

# Safety Performance Conditions in the Engineering Projects [ Owner & Contractors Points View]

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## Abstract

The aim of this paper is to study the safety performance in construction projects in Gaza Strip. The objectives of this paper have been achieved through studying 53 questionnaires distributed to practitioner contractors and owners. The research results indicate that the safety conditions in local construction industry is not enough; meanwhile, there is no regulations and rules that control the safety conditions in the local construction industry.

The results show that there is lack of knowledge in safety performance conditions that affect most of local projects. The results show that both of owners and contractors are not satisfied with level of applying safety conditions in the construction projects. The results of this paper recommended both of private and public firms to bear the responsibility of establishment of regulations and rules to organize the construction safety conditions in local construction projects.

## 1. INTRODUCTION

The construction industry is one of the most hazardous industries. Wherever reliable records are available, construction is found to be one of the worst, and often the worst industry on health and safety criteria. Many construction hazards lead to loss of life, injuries, disease and permanent disability. Also the direct impacts on the worker of such hazards can include loss of working days due to disease or injury and job loss. These effects generally spill over to the family, community and society around the worker (Larcher, and Sohail, 1999).

### Safety perception

In understanding the safety climate or culture of a workplace, the perceptions and attitudes of the workforce are important factors in assessing safety needs. Safety solutions may fail if they do not take into account these prevailing attitudes and perceptions. Also, changes in attitudes and perceptions about safety are often likely outcomes of safety interventions (Williamson, Feyer, Cairns, and Biancotti, 1997).

Since construction engineering projects involve large quantum of labor and workforce, it is more prone to casualties and injuries, as compared to other contemporary industries [Hasnain, 2008]. This situation is compounded by bad working environments, confined spaces, unsafe work methods, equipment and produces (Farooqui, 2007).

Kam (2003) in his research believed that safety professionals must understand human perceptions and information processing if they are going to develop effective safety instructions. To understand how to make workers behave safely, the mere focus on external factors that stimulate the desired behaviors seem to be inadequate. The study of process includes how individuals perceive, interpret, and mentally store the information they receive from the environment seems inevitable if they are going to construct an adequate model that can effectively predict workers safe behavior.

### Safety management

One of the best ways to avoid injuries and minimize costs is through good planning and co-ordination - both before and on the job. This should start when the decision is made to go ahead with the project, and should consider all stages and parties associated with the work (OSHA, 1999). Effective planning for health and safety is essential if projects are to be delivered on time, without cost overrun, and without experiencing accidents or damaging the health of site personnel. These are not easy objectives as construction sites are busy places where time pressures are always present and the work environment ever changing (Cameron, Duff and Hare, 2000).

Safety management relates to the actual practices, roles and functions associated with remaining safe (Mearns, Whitaker and Flin, 2003).

Safety management is taken to be the total of activities conducted in a more or less coordinated way by an organization to control the hazards presented by its technology. These hazards may be potential harm to its assets (damage to buildings, plant, etc.), its work force, its customers or those living around the sites (Hall, 2003).

### **Improving construction safety**

Cagno, giulio, and trucco (2001) stated that the progressive improvement of safety conditions is a primary need in all countries. The continuous improvement of safety conditions essentially depends on the risk assessment process and on the coherence of decisions taken to eliminate or reduce risk. The three critical issues in an adequate safety management process can be derived to:

- Systematic identification and analysis of hazards and assessment of risk,
- Procedures to define priorities and budgeting to support the decision-making process, and a system to monitor and verify results, i.e. audit activities and indicators which measure company performance in terms of safety improvements.

Kartam (1997) developed a system to integrate safety and health issues into all phases of a construction project from design and planning through construction and startup and maintenance. The system was based on the :

1. engineering, by specifying actions such as substituting less hazardous materials, using warning devices, and prescribing protective equipment,
2. education, by using the system as a teaching and training tool,
3. enforcement, by following federal, state, and local laws and regulations.

### **Benefits of applying safety**

Applying safety regulations and provisions has several benefits may be personal, social, financial, or on the reputation of company. Following can summarize these benefits:

- reduced workers compensation claims.
- reduced expenses related to injuries and illnesses.
- reduced absenteeism.
- lower employee complaints.
- improved employee morale and satisfaction.
- increased productivity.
- reduction of hidden cost.
- reduced insurance cost.

### **Construction safety in gaza strip**

Statistics also showed that more than one third of fatalities among workers were dead during the working in construction site. Falls and excavations were the main factors causes for the death of construction workers. The main causes of injuries in the Gaza Strip are classified into five categories, the categories are, falls, struck by falling object, struck by moving or stable object, caught in/between, machines, and others (Hassona, 2005).

Health and Safety in Gaza Strip is not widely recognized as inherent characteristic of construction projects. Contractors consider health and safety a legal requirement that means spending money without any profit, although a quick look at the cost of workplace injuries and the potential return on investing in accident prevention shows that a safe and healthy workplace can be a good profit. This situation resulted in the increased number of accidents. The accident rate in construction is highest when compared with other industries. Statistics have remained reasonably constant over the past six years, it has the construction industry generally accounting for nearly 20% of all industrial injuries, (Abu Alqumboz, 2007).

Construction injuries and fatalities in gaza strip are very high when compared to other industries and with construction in other countries.

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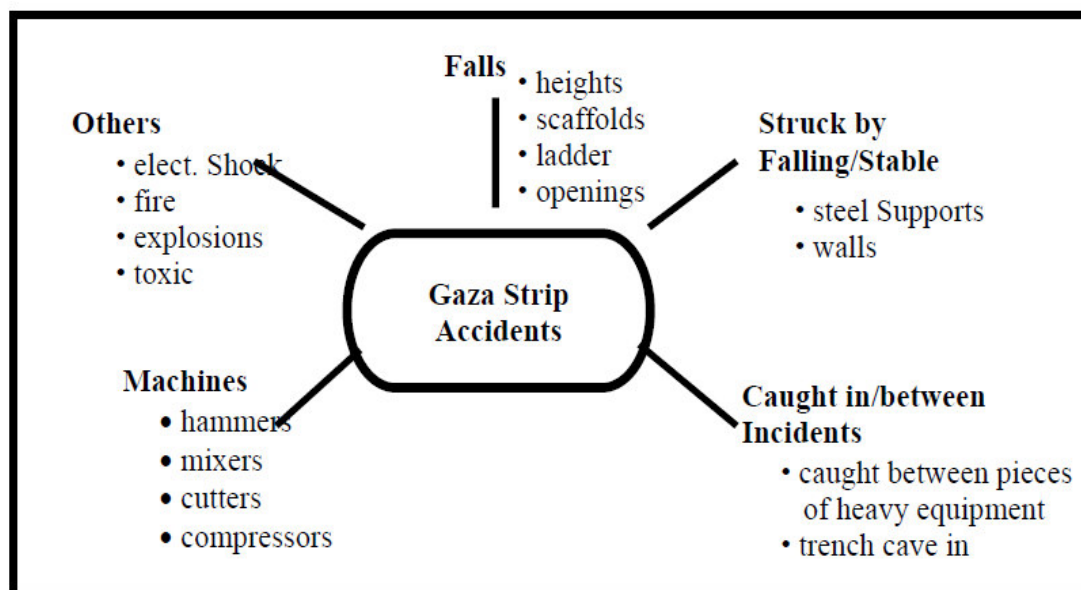


Figure1: The main causes of injuries (Categories)

## 2. MEHODOLOGY

The researchers did a wide literature review to disclose the issues related to safety performance in construction projects.

A sample of the most experienced owners and contractors in gaza were consulted in designing the questionnaire . A total of 53 questionnaires were randomly distributed to targeted owners and contractors . All of them have fully completed the questionnaires properly.

The respondents were asked to give score for each answer starting from 0 to 100 .The average of this score will be taken as: No, seldom, sometimes and always. For direct question Yes or No, the score is : total numbers yes, and total questionnaires response = %. Total numbers No, total questionnaire response= %. For open question the researcher presented each opinion individually for each questions.

## 3. SAMPLE DISTRIBUTION

After gathering the date and analyzing the questionnaire the date was classify into different tables :

- Table No.(1):[ type - experience - value project]
- Table No.(2): [ safety procedure -]
- Table No.(3): [Training –Motivation –Satisfaction]

### Sample Distribution Results

Table 1: type - experience - value project

Question No.	Question	Categories	Respond Number		Percentage
			Owner	Contractor	
<b>Total Responds Numbers</b>			<b>32</b>	<b>21</b>	
<b>Q 1</b>	<b>Organization</b>	<b>Owner</b>	<b>32</b>	<b>0</b>	<b>60%</b>
		<b>Contractor</b>	<b>0</b>	<b>21</b>	<b>40%</b>
<b>Q 2</b>	<b>Title name</b>	<b>Project Manger</b>	<b>22</b>	<b>9</b>	<b>58%</b>
		<b>Site Engineer</b>	<b>8</b>	<b>14</b>	<b>42%</b>
		<b>Design Eng.</b>	<b>0</b>	<b>0</b>	<b>0%</b>
		<b>Others</b>	<b>0</b>	<b>0</b>	<b>0%</b>
<b>Q 3</b>	<b>Specializations</b>	<b>Civil</b>	<b>24</b>	<b>18</b>	<b>79%</b>
		<b>Architect</b>	<b>2</b>	<b>1</b>	<b>566%</b>
		<b>Electrical</b>	<b>2</b>	<b>2</b>	<b>755%</b>
		<b>Others</b>	<b>4</b>	<b>0</b>	<b>755%</b>
<b>Q 4</b>	<b>Experience Year</b>	<b>1to 5 year</b>	<b>4</b>	<b>8</b>	<b>23%</b>
		<b>5to 10 year</b>	<b>12</b>	<b>7</b>	<b>36%</b>
		<b>More than 10</b>	<b>16</b>	<b>6</b>	<b>42%</b>
<b>Q 5</b>	<b>Type of project implemented</b>	<b>Roads</b>	<b>1</b>	<b>0</b>	<b>2%</b>
		<b>Sewage</b>	<b>10</b>	<b>5</b>	<b>28%</b>
		<b>Waters</b>	<b>1</b>	<b>0</b>	<b>2%</b>
		<b>Buildings</b>	<b>1</b>	<b>0</b>	<b>2%</b>
		<b>Others</b>	<b>0</b>	<b>0</b>	<b>0%</b>
		<b>Most of all</b>	<b>19</b>	<b>16</b>	<b>66%</b>
<b>Q 6</b>	<b>Value of executed projects with in last five years</b>	<b>Less 0.5 M \$</b>	<b>1</b>	<b>1</b>	<b>4%</b>
		<b>0.5 to 1.0 M \$</b>	<b>1</b>	<b>1</b>	<b>4%</b>
		<b>1.0 to 2.0 M \$</b>	<b>6</b>	<b>6</b>	<b>23%</b>
		<b>2.0 to 5.0 M \$</b>	<b>11</b>	<b>4</b>	<b>28%</b>
		<b>More 5.0 M\$</b>	<b>13</b>	<b>9</b>	<b>42%</b>

*Table 2: Safety Procedure*

Question No.	Question	Categories	Respond Number		Percentage
			Owner	Contractor	
Q 7	Project Injures	Yes	11	9	38%
		No	21	12	62%
Q 8	First Aid	Yes	17	13	57%
		No	14	8	43%
Q 9	Accidences Recoded	Yes	14	15	55%
		No	18	6	45%
Q10	Safety Procedures at site	No	0	0	0%
		Seldom	2	1	6%
		Sometimes yes	16	11	51%
		Always	14	9	43%
Q 11	Safety Plan before starting work	No	1	1	4%
		Seldom	3	6	17%
		Sometimes yes	10	4	26%
		Always	18	10	53%
Q 12	Safety Plan Approval before starting work	No	1	2	6%
		Seldom	5	6	21%
		Sometimes yes	9	6	28%
		Always	17	7	45%
Q 13	Safety procedure during work	Yes	29	20	92%
		No	3	1	8%
Q 14	Safety Evaluations	Yes	22	14	68%
		No	10	7	32%
Q 15	Safety Meeting at Site	Yes	11	9	38%
		No	16	17	62%

*Table 3: Training –Motivation –Satisfaction*

Question No.	Question	Categories	Respond Number		Percentage
			Owner	Contractor	
Q 16	Procedures against violation	Yes	20	9	55%
		No	12	12	45%
Q 17	Safety Training	Yes	8	4	23%
		No	24	17	77%
Q 18	Motivations for Staff	Yes	2	5	13%
		No	30	16	87%
Q 19	Motivations for Labors	Yes	0	2	4%
		No	32	19	96%
Q 20	Procedures against Labors	Yes	16	12	53%
		No	16	9	47%
Q 21	Work Site emergency tools	No	4	2	11%
		Seldom	5	1	11%
		Sometimes yes	13	9	42%
		Always	12	7	36%
Q 22	Importance of safety conditions	Not important	2	0	2%
		less important	0	0	0%
		important	2	5	13%
		very important	29	16	85%
Q 23	Safety Satisfaction	No	12	4	30%
		Seldom	10	5	28%
		Sometimes yes	10	5	28%
		Always	0	7	13%

#### 4. DISCUSSION AND ANALYSIS

The results concern with Question No. 7 in Table 2 is shown in figure (2) it shows that majority of the responded persons had injuries occurred in past projects 38% . the reset responded indicate they don't have any injuries occurred 62 % . if we compare this rate to the international standers it mean we have a very high percentage of injuries occurred .

This result show that :

Most of this injuries occurred results of down fall . (high % )  
 Fallings of wall or sand or others .( high % )  
 Falling of solid part over the persons . ( few % )  
 Electrical chock injuries .( seldom % )

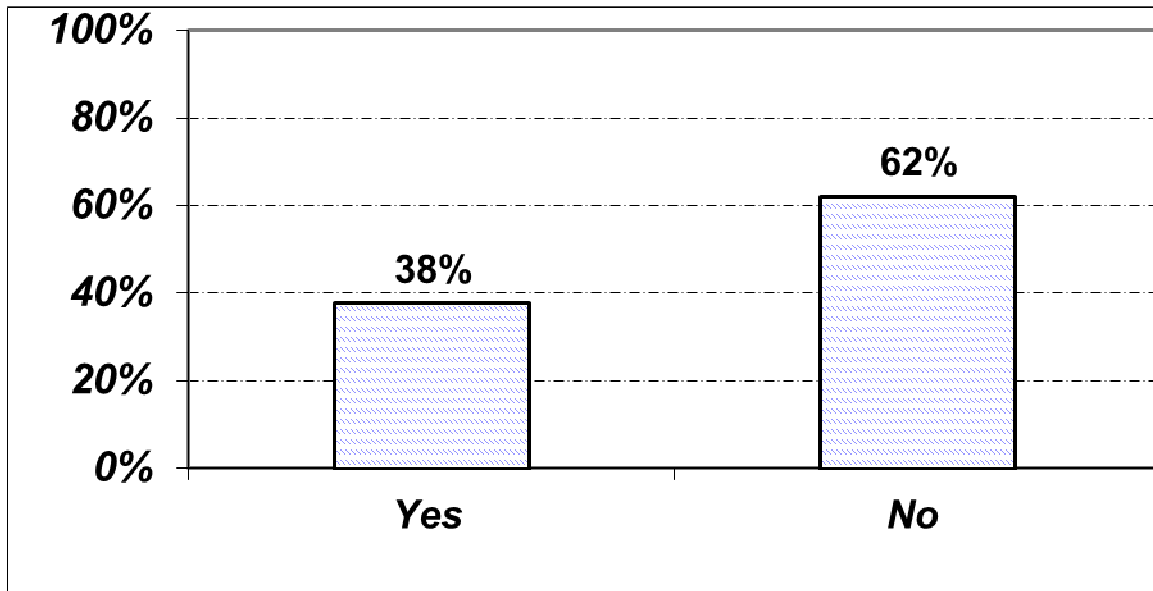


Figure 1: Project injures or death cases

The results concern with Question No. 8 in Table 2 related to project injures and first aid introduced as shown in figure (3),it indicates that 57 % of injuries first aid was introduced form the two side the owner and contractor and kind and way of first aids introduced as the following:-

- Treated in the site . ( high % )
- Translated to the nearest medical center by using the site care ( high % )
- Translated by the ambulance provided with medical staff .(few% )
- The injury was dangerous which causes quiche death . ( seldom % )
- The rest of the percentage indicate that 43% of injuries No first aid was introduced .

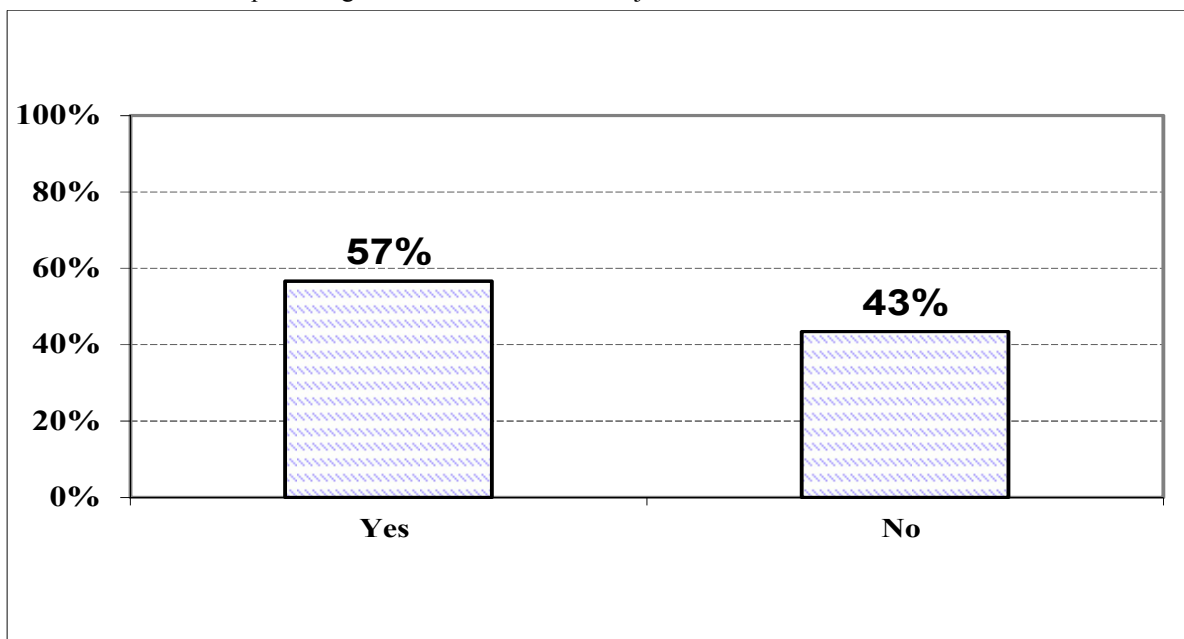
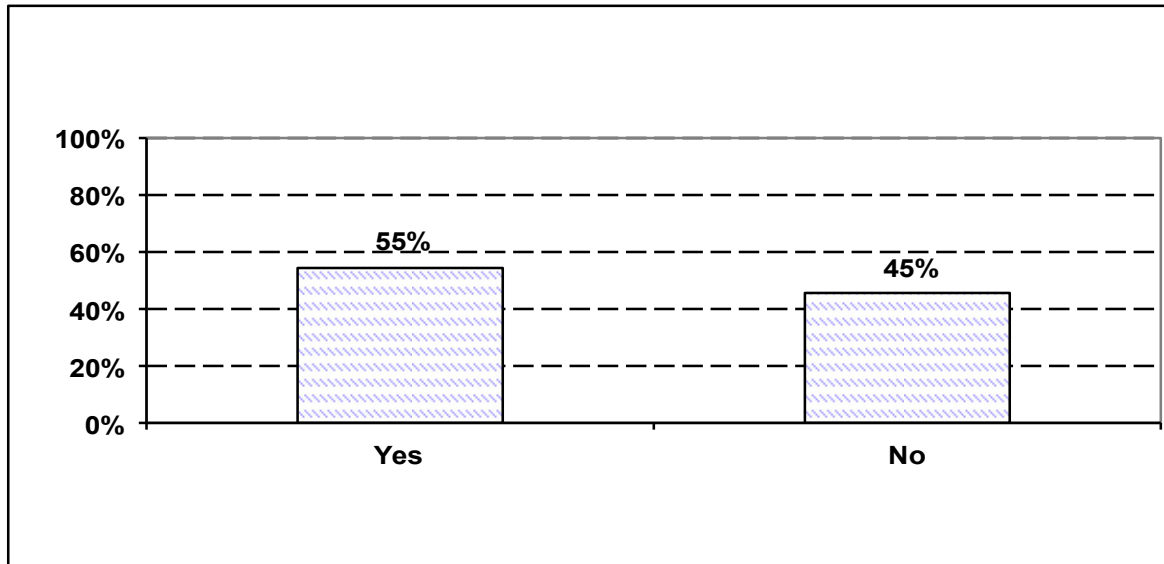


Figure3: First Aid introduced

The results concern with Question No. 9 in Table 2 related injures recorded procedures,as shown in figure (4) indicates that 55 % of injuries cases was recorded . This result show that the cases recorded as the

following :

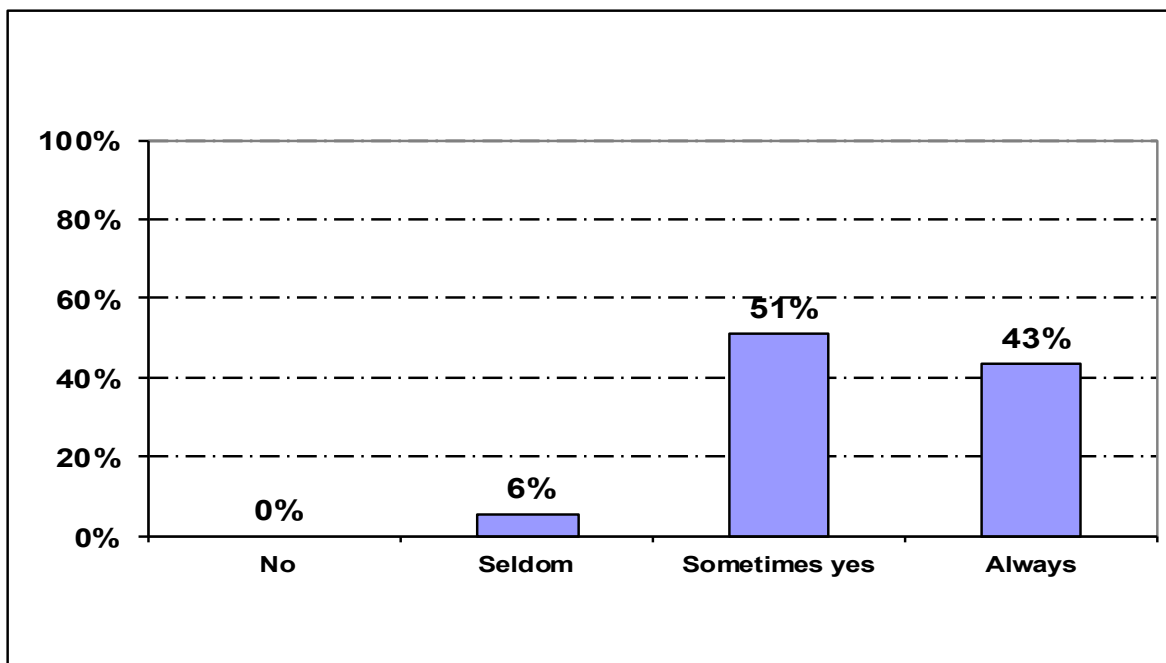
- By calling the police in quickly manner and make official report about the injury - ( high %)
- By specialize person . (few % )
- By unspecialized person . (few % )
- The rest of the percentage indicate that 45% of injuries No cases was recorded.



*Figure 2: Accidences Record for all Implementet Projects*

The results concern with Question No. 10 in Table 2 related to Safety procedures taken in work site ,as shown in figure (5), it indicates that 43 % of responders always that safety procedures taken in the work site , 51 % of sometimes Safety procedures taken in the work site , 6 % seldom Safety procedures taken in the work site, 0 % No Safety procedures taken in the work site. This result show that :

- Safety procedures taken in work site has middle percentages.
- Safety procedures is not different from sitetosite.



*Figure 3: Safety Procedures at construction Site*

The results concern with Question No. 11 in Table 2 related to Safety plan been put before startingimplementing the project as shown in figure(6) ,it indicates that 53 % of responders always that safety plan been put before starting the project and 26 % of sometimes of responders that safety plan been put before starting the project , 17 % seldom of responders that safety plan been put before starting the project , 4 % No



of responders that safety plan been put before starting the project . This result show that : 52 % of safety plan been put before starting implementation projects its indicate a low percentage of performance .

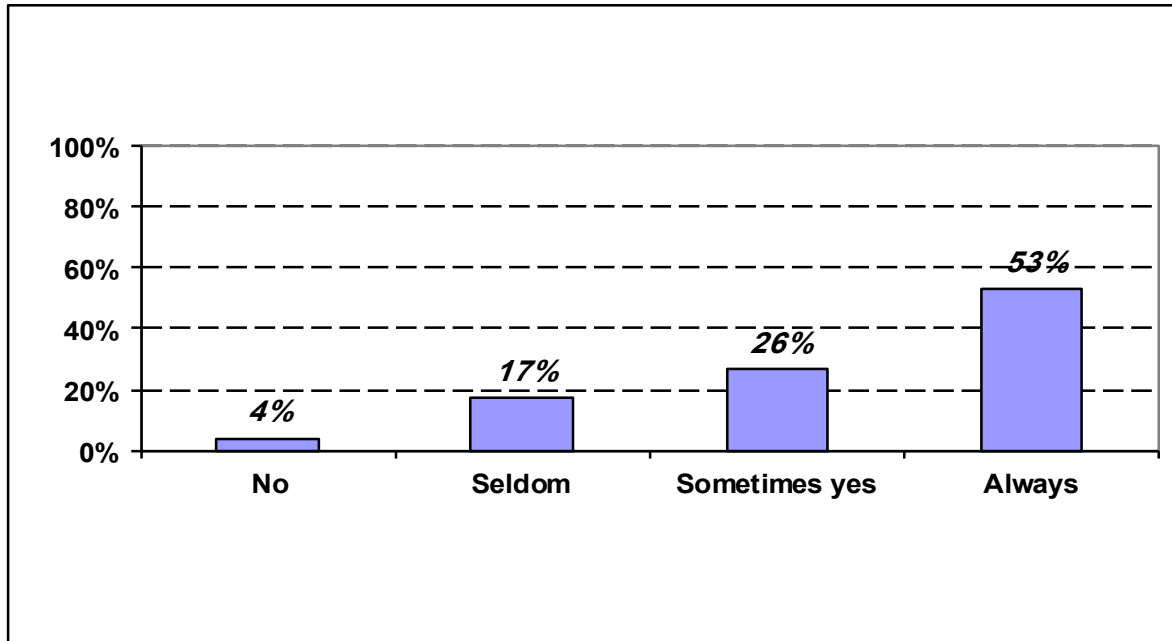


Figure 4: Safety Plan Before Starting Work

The results concern with Question No. 12 in Table 2 related to Safety plan approval before starting implementing the project as shown in figure(7) , it indicates that 46 % of responders always that Safety plan approval before starting the project and 28 % of sometimes of responders that Safety plan approval before starting the project , 21 % seldom of responders that Safety plan approval before starting the project , 7 % No of responders Safety plan approval before starting the project This result show that :

46 % of safety plan been study before taken approved before starting implementation projects its indicate a low percentage of performance

The results concern with Question No. 13 in Table 2 related to Safety procedures followed through implementing the project as shown in figure(7),it indicates that:

92 % of safety procedures followed through implementing the project , but there is different way as mention in the choosing the ways of procedures they followed as:

Sudden site visit of administration project staff .

Reports from the specialize person who responsible about safety procedures .

Daily report from site engineer .

Periodic meeting with site staff .

The rest of 8 % ( low percentage ) the don't follow up safety procedures through implementing projects .

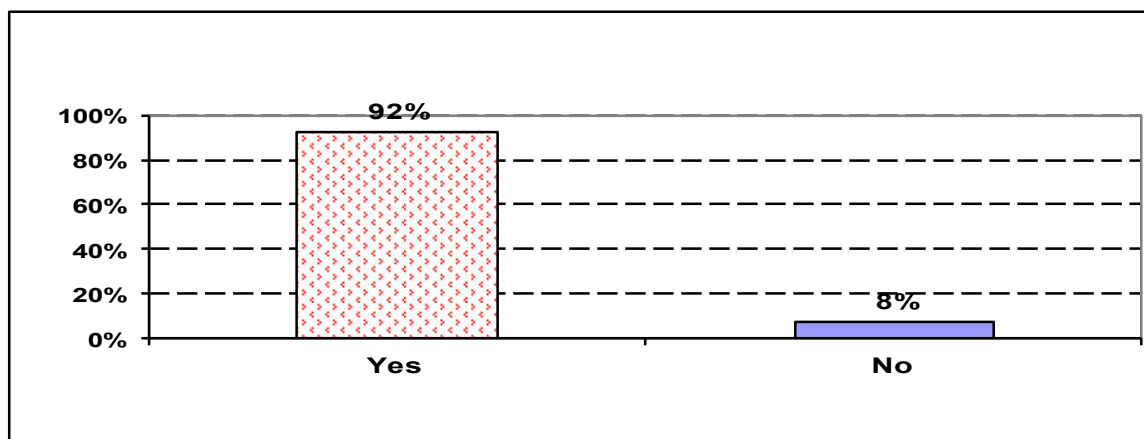


Figure 5: Safety Procedure during work

The results concern with Question No. 14 in Table 2 related to the safety level evaluated in the implemented projects and benefiting with its in other projects in future, indicates that 68 % of responders yes and 32 % of responders that No evaluations is done.

This result show that the yes responders they have used different way of evaluations the projects :

By reviewing the daily reports end of the projects ( high % ) .

By showing the size and type of accidents and injures that happened during implementation stage of project. ( high % ) .

By making conclusion and recommendation related of safety procedures in the end of project that may be used and benefiting in other projects . ( high % )

The results concern with Question No. 15 in Table 2 related to the safety periodic meeting hold in the work site, indicates that 38 % of responders yes and 62 % of responders that No safety periodic meeting is done .

This result show that the yes responders they do safety periodic meeting :

When it requested and attended by the project manger and the supervision engineer ( high % ) .

Every months and attended by the project manger and the supervision engineer (high % ) .

Every week and attended by the project manger and the supervision engineer (low % ) .

The results concern with Question No. 16 in Table 3 related to the are there stringent procedures taken against the contractor who not committing of the safety procedures during the project implementation, indicates that 55 % of responders yes and 45 % of responders that No stringent procedures is taking .

This result show that the yes responders the have used different way of stringent procedures taken :

- By written warning to the contractor ( high % ) .
- By discount some against the contractor .( high % ) .
- By stop the contractor .( low % ) .
- By listing the contractor name in the black list .( seldom % ) .

The results concern with Question No. 17 in Table 3 related to the safety training for the administrative and labors to apply the safety procedures before starting to implement the project, indicates that 23 % of responders yes and 77 % of responders that No safety training is done .

This result show that the high percentage is indicate No, and the No responders they don't have safety training before starting, for the yes responders they have used different way for training as :-

By making a special workshops for discussing the safety procedures requirements ( high % ) .

By making a special training for applying the safety procedures.( low % ) .

The results concern with Question No. 18 in Table 3 related to the are there a special motivations offer to administrative staff and site engineer related to apply the safety procedures in the site, indicate that 13 % of responders yes and 87 % of responders that No motivation is offer .

This result show that the yes responders they receive special motivation is very low percentage, the kind and nature of motivation as the following :

By receiving financial motivation ( high % ) .

By incorporeal motivation .( low % ) .

For the No responders the result show that there is no any motivation offer for the administration staff .( high % )

The results concern with Question No. 19 in Table 3 related to the firm offering a special motivations offer to labors related to apply the safety procedures in the site, indicates that 4 % of responders yes and 96% of responders that No motivation is offer for labors .

This result show that the yes responders that the firm offers special motivation is very low percentage, The kind and nature of motivation as the following :

By receiving financial motivation ( high % ) .

By incorporeal motivation ( low % ) .

For the No responders the result show that there is no any motivation offer for the labors ( high % )

The results concern with Question No. 20 in Table 3 related to stringent procedures taken against the labors who did not committing of the safety procedures during the project implementation, indicates that 53 % of responders yes and 47 % of responders that No stringent procedures is taking This result show that the yes responders they used different way of stringent procedures taken :

By written warning to the labor ( high % ) .

By stop labor working in the project for one day (high % ) .

By stop the labor working in the project ( low % ) .

The results concern with Question No. 21 in Table 3 related to work site first aid and emergency tools found in the construction site, indicates that 36 % of responders always there is safety first aid and emergence tools and 42 % of sometimes of responders there is safety first aid and emergence tools, 11 % seldom of responders, 11 % No of responders there is safety first aid and emergence tools.

This result show that most of construction site theirs is no safety first aid and emergence tools . and that importance of this tools is not clears .

The results concern with Question No. 22 in Table 3 related to importance of safety conditions in the implementation of construction projects , indicates that 85 % of responders very importance the safety conditions to sites and 13 % of responders Important , 0 % of responders less important, 2% of responders not important .

This result show that the yes responders [ very important ] for the safety condition in the implementation of engineering projects very high percentage, this result show that all owners and contractor believe of safety conditions importance .

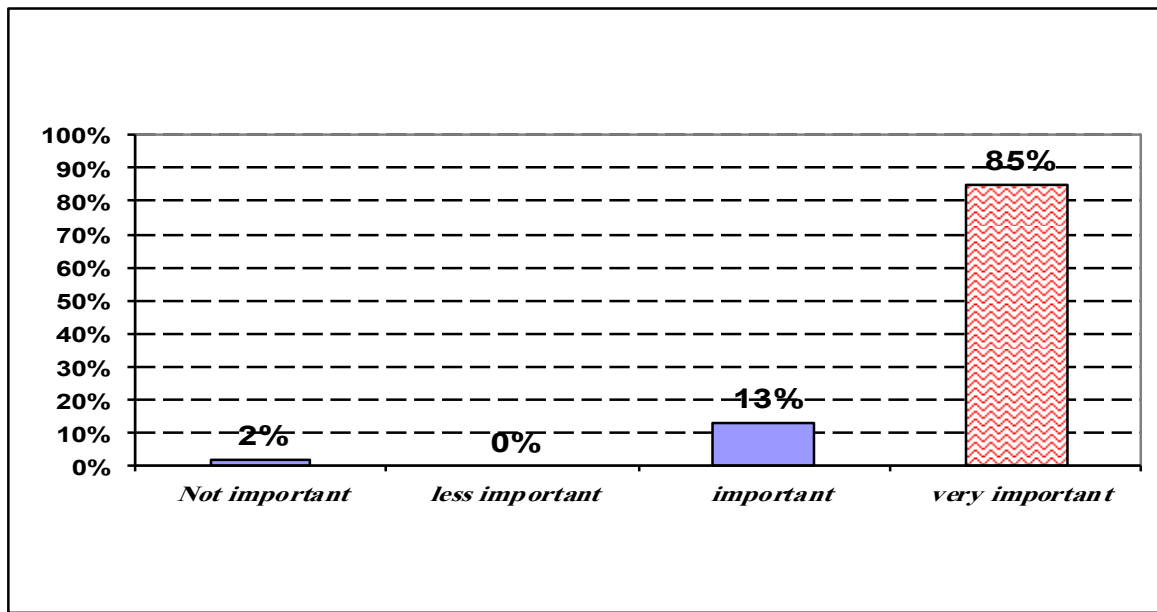


Figure 6: Importance of safety Conditions

The results concern with Question No. 23 in Table 3 related to the satisfied about the level of applying the safety conditions in the engineering projects ,as shown in figure (9), it indicates that 14 % of responders yes always they satisfied with safety conditions in engineering projects , and 28 % of responders yes some times,28 % of responders seldom , 30 % of responders No .

This result show that most responders they are not satisfied with the safety conditions in construction projects .

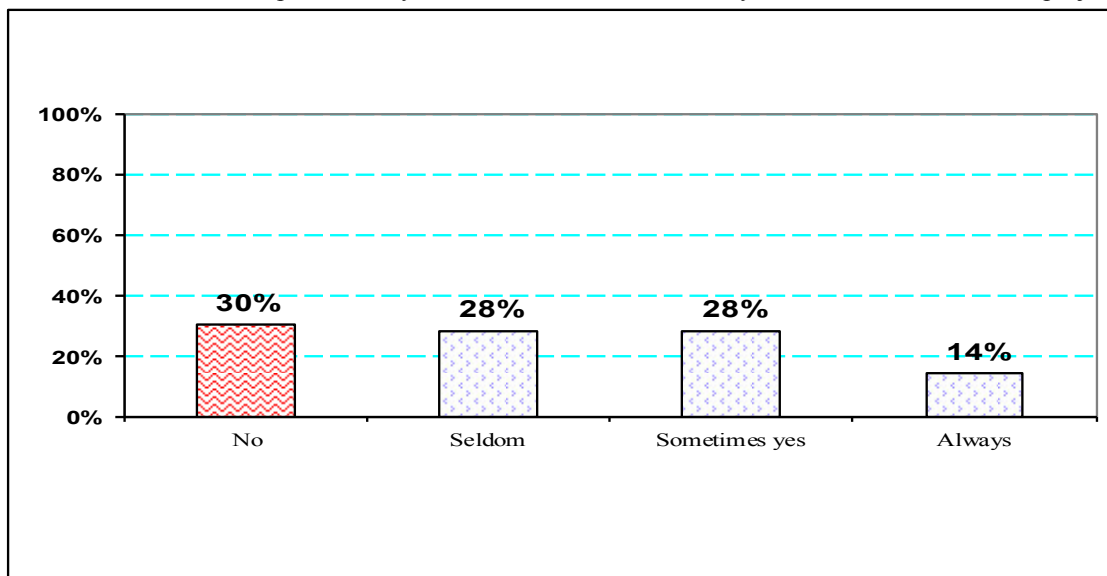


Figure 7: Safety Satisfaction

## 5. CONCLUSIONS

This paper has clarified that the safety conditions in the local construction industry is not enough. It notes that there is no regulations and rules that control or organize the safety performance, meanwhile, there is a lack of knowledge in safety conditions affect most of local projects. This in turn , causes a lot of injuries and accidents in projects.

The results show also, that neither owners nor contractors are fully committed to safety regulations. Finally, it is noted that most of the owners and contractors are not satisfied with level of applying safety conditions in construction projects.

The results of this paper recommended private and public firms to establish the regulation and rules to organize construction safety conditions.

## 6. RECOMMENDATIONS

The responsible privet or public firms should take the responsibility to establish the regulation and rules to organize theconstruction safety conditions.

The owners of construction projects should do a regular site inspections to check up safety conditions .

Safety cost should be included in the total project cost

Safety training should be increase for every level of construction projects .

Motivation issues should be increase to effect the site workers.

Safety cultures should be bring out to every one on constructions site

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