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ASSESSMENT OF SAFETY AND HEALTH MEASURES (SHASSIC METHOD) IN CONSTRUCTION SITES

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ABSTRACT: Construction employment statistic compiled by construction industry development board reveal that construction workers constitute about 7.1% of the total workforce in Malaysia and generally accounted for 11% of all industries workers fatalities. As at 2010 occupational accidents in Malaysia includes 66 death, 4 cases of permanent disability and 50 cases of non permanent disability. OSHA '94 clearly define that the management of safety and health at workplace is the responsibility of those who create the risk and those who work with the risk, under this act it is the duty of the employer to maintain a accident free construction site. As such there is need to examine the performance of health and safety measures of contractors at sites. In order to examine the safety performance, a safety and health assessment system in construction industry is used so as to have a platform of assessing/evaluating contractor's safety and health measures at site. Five different sites were considered for this study, and an average score of 60.35% was obtained from the sites. Therefore, it was concluded that most sites happen to managed and document their potential and significant high risks/hazard, but still there are few medium risks activities that were neglected. To deal with it, effectively a culture of safety and commitment from the top management are essential to achieve a high safety performance.

Keywords: Safety; Construction; Performance; Culture; Medium

1. INTRODUCTION

According to international labor organization (ILO), there are more than 100million construction workers worldwide, more than half of those workers are found in Asia home to two of the biggest developing countries, China and India (Chang 2008). Construction is a risky business with 13 workers per 100,000 being killed in construction as against 5 per 100,000 in the all-sector average. Construction also exposed workers to a wide range of health problem ranging from asbestosis to back pain, hand-arm vibration syndrome to cement burns, (Fact. 2000). The injuries and the illness associated with the construction show that the industry is the most hazardous occupation and high-risk environment in the world, where workers face a greater risk of work-related fatality or injury, due to poor safety performances (Zhang and Wu 2009; Zhang, Wu et al. 2010).

According to BWI (Building and Wood Workers International) study on global construction and Asian workers. "The construction site is increasingly becoming a site where informal meet global capital" Because of economic globalization, there is now increased pressure on individual construction firms to keep labor as informal as possible so as to cut off production cost, keeping labor "informal primarily refer to employers obscuring employee-employer relationships through subcontracting and hiring migrant workers from developing countries where unemployment and underdevelopment level is

high. This irregular and informal work essentially means 'unprotected' labor, low wages, unhealthy working conditions, long work hours, and the absence of entitlements such as paid days-off and vacation-sick leaves, health insurance. Social security benefits and pension funds. (Abao 2010).

A construction employment statistic compiled by construction industry development board (CIDB.) revealed that construction workers constitute about 7.1% of total workforce in Malaysia (DOSH 2010). But, yet, the industry generally accounts for 11% of all industrial workers fatalities (DOSH 2007).

Malaysia is a country with much construction accidents record, which means that accident is happening in the Malaysia construction sites. This according to (Zakaria, Hussin et al. 2010) is truly proven when the NIOSH Chairman Datuk Lee Lam, in 1998, stated that there were 1,195 confined space accident which 122 workers suffered permanent disabilities and 7 other killed compared to 1,365 cases in 1997 which recorded 44 permanent disabilities cases and 6 fatalities. According to the Minister of Human Resources Datuk Seri Dr. fong Chan Onn also remained concerned with this situation. He said that the problem that is still happens because there are certain contractors and sub contractors continued to flout safety rules. One of which was the use of unskilled workers to erect scaffolding for high-rise construction, this is too dangerous when the scaffolding is not up to the specifications because it could collapse that may result in death or serious injury to workers.

In another word, Datuk Seri Dr. Fong Chan Onn, the Minister of Human Affairs said that, the laws and regulation alone do not ensure health and safety practices at construction site that what is required is adoption and implementation of safety-conscious contractors supported by experienced and trained employees. According to the Minister, to avoid mishap (accident) at the workplace (construction sites) attention must be given to safety at the conception of the project, OSH management must be practices at all level of the construction from top management to the laborers at workplace. That is paramount for everyone to be involved in the OSH practices at the workplace.

As at 2010, Occupational accident in the Malaysia construction sector alone includes 66 death 4 cases of permanent disability and 50 cases of non-permanent disability (DOSH 2011). Also, according to CBS Interactive Business Network 2007, since 2001, the Malaysia construction scene has consistently recorded fatality rate of over 25% per 100,000 workers.(CIDB. 2007.)

Safety at construction site is the responsibilities of the contractors. Occupational safety and health act 1994(OSHA 94) and factories and machinery act 1967 (FMA 67) are the main legislation that governs safety and health in construction in Malaysia as both acts are regulated by the Department of occupational safety and health (DOSH). The OSHA 94 clearly define that the management of safety and health at work place is the responsibility of those who create the risks and those who work with the risk" (OSHA, 1994). Under this act the responsibilities of maintaining occupational safety and health at construction site lies with employer. In response, safety and health regulations have been subjected to major revisions during the last three decades in some cases new legislative and regulation approaches have entirely replaced existing regulation and legislation, and the emphasis has been on individuals and their duties which is based on the principals designed specifically to increased awareness of the problem associated with safety and health issues.

In Malaysia such new regulations and legislation were develop by a technical committee on safety and health in construction with the assistance of construction industry development board Malaysia, which acted as a moderator and facilitator for the technical committee throughout the development process. The committee has develop a construction industry standard (CIS.) refer to as CIS 10:2008. The CIS 10:2008 on safety and health assessment system in construction adopted several component with reference to occupational safety and health act and regulation (OSHA) 1994 (Act 514), such as Factory and Machinery Act (FMA),1967 (ACT 139), Occupational Health and Safety Management System, OHSAS 18001: 2007; Occupational Safety and Health Management System, MS: 1722: 2005, it also depend on new or updated information and development concerning safety and health issues made available through the technical committee. The CIS10:2008 (Safety and Health Assessment System in Construction) was develop in order to have a standard platform of assessing contractors performances as regard to construction safety and health in sites.

By any relevant measures, construction is a not a safe industry (Everret and Frank 1996); (Gyi, Gibb et al. 1996.); (Ikpe 2009) and as a result has gained an unenviable reputation in relation to the health, safety and welfare of it workers (Egan 1998); (Bomel 2001); (HSE 2005); (Ikpe 2009). As such there is need to examining the effectiveness of performances compliances of health and safety of various contractors at construction site.

2. REVIEW OF RELATED LITERATURE

The Malaysia government through the construction industry development board (CIDB) has put more emphasis of OSH at construction site, but still there were concern by CIDB over the growing of OSH at construction sites.

According to (Bakri, Mohd Zin et al. 2006), that the promulgation of the occupational safety and health act in 1994 has made further provision for securing the safety, health and welfare of any person at workplace, it is based on the concept of self-regulated whereby the Act places certain duties on employers, employees, self-employed persons, manufacturers, designers and suppliers. It also places emphasis on the prevention of accident, ill health and injury. This is the main Act which can reduce occupational incident and accident in Malaysia.

In addition, there are many law and government oversight organization that require construction companies and real estate developers to ensure the safety of both their employees and the public. This includes all type of required safety training that helps ensure the proper use of tools and removal of physical hazards that can cause injuries. Negligence related to those mandatory steps and/or the improper use of equipment put everyone at risk for serious and life threatening injuries, the recovery from a workplace or construction injury can be a long painful and costly.

There are many type of construction sites accidents; Back and Neck Injuries, Burns, Trip and fall/slip, Defective equipment and Machinery Accident, Falls from ladders and scaffolds, Falling debris/object, etc.

The most common type of accident to workers in Malaysia construction industry as at 2009 has been published by Department of occupational safety and health were shown in table 2

From the table, Falling, Stepping against or struck by object and exposure to or contact with harmful substances all together accounted for 72.8% (59 of 81) of all the fatal accident to construction workers, while 65.8% (50 of 76) are non-fatal. According to (Abdul Rahim Abdul Hamid, Muhd Zaimi Abd Majid et al. 2008), those three are the most commonly found construction accidents, which are attributed to poor fall protection, poor housekeeping or poor work method.

(AbdulRahim *et al*, 2008) studies the courses of occupational accident in Malaysia construction industry and indicated that the major courses of construction accident are

1. Management failure (29.2%), such as poor inspection, poor safety policies and lack of safety education programs.
2. Unsafe method (Incorrect work procedure) (26.4%), mostly related to incorrect work procedure. This can undermine all the organization's safety and health procedures to be ignored or, worse yet.
3. Lack of personal protective equipment usage and worker negligence contributes to the cause of accident.
4. Unsafe equipment (9.7%).
5. Jobsite condition (11.1%).

Despite the fact that the designer and the client are nowadays interested on the issue of safety at the construction sites, the management of construction safety on sites is the responsibility of the contractors. (Zhang, Jun et al. 2010; Ghani, Hamid et al. n.d), contractors are aware that they have a role to play in promoting safety programmers and safety behavior as stipulated in OSHA 1994 Section 17 (Duties of employers and self employed to their employees). They have an obligation to ensure that their workers are not exposed to risk which can affect their safety and health.

(Ghani et al., n.d) reveal that majority of the contractor in Malaysia fail to instill a safety culture among their staff and workers. This problem is with the officers in charge, especially the safety and health officer, as they do not have autonomy power to strictly enforce the regulation as they are employed by the contractor. Therefore for effective implementation of safety and health at construction site, there is the need for full support to the safety and health officer from the contractor. And at the same time a commitment and support from top management is needed in order to improve safety performances on sites.

3. MATERIAL AND METHOD

This study centers on qualitative in nature as it allows the researcher to come in direct contact with those in study, as qualitative research is used to gain insight into people's attitudes, behaviors, value systems, concerns, motivation, aspiration, culture or lifestyles (safety of construction worker on site). On the other hand it's used to inform business decisions policy formation, communication and research focus groups etc. about the extent of situation of things (sites condition to the management).

3.1 SAFETY AND HEALTH ASSESSMENT SYSTEM IN CONSTRUCTION (SHASSIC)

Safety and Health Assessment System in Construction (SHASSIC) is an independent method of assess and evaluate the safety and health performance of a contractor in the construction sites. The SHASSIC assessment is recommended to be carried out when the actual physical work progress had achieved or fall within 25% to 75% where by various types of trades works are being carried out. SHASSIC cover 3 main components of assessment

i.e document check, workplace inspection and employees interview.

3.2 ASSESSMENT METHOD

A. Weightage

The weightage for safety and health performance are allocated in accordance to 3 (three) components as shown in the Table 3.

Table 3, Allocation of weightage for components.

COMPONENTS	WEIGHTAGE.
Document check	40%
Workplace inspection	40%
Employee interview	20%
Total score	100%

Source: CIDB CIS 10:2008

The weightage system is aimed at making the score quantitative in representing the safety and health performance of the respective contractor.

Basic formulas for respective component weightage are as follows

- a- Document check.

$$\frac{\text{Total Number 'C' Scored}}{63} \times 40\% = \text{SHASSIC score for Document Check-(A)}$$
 (63 – Number of 'NA')
- b- Workplace inspection.

$$\frac{\text{Total Number 'C' Scored}}{310} \times 40\% = \text{SHASSIC score for workplace inspection- (B)}$$
 (310 – Number of 'NA')
- c- Employee's interview.

$$\frac{\text{Total Number 'C' Scored}}{330} \times 20\% = \text{SHASSIC score for employees interview-(C)}$$
 (330 – Number of 'NA').

Where, 'C' is the total number of "Compliance, NA is the total number of item that is "Not Applicable".

B. Star Ranking

The total SHASSIC score in Document check (A) plus (+) total SHASSIC score in Workplace inspection (B) plus (+) total SHASSIC score in Employees interview (C) Component shall justifying the ranking star or stars. Stars awarded ranges from 1 star to 5 stars as shown in table 4.

3.3 SHASSIC DATA COLLECTION

For the purpose of this work, 5 (five) construction site were selected, with the following criteria.

- a- That the construction site must be building/civil construction work.
- b- That the contract price of such work must be above, 20 million Malaysian Ringgit.
- c- That the work process must be between 25% to 75% completion.

4. RESULTS AND DISCUSSION

Table 5 shows the results of the five sites as regard to document check, workplace inspection and employee interview;

Table 6 shows the average results of the five sites, the average scores of the SHASSIC conducted is 60.35%, and qualified the sites as 3-star in ranking. The sites scores fall within 55-69 in the ranking stars.

The average scores of the five sites were represented in the figure 1, while figure 2 is the percentage contribution of the 3 component.

From figure 6, Document check is 59.65% from the total score of document check that is most documents on sites as regard to safety and health plan are not properly managed by the sites office. As for the workplace inspection, it scores 54.43% from the total workplace inspection, the percentage score is less than those of document check and employees interview. This means that the facilities provided to construction workers at workplace are below standard, the workers are generally exposed to work site hazard. The employee interview scores 73.60% from the total employee interview; this is a good result as most employees at all sites have a good knowledge of OSH management system at construction sites.

A. Combined scores of document check

Table 7 show the differences between the obtained scores and total scores of document check for the five sites;

One component score below average, that is accident investigation and reporting, and this means that no proper procedure for investigating accident and most accident that occur are not properly documented and managed. Other components that need improvement are OSH organization, Training and Promotion and record management and performance monitoring.

B. Combined scores for workplace inspection.

As regard to the workplace inspection, certain component show a good result like ventilation, illumination/light, suitable working tool/equipment, toilet, and first aid box and designated rest area.

Some show a poor result as action need to be taken in order to improve on them. This is due to their importance in workplace, those components include, Machinery, Scaffold, Sinages color code, Notice, Housekeeping, Personnel protective equipment, Barricades for hazard area, Prevention of falling object and vehicular traffic management. The others are considers moderate thus, there is need for improvement on them, table 8.

C. Combined score for employees interview

The section is divided into 3 sub-sections;

1- Management interview combined scores.

Table 9, show the obtained scores and the total score from the management interviews; In terms of training and promotion, the management personnel lack adequate knowledge as most sites has no proper procedure for training and promotion and this means that most management personnel have not been attending any form of training as regard to OSH in workplace like those organize by NIOSH and CIDB.

Also there is need for the management personnel to equip themselves with adequate knowledge of HIRARC procedure in order to be able to carry out HIRARC at workplace.

2- Combined scores for safety and health committee members.

Table 10, show the obtained scores and total scores from the safety and health committee members' interview.

The law required that any workplace site that employed more than forty employees must have a safety and health committee, the function of such committee can be as a management function or as an advisory function. Therefore, there is need for all the members of the committee to have a full knowledge of safety and health at workplace. From the table, it show that most members of the committee lack adequate knowledge about safety and health at workplace most especially in training and promotion, and emergencies preparedness. Those two component show poor result of understanding among the committee members.

3- Combined scores for construction workers interview.

From the table, it can be concluded that most construction workers has no adequate knowledge about safety and health at workplace. It is only in 2 components that the workers perform very good i.e there understanding of HIRARC, the risk they are working with and, accident investigation and reporting, what they will do in case of an accident on site. A lot need to be done to improve workers understanding of safety and health at workplace most especially as regard to OSH policy, OSH organization, Training and Promotion, Machinery and equipment handling and Emergency preparedness in case of any outbreak of events.

5. CONCLUSION AND RECOMMENDATION

This study is aimed at examining the performance of safety and health measures at construction sites using the safety and health assessment system in construction (SHASSIC), which is an independent method of evaluating contractor's performances on safety and health measures in construction sites. The average result of the SHASSIC of the five sites is 60.35% which fall within (55 - 69) in the star ranking and qualify the sites as 3-star in ranking. Based on this it can be concluded that most construction sites happen to managed and document their potential and significant high risks/hazard, but still

there are few medium risks activities that are not well managed and documented due to negligence on the side of the management. The onus is on the management and the workers to be responsible for safety issues in construction sites and as such much work is needed to ensure the successful implementation of safety prevention at construction sites. To deal with it effectively, a culture of safety and commitment from the top management are essential to achieve a high safety performance. A positive safety culture can be achieved when it is supported by formal management systems fully implemented and funded together with disciplined employees (Zhang, Wu et al. 2009; Zhang, Wu et al. 2010).

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Appendices

Table 1, were some selected accidents cases in Malaysia as at December 2010.

S/NO	DATE	CASE TITLE	LOCATION	SUMMARY OF ACCIDENT	CLASSIFICATION.
1	29/4/2010	Killed by tractor on commuting to workplace.	Serdang, kedah	AzlinBtAriffin 28years was killed in accident during on the way to workplace.	Fatal
2	21/3/2010	Found death in confined space.	Beauford, Sabah	Wahab(30yrs),Ajin (20yrs), Mus(25yrs), Armuji(18yrs),Anur (17yrs), Danbansai(17yrs), were killed in a confined space(treated water pumping tank) they were killed due to toxic gases.	Fatal
3	21/1/2010	Killed by standing calibrator machine.	SimpangRengam industries estate.johor.	Abdul hossain 35yrs from Bangladesh was killed after hit by the standing calibrator door, which is not properly closed.	Fatal.

4	4/4/2010	Falling from high	Kaulalumpur, jalan Galloway.	Sugeng 28yrs from Indonesia was killed after fell from 24 th floor to 6 th floor during cleaning and clearing at the 24 th .	Fatal
5	24/4/2010	Hit by bulldozer	KawasanperindustrianrembinfasaMalaka.	Mohammed Rafizsham was killed after a bulldozer toppled during clearing the workplace.	Fatal.
6	29/3/2010	Scaffold collapse.	Molamkaulanerus, Terengganu.	Nurulislam 37yrs from Bangladesh was killed after scaffold collapsed at a construction site.	Fatal
7	19/4/2010	Falling from height	MukimBatukaulalumpur	Sajjad khan from Pakistan was killed after falling from heigh, during the incident the victim was putting 'silicon' in between the window mirror. Unfortunately he step on the area that has no mirrir installed and felt down on the skylift.	Fatal.

Dosh, 2011.

Table 2, Type of Accidents in construction industry as at 2009, as obtain from Department of Occupational safety and health Malaysia.

TYPE	FATAL ACCIDENT	NON-FATAL ACCIDENT.	TOTAL ACCIDENT.
Fall	34	16	50
Struck by falling object	14	12	26
Stepping on, striking or struck by object	7	6	13
Caught in or between object	9	13	22
Overexertion to or strenuous movement	0	1	1
Exposure to or contact with extreme temperatures.	1	2	3
Exposure to or contact with electric current	5	1	6
Exposure to or contact with harmful substances	11	22	33
Other types of accident N.E.C	0	2	2
TOTAL	81	76	152

Dosh 2011

Table 4, Stars Ranking.

SHASSIC (score %).	Star(s) Awarded.	Justification.
85 to 100	*****	Potential and significant workplace high risks/hazards are managed and documented.
70 to 84	****	Potential and significant workplace high risks/hazards are managed and documented but there are few low risks work activities are neglected.
55 to 69	***	Potential and significant workplace high risks/hazards are managed and documented but there are few medium risks work activities are neglected.
40 to 54	**	Potential and significant workplace high risks/hazards partly managed and not properly

39 and less	*	documented. Potential and significant risks/ hazards poorly managed and not properly documented.
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Source: CIDB CIS 10: 2008.

Table 5, result of five sites (SHASSIC).

	Document check 40%	workplace inspection 40%	employee interview 20%
Site A	35.33%	26.19%	15.96%
Site B	14.74%	9.50%	10.75%
Site C	23.05%	26.06%	16.61%
Site D	32.00%	25.87%	19.78%
Site E	14.19%	21.21%	10.49%
TOTAL =	119.31%	108.83%	73.59%

Table 6, Average scores.

$\frac{119.31 \times 40}{200}$ = 23.86%	$\frac{108.83 \times 20}{200}$ = 21.77%	$\frac{73.59 \times 20}{100}$ = 14.72%
THEREFORE TOTAL SHASSIC = 60.35%, (55-69), 3 STAR IN RANKING.		
100%	59.65%	54.47%
		73.60%

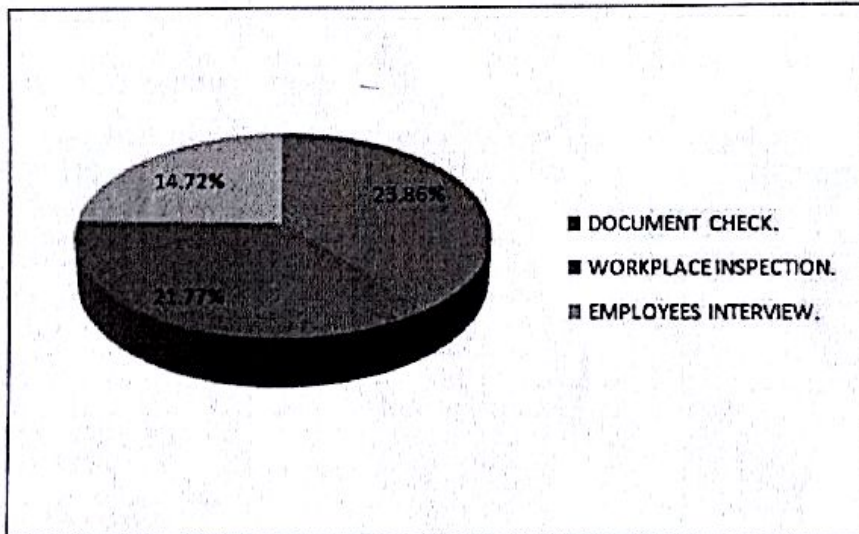


Fig. 1: SHASSIC score for the five sites.

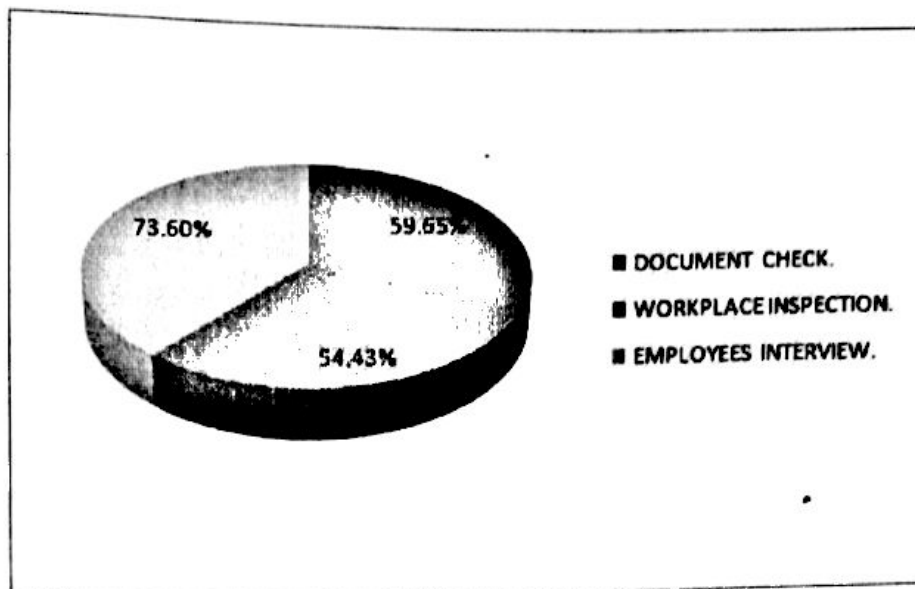


Fig 6, % contribution of the 3 component to SHASSIC.

The table 7 shows the combine scores of Document check of all the five sites;

	Obtained scores	Total scores
OSH Policy	28	30
OSH Organization.	38	55
HIRARC	15	25
Training and Promotion	24	40
Machinery Management	21	31
Material Management	11	23
Emergency Response Plan (ERP)	11	20
Accident Investigation and Reporting	9	19
Record Management and Performance Monitoring.	31	45

The table 8, shows the combine scores for workplace inspection of the five sites.

Components	Obtained scores	Total scores
Machinery	27	39
Scaffold	19	35
Sinages color code	25	70
Notice	27	53
Ventilation	6	6
Housekeeping	32	63
Illumination/light	7	7
Fire protection	12	15
Personnel protective equipment.	60	94
Barricades for hazard area.	5	39
Access/egress	17	24
Suitable working tool/equipment	20	20
Electric safety	5	6
Prevention of falling object	8	23
Hazardous substances	3	5
Safety policy	5	6
Perimeter hoarding	4	7
Vehicular traffic management.	1	19
Toilet.	7	7
First aid box	6	6
Designated rest area	6	6
Water ponding.	2	5

Table 9, combine scores for management interview.

Components.	Obtained scores	Total scores
OSH policy.	8	10

OSH organization.	9	10
HIRARC.	10	15
Training and Promotion	2	5
Material management.	6	10
Emergences preparedness	5	5
Accident investigation and reporting	3	5

Table 10, combined scores for health and safety committee members.

Components	Obtained scores	Total scores
OSH policy	13	15
OSH organization	29	30
Training and Promotion	3	9
Emergence preparedness	3	14

Table 11, show the obtained score and the total score for workers interview.

Components	Obtained scores	Total scores
OSH policy	118	200
OSH organization	247	300
HIRARC	95	100
Training and Promotion.	118	195
Machinery and Equipment	22	35
Material Management	18	19
Emergences preparedness	249	349
Accident investigation and reporting	94	100

Table 11, show the obtained score and the total score for workers interview.

Components	Obtained scores	Total scores
OSH policy	118	200
OSH organization	247	300
HIRARC	95	100
Training and Promotion.	118	195
Machinery and Equipment	22	35
Material Management	18	19
Emergences preparedness	249	349
Accident investigation and reporting	94	100