

# Minimum Requirement For Safety Acts In Egyptian Construction Market

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**Abstract:** Construction industry has various risks due to the activities, individuals and many companies in different scales that it contains. Besides, construction materials, machinery, tools, tasks and handling skills all come with their own risks. Therefore, construction industry is prone to many hazard and accident potential. Accidents can be avoided mostly by implementing health and safety laws and regulations ensuring those protocols are continuously maintained. Fall from height consider the most frequently common on construction industry, Bureau of labour's statistic records 39.9% total deaths in construction due to falls which is greater than any other reason of death. In 2018 fall protection was the most commonly cited violation for the Oregon construction industry total number of violations 443 with total penalty more than 900000 \$. In Egypt there are 3517 fatal accidents in construction project during 2017 only based on immigration and work force minister. This research presents the safety procedure in mega project in Egypt three of them was residential building locate on the capital new city, high rise building Masa hotel locate on new El-Alamein city, this a Construct the questionnaire form which content all the regulations and acts presented by osha, the scope of sampling is the three mega construction company in Egypt Orascom construction, Arab contractor Co., Sodic.

**Index Terms:** Safety Acts, regulations, accident numbers, PPE, Guardrail, scaffolding.

## 1. INTRODUCTION

In Japan on 1947 start with labor laws, acts of workplace protection in 1972 JNIOH National Institute of Occupational Safety and Health, Japan state that the most common cause of deaths in workers in Japan is fall from height. The National goal Institute of Occupational Safety and Health Research hazards and industrial toxicity and work attention and Analyze substances causing regular injuries at work dangers and toxicity that result in decreases in workplaces, Explosions, chemical and physical events, and actions Study on preventive action. [1]. Early of 1970 the number of accidents of workers at work in United state of America increased so the American congress approve Occupational Healthy and safety administration, this administration responsible for apply the safety regulations, safety acts composed to ;Recordkeeping (Part 1904),General Industry (Part 1910),Maritime (Part 1915, 1917 & 1918),Construction (Part 1926),Agriculture (Part 1928),State Plans (Part 1952) [2]. China started with safety legislation early of 1994, fall protection was stated and included in two clause scaffolding, ladders and walking on surface, Holes covers, boundary and handrail, midtrial criteria. Similar to OSHA[3].

France it's the first country deal with safety early of 1880 by safety of dock port and seaman. In 1937 France enforce the Safety Provisions (Building) Convention agreement 37. Of international labor organization. The Conseil orientation sur les conditions de travail (COCT) state that fall protection come first of reason of accident in France[4].

All the previous statement proving that the falls from height by workers come first in all country cause of deaths. So, the aim of this study to enhancing safety performance for construction by identify the minimum requirement to keep the labor safe during project life cycle from risk of falls. And also provide the minimum requirement from the other kind of hazards. highlight

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the common cause of deaths which is risk of falls, trips, trice. Meanwhile, this research is organized into five sections for clarity. The introduction presented the background of the study which culminated into the aim and objectives of the study. The Literature review presented the results of existing studies while taking a particular reference to the construction health and safety management system, safety performance, safety regulations, safety knowledge and compliance and identifying the gaps therein. The methodology adopted in carrying out the study is presented in the methodology section while the results of the study are presented and discussed in the next section. Finally, conclusion section contains the general outcome and the success of the study, including the recommendations.

## 2. LITERATURE REVIEW

The first workplace health laws in Egypt was Document dated 5 July 1909[4]. It dealt with the work Kids at factories for cotton ginning. (April 5,1959) No.91 (Labor Code). Jobs protected and preserved Workers, terms of work and related departments Health and safety at work and penalty provisions[5]. Replaced by this law:: Act No.48(1933) on the job in the industry of youth employees of both sexes;

- [1]. Act No 80 (1933) on women's in industrial employment[6];
  - [2]. Act No 147 (1935) developing unstable sectors for hours of work;
  - [3]. Law No. 317 (1952) on individual employment contracts[7]
  - (4). Act No. 46 (1958) organizing work in mines and quarries; and Act No.14 (1959) governing vocational rehabilitation and employment of disabled persons.
- Overall, Egyptian Law regulations in Occupational Safety and Health is enrolment under the following organizations.

- (1). The International Labor Organization (ILO)
- (2). Occupational Safety and Health (OSH)
- (3). World Health Organization (WHO)

In 2003 Law No.12 (2003) [8], Book V: Occupational safety and health (OSH) and Assurance of the adequacy of the Working Environment: Used to organize employment relations, clarify the duties and rights of the parties to the employment agreement, and to ensure safety and health at the workplace [9], [10] This law consist of

(1). Decree No.126 (2003) replacing No.75 (1993) defining procedures and forms for the notification of work-related accidents, injuries, fatalities and diseases.

(2). Decree No.211 (2003) replacing No.55 (1983) specifying conditions and precautions essential for the provision of OSH measures at the workplace.

(3). Decree No.134 (2003) replacing No.116 (1991) defining the types of establishments covered, OSH services and committees, and related OSH training institutions.

The main objective and scope of Book V of Law 12/ 2003 [8] on OSH are requirements for the selection and establishment of sites, responsibilities of employers to ensure safety and health at workplaces, Establishment of the administrative authority to enforce its provision (OSH inspection) Organization of OSH at the enterprise level (OSH Committees), obligation of employers to report accidents at work and provide related statistics Setting-up of consultative bodies at national and provincial levels (governorates).

### 3. PROBLEM DEFINITION

The last report of minister of work and emigration [11],[12] state that there are 3517 fatal accident of workers in construction work this number increase by 1000 fatal accident of construction workers as stated in (2003) by International Labor Organization that Egypt register 1500 fatal accident every year. The increasing in fatal accident of worker in construction work due to the huge development in Egypt. The maintenance and development of the main road network between the governorates is approved for 10 billion EGP pounds annually, and the local road network within the governorates is approved for 3 billion EGP pounds annually, in addition to a special appropriation this year for 10 billion pounds, pointing out that there are 600 bridges and a tunnel that have been implemented at a financial cost of 85 billion EGP in addition to a number of 325 bridges and tunnels currently being implemented, whether on the main roads, the Nile axes, railway crossings, a metro network and a monorail electric train with a total length of 604 linear kilometers at a cost of 407 billion EGP pounds, in addition to 5 tunnels below the Suez Canal with a total length of about 24 km Meters and a financial cost of about 30 billion EGP pounds"[13]. noted that Egypt jumped in the international rankings for road quality by 90 places, from 113th to 28th in the world." [13]. Therefore, the numbers of fatal accident increased.

### 4. OBJECTIVE

This research presents the safety procedure in mega projects in Egypt three of them was residential building locate on the capital new city, high rise building masa hotel locate on new alamen city, Construct the questionnaire form which content all the regulations and acts presented by osha, the scope of sampling is the three mega construction company in Egypt Orascom construction, Arab contractor Co., Sodic. This research provides the minimum regulations and acts to be circulated to all other projects and company to minimize the fatal accident, injury and near miss.

### 5. RESEARCH METHODOLOGY

1. the first construct the questionnaire a distribute to the top three company in construction market Egypt with total work 2000,000,000 LE and MORE. The questionnaire determine the

minimum CHECKILIST need to prevent labor from hazards requirement and corrective recommended action based on multi common Hazards register. This checklist recommends to apply in all the construction sector based on the accident high record and the current construction situation which is increase in all part of Egypt. Qualitative assessment was used to get the result of questionnaire.

2. This research presents the safety procedure in mega project in Egypt three of them was residential building locate on the capital new city, high rise building masa hotel locate on new alamen city, this a Construct the questionnaire form which content all the regulations and acts presented by osha, the scope of sampling is the three mega construction company in Egypt Orascom construction, Arab contractor Co., Sodic.

3. The questionnaire composed to two part the first part content of the identify of expert and years of experience in

4. safety. The second part content of the checklist of minimum requirement can be apply for Egyptian construction industry.

### 6. CASE STUDIES

Project 1: New Alamein Towers

The New Alamein Towers occupy one of the most prominent locations in Al Alamein City. They are located on north coast of Egypt Fig.1 New alamen Location in Egypt., the city beach with a recreational area fall in the middle of them. They also overlook El Alamein Lake.



Fig 1. New Alamen Towers Location in Egypt.



Fig 2. New Alamen Towers.

**PROJECT 2: NEW ALAMEIN TOWERS**

R5 Compound Located at The New Administrative Capital (NAC) is a large-scale project in Egypt that has been under construction since 2015. Even the surrounding cities, such as: Badr City and New Cairo, their economic value and price per square meter have been increased, especially with the start of the construction of investment projects, as large companies need housing units for its manpower. Fig.3 shown the location of capital administrative city in Egypt.



**Fig.3** location of capital administrative city in Egypt



**Fig 4.** the R5 Compound in New Administrative City.



(a)



(b)

**Fig 5.** Workers wear full fall protection harness (Working at Height).

Working at height need to wearing Harness fig 5.a, b for worker wear harness in to different sites.

**7.ANALYSIS**

the result of first questionnaire to be apply in Egyptian market for the total construction company all grade. This data from the 6 Project all company individual. The answer of questions by yes, No and comments. The questionnaire composed of 8 part, all expert asked about the main items in questionnaires and what apply at the company on the projects. The eight part questions relate to

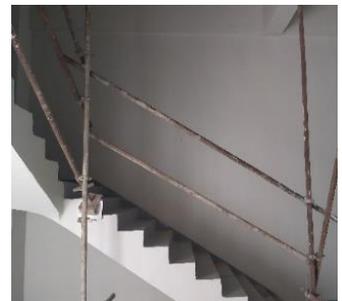
- 1-Harness
- 2-PPE
- 3-siderails, Guardrails.
- 4-Electrical
- 5-Tools and Machinery uses
- 6- Heavy equipment
- 7-Scaffolds
- 8-excavations

**TABLE 1.**

**PART ONE DATA ANALYSIS FROM QUESTIONNAIRE RELATED TO HARNESS**

	C1	C2	C3
1. Fall protection provided for heights 1.8m or more	Yes	No 3m at least	yes
2. Harness is worn properly and attached to secure anchorage.	yes	yes	yes
<ul style="list-style-type: none"> <li>• Anchor</li> <li>• Body support</li> <li>• connector</li> <li>• Decelerator</li> </ul>			

Note (1). The three company agree with the harness is the most appropriate and suitable tool to working at height safe but the height is A point of contention C1 and C3 agree with OSHA 1.8m but C2 take three-meter act of precaution working at high and The difficulty of providing a safety Harness for all workers due to high cost of Harness Corresponding to specifications.



**Fig 6.** represent the guardrails in the three company in multi project.

**TABLE 2.**

**PART TWO DATA ANALYSIS FROM QUESTIONNAIRE RELATED TO GUARDRAILS**

	C1	C2	C3
3. Slide guards are installed across full width and all sides (steel or wood) booth accepted	yes	yes	yes
4. guardrails set up for openings >1.9M above lower level	yes	yes	yes

Temporary construction guardrails are required by OSHA and are designed to provide fall protection for people who are

working at height. These temporary safety railing systems are appropriate for construction, infrequent roof maintenance, and roof repairs. The main component of guardrail is top rail, mitral and toe boot.

work illustrate.

**TABLE 3.**

**PART THREE PERSON PROTECTION EQUIPMENT DATA ANALYSIS FROM QUESTIONNAIRE RELATED TO PPE.**

	C1	C2	C3
Hard Hats 1. Supplied by workers 2. Worn when required	yes	yes	yes
Boots 1. Supplied by workers 2. Worn when required	yes	yes	yes
Safety vest	yes	yes	yes
Hearing Protection 1. Supplied by workers 2. Worn when required	Ok	Ok	Ok
eye Protection 1. Supplied by workers 2. Worn when required	Ok	Ok	Ok
respiratory Protection 1. Supplied by workers 2. Worn when required	Ok	Ok	Ok

**TABLE 4.**

**PART FOUR DATA ANALYSIS FROM QUESTIONNAIRE RELATED TO SCAFFOLDS**

	C1	C2	C3
Fall protection used if over 3 meter height(Safety nets,anchors)	Safety harness	PPE	PPE

**The main comments from experts for ensure the scaffolds safe**

- (1). Ensure that all involved workers are wearing personnel protective equipment, received job task briefing and start card, and tool box talk.
- (2). Assessment and erection design shall be made by competent person before work start. Proposed use of the scaffold, taken into account the number of the personnel, weight, load, height, and capacity as per HSE OCI scaffold procedure HSE-P-11. (21)
- (3). Handling materials training shall be provided for all workers before work start. Care shall be taken to ensure suitable means of maneuvering equipment during the erection process, using mechanical lifting equipment where possible. The surrounded area shall be barricaded and Working Over Head signs will have provided.
- (4). Personnel fall protective equipment such as safety harness, fall arrest system shall be worn during working over than 2 m. Temporary access and platform shall provide during erection operation for the scaffolds. Only trained person who shall work to erect the scaffold after conducted medical check for fitness to work.
- (5). All personnel shall be aware of the potential hazard associating when erecting or dismantling of scaffold. Drink plenty of liquids are required.
- (6). OCI Adverse Weather Condition Procedure HSE –P-56 shall be implemented in this case of activity.



**Fig 7. Full PPE.**



**Fig 8. represent the scaffold requirement**

To keep worker safe from hazards PPE is the most important point in safety act, it can prevent all the heat accident which cause immediately death from fall or falling object. The vest safe the life of worker due to machine movement and unclear view. boat also prevent the worker from falling object or poorhouse keeping on the floor and land skip. The expert judge that this tools like eye protection tools using when the task need this tools so it cannot coverage all workers but washing when use from one to others. Hearing protection is need when there is high wave of sound as Egyptian code of

**TABLE 5.**

**PART FIVE DATA ANALYSIS FROM QUESTIONNAIRE RELATED TO MACHINE HAZARDS**

	C1	C2	C3
1. Workers are trained on the use of power tools.	yes	yes	yes
2. Workers have appropriate PPE and	yes	yes	yes

keep clothing away			
3. Workers are trained prior to using nail guns	Not all	Not all	Not all
4. Tile and concrete are cut with wet methods	Not all	Not all	Not all

The three company agree with workers training on the use of power tools, have appropriate PPE and keep clothing away. Not all the workers are need to use nail guns specially form workers only.

**TABLE 6. PART SIX DATA ANALYSIS FROM QUESTIONNAIRE RELATED TO ELECTRICALLY HAZARDS**

Electrical Safety Acts	C1	C2	C3
1. Work on electrical circuits or energized equipment is begun only after all power sources have been identified, de-energized and locked out or tagged out.	yes	yes	Yes
2. Overhead and underground electrical power lines are located, identified, and avoided.	yes	yes	Yes and sign
3. Ladders, scaffolds, equipment or materials more than 5 m from any electrical power lines	3 m ok	yes	yes
4. Housekeeping around electric units	yes	yes	yes
5. Electric generators around safe fence	yes	yes	yes



**Fig 9.** represent the Electrical unit requirement and Housekeeping

All electrical connections must be without any defects and power hand tools must be connected to GFCI/ RCD. All circuits shall be protected against overload. Temporary power

lines shall be elevated over traffic.

Housekeeping must be conducted daily to assure clean and safe site. Work will not be allowed in those areas that don't comply with the housekeeping requirement.

**TABLE 7.**

**PART SEVEN DATA ANALYSIS FROM QUESTIONNAIRE RELATED TO EXCAVATIONS**

	C1	C2	C3
1. Soil and conditions are inspected everyday	yes	yes	yes
2. Safe exits (ladders) for excavations greater than 3M. deep	yes	yes	yes
3. Shoring, shielding, and inclination assessed for excavations greater than 3m. deep	yes	yes	yes

**The three experts state some acts and regulations based on excavations activity:**

- Follow the regulations of Egyptian code, OSHA. For excavation slope with the different kind of soil.
- All worker wear safety vest to be visible in night shift.
- Ensure that all involved workers are wearing personnel protective equipment, received job task briefing and start card, and toll bob talk.
- Ensure all equipment has 3rd party certificates and the operators provide competency certificates for relevant plant. Flagman to be used at all times to direct equipment to designated areas, highlighted on sketch and marked with flags.
- Ensure only authorized Personnel to enter area and competent personnel to operate machinery mandatory PPE to be worn with addition dusk mask and ear protection should noise levels exceed 85DbA area to be barricaded off flagman to be present at all times check ground for stability.
- All moving Vehicles shall have a back-up alarm. In case no back up alarm installed, a flag man can control traffic for the moving vehicles. Flagman to be used at all times to direct equipment to be designated areas, highlighted on sketch and marked with flags check ground for stability
- Flagman to be used at all times to direct equipment to be designated areas, highlighted on sketch and marked with flags check ground for stability.
- Any excavation more than (1.2 m) deep shall be secured and protected Access way or ladder shall be provided each 25 f into the excavation. Ensure that area has been fully barricaded and secured. Walkway or bridges with standard guardrails shall be provided where workers are required to cross over excavation.
- All hand tools shall be in good repair and used only for the purpose for which designated. All hand tools shall be inspected tested for safe operation conditions prior to use.
- All electrical connections must be without any defects and power hand tools must be connected to GFCI/ RCD. All circuits shall be protected against overload. Temporary power lines shall be elevated over traffic.
- Housekeeping must be conducted daily to assure clean and safe site. Work will not be allowed in those areas that don't comply with the housekeeping requirement.

Part Eight Data Analysis from Heavy Equipment

The expert state the minimum actions to

- (1). Ensure that the weight of load is within the safe working load (SWL) limit of the certified crane and well balanced.
- (2). Operator must use safety features built into crane e.g. outriggers fully extended, to ensure the crane is stable. On soft ground, proper support must be provided.
- (3). One competent rigger only to give signals to the crane operator.
- (4). Riggers must monitor the load at all times and control with tag lines.
- (5). Crane operator shall never leave the crane unattended while the load is suspended.
- (6). Before starting any movement of the crane, warn the other workers by blowing horn.
- (7). Load must not be carried over people.
- (8). Ensure that all lifting slings are certified and without defects.
- (9). Follow proper manual lifting methods. Use sufficient personnel and PPE for heavy loads.
- (10). Induction course shall be made to the workers, no stay under lifted loads.

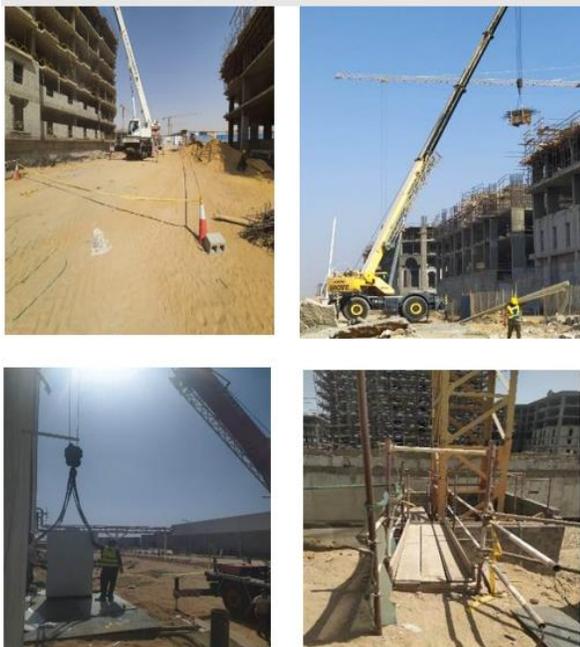


Fig 10. Represent the Minimum Requirement for Heavy Equipment Movement.

Each expert asked for the percentage of each part from the eight part of questionnaire which is important to Egyptian market and minimize the number of accident. After aggregate the result.

TABLE 8. EXPERT JUDGEMENT %

Questionnaire related to :	EXP 1	EXP 2	EXP 3	%
1 Harness	15	21	25	0.203333
2 PPE	20	19	24	0.21

3	Guardrail	15	10	20	0.15
4	Electrical	20	8	8	0.12
5	Use of machinery	3	2	2	0.023333
6	Scaffolds	7	10	2	0.063333
7	Excavation	6	20	9	0.116667
8	Heavy Equipment Movement	14	10	10	0.113333

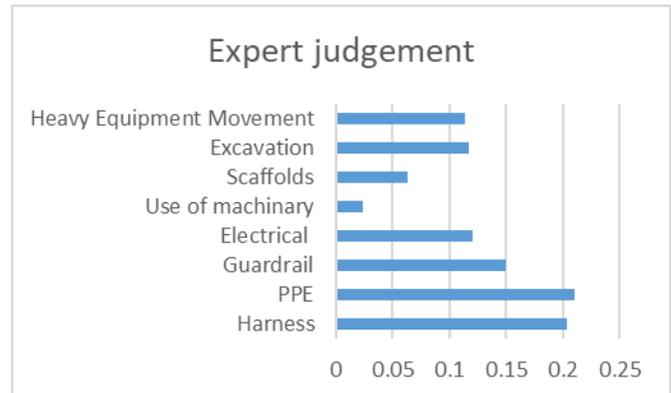


Fig 11. Represent Expert Judgement in Eight Main element of safety.

From fig.11, Table.8 the main cause of accident in construction is fall or working at height in all part of world as stated. If all worker wears good PPE condition keeping the worker away from movement hazard, falling objects, food penetration object, trip trek. The second in importance is safety Harness for worker work at height of from scaffolding, fall arrest will be very far in cost to Egyptian market. The third in importance is Guardrail around the sides or around opening.

8. CONCLUSIONS

This research illustrated the minimum requirement to keep the labors and workers away from hazards (Safety acts and programs). In this research so many case studies were illustrated from Egypt; R5 compound located at the new Capital city, Masa Towers and Gates located in new Al-Alamen city. There are Questionnaire form were filled with the HSE Managers of the three Mega construction company in Egypt; Arab Contractors, Orascom construction and Sodic. There are minimum safety acts the three expert agree with it; all the workers wear full PPE, Safety sine, Full protection Boundary, TopHandril, Midhandril, tows board, electrical protection, Good Housekeeping, holes cover or outer it with limits, equipment movement, and wake roads safe far away from equipment movement. All this safety acts keep workers safe from fall, hit by equipment and electrical chock. These three scenarios occupied the maximum numbers of accident in Egypt. As demonstrated in this document, the numbering for sections upper case Arabic numerals, then upper case Arabic numerals, separated by periods. Initial paragraphs after the section title are not indented. Only the initial, introductory paragraph has a drop cap.

REFERENCES

[1] Labour Standards Law [Law No. 49 of 7 April 1947 as amended through Law No. 107 of 9 June 1995]. Labour

- Laws of Japan. Ministry of Labour. Institute of Labour Administration. Tokyo. Japan. 1995, pp. 71-110, 7th ed.
- [2] Occupational Health and safety administration (2020), United State of America Department of labor. <https://www.dol.gov/>
- [3] Labor Law of the people 's republic of china Congress on July 5, 1994 and promulgated by Order No. 28 of the President of the People's Republic of China, <https://www.ilo.org/dyn/natlex/docs/ELECTRONIC/37357/108026/>
- [4] Peri, O. (2005). Ottoman Symbolism in British-Occupied Egypt, 1882-1909. Middle Eastern Studies, 41(1), 103-120. Retrieved October 5, 2020, from <http://www.jstor.org/stable/4284347>
- [5] El-Ata, G. A., , Arnaout, S. N. (2002). Occupational health in Egypt. Occupational medicine (Philadelphia, Pa.), 17(3), 509–vi.
- [6] El-Ata, G. A. A., and M. Nahmias (2005), Occupational Safety and Health in Egypt; A National Profile, , Geneve, International Labour Organization and World Health Organization,.
- [7] El-Ata, G. (2014), "Health coverage for workers in Egypt", Egyptian Journal of Occupational Medicine, vol. 38, issue 1, pp. 23-42.
- [8] Egypt Labour Code (No. 12 of 2003). 2003, "Labour codes, general labour and employment acts" Middle East Library for Economic Services (MELES), Cairo, Egypt, 109p. (DOC.NORMES) [https://www.ilo.org/dyn/natlex/natlex4.detail?p\\_isn=64693&p\\_lang=en](https://www.ilo.org/dyn/natlex/natlex4.detail?p_isn=64693&p_lang=en)
- [9] International labor organization, Egypt laws and codes Last NATLEX review: 2019-05-21, [https://www.ilo.org/dyn/natlex/natlex4.countrySubjects?p\\_lang=en&p\\_country=EGY&p\\_order=ALPHABETIC](https://www.ilo.org/dyn/natlex/natlex4.countrySubjects?p_lang=en&p_country=EGY&p_order=ALPHABETIC)
- [10] Abo-el-Ata, G. A., et al. (2007). "Evaluation of disability due to B and/ or C viral hepatitis among health care workers in Cairo University Hospitals." Egyptian Journal of Occupational Medicine 31(1): 1-27.
- [11] Egyptian Man power and immigration report (1) (2017). "Workers accidents in Construction". 2017(3), pp1-4.
- [12] Egyptian Man power and immigration report (2) (2019). "Workers accidents in Construction city and providence distribution". 2017(4), pp1-12.
- [13] Annual Government of Egypt Report (2018/2019), "Egypt taking off report", <https://cabinet.gov.eg/Arabic/GovernmentStrategy/Pages/Annualgovernmentreport.aspx>
- [14] Frost, Rachael et al.(2020)"Using Remote Interventions in Promoting the Health of Frail Older Persons Following the COVID-19 Lockdown: Challenges and Solutions", Journal of the American Medical Directors Association, Volume 21, Issue 7, 992 – 993
- [15] Mohamed SH, El-Ansary AL, El-Aziz EMA.(2018) Determination of crystalline silica in respirable dust upon occupational exposure for Egyptian workers. Ind Health. 1;56(3):255-263. doi: 10.2486/indhealth.2016-0192. Epub 2017 Dec 2. PMID: 29199263; PMCID: PMC5985465.
- [16] Abdel-Fattah WI, Sallam AS, Diab AM, Ali GW.(2015). Tailoring the properties and functions of phosphate/silk/Ag/chitosan scaffolds. Mater Sci Eng C Mater Biol Appl. 2015 Sep;54:158-68. doi: 10.1016/j.msec.2015.05.015. Epub 2015 May 8. PMID: 26046279.
- [17] Moawed.M, eldirery lb. "Free convection heat transfer inside vertical and inclined elliptic tubes with different axis ratio and different inclination and orientation angles" April 2008 Energy Conversion and Management 49(4):587595 DOI: 10.1016/j.enconman.2007.07.037