Risks Concerning Work in Building Materials Industries (Case Study of Marble and Granite Mining Region in Tora)

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Abstract: The research addresses the risks related to building materials industries. Workers are exposed to risks in construction and building sites in general. As well as the risks connected with the manufacturing of marble and granite as one of building materials industries are discussed in the current work. It is considered as one of the feeding industries in the construction sector. Marble and granite mining area in Tora (Shak Elsoban) is considered as case study in these research. The risks that workers are exposed to in the site area are studied and analyzed with focus on the effect of these risks on the economies of the industry, which in turn affect the building materials industry. Study and analysis of identification and legalization of the risks related to working sites according to the practical are done. The study are depends mainly on the reality of the statistic data available about accidents and injuries types and effects. The research ends with a package of conclusions and recommendations which establish clear strategies to limit the risks of such an important industry with taking into account the economical factors.
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Key words: risks, building materials, mining industries, pollution, wastes

1. Introduction:

The term of industrial health is an important term which is developed in recent times to reflect factors of security and safety that should be made available in facilities during the performance of various industrial processes. It is consider health work conditions which are an important factor in economics of any industry [1,2] .

Industrial health is a science that deals with four main factors for prevention and improving the health and safety and raising the efficiency of workers in the areas of their professional work. Therefore, working conditions should be compatible with the requirements of the industrial health. The most important factors of industrial health are summarized as **enough space, healthy environment , lighting appropriate,** and **reducing noise.** At the start, it is important to understand the technique of manufacturing process and identify its major factors. Analyze and identify the interactive and reciprocal relationship between each factor to achieve a secure engineering product at all manufacturing stages. The selection of materials in accordance with international standard specifications criteria of quality and safety are the key element in achieving industrial safety during manufacturing process. The safe disposal of exhaust resulting from industry, turn over security of the commodity and product are essential parts of the industrial health concept and its achieving factors [3,4] . One of the objectives of safety and professional health is to maintain elements of production in the forefront of which the human race .Legislation and laws give the right to the human being to get a safe working environment [5,6]. The following table **(1) shows the impact of the circumstances and factors in the work environment on the efficiency of performance, it** record heat and humidity equations and the extent of their impact on the efficiency of workers in the industrial environment and their ability to complete the work [7,8].

It is already clear the importance of the existence of measurement devices in the work environment to maintain appropriate rates for work. According to the statistical data of the International Lab Organization in USA about two million people lose their lives because of accidents and work injuries. Workers are exposed to about270 million work accident and 160 million diseases infection cases linked to the work annually [10,11].

Work accidents and injuries have changed their form, but did not lose their destructive capability, work accidents and injuries still have heavy losses and damages.

Whether the individual who was injured or his family or the institution he works for are affected by accidents and injuries of work direct and indirect.

In addition to the number of deaths and injuries mentioned above, it costs enormous economic losses. Work accidents and injuries were valued the costs of the year 2001 by 4% of the total world gross domestic product (GDP) which is evaluated to be more than the amount of $1251353 millions dollars as business interests. The world spends about $170.9

billion dollars annually on the effects resulting from accidents and work injuries according to what estimated by the department of Health and Safety in USA [12].

Table (1) The impact of the circumstances and factors in the work environment on the efficiency of performance [9].

Temperature rest	Relative air humidity	The impact on human and efficiency
21°C	**40%**	The maximum rest
	75%	Work without feeling bored
	85%	Feeling bored
	91%	Tiredness and no rest
24°C	**65%**	No rest
	80%	Severe boredom
	100%	It is impossible to carry out the hard work
31°C	**25%**	subliminal uncomfortable
	50%	Work is still possible
	65%	It is impossible to carry out the hard work
	80%	A rise in body temperature

In Latin America alone costs of accidents and work injuries in the year 2000 were estimated to be about $ 76 billion dollars. The organization ISO has issued a new standard specification on technical terminology for the chain of standard specifications ISO 14000, this specification is expected to contribute in clarifying the definition of environmental terms and definitions. It will also help to facilitate explaining the activities of environmental management and uses of terms [13,14].

This specification will also help all users of the chain of the international specifications ISO14000 and professionals working in the area of environmental management to safe money, time and efforts, which are wasted in the search for the meanings of environmental terms. This specification represent the fruit of cooperation between technical experts in the Technical Committee ISO 2007, experts and technical terms ISO organization workers. This version of specification will be made available in the form of a dictionary that includes all the definitions contained in the international specification series and will be issued in both English and French languages [15,16] .

History and formation of marble and granite

Marble is one of materials used in Islamic art and religious in many areas, it is a rocky substance witch is formed by warming transition of limestone, it consists of calcium carbonate, which is evolving from rocks dominated by white red and black colors**.** Egypt did not know the use of marble until the end of the Al Ayobi times. In recent ages marble and ornamental stones in embellishing buildings whether outside or inside. Solid types of marble are chosen for these embellishment which have bright colors, can be burnished and polished, they give beautiful reflections of light .Marble is also used in the furniture industry in making boxes for electricity and in the establishment of memorial and upright tombstone and the clinics [17].

Granite is a ground fiery rock formed under high temperatures characterized by coarse fabric granules. It freezes slowly under earth surface, which allowed the growth of clear crystals There are other types of granite characterized in terms of fabric, which are characterized with the rest of fire rocks, this fabric indicates that the granite freezes in two stages .the First slowly and the other rapidly [18].

The ancient Egyptians knew granite especially the black and pink granite. They used it in temples and the unique pieces of arts, this industry has prospered a great prosperity in the times of the modern nation. Egyptian granite is internationally described as the strongest kind of high solidity, one of its advantages is that it does not absorb water. this gives it a high proportional advantage especially in the areas of high humidity such as beaches. The colors of Egyptian marble lie exclusively between beige and yellow with their degrees. There is a proportional advantage for the Egyptian marble, beside its desired color, its price is still an international competent ,especially in the circumstances of low exchange rate of the Egyptian pound ,compared with dollar [19].

Marble and granite industry and its effects on the environment .

Granite is a ground firestone with coarse textile ,rich with Quartz, Feldspar, Potash, Muscovite, poor of iron and magnesium minerals, so it is classified as acidic [20].

Formation of marble and granite in the earth

The industry of building materials from natural stones is considered as one of the most important industries which helps in the civilization spread on the surface of the earth, **Fig (1) shows international market of marble and granite,** but the dust resulting from this industry has great damage on agriculture ,human being and animal who are exposed to it .Despite of the non stopping calls to get

rid of this dust and prevent it from coming out through the chimneys of these manufactures by using filters, but pollution of the environment is still going on [21,3].

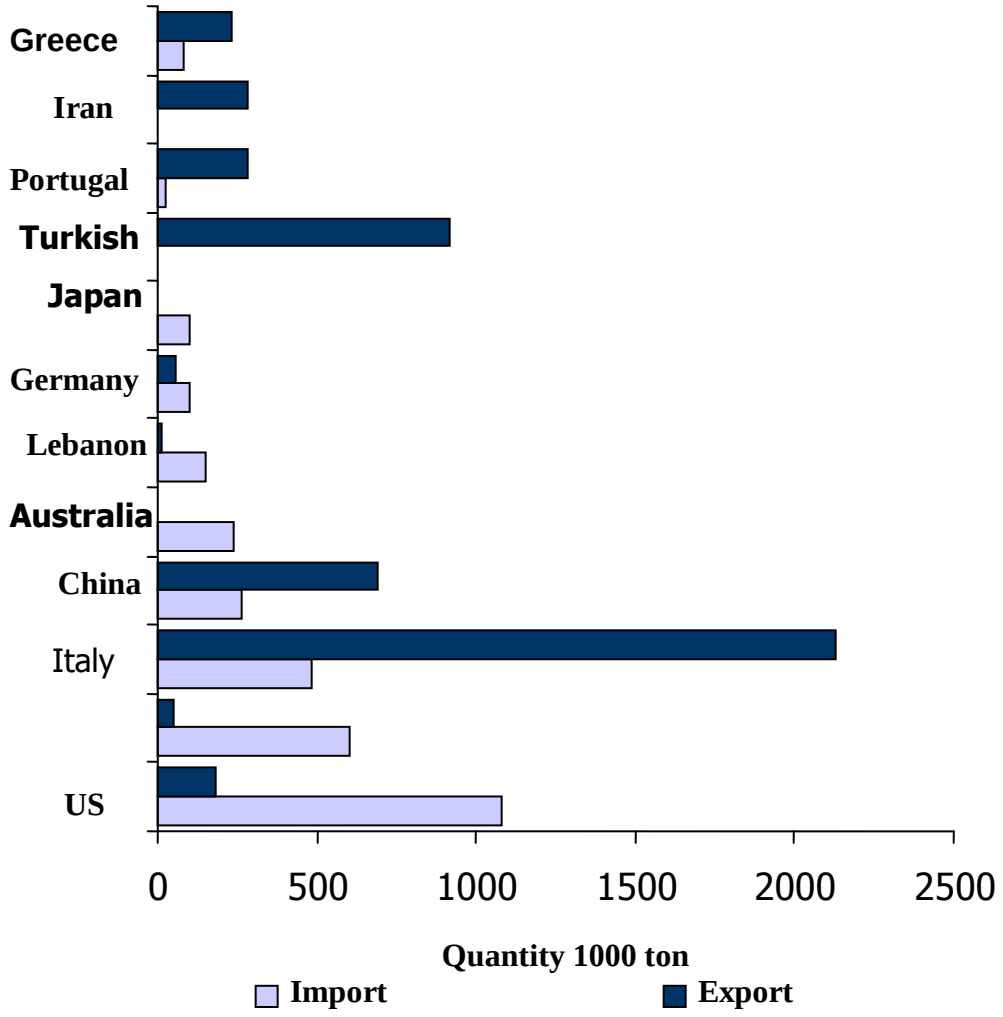


Fig (1) International market of marble and granite [22]

Production of marble and granite in Egypt

The mining of marble and granite are one of the most important mining industries, which are spread in different areas in Egypt **Fig (2) and fig (3) show the mining areas of granite and marble in Egypt respectively**

The most important area for mining of marble and granite is Shak El Toaban , which lies on the road of the Autostrad, in the southern area, in Cairo. This area lies in the south of Maadi on the Autostrad road. it has many manufactures for marble, granite and other building materials, its total space is estimated at 1000 acre .this area is the most important area in the world for the production and manufacturing of raw marble which is exported to all countries in the world .it has been given this name for its natural conditions and its geographical form as well as its characterized history, it has gone through different periods till it reached what it is now, it is a mountain area far away from inhabitedness, it was specialized in lime Articles and stone pit materials, it did not produce marble in the beginning. It holds about 300 manufactures and more than two thousand workshop for the supplementary industries in which about 25 thousand are employed that is beside the indirect employment which is estimated at 30 thousand workers [23,24] .

The area of Shak El Thoban comes in the third stage on the international level in the list of the most important areas that produces the highest quality of marble in the world. It also produces 78% of the total amount of marble in Egypt. The investment in this

area is more than 3 billion Egyptian pounds, it is expected to increase to 5 billion after the improvement of the area to provide 35 thousand direct working opportunity, as well as indirect opportunities [25] .

The amount of exports are expected to increase in the near future. Today, it is estimated to be 225 million Egyptian pounds, the owners of the stone pit have started using the wild land in the area to build marble manufactories, the area has started to receive the raw marble from the Galala mountain in Suez ,the Red sea and Aswan. The total of Egyptian production coming to Shak Elsoban area is reached 70% besides what are arrived from abroad for example from Turkey, Italy, India and others, so it has become a marble manufacturing area beside of being stone pit area, the manufactures procedure have been improved and have used the highest level of technology. **Fig (4) shows the estimated cost for the economies of marble and granite industry.** The direct and indirect work opportunities in the area are estimated at 75 thousand, it starts from lime, constructive and completing tasks. The total space of the industrial area reaches 400 acre in which 235 manufactories and 300 workshop are found most of them work in the industry of marble, granite and stone of all kinds. There are different kinds of marble in this area such as marble of Zafarana, pink, peige, yellow, perlatau, tersta, elmenya, alpechino, white and black marble, al galala, white marble with green lines, chrestina marble, alfelto and different kinds of granite. Shak el thoban becomes one of the biggest industrial area for granite, this area is characterized by people with experience and skills [5,9] .

Shak El soban area has won an international and local reputation in manufacturing and exporting of marble and granite. It is located in the east of the Autostrad road 5 km deep in the desert on the border of the sanctuary of the valley Degla in the east in the area of Tora Maadi. Figs (5), (6) and (7) show the shak Elsoban area from satellites [8] .

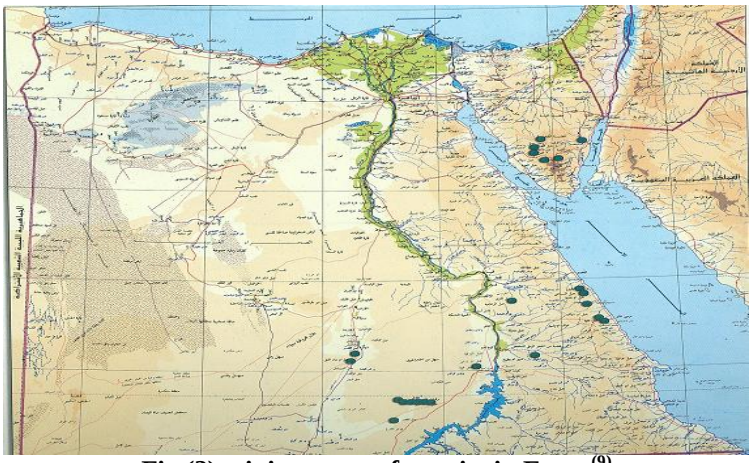


Fig (2) mining areas of granite in Egypt[9]

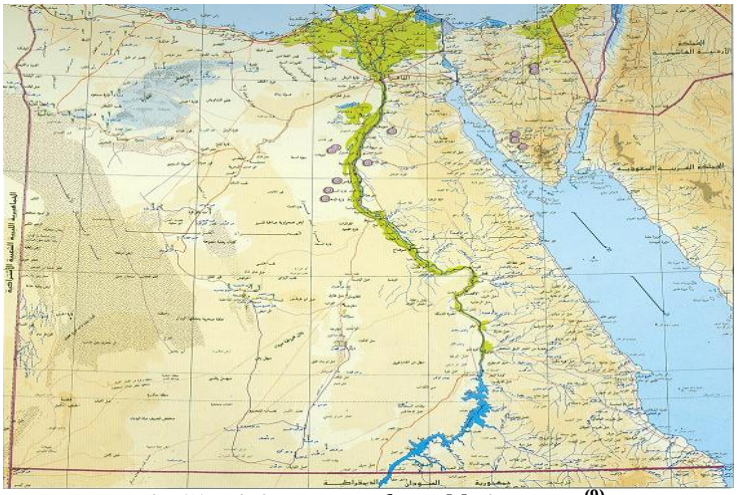


Fig (3) mining areas of marble in Egypt[9]

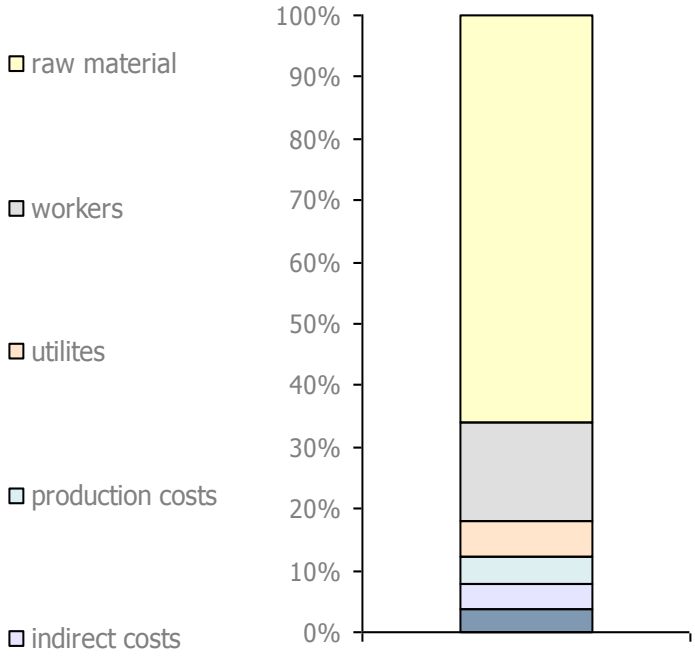


Fig (4) estimated cost for the economies of marble and granite industry

Shak el Soban area was divided into three main regions:-

The First region is the area existing currently and has the marble manufactories, it is the territory of the status of the hands of

The Second region is considered the first stage of the project to plan and specify the industrial area in Shak el Thoban and the space available for investment is 35 acre and the specified space is 30 acre and the spaces that have not been specified is 5 acre ,the number of projects is 39 projects ,working opportunities are 1980 opportunities, the amount of investment is 21.9 million Egyptian pounds.

The Third region it is the second stage of the project to plan and specify the industrial area in Shak el Thoban and the space offered for investments 290 acre, the space specified is 104 acre and the spaces that have not been specified are 186 acre the number of project is 103 industrial projects. the opportunities of work are 5346 opportunities, the amount of investment is 308 million Egyptian pounds. the dominating characteristic in the market of marble and granite is the randomness of distribution this is why the locale product does not contribute to the marble and granite in big portion. **Fig (8) shows the strategies of marble and granite wastes in Egypt and randomness in distribution, while fig (9) shows volume of investment of marble in the Egyptian market and fig (10) shows the marble imports and exports in tons [13,14].**

Fig (5) The location of shak elsoban and its borders from satellite [15]

Fig (6) Shak Elsoban from satellite[15]

Fig (7) Stone pit area from satellite[15]

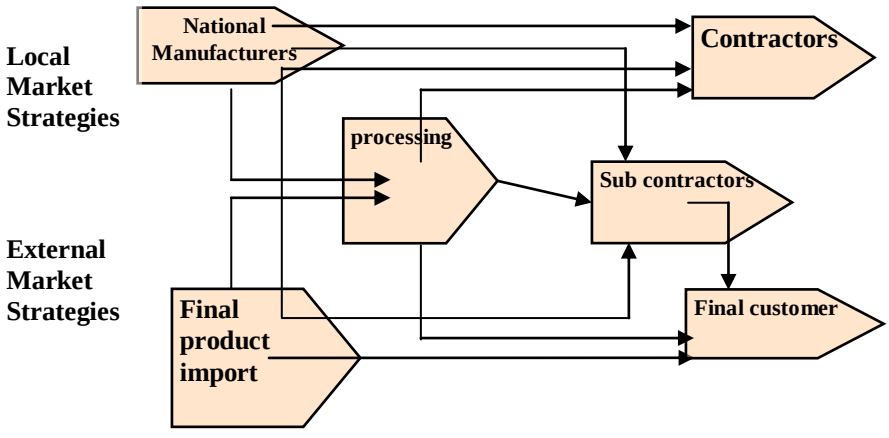


Fig (8) The strategies of marble and granite market in Egypt [16]

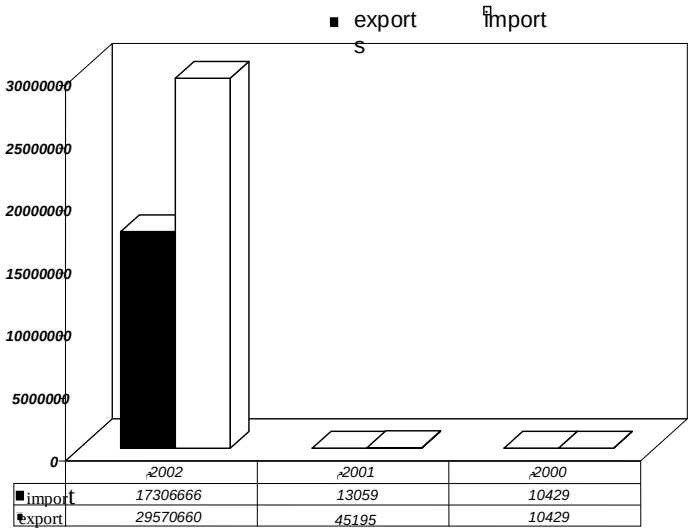


Fig (9) volume of investment of marble in the Egyptian market [17].

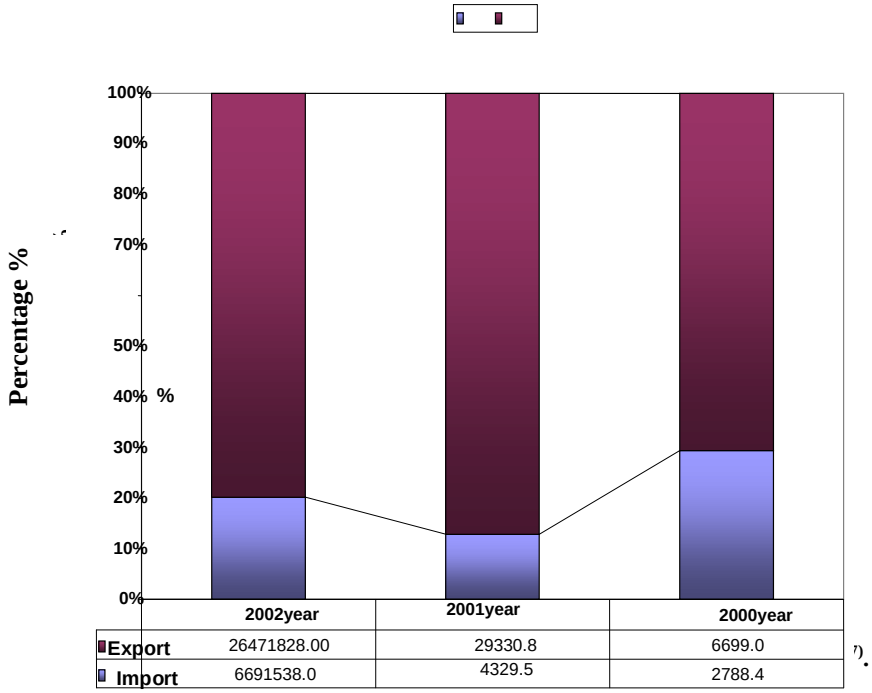


Fig (10) the marble imports and exports in tons[17].

Reasons of problem increase

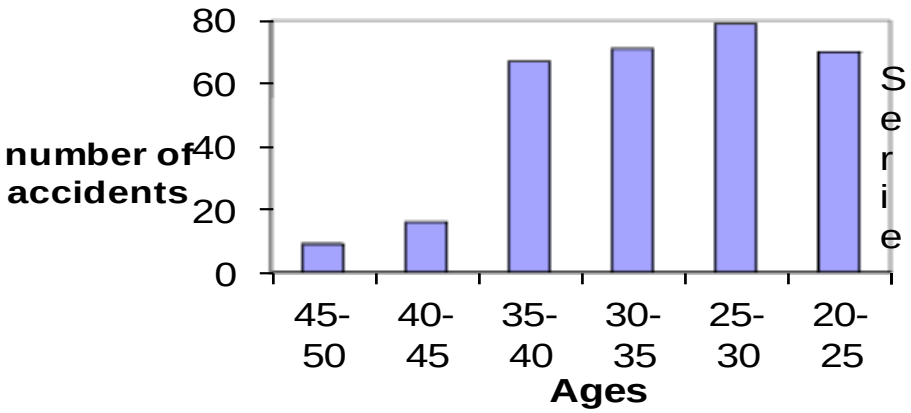
1. one of the most important areas of marble industry in the world is Shak el Thoban is still suffering from randomness and lack of services and utilities
2. most factories in shak el Thoban do not have the necessary licenses to carry out the business
3. the area does not have proper drinking water. The water is being sold in vehicle which is brought directly from the Nile covered with moss and bacteria and there is no sanitation to help taking away the remains
4. accidents are repeatable because of low level of vision high temperature and humidity, large number of impurities and suspended objects in the surrounding environments, sand and dust resulting from the cutting and polishing operation of marble specially the humid remains which calls (alsohla)
5. the road is not surfaced, narrow and always crowded which lead to many accidents.
6. hinders private cars are carry injured people to the hospital because the ambulance serves only the housing area and not the industrial area
7. the emergency unit is a new building that have no helpers, no doctors and no medical devices
8. there is no control over food and food stores, the meals are contaminated
9. the area suffers from the lack of electricity
10. many death cases that have been recorded by the fact-finding committee were people who died on their way to the hospitals because of the delay of ambulance.
11. using dangerous materials in the manufacturing operation as fire water used in glowing marble lead to many injuries
12. working children phenomenon is against children rights convention 1989 that banned the working of children in stone pits. Fig(11)shows the number of accident as function of ages.

The negative effects of the marble and granite remains

The outbreak of chest and allergy disease between workers and residents due to dust and sand caused by sawing and cutting marble that can even be respiratory rigidity and cancer, they cause death specially with negligence of gloves and chest filters, chest disease are spread between workers because of drinking water and food contamination which in turn caused kidneys ache, diseases also caused by high temperature and lack of clean water, vomiting cases and intestinal ache between workers caused by eating contaminated food . Fig (12) Rate and kind of accidents. Breaking bones injuries in feet and legs occur in front of the accidents then followed by head injuries while death cases are due to electric stun and falling of marble blocks on the victims

The economic effects

The quantity of wastage lift up the price of the final product and affects the economies of the industry. Fig (13) show the rate of cost increase with losses increase



Fig(11)the number of accident as function of ages[(1)]

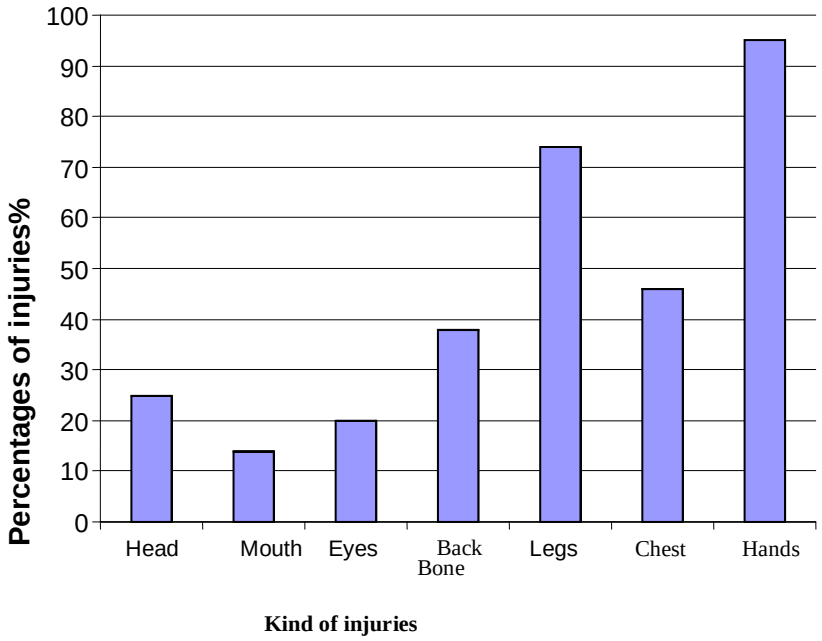


Fig (12) Rate and kinds of accidents[1].

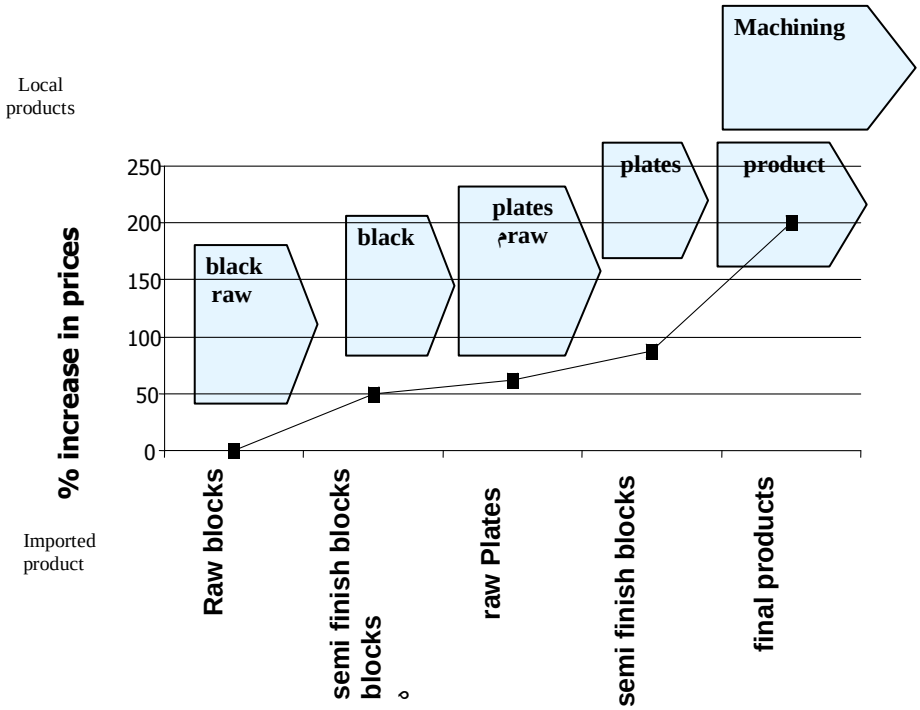


Fig (13) rate of cost increase with losses increase

Conclusions

The operation of marble and granite mining and production can happen in all air conditions and rude environmental factors, workers in this section are exposed to many dangers that can be divided into :-

1. workers in marble and granite mining are exposed to many dangers such as air factors as temperature, cold and wind.
2. pressure caused by long distances in tough areas and getting far from the main service camp during the operation of transportation.
3. the possibility of getting respiratory diseases due to being exposed to severe air conditions, also diseases in the areas where there is settling diseases.
4. workers are exposed to many dangers as falling from above when climbing the mountains or going down to the mines also during installing devices.
5. being exposed to loud noise.
6. injuries caused by carrying and installing devices, saws and rubbing stones.
7. risks of shaking when igniting the motors,
8. risks of slipping,
9. skin infection caused by dust and contaminated water and diseases caused by the materials exist in the remains (sohla) or the chemical materials used in polishing.
10. the mining sector of marble and granite is one of the sectors that have probability of accidents caused by many operations and kinds of produced and manufactured materials
11. Temperature and humidity are considered to be the main factors in controlling lightening.
12. one of the important factors that affects the working environment is the existence of gases and dust specially the gases caused by the manufacturing operation .the existence of gases is as important as temperature degree and humidity, it has a direct effect on temperature.
13. the protection against industrial gases takes many ways according to its kinds and effects and risks regarding poison and volume of granules, use of protective masks against gases which suite the kind and volume of dust and gases .

Causes of work accidents and injuries can be summarized in the following :-

First: Reasons have relation with workers include:-

1. not paying attention and concentrating at work .
2. lack of training and experience
3. the failure to follow rules and instructions of safety
4. lack of experience and training to use tools and devices
5. not wearing personal protective equipment

Second: reasons have relation with work environment :-

1. chemical factors (vapor, gases .....)
2. physical factors (noise, temperature.....)
3. biological factors(bacteria.....)
4. lack of cleaning and tidiness of work place
5. mistakes at planning and execution periods
6. lack of safety tools
7. risks of materials and tools that have radioactivity which appear naturally

Conclusions concerning the case study

Through the study of work accidents and injuries in this important site Shak el Soban, it is clear that the main reason for work accidents and injuries were detected as follow:-

1. Workers do not stick to rules, instructions and guidelines of safety in carrying out the business
2. summer months are the months in which work accidents and injuries happen because of high temperature degree
3. the first age group are more exposed to accidents and injuries, accidents decrease as one gets older and have the necessary experiences
4. the rate of absence days for each injury is in betterment from one year to the other
5. the main reason for most accidents was electric stun and negligence
6. the accident and injuries were distributed along all positions in the site.

Recommendations

1. a mechanism to deal with the remains weather, gases and harmful dust by recycling it or by safely getting rid of it must be mentioned.
2. providing rescue cars in the area that can provide protection and first aids to the probable injury.
3. changing the emergency point into a small hospital to be able to deal faster with injury cases.
4. controlling the use of dangerous tools and chemicals in the productive and industrial operation.
5. it is necessary to create sidewalk, surfacing, lighting in all roads, preplanning the area to provide clean water and industrial drainage with cooperation of governmental and public efforts
6. awakening workers in this section of following guidelines, and safety instructions in doing the jobs.
7. the use of gloves masks because the nature of work in this area is dangerous and requires precautions
8. choosing the right persons for each kind of job and excluding children employment

9. having commitment towards the conventions and international laws dealing with workers rights and children employment
10. develop new laws that guarantee workers and residents rights through clear environmental policies
11. training in all stages and all levels to reduce accidents and injuries of work
12. giving and arranging breaks in summer and winter to be fitting with temperature degree.
13. Legalization of working hours according to age categories and work type
14. having health insurance to all workers, periodic disclosure and providing healthy food to be suitable with the kind of effort, perform and awakening them to their rights in cases of disability death and injury.
15. planting the area with green spaces and making wall around it to prevent pollution from creeping to the housing area.
16. measurement devices that have to be used in the industrial environment to supervise the suitable conditions of work such as hygrometer to measure humidity, gases detectors, temperature sensor and antimatter which give an indicator of work state in work environment

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References

1. …….The Fact-finding comittee reports (non governmental organizations) about situation in Shak Elsoban, 2007.
2. Hose G, Hyne R, Lim RP(2002). How important is the 'eco' in Ecotoxicology, Australian Marine Sciences Association Annual Conference, Australian Marine Sciences Association, 50, Sydney2002.
3. ……Recommendation of 10th World Congress of the International Organization of Psychophysiology (IOP), Elsevier Science, 39, Sydney, 2000.
4. .....Industrial safety,world health organization (WHO). (Google advanced search)
5. Martin Grayson, Encyclopedia of Composite Materials and Components, 1983, pp. 324-340.
6. ……..www.britannica.com/bcom/eb/article/printable/2/0,5722,118752,00.html, 1999.
7. Doetze J. Sikkema (2002). "Manmade fibers one hundred years: Polymers and polymer design". *J Appl Polym Sci, John Wiley & Sons, Inc.* (83): 484-488.
8. ……http://www.construction-institute.org
9. ……Atlas of mining wealth in Egypt, National projects, HBRC,2007.
10. ……http://www.hse.gov.uk/construction/designers/index.htm
11. ……http://www.designforconstructionsafety.org
12. …….http://www.workcover.nsw.gov.au/Publications/OHS/SafetyGuides/chairsafetyindesigntool.html
13. .....Industrial Accident Prevention, the Dresden Institute for Industrial Safety and Protection, Technical fundamentals series, 2002.
14. Sarkar, P.B……., *Sci. & Culture, 1* (1935) 60, 3 (1937) 411, 485, 551.
15. ……www.googleearth.com
16. …….Report of Prime minister center, imports and exports annual report,2009.
17. Reports of ……..??????
18. Gravitis, J. and P. Erins(1983)……. *J. Appl. Polym. Sci.*, Appl. Polym Symp., *37*: 421.
19. Staudinger, H. (1920)……., Ber 53B:1073.
20. Carothers, W. H. and J. W. Hill(1932)……..J *Am. Chem. Soc.*, 54 1559.
21. …….E.1. Dupont de Nemours and Company, US Patent 2,130,523, (1938).
22. . Shlack, P. , (1941)., US Patent 2,241,321
23. Whinfield, J. R. and J. T. Dickson(1941)……., British Patent 578,079
24. Proceedings of the American Association for Cancer Research 41, Cadmus Journal Services, 709, San Francisco, 2002.
25. Ghosh, *P(2002). Polymer Science and Technology-Plastics, Rubbers, Blends and Composites*, 2nd ed., Tata McGraw-Hill, New Delhi, 2002.

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