working parallel to linear spring as show in Fig. ٣. The importance of the damper is that, it takes the effect of energy dissipation as used by Anagnostopoulos (١٩٨٨).

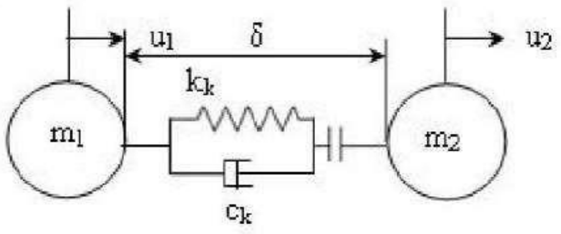

Fig. ٣. Kelvin-Voight element

The second term, taking into consideration the energy dissipation during mass vibra- tion is taken into consideration by the expressed Eqs. (٦) and (٧).

١,١,١ Analytical solution

To obtain pounding force in spring it must be added to the general Equation of motion(Ks) was expressed by Eq. (١٠).

$$m \ddot{x} + c \dot{x} + k x + k_s x = m \ddot{x}_g \quad (١٠)$$

Where x is the displacement vector for all degree of freedom, $\dot{x}$ is the velocity vector for all degree of freedom, $\ddot{x}$ is the acceleration vector for all degree of freedom, m is the Mass matrix for structure degree of freedom, c is the damping matrix estimated by Rayleigh Equation, k is the stiffness matrix for structure degree of freedom, $\ddot{x}_g$ is the input ground motion, and k_s is the stiffness matrix for gap element.

When colliding occurs between two structures each of them estimated by Eqs. (١١) and (١٢) according to gap element under compression or tension force as shown in Fig. ٤ (Mate et al. ٢٠١٤).

$$m_1 \ddot{x}_1 + c_1 \dot{x}_1 + k_1 x_1 + k_s x_1 = - m_1 \ddot{x}_g \quad (١١)$$

$$m_2 \ddot{x}_2 + c_2 \dot{x}_2 + k_2 x_2 - k_s x_2 = - m_2 \ddot{x}_g \quad (١٢)$$

Where x١ and its derivatives ẋ١ and ẍ١ are displacement, velocity and acceleration for structure (١) respectively while x٢ and it derivatives ẋ٢ and ẍ٢ are displacement, velocity and acceleration for structure (٢) respectively, and k_S is spring stiffness.

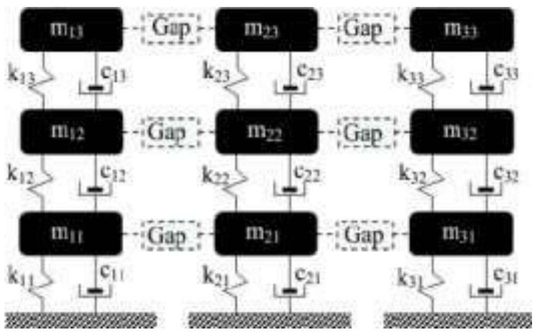

Fig. ٤. MDOF for three adjacent masses

٢,٢ Code Requirement to avoid pounding

Most of the code calculates the gap distance based on the maximum displacement of the adjacent structure. Then different techniques are used to calculate the gap distance, some of the techniques are Square Root of Sum of Squares (SRSS) and Complete Quadratic Combination (CQC). Table ١ summarizes the different equation to calculate the gap according to different international codes .

Table ١. Minimum separation distance for various codes

Code	Separation distance (□m)
Egyptian Code (ECP: ٢٠٣-٢٠٠٧)	Estimate overall displacement for two structure and take square root sum of the square (SRSS) but if slabs have same elevation multiple ٠,٧ to get minimum separation distance. □m = $\sqrt{\delta m_1^2 + \delta m_2^2}$
Uniform Building Code (UBC-١٩٩٧)	Take square root sum of the square for adjacent building for max building. □m = $\sqrt{\delta m_1^2 + \delta m_2^2}$
Federal Emergency (FEMA:٢٧٣-١٩٩٧)	Prevent pounding by separation distance which equal ٤٪ multiple overall height.
Indian standard	(IS:١٨٩٣-٢٠٠٢)

١ _Methodology

١,١ Brief description of the study buildings

The buildings in this study were selected as two dimensional building with multi-floorand multi-bay reinforced concrete structure. Fig. ٥ shows two adjacent buildings with length of ١٨m and ٣٦m were used in this study. Floor height of the buildings is equal ٣,٠m. Building with ١٨m length, four models were built with number of floors of ٣،٦،٨and ١٢ floor while for building with ٣٦m length, two models were built with number of floors of ٦ and ١٢ floor. Buildings are symmetric along its axes and thus torsional effect was not considered in analysis accordingly. Buildings were consideredfixed in their conn

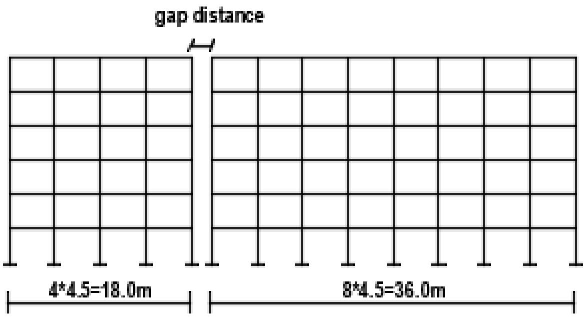

Fig. ٥. Building layout (Elevation)

ection with the foundation. A ٣D finite element is constructed for each one of the studied structures separately. An available software package known asETABS was utilized for the modeling and analysis. Table ٢ shows the list of study cases for the buildings.

Table ٢. List of study cases for the buildings.

Case	Left building		Right building	
	No. of floor	No. of bays	No. of floor	No. of bays
١	٣	٤	٦	٨
٢	٦	٤	٦	٨
٣	٦	٤	١٢	٨
٤	٨	٤	١٢	٨
٥	١٢	٤	١٢	٨

١,١ Materials Properties

Characteristic compressive strength of reinforced concrete is ٢٥N/mm٢, Yield stress of reinforced steel is ٣٦٠N/mm٢, Passion's ratio is ٠,٢, and Young's modulus estimat-ed according to Egyptian code by Eq. (١٣).

$$E = 1400\sqrt{F_{cu}} \qquad (١٣)$$

Where, F_{cu} is the characteristic compressive strength of reinforced concrete.

۱,۲ Properties of Gap Element

Separation distance between adjacent buildings was modeled with gap element using ETABS program as shown in Fig. ٦. This element is a compressive force only trans- mitted when buildings are in contact while zero in tension or when the relative dis- placement between the adjacent elements is less than the initial separation distance. The gap element is non-linear element has two significant parameters; namely the stiffness and the opening. Gap element force deformation relation is given by the following Eq. (۱٤).

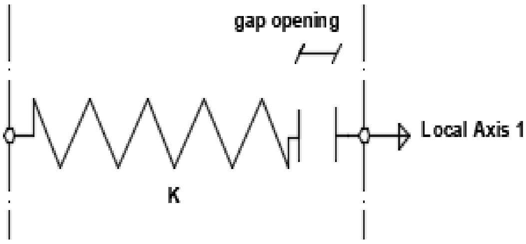

Fig. ٦. Gap element

Where, K_g is the spring stiffness of the contact element, d is the building displace- ment, and open is the separation or initial gap which must be zero or positive, the following criteria was considered for the gap element:-

- Stiffness: take gap stiffness as axial stiffness of colliding slabs for two adjacent building by using Kelvin Voight method $K=۲*۱۰^{٦}$ KN/m (Maison and Kasai, ۱۹۹۲).
- Opening: is a separation distance between two adjacent structures. In this study,
  opening was assumed ٥ mm, ۱۰ mm, ۲۰ mm, and ٤۰mm.

۲,۳ Loads

۲,۳,۱ Vertical Loads

Vertical loads included own weight of the different elements which is calculated by program. It included also live load was taken ۲,۰KN/m^{۲} and flooring cover was taken ۱,٥KN/m^{۲}.

۲,۳,۲ Seismic Loads

To get the structural response of the structure during and after seismic load excitation time history need to be carried out. In this study, three seismic records are utilized. These records are Friuli, Newhall, Sylmar earthquakes which selected to present low, moderate and high ground motion. The maximum ground acceleration for each record are ۰,۳۱g, ۰,٦g, and ۰,۷٦g, respectively. The acceleration record of the selected ground motion are shown in Figs. ۷, ۸, and ۹ for Friuli, Newhall, and Sylmar, respec- tively. Input earthquake records which have a relationship between ground motion and time. The records obtain from seismologist records. The condition of ECP code the artificial less than or equal three earthquakes. If exposed the structure to earth- quake such as Friuli ground motion which max design acceleration by .٣١g, should bescaled to ECP code max acceleration .١٥g.

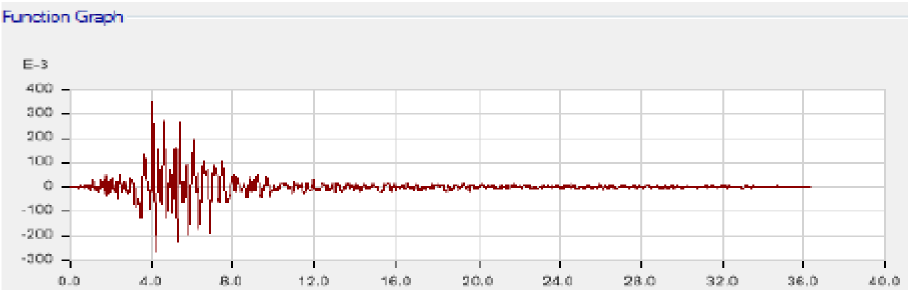

Fig. ٧. Time history graph between time (sec) and ground motion (Friuli)

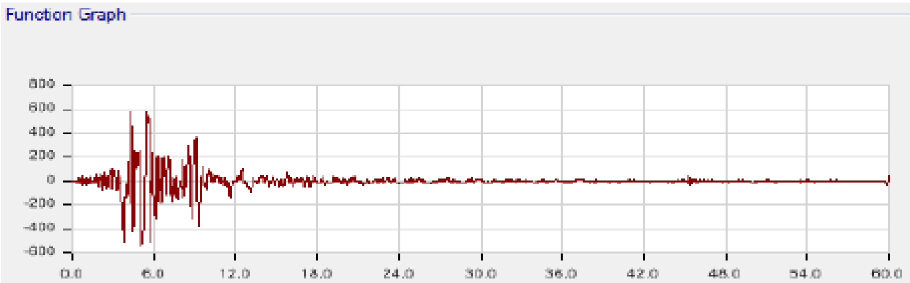

Fig. ٨. Time history graph between time (sec) and ground motion (Newhall)

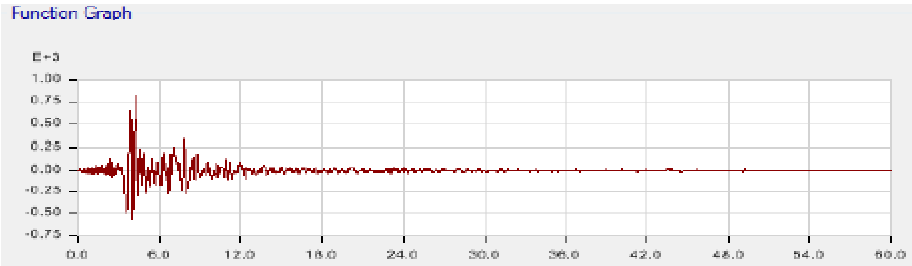

Fig. ٩. Time history graph between time (sec) and ground motion (Sylmar)

٢,٤ Design of Buildings

Studied buildings were designed according to Egyptian code requirements. Table ٣ summarized the beams and columns dimension from structure design.

Table ٣. Columns and beams dimensions

Buildings	Beams	Inner columns	Outer columns

	(cm)	(cm)	(cm)
٣- floor	٣٠*٦٠	٣٠*٣٠	٤٠*٤٠
٦- floor	٣٠*٦٠	٣٥*٣٥	٥٠*٥٠
٨- floor	٣٠*٦٠	٤٠*٤٠	٦٠*٦٠
١٢- floor	٣٠*٦٠	٥٥*٥٥	٧٠*٧٠

٢,٥ Model Analysis

Structures are simulated using finite element program (ETABS) to obtain straining action and check safety of section. This section exhibits properties of model such as time period of structure and mass participation in models because ECP mention as in seismic analysis mass participation must exceeded ٩٠٪ of total mass. Table ٤ present time periods for first four models for each buildings. Table ٥ summarized the result for calculated mass participation factor.

Table ٤. Fundamental period for all height of building

No. of bays	No. of floor	Model ١	Model ٢	Model ٣	Model ٤
٤	١	٠,٥٧٣	٠,٠٢٥	٠,٠١٧	٠
٤	٣	٠,٨١٣	٠,٢٥٤	٠,١٦٥	٠,٠٥٨
٤	٦	١,٤١	٠,٤١	٠,٢١٤	٠,١٥
٤	٨	١,٥٣	٠,٤٧٣	٠,٢٢٣	٠,١٧٦
٤	١٠	١,٨٦	٠,٥٧٥	٠,٣١٩	٠,٢١٥
٤	١٢	٢,١٦	٠,٦٩٤	٠,٣٨٥	٠,٢٥٣
٨	١	٠,٦١٥	٠,٠٩٥	٠,٠٥٠	٠,٠٣٨
٨	٣	٠,٧٦٩	٠,٢٥٣	٠,١٥٩	٠,٠٥٠
٨	٦	١,٢٢٠	٠,٣٩٢	٠,٢٢١	٠,١٤٨
٨	٨	١,٥٣١	٠,٤٨٦	٠,٢٦٧	٠,١٧٦
٨	١٠	١,٨١٩	٠,٥٦٣	٠,٣٢٠	٠,٢٠٨
٨	١٢	٢,١٦١	٠,٦٧٧	٠,٣٧٥	٠,٢٤٨

Table ٥. Mass participation for all modes building

No. of bays	No. of floor	Model ١	Model ٢	Model ٣	Model ٤	Total Modes
٤	١	١٠٠٪	٠	٠	٠	١٠٠٪
٤	٣	٨٧,٨٪	٩,٠٪	٢,٤٪	٠	٩٩,٢٪
٤	٦	٨٢,٣٪	١٠,٢٪	٤,٠٪	٢,٠٨٪	٩٨,٦٪
٤	٨	٨٠,٣٪	١٠,٢٪	٤,١٪	٢,٣٪	٩٦,٩٪
٤	١٠	٧٩,٤٪	١٠,٠٪	٤,٠٪	٢,٣٪	٩٥,٧٪
٤	١٢	٧٨,٨٪	١٠,٤٪	٤,٠٪	٢,٣٪	٩٥,٥٪
٨	١	١٠٠٪	٠	٠	٠	١٠٠٪

٨	٣	٨٧,٧٪	٩,٩٪	٢,٢٥٪	٠	٩٩,٨٥٪
٨	٦	٨٢,٣٪	١٠,١٪	٤,٠٣٪	٢,١٪	٩٨,٥٣٪
٨	٨	٨٠,٣٪	١٠,١٢٪	٤,١٥٪	٢,٣٦٪	٩٦,٩٣٪
٨	١٠	٧٩,٥٪	٩,٩٪	٤,٠٪	٢,٣٪	٩٥,٧٪
٨	١٢	٧٨,٩٪	٩,٨٪	٤,٠٪	٢,٣٪	٩٥,٠٪

٢,٥,١ Colliding Model

Model in this study assumed collision between structures (slab to slab), which linked (tied) at each floor by gap element in structures with equal height. But in unequal height building floor linked at the shorter floor. Another floor in the tall building is free as shown in Fig. ١٠. Colliding occurs between two adjacent structures when the stress on spring is a higher value than tensile spring resistance.

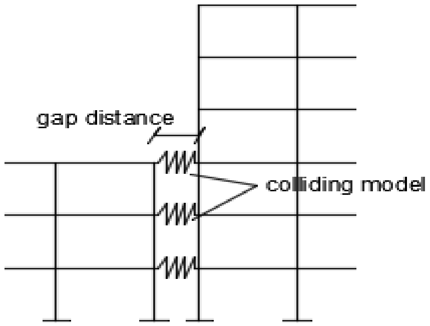

Fig. ١٠. Collision points at slab to slab

١,١,١ Pounding Verification Model

In order to make sure this model is valid to use, must make check under another pro- gram such as SEISMOSTRUCT software program which published at thesis by To- hamy (٢٠١٧). In our example, two adjacent ٢-D Frame consists of ٩ and ١٢ floors respectively under ELCENTRO ground motion scaled to ٠,١٥g. The separation dis- tance between two buildings is zero. The output result from ETABS ٢٠١٣ and SEISMOSTRUCT for max pounding for at ٩th floor is ٤٦٨,٤ and ٤٠٩ respectively with a different ratio less than ١٥٪.

٣ Results

٣,١ Sufficient gap according to the Egyptian code

This section discusses calculation of sufficient according to Egyptian code which accommodates relative displacement and input Newhall and Sylmar earthquake ground motion for all cases. Tables ٦ and ٧ show the sufficient gap according to Egyptian code under Newhall and Sylmar ground motion, respectively.

Table 6. Sufficient gap according to Egyptian code under Newhall ground motion

Case	Elastic max. displacement (mm)		Square root sum of the square (SRSS) (mm)	Multiple 0.7(impact slab to slab) (mm)	Sufficient distance (Multiple 0.7*R*Δ) (mm)	Ratio from sufficient separation distance		
	4-bay	8-bay				25% (mm)	50% (mm)	75% (mm)
1	15.1	26.9	30.85	21.6	75.6	18.9	37.8	56.7
2	22.7	19.9	30.18	21.13	74.0	18.5	37.0	55.5
3	22.7	52.7	57.4	40.16	140.6	35.15	70.3	105.5
4	33.0	52.7	62.2	43.5	152.3	38.1	76.2	114.2
5	53.9	52.7	75.4	52.75	184.7	46.2	92.4	138.5

Table 7. Sufficient gap according to Egyptian code under Sylmar ground motion

Case	Elastic max. displacement (mm)		Square root sum of the square (SRSS) (mm)	Multiple 0.7(impact slab to slab) (mm)	Sufficient distance (Multiple 0.7*R*Δ) (mm)	Ratio from sufficient separation distance		
	4-bay	8-bay				25% (mm)	50% (mm)	75% (mm)
1	16.0	32.9	36.6	25.6	89.65	22.4	44.8	67.2
2	19.8	17.8	26.6	18.65	65.2	16.3	32.6	48.9
3	19.8	44.1	48.3	33.85	118.4	29.6	59.2	88.8
4	29.1	44.1	52.83	37.0	129.4	32.35	64.7	97.0
5	45.2	44.1	63.15	44.20	154.7	38.6	77.3	116

Fig. ١١ shows that, pounding force didn't occur at the ٥٠٪, ٧٥٪ and ١٠٠٪ of suffi- cient separation distance in all cases but at ٢٥٪ of sufficient separation distance pounding occur at case ١ and case ٤ as value of pounding force ٢٧٩ KN and ١٨١ KN, respectively. The previous result indicate that sufficient separation distance which was estimated by Egyptian code by SRSS was safer. All cases in the analysis didn't colliding occur for ٥٠٪ for sufficient gap according to ECP.

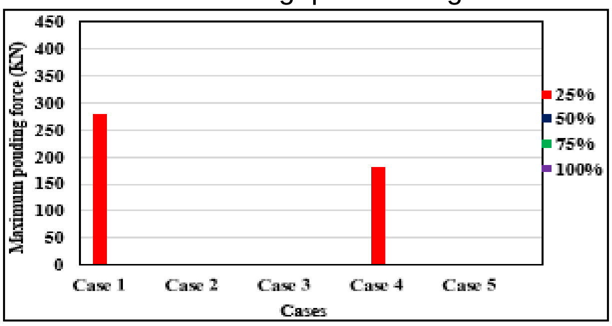

Fig. ١١. Relation between increase gap and max pounding force under Newhall ground motion

٣,٢ Max pounding force

Pounding force is discussed for each study cases. The pounding force is estimated for adjacent structures under various gap distances such as ٥, ١٠, ٢٠, and ٤٠mm under three earthquake ground motions. Cases ٢ and ٥ present buildings with equal height while other cases simulate buildings with different heights. Results of these cases will be presented and discussed in the following sections.

٣,٢,١ Case ١

In this case, two adjacent building vibrate under three earthquake ground motion are Friuli, Newhall, Sylmar. Left building is ٣-floor with ٤-bays and right building is ٦- floor with ٨-bays as shown in Fig. ١٢.

Fig. ١٢. Case ١ (٣-floor and ٦-floor)

The maximum pounding force at each floor for both ٥mm and ١٠mm separation dis- tance under three earthquake ground motion is shown in Figs. ١٣ and ١٤, respectively.

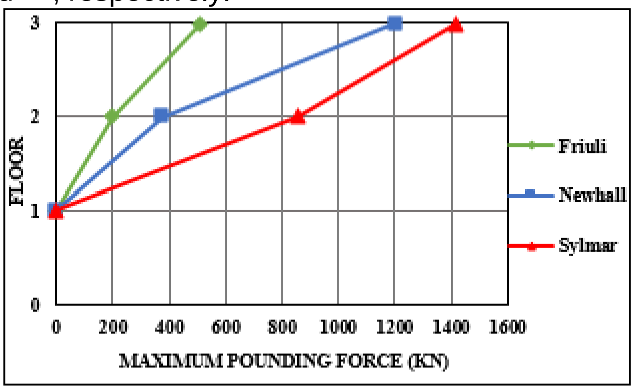

Fig. ١٣. Distribution of max pounding force on various floors (gap ٥mm)

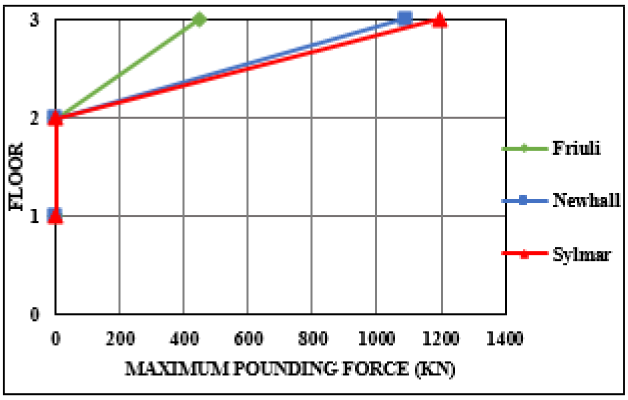

Fig. ١٤. Distribution of max pounding force on various floors (gap ١٠ mm)

Maximum pounding force was observed at a top floor (last connected floor) under three earthquake ground motion. Pounding force reduced when gap distance increase from ٥mm to ١٠mm for three earthquake ground motion this indicates that the pound- ing force is inversely proportional to the separation distance. No pounding force ob- served at ١st floor for gap ٥mm in addition to no pounding force observed at ١st and ٢nd floor for gap ١٠mm. when gap increased to ٢٠mm and ٤٠mm, no pounding force was observed for three earthquake ground motion.

١,١,١ Case ٢

In this case, two adjacent building vibrate under three earthquake ground motion are Friuli, Newhall, Sylmar. Left building is ٦-floor with ٤-bays and right building is ٦- floor with ٨-bays as shown in Fig. ١٥.

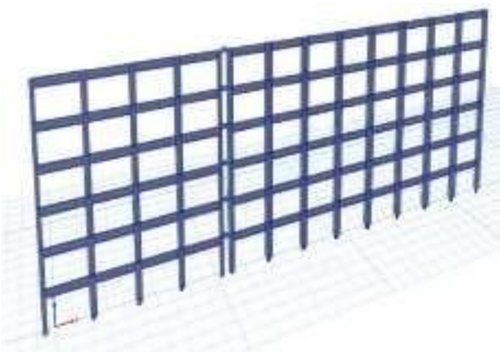

Fig. ١٥. Case ٢ (٦-floor and ٦-floor)

Two structure didn't collide with each other because the two adjacent structures have same time period, two structure vibrate in phase (vibrate in the same direction) so the force of the spring is equal zero for gaps ٥, ١٠, ٢٠ and ٤٠mm.

١,١,١ Case ٣

In this case, two adjacent building vibrate under three earthquake ground motion are Friuli, Newhall, Sylmar. Left building is ٦-floor with ٤-bays and right building is ١٢- floor with ٨-bays as shown in Fig. ١٦.

Fig. ١٦. Case ٣ (٦-floor and ١٢-floor)

The maximum pounding force at each floor for ٥mm, ١٠mm, and ٢٠mm separation distance under three earthquake ground motion is shown in Figs. ١٧, ١٨, and ١٩, re- spectively.

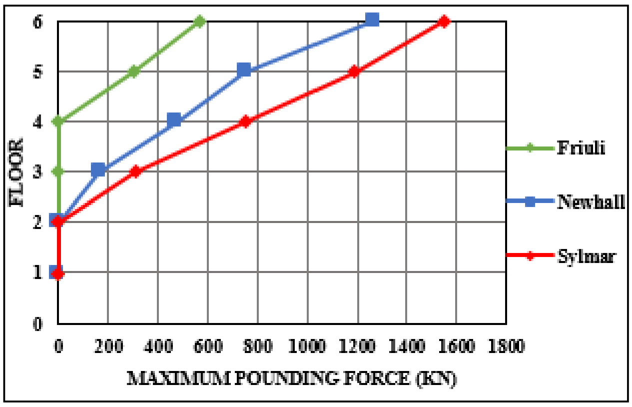

Fig. ١٧. Distribution of max pounding force on various floors (gap ٥mm)

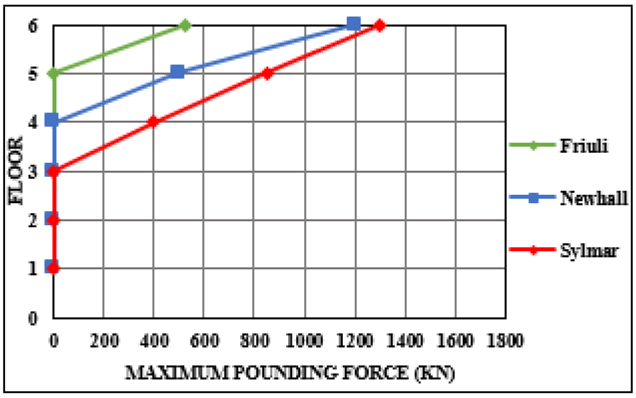

Fig. ١٨. Distribution of max pounding force on various floors (gap ١٠mm)

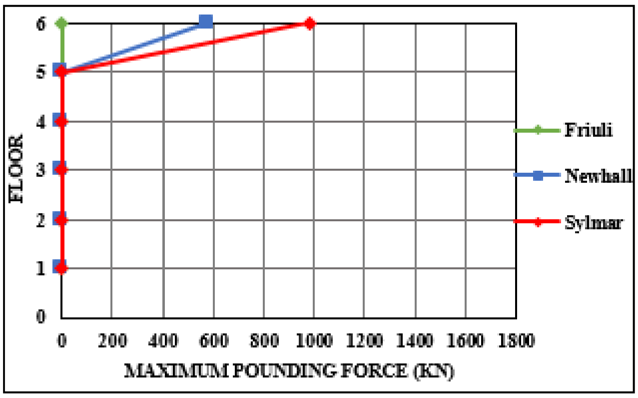

Fig. ١٩. Distribution of max pounding force on various floors (gap ٢٠mm)

Maximum pounding force was observed at a top floor (last connected floor) under three earthquake ground motion. Pounding force reduced when gap distance increase from ٥mm to ٢٠mm for three earthquake ground motion this indicates that the pound- ing force is inversely proportional to the separation distance. For Friuli earthquake ground motion, no pounding force observed at ١st, ٢nd, ٣rd, and ٤th floor for gap ٥mm while no pounding force was observed for all floors for gap ٢٠mm. For Newhall and Sylmar earthquake ground motion, no pounding force observed at ١st, and ٢nd floor forgap ٥mm while no pounding force was observed at ١st, ٢nd, ٣rd, ٤th, and ٥th floor for gap ٢٠mm. When gap increased to ٤٠mm, no pounding force was observed for three earthquake ground motion.

١,١,١ Case ٤

In this case, two adjacent building vibrate under three earthquake ground motion are Friuli, Newhall, Sylmar. Left building is ٨-floor with ٤-bays and right building is ١٢- floor with ٨-bays as shown in Fig. ٢٠.

Fig. ٢٠. Case ٤ (٨-floor and ١٢-floor)

The maximum pounding force at each floor for ٥mm, ١٠mm, and ٢٠mm separation distance under three earthquake ground motion is shown in Figs. ٢١, ٢٢, and ٢٣, re- spectively.

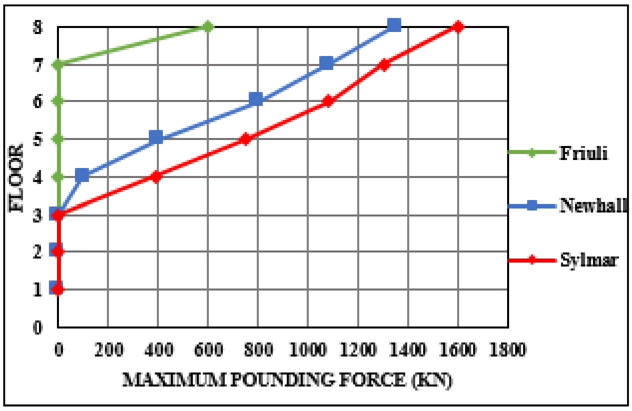

Fig. ٢١. Distribution of max pounding force on various floors (gap ٥mm)

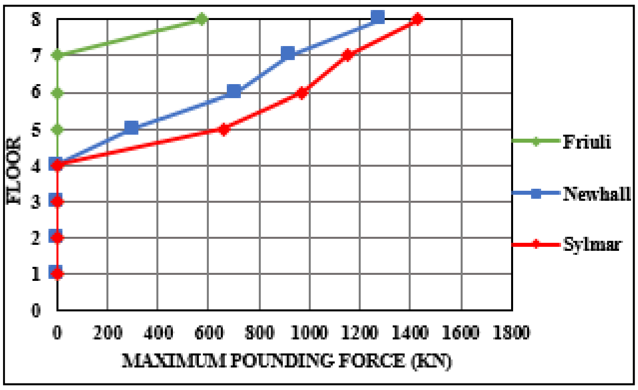

Fig. ٢٢. Distribution of max pounding force on various floors (gap ١٠mm)

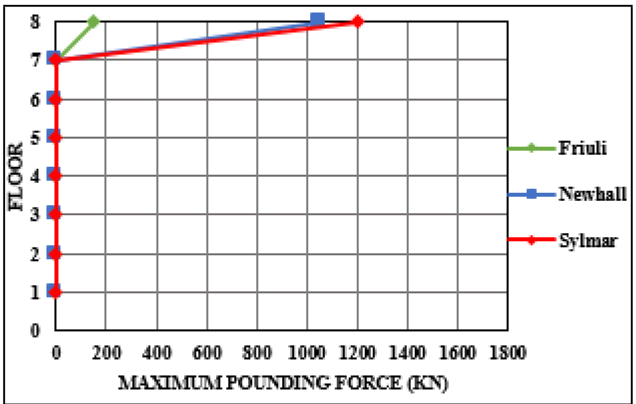

Fig. ٢٣. Distribution of max pounding force on various floors (gap ٢٠mm)

Maximum pounding force was observed at a top floor (last connected floor) under three earthquake ground motion. Pounding force reduced when gap distance increase from ٥mm to ٢٠mm for three earthquake ground motion. This indicates that the pounding force is inversely proportional to the separation distance. For Friuli earth- quake ground motion, no pounding force observed at ١st, ٢nd, ٣rd, ٤th, ٥th, ٦th, and ٧th floor for gap ٥mm, ١٠mm, and ٢٠mm. For Newhall and Sylmar earthquake ground motion, no pounding force observed at ١st, ٢nd, and ٣rd floor for gap ٥mm while no pounding force was observed at ١st, ٢nd, ٣rd, ٤th, ٥th, ٦th, and ٧th floor for gap ٢٠mm. When gap increased to ٤٠mm, no pounding force was observed for three earthquake ground motion.

١,١,١ Case ٥

In this case, two adjacent building vibrate under three earthquake ground motion are Friuli, Newhall, Sylmar. Left building is ١٢-floor with ٤-bays and right building is ١٢-floor with ٨-bays as shown in Fig. ٢٤.

Fig. ٢٤. Case ٥ (١٢-floor and ١٢-floor)

Two structure didn't collide with each other because the two adjacent structures have same time period, two structure vibrate in phase (vibrate in the same direction) so the force of the spring is equal zero for gaps ٥, ١٠, ٢٠ and ٤٠mm.

٣,٣ Effect of Gap Distance on Pounding Force

The effect of various gap distance on pounding force is shown in Figs ٢٥, ٢٦, and ٢٧ for all study cases. Under three earthquake ground motions, increasing gap distance between adjacent buildings causes decrease in pounding force.

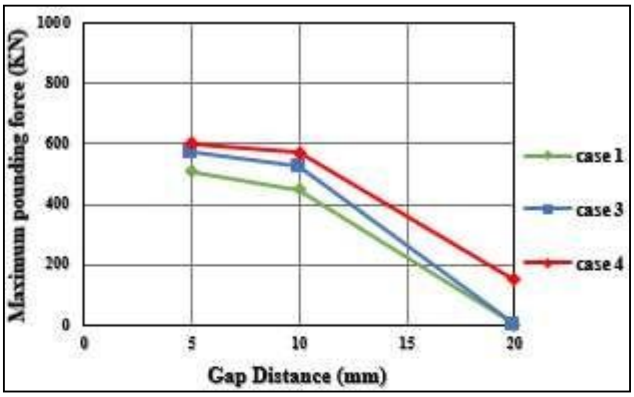

Fig. ٢٥. Max. Pounding force at various gap under Friuli ground motion

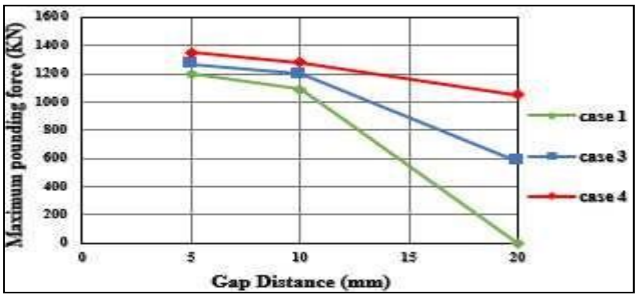

Fig. ٢٦. Max. Pounding force at various gap under Newhall ground motion

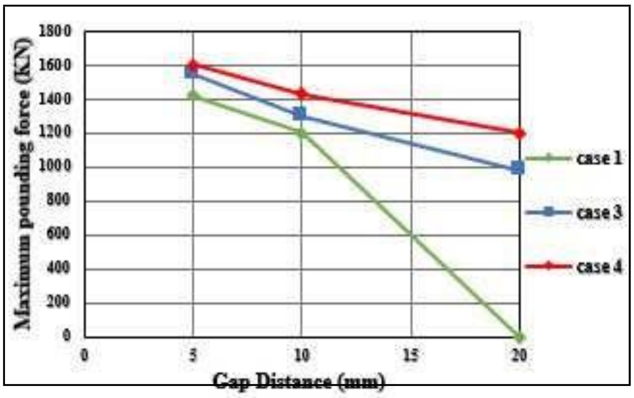

Fig. ٢٧. Max. Pounding force at various gap under Sylmar ground motion

٤ Conclusion

Upon the results and the parametric study of this research work, it may be concludedthat:-

- Separation distance which estimated by the Egyptian code is conservative. Pound- ing start to occur between buildings at a distance equal to half that required bythe code.
- Increase the initial separation distance between buildings decreases the poundingforce between them. This has been observed in all studied cases.
- All cases in this study, pounding does not occur between building having

equal
height and with near time period.

- Increase mass for two adjacent buildings lead to increase max pounding force.

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An Analytical Study of Accidents in Construction Sites

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Abstract

The administration is concerned with the implementation of the work and achieving its goals in a sound administrative, legal and technical framework. It is the responsibility of the administration to organize and follow up the work to ensure its implementation without obstacles and without departing from the permissible framework of cost, quality and time period. This research aims to identify the types of accidents and injuries that occur at construction and building sites. To achieve the goals of this study, a statistical analysis was made of a group of workers accidents at the implementation sites. And from the reality of the accident record in the implementation periodfor each project and based on the data for those records, this study analyzed data that pertains to the type of work of the worker, the cause of the accident, and how the accident occurred. The research shows the frequency of accidents and the identification of ratios and the most important accidents that occupy a large percentage, and based on their identification, they will be a focus of attention from the Occupational Safety and Health Administration in construction and building sites

Key Words

Construction site accidents, Occupational safety and health management, Work regulations, WorkLaw, Construction management.

Introduction

Occupational safety and health management and protection of employees from work hazards and occupational diseases is an important topic, because this topic closely related to the human and ethical aspects of the employer towards his employees, as the employer is the main cause of employment. In Egypt, Occupational Safety and health is subject to international labor laws, which are ratified by the Egyptian labor laws as part of each job (Shararah, ٢٠١٦)

The first Occupational Safety and health legislation released in ١٨٠٢ in England. Since that date, many local and international laws and conventions mandated to achieve a safe working environment for employees. (OSH Act of ١٩٧٠)

Labor Law No. ١٢/٢٠٠٣, Chapter ٥ (Occupational Health and safety) and Chapter ٦ (penalties), Decree No. ٢١١ of ٢٠٠٣ states the conditions and precautions for the provision of means of Occupational Safety and health in the workplace. Decree No.

١٢٦ of ٢٠٠٣ states the statistical forms of serious injuries, accidents and diseases. Decree No. ١٣٤ of ٢٠٠٣ states the identification of establishments, Occupational Safety and health agencies and training authorities, and Decree No. ١٣٤ of ٢٠٠٣ states the organization of the Occupational Safety and health advisory body. Chapter –VII of the –Labor Code Article ٢٠٢ to Article ٢٣١II states safety of the working environment, the facility obligation to establish and provide means of safety and occupational health, to ensure the Prevention of all risks depending on the work nature, as well as to establish and carry out a risk assessment, analysis and emergency plans.

The FIDIC contract, Terms of Civil Engineering Contracting, part one (general terms), article ١٩,١ stated –Obligated the contractor to take into account the safety of all persons entitled to be at the site and avoid risks on themII.

Occupational Safety and Health Management in construction projects is a big challenge, as each project has its own character and has different risk group than any other project, so it is difficultto work because there is no firm base to rely on. (Gould and Joyce, ٢٠٠٠)

In the construction sector, the working environment is wide-open, the workplace changes from one project to another, and each project has a different nature from any other project in terms of the quality of the business items and their quantities and specifications. (Moses, ٢٠٠٣)

In construction industry work, there is a need to use machines and equipment in order to make thework more efficient and faster. Therefore, we need to update the machine type regularly, and to keep track on the new technology of the new machines as many updates of the machines helps onthe Occupational Safety and Health Management, which result in decreasing the occupational risks. (Hislop, ١٩٩٩).

As shown by research (Amt für Veröffentlichungen der E. U., ٢٠١٢) for narrow workplaces. In spite having clear strategies and plans for Occupational Safety and health in the workplace, and the capability to analyze risks to fond the basis for determining the necessary requirements for Occupational Safety and health, the percentage of accidents increases as the size of the workplacedecreases. Also the percentage of accidents caused by explosions, suffocation, and electrical shocks. The research also shows the importance of employees ' participation (after training and raising awareness of Occupational Safety and health regulations) to the assessing risks as they areknow their workplaces. Therefore identifying risk reasons factors - how to identify risks – how to assess risks – how to identify needs to prevent or minimize them – how to evaluate results – and measure the effectiveness of the risk elimination – or decreasing – processes, how to evaluate the results – how to measure the efficiency of those operations.

The costs of occupational safety and health considered as the price of what the organization - or the work system – needs to protect employees. In addition to administrative expenses such as; thesalaries of engineers and safety's and occupational health's supervisors. On the other hand, safetyand occupational health saves the organization a lot of expenses, as lot of losses happens if an accident happens, as this means that work is delayed, and cost the organization many compensation, as it also affects the overall workers' performance level. The negative impact of accidents is by far more than the costs of safety and occupational health requirements. Countries pay lot of costs due to accidents and injuries. Occupational safety and health is not a burden that increasing the project's costs. As the cost of accident or injuries (when occurs) is high in the formof workers' injuries, as well as the negative economic impact, which confirms that Occupational safety and health is a necessary action that must be taken into account. Therefore, the occupational safety and health costs are not an overburden for the project, but rather have a returnon it. By applying safety and occupational health requirements we can reduce - if not avoid - injuries, accidents and occupational diseases. Therefore, saving time lost due to injuries and accidents. Bad workers' psychological state occurs as accident happens avoided. Moreover, avoiddecreasing performance rates as well and working hours' loos. (Sharara, ٢٠١٦).

The risks study is for not only in site risks that affect workers in site, but also for those out of the site risks. The occupational safety and health team must study the surrounding environment, the potential risks, and how to prevent them or at least reduce their impact.

Duties and responsibilities of Occupational Safety and health department:

- **Organizing and planning work:** Based on the study of the project, the activities of the project, and the implementation method, and study the work schedules from the perspective of Occupational Safety and health. The necessary work plans to ensure the workers' safety. Developa review system and monitor the expected risks protecting tools.
- **Make the Occupational Safety and health plan:** Based on business analysis, work schedule study, and risk identify. Choose the personal protection hardware tools. Review and test the proposed used tools (ladders, scaffolding, hand tools, tools and electrical appliances, etc.).

– The number of employees: the number of Occupational Safety and health personnel isdetermined based on the number of employees, as well as the quality of work and the degree of risks. Knowing the number of employees is an essential factor for many calculations of Occupational Safety and health plans, as well as to calculate the numbers of work needs of accommodation – toilets – number of first aid teams and necessary equipment.

- **Contingency plan:** In addition to previously notes make an emergency plan.

and that the construction industry is the second most dangerous working sector and the most caused injuries accidents.

The research (Hassan, ٢٠٠٩) examined the concept and importance of Occupational Safety and health and its responsibility, and correlated a relationship between occupational safety and health and employee productivity. As the more concern, the corporate management's in Occupational Safety and health, the more to accidents preventing or reducing their frequency to minimize injuries, to preserve the employees' lives. One of the worst consequences of accidents is the psychological impact on the injured workers and on their colleagues. The research also classifies the factors affecting the productivity of workers as technical factors related to the work nature, and humanitarian factors that includes skills and colleagues relationships that affected by accidents and injuries, causing low worker productivity. The study recommends the importance of expanding the powers of the Occupational Safety and Health Administration because of its roleand impact on the productivity of workers.

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The research (Ismail, ٢٠١٢) evaluated the effectiveness of Occupational Safety and health procedures in scientific laboratories in Palestinian universities. The research collected information and data related to the work nature, safety procedures followed, accidents causes, andintensification of training courses on Occupational Safety and health. The study indicated that there are no plans for occupational safety and health, as it was evident through the study's results that there is no interest in having records of accidents and injuries to workers.

The study (Ezzat, ٢٠٢٠) aims to assess the effectiveness of Occupational Safety and health system by identifying strengths and weaknesses of scientific laboratories of the Technical Collegeunder study and how to overcome weaknesses by identifying the performance gap. The importance of research shows in reviewing Occupational Safety and Health Management System Requirements and identifying strengths and weaknesses. Based on the issuance of OHSAS١٨٠٠١, one of the fundamental developments and improvements worldwide to address problems accompanied the technological development and technical excellence in labor organizations, the aim is to reduce risks, reduce or prevent injuries and accidents at work and improve the environment and performance of the enterprise. The study contributed also in increasing the awareness of the staff and the faculty management of the international standards and modern systems importance that achieve continuous improvement. Among the research results, the lackof identification of risk sources, the lack of clear standards within the laboratories, and the recommended to pay attention to Occupational Safety and Health Management system needs in the design of construction works, and the necessity of work risk analysis, training on Occupational Safety and health programs.

The main objective of (Mohammed, ٢٠٠٧) research is to identify the causes of labor fall accidentsat buildings and construction sites, and to identify any additional useful information to reduce the prevalence of fall accidents in the future through the applying of the fall protection plan. The research found out that fall accidents have become one of the main categories in occupational death accidents and that fall protection systems are not regularly used to prevent accidents in the construction industry. The examined data for the period (٢٠٠٤ to ٢٠٠٧) and the results show that most falls occur at altitudes below ٩,١٥ meters that occur in new construction projects with relatively low construction cost. The study also concerned the typical workers ' compensation rates, based on which the items of works that had the largest proportions and concrete works that had the largest compensation ratio were identified. The study also concerned with the typical workers ' compensation rates, based on that the items of works that had the largest proportions areidentified, concrete works had the largest compensation ratio. In addition, it determines the rates frequency, and the higher risk rates for different work areas (agriculture, mining, electricity, construction, trade, transportation, etc.). The study showed that the frequency of construction work was the largest percentage (٢٤,١٪) and was the second for the risk ratio for work area (٠,٩٩) after mining work.

Causes of the research problem:

١. Lack of adequate preparations in many work locations to avoid or minimize accidents.

٢. Lack of attention to the presence of trained cadres to study the site and work requirementsregarding occupational safety and health.

٣. Insufficient studies to avoid accidents.

Research objectives:

The research study aims to achieve the following:

- The study aims to identify the causes of frequent accidents of construction workers at construction sites.

Develop accident recurrence rates to develop the determinants and items that lead to better understanding and formulation of the causes of accidents and injuries that have a role to contribute better work plan to avoid them

Methodology:

The study took the analytical approach as a research method; accordingly, the following methodological steps identified as the basis for the study in this research:

The research study is the theoretical framework of the problem, by showing the importance of Occupational Safety and Health, and study how to manage it. That ensures avoiding accidents or at least reduce them. This is done through a research plan to assemble, organize, and analyze data.

The study also followed the inductive approach by using questionnaire, evaluation and analysis ofdata to define accidents types and their causes. Some construction projects were chosen, those which statistics and data were available. The scope of the study was on residential buildings,

schools and administrative buildings with different heights ranging from two to seven floors, forperiod of ٢٠١٢ to ٢٠١٩.

The study addressed injuries and accidents recorded records of sites that have compiled data,regardless of other health problems that were not recorded or long-term diseases.

Recording information:

The method of recording accidents and collecting information about them and resulted injurieswas used:

Criteria for recording an accident or injury:

- Make inquiries properly.
- taking the information from an eyewitness.
- Taking information from more than one person, and compare them.
- Discuss individuals about what they mean from their words exactly, as many words can carrymore than one meaning according to the person.

How to record accidents (collect data needed to make accidents soundstatistics):

- Explain the situation - how did the accident or injury happened?
- How to avoid such an incident in the future?

Data, including statistics for the injured worker or causing the accident:

Worker's name, worker's age, worker's work (occupation), how long he has been working(New/old worker), has he previously suffered accidents or injuries.

Data, including work and accident statistics:

Time of accident (date of Accident Day / hour), place of accident, cause of accident, type ofaccident, result of accident.

The classification of incidents or injuries based on the causes of accidents or injuries:

- Worker‘s error: worker‘s error due to negligence or fatigue or .etc.
- Mechanical defect (technical error): technical error because of a tool‘s failure or machinetechnically and resulting in the accident.
- Administrative error: administrative error because of a deficiency or defect in the plan appliedto protect employees.

Classification of types of accidents or injuries based on the result of accidents or injuries: Based on the study cases data, the types of accidents based on their results classified into threebasic types:

- An accident causes ٣ days of incapacity for work.
- An accident causes a lack of working capacity.
- An accident causing death within ٣٠ days of the accident.

Results:

Statistical analysis of accident cases:

Data collected for ٢٠ projects of residential buildings, schools and administrative buildings. The height of buildings ranging from ٢ to ٧ floors. The project costs ranged from ١٠ million to ٥٠ million. Projects with an occupational safety and health system as well as an injury and accident

record selected. Injuries and accidents analyzed based on specific criteria as they are in the analysis of accidents and injuries as will be explained in the analysis of the results.

These projects characterized by the existence of an occupational safety and health system. They also provide a system of recording accidents and injuries. As using different ways to record accidents, or to not complete the record of some data or information for some projects, and the different style of record the accidents from project to project (there is no standard way to record the accidents) made it hard to complete the forms as it should be. Accordingly, it was attemptedto make use of the statistics in the project records as much as possible, for example not to confirmthe quality of work for the worker specifically for the concrete works item accidents if the workeris a carpenter or steel former.

The study‘s time range of the projects is during ٢٠١٢ to ٢٠١٩.

This study analyzed accident and injury data based on the following criteria:

- Ratios of accidents or injuries based on the type of work.
- Accidents or injuries ratios based on the cause of the accident.
- Accident or injury ratios based on how the accident occurred.
- Accidents or injuries rations due to the worker‘s fall down.

This research calculated the number of accidents without taking into account the size of theinjury, just took the number of all accidents and injuries. To find out the project‘s level in termsof Occupational Safety and health, the following equations can measure the rates of injuries and accidents; compare them with similar projects to see the level of application of Occupational Safety and health requirements through the following two equations: (spark, ٢٠٠٣)

First rate:

Frequency meter is used:

Frequency rate = $\frac{\text{Number of Injuries during the year x ١٠٠٠}}{\text{Number of Workers x ٢٤٠٠}}$

Where:

- ٢٤٠٠: Represents the number of working hours per worker during the year.
- ١٠٠٠: Represents the number of workers for whom the rate is calculated.

Second rate:

The intensity scale is used:

Risk rate = $\frac{\text{Number of lost days x ١٠٠٠}}{\text{Number of Workers x ٢٤٠٠}}$

Where:

- ٢٤٠٠: Represents the number of working hours per worker during the year.
- ١٠٠٠: Represents the number of workers for whom the rate is calculated.(Mohamed, ٢٠٠٧)

Percentages of Accident Incidence Rates:

Accident and injury ratios for work items - regardless of the quantities of work items and theduration of execution of each item- as these ratios based on the number of accidents and injuries

and not frequency or risk rates. These statistics show the percentage of accidents and injuries regardless of the number of workers performing the item.

Taking into consideration the different ways of recording and gathering information about accidents and injuries in the construction sites and their data, some work items merged and considered as one item as follows:

- Concrete works where it contains carpentry, steel work and concrete casting.
- Door and window works regardless of the quality of the materials because they cannot be separated in some sites statistics،
- Also include all incidents that concern with flooring work regardless of the type of materials used.
- And make an extra item for the rest of the work accidents that has few percentages, such as heat insulation works, injuries and accidents for the work of fixtures assistance, administrators, supervisors and technicians.

- Statistical analysis of the proportions of accidents or injuries based on the type of worker'swork:

Table (١) ratios of accidents or injuries based on the type of worker's work

No.	Aspect	%
١.	Accidents or injuries based on the type of worker's work	
١,١	Concrete work	٢١,٦
١,٢	Dig work	١٥,٣
١,٣	Electric works	١١,٤

١,٤	Exterior painting works	٩,٢
١,٥	Doors and windows works	٨,٥
١,٦	Sanitary works	٦,٧
١,٧	Brick works	٦,٥
١,٨	Indoor painting works	٣,٧
١,٩	Moisture insulation works	٣,٣
١,١٠	Flooring works (parquet, marble, etc.)	٢,٩
١,١١	False Ceiling works	٢,٣
١,١٢	Heat insulation works	٠,٨
١,١٣	Other accidents types	٧,٨

Figure (١) Percentage of accidents and Injuries for Different Work Types

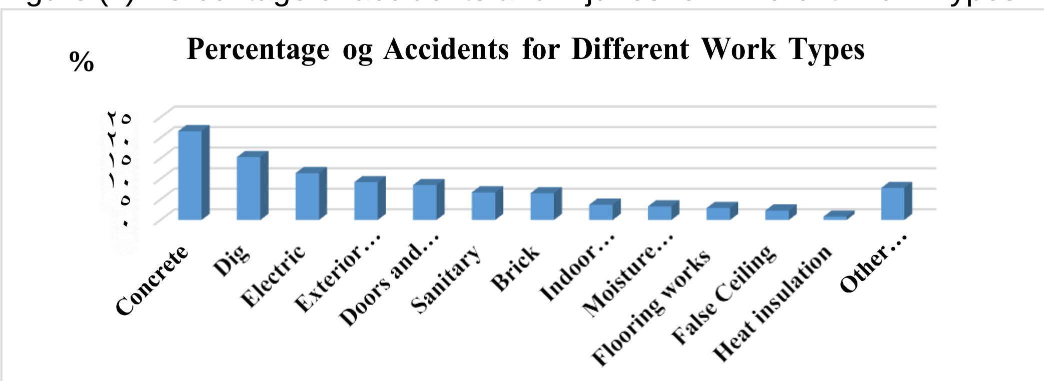


Table (١) and Figure (١) show accident ratios based on the type of work.

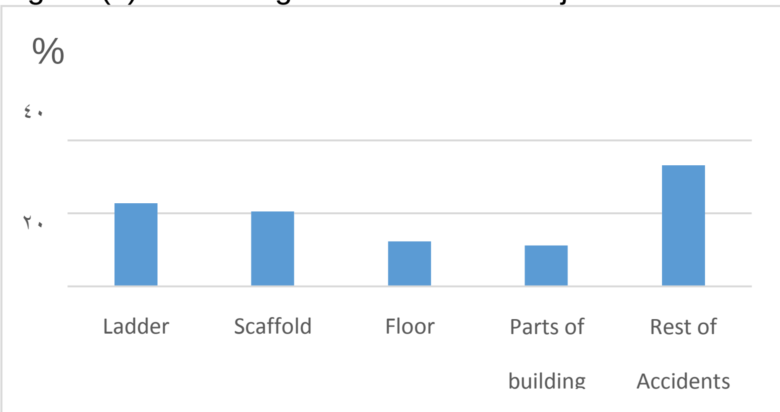
- The concrete works (includes carpentry, steel bars and casting works) reached ٢١,٦٪ of the totalaccidents and injuries at the site.
- Accidents and injuries for digging work reach ١٥,٣٪, although dibbing workers do not represent a large proportion of the total number of site workers, and average period of digging work is not more than ١٠٪ of the total constructing period.
- Accidents and injuries of electrical works up to ١١,٤٪ despite the small number of workers،
- Accidents and injuries of outdoor painting works up to ٩,٢٪،
- Accidents and injuries of door and window works up to ٨,٥٪, all collected data for door and window works regardless the used material type.
- Accidents and injuries of sanitary works up to ٦,٧٪. This percentage considered a largeproportion in relation to the workers' number for this item and for the implementation duration. The reason for the registration of accidents and injuries for sanitary works in general, both for external works (the main lines and for the main drainage works), and the interior works. External sanitary works of buildings represent a greater risk than internal sanitary works. However, the recording of incidents did not specify the work location.
- Accidents and injuries of buildings works up to ٦,٥٪ despite the large workers'

number the percentage is relatively low. This analysis emphasize the theory; ‒when the risk shows in front of the eye, there would be less risk‖, especially during the construction of external walls.

Table (٢) Statistical analysis of accident or injury ratios based on the cause of the accident:

No.	Standard	%
٢	Accidents or injuries based on incident cause	
٢,١	Ladder	٢٢,٧
٢,٢	Scaffold	٢٠,٦
٢,٣	The floor	١٢,٤
٢,٤	Parts of the building (column, beam, bricks, etc)	١١,٢
٢,٥	The rest of the accidents (mechanical, road equipment, etc)	٣٣,١

Figure (٢) Percentage of accidents or injuries based on the accident reason



It is clear in the general content of accident and injury ratios for employees on site the concept that accident ratios refer to the type of risk for business items.
In Table (٢) and Figure (٢) analysis of accidents and injuries based on the place that

caused the accident, where the causes of accidents monitored for some accidents and injuries, are:

- Percentage of accidents and injuries due using ladder up to ٢٢,٧٪, use a ladder in general, or working on ladder in particular, as ladder failure due to break or anything else make an accident.
- Percentage of accidents and injuries due to working on scaffolding comes after the ladders by ٢٠,٦٪, accidents here happens due to problem in the scaffold itself, or worker's negligence.
- Percentage of accidents and injuries of working on the site floor up to ١٢,٤٪. This shows the need and the importance of attention to arrange, organize, and clean the site, as just walking on slippery floor or the existence of out of order waists may lead to an accident.

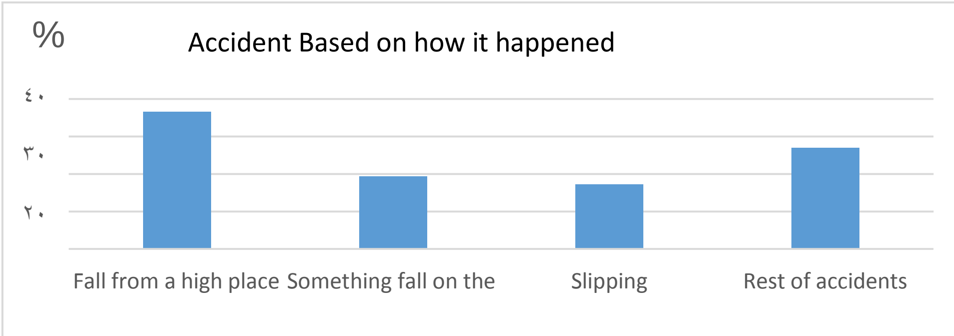
- The rest of the building parts (column, beam, walls, etc.) come .after that with accident and injuries percentage up to ١١,٢٪. The reason may be a falling part on a worker.
- And the rest of the site accidents and injuries up to ٣٣,١٪. The rest of the accidents were collected, for example; due to an equipment malfunction, tool problem, mechanization, accident or injury may happen outside the building but still on site.

- Statistical analysis of accident or injury ratios based on how the accident occurred:

Table (٣) percentage of accidents or injuries according to how the accident happens

No.	Standard	%
٣	Accidents Based on how it happens	
٣,١	Fall from a high place	٣٦,٥
٣,٢	Something fall on the head	١٩,٣
٣,٣	Slipping	١٧,٢
٣,٤	Rest of accidents reasons	٢٧

Figure (٣) Percentage of accidents based on how it happens



Here the accidents analyzed based on some of the collected information to describe the accident and used as criteria for the analysis of accidents and injuries. Whether the accident occurred dueto the fall of the worker, the fall of anything on the worker, the worker slid, and leave the rest of the accidents as each of them separately does not represent a large percentage.

It is clear from Table (٣) and Figure (٣) the analysis of accidents and injuries based on the criteriathat answers the question about how the accident occurred, giving the percentage of accidents andinjuries:

- The result of a fall from an altitude of ٣٦,٥٪, which makes it a point of analysis as in Table (٤).
- The percentage of something fall on the head up to ١٩,٣٪, which is also an important point to consider reduce the incidence of accidents and injuries.
- The result of the worker slide is up to ١٧,٢٪, which confirms that a fairly percentage of accidents occur due to the lack of arrangement of the site. That confirm with the results of table (٢), that the percentage of accidents caused accident floors, which can be reduced by cleaning andput things in order.
- The remaining ٢٧٪ of accidents occur during movement include; moving across site, going up, moving on a ladder or scaffold, jumping. The breakdown of the percentage of such incidents shows in Table ٤.

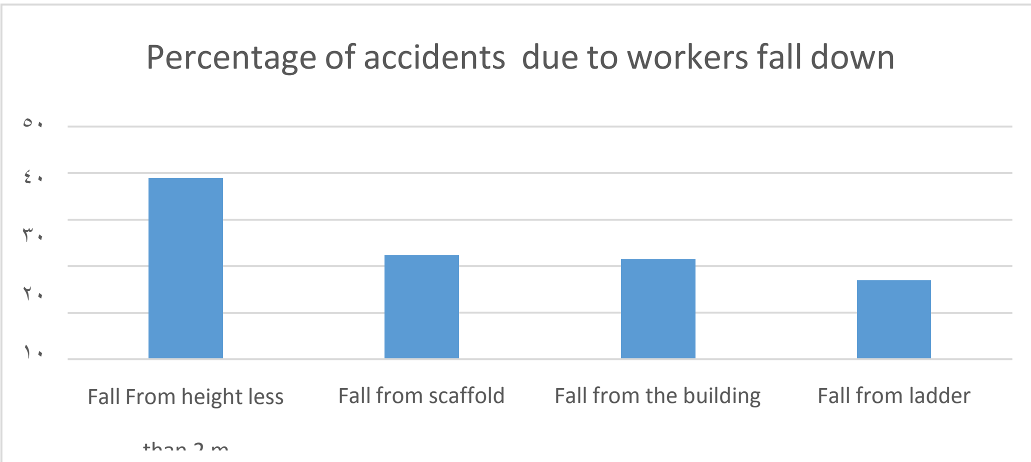
- Statistical analysis the proportion of accidents or injuries due to the fall of the worker:

Table (٤) Percentage of accidents and injuries due workers fall down

No.	Standard	%
	Accidents or injuries due to workers fall down	

٤,١	Worker fall from less than ٢ m height	٣٨,٩
٤,٢	Worker fall from Scaffold	٢٢,٥
٤,٣	Worker fall from building	٢١,٦
٤,٤	Worker fall from ladder	١٧,٠

Figure (٤) Percentage of accidents and injuries due to worker fall down



It is clear from Table (٤) and Figure (٤) the analysis of accidents and injuries due to the fall of theworker either from the height represented up to ٣٦,٥٪ of the total accidents. These accidents and injuries analyzed based on the height of less than ٢ m regardless of whether the worker is standing on a ladder or from height more than that as fall from a floor out of the building, the results are:

- The result of a fall from less than ٢ m height ٣٨,٩٪, this analysis shows the problem of risk when the risk is far from expected, as ٢ m does not considered danger, no worker fear from it.
- While the fall from the scaffold ٢٢,٥٪, which confirms the importance of the care of scaffold plan, which confirms the analysis of table (٢) analysis of accidents or injuries based on the cause of the accident which was up to ٢٠,٦٪.
- And a fall from the building by ٢١,٦٪.
- A fall from a ladder up to ١٧,٠٪, whether it moves in general or an exceptional reason in particular, which also confirms the analysis of table (٢) analysis of accidents or injuries based on the cause of the accident, in which accidents of the ladder ٢٢,٧٪ of the total accidents.

Research summary:

Workplaces vary in the severity of risks and the absence of regulations and standards can create many risks and accidents, which can lead to significant consequences and damage to the workplace and to the economy in general. Risk assessment and knowledge of all potential risks inthe workplace. It is necessary to know how to avoid them.

The administration is concerned with implementing the work and achieving its goals within a sound administrative, legal and technical framework. It is the responsibility of the administration to organize and follow up the work to ensure implementation without obstacles and without departing from the permissible cost framework plan, quality and time period. In addition to these responsibilities, the Occupational Safety and health responsibility to protect employees from work risks as required by the labor law as well as the Egyptian code for project management isthe responsibility of the owner, who thus grants it to the implementation contractor of works and under the supervision of the project consultant. This research aims to identify the types of accidents and injuries that occur at construction sites. In order to achieve the objectives of this study a statistical analysis of a group of incidents of workers at the implementation sites in the period ٢٠١٢ to ٢٠١٩ for multiple projects in the Arab Republic of Egypt. From the record of incidents in the implementation period of each project, and based on the data of these records. This study analyzed the data related to each worker's work type, the cause of theaccident, and how the accident occurred, examined injuries and accidents recorded in the sites records log that have been compiling, regardless of other health problems that are not recorded or long –term diseases. It is obvious from the general terms of accident and injury ratios for employees on site that the concept of accident ratios refer to the type of risk for business items. Whether these points are a business item, certain weaknesses of tools or due to certain behavior, based on the focus of the Occupational Safety and health team on how to avoid the site highest risk ratio. The research has reached the emphasizing of the accidents frequency and determined the proportions, and the most relevant accidents that have large percentage. Based on the identification of them, the Department of Occupational

Safety and health in construction sites should focus on how to overcome them.

Outcome:

It is clear from the general point of view for accident and injury ratios of site workers thataccident ratios refer to the type of business items risk. Whether these points are a business item, certain weaknesses of tools or due to certain behavior, which would be avoided by the Occupational Safety and health team focusing.

The research focused on accidents and injuries analysis to determine the most dangerous points when the risk is great and the result of research show the following:

- For work items:

Concrete works come in first place with up to ٢١,٦٪ of total accidents and injuries, followed by excavation works with ١٥,٣٪, electric works with up to ١١,٤٪, exterior painting works with upto ٩,٢٪, door and window works with up to ٨,٥٪, sanitation works ٦,٧٪, and brick building works accidents and injuries with up to ٦,٥٪.

- Based on where the accident happened:

The proportion of accidents and injuries of ladders is ٢٢,٧٪, followed by scaffolding by ٢٠,٦٪, flooring by ١٢,٤٪, the rest of the building by ١١,٢٪, and the rest of the site accidents and injuriesby ٣٣,١٪.

To describe the accident or in the sense of how the accident occurred, the ratio of accidents and injuries:

As a result, of a fall from an altitude of ٣٦,٥٪, as a result of something fall on the head ١٩,٣٪, asa result of a slide ١٧,٢٪, the rest of the accidents by ٢٧٪ during the overall movement.

Analysis of accidents and injuries due to the fall of the worker from a height, which accounted for ٣٦,٥٪:

As a result of a fall from a height of less than ٢ m ٣٨,٩٪, a fall from a scaffold ٢٢,٥٪, a fall froma building ٢١,٦٪, a fall from a ladder ١٧,٠٪.

Recommendations:

Despite the applying of the projects sites the rules and regulations of Occupational Safety and health, and the presence of safety team obligated to continuous follow-up the employees, and record accidents and injuries, there are still accidents and injuries that have to be taken into account by the team with more concern in order to decrease those accidents to the minimum. The following recommendations are meant to make the working environment safer:

- Make more attention to work items that cause many accidents.
- make an administrative system that reviews ladders, scaffolding, electric tools and handy tools to ensure their safety before use as well as after use.
- Review the fall protection systems on the scaffolding and the edges of the building before and after use.
- Continuous supervision of all workplaces on site to ensure the application of Occupational Safety and health regulations.
- Make statistics of accidents and injuries periodically (example monthly, and not exceed three months period), announce their results to the Occupational Safety and health team to takeappropriate actions, and for workers to draw their attention to the site weaknesses places and follow up notes and errors to prevent recurrence.
- Conduct training sessions continuously to awareness raise of employees and remind them of theregulations to avoid accidents, use accident ratios to benefit from them not to repeat.
- Make more concern of problems and weaknesses of the site for continuous improvement, such as arranging the site workplace.
- Take care of cleanliness throughout the site, in the workplace, corridors, rest areas and others.
- Provide workers with safe places to eat food as well as provide bathrooms for workers usage

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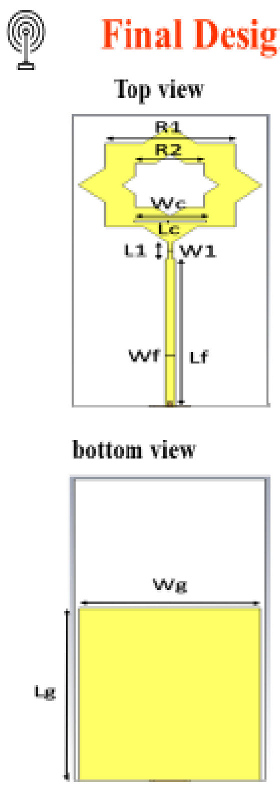
من اخبار الأقسام

a) Single Antenna:



Parameter	Value(mm)	Parameter	Value(mm)
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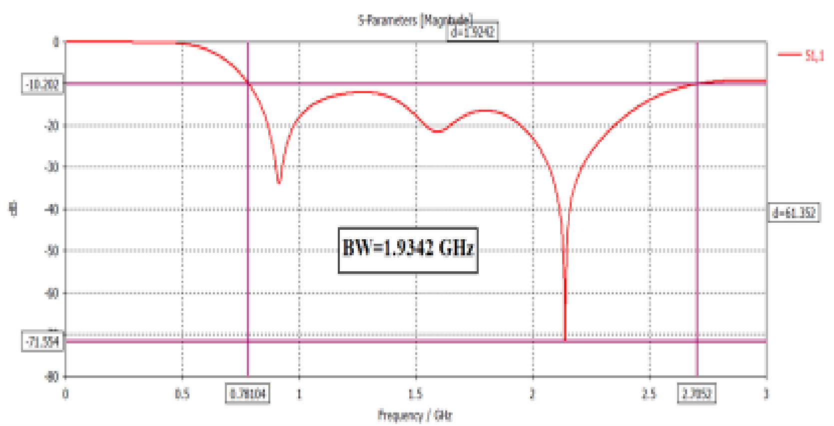
W	60.0	Wf	3.1
Lg	80.0	L1	8.045
Wg	57.0	W1	1.5
R1	40.0	R2	21.2
Wc	22.0	Lc	1.0

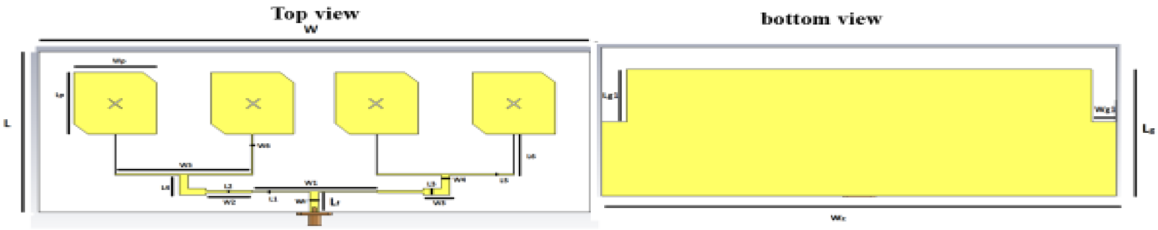


2023

37

b) Array Antenna:

Array Antenna



parameter	Value (mm)	parameter	Value (mm)
Lp	30	W3	9.6
Wp	30	L4	9.6
L1	0.5	W4	3.11
W1	45.3	L5	0.7
L2	1.12	W5	50
W2	16.7	L6	20
L3	3.11	W6	0.3
Lf	9.7	L	78
Wf	3.11	W	200

تعاون الطلاب مع معهد بحوث الالكترونيات خلال المدة من ١٥ أكتوبر ٢٠٢٢ الي ٣١ ديسمبر ٢٠٢٢ بعنوان

"Design and simulation of microwave Circuits & antenna using ADS/CST-MWS/HFSS CAD tools

for energy harvesting applications "

تعاون طلاب الفرقة الخامسة اتصالات لعام ٢٠٢٢/٢٠٢٣ مع المعهد القومي للاتصالات للقيام بعمليات التصنيع والقياس .

<u>اثناء عمليات التصنيع :</u>

<u>اثناء عملية الاختبار والقياس :</u>

قسم عمارة :

مشروع تخرج قسم عمارة :

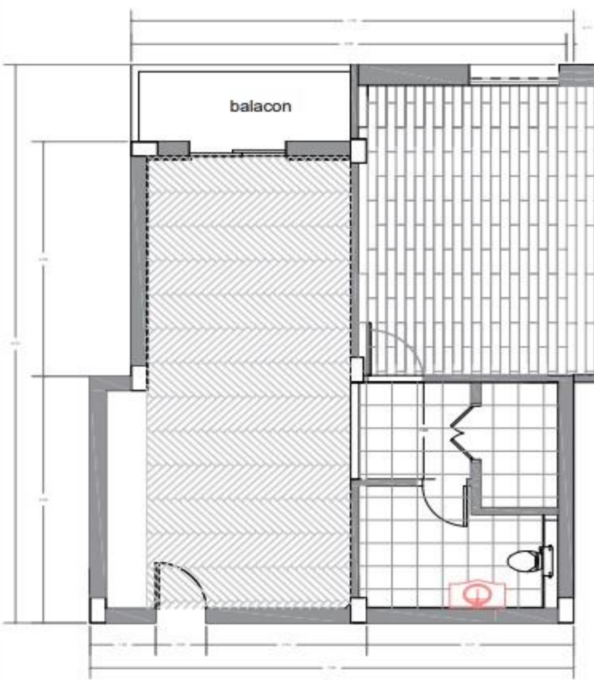
تم الحصول على المركز الأول والثانى على مستوى الجمهورية بمسابقة الإدارة العامة لرعاية الطلاب

Ministry of High Education and Scientific Research
Obour High Institute for Engineering and Technology
Department of Architecture / fifth year

KEY PLAN

KEY PLAN

SUBJECT	INTERIOR DESIGN
PROJECT NAME	HOTEL SUITE
SHEET TYPE	PLAN
SHEET NUMBER	(1)
PRESENTED BY	MOHAMED IBRAHEM
PRESENTED TO	DR.DALIA MAGDY ENG.AYA ASHOR ENG.AHMED RABIE
SCALE	1/20



FACTORY	NAME& DIMENTION	MTL
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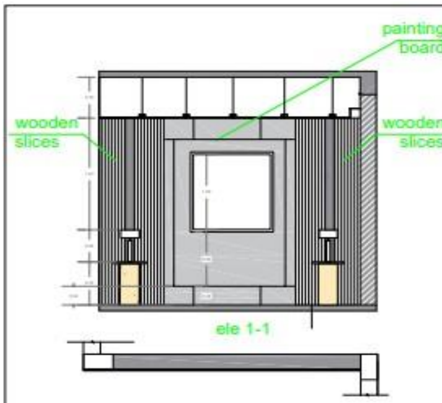
Engineering industry	PARQUET 1.00*15	
CLEOPATRA	LORENZO	

Ministry of High Education and Scientific Research
Obour High Institute for Engineering and Technology
Department of Architecture / fifth year

KEY PLAN

KEY PLAN

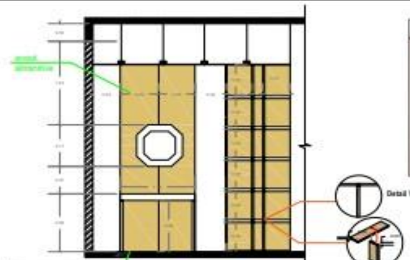
SUBJECT	INTERIOR DESIGN
PROJECT NAME	HOTEL SUITE
SHEET TYPE	FLOOR PLAN
SHEET NUMBER	(2)
PRESENTED BY	MOHAMED IBRAHEM
PRESENTED TO	DR.DALIA MAGDY ENG.AYA ASHOR ENG.AHMED RABIE
SCALE	1/20



ele 1-1

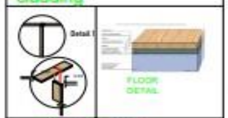
shot 1

shot 2



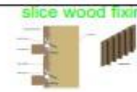
ele 3-3

- wood slices
- plastic slices
- altrantive marble
- aro wood cladding

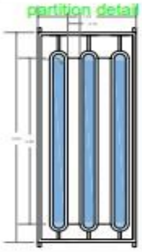


wood cladding

slice wood fixing



partition detail

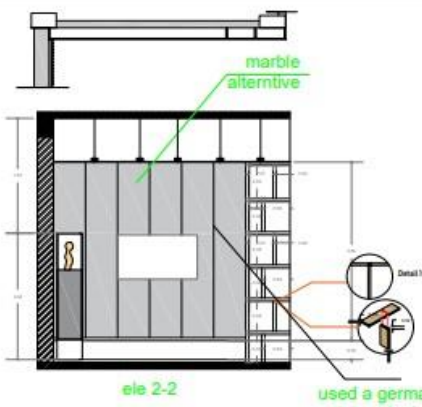


Ministry of High Education and Scientific Research
Obour High Institute for Engineering and Technology
Department of Architecture / fifth year

KEY PLAN

KEY PLAN

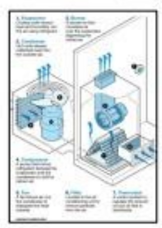
SUBJECT	INTERIOR DESIGN
PROJECT NAME	HOTEL SUITE
SHEET TYPE	ELEVATIONS
SHEET NUMBER	(3)
PRESENTED BY	MOHAMED IBRAHEM
PRESENTED TO	DR.DALIA MAGDY ENG.AYA ASHOR ENG.AHMED RABIE
SCALE	1/20



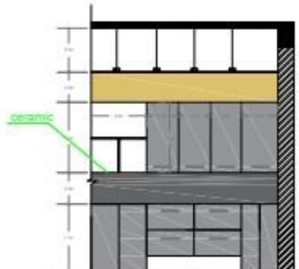
ele 2-2

shot 3

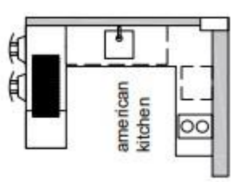
- altrantive marble
- aro wood cladding
- khachmonium
- black Ceramic



shot 4



ele 4-4



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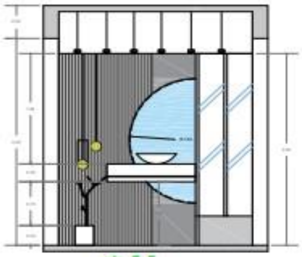
KEY PLAN

KEY PLAN

SUBJECT	INTERIOR DESIGN
PROJECT NAME	HOTEL SUITE
SHEET TYPE	ELEVATIONS
SHEET NUMBER	(4)
PRESENTED BY	MOHAMED IBRAHEM
PRESENTED TO	DR.DALIA MAGDY ENG.AYA ASHOR ENG.AHMED RABIE
SCALE	1/20



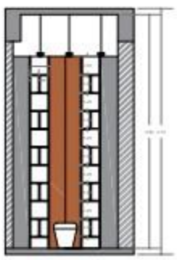
ele 5-5

shot 4

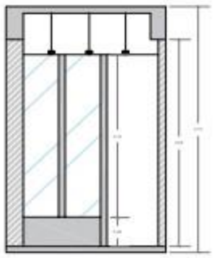
Moisture resistant wood slices

mirror

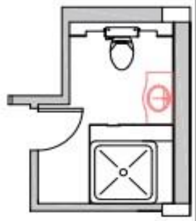
slice wood fixing



ele 6-6



ele 7-7



Ministry of High Education and Scientific Research
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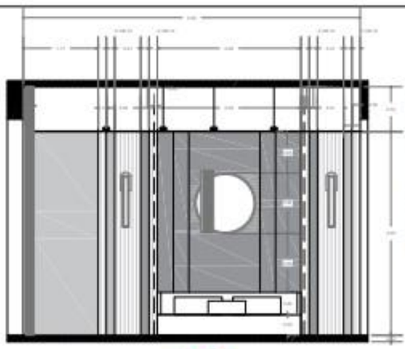
Department of Architecture / fifth year

KEY PLAN

KEY PLAN

SUBJECT	INTERIOR DESIGN
PROJECT NAME	HOTEL SUITE
SHEET TYPE	ELEVATIONS
SHEET NUMBER	(5)
PRESENTED BY	MOHAMED IBRAHEM
PRESENTED TO	DR.DALIA MAGDY ENG.AYA ASHOR ENG.AHMED RABIE
SCALE	1/20



ele 7-7

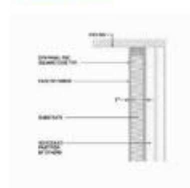
shot 5

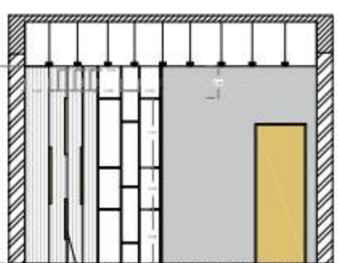
gray paint

gepsum pannels

DFB pannel

plastic slices

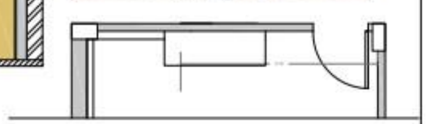


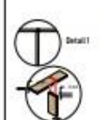


ele 8-8

light profile

shot 6





light profile

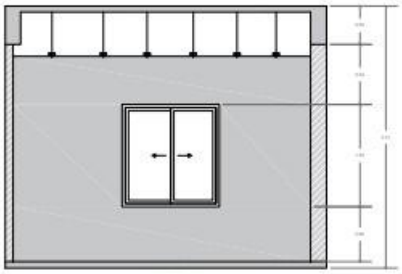
fixing of gipsum wall

Ministry of High Education and Scientific Research
Obour High Institute for Engineering and Technology
Department of Architecture / fifth year

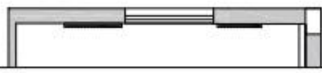
KEY PLAN

KEY PLAN

SUBJECT	INTERIOR DESIGN
PROJECT NAME	HOTEL SUITE
SHEET TYPE	ELEVATIONS
SHEET NUMBER	(6)
PRESENTED BY	MOHAMED IBRAHEM
PRESENTED TO	DR.DALIA MAGDY ENG.AYA ASHOR ENG.AHMED RABIE
SCALE	1/20



ele 9-9

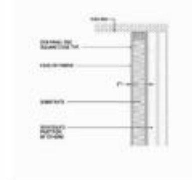


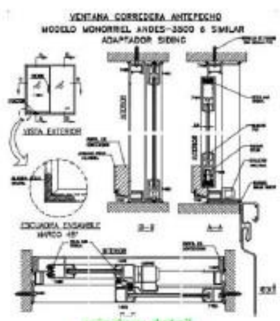
gray paint

gepsum pannels

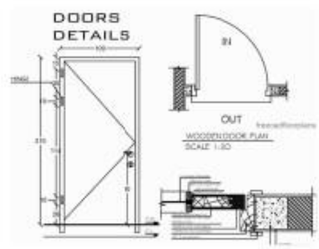
DFB pannel

plastic slices

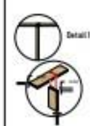




window detail



door detail



light profile

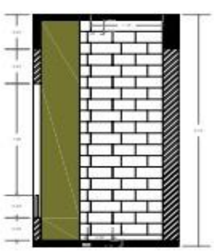
fixing of gipsum wall

Ministry of High Education and Scientific Research
Obour High Institute for Engineering and Technology
Department of Architecture / fifth year

KEY PLAN

KEY PLAN

SUBJECT	INTERIOR DESIGN
PROJECT NAME	HOTEL SUITE
SHEET TYPE	ELEVATIONS
SHEET NUMBER	(7)
PRESENTED BY	MOHAMED IBRAHEM
PRESENTED TO	DR.DALIA MAGDY ENG.AYA ASHOR ENG.AHMED RABIE
SCALE	1/20



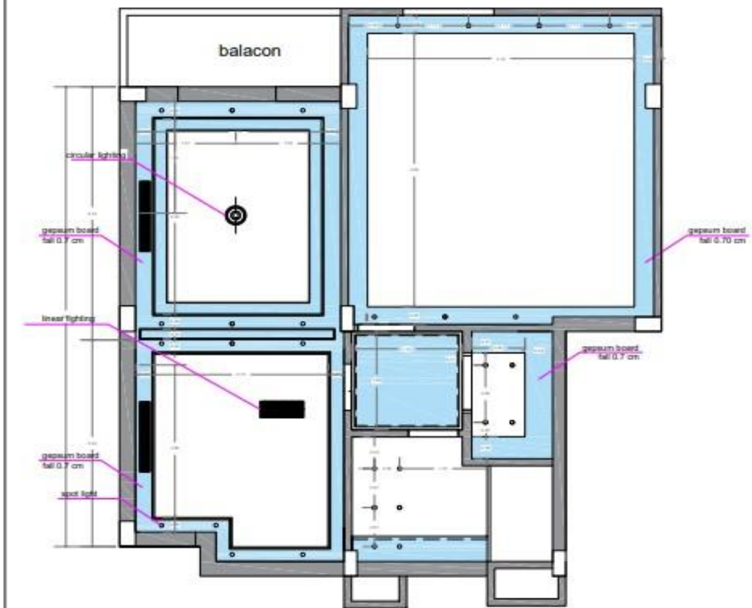
ele 10-10

Ministry of High Education and Scientific Research
Obour High Institute for Engineering and Technology
Department of Architecture / fifth year

KEY PLAN

KEY PLAN

SUBJECT	INTERIOR DESIGN
PROJECT NAME	HOTEL SUITE
SHEET TYPE	ELEVATIONS
SHEET NUMBER	(8)
PRESENTED BY	MOHAMED IBRAHEM
PRESENTED TO	DR.DALIA MAGDY ENG.AYA ASHOR ENG.AHMED RABIE
SCALE	1/20



company	[illegible]	watt	description	light element
[illegible] company	[illegible] cool white	30w	spot light (indirect)	
[illegible]	[illegible] cool white	[illegible]	linear chandelier (direct) [illegible]	
[illegible]	[illegible] cool white	[illegible]	circular chandelier (direct) [illegible]	
[illegible] company	[illegible] daylight	30w	spot light (indirect)	
[illegible] company	[illegible] warm white	30w	spot light (indirect)	

- gepsum board(fall 70cm)
- golden steel slices
- white paint

Ministry of High Education and Scientific Research
Obour High Institute for Engineering and Technology
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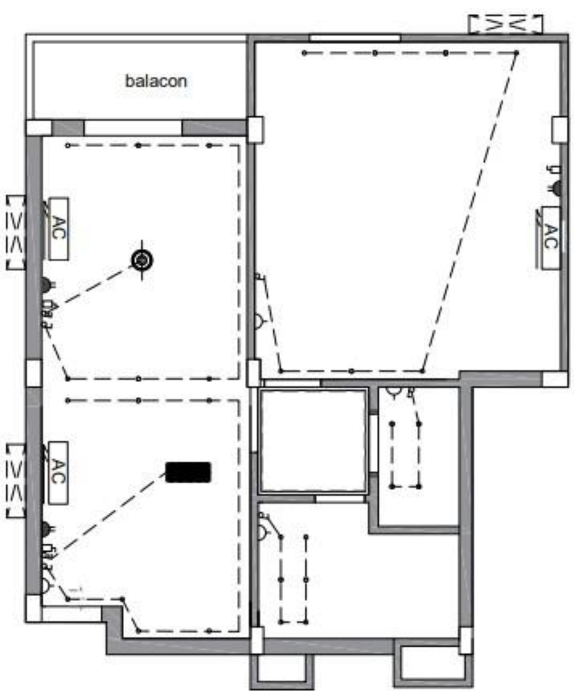
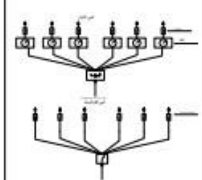
KEY PLAN

KEY PLAN

SUBJECT	INTERIOR DESIGN
PROJECT NAME	HOTEL SUITE
SHEET TYPE	CELLING
SHEET NUMBER	(9)
PRESENTED BY	MOHAMED IBRAHEM
PRESENTED TO	DR.DALIA MAGDY ENG.AYA ASHOR ENG.AHMED RABIE
SCALE	1/20





detail of electric flow

description	symbol
high electric	
medium electric	
low electric	

description	symbol
air conditon switch	
Electric heater switch	
light switch (single)	
light switch (double)	

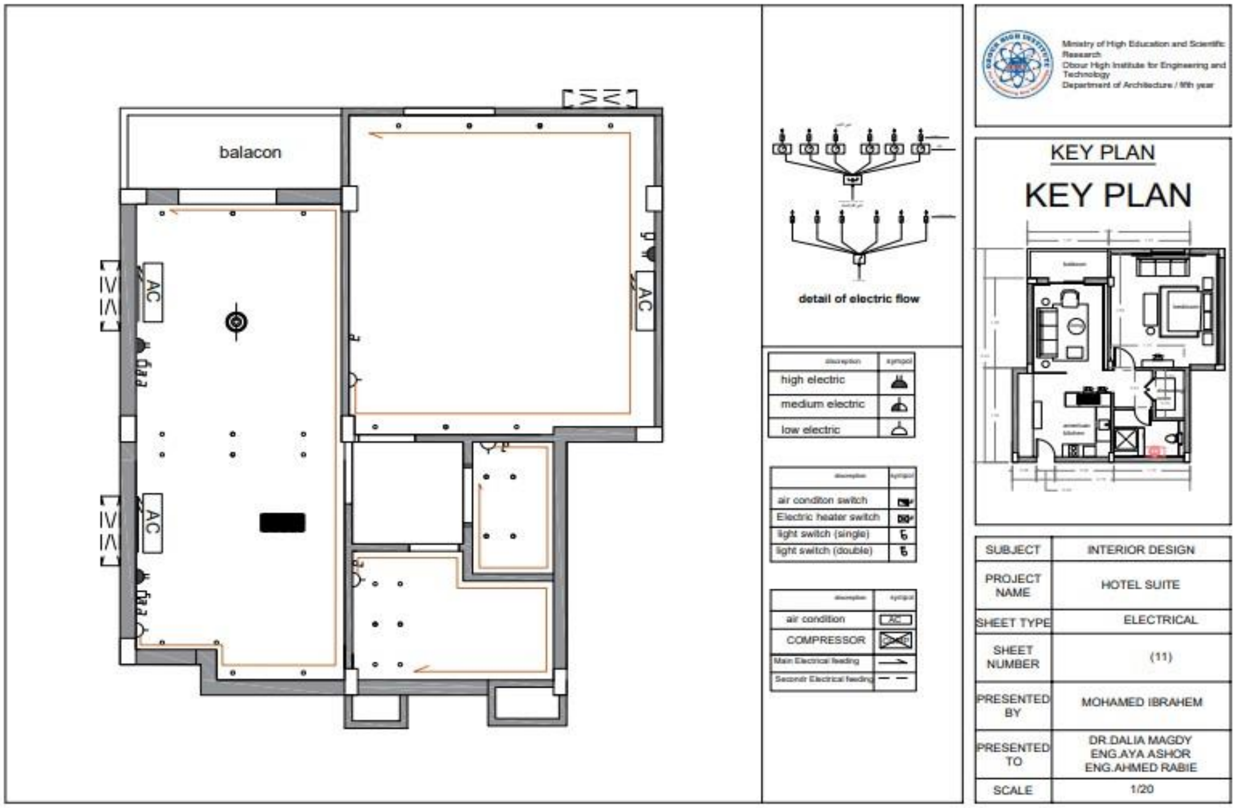
البيان	الرمز
air condition	AC
COMPRESSOR	
Main Electrical feeding	
Secondr Electrical feeding	

Ministry of High Education and Scientific Research
Obour High Institute for Engineering and Technology
Department of Architecture / fifth year

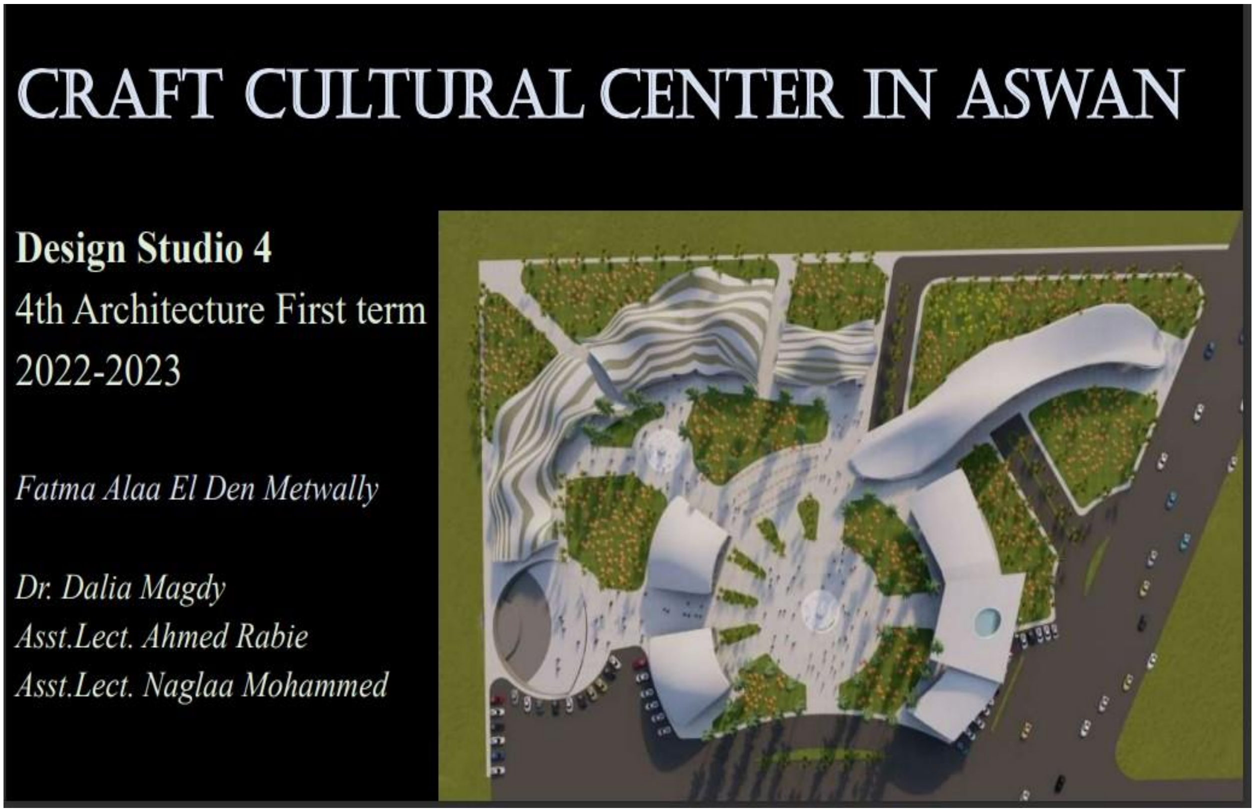
KEY PLAN

KEY PLAN

SUBJECT	INTERIOR DESIGN
PROJECT NAME	HOTEL SUITE
SHEET TYPE	ELECTRICAL
SHEET NUMBER	(10)
PRESENTED BY	MOHAMED IBRAHEM
PRESENTED TO	DR.DALIA MAGDY ENG.AYA ASHOR ENG.AHMED RABIE
SCALE	1/20

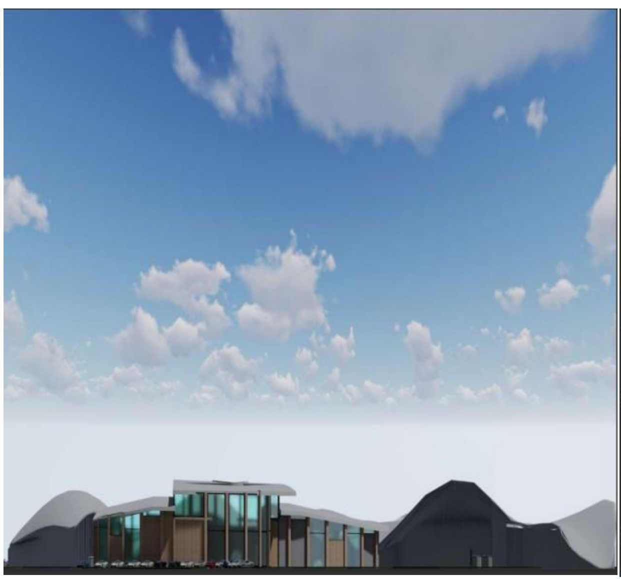

balacon
AC
AC
AC
detail of electric flow
description
symbol
high electric
medium electric
low electric
air conditon switch
Electric heater switch
light switch (single)
light switch (double)
air condition
COMPRESSOR
Main Electrical feeding
Secondr Electrical feeding
Ministry of High Education and Scientific Research
Obour High Institute for Engineering and Technology
Department of Architecture / fifth year
KEY PLAN
KEY PLAN
SUBJECT
INTERIOR DESIGN
PROJECT NAME
HOTEL SUITE
SHEET TYPE
ELECTRICAL
SHEET NUMBER
(11)
PRESENTED BY
MOHAMED IBRAHEM
PRESENTED TO
DR.DALIA MAGDY
ENG.AYA ASHOR
ENG.AHMED RABIE
SCALE
1/20

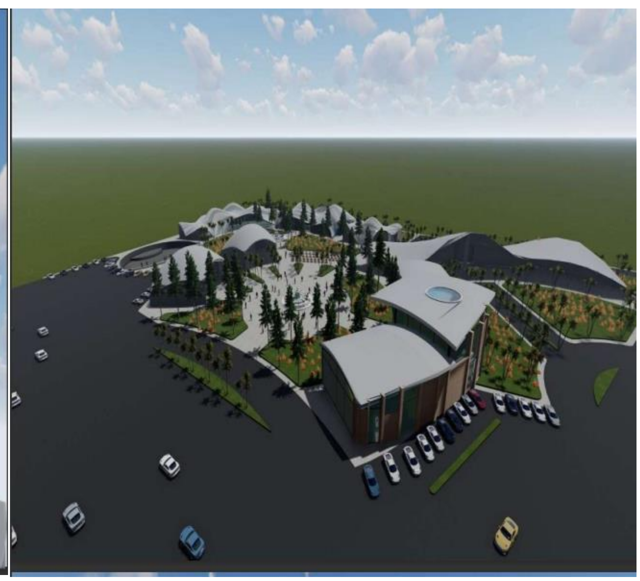

INTERIOR
DESIGN
OBOUR HIGH INSTITUTE FOR
TECHNOLOGY AND ENGINEERING
FIFTH YEAR ARCHITECTURE - CLASS 2022-2023 FIRST TERM
PRESENTED BY / MOHAMED IBRAHEM AHMED
PRESENTED TO
DR- DALIA MAGDY
ENG- AYA ASHOUR
ENG- AHMED RABEA

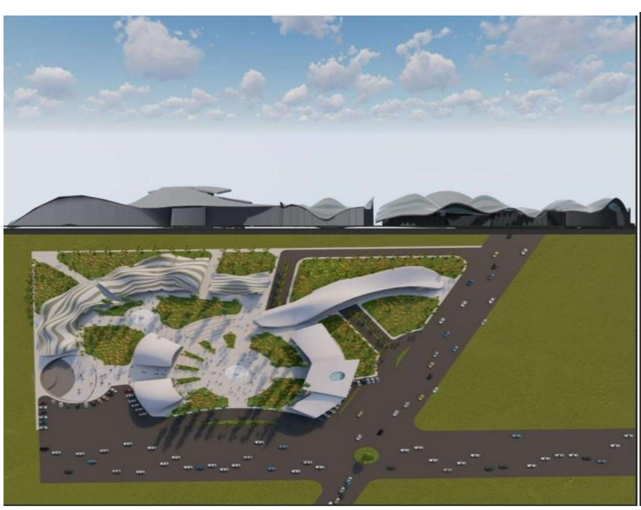

CRAFT CULTURAL CENTER IN ASWAN
Design Studio 4
4th Architecture First term
2022-2023
Fatma Alaa El Den Metwally
Dr. Dalia Magdy
Asst.Lect. Ahmed Rabie
Asst.Lect. Naglaa Mohammed

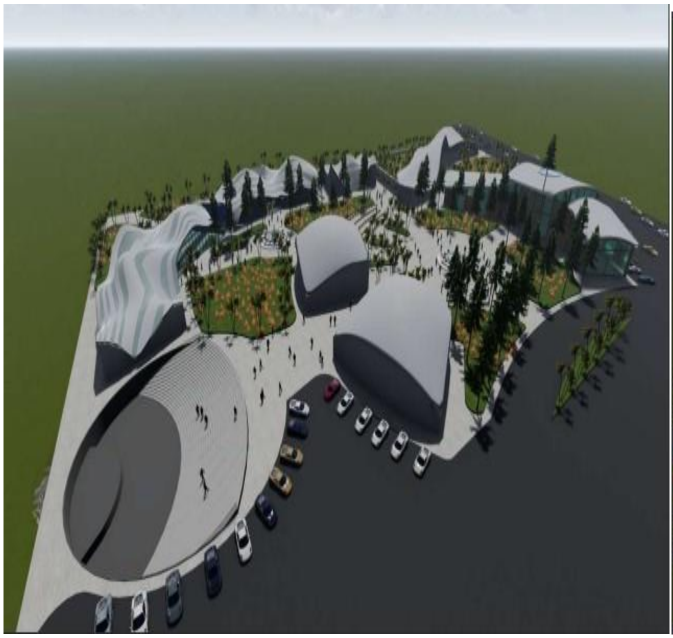

concept
studies
A literal cultural center in Aswan
Submitted by: Fatima Aladdin Metwally
Submitted to: Dr. Dalia Magdy
Engineer: Naglaa Mohamed
Engineer: Ahmed Rabie
lay out
scale1:500
master plan scale1:400
first floor motel scale1:200
elevations

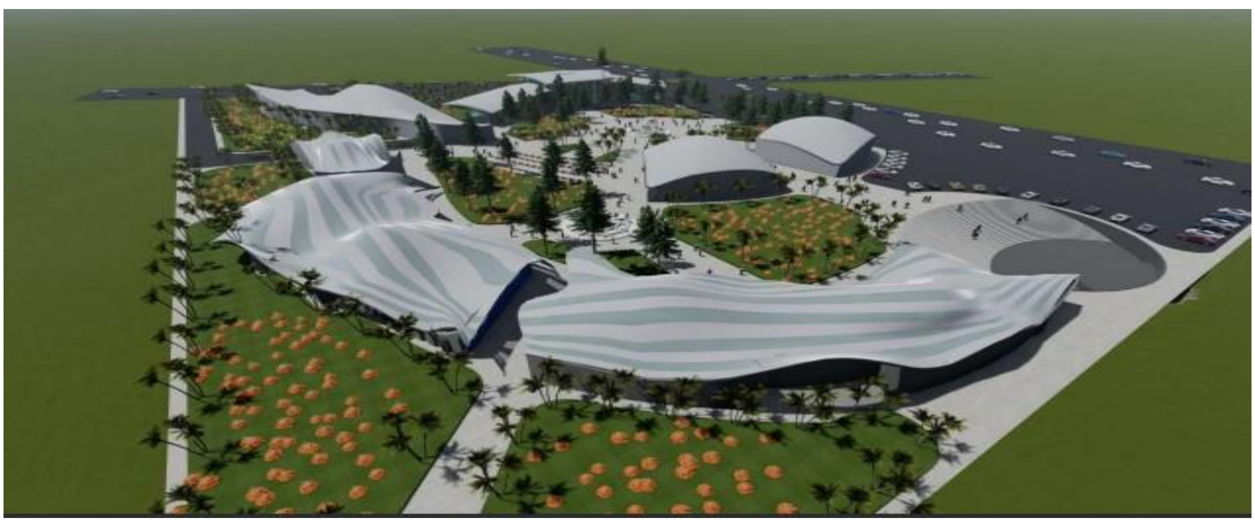

concept
studies
location
A literal cultural center in Aswan
Submitted by: Fatima Aladdin Metwally
Submitted to: Dr. Dalia Magdy
Engineer: Naglaa Mohamed
Engineer: Ahmed Rabie
lay out scale:300
elevations

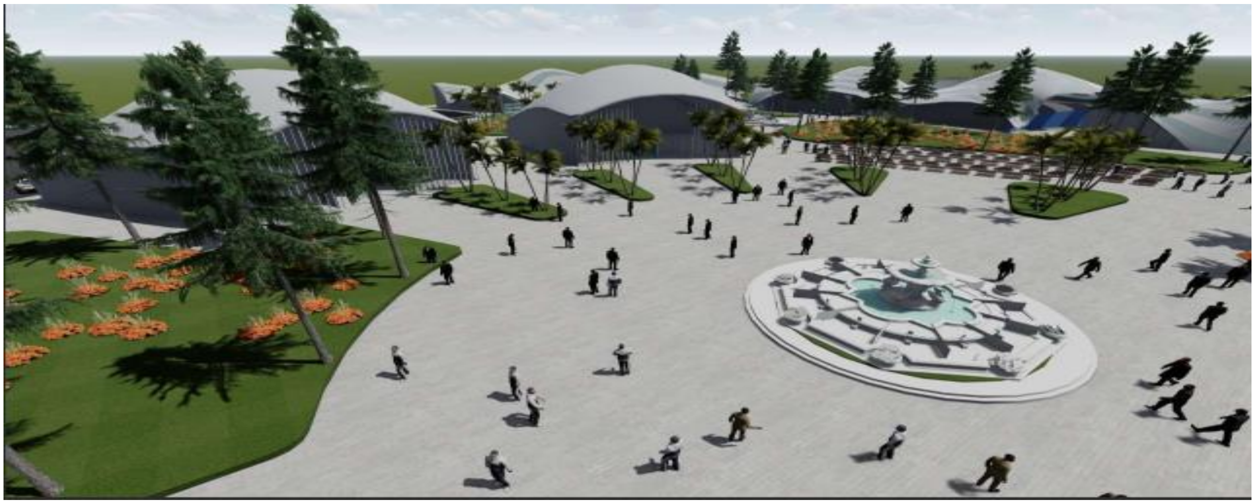


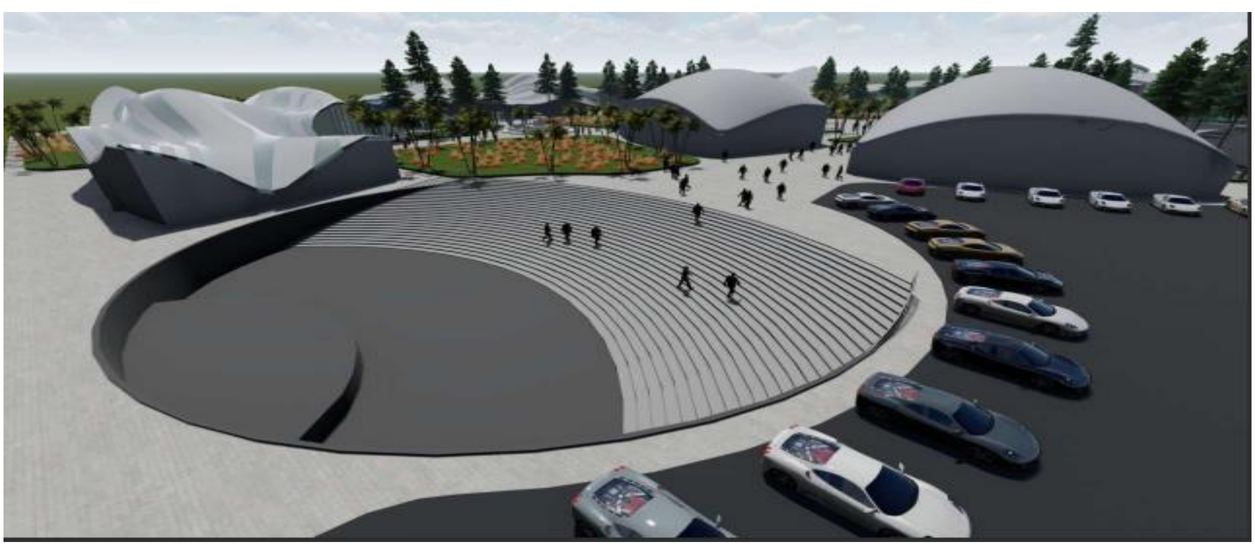


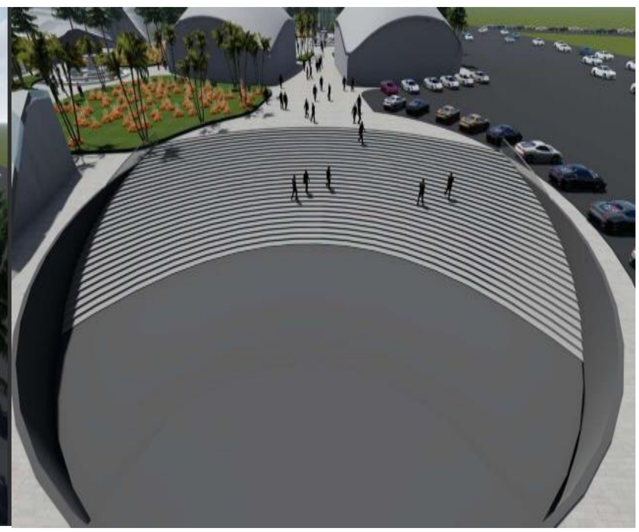










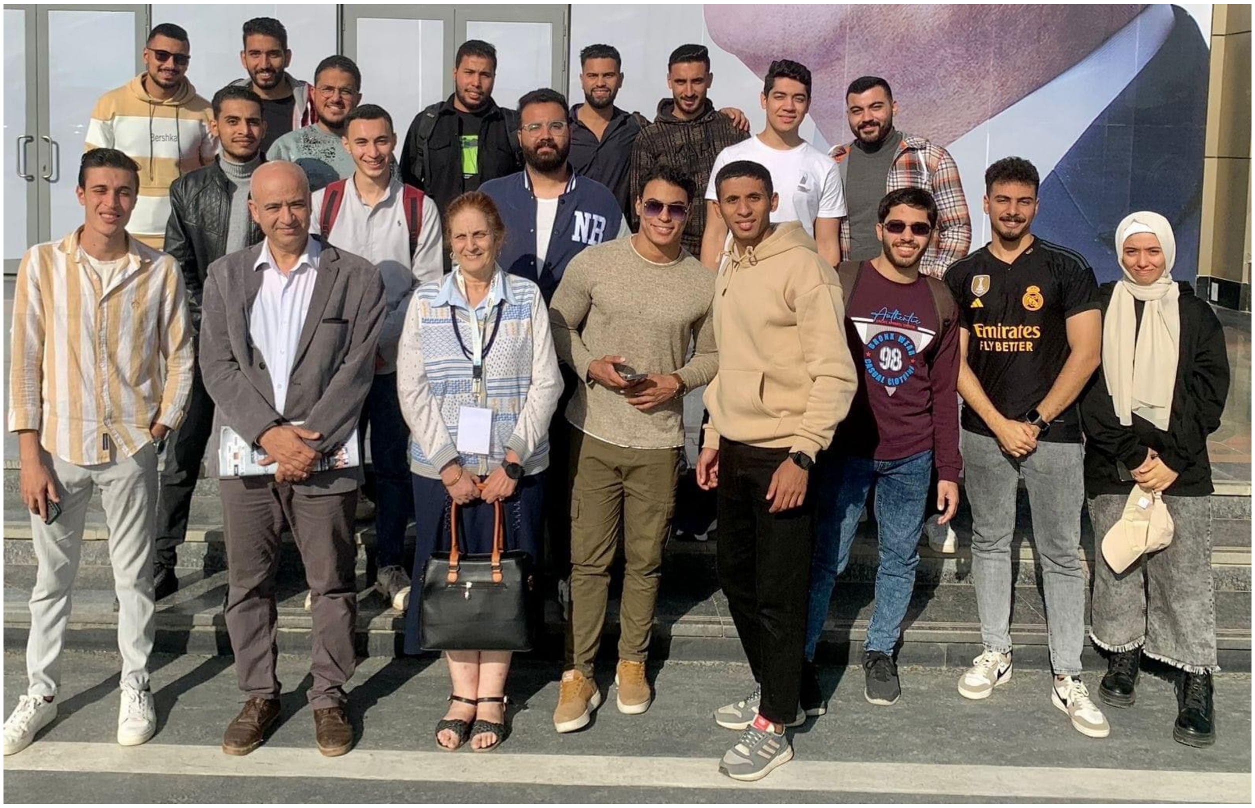
الأنشطة الطلابية

حفل استقبال الدفعة الجديدة لعام ٢٠٢٢ / ٢٠٢٣

مشاركة طلاب المعهد بحضور ورشة عمل تعليم اساسيات فن النحت والخزف للمعاهد العليا

<u>مشاركة الطلاب فى حفل ختام لقاء الصداقة العلمي لطلاب المعاهد العليا والمتوسطة بكافة التخصصات العلمية تحت اشراف وزارة التعليم العالى</u>

<u>رحلة علمية قام بها برنامج هندسة وتكنولوجيا الحاسبات ونظم التحكم وبرنامج هندسة وتكنولوجيا الاتصالات بزيارة معرض القاهرة الدولى .</u>



<u>زيارة الطلاب بقسم عمارة لمشروع مبنى بنك أبو ظبي التجاري بالتعاون مع شركة</u>

<u>" Nextep construction "</u>

رحلات ترفيهية للطلاب

رحلات الأقصر واسوان للعام الجامعي ٢٠٢٣/٢٠٢٢