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Evaluation of Safety Systems in Iraqi Construction Projects

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Abstract

Constructions projects have the most complicated Operational activities and many activities which need to be executed simultaneously and in the same place. The properties and context of this type of project therefore makes it a highly hazardous place for staff. Building advanced and smart building's safety systems according to a variety of chal-lenges involved makes the construction projects safer and avoids any unexpected costs caused by accidents which can occur during work on a construction site. This paper evaluates the current safety systems in Iraqi construction projects in different ministries and adopts quantitative approaches to collect data by applying a questionnaire survey specially pre-pared for this purpose. The results of the research showed that the safety systems in Iraqi construction were very poor in many aspects for management safety requirements and neutral with respect to site safety and labour safety requirements. In addition to this, the results indicated that the support of the ministries (higher management) was subpar standard in the field of occupational safety levels.

Keywords: Accidents, Construction, Inspections, labour, Safety system.

INTRODUCTION

The construction industry is characterised by poor safety records and is hazardous compared to other industries. Therefore, nowadays the idea of a safety system is a necessity [1]. Construction projects are extremely complex working environments, because of their dynamic character and the synchronized involvement of various resources and relative components [2]). Moreover, in spite of the advanced technology for ensuring site's safety site protection for all staff and workers, construction sites still present high accident rates. Many workers are killed or injured on construction sites because of accidents [3]. Hence, the effect of accidents on construction projects sites has become a considerable problem worldwide [4]. Despite construction safety witnessing a considerable improvement and reaching a plateau of safety over the last few decades, accidents still continue to occur on construction sites so that construction has become major hazardous industry in many countries [5]. This is attributed to the unique features of the industry, for example, multi-organizational project configuration, diverse tradeoffs and a continually changing work environment [6].

Many studies explain the effect of poor safety systems on people' life in construction industries. In some countries, such as the United States of America (USA), the construction industry accounted for 20% of all professional fatalities, the affected workers constituting just 5% of the USA' workforce, while in Hong Kong the construction industry has accounted for more than one third of all industrialized accidents over the last ten years. In Singapore, the construction industry has up to 29% of the total number of industrialized workers. In Kuwait, the construction industry has also had 42% of all occupational victims over the last 10 years [7]. Moreover, according to the latest statistics, the European construction field has recorded numerous accidents, falls from heights causing the highest number of victims. This represents 52% of all accidents, with the number of fatal accidents due to objects falling from overhead amounting to 36% of all accidents occurring on construction project sites [8].

Inspections and monitoring are considered to be the most important factors in the safety systems of construction project success and are the responsibility of everyone working on a construction site. External pressure through regulations and inspections is generally accepted as being essential for safety of on-site activities, since the lack of safety can be an obstacle to short-term costs and time objectives. Such regulations are constantly developing and are regularly prescriptive [9]. There is very little literature on how safety inspections are really performed, which contrasts with more knowledge on quality inspections [10]. Traditional safety inspections take place according to regulations and depend on co-accordance monitoring conformity with prescriptive regulations, instead of carrying out a broader assessment of the efficiency of a company's risk management system [11]. There is discussion concerning the effectiveness of the receptive regulations impression, which indicates the idea of focusing inspection efforts on organisations that demonstrate lower safety performances [12].

Woodcock, [10] reveals that safety inspection decisions are not explicit pass-fail options, and an inspector does not instinctively know how to recognize and assess risks when they exist. Here, construction firms should inspect each site with a safety engineer and current safety programs. Nevertheless, it is unfortunate that accidents still occur due to the insufficiency of these provisions [3].

When an accident occurs on a construction site, all the project stockholders, such as the architects, site engineers, owners, contractors, subcontractors, insurance companies and suppliers of equipment may be held responsible for insufficient safety provisions [13]. The construction industry is therefore characterised by multiple stakeholders, such as regulators, owners, clients, contractors, subcontractors, suppliers and workers. These all play different roles in contributing to site safety, which has the inevitable result of a coordination crisis [14].

The behaviour of people is considered to be one of the most importance factors generating accidents on building sites. Here, Workers' habits are a highly important factor in workplace safety; numerous accidents are frequently caused by unsafe actions, where the combinations of human attitudes have an impact [15]. These factors had therefore been recognised as affecting the climate of safety on the construction site, the most significant ones being: individual behaviour, organizational characteristics and workers' perceptions [16]. Li et al., [17] asserted that 80% of all accidents on a construction site occur because of dangerous human behaviour, and most of victims are workers who fall from heights, are hit by moving objects or are struck by moving loaders or vehicles. Moreover, most of these workers have a low educational level and are poorly informed about safety considerations as they move from one project to other. This presents obstacles when setting out to improve safety[18].

In Arabic countries, construction industry safety conditions are similar to those in developing states countries. On the construction site, the working environment is continually changing, the construction sites exist for a relatively short time and activities and natural hazards change daily. Hence, the main occurrence of construction accidents take place on projects that exceed their budget and those that were competitively bid for [19]. Kartam et al.,[20] defines the safety problems on construction sites in Kuwait state as follows: they require safety regulations, have competitive tendering, are a small component of a larger construction company, make extensive use of subcontractors, lack relevant accident data, make widespread use of foreign labour; have disorganized labour, have a high labour turnover, make little priority for safety, have seasonal employment and weather problems. In Iraq, there is little literature relating to safety and security systems in the construction industry. This is exacerbated by the fact that the country generally faces large problems as far as safety is concerned owing to the effects of terrorism which damages everything on a daily basis. Hatem and Samiaah, [21] have revealed the extent to which terrorist attacks affect construction industry projects in terms of time, cost, and quality. The results of their study should therefore improve the awareness of all construction stakeholders concerning the effect of the terrorist attacks on the construction industry projects. Eventually, this may improve risk management assessments and help contractors to correctly protect projects and buildings which reduce injuries and victims in the event of terrorism. It is good to have best frame rate at which time-lapse movies should be recorded so as to enable accurate observation and interpretation of the site activities[22].

This paper evaluates the safety systems in Iraqi construction projects to build an overview of the state of safety in Iraqi construction projects and reference to the points that suffer from the weakness and which what ministry need to rearrange their priorities with regard to the subject of safety for its projects and. The evaluation focuses on three elements in this system, namely safety management, site safety and labour safety requirements. The study has been conducted using a questionnaire technique for each item in each of these components to identify the level of safety for these projects.

RESEARCH METHODOLOGY

This paper studies the safety system used in Iraqi construction projects and then evaluates the requirements for each item in this system. The information was gathered using questionnaires, with the main focus being on a selected and wide range of respondents from construction projects industry in Iraq (Diyala governorate case study). The study involved many construction projects in different fields in the Diyala governorate. A quantitative technique was used for this research and the data were collected using a questionnaire survey. This was distributed to stakeholders who participated in the implementation stages for these projects. The projects were selected randomly in construction sectors such as the Ministry of Education, the Ministry of Higher Education and Scientific Research, the Ministry of Municipalities and Public Works, the Ministry of Construction and Housing, the Ministry of Communications and the Ministry of Health. The objective of the questionnaires was to gather information about the safety systems in each project, and individual respondents explained how many safety requirements were applied in each project and showed the weak points in the current system. There were 130 copies of the questionnaire were distributed and 124 copies of the questionnaire were received from the respondents with a response rate = 95%. The percentageage of males was 66.13% while that of females was 33.87%.

The questionnaire consisted of close-ended questions and was classified into two sub-sections. It was also distributed to a people with expertise in the construction industry. The questionnaire was carefully worked out using appropriate statistical techniques and the data was analysed qualitatively using the Statistical Packaging for Social Science (SPSS) software, Version 24. Many statistical steps were undertaken in the data analyses, which lead to extraction of descriptive statistics (measures of central tendency, frequency distributions and measures of dispersion). Finally, the reliability and validity of the data were measured.

It was important before distributing the questionnaire copies to the participants, to refer the questionnaire to a number of arbitrators who work on construction projects at the implementation stage. The object of this step was to measure their apparent honesty and to act on their recommendations in order to optimise the success of the questionnaire. Here, the arbitrators had to meet many requirements, such as scientific, professional and academic needs. Therefore, after the questionnaire had been commented on by the arbitrators, some of the items were partially changed, while other items were changed completely. Following this, a final version of the questionnaire was generated. For privacy and personal reasons, the arbitrators requested that the researcher should not mention their names and therefore the initial letter of name for each arbitrator was recorded instead. Table (1) sets out the arbitrators' details.

Table 1. Arbitrators Information

Arbitrator Name	Education Level	Year of Expertise	Ministry Name
H	Ph.D.	20	Ministry of Higher Education and Scientific Research
A	B.Sc.	18	Ministry of Education
Y	B.Sc.	21	Ministry of Municipalities and Public Works
I	M.Sc.	23	Ministry of Construction and Housing
L	M.Sc.	16	Ministry of Communications
S	B.Sc.	19	Ministry of Health

In addition to the English language, the questionnaire was also written in Arabic to aid comprehension for the people participating so that they were able to give their opinions about their projects confidently. The questionnaire was provided with a covering letter, this explaining the concepts of the research, the approach for responding, the objectives of the study and the protection of information to facilitate and encourage a high rate. The questionnaire in this research consists of two sections, as follows:

General Information of Respondents

This section is associated with general information about the projects and respondents. The people were requested to respond with general information relating to their positions and knowledge in the construction industry. The section was therefore designed to collect general demographic features of the respondents as well as the educational level, age, expertise and occupation of the participants.

Information Concerning Safety in Projects

This section was used to establish the safety conditions in the respective projects. The section therefore investigated the respondents' viewpoints about the safety systems used in projects in Iraq. The questionnaire in this section consists of three parts. Part A - "management safety requirements "concerns the level management in order to improve safety systems in the construction sites; this management is usually in the ministries and commissions. This part consists of 18 items to measure the degree of safety for each requirement and to gauge the level of safety practices in the construction projects. Part B, "site 's safety requirements", measures the amount of site requirements according to a number of aspects, these requirements had been provided in the construction site to make the site safe. This part consists of 10 items. Part C "Labour safety requirements", as the title indicates, concerns labour safety requirements relating to the workers' staff situation on site. This is studied from different perspectives, such as the cultural, behavioural, experience and education level, and consists of 4 items. The degree of the safety conditions had been defined based on a seven-point Likert scale [23] , these being categorised as: none (1), very poor (2), poor (3), neutral (4), good (5), very good (6), excellent (7).

RESULTS AND DISCUSSION

General Information for Participants

Table (2) represent respondent profile which include information about ministry name, group(job), educational level, experience, and the number of people in each project.

Table 2: respondent profile

Information about	Categories	Percentages %
number of respondents in each ministry	Ministry of education	21
	Ministry of higher	19
	education and scientific	
	research	19
	Ministry of municipalities	16
	Ministry of construction	
	and housing	15
	Ministry of	10
	communications	
	Ministry of health	
group the participants belonged to	Designer	8
	Site engineer	29
	Contractor	18
	Consultant	3
	Project manger	13
	Material supplier	8
	Skilled labour	8
	Labour	13
Educational level	Diploma	7
	Primary	12

	Secondary	10
	Bachelor	55
	Master	12
	Ph.D.	4
experience	Less than 2 years	13
	Between 2-5 year	14
	Between 6-10 year	23
	Between 11-15 year	18
	Between 16-20 year	16
	Between 21-25 year	11
	More than 26 year	5
Number of people in each project	Less than 50	56
	51 to 100	16
	101 to 150	10
	151 to 300	6
	More than 300	12

Reliability and Validity

Questionnaire reliability indicates the stability of the results when these are redistributed again for the same sample, while validity refers to the degree to which an instrument computes what it is intended to be measuring [24]. To insure the reliability and validity of the questionnaire, many methods are used to measure this appropriately. In this research, Cronbach's Coefficient Alpha was used to measure the reliability of responses. This technique was applied to evaluate the reliability of the questionnaire between each section and the mean of all the sections of the questionnaire. The common range of Cronbach's coefficient alpha rates is between 0.0 and 1.0, with the higher values reflecting the advanced degree of internal consistency. In a mathematical model, validity is equal to the square root of the reliability coefficient [25]. Table (3) illustrates the value of reliability and validity for the means of all parts of the questionnaire. The means of these values for reliability and validity are 0.969 and 0.984 respectively, which indicates that this range is literally high and the result ensures the reliability of the questionnaire. Hence, it can be seen from the above values that the questionnaire was valid, reliable, and ready to be distributed to the sample of people.

Table 3: Reliability and Validity Coefficient According to Questionnaire 's Section

Parts	Number of Items	Reliability	Validity (square root of Reliability)
Part A(Management Safety Requirements)	18	0.948	0.974
Part B(Site Safety Requirements)	10	0.961	0.980
Part C(Labour Safety Requirements)	4	0.860	0.927
Total	32		
Average		0.969	0.984

To evaluate each section in three elements (i.e. management safety, site safety and labour safety), it was necessary to create a scoring system using a Likert scale for each part of the questionnaire (none, very poor, poor, neutral, good, very good and excellent). Table (4) therefore, illustrates the scoring system for the Likert scale (1 to 7) to evaluate each item in the questionnaire.

Table 4. Scoring System

Item	Expression of the questionnaire	The scores of these levels	The value of Likert scale
1	None	1 points	1to 1.86
2	Very poor	2 points	1.86 to 2.72
3	Poor	3 points	2.72 to 3.58
4	Neutral	4 points	3.58 to 4.44
5	Good	5 points	4.44 to 5.3
6	Very good	6 points	5.3 to 6.16
7	Excellent	7 points	6.16 to 7

Part A (Management Safety Requirements)

The results of the analysis of the questionnaire relates to the management safety requirements offered by higher management, this showing a considerable weakness in the management of the application of safety standards in the various fields. This includes a lack of attention to the allocation of a budget for safety within the total project's total budget. According to this weakness, it is obvious that there are shortcomings in the implementation of safety programs as well as a lack of training and a lack of meetings between the management teams with expertise in the safety field with workers and project staff. In addition, most of the projects do not have office specialists for safety requirements. This weakness is attributed to higher management being unaware of safety considerations they would also disregard for human life in their thinking. From the evidence, it is clear that the higher management in many construction contracts was not serious about forcing contractors to provide all the necessary safety requirements.

Table (5) (see appendix) explains the score for each item in part A of the questionnaire relating to safety managment systems. Each item in the table has a code; for example, M1, M2...M3, which replace replying writing the items in the table. It is clear from the statistical analysis of the questionnaire in this section that the requirements for safety were poor in general. On average the mean was 3.0975 according to the scoring system on the Likert scale, this ranging between 2.72 and 3.58, with the standard deviation for all items in this section being 1.090. The percentage of items that were very poor amounted to 17%, those which were neutral were 12%, while poor items were 71%. This indicates that the management requirement safety was poor in different projects belonging to different ministries. Figure 1 confirms the results in the table (4): it shows the relationship between the frequency and value of the scoring system for the management safety requirements. Here it is clear that the highest point of respondents (represented in the vertical axis) occurred in the poor area, this ranging between 2.72-3.58. In other words, the figure reveals that the service of the management toward safety requirements was at the lowest level.

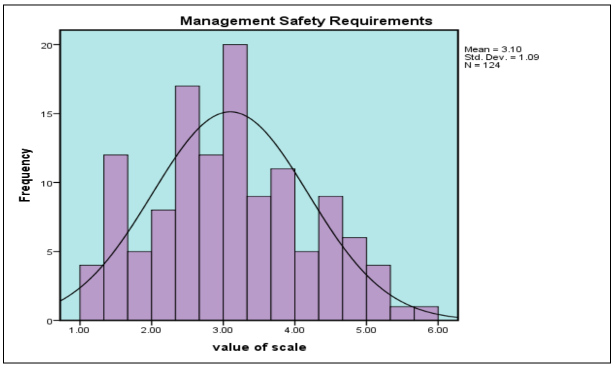

Figure 1. Relationship between frequency and value of scale for management safety

Part B (Site Safety Requirements)

This section explains the results of the analysis of the questionnaire associated with the site safety requirements which are provided by the site management. This section also describes numerous aspects on a construction site, such as site organization, suitable site fencing, monitoring and inspections, signs, signals and benchmarks, the use of advanced construction technology, and so on. Generally, the role of the site management requirement was neutral for different projects in different ministries.

Table (6) (in the appendix) demonstrates the score for each item in part B in the questionnaire, this relating to the site safety systems. In the same way as with Table 4, each item in the table has a code, for example S1, S2...S3, instead of writing the item in the table. It is clear from the statistical analysis of the questionnaire in this section that the requirements for safety are generally neutral, with an average mean of 3.78 according to the scoring system of the Likert scale, this ranging between 3.58 4.44. The standard deviation for all items in this section is 1.907. The items which were poor amounted to 10%, while the rest of the items were neutral, which is 90% of the total number of items in the site safety requirements. This indicates that the site safety requirements were neutral in different projects from different ministries. It is evident that this section is a slight improvement on the previous section (i.e. the management safety system), this being poor. Figure 2 illustrates the relationship between frequency and the value of the scoring system scale in part B (i.e. the site safety requirements). The figure shows how most of the respondents indicated that the site safety system was neutral and the highest point in the curve was in the neutral region, this ranging between 3.58 and 4.44, indicating that part B is neutral. However, despite this, it still remains at a low level in terms of safety requirements, this being due to the weakness of the site management. This correlated financially with the higher management.

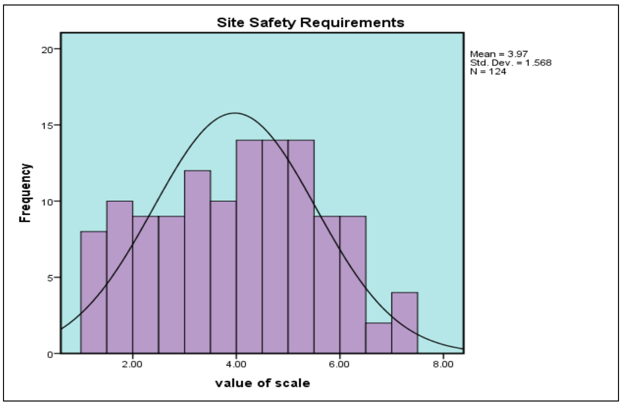

Figure 2. Relationship between frequency and value of scale for site safety requirements

Part C (Labour Safety Requirements)

This section shows the results of analysis of the questionnaire as regards the labour safety requirements. In particular, it concerns aspects such as behaviour, cultural awareness and labour skills. For the most part, this section was neutral for different projects from different ministries. The weaknesses in this section were due to a lack of attention or interest in labour safety. Moreover, there are weaknesses in the culture so that the resulting risks during the implementation of construction projects are avoided and ignored.

Table (7) (in the appendix) shows the score of each item in part C of the questionnaire as regards the labour safety system. As already indicated, each item in the table has a code; for example, L1, L2...L3, instead of entering this item in the table. The general trend for the labour safety system is neutral, with an average mean of 3.6559 according to the scoring system for the Likert scale, this ranging between 3.58 and 4.44, with a standard deviation 1.234. This result indicates that the labour safety requirement is neutral in diverse projects. Hence, the results for part C are in accordance with Figure 3, which demonstrates the relationship between frequency and the scoring scale system. Here, it is evident that the highest point in the respondents' axis occurs in the neutral region which indicates that the labour safety system is neutral. It is apparent in both sections that site safety and labour safety requirements were slightly better than the management safety requirement, which was poor.

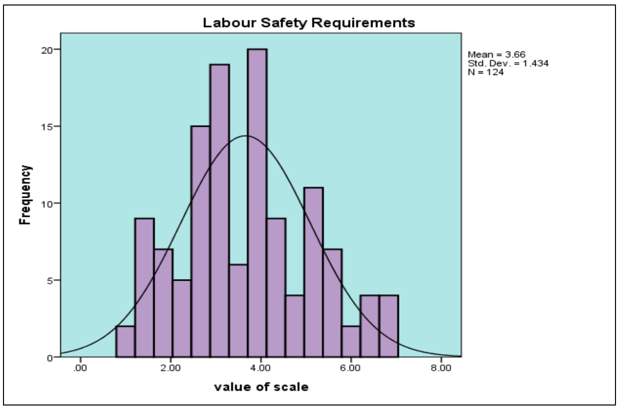

Figure 3. Relationship between frequency and value of labour for site safety requirements

Scores of Ministries Analysis

As mentioned above, this paper included numerous projects from various ministries. Table (8) makes a comparison between the scores of the mean for three parts of the questionnaire. Here, in the management safety requirements section, the Ministry of Housing and Construction has the best results, this being neutral with a mean of 3.96. The same ministry was also best in site safety requirements, which obtained a good score with a mean of 4.76 in comparison to other ministries. This was due to this ministry specialising in the construction sector in Iraq more than the other ministries in this paper. Hence, the staff of this ministry have experts as well as a training program in the safety field. In the labour safety requirements section, three ministries are neutral and the score of ministry education is the highest, with a mean of 4.32.

Table 8. Safety Scores in the Ministries

Parts / Ministry	Scale	Management Safety	Site Safety	Labour Safety
Ministry of Health	mean	3.32	4.21	3.46
	result	poor	neutral	neutral
Ministry of Communication	mean	3.24	3.99	3.37
	result	poor	neutral	poor
Ministry of Education	mean	2.76	4.17	4.32
	result	poor	neutral	neutral
Ministry of Municipalities and Public Works	mean	2.66	3.01	2.66
	result	Very poor	poor	Very poor
Ministry of Higher Education and Scientific Research	mean	2.93	3.87	3.81
	result	poor	neutral	neutral
Ministry of Housing and Construction	mean	3.96	4.76	4.15
	result	neutral	good	neutral

CONCLUSIONS AND RECOMMENDATIONS

In this paper, an evaluation of safety system requirements in Iraqi construction projects was made. This was then discussed thoroughly by making an analysis of the questionnaire survey constructed for this purpose. In general, the results proved that the safety system requirements in Iraqi construction projects were at a poor level on many occasions. In the section "management safety requirements", the results were poor, with an average mean of 3.0975 according to the scoring system, this ranging between 2.72 and 3.58. For "site safety management", there was a neutral evaluation, with an average mean of 3.78, according to the scoring system, this ranging between 3.58 and 4.44. As far as the "labour safety system" was concerned, the results of the evaluation of this section also came out as neutral, with an average mean of 3.6559 according to the scoring system, this ranging between 3.58 and 4.44. For the ministries, it is evident that the Ministry of Construction and Housing performed best in all three safety requirements while the Ministry of Municipalities and Public Works was the worst in all the safety sections, with the other ministries ranging between them. The reason behind this is that some ministries are interested in safety requirements while others neglect them.

A set of recommendations should be taken into consideration for the purpose of strengthening all safety aspects, including legislation and the strict laws of central government, ministries and contracting companies related to the application of a proper safety system. It is also important to increase the training for staff and workers to avoid the probable dangers brought about by the weaknesses of the safety systems in the construction industry. Additionally, a safety culture for workers in the construction sector should be promoted through periodic meetings and the provision on site of signs and signal in order to avoid problems.

The heading of the Acknowledgment section and the References section must not be numbered.

SAP Productions wishes to acknowledge all the contributors for developing and maintaining this template.

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Appendices

Questionnaire

This questionnaire was used to evaluate the safety on construction projects in Iraq

Section One: Personal information:

1. Full name:

Age:

2. Sex:
- ☐ Male
- ☐ female

3. Ministry Name:

4. Which group do you belong to?
- ☐ Designer
- ☐ Site engineer
- ☐ Contractor
- ☐ Material supply
- ☐ consultant
- ☐ Project Manger
- ☐ Skilled Labour
- ☐ Labour

5. Work experience:
- ☐ Less than 2 years
- ☐ 2-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-20 years
- ☐ 21-25 years
- ☐ More than 26 years

6. Educational level:
- ☐ Primary
- ☐ Secondary
- ☐ Diploma
- ☐ Bachelor

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- Masters
- PhD

Section Two: Evaluation of Safety system in Iraqi projects.

Answers for each item depend on the Likert scale:

No.	Item	None	Very poor	Poor	Neutral	Good	Very good	Excellent
M1	What is your evaluation of the role of the safety office on the construction project site?							
M2	What is your evaluation of the safety budget allowance for the total project budget in the project?							
M3	What is your evaluation of the insurance budget allowance for labour and staff in the project?							
M4	What is your evaluation of the number of safety requirement in this project to protect staff and workers?							
M5	What is your evaluation of the safety laws in terms of deficiencies and weaknesses in the project?							
M6	What is your evaluation of the degree of importance the ministry gives to the safety system in the project?							
M7	What is your evaluation of the degree of importance the management gives to the safety system on the construction site?							
M8	What is your evaluation of the number of advanced plans and strategies by the management to develop safety systems on the construction site?							
M9	How do you evaluate the degree of importance the site engineer gives to the safety system on the construction site?							
M10	How do you evaluate the degree of importance given to experienced security firms to protect the site for the safety system in the project?							
M11	What is your evaluation of the management's role in reducing the impact of terrorist attacks for the safety system in the construction project?							
M12	What is your evaluation to the role of governmental flow-up as regards the safety system in the construction project?							
M13	What is your evaluation of the safety system law which applied in the construction project?							
M14	What is your evaluation of the amount of financial and administrative corruption with the safety system in the construction project?							
M15	What is your evaluation of the management's awareness of the safety system in the construction project?							

M16	What is your evaluation of the extent of a clear policy and development programs by the management to support the safety system in the construction project?							
M17	What is your evaluation of the management's regular meetings for staff and workers to make them aware of the necessity of supporting the safety system in the construction project?							
M18	What is your evaluation of the comprehensive contingency plan in the event of a disaster with the safety system in the construction project?							
S1	What is your evaluation to the amount of the arrangement and organizing of the site on safety system in the construction project?							
S2	What is your evaluation of the amount of protection for the site in the safety system of the construction project?							
S3	What is your evaluation of the number of inspections and amount of camera monitoring for the whole site with the safety system in the construction project?							
S4	What is your evaluation for the number of signs, signals and benchmarks with the safety system in the construction project?							
S5	What is your evaluation of the provision for public facilities (such as smoking areas, restaurants, first aid, ambulances, etc) in the safety system for the construction project?							
S6	What is your evaluation as regards the number and location of the fire extinguishers in the safety system for the construction project?							
S7	What is your evaluation of the amount of protective clothing and helmets in the safety system for the construction project?							
S8	What is your evaluation for the frequency of maintenance for the machines and vehicles on site for the safety system in the construction project?							
S9	What is your evaluation of the amount of advanced construction technology with the safety system in the project?							
S10	What is your evaluation of the amount of illumination on the site for night work?							
L1	What is your evaluation to the amount of the behaviour and culture of the staff and workers with the safety system in the construction project?							
L2	What is your evaluation of the age and experience of workers and staff with the safety system in the construction project?							
L3	What is your evaluation of the awareness of the workers and staff with the safety requirements for the safety system in the construction project?							
L4	What is your evaluation of the decisions made by the operators with loaders and heavy equipment in terms of the safety system in the construction project?							

Table 5. Management Safety Requirements Analysis

Item Code	Scale	None	Very poor	Poor	Neutral	Good	Very good	Excellent	N	Mean	Std. Deviation	Result
M1	frequency	37	22	28	20	13	4	0	124	2.67	1.447	Very poor
	Valid percentage	30.1	17.9	22.8	16.3	10.6	2.4	0				
M2	frequency	52	24	25	13	8	1	1	124	2.29	1.381	Very poor
	Valid percentage	40.5	19.8	20.7	10.7	6.6	0.8	0.8				
M3	frequency	58	21	27	8	8	2	0	124	2.21	1.327	Very poor
	Valid percentage	42	20.2	22.7	6.7	6.7	1.7	0				
M4	frequency	17	39	31	21	12	3	1	124	2.89	1.332	Poor
	Valid percentage	13.8	30.9	25.2	17.1	9.8	2.4	0.8				
M5	frequency	28	29	25	17	20	4	1	124	2.92	1.541	Poor
	Valid percentage	23	22.1	20.5	13.9	16.4	3.3	0.8				
M6	frequency	21	30	26	22	19	5	1	124	3.07	1.495	Poor
	Valid percentage	17.2	23	21.3	18	15.6	4.1	0.8				
M7	frequency	18	22	25	30	26	3	0	124	3.30	1.418	poor
	Valid percentage	14.9	15.7	20.7	24.8	21.5	2.5	0				
M8	frequency	26	29	29	19	17	3	1	124	2.92	1.453	Poor
	Valid percentage	19.8	23.1	24	15.7	14	2.5	0.8				
M9	frequency	28	21	13	9	28	17	8	124	3.57	2.005	Poor
	Valid percentage	22.6	16.9	10.5	7.3	22.6	13.7	6.5				
M10	frequency	13	26	21	22	33	9	0	124	3.53	1.511	Poor
	Valid percentage	10.7	19.7	17.2	18	27	7.4	0				
M11	frequency	26	24	24	16	26	7	1	124	3.27	2.330	Poor
	Valid percentage	21.1	18.7	19.5	13	21.1	5.7	0.8				
M12	frequency	17	16	17	30	19	14	11	124	3.83	1.844	Neutral
	Valid percentage	14.2	13.3	14.2	21.7	15.8	11.7	9.2				
M13	frequency	19	22	24	23	30	3	3	124	3.38	1.566	Poor
	Valid percentage	15.6	16.4	19.7	18.9	24.6	2.5	2.5				
M14	frequency	28	25	26	26	16	1	2	124	2.90	1.485	Poor

	Valid percentage	23	20.5	19.7	21.3	13.1	0.8	1.6				
M15	frequency	36	22	21	16	25	3	1	124	2.88	1.628	Poor
	Valid percentage	29.3	17.9	16.3	13	20.3	2.4	0.8				
M16	frequency	31	29	22	19	18	3	2	124	2.85	1.562	Poor
	Valid percentage	25	23.4	17.7	15.3	14.5	2.4	1.6				
M17	frequency	21	17	31	19	22	9	5	124	3.42	1.695	Poor
	Valid percentage	17.2	13.9	23.8	15.6	18	7.4	4.1				
M18	frequency	18	10	19	33	26	11	7	124	3.80	1.699	neutral
	Valid percentage	14.8	8.2	15.6	25.4	21.3	9	5.7				
Total	frequency	29	22.8	24.3	19.4	20.3	5.6	2.6	124	3.0975	1.090	Poor
	Valid percentage	23	17.9	19.5	16.2	16.6	4.6	2.1				

Table 6. Site Safety Requirements Analysis

Item Code	Scale	None	Very poor	Poor	Neutral	Good	Very good	Excellent	N	Mean	Std. Deviation	Result
S1	frequency	9	12	21	16	35	24	7	124	4.26	1.652	Neutral
	Valid percentage	7.3	9.7	16.9	12.9	28.3	19.4	5.6				
S2	frequency	6	16	20	21	29	20	12	124	4.28	1.675	Neutral
	Valid percentage	4.8	12.9	16.1	16.9	23.4	16.1	9.7				
S3	frequency	1	14	19	25	32	17	16	124	4.37	1.729	Neutral
	Valid percentage	5.7	11.4	15.4	15.4	25.2	13.8	13				
S4	frequency	17	17	19	17	31	10	13	124	3.88	1.885	Neutral
	Valid percentage	14	14	15.7	11.6	25.6	8.3	10.7				
S5	frequency	13	18	17	22	26	16	12	124	4.02	1.820	Neutral
	Valid percentage	10.6	14.6	13.8	17.1	21.1	13	9.8				
S6	frequency	28	19	17	12	22	15	11	124	3.57	2.029	poor
	Valid percentage	22.8	15.4	13	9.8	17.9	12.2	8.9				
S7	frequency	21	16	15	22	18	23	9	124	3.85	1.933	Neutral
	Valid percentage	17.1	13	12.2	17.1	14.6	18.7	7.3				

S8	frequency	23	14	22	16	17	24	8	124	3.75	1.955	Neutral
	Valid percentage	18.9	11.5	18	11.5	13.9	19.7	6.6				
S9	frequency	11	16	25	28	18	16	10	124	3.92	1.737	Neutral
	Valid percentage	9.2	13.3	20.8	20	15	13.3	8.3				
S10	frequency	19	19	19	19	20	17	11	124	3.78	1.907	Neutral
	Valid percentage	15.3	15.3	15.3	15.3	16.1	13.7	8.9				
total	frequency	14.8	16.5	19.1	20.6	23.7	18.4	10.9	124	3.78	1.907	Neutral
	Valid percentage	11.9	13	15.6	16.2	19.1	14.7	8.8				

Table 7. Labour Safety Requirements Analysis

Item Code	Scale	None	Very poor	Poor	Neutral	Good	Very good	Excellent	N	Mean	Std. Deviation	Result
L1	frequency	10	34	24	18	20	8	10	124	3.56	1.739	Poor
	Valid percentage	8.2	27.9	18	14.8	16.4	6.6	8.2				
L2	frequency	10	13	19	26	24	22	10	124	4.19	1.708	Neutral
	Valid percentage	8.1	10.5	15.3	21	19.4	17.7	8.1				
L3	frequency	24	27	29	20	12	9	3	124	3.06	1.612	Poor
	Valid percentage	19.4	21.8	23.4	16.1	9.7	7.3	2.4				
L4	frequency	17	16	18	20	32	14	7	124	3.84	1.764	Neutral
	Valid percentage	13.7	12.9	14.5	16.1	25.8	11.3	5.6				
total	frequency	15.25	22.5	22.5	21	22	13.25	7.5	124	3.6559	1.234	Neutral
	Valid	12.3	18.1	17.7	16.9	17.7	10.7	6				