STUDY OF SAFETY TRAINING NEEDS FOR CONSTRUCTION WORKERS, SUPERVISORS, MIDDLE MANAGEMENT AND TOP MANAGEMENT

A thesis submitted in partial fulfillment of
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by

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DEDICATED

TO

MY MOTHER AND DECEASED FATHER

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I am thankful to Almighty Allah, who gave me strength to complete my research. I would like to pay debt of gratitude to my advisor Dr. Rafiq Muhammad Choudhry, who always remained available whenever I needed him for his fathomless guidance, valuable time and encouragement, to complete my research work. I am also extremely grateful to the committee members, Dr. Muhammad Nasrullah Khan, Dr. Muhammad Babar Khan, Dr. Hamza Gabriel and Assistant Professor Zia ud Din, for their sincere guidance to complete my research work. I pay my special gratitude to Lieutenant Colonel Mughees Aslam, a close friend and colleague who never left me alone at the time of need and guided me in every sense of the word. I owe my special thanks to the respondents for their valuable contribution to this research. Last but not the least, I pay my earnest gratitude to my mother, brother Fawad Haider, wife and children Raza, Hussain and Aks-e-Fatima for their unending support, encouragement, prayers and patience.

ABSTRACT

A well-trained workforce is the most important pre-requisite to ensure a safe working environment on a construction site and for safety performance of an organization. In order to determine which training is needed for construction workers, supervisors and management, training needs assessment should be carried out. Unfortunately, poor safety practices owing to lack of safety training have badly affected construction industry in Pakistan when rates of occupational injuries and diseases are very high in the industry. For the construction safety training to become effective, training needs for all tiers must be known. Probably, no study in this regards is carried out in Pakistan. The objective of this research is to investigate training needs for workers and various management tiers in the industry. This research is based on a questionnaire survey which was used to collect from clients, consultants and contractors in the industry. For the development of the questionnaire, detailed literature review was carried out and safety training indicators were identified. The assessment of training needs was carried out by finding out the commitments of management, supervisors and workers for these safety training indicators through 44 question statements by using a five point likert scale. The outcome of this assessment helped in defining the pertinent areas of construction safety training for the construction industry. The questionnaire was pilot tested after discussing with the experts in the construction industry as well as academia. Based on a previous research, the sample size was selected which came out to be 96. To get responses, random sampling was adopted and questionnaire was distributed by hand, online, visiting ongoing construction sites and companies involved in civil engineering works in Pakistan. A total of 98 valid responses were analyzed. Various statistical tests were performed on the gathered data to make necessary inferences. Results demonstrate that safety training indicators formulated to find safety training needs in the industry are followed at only 47.15 % with a population mean as $40.3 \leq \mu \leq 49.8$. The most poorly followed safety training indicator was ‘construction safety management plan’ followed at only 38.46% along with ‘safety in the mindset’ (44.58%). The workers and management show commitment for the training indicator of ‘accident reporting’ which is at 62.07% however, needs a lot of improvement in ‘accident recording and investigation mechanism’. For a preferred safety training option, 50%of the respondents recommend

that general safety is to be included in the syllabi at school level for all the tiers. Additionally, 80% of the respondents recommend that professional institutes for management and on-job training and vocational or technical institutes for supervisors and workers are best suited for construction safety training. Finally, this study may be useful for clients, consultants, contractors and other stakeholders who desire to improve safety in the construction industry of Pakistan.

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LIST OF ABBREVIATIONS

GoP	Government of Pakistan
MoPTT	Ministry of Professional and Technical Training
SBP	State Bank of Pakistan
PEC	Pakistan Engineering Council
USA	United States of America
UK	United Kingdom
ILO	International Labour Organization
OSHA	Occupational Safety and Health Administration
OHS	Occupational Health and Safety
H&S	Health and Safety
SH&E	Safety, Health and Environmental
PPE	Personnel Protective Equipment
CIWCE	Centre for Improvement of working Conditions and Environment
SPSS	Statistical Package for Social Sciences
ANOVA	Analysis of Variance
RII	Relative Importance Index
RIR	Recordable Incident Rate
STI	Safety Training Index
SPI	Safety Performance Index
CI	Construction Industry

Chapter 1

INTRODUCTION

1.1 STUDY BACKGROUND

Construction industry (CI) is one of the most challenging and risky industries all over the world (Hinze, 1997; Kartam, 1997). Safety figures for construction show high fatality and injury rates throughout the world (Suazo and Jaselskis, 1993; Ahmed *et al*., 2000; Teo *et al.*, 2005). As per estimates, fatal accidents in CI happen to the tune of 60,000 every year around the world. In the United States, CI accounted for 20% of all occupational fatalities, whereas they made up only 5% of the country's work force (National Safety Council 1997 statistics). This figure was reduced to 5.4% in USA by implementing safety practices (National Safety Council 2007 statistics). Construction companies around the globe are implementing safety, health and environmental management systems to reduce injuries, eliminate illness, and to provide a safe work environment for their employees (Choudhry *et al*., 2008a).

In Pakistan, major laws concerning occupational health and safety (OHS) are *'Factories Act 1934 (chapter 3)'* and *'Government of Pakistan Labor Policy 2010 (Para-42)'*. Factories Act 1934 is silent on Training aspects of OHS, whereas Para- 42 of Labor Policy does emphasize on Skill Development of work force. Unfortunately, these laws are neither enforced in true spirit nor do procedures for implementing and monitoring these laws exist. Resultantly, safety practices and especially safety training is non-existent on most of the construction sites.

The total labor force of Pakistan comprises approximately 39.40 million people. The CI has a share of 2.5% in the GDP (SBP annual report 2010-2011) and it has employed 6.29% directly and 30-40% indirectly of the total labor force of Pakistan (Survey of Pakistan 2008). Anecdotal evidence indicates that construction worker injuries and fatalities in Pakistan could be as high as 20-25%. Informal assessments have identified that safety non-performance has not only led to unsafe project sites but has also resulted in construction delays, cost overruns, poor productivity and poor product and process (Farooqui *et al.*, 2008). Hence, there is a need to inculcate safety culture in CI in Pakistan which cannot be imagined without establishing proper safety training

programs. It is, imperative to include safety training as a MUST subject during training of construction work force including management in every tier. Research has shown that superintendent and those in other management or supervisory positions can play key roles in influencing project safety (Hinze, 2006). Safety management and workers are required to acquaint themselves with the challenges of ever–growing construction technology, new methods and procedures of construction work, and management techniques which requires training and retraining.

This safety training should be part of a systematic safety management program as research show that developing countries need to implement safety management systems to improve safety performance (Choudhry *et al*., 2008b). This training should be delivered in a manner which should be most effective and able to improve safety performance of CI in Pakistan. This research is aimed at statistically analyzing data to ascertain area where workers and various management tiers in CI in Pakistan are weak in either safety performance or safety knowledge so as to recommend them for safety training with an appropriate training option and method to be adopted in CI in Pakistan to improve upon safety performance.

1.2 RESEARCH SIGNIFICANCE

This research has following significance:-

a. Probably no research work has been done on construction safety training in CI in Pakistan; therefore this research will help all stakeholders of CI to conduct construction safety training for work force and management. This will naturally enhance safety performance of construction organization and reduce losses in terms of human resource, cost and time.
b. This research will provide basis to carry out more specific research on construction safety training i.e. fall protection or electrocution guidelines, training in construction safety rules and regulations, job-specific construction safety training etc.
c. By having a safety trained work force, CI in Pakistan will be better placed to compete internationally where construction safety performance is considered as one of the important criteria while awarding contracts.

1.3 RESEARCH OBJECTIVES

The objectives of this research are:

a. To study safety training needs from international practices or research previously conducted;

b. To identify the specific safety training needs of construction site workers, supervisors and managers for construction projects in Pakistan;

c. To analyze and evaluate safety training needs for stakeholders of the CI.

1.4 SCOPE

a. The study is limited to CI in Pakistan.

b. Identification of preferred training delivery systems and methods for workers and management of CI in Pakistan is within the scope of this thesis.

1.5 LIMITATION

a. Few of the stakeholders were either biased or reluctant to share actual state of safety culture of their organization; therefore site visits of many important projects were conducted personally followed by face to face interviews of the management.

b. Probably no research has been carried out in construction safety training in Pakistan; therefore a survey questionnaire was specially designed to get the indications of safety practices where construction site workers and management lack in safety conformance. In this way preferred safety training for workers and management can be recommended in the areas where they have gaps. These safety training indicators were identified through study of previous research, internationally adopted safe practices, safety training manuals of international OHS organizations and globally recognized construction safety related duties.

b. Due to paucity of time, it was almost impossible to visit each and every project personally; therefore questionnaires were floated in CI in Pakistan using Google Document and postal service. Out of 130 questionnaires which were sent to contractors, clients and consultants, 98 valid responses were received which were analyzed using descriptive statistics.

1.6 ORGANIZATION OF THESIS

This thesis contains five chapters. Chapter 1 contains introduction to general safety and safety training, chapter 2 contains literature review, Chapter 3 contains discussion on research design and method and chapter 4 encompasses analysis. The chapter 5 contains conclusions with recommendations.

1.7 SUMMARY

This chapter contains a brief introduction to importance of safety and safety training in the CI and listed the objectives of this research. A vast study of literature review provided theoretical base for the study (see Chapter 2). This chapter has concisely emphasized the research significance, its scope along with limitations. Moreover, overview of the dissertation is contained in this chapter.

Chapter 2

LITERATURE REVIEW

2.1 INTRODUCTION

Workplace safety is a complex phenomenon and the subject of attitudes and safety performance in CI is even more complex (Choudhry *et al*., 2008). It is, therefore required that safety should not be left alone on to the owner or simply contract clauses/ regulations as it is the responsibility of every person at site and owing to its complex nature cannot be ensured without proper training. Farr and Sullivan Jr. (Farr and Sullivan Jr., 1996) regarded training to be critical for any industry which desires to remain competitive in a complex and ever-growing world of technology. They believed that due to technology, various architectural, engineering and construction workforce may become outdated within three years without continuous training and the training costs may increase five times in near future. Adams (Adams, 1992) believed that for any training to be effective, its contents must replicate the real needs of the participants. Construction safety training is one of the significant constituents of a good safety management system which can provide a well-trained work force and progressively improve the safety performance of an organization. "A well-trained workforce is perhaps the most important pre-requisite to ensuring a safe working environment on a construction site. Trained workers will understand the nature of the work, the safe use of tools and equipment, the types of materials being used, the risks that are generally encountered when performing the work, and the appropriate measures to reduce or eliminate the work hazards" (Hinze, 2006).The CI constitutes 11% of injuries and 20% fatalities as a result of all occupational accidents (Arumugam *et al.*, 2007). As per ILO 2005 statistics, one in every six fatal accidents at work occurs on construction sites. If this problem is to be negotiated to reduce the fatality rate, then only answer to it is safety training. In a benchmarking study of safety performance in CI in Pakistan (Zahoor, 2012), the factor of safety training came out to be the most neglected aspects among all indicated safety performance factors. It indicates that CI in Pakistan is yet to realize that safety cannot be ensured without prior training. It also indicates that a lot of work is required in particular field of safety training from the very basic level.

2.2 WHO NEED HEALTH AND SAFETY TRAINING?

H&S training guide of Health and Safety Executive (HSE), UK, recommends that following persons present in your organization should need safety training if you are owner of that organization.

2.2.1 You Need Training

Whether you are an employer or self-employed, you are required to identify and control hazards and risks at your work place. You should know the procedure to get help from trade association, H&S authorities and chamber of commerce etc. You are required to know that you should consult your employees, or their representatives, on health and safety issues. If you do not know these, then you would definitely benefit from training.

2.2.2 Your Managers/ Supervisors Need Training

If you are employing managers or supervisors they need to know your expectations on health and safety issues, and how you expect them to deliver. They need to understand your H&S policy, there role in it, and how you want H&S managed. They would also require training in the specific risks of your processes and control methodology.

2.2.3 Your Employees Need Training

Everybody working for you, including self-employed persons, require the knowledge to work safely and avoid risk to life and health. They should also need to know about your H&S policy, your organization for implementing it, and their role. They must know how they can raise any H&S concerns and issues with you.

2.2.4 Contractors and Self-Employed Persons Need Training

Every contractor, sub-contractor or people working for you do need training. Remember, these persons might not be conversant with the working environment of your organization and its safety systems you have put in place for other regular employees.

2.3 ADVANTAGES OF SYSTEMATIC CONSTRUCTION SAFETY TRAINING

Occupational Safety and Health Information Manual by Work Cover NSW, 1999, recommends that good safety training cannot be achieved by a ‘hit or miss’ approach; it should

be thoroughly planned, implemented and evaluated. It is, very important and beneficial to set aside funds and resources at the very outset of project so that they should not be spent on other areas. In a study carried out by J.W.Hinze, more injuries were seen on projects where funds were not set aside for safety training. (Hinze, 2006)

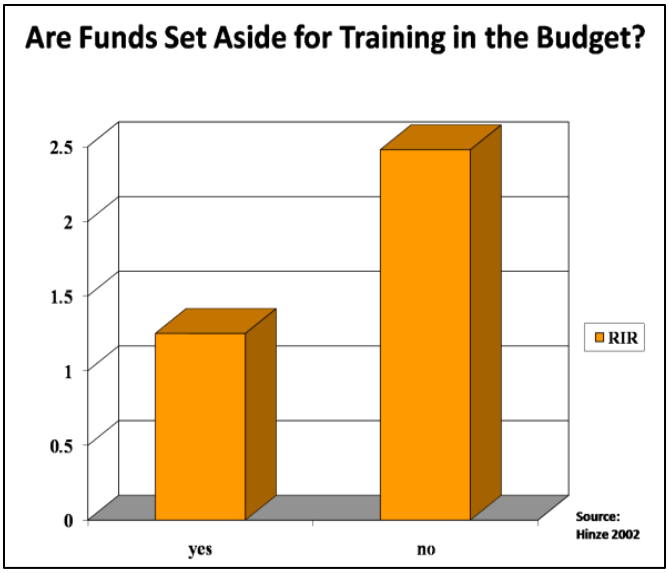

Figure 2.1: Advantages of systematic construction safety training

There can be numerous advantages of systematic construction safety training for various tiers of construction project management and workers. Some of the advantages are mentioned in succeeding paragraphs.

2.3.1 Advantages for Top Management

a. Top Management will get knowledge of safety laws, rules and regulations and abiding by them will save their organization from unnecessary project stoppages, tort liabilities and such other legal suits and hurdles.
b. Top Management will feel more knowledgeable and comfortable to give guidelines to middle management for preparation of organization's own safety policy and safety management plan/ system.
c. Organization will be able to maintain good reputation owing to enhanced safety

performance; thus it will be able to compete more, do more business and have more chances of financial benefits.

d. Early start and completion of projects due to fewer accidents, lesser absence, more productivity and timely actions to fulfill requirements of safety regulatory authorities of the region.
e. Project completion in cost effective manner since workers are skillful, confident and better equipped for day to day work and even for challenging situations which will result in fewer accidents, lesser delays/ day work losses, more productivity, lesser wastage in workers compensation and insurances, lesser damage to men and material, lesser payments in compensations or insurances.
f. Goals and objectives of training will be achieved more efficiently and effectively by targeting specific problem areas and deficiency in skills and knowledge of management or workers.

2.3.2 Advantages for Middle Management

a. Middle Management would be more knowledgeable and comfortable to prepare and render recommendations on organization's own safety policy and safety management plan/ system.
b. Middle management would be able to effectively implement and evaluate its safety management system.
c. Hazards identification and their tackling, mitigation or avoidance would be much easier.
d. It would be much easier to meet the dead lines of the project in a cost effective way through a versatile safety aware work force.
e. Better safety management skills and knowledge would enhance the competency of the managers and would help in pursuing their careers in the relevant field.

2.3.3 Advantages for Supervisors

a. Supervisors would be more knowledgeable and confident to render their input to middle management on safety related issues and organization's safety management plan/ system.

b. Supervisors would be able to effectively implement and evaluate organization's safety management system/ policies.
c. Work site hazards identification and their tackling, mitigation or avoidance would be much easier.
d. It would be much easier to meet the dead lines of the assigned tasks in a cost effective way through a versatile safety aware work force.
e. Better safety management skills and knowledge would enhance the competency of the supervisors and would help in pursuing their careers in the relevant field.

2.3.4 Advantages for Workers

a. Workers would be more knowledgeable and confident to render their input to supervisors and management on safety related issues.
b. Workers would be able to effectively follow organization's safety management system/ policies and consider it in their own benefit.
c. Work site hazards identification and their tackling, mitigation or avoidance would be much easier.
d. It would be much easier to complete the assigned tasks in a cost effective and timely manner.
e. There would be lesser accidents thus lesser loss to men, material or machines.
f. Greater employee satisfaction and increased self-confidence as a result of strengthened competency base, employment opportunities and inner feel that they are being looked after well.

2.4 INTERNATIONAL OCCUPATIONAL SAFETY AND HEALTH ORGANIZATIONS

Almost all developed countries have safety regulatory bodies and authorities which can implement their construction related policies while keeping safety training as one of the important aspects to ensure and enhance safety performance. Few of the renowned organizations will be discussed in the succeeding paragraphs.

2.4.1 International Labor Organization (ILO)

ILO is an international organization to safeguard the rights of labors (www.ilo.org). Its

constitution emphasizes that workers should be protected from occupational health hazards. The ILO has adopted more than 40 standards specifically dealing with occupational safety and health, as well as over 40 codes of practice. Nearly half of ILO instruments deal directly or indirectly with occupational safety and health issues. It has formulated and made available on its website extremely effective construction safety training and guidance material equally useful for professional organizations, safety educational and training institutes, employers safety managers and employees.

2.4.2 USA- Occupational Safety and Health Authority (OSHA)

Some important details of OSH Act, its agencies and regulations will be discussed in the succeeding paragraphs (Hinze, 2006).

a. **OSH Act.** In 1970, US congress passed an act called Occupational Safety and Health Act (OSH Act) for a safer workplace for workers.

b. **OSH Act agencies**. Under OSH Act, three agencies were formulated, Occupational Safety and Health Authority (OSHA), the National Institute for Occupational Safety and Health (NIOSH) and Occupational Safety and Health Review Commission (OSHRC). OSHA promulgates new regulations and enforces regulations at work areas and also collect data on work related injuries/ illnesses. NIOSH is research arm of OSHA which carries out studies on safety, assists OSHA; recommend new regulations and carries out some training. OSHRC performs a judiciary role for employers who disagree with OSHA's decision on violation of its standards.

c. **29CFR 1926.21, safety training and education regulation**

   1) OSHA has promulgated many standards which contain different regulations. 29 CFR 1926.20 pertains to general safety and health provisions whereas 29 CFR 1926.21 is regarding safety training and education. Major points of employers' responsibilities as explained by 1926.21(b) (2) are summarized as under:-
   2) The employer should make him available for safety and health training.
   3) The employer is responsible to instruct each employee for the presence, recognition and avoidance of unsafe conditions and potential hazards, safe handling of poisonous or harmful substances, liquids or gases at work place.

4) Employees should be instructed of potential hazards of confined spaces and proper use of emergency and personnel protective equipment.

2.4.3 UK- Health and Safety Organizations

Few of the important details of UK H&S organizations are discussed in the succeeding paragraphs (http://www.hse.gov.uk/pubns/indg345.pdf).

a. **HSE (Health and Safety Executive).** In 1974, the Health and Safety at Work Act specified principles for managing health and safety at work in United Kingdom. This legislation along with formulation of the HSE placed more emphasis on UK employers to ensure occupational safety and health. This Act bound the employers to provide information, instruction, training and supervision to ensure the health and safety at work of their employees. It was further strengthened by the Management of Health and Safety at Work Regulations 1999, which identify situations where health and safety training is predominantly necessary, e.g. when workers start work, shift to new or more risky work and where existing skills may require updating.

b. **NEBOSH (National Examination Board in Occupational Safety and Health).** It is a UK-based independent examination board delivering vocational qualifications in health, safety & environmental practice and management. NEBOSH develops syllabi for its qualifications and its courses are delivered by NEBOSH Accredited Course Providers. NEBOSH qualifications are recognized by relevant professional membership bodies including the Institution of Occupational Safety and Health (IOSH), the International Institute of Risk and Safety Management (IIRSM) and the Institute of Environmental Management and Assessment (IEMA).

2.4.4 JCOSHA (Japan Construction Occupational Safety and Health Association)

JCOSHA was established in 1964, approved by the Minister of Health, Labor and Welfare, in accordance with the provisions of the Industrial Accident Prevention Organizations Law (http://www.kensaibou.or.jp/english/activity/training_activities.html). The JCOSHA headquarters develop unique and characteristic trainings that meet the demands of the industry. It's Construction Occupational Safety and Health Training Center runs Construction safety training courses for the industry (http://www.kensaibou.or.jp).

2.4.5 Safe Work Australia (Emerged from previous National Occupational Health and Safety Council (NOHSC)-1985)

Safe Work Australia is an Australian Government statutory agency established in 2009 under the Safe Work Australia Act 2008 (http://www.safeworkaustralia.gov.au/sites/SWA). Their primary responsibility is to improve work health and safety and workers' compensation arrangements across Australia. This responsibility is being carried out by developing, implementing and driving the new National Work Health and Safety Strategy 2012–2022 (http://www.safeworkaustralia.gov.au/sites/SWA).

2.4.6 China Occupational Safety and Health Authority (COSHA)

The China Occupational Safety & Health Association (COSHA), formerly known as the Chinese Society for Science & Technology of Labor Protection (CSSTLP), is a non-government organization established by OSH practitioners and registered with the Chinese Ministry of Civil Affairs *(www.cosha.org.cn)*. The COSHA is well supported by the State Administration of Work Safety (SAWS). The SAWS is an agency directly under the State Council for overall supervision and regulation of work safety and it is also the working body of the Office of the State Council Work Safety Commission (http://english.gov.cn/2005-10/20/content_80531.html).

2.5 LEVELS OF CONSTRUCTION SAFETY TRAINING

There are three basic levels of construction safety training (Rowlinson, 2004) which have been discussed in succeeding paragraphs:

2.5.1 Induction/ Orientation Training

Induction training is aimed at the worker just about to join the construction site and its aim is to improve basic safety awareness. This type of training can be very general in nature and would cover items such as personal protective equipment, working at heights, fall protection, etc. Many developed countries like Australia, UK, US and Hong Kong etc have introduced such training along with a green card which allows a worker to enter the site; without the card the worker is deemed not to be prepared for work (S. Rowlinson, 2004). Research (Hinze, 2002) has shown that orientation training to all workers will enhance the safety performance of the organization (Figure 2.2).

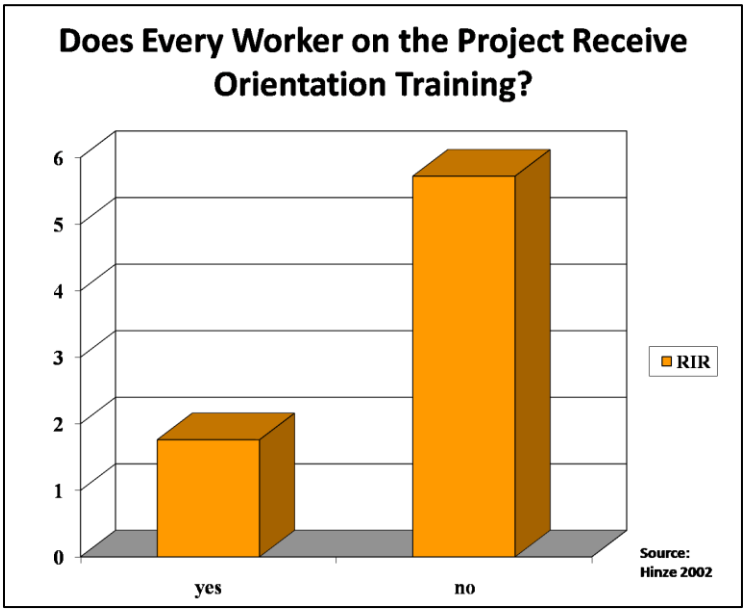

Figure 2.2: Effect of orientation training

Research (Hinze and Harrison, 1981; Eich, 1996; Hinze, 2002) also shows that formal orientation training also reduces the injury rate of the organization (Figure 2.3). A formal training means that standard material is prepared so that every worker gets same knowledge that every other worker gets.

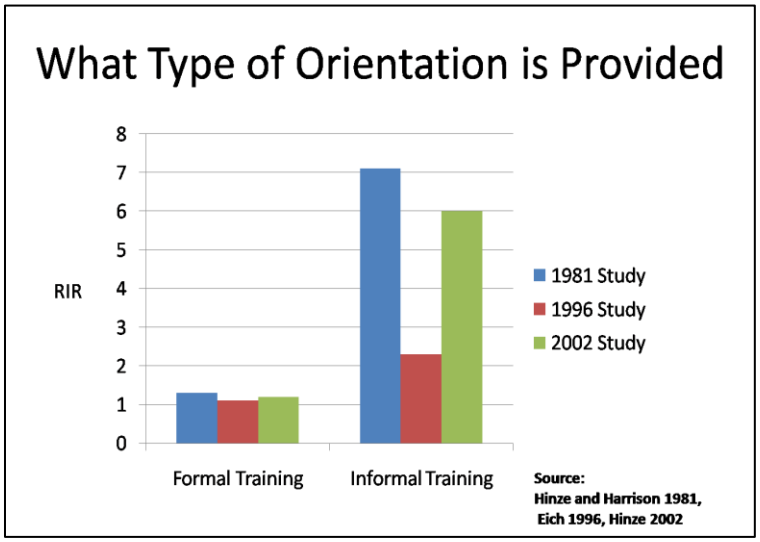

Figure 2.3: Effect of formal and informal orientation training

2.5.1.1 When OHS induction training be provided

Occupational and Safety Information Manual, NSW CI, 1999, recommends that OHS induction training should be conducted on following occasions.

a. Construction work for the first time, they must be provided with General OHS induction training.
b. A new construction work activity, they must be provided with Work Activity OHS induction training.
c. Work on a new construction site, they must be provided with Site specific OHS induction training.

Research (McMeel, 1979) has shown that if workers are put to work without adequate induction training then there would be more chances of injury rate to be increased on the project. The Figure 2.4 shows what foremen normally do with new workers at a construction site and what could be the results of doing that on recordable injury rate.

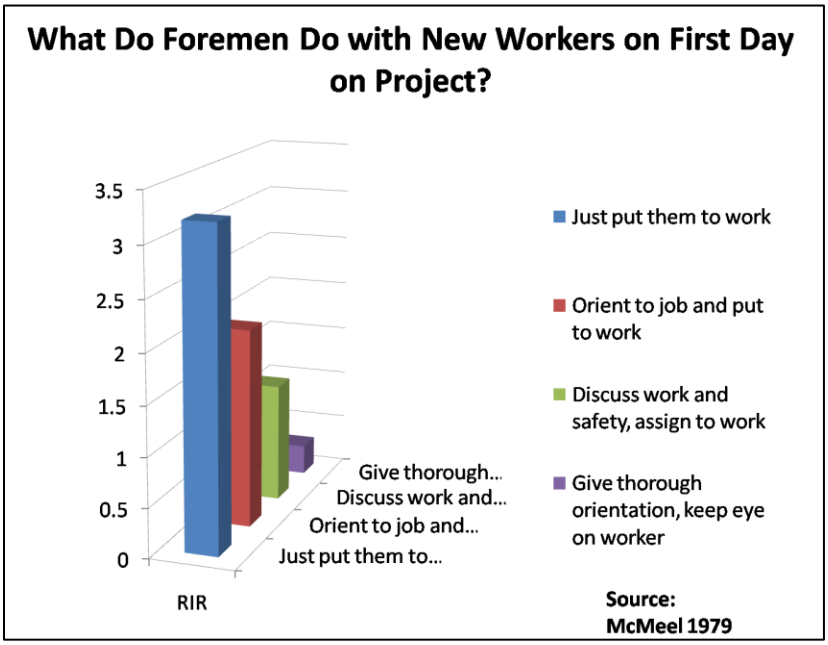

Figure 2.4: What do foremen do with new workers on induction?

2.5.1.2 Topics of OHS induction training

There could be numerous topics which could be covered in OHS Induction training for new workers on site or on coming to a new project or organization. These subjects will be beneficial for the workers and safety performance of the organization will also be enhanced. Few of the topics that may be covered in OHS induction training (Hinze, 2006) could be as under:

a. Introduction to key company personnel, safety personnel and immediate supervisors
b. General Company Policies
c. General and Specific Safety Policies
d. Project scope and schedule
e. Project layout and potential hazardous areas
f. Specific instruction of concerned work assignment

2.5.2 Refresher Training

Refresher training (Rowlinson, 2004) is aimed at those employees who have been doing the same job for many years. People such as these have many years of experience in traditional methods of construction. However, they may well not be up-to-date with modern or innovative methods. Also, it is quite possible that they may have slipped into bad practice or simply forgotten some of the things that they have learned in the past. For example, a steel fixer may have been working on bridge deck construction for many years and may have grown unfamiliar with some of the hazards and technology used in high-rise construction (such as cast in place formwork). Hence, before being transferred to a new building project it would be sensible to send such a tradesman on a refresher course. These courses can cover a whole range of topics but they should be targeted at particular tradesmen and at new projects coming up.

2.5.3 Ongoing Training

Ongoing training (Rowlinson, 2004) addresses the needs of salaried workers for re-training in new techniques and the needs of new workers to be trained from scratch. At this point one might make a distinction, what really required is not just training but education, i.e. an understanding of the need for safety procedures and a perception of one's responsibility to work safely for the sake of oneself and co-workers. Following might be few of the typical training

topics for ongoing training.

a. Craft and technical training for specific trades which teaches safe practice and procedures. This might include signaling training for banks-men and trench shoring for excavation workers. General safety precautions for working in confined spaces might also come into this category;
b. Supervisory training for gangers and foremen which would include elements of craft training indicated above but also more general oversight such as hazard hunts and toolbox talks;
c. Managerial training aimed at site and project managers and head office staff which deals with the details and philosophy of safety management and includes the compliance with and need for statutory requirements such as safety meetings and inspections.

2.6 TRAINING NEEDS ASSESSMENT FOR AN ORGANIZATION

2.6.1 What is a Training Needs Assessment?

A training needs assessment is used to determine whether training is the right solution to a workplace problem. It is an "ongoing process of gathering data to determine what training needs exist so that training can be developed to help the organization accomplish its objectives" (Brown, 2002). Said more simply, it is the "process of collecting information about an expressed or implied organizational need that could be met by conducting training" (Barbazette, 2006).

2.6.2 Why Training Needs Assessment is Required

Training needs assessment can help determine current performance or knowledge levels related to a specific activity, as well as the optimal performance or knowledge level needed. For example, suppose slips, trips and falls are up 25% in the production line area. This could signal a developing problem. By conducting needs assessments, the company can gather information regarding the competence of workers or the task itself; such information helps identify causes of problems (Rossett, 1987).

2.6.3 Adequacy of Training

Sometimes, too much training can reduce its effectiveness and decrease its credibility. The difference between effective and ineffective training may be death, injury, pain, suffering and

lost profits (Whiles, 1999).While workers without occupational safety and health training are likely at a greater risk for workplace injury and illness, it is the adequacy of this training that is critical (Cohen & Colligan, 1998). The resources spent on training are astonishing. An estimated $50 billion is spent annually on formal training; in which amounts spend on less-structured, informal training is not included (Broad & Newstrom, 1992).

2.6.4 Models for Training Needs Assessments

2.6.4.1 McClelland (1993)

McClelland (1993) discusses an open-systems model for conducting training needs assessments. This model involves an 11-step approach to conducting a training needs assessment.

1. Define assessment goals.
2. Determine assessment group.
3. Determine availability of qualified resources to conduct and oversee the project.
4. Gain senior management support for and commitment to the process.
5. Review and select assessment methods and instruments.
6. Determine critical time frames.
7. Schedule and implement.
8. Gather feedback.
9. Analyze feedback.
10. Draw conclusions.
11. Present findings and recommendations.

2.6.4.2 OSHA's training guidelines follow following model

a. **Determining if training is needed**. Whether or not training is right solution to a problem must be determined as the first step. Whenever employees do not perform their jobs as required, it is often considered that training will bring them up to standard. However, it is possible that other actions (such as hazard abatement or the implementation of engineering controls) would enable employees to perform their jobs properly. Problems that can be addressed effectively by training include those that arise from lack of knowledge of a work process, unfamiliarity with equipment, or

incorrect execution of a task (OSHA).

b. **Identifying training needs**. If training is right solution to a problem then what training is required is the next step. For this, it is necessary to identify the gaps in training i.e. what the employee is required to do and what is deficient in his performance.
c. **Identifying goals and objectives**. Once the kind of training that is needed has been determined, it is equally important to determine what kind of training is not needed. This avoids unnecessary training and tailors the training to meet the needs of the employees.
d. **Developing learning activities**. Learning activities allow employees to exhibit that they have attained the preferred skills and knowledge. In order to ascertain that employees transfer the skills/ knowledge from the learning activity to the job, the learning conditions should be same as the actual job conditions
e. **Conducting the training**. With the completion of the steps outlined above, the employer is ready to begin conducting the training.
f. **Evaluating program effectiveness**. To make sure that the training program is accomplishing its goals, an evaluation of the training can be valuable.
g. **Improving the program**. If, after evaluation, it is clear that the training did not give the employees the level of knowledge and skill that was expected, then it may be necessary to revise the training program or provide periodic retraining.

2.7 CONSTRUCTION SAFETY TRAINING IN CI IN PAKISTAN

Pakistan's CI is suffering badly from poor safety performance in terms of project delays and huge human resource and financial losses. It shows that there is a great potential and need to introduce a systematic safety training program which should be accepted and implemented equally by relevant Government departments and CI in Pakistan. It may be highlighted that appreciable work in the field of safety management has been done in Pakistan but little or no work is available in the particular field of construction safety training for workers and management.

In a benchmarking study of safety performance in CI in Pakistan (Zahoor, 2012), it was

concluded that safety training is the most neglected safety factor which was ranked last among 13 identified safety performance factors. Results show that on some sites, workers are made aware through safety posters and safety signs but detailed training/ briefing is not carried out for new workers. Refresher training is not at all conducted. Criteria for workers selection is their skill level only. No job specific training is given to workers to ensure their safety while performing hazardous task. Moreover, organizational chart showing safety duties is not displayed on most of the sites. Another gray area is that employees of subcontractor are not given any safety training and not provided with any safety equipment. This factor needs special attention by all the stakeholders in CI in Pakistan.

There is extremely less formal education and training on construction safety is available. Centre for Improvement of Working Conditions and Environment (CIWCE) is a provincial government institute which works under labor department of Punjab, CIWCE has as special focus on OHS but also give little training on construction safety. Pakistan Engineering Council (PEC) do not carry out formal construction safety training, however under Continued Professional Development (CPD) activities, few professional development short courses are offered. Few Universities in which National University of Science and Technology (NUST) is a pioneer institute which have started professional program for undergraduate and postgraduate in students in Construction Engineering and Management, Few Private institutes like Vivid Institute of Occupational Safety and Health (http://www.vividpk.com/about-viosh.html) are also providing construction safety short courses and certificates from international safety training authorities like OSHA and NEBOSH etc.

There is no regulatory authority in Pakistan for occupational health and safety management like OSHA in United States (Ali T.H., 2006). The primary construction regulatory body i.e. Pakistan Engineering Council (PEC) has though incorporated H&S clauses in the contract document but it still has to develop safety laws and regulations, to be applicable for all the stakeholders of CI (Ahmed, 2007). In Pakistan, major laws concerning occupational health and safety (OHS) are *'Factories Act 1934 (chapter 3)'* and *'Government of Pakistan Labor Policy - revised in 2010 (Para- 42)'*. Factories Act 1934 is silent on Training aspects of OHS, whereas Para- 42 of Labor Policy does emphasize on Skill Development of work force. Unfortunately

these laws are neither enforced in true spirit nor do procedures for implementing and monitoring these laws exist. Resultantly, safety practices and especially safety training is non-existent on most of the construction sites. Figure: 2.5 shows the available data from labor division of Pakistan about industrial accidents in the factories. Graph explains that number of fatalities have increased from 30 (in year 2003) to 160 (in year 2007). This increase in frequency of accidents warrants the need of establishing a regulatory authority to enforce safety.

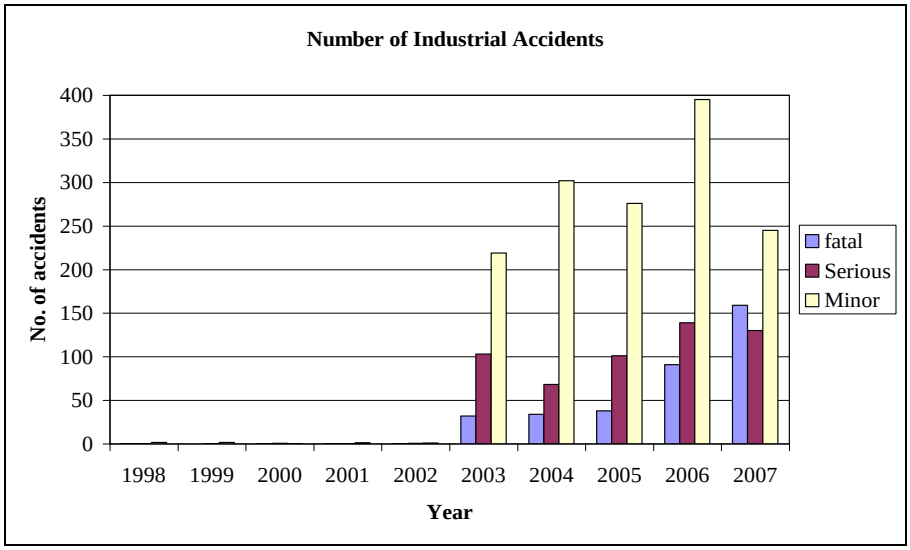

Figure 2.5: Number of industrial accidents in Pakistan

(Source: GoP Labor Division statistics)

2.8 SAFETY TRAINING NEEDS FOR CI IN PAKISTAN

2.8.1 Construction Safety Related Duties of Management and Site Workers

In order to find out the training needs of CI in Pakistan, first of all globally accepted construction projects safety related duties of management and site workers is required to be ascertained. If by some way non-compliance of these duties and safety practices by various tiers of management including workers are found, it will automatically highlight the gray areas/ subjects where safety training must be emphasized in CI in Pakistan. Following are broad safety related duties as accepted by International Labor Organization and other developed countries regulatory authorities:-

2.8.1.1 Employer

a. Frame a policy for safety and health of staff at work place.
b. Make provisions for a safe working atmosphere for his personnel and safeguard others who are likely to be affected by the work.
c. Give adequate and suitable information, training and guidance to his employees.
d. Lay down H & S standards and appropriate procedures.
e. Appoint suitable staff to ensure that the H & S policy is effectively implemented, and H & S procedures are strictly observed.
f. Provide adequate PPE for his personnel.

2.8.1.2 Safety officer

a. Assist his employer to implement the safety policy and the H & S requirements as specified under the law and contract.
b. Assist in ensuring that all plant, machinery, equipment and tools are maintained in safe working order
c. Assist in ensuring that all fire services installations and fire escapes are maintained in good working order.
d. Assist in ensuring the H & S condition and good housekeeping in the workplace.
e. Conduct safety inspections to project sites, plants and workshops, and prepare inspection reports.
f. Ensure the observance of the safety rules and safe practices by the staff, and assist in the supervision of safety supervisors.
g. Report to the site management any unsafe practices and unsafe conditions in the workplace.
h. Carry out risk assessment.
i. Conduct accident investigation and prepare investigation reports; and recommend preventive measures to avoid recurrence.
j. Organize and conduct safety training courses.

2.8.1.3 Safety supervisor

a. Assist his Safety Officer and site management in implementing H & S requirements

and instructions.

b. Be familiar with the laws, regulations and policies applicable to the work and make sure that they are followed.
c. Keep all staff informed of the safety policy and take all reasonably practicable steps for carrying it out.
d. Incorporate safety instructions in routine orders and see that they are obeyed.
e. Take all reasonable steps to prevent workers from taking risks.
f. Assist the safety Officer in arranging new employees.
g. Conduct Tool Box Talks for workers.
h. Ensure that PPE are used properly.
i. Ensure that all plant and equipment are in a safe and secure state when left unattended.
j. Remind the management to replenish first aid boxes at regular intervals.
k. Report to the management and/or Safety Officer on matters relating to safety and health.

2.8.1.4 Safety representative

a. Safety representative is generally a foreman or ganger of a specific trade working full-time on site.
b. Assist the safety officer and the site management in enforcing the safety and health requirements and instructions.
c. Incorporate safety instructions in routine orders and see that they are obeyed.
d. Take all reasonable steps to prevent workers from taking risks
e. Ensure that protective clothing and equipment are used whenever appropriate.
f. Report to the site management and/or safety officer on matters relating to safety and health.

2.8.1.5 Employees

a. Understand the safety policy and co-operate with the employer in administering it.
b. Work safely and avoid risks.
c. Use the PPE as required.

d. Take immediate action to rectify any unsafe conditions and report them immediately to their supervisors or the responsible person in control of the workplace.
e. Report all accidents to the supervisors immediately after their occurrences.

2.8.2 Indicators of Safety Training Needs for CI in Pakistan

Traditional measures of safety are after-the-fact measures; namely, that safety is measured after injuries have already occurred. These measures are labeled reactive, trailing, downstream, or lagging indicators. Focusing on these measures e.g. accident rates and compensation costs means that the "success of safety is measured by the levels of system failure" (Cohen, 2002).

In recent years, there has been a movement away from *'lagging indicators'* towards *'leading indicators'* for measuring safety, such as site investigation and measurement of safety climate and safety practices (Flin *et al.*, 2000).

From the literature review of previous studies, construction safety training manuals of ILO, OSHA and other developed countries' regulatory authorities (as mentioned in chapter 2) and globally recognized construction safety related duties, a list of safety training indicators was identified. This list was further shortened to suit CI in Pakistan and grouped into five major indicators of safety training needs to assess the present and desired level of safety training for management and the workforce of CI in Pakistan. The outcome of this assessment will help in defining the pertinent subjects/ areas where training is needed for CI in Pakistan. The safety training indicators are mentioned in succeeding paragraphs.

a. **Safety in the mindset.** Safety in the mindset means awareness of safety importance, demonstration of safe behavior, inclination towards safety practices and indoctrination of safety concepts in the minds etc. These all contribute towards development of a safety climate or safety culture. The terms safety climate and safety culture are very similar in definition. Safety climate is the shared perceptions and belief between managers and workers towards safety (Cooper & Philips, 1994). Management's commitment is a central element of the safety climate (Zohar, 1980). Safety Culture on the other hand, is the ability to manage safety from the top of the ranks to the bottom workers (Mohamed, 2004). According to Choudhry and Fang (2009), a positive safety climate/ culture is required for improving safety performance on construction projects.

Choudhry and Fang performed a safety climate survey to ensure accountability of management leadership and support for safety. The results from their survey showed the importance of management and employee involvement and inappropriate safety procedures and work practices on construction projects. Safety climate and culture are very important aspects of construction safety. Safety culture establishes the environment and safety climate enforces it from all levels. In order for workers to be trained properly, they must have the proper attitude and mindset to follow safety procedures. Safety training can be effective when only the workers' behavior, educational status, safety climate/culture and attitude are geared towards the importance of safety (Mayeana Kamara, 2010).

b. **Construction safety laws, rules and regulations**. Research shows that worker's perceptions relate to a reduction in accident rates within an existing regulatory environment (Gun, 1993, Cox and Cheyne, 2000). Hence, the existence, implementation and knowledge of construction safety laws, rules and regulations will enhance the safety environment of an organization. Pakistan's construction industry (Tauha Hussain Ali, 2006) lacks formal safety management systems and effective health and safety regulations. Many of the sectors, with serious OHS hazards like construction are not covered under these laws, even though they contain very few technical standards. These laws urgently require revision and updating (Awan, 2001).

c. **Construction safety management plan/ system.** The term Construction Safety Management Plan or System defines a safety framework which includes all actions for betterment of safety environment and practices in an organization. Broadly, it includes management and employee responsibilities, safety policies, plans, committees, inspections, audits, training for employees, selection and control of subcontractor, safety provisions in contract documents etc. The awareness, implementation and adoption of a safety management plan will certainly reduce likely injuries and fatalities on a project.

Japan Construction Occupational Safety and Health Association (JCOSHA) defines construction safety management system as "Construction occupational health and safety management system (COHSMS) constitute a set of measures concerning health

and safety management that are implemented and operated continually and holistically, conducted in conjunction with other management systems, such as construction management system". The system comprises mainly the following;

1) Declaration of policies related to health and safety.
2) Investigation of risks and/or hazards and determination of countermeasures to be taken based on the result of the investigation.
3) Adoption of targets for health and safety.
4) Formulation, implementation, evaluation and improvement of plans for health and safety.

d. **Safety and health of work place.** Safety and health of work place under an effective safety management plan contains various aspects which can ensure safe and healthy environment at work place. Since minutest details are beyond the scope of this study, therefore safety and health of work place is covered under following major headings:-

1) Safety against major causes of accidents

The major causes due to which injuries and fatalities occur in construction can be divided into five major categories of incidents (Hinze, 2006) which are *fall, struck by, caught in/ between, electrical shock, and other* incidents. In order to reduce the major accidents and injuries on a work place, training is required to reduce incidents in these major categories of incidents.

2) House keeping

Construction Site Safety Handbook for Public Works Program, Work Bureau, 2000, Government of Hong Kong, recommends following important points to be kept in mind for housekeeping:

a) Maintain lockers, mess rooms, canteens and washrooms in a clean and sanitary condition at all times.
b) Keep all passageways, staircases, landings, and means of escape clear and unobstructed at all time.
c) Stack raw materials and finished products clear of passageways and means of escape.

d) Do not leave tools on the floor, or in any location where they can be easily dislodged. Provide proper storage, such as tool boxes or containers for tools and equipment.

3) First aid

Construction Site Safety Handbook for Public Works Program, Work Bureau, 2000, Government of Hong Kong, recommends following important points that should be kept in mind for first aid.

a) At least one person trained in first aid shall be included in the team of responsible persons in charge of first aid boxes
b) Provide a person trained in first aid to a construction site with 30 to 99 workmen. At least two persons trained in first aid are required for a construction site with 100 or more workmen.
c) A construction site with five or more workmen shall have a first aid box (preferably a portable one). A separate first aid box shall be provided for every 50 workers on site.
d) Every first aid box shall be marked plainly “FIRST AID.
e) Adequate first aid equipment shall be provided according to Table: 2.1.
f) A stretcher should be provided to a construction site with 50 or more workmen.

Table 2.1: Recommended first aid equipment as per employment

Requirement	No. of persons employed		
	<10	10 -49	>49
A copy of the Hints on First Aid issued by the Labour Department	1	1	1
Small sized sterilised unmedicated dressings	6	12	24
Medium sized sterilised unmedicated dressings	3	6	12
Assorted sized adhesive wound dressings	12	24	36
Triangular bandages 1.3m x 0.9m x 0.9m	2	4	8
Adhesive plaster 25mm x 4.5mm	1	1	2
Cotton wool, 300gm packet	3	6	12
Pressure bandage	1	1	1
Safety pins	Sufficient supply		
Assorted sized waterproof adhesive wound dressings	Sufficient supply		
Assorted sized waterproof adhesive plaster	Sufficient supply		
Eye bath	Sufficient supply		

e. **Accident reporting and investigation mechanism.** Accident reporting should be done in an effective and timely manner which will include all accidents and near misses so that the problem could be analyzed and an appropriate response strategy could be formulated. As per Construction Site Safety Handbook for Public Works Program, Work Bureau, 2000, Government of Hong Kong, following are important points to be kept in mind for accident reporting and investigation mechanism:

1) Accident investigation should be carried out as quickly as possible.
2) Conduct interviews with as many witnesses as suitable.
3) Total dependence should not be placed on single source of evidence.
4) Prepare an investigation report which should be as short as possible, but should be detailed enough for its purpose. The report should contain the following:
   a) A summary of what had happened;

b) A summary of events prior to the accident;
c) Information gathered during the investigation;
d) Details of witnesses;
e) Information on injury or loss sustained;
f) Conclusions and possible cause(s) of the accident;
g) Recommendations to prevent recurrence;
h) Supporting materials (photographs, diagrams, etc.

2.8.3 Education and Training Options in Pakistan

In Pakistan, students get their primary and secondary education from schools i.e. 1st grade through 10th grade. After 10th grade most of them continue their studies from government and private colleges to get their bachelor's degrees. All those who still continue their education join universities to get post graduate degrees. Those who do not afford to go to schools at any stage of primary or secondary education either learn at home or get on job training from workshops, factories or field projects etc. Few students also resort to vocational training institutes to get specific skills for their jobs.

It is pertinent to mention here (to the best of author's knowledge) that no subject on general or construction safety is being taught in the curriculum of primary or secondary school classes. However, professional universities especially National University of Sciences and Technology (NUST) and Nadirshaw Eduljee Dinshaw University of Engineering and Technology (NEDUET) are prominent universities which have started programs in construction engineering and management and offer courses in construction safety. In addition to professional universities, some vocational institutes, PEC, few private institutes, CIWCE and Skill development Council of Government of Pakistan also conduct short courses on safety. Moreover, students can also get on-line construction safety courses from local or international training institutes. It seems that though slow but there is an emerging trend in occupational safety and health awareness in Pakistan which may lead to formulation of an occupational safety and health regulatory body.

2.8.4 Safety Training Methods for CI

Adams (Adams, 1992) defined training methods as the fundamental catalysts and stimulators for learning. In his comparative study of most often used training methods, he

discovered that no global consensus exist on preferred methods. This was confirmed by Ogunlana, Thapa and Dey (Ogunlana et al. 2002) when they concluded it is not a question of 'either/or' but of which method is suitable for a certain purpose, at a definite time, and in specific circumstances. However, research (Goetsch, 1993) shows that various learning styles have different retaining percentages as shown in Table: 2-2.

Table 2.2: Retaining Percentage of Learning Styles

Learning Style	**Retaining Percentage**
Reading	10%
Listening to Lectures	20%
Observing	30%
Observing and Listening	50%
Observing and speaking	70%
Listening lectures and doing same	90%

Following are few of the renowned training methods as discussed by K.T.Odusami (K.T. Odusami, et al 2007) and Goetsch (Goetsch, 1993). These training methods can also be applicable to CI in Pakistan. All the methods may not be suited for every tier in the organization; therefore it is necessary that choice of an appropriate method should be made for a particular tier.

2.8.4.1 Lectures

It is a classical teaching method. An organized oral presentation of subject matter on a definite topic prepared for specific purpose by the instructor. It is rarely used in its pure form without provision for additional methods, for example, discussion, question and answer, visual aids. Probably the most familiar and widely used instructional method is the lecture.

2.8.4.2 Films, tapes and videos

Information provided on films, tapes and videos are used as a supplement to other training methods or as the main vehicle of learning. While audio tapes use only narrations, films and videos further allow weaving in of real life demonstrations or action lots and graphics to visually illustrate the skills, concepts and facts being presented.

2.8.4.3 Field trips

This is often used in training for specific skills. Trainees learn while they are actually on the job and are being productive. It is usually combined with classroom training or other off-the-job approaches as well. Brief educational visit lasting a day or at most two to provide free hand information of objects and people being studied which would never occur in classrooms or conference rooms.

2.8.4.4 Conferences/ seminars

It is a meeting of people in a large or small group to discuss openly a specific problem or topic of common interest with the eventual acceptance of the conclusions made by group members. The term often used for gatherings of people from a given profession or association. The seminars have larger perspectives but lesser frequencies as compared to conferences.

2.8.4.5 Case studies

It is a popular approach for teaching management processes. It involves a discussion by a group of a case report which poses a number of questions on issues of current interest to the trainees. The report, a written or filmed description of an actual or an imaginary problem situation is presented in sufficient detail to enable rigorous analysis of problems and recommendation of appropriate action by the group. In using the case method, the instructor collects cases on a subject area which would represent a variety of real issues inherent in the study of the subject.

2.9 SUMMARY

Construction safety training has been discussed in this chapter. Who needs safety training; advantages of systematic safety training and safety laws in Pakistan are explained. Type of safety training and models of safety training needs assessment are discussed. Moreover, indicators for construction safety training needs for CI in Pakistan have also been discussed in detail.

Chapter 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

Research methodology shows that how researchers intend to carry out their study to obtain and address research objectives (Saunders *et al.,* 2007). Main methods to collect research data are questionnaire survey and interviews. This study is conducted as an exploratory research to construction safety training needs for management, supervisors and workers in Pakistan and suggests a preferred training system and delivery method. The layout of this research is given in Figure 3.1.

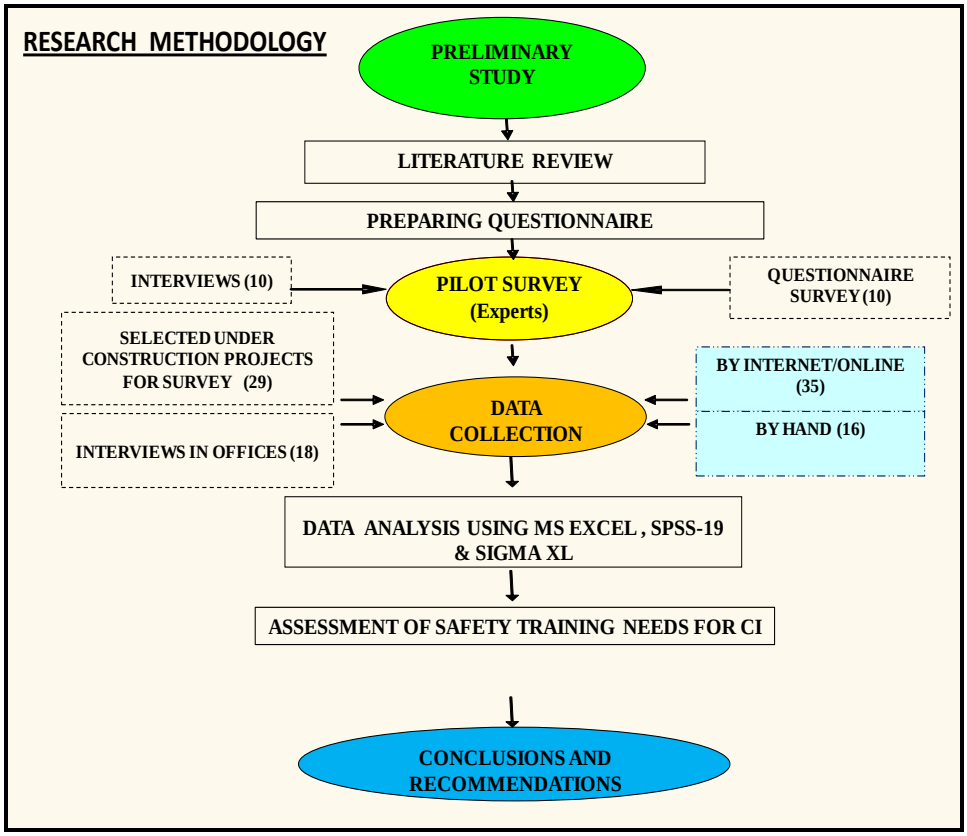

Figure 3.1: Research methodology

3.2 RESEARCH METHOD

In this study, questionnaire survey is administered as it is the most appropriate method for this kind of study (Naoum, 2007). For the design of questionnaire, a five point likert scale is used, to explore the complete range of possible replies between "Yes" and "No" (Fellow and Liu, 2003).

3.2.1 Pilot Survey

Pilot survey was carried out from 10 respondents who are quite educated and experienced in the CI. The aim of the pilot survey was to check the authenticity and applicability of the questionnaire as per Pakistani environment and whether or not it is easily understandable. The respondents were selected from the contractor, consultant, clients and academia. As a result of pilot survey, those questions which were pertaining to training delivery systems/methods and repeated after each training indicator were removed and placed at the end of questionnaire. Moreover, few pertinent questions pertaining to construction management plan were added but overall length of the questionnaire was reduced. The final questionnaire was circulated in the CI in Pakistan to get the responses.

3.2.2 Questionnaire

After the preliminary study, detailed literature review is carried out and various construction safety training manuals are examined. From the literature review of previous studies, construction safety training manuals of ILO, OSHA and other developed countries' regulatory authorities (as mentioned in chapter 2) and globally recognized construction safety related practices, a list of safety training indicators was identified. This list was further shortened to suit CI in Pakistan and grouped into five major indicators of safety training needs to assess the present and desired level of safety training for management and the workforce of CI in Pakistan. This assessment of training needs is carried out by finding out the conformance of management, supervisors and workers for these safety training indicators through 44 question statements. The statements are formulated in such a way that conformance for safety practices of all tiers of work force should be amply highlighted and deficiency level could be ascertained. The outcome of this assessment will help in defining the pertinent subjects/ areas of training, preferred training system and methods of delivery for CI in Pakistan.

The respondents were given 6 choices to answer the corresponding questions. The respondents had to evaluate the practices with in their organization while answering the questions. A sample question is presented inTable3.1:-

Table 3.1: Question for construction safety management plan

Safety Training Indicator *Please encircle one box best suited with the practices of your company*		**Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**	**NA**
3.Construction Safety Management Plan *(To include Management and Employee responsibilities, Safety Policies, Plans, Committees, Inspections, Audits, Training for Employees, Selection and Control of Subcontractor, Contract Documents etc)*							
01	Is Safety Management Plan of some kind influenced from OSHA or some other Safety Organization prepared in the organization before start of any project?						

To perform the quantitative analysis on the survey data, numerical values are assigned to the answers. These numerical values are as follows:-

Never	0
Seldom	1
Sometimes	2
Often	3
Almost Always	4
Blank/ NA	0

Answers of NEVER are assigned 0 score because the respondents organization has never carried out the safety practice asked in the statement under some safety training indicator. Score of 1 has been assigned to answers of SELDOM because of very little respondents organization has rarely carried out the safety practice asked in the question. The answers SOMETIMES are assigned score of 2 because the respondents organization sometimes carries out the practice and

sometimes does not carry out it. The answer OFTEN is assigned the score 3 because the respondents organization frequently carry out the practice. The highest score i-e 4 is assigned to the answer ALMOST ALWAYS which means that respondents organization regularly carries out the practice asked in the question statement. BLANK cells and NA answers are assigned score 0 assuming that the respondents have left it blank because either the asked practice does not pertain to his organization or he simply does not understand the practice. If the respondents or their organization cannot understand a practice it is next to impossible to implement it. The N/A choice will also provide the cushion against unreasonable/ unrealistic answers. The conformance for safety practices was calculated in percentage by this formula:

$$\text{Conformance for safety indicator (\%)} = \frac{\text{Sum of all the actual answers x 100}}{\text{Sum of highest answer scores}}$$

Online version of the questionnaire was also prepared in Google documents apart from the print outs. The words format of the questionnaire is attached as Appendix II. Following methods were used to get the responses:-

a. Distribution by hand
b. Distribution on internet
c. Visits to sites and personnel interviews on site
d. Visit to offices and personnel interviews

3.3 SURVEY SAMPLE

3.3.1 Sample Selection

One of the aims of statistics is to assess about some characteristics of the population by sampling. For good results sample should be a true representative of population. The sample for this study is collected from a population of civil engineers working in construction organizations/firms in Pakistan. As per the PEC magazine 2013, there are around 32184 registered civil engineers. Assuming that 15 thousand are unregistered engineers or in process of registration, the total population size can be calculated as approx. 50000. For this study, random sampling technique is adopted by selecting the civil engineers at random all over the Pakistan. However, most of the projects are selected from the Province of Punjab especially from the cities of Rawalpindi, Islamabad, Lahore and Multan. Total of 29 under

construction projects and 18 offices of different organizations/firms are selected for personnel interviews with the key project stakeholders.

The questionnaire was distributed to 130 randomly selected potential respondents, working with different organizations/ firms. There are 98 valid responses out of 130, showing a response rate of 75%. Response by clients is 40.21%, consultants 27.84% and contractors 31.96%.

3.3.2 Sample Size

Factors which should be taken into account in determining an appropriate sample size are:

a. Sampling error
b. Population size
c. Confidence level

Equation (3-1) gives the formula which can be used to calculate the sample sizes (Dillman, 2000):

$$\mathbf{Ns} = \frac{\mathbf{Np(p)(1-p)}}{\mathbf{(Np-1)(B/C)^2 + (p)(1-p)}} \quad (3\text{-}1)$$

where;

Ns: sample size for the desired level of precision

Np: population size i.e. 50000

P: proportion of the population that is expected to choose one of the responses categories (yes/no); $P = 0.65$

B: acceptable sampling error; (±10% or ±0.10)

C: Z statistic associated with the confidence level (1.96 corresponds to 95% confidence level)

Assuming that 15 thousand are unregistered engineers or in process of registration, the total population size can be concluded as approximately 50000 (Np). Since safety training is the weakest factor in CI in Pakistan, therefore it is expected that not been followed by the

civil engineers/organizations/companies; it means 65% (p) of the population are expected to give lower values to the answers. Acceptable level of sampling error is taken as 10% and Confidence Interval as 95%. By applying these values in equations (3-1), the sample size calculated as 96 for sampling error as ±10%. Analysis of obtained data by SPSS-19, gave maximum sampling error as ±9.70% that is less than ±10% therefore any sample more than 96 is acceptable. Hence, a sample used in this study containing 98 respondents is fairly reliable for analysis.

3.4 RELIABILITY AND VALIDITY OF SURVEY

The reliability and validity of a study determine that the research instrument fulfills its envisioned purpose. "*Reliability* pertains to the consistency of a measure with a probability of getting similar results if the measure is duplicated" (Oppenheim, 1992). Reliability can be assessed in many ways however vastly used method in researches is internal consistency. *"Validity* determines whether the score or question can measure what it is supposed to measure" (Oppenheim, 1992).

3.5 DATA ANALYSIS TECHNIQUES

MS excel, Minitab and SPSS-19 are used to analyze data. The study follows common level of significance which is $\alpha = 0.05$. Statistical techniques that are used in this study for analysis are mentioned in succeeding paragraphs.

3.5.1 Test for Normality

The assessment of data normality is invariably a pre-condition to apply various statistical tests. Normality test is performed to assess whether or not the data is normally distributed, i.e. whether or not data is parametric. A well-recognized and thorough test of normality i.e. Shapiro-Wilk test was performed which is appropriate for data sets of about two thousands (2000) elements or less is presented by. In order to assume the data as adequately normal, the significance value should be non-significant (i.e. greater than 0.05). To apply normality test for a data set having more than 2,000 values, Kolmogorov-Smirnov test, also termed as K-S Lilliefors, is more appropriate. Anderson Darling test was also performed to check the normality with same characteristics. Hence in this study Shapiro-Wilk test and Anderson Darling test are used to check the normality owing to the limitation of sample size. In case the data set fails normality,

before going to the non-parametric; the data is either carefully observed for outliers or errors or transformed by Box Cox Transformation to make it normal. Box Cox transformation use the value of lambda and raises the data set values by taking the power of lambda in the range of -5 to 5 and then determines the best fit power.

3.5.2 Kruskal-Wallis Test

The Kruskal-Wallis is used to assess whether or not three or more independent groups have identical or diverse perception on some variable of interest. It is more appropriate for finding statistical evidence of inconsistency or differences in perception, using mean values. The Kruskal-Wallis test was performed for non-parametric data because the collected data did not pass the normality test. The null hypothesis (Ho) for the test is that the means of variables are equal and if the result is significant then it is rejected. In order to assess the difference in perception between two independent groups, Mann-Whitney test was performed.

3.6 SUMMARY

This study has used multiple research methods for collection of data of CI in Pakistan. Questionnaire survey has been selected to collect the data of industry. The research method, questionnaire design, design of the survey and analysis techniques are discussed in this chapter which gives sufficient overview of the methodology of this research.

Chapter 4

DATA ANALYSIS AND RESULTS

4.1 INTRODUCTION

Poor safety practices are indication that safety training in CI in Pakistan is not satisfactory. One of the major reasons could be non-existence of any regulatory body in Pakistan like OSHA to implement its safety policies, rules and regulations. Although Government has formulated labour laws but neither are they observed in true spirits nor construction safety or safety training emphasized in them. As a result major focus of constructors and consultants is towards progress of projects; most of them are unaware of the fact that implementation of safety itself can reduce causes of delays in projects.

Apparently owners, contractors and consultants do not find any attraction in implementation of safety being a non-pay item in contract documents and no fear of any safety regulatory body. That is why it is understandable why safety training has lowest Safety Performance Index in CI in Pakistan (Zahoor, 2012). Recently, a trend has been seen in which large construction companies have started investing in safety. However, they need to be encouraged to spend more in this field by providing incentives by the concerned Government Agencies like PEC etc. This is the correct time when safety training should be made mandatory for workers and supervisors by some kind of regulatory body before induction in any construction project. As per authors knowledge general safety is not imparted in school education which might be a cause that safety is not inculcated in the mind-set of a common man. Recently construction safety training is seen to be included as a subject in professional construction training institutes which is good sign for CI. In the opinion of the author, level or system and method of training for a construction person should be in accordance with his background education and the anticipated duties he is required to perform.

Data collected by questionnaire survey and interviews has been analyzed through MS excel, Minitab

and SPSS-19. Discussion on results has been done in succeeding paragraphs.

4.2 CHARACTERISTICS OF RESPONDENTS

4.2.1 Grouping of the Respondents

There are 98 valid responses out of 130, which show a good response rate i.e. 75%. Response by clients is 40.21%, consultants 27.84% and contractors 31.96%. Grouping and relevant frequencies (in percentages) of respondents are shown in Figure 4.1:

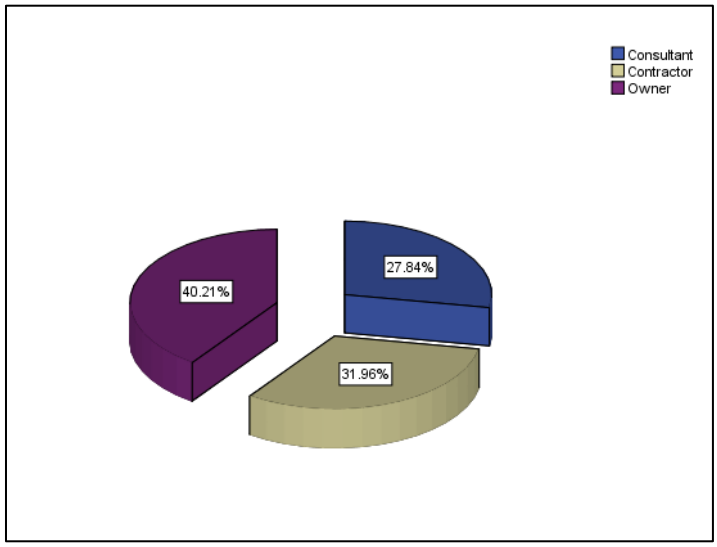

Figure 4.1: Grouping of the respondents

4.2.2 Experience of Respondents in the CI

Respondents have different experience in CI (see Figure 4.2). Nearly 9.18% of respondents possess more than 20 years of experience. 11.22% of respondents have accumulated 16-20 years of construction experience, 35.71% have 11-15 years of construction experience and 31.63% have 6-10 years of construction experience; whereas only 12.24% have 0-5 years of construction experience. Therefore, the data collected from these professionals may be accepted as reliable.

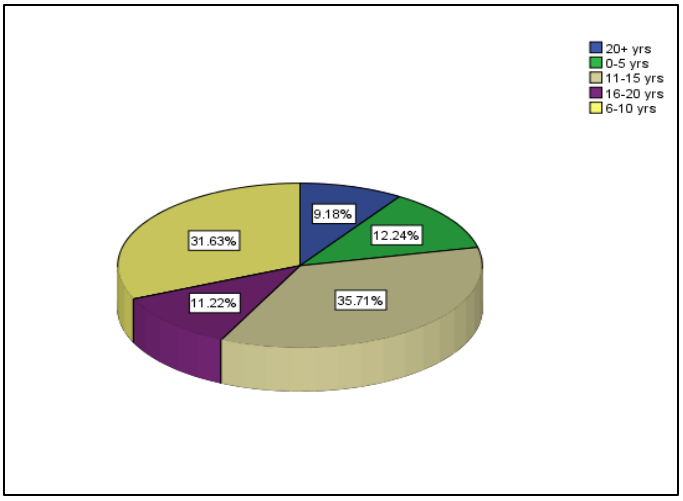

Figure 4.2: Percentage of respondents basing on industry experience

4.2.3 Profession of the Respondents in the CI

Respondents to this survey belong to different professions in the CI which is shown in percentage in Figure 4.3. Approximately 3.06% of the respondents are architects, 84.69% of the respondents are civil engineers, 1.03% of the respondents are construction/ technical supervisors, 6.12% of the respondents belong to some other profession like educationist etc and 5.10% of the respondents are safety supervisors.

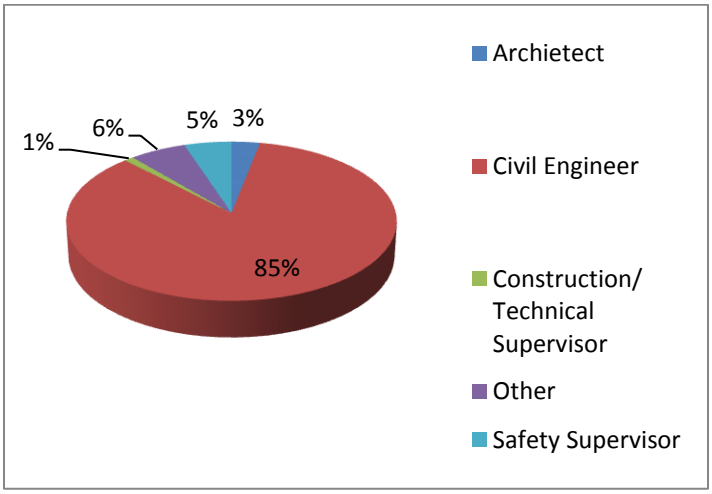

Figure 4.3: Percentage of the respondents basing on their profession

4.2.4 Education of the Respondents

Respondents have different educational background which is shown in percentage in Figure 4.4. Approximately 7.00% of the respondents are diploma holders, 48.50% have acquired Bachelor's degree, 37.50% of the respondents have acquired Master's degree and 7.00% of the respondents have acquired doctorate degree.

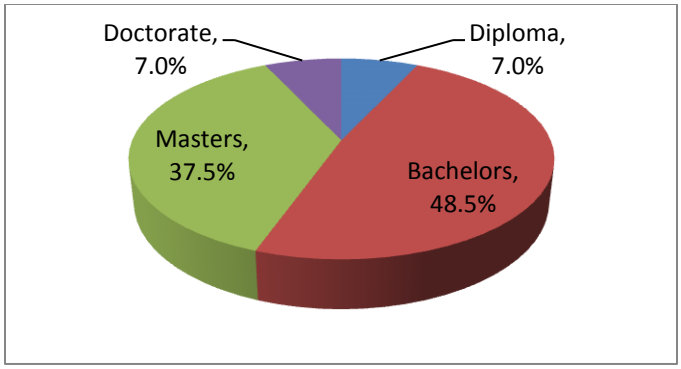

Figure 4.4: Percentage of the respondents basing on their education

4.2.5 Geographical Operation Locaton of the Organization

Organizations of the respondents are spread in Pakistan and abroad as shown in Figure 4.5. Approximately 3organizations of respondents are spread only in abroad, 57 are spread in Pakistan and 38of the organizations of respondents are spread in Pakistan and abroad.

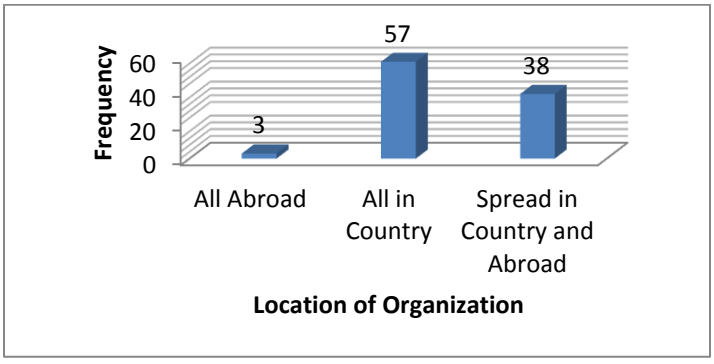

Figure 4.5: Geographical operation location of organization

4.2.6 Area of Operation of Respondents' Organization

Respondents' organizations have experience in multifarious civil area of operations which is shown in Figure 4.6. Approximately 30 organizations have experience in project and design, 40 in building works, 20 in pipeline projects, 25 in industrial facilities projects, 6 in tunnel projects, 55 in highways/ transportation facilities projects, 10 in airport projects, 15 in canals and irrigation facilities projects and 10 in some other category.

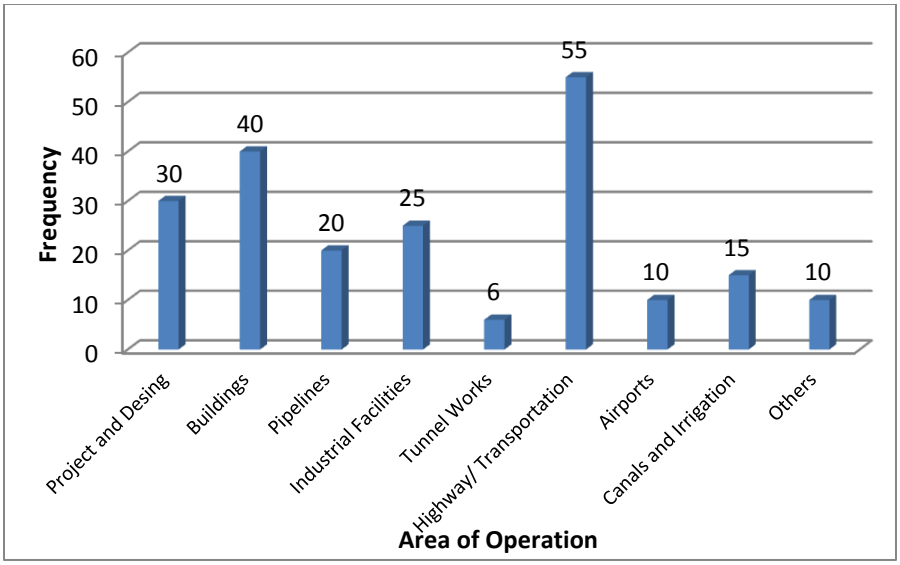

Figure 4.6: Area of operation of respondents' organizations

4.2.7 Average Annual Turnover of Respondents' Organizations

Respondents' organizations have different volume of annual turnover which is shown in Figure 4.7. Approximately 6 organizations have annual average turnover within a range of 1-10 million rupees, 28 organizations have annual average turnover within a range of 10-100 million rupees, 30 organizations have annual average turnover within a range of 100-1000 million rupees and 34 have annaual turniover of more than 1000 million rupees.

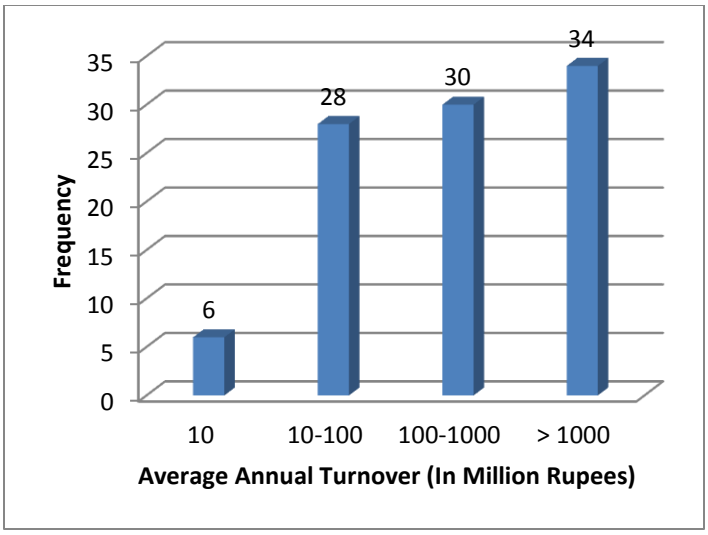

Figure 4.7: Average annual turnover of respondents' organizations

4.2.8 Major Clients of Respondents' Organizations

Respondents' organizations have had experience with clients who pertain to different sectors which is shown in Figure 4.8. Approximately 62 respondents' organizations have major clients in the public sector, 14 have major clients in private sector whereas 22 have major clients in public and private sector both.

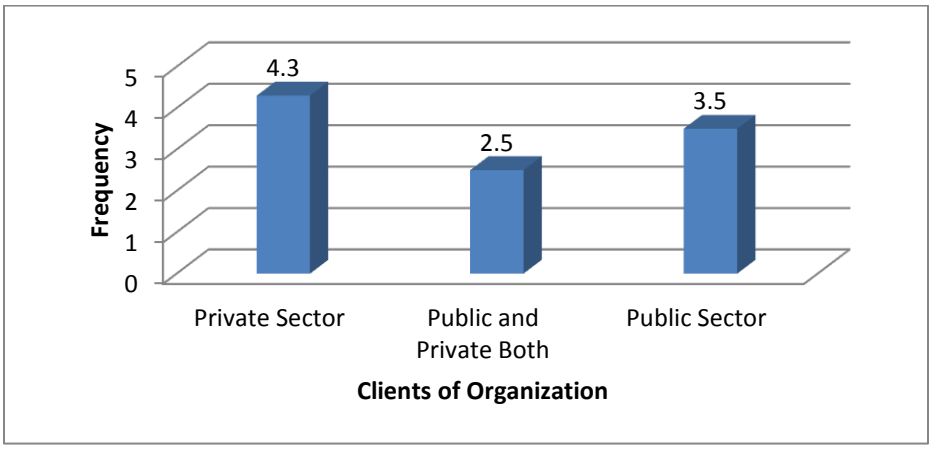

Figure 4.8: Major client of respondents' organizations

4.2.9 Average No of Employees of Respondents' Organizations

Respondents belong to different sizes of organizations in terms of number of employees enrolled in head offices, site offices and construction sites. The data is shown in Figure 4.9. Approximately 9 organizations have employees within a range of 10-100 persons, 34 organizations have employees within a range of 100-500 persons, 9 organizations have employees within a range of 500-1500 persons and 46 have greater than 1500 employees.

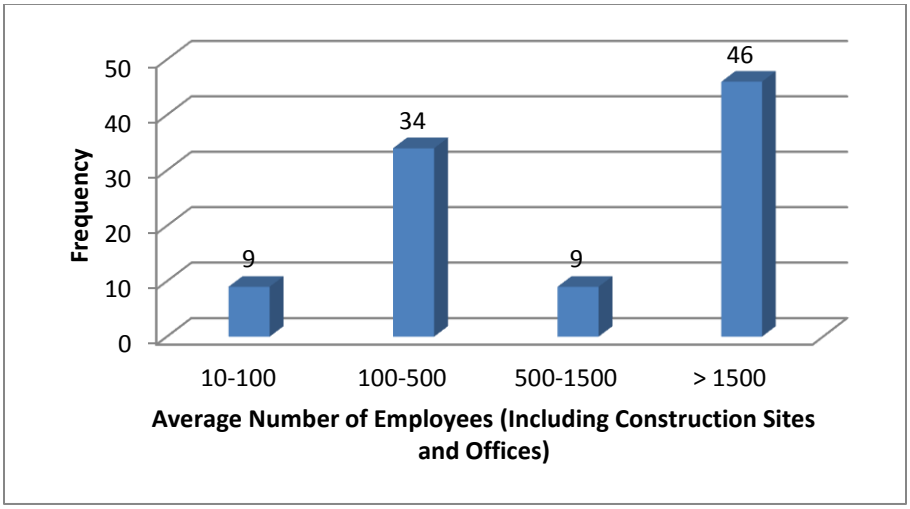

Figure 4.9: Average number of employees of respondents' organizations

4.3 STATISTICAL ANALYSIS

4.3.1Reliability of the Sample

4.3.1.1 Cronbach's Coefficient Alpha Method

It is the most common method to determine internal consistency (reliability). It is used to check the reliability of scale when questions are based on likert scale. If the value of Cronbach's Coefficient Alpha obtained higher than 0.7, then it depicts that data is acceptable for further analysis whereas for a value higher than 0.9, data is excellent for analysis (Li, 2007). For the collected data, Cronbach's Coefficient Alpha value is calculated as 0.978 using SPSS which shows that data is reliable for further analysis19 (see Table 4).

Table 4.1: Reliability statistics

Summary			Cronbach's Alpha	Number of Items
Cases	N	%	.978	44
Valid	98	100.0		
Excluded	0	.0		
Total	98	100.0		

4.3.1.2 Split-Half Method

It also checks the reliability of data while splitting it in two equal parts of 22 items each as shown in Table 4.2. For 1st part Cronbach's Alpha value is 0.964 and for the 2nd part its value is 0.955. Higher value of Split-Half coefficient alpha (closer to 1) shows reliability of data for further analysis.

Table 4.2: Reliability statistics

Total No of Items	Cronbach's Alpha			
44	Part 1		Part 2	
	No of Items	Value	No of Items	Value
	22[a]	**0.964**	22[b]	**0.955**

4.3.2 Normality Test

In order to assess the normality of data, 'Shapiro-Wilk test' is conducted i.e. the data is

parametric or non-parametric. The obtained significance values are less than 0.05 (significance values are required to be greater than 0.05 for normal data). Hence, the data is not normal and non-parametric tests would be performed for further analysis. To check the best fit distribution, different quality control tests for individual distributions were performed and it is found that no distribution best fits the data hence general non parametric test was performed for further analysis. Results of Shapiro-Wilk test show that data is not normal (see Table 4.3).

Table 4.3: Test of normality – Shapiro-Wilk Test

Safety Training Indicators (STI)	Shapiro-Wilk Test		Safety Training Indicators (STI)	Shapiro-Wilk Test	
	Statistic	Sig.		Statistic	Sig.
STI-01	.842	.000	STI-23	.830	.000
STI-02	.809	.000	STI-24	.853	.000
STI-03	.803	.000	STI-25	.869	.000
STI-04	.872	.000	STI-26	.782	.000
Overall % of safety in the mind set	.908	.000	Overall % Safety Against Major Causes of Accidents	.880	.000
STI-05	.866	.000	STI-27	.820	.000
STI-06	.906	.000	STI-28	.823	.000
STI-07	.911	.000	STI-29	.847	.000
			Overall % Housekeeping	.885	.000
STI-08	.870	.000	STI-30	.828	.000
STI-09	.747	.000	STI-31	.866	.000
STI-10	.807	.000	STI-32	.779	.000
Overall % of Construction Safety Laws, Rules and	.925	.000	STI-33	.862	.000

Safety Training Indicators (STI)	Shapiro-Wilk Test		Safety Training Indicators (STI)	Shapiro-Wilk Test	
	Statistic	Sig.		Statistic	Sig.
Regulations					
STI-11	.838	.000	Overall % First aid	.891	.000
STI-12	.844	.000	STI-34	.880	.000
STI-13	.826	.000	STI-35	.904	.000
STI-14	.720	.000	STI-36	.852	.000
STI-15	.844	.000	STI-37	.872	.000
STI-16	.855	.000	STI-38	.846	.000
STI-17	.863	.000	Overall % Personnel Protective Equipment (PPE)	.838	.000
			Overall Safety and health at work place	.862	.000
STI-18	.856	.000	STI-39	.872	.000
STI-19	.821	.000	STI-40	.869	.000
STI-20	.830	.000	STI-41	.887	.000
STI-21	.689	.000	STI-42	.839	.000
STI-22	.739	.000	STI-43	.790	.000
Overall % Construction Safety Management Plan	.855	.000	STI-44	.882	.000
			Overall % Accident Reporting and Investigation Mechanism	.967	.016
Overall Safety Perception About Safety indicators to Assess Safety Training Needs				.870	.000

4.3.3 Wilcoxon Signed Ranked Test

To infer about the population mean, the non-parametric test Wilcoxon Signed Ranked was performed. The Wilcoxon signed-rank test is a non-parametric statistical hypothesis test used when comparing two related samples, matched samples, or repeated measurements on a single sample to assess whether or not their population means ranks differ. The result of this test gives the population means at 95% confidence interval for different safety indicators for CI in Pakistan (see Table 4.4).

Table 4.4: Wilcoxon Signed-Rank Test to infer population mean

Safety Training Indicators	Mean	Population Mean
Overall % Safety in the Mindset	44.57	$37.50 \leq \mu \leq 46.88$
Overall % Construction Safety Laws, Rules and Regulations	45.02	$37.5 \leq \mu \leq 47$
Overall % Construction Safety Management Plan	38.45	$29.2 \leq \mu \leq 41.7$
Overall % Safety and Health of Work Place	45.6	$42.2 \leq \mu \leq 48.36$
Overall % Accident Reporting and Investigation Mechanism	62.07	$60.10 \leq \mu \leq 64.50$
Overall Safety Perception About Safety indicators to Assess Safety Training Needs	47.15	$40.3 \leq \mu \leq 49.8$

4.3.4 Kruskal Wallis Test for all Safety Training Indicators

The collected data is non-parametric therefore, Kruskal Wallis test is performed to assess whether or not all stakeholders i.e. owners, consultants and contractors have similar perception regarding the performance level of all safety training indicators or otherwise. Results are shown in subsequent paragraphs.

4.3.4.1 Kruskal Wallis Test for safety in the mindset

Kruskal Wallis test is performed for safety in the mindset indicators and results are shown as Table 4.5. The significance values for conformance of safety practices by various tiers of organization can be seen to identify the perception difference among owners, consultants and contractors. The highlighted figures show difference in perception since significance values are less than 0.05 (see Table 4.5).

Table 4.5: Kruskal Wallis Test for safety in the mindset

Ser	Safety Training Indicators	Significance
	Safety in the Mindset	
1	Top/ Middle Management's conformance level for commitment to implement safety culture	.021
2	Supervisors conformance level for commitment to give preference to safety over the progress	.164
3	Worker's conformance level to show inclination/ acceptance towards safety culture through behavior	.160

Contractors, owners and consultants have the same perception regarding safety in the mindset except for safety in the mindset for top and middle management because of greater p-

value than 0.05 (see Table 4.5). To see the differences among different two groups, Mann-Whitney test was performed. The results show (see Table 4.6) that the difference in perception is among contractor and owner for safety in the mindset for top and middle management's commitment to implement safety culture.

Table 4.6: Mann-Whitney Test for safety in the mindset

Safety Practices	Comparison Between		
	Consultant-Contractor	Consultant-Owner	Contractor - Owner
Top/ Middle Management's conformance level for commitment to implement safety culture	.065	.670	.004

4.3.4.2 Kruskal Wallis Test for construction safety laws, rules and regulations

Kruskal Wallis test is performed for Construction Safety Laws, Rules and Regulations indicators and results are shown in Table 4.7. The significance values for conformance of safety practices by various tiers of organization can be seen to identify the perception difference among owners, consultants and contractors. The highlighted figures show difference in perception since significance values are less than 0.05 (see Table 4.7).

Table 4.7: Kruskal Wallis Test for safety laws, rules and regulations

Ser	Safety Training Indicators	Significance
	Construction Safety Laws, Rules and Regulations	
1	Management's conformance level to provide Safety laws, rules or regulations in some form in the organization	.108

Ser	Safety Training Indicators	Significance
2	Top and Middle Management's conformance level for knowledge regarding safety laws, rules or regulations	.192
3	Top Management's conformance level for willingness to implement the safety rules and regulations strictly	.001
4	Supervisor's conformance level to know the methods to implement safety rules and regulations	.001
5	Supervisor's conformance level for actual knowledge of these rules and regulations	.001
6	Management's conformance level to make workers legally bound to follow the safety rules and regulations	.009
7	Worker's conformance level to actually follow safety rules	.013

Contractors, owners and consultants have the same perception regarding existence of some safety rules in the organization and knowledge of top and middle management for safety laws, rules and regulations (see Table 4.7). However, contractors, owners and consultants have difference in perception for following safety practices.

a. Top Management's conformance level for willingness to implement the safety rules and regulations strictly
b. Supervisor's conformance level to know the methods to implement safety rules and regulations
c. Supervisor's conformance level for actual knowledge of these rules and regulations
d. Management's conformance level to make workers legally bound to follow the safety rules and regulations
e. Worker's conformance level to actually follow safety rules

To see the differences among two different groups of stakeholders, Mann-Whitney test was performed. The results show (see Table 4.8) that the difference in perception is between owner and contractor for conformance level of all above mentioned safety practices.

Table 4.8: Mann-Whitney Test for safety laws, rules and regulations

Safety Practices	Comparison Between		
	Consultant-Contractor	**Consultant-Owner**	**Contractor - Owner**
Top Management's conformance level for willingness to implement the safety rules and regulations strictly	.062	.650	.000
Supervisor's conformance level to know the methods to implement safety rules and regulations	.056	.282	.000
Supervisor's conformance level for actual knowledge of these rules and regulations	.316	.081	.000
Management's conformance level to make workers legally bound to follow the safety rules and regulations	.217	.073	.004
Worker's conformance level to actually follow safety rules	.089	.248	.006

4.3.4.3 Kruskal Wallis Test for construction safety management plan

Kruskal Wallis test is performed for Construction Safety Management Plan indicator and

results are shown in Table 4.9. The significance values for conformance of safety practices by various tiers of organization can be seen to identify the perception difference among owners, consultants and contractors. The highlighted figures show difference in perception since significance values are less than 0.05 (see Table 4.9).

Table 4.9: Kruskal Wallis Test for safety management plan

Ser	Safety Training Indicators	Significance
	Construction Safety Management Plan	
1	Management's conformance level to introduce some kind of construction safety management plan influenced from OSHA or some other Safety Organization prepared in the organization before start of any project	.012
2	Top/ Middle Management's conformance level to implement Safety Management Plan in true spirits	.004
3	Management's conformance level to conduct Safety Induction Training for new employees or before start of work on new job/ site	.196
4	Management's conformance level to conduct Refresher Training in Safety periodically	.025
5	Management's conformance level to select subcontractors who show good safety performance	.014
6	Management's conformance level to include Construction Safety related clauses in contract documents	.000
7	Middle Management/ Supervisor's conformance level to recognize the potential hazards 0f accidents before undertaking any activity as well as project	.037
8	Middle Management/ Supervisor's conformance level for knowledge of safety before undertaking a project	.000
9	Supervisor's conformance level to understand the plan and implement it	.021
10	Worker's conformance level for knowledge of relevant safety measures before starting any activity	.089

Ser	Safety Training Indicators	Significance
11	Worker's conformance level for knowledge of Construction Safety before employment	.089
12	Management's conformance level to introduce a Reward and Punishment Program for Safe and Unsafe Behavior respectively	.384

Table 4.9 depicts that contractors, owners and consultants have same perception for following safety practices.

a. Management's conformance level to conduct safety induction training for new employees or before start of work on new job/ site;
b. Worker's conformance level for knowledge of relevant safety measures before starting any activity;
c. Worker's conformance level for knowledge of construction safety before employment;
d. Management's conformance level to introduce a reward and punishment Program for Safe and Unsafe Behavior respectively.

However, contractors, owners and consultants have different perceptions for following safety practices.

a. Management's conformance level to introduce some kind of construction safety management plan influenced from OSHA or some other Safety Organization;
b. Top/ Middle Management's conformance level to implement Safety Management Plan in true spirits;
c. Management's conformance level to conduct Refresher Training in Safety periodically;
d. Management's conformance level to select subcontractors who show good safety performance;
e. Management's conformance level to include Construction Safety related clauses in contract documents;

f. Middle Management/ Supervisor's conformance level to recognize the potential hazards 0f accidents before undertaking any activity as well as project;
g. Middle Management/ Supervisor's conformance level for knowledge of safety before undertaking a project;
h. Supervisor's conformance level to understand the plan and implement it.

To see the differences among two different groups of stakeholders, Mann-Whitney test was performed. The results show (see Table 4.10) that the difference in perception is between owner and contractor for conformance level of all above mentioned safety practices in which difference was found.

Table 4.10: Mann-Whitney Test for construction safety management plan

Safety Practices	Comparison Between		
	Consultant-Contractor	**Consultant-Owner**	**Contractor - Owner**
Management's conformance level to introduce some kind of construction safety management plan influenced from OSHA or some other Safety Organization prepared in the organization before start of any project	.464	.067	.003
Top/ Middle Management's conformance level to implement Safety Management Plan in true spirits	.121	.258	.000
Management's conformance level to conduct Refresher Training in Safety periodically	.816	.059	.016
Management's conformance level to select subcontractors who show good safety	.327	.154	.004

Safety Practices	Comparison Between		
	Consultant-Contractor	**Consultant-Owner**	**Contractor - Owner**
performance			
Management's conformance level to include Construction Safety related clauses in contract documents	.371	.204	.000
Middle Management/ Supervisor's conformance level to recognize the potential hazards 0f accidents before undertaking any activity as well as project	.907	.062	.019
Middle Management/ Supervisor's conformance level for knowledge of safety before undertaking a project	.889	.102	.000
Supervisor's conformance level to understand the plan and implement it	.467	.084	.008

4.3.4.4 Kruskal Wallis Test for safety and health of work place

4.3.4.4.1 Kruskal Wallis Test for safety against major causes of accidents

Kruskal Wallis test is performed for Safety against Major Causes of Accidents indicators and results are shown in Table 4.11. The significance values for conformance of safety practices by various tiers of organization can be seen to identify the perception difference among owners, consultants and contractors. The highlighted figures show difference in perception since significance values are less than 0.05 (see Table 4.11).

Table 4.11: Kruskal Wallis Test for safety against causes of accidents

Ser	Safety Training Indicators	Significance
	Safety against Major Causes of Accidents	
1	Top Management's conformance level to provide ample resources and opportunities to prevent against Major Causes of Accidents	.047
2	Middle Management's conformance level to effectively establish a culture and strategy to prevent against Major Causes of Accidents	.000
3	Supervisor's conformance level's ability to understand, implement and supervise the safety measures against Major Causes of Accidents	.029
4	Worker's conformance level to follow the safety instructions to prevent against Major Causes of Accidents	.260

Contractors, owners and consultants have the same perception regarding workers inclination to follow safety instructions to prevent against major causes of accidents (see Table 4.11). However, they have difference in perception for conformance of following safety practices:

a. Top Management's conformance level to provide ample resources and opportunities to prevent against Major Causes of Accidents.
b. Middle Management's conformance level to effectively establish a culture and strategy to prevent against Major Causes of Accidents.

c. Supervisor's conformance level's ability to understand, implement and supervise the safety measures against Major Causes of Accidents.

To see the differences between two different groups of stakeholders, Mann-Whitney test was performed. The results show (see Table 4.12) that the difference in perception is between owner and contractor for conformance level of all above mentioned safety practices in which difference was found.

Table 4.12: Mann-Whitney Test for safety against causes of accidents

Safety Practices	Comparison Between		
	Consultant-Contractor	**Consultant-Owner**	**Contractor - Owner**
Top Management's conformance level to provide ample resources and opportunities to prevent against Major Causes of Accidents	.827	.062	.027
Middle Management's conformance level to effectively establish a culture and strategy to prevent against Major Causes of Accidents	.216	.071	.000
Supervisor's conformance level to understand, implement and supervise the safety measures against Major Causes of Accidents	.569	.117	.012

In order to find out the most frequent causes of accident in CI in Pakistan, the respondents were asked about the accidents which they had experienced the most during construction projects. The responses are shown in the Figure 4.10 & Figure 4.11. The Figure 4.10 shows that the pri-1 cause of accident in building projects was '*fall of individual from height'* (66 responses) followed by '*electrical shocks'* and '*struck by an object/ machinery'*. The

Figure 4.11 shows that the pri-1 cause of accident in road projects was '*struck by an object/ machinery'* (87 responses) followed by '*fall from heights'* and '*caught in between the plants, machinery, object, confined space'*.

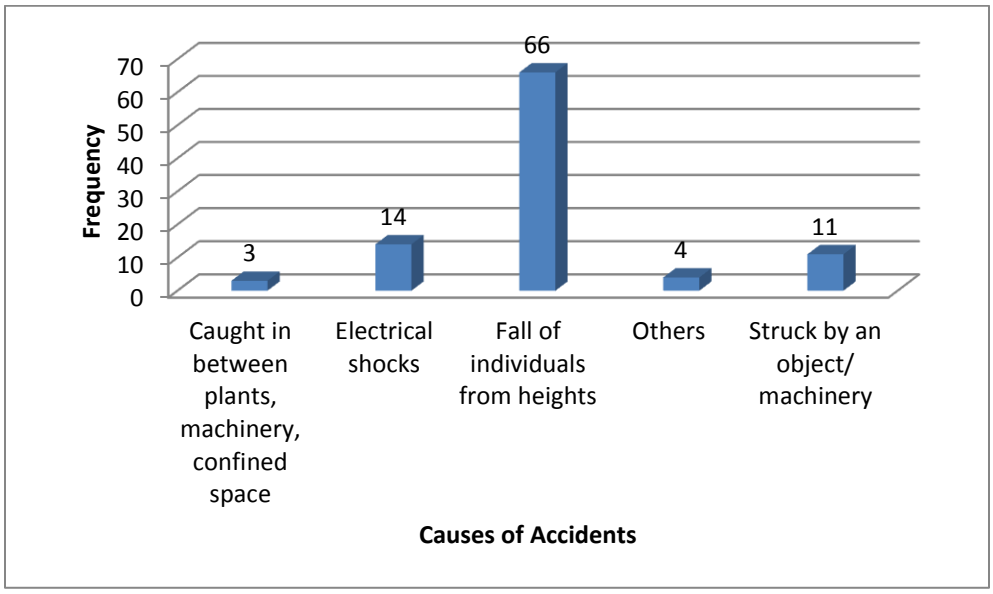

Figure 4.10: Priority-I -Causes of accidents in building projects

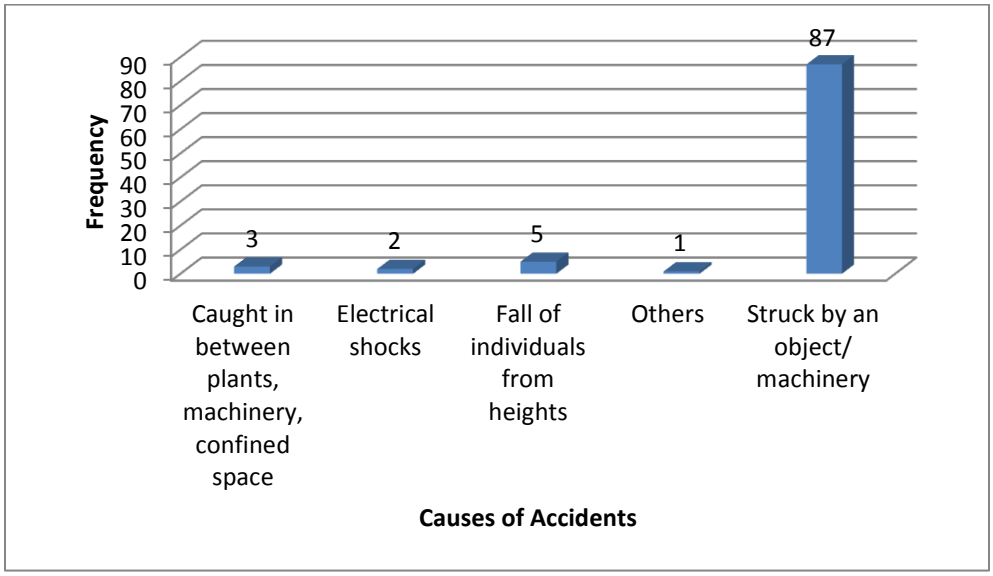

Figure 4.11: Priority-I -Causes of accidents in road projects

4.3.4.4.2 Kruskal Wallis Test for housekeeping

Kruskal Wallis test is performed for the indicator of Housekeeping and results are shown in Table 4.13. The significance values for conformance of safety practices by various tiers of organization can be seen to identify the perception difference among owners, consultants and contractors. The highlighted figures show difference in perception since significance values are less than 0.05 (see Table 4.13).

Table 4.13: Kruskal Wallis Test for house keeping

Ser	Safety Training Indicators	Significance
	House Keeping	
1	Top Management's conformance level to give due consideration to the Housekeeping of construction sites, offices and residential area	.268
2	Middle Management/ supervisory staff's conformance level to regularly check the house keeping	.224
3	Worker's conformance level for willingness to ensure cleanliness of sites and residential area without any orders	.015

Contractors, owners and consultants have the same perception for conformance of following safety practices (see Table 4.13):

a. Top management's conformance level to give due consideration to the housekeeping of construction sites, offices and residential area.
b. Middle management/ supervisory staff's conformance level to regularly check the house keeping.

However, contractors, owners and consultants have difference in perception for worker's conformance level to willingly ensure cleanliness of sites and residential area without any orders.

To see which two groups of stakeholders have difference in perception, Mann-Whitney test was performed. The results show (see Table 4.14) that the difference in perception is between owners and contractors for conformance level of above mentioned safety practices in which difference was found.

Table 4.14: Mann-Whitney Test for house keeping

Safety Practices	Comparison Between		
	Consultant-Contractor	**Consultant-Owner**	**Contractor - Owner**
Worker's conformance level for willingness to ensure cleanliness of sites and residential area without any orders	.110	.358	.005

4.3.4.4.3 Kruskal Wallis Test for first aid

Kruskal Wallis test is performed for the indicator of First Aid and results are shown in Table 4.15. The significance values for conformance of safety practices by various tiers of organization can be seen to identify the perception difference among owners, consultants and contractors. The highlighted figures show difference in perception since significance values are less than 0.05 (see Table 4.15).

Contractors, owners and consultants have the same perception for conformance of following safety practices (see Table 4.15):

a. Supervisor's conformance level to keep and make appropriate use of the first aid boxes.
b. Work force's conformance for level of training to effectively provide first aid to the affected.

Table 4.15: Kruskal Wallis Test for first aid

Ser	Safety Training Indicators	Significance
	First Aid	
1	Top Management's conformance level for concern to immediately provide first aid to the affected	.001
2	Middle Management's conformance level to make provisions to provide first aid to work force	.005
3	Supervisor's conformance level to keep and make appropriate use of the first aid boxes	.199
4	Work force's conformance for level of training to effectively provide first aid to the affected	.129

However, contractors, owners and consultants have difference in perception for top management's conformance level to immediately provide first aid to the affected and middle management's conformance level to make provisions to provide first aid to work force. To see which two groups of stakeholders have difference in perception, Mann-Whitney test was performed. The results show (see Table 4.16) that the difference in perception is between owners and contractors for conformance level of above mentioned safety practices in which difference was found.

Table 4.16: Mann-Whitney Test for first aid

Safety Practices	Comparison Between		
	Consultant-Contractor	Consultant-Owner	Contractor - Owner
Top Management's conformance level for concern to immediately provide first aid to the affected	.456	.076	.000
Middle Management's conformance level to make provisions to provide first aid to work force	.161	.177	.001

4.3.4.4.4Kruskal Wallis Test for personal protective equipment (PPE)

Kruskal Wallis test is performed for the indicator of PPE and results are shown in Table 4.17. The significance values for conformance of safety practices by various tiers of organization can be seen to identify the perception difference among owners, consultants and contractors. The highlighted figures show difference in perception since significance values are less than 0.05 (see Table 4.17).

Contractors, owners and consultants have the same perception for conformance of following safety practices (see Table 4.17):

a. Top Management's conformance level for willingness to provide PPE to the working parties.
b. Supervisor's conformance level to ensure the use of PPE forcefully.
c. Management's conformance level to effectively train the workers to use the PPE.

Table 4.17: Kruskal Wallis Test for personal protective equipment

Ser	Safety Training Indicators	Significance
	Personal Protective Equipment (PPE)	
1	Top Management's conformance level for willingness to provide PPE to the working parties	.225
2	Middle Management/ Supervisor's conformance level to ensure the use of PPE by all the working men including themselves	.000
3	Supervisor's conformance level to ensure the use of PPE forcefully	.114
4	Management's conformance level to effectively train the workers to use the PPE	.239
5	Worker's conformance level to consider the use of PPE as effective accident preventing tools and willingness to use them for their own safety	.004

However, contractors, owners and consultants have difference in perception for conformance of following safety practices:

a. Middle Management/ Supervisor's conformance level to ensure the use of PPE by all the working men including themselves.
b. Worker's conformance level to consider the use of PPE as effective accident preventing tools and willingness to use them for their own safety.

To see which two groups of stakeholders have difference in perception, Mann-Whitney test was performed. The results show (see Table 4.18) that the difference in perception is between owners and contractors for conformance level of above mentioned safety practices in which difference was found.

Table 4.18: Mann-Whitney Test for personal protective equipment

Safety Practices	Comparison Between		
	Consultant-Contractor	**Consultant-Owner**	**Contractor - Owner**
Middle Management/ Supervisor's conformance level to ensure the use of PPE by all the working men including themselves	.308	.101	.000
Worker's conformance level to consider the use of PPE as effective accident preventing tools and willingness to use them for their own safety	.280	.056	.001

4.3.4.4.5 Kruskal Wallis Test for accident reporting and investigation mechanism

Kruskal Wallis test is performed for the indicator of Accident Reporting and Investigation Mechanism and results are shown in Table 4.19. The significance values for conformance of safety practices by various tiers of organization can be seen to identify the perception difference among owners, consultants and contractors. The highlighted figures show difference in perception since significance values are less than 0.05 (see Table 4.19).

Contractors, owners and consultants have the same perception for conformance of all safety practices mentioned in Table 4.19 except following (see Table 4.19):

a. Middle Management's conformance level for concern to investigate the causes of accidents and near misses.
b. Worker's conformance level to report the accidents in time and cooperate in investigations.

Table 4.19: Kruskal Wallis Test for accident reporting and investigation mechanism

Ser	Safety Training Indicators	Significance
	Accident Reporting and Investigation Mechanism	
1	Management's conformance level to have a written accident reporting and investigation mechanism in the organization.	.545
2	Top Management's conformance level to give priority to accident compilation and investigation	.069
3	Middle Management's conformance level for concern to investigate the causes of accidents and near misses	.037
4	Supervisor's conformance level for ability to compile the accident report effectively.	.308
5	Supervisor's conformance level to report the incidents in time	.095
6	Worker's conformance level to report the accidents in time and cooperate in investigations	.001

To see which two groups of stakeholders have difference in perception, Mann-Whitney test was performed. The results show (see Table 4.20) that the difference in perception is between owners and contractors for conformance level of above mentioned safety practices in which difference was found.

Table 4.20: Mann-Whitney Test for accident reporting and investigation mechanism

Safety Practices	Comparison Between		
	Consultant-Contractor	Consultant-Owner	Contractor - Owner
Middle Management's conformance level for concern to investigate the causes of accidents and near misses	.172	.325	.011
Worker's conformance level to report the accidents in time and cooperate in investigations	.670	.076	.000

4.4 MISCELLANEOUS SAFETY TRAINING PRACTICES

4.4.1 Budget Allocation for Safety Training

Respondents belong to organizations which have different budget allocations for their projects in terms of percentage of cost of projects which are shown in Figure 4.12. It shows that approximately 56 organizations do not allocate any budget for safety training, 28 organizations allocate budget less than 1% of project cost, 14 organizations allocate within a range of 1-2% of project cost and no organization allocate within a range of 2-4% of project cost.

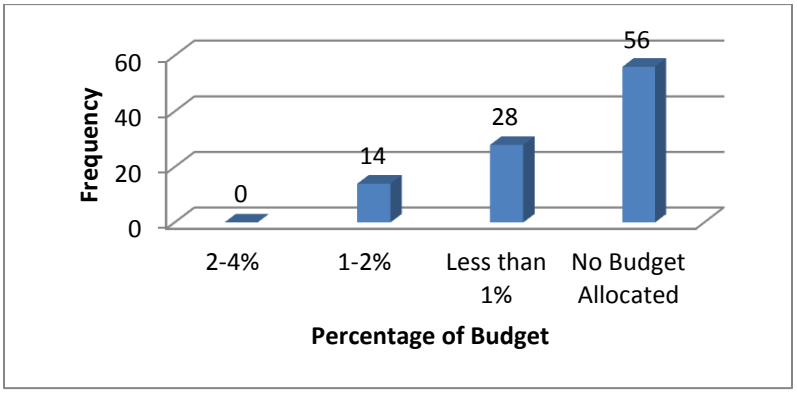

Figure 4.12: Budget allocation for safety training

4.4.2 Frequency of Tool Box Meetings

Respondents belong to organizations which have different schedules for conducting routine tool box meetings (see Figure 4.13). Approximately 46.94% of organizations do not have a culture to conduct routine tool box meetings, 6.12% of organizations conduct daily tool box meetings, 1.02% of organizations conduct twice a week tool box meetings, 10.20% of organizations conduct weekly tool box meetings, 17.35% of organizations conduct fortnightly tool box meetings and 18.37% organizations consider tool box meeting not applicable for them.

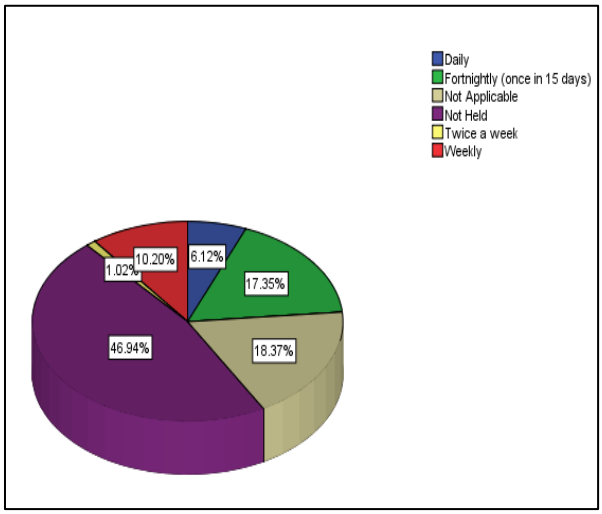

Figure 4.13: Frequency of the tool box meetings in the organization

4.4.3 Responsibility to Conduct Safety Training

The responsibility to conduct safety training for the employees is different for different respondents' organizations (see Figure 4.14). It can be clearly seen that 25% of the organizations do not conduct training; whereas in 17% organizations safety officer is responsible for conducting safety training, in 16% organizations project director (office) is responsible for conducting safety training, in 6% organizations field supervisor is responsible for conducting safety training, in 3% organizations employees themselves are responsible for conducting safety training and in 31% organizations construction manager is responsible for conducting safety training.

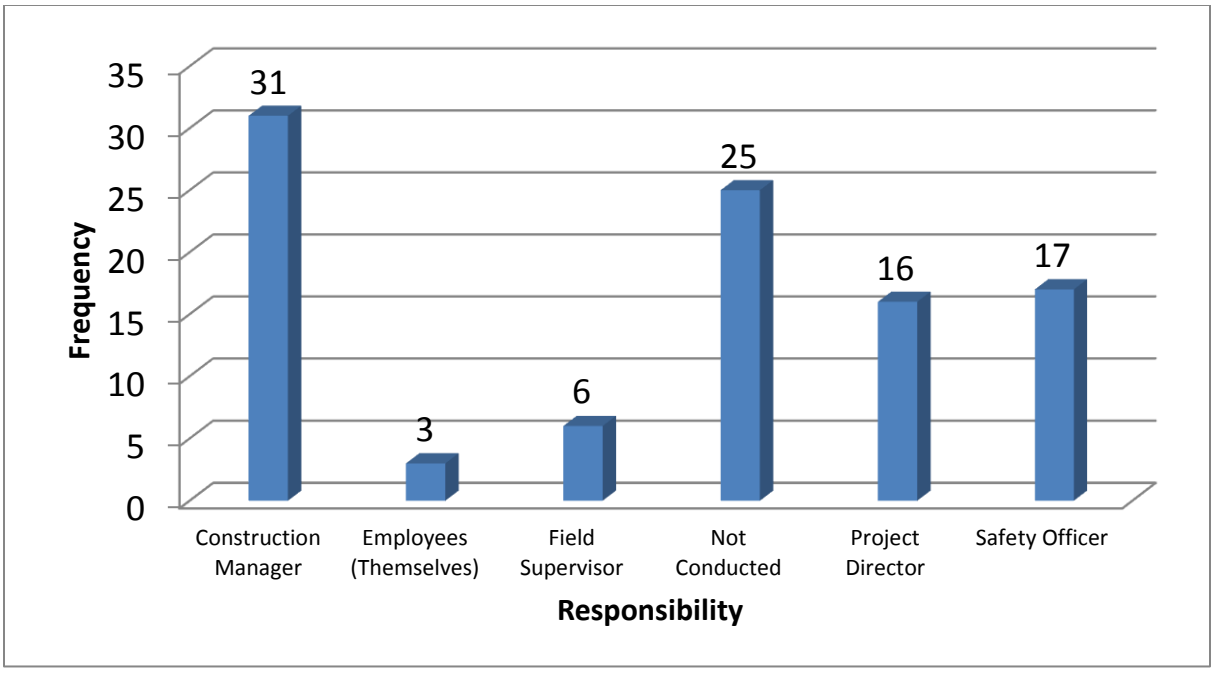

Figure 4.14: Responsibility to conduct safety training

4.5 OVERALL RANKING OF SAFETY TRAINING INDICATORS BY MEANS

The questionnaire comprises 44 question statements comprising safety practices to assess the gaps in performance level/ current state of safety training in CI in Pakistan. These statements are grouped in 5 safety training indicators. The data obtained from 98 respondents is evaluated using MS excel, Mintab and SPSS-19. Ranking of these 5 safety training indicators based on means is given in Table 4.21 and shown graphically in Figure 4.15. Safety Training Index (STI) of the Pakistani CI is calculated as 47.15%. Out of 5 safety training indicators, the indicator of *'Accident Reporting and Investigation Mechanism'* has the highest value of STI (62.07%) whereas *'Construction Safety Management Plan'* has the lowest value of STI (38.46%). It implies that *'Construction Safety Management Plan'* requires most training in Pakistani CI, followed by *'Safety in the Mindset'*, *'Construction Safety Laws, Rules and Regulations'* and *'Safety and Health of Work Place'*.

Table 4.21: Mean and ranking of overall Safety Training Indicators

S. No	Safety Indicators (5)	Mean Percentage	Overall Ranking of Safety Training Indicators
1	Safety in the Mindset	44.58	4
2	Construction Safety Laws, Rules and Regulations	45.03	3
3	Construction Safety Management Plan	38.46	5
4	Safety and Health of Work Place	45.61	2
5	Accident Reporting and Investigation Mechanism	62.07	1
Average of CI in Pakistan		47.15%	-

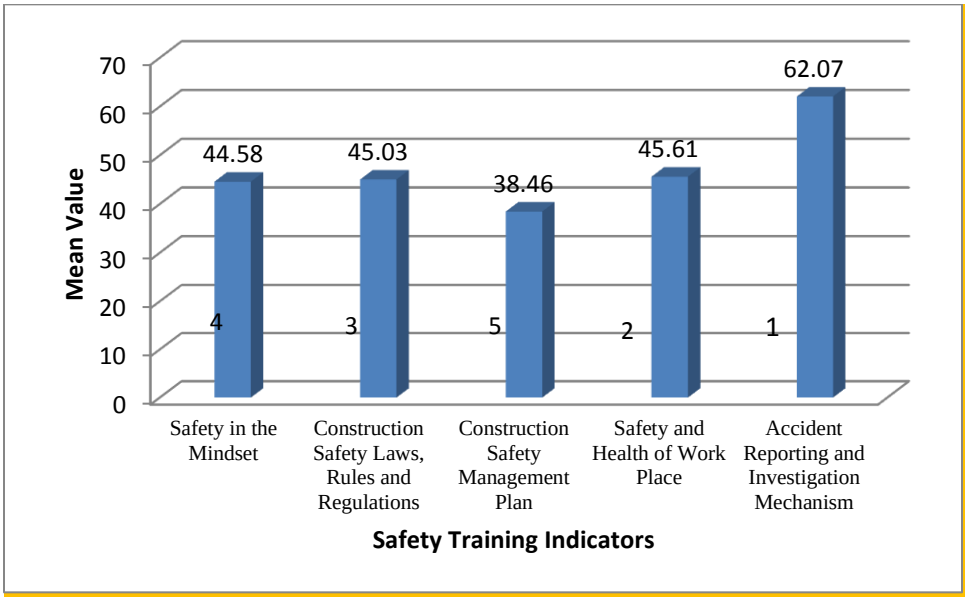

Figure 4.15: Mean and ranking of Safety Training Indicators

4.6 RANKING OF ALL SAFETY TRAINING INDICATORS BY MEANS

The data collected through 98 respondents for forty four (44) safety practices & commitments are grouped into 5 safety training indicators which have been analyzed using SPSS-19 and MS excel. The means, percentages and rankings of all safety practices & commitments have been calculated. Table 4.22 shows the ranking of all safety practices & commitments within each indicator and overall also. Mean value of all safety training indicators for CI in Pakistan is computed as 47.15% which should ideally be closer to 100. This warrants attention of all stakeholders of CI to give emphasis on safety training to improve safety performance of CI in Pakistan.

Table 4.22: Ranking of all Safety Training Indicators by means

Safety Training Indicators		Code	Mean (Percentage)	Ranking of STI Based on Means	
				Within the Indicator	Overall (44 STI)
1. Safety in the Mindset					
01	Top/ Middle Management's conformance level for commitment to implement safety culture	STI-01	60.45	1	9
02	Supervisors conformance level for commitment to give preference to safety over the progress	STI-02	31.88	2	35
03	Worker's conformance level to show inclination/ acceptance towards safety culture through behavior	STI-03	24.74	3	41

2. Construction Safety Laws, Rules and Regulations					
04	Management's conformance level to provide Safety laws, rules or regulations in some form in the organization	STI-04	68.37	1	3
05	Top and Middle Management's conformance level for knowledge regarding safety laws, rules or regulations	STI-05	64.03	2	6
06	Top Management's conformance level for willingness to implement the safety rules and regulations strictly	STI-06	59.44	3	11
07	Supervisor's conformance level to know the methods to implement safety rules and regulations	STI-07	51.02	4	17
08	Supervisor's conformance level for actual knowledge of these rules and regulations	STI-08	36.48	5	30
09	Management's conformance level to make workers legally bound to follow the safety rules and regulations	STI-09	28.06	7	40
10	Worker's conformance level to actually follow safety rules	STI-10	31.12	6	37
3. Construction Safety Management Plan					
11	Management's conformance level to introduce some kind of construction safety management plan influenced from OSHA or some other Safety Organization prepared in the organization before start of any project	STI-11	39.29	6	27
12	Top/ Middle Management's conformance level to implement Safety Management Plan in true spirits	STI-12	41.07	5	25
13	Management's conformance level to conduct Safety Induction Training for new employees or before start	STI-13	32.40	7	34

	of work on new job/ site				
14	Management's conformance level to conduct Refresher Training in Safety periodically	STI-14	23.72	11	43
15	Management's conformance level to select subcontractors who show good safety performance	STI-15	30.10	9	39
16	Management's conformance level to include Construction Safety related clauses in contract documents	STI-16	62.50	1	7
17	Middle Management/ Supervisor's conformance level to recognize the potential hazards 0f accidents before undertaking any activity as well as project	STI-17	59.18	2	12
18	Middle Management/ Supervisor's conformance level for knowledge of safety before undertaking a project	STI-18	53.83	3	15
19	Supervisor's conformance level to understand the plan and implement it	STI-19	43.37	4	22
20	Worker's conformance level for knowledge of relevant safety measures before starting any activity	STI-20	31.38	8	36
21	Worker's conformance level for knowledge of Construction Safety before employment	STI-21	19.90	12	44
22	Management's conformance level to introduce a Reward and Punishment Program for Safe and Unsafe Behavior respectively	STI-22	24.74	10	42
4. Safety and Health of Work Place					
	a. Safety Against Major Causes of Accidents				
23	Top Management's conformance level to provide ample resources and opportunities to prevent against Major Causes of Accidents	STI-23	41.07	3	26

24	Middle Management's conformance level to effectively establish a culture and strategy to prevent against Major Causes of Accidents	STI-24	41.84	1	23
25	Supervisor's conformance level's ability to understand, implement and supervise the safety measures against Major Causes of Accidents	STI-25	41.58	2	24
26	Worker's conformance level to follow the safety instructions to prevent against Major Causes of Accidents	STI-26	38.01	4	29
	b. Housekeeping				
27	Top Management's conformance level to give due consideration to the Housekeeping of construction sites, offices and residential area	STI-27	56.12	1	14
28	% Conformance of Middle Management/ supervisory staff's to regularly check the house keeping	STI-28	50.51	2	18
29	Worker's conformance level for willingness to ensure cleanliness of sites and residential area without any orders	STI-29	30.61	3	38
	c. First Aid				
30	Top Management's conformance level for concern to immediately provide first aid to the affectees	STI-30	73.47	1	2
31	Middle Management's conformance level to make provisions to provide first aid to work force	STI-31	62.50	2	8
32	Supervisor's conformance level to keep and make appropriate use of the first aid boxes	STI-32	45.66	3	21
33	Work force's conformance for level of training to effectively provide first aid to the affectees	STI-33	35.97	4	32

d. Personnel Protective Equipment (PPE)					
34	Top Management's conformance level for willingness to provide PPE to the working parties	STI-34	53.83	1	16
35	Middle Management/ Supervisor's conformance level to ensure the use of PPE by all the working men including themselves	STI-35	46.68	2	19
36	Supervisor's conformance level to ensure the use of PPE forcefully	STI-36	38.27	3	28
37	Management's conformance level to effectively train the workers to use the PPE	STI-37	36.22	4	31
38	Worker's conformance level to consider the use of PPE as effective accident preventing tools and willingness to use them for their own safety	STI-38	33.42	5	33
5. Accident Reporting and Investigation Mechanism					
39	Management's conformance level to have a written accident reporting and investigation mechanism in the organization.	STI-39	64.80	3	5
40	Top Management's conformance level to give priority to accident compilation and investigation	STI-40	60.20	4	10
41	Middle Management's conformance level for concern to investigate the causes of accidents and near misses	STI-41	57.91	5	13
42	Supervisor's conformance level for ability to compile the accident report effectively.	STI-42	46.68	6	20
43	Supervisor's conformance level to report the incidents in time	STI-43	77.55	1	1
44	Worker's conformance level to report the accidents	STI-44	65.31	2	4

	in time and cooperate in investigations				
	Average of CI in Pakistan		47.15%		

4.7 CONFORMANCE OF VARIOUS TIERS FOR SAFETY TRAINING INDICATORS

The results show that top and middle management show better conformance for accident reporting and investigation mechanism and safety in the mind-set whereas least conformance is shown for construction safety management plan. The perception of top and middle management regarding safety training indicators is graphically represented (see Figure 4.16 and Figure 4.17).

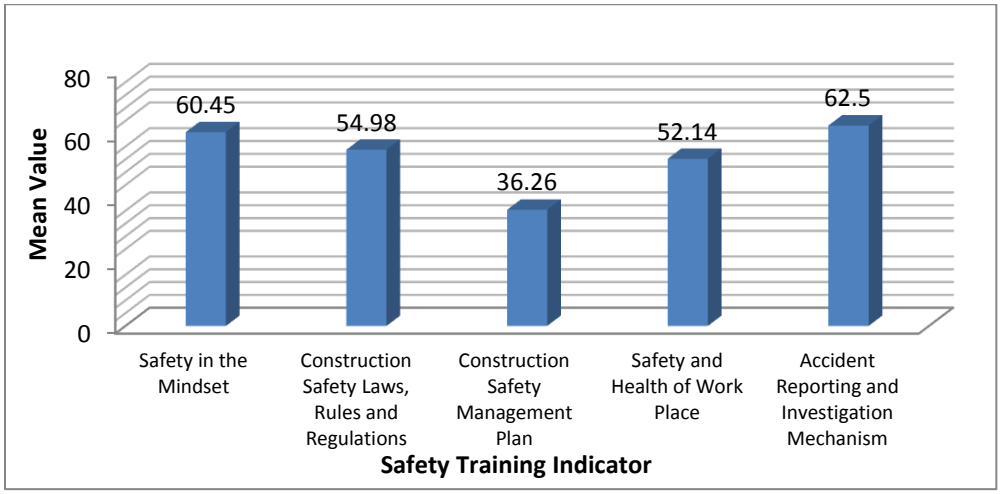

Figure 4.16: Safety Training Indicators - Top Management

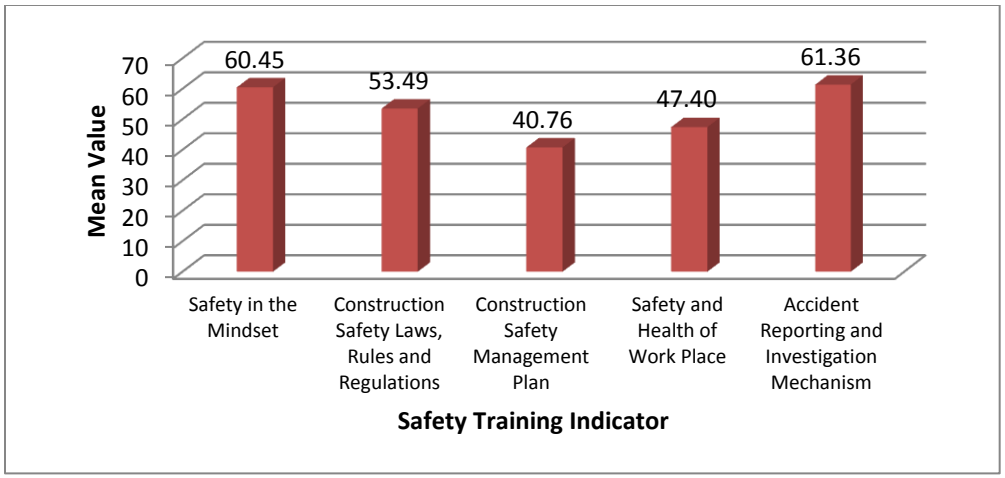

Figure 4.17: Safety Training Indicators - Middle Management

The results show that supervisors give preference to accident reporting of incidents in a timely manner. Moreover, they show concern to relevant knowledge related to construction safety management plan i.e. knowledge of safety and ability to recognize the potential hazards of accidents before undertaking any activity/project but show little concern for understanding and effectively implementing the safety management plan. However, least preference is being given to safety in the mindset.The perception of supervisors regarding safety training indicators is graphically represented in Figure 4.18.

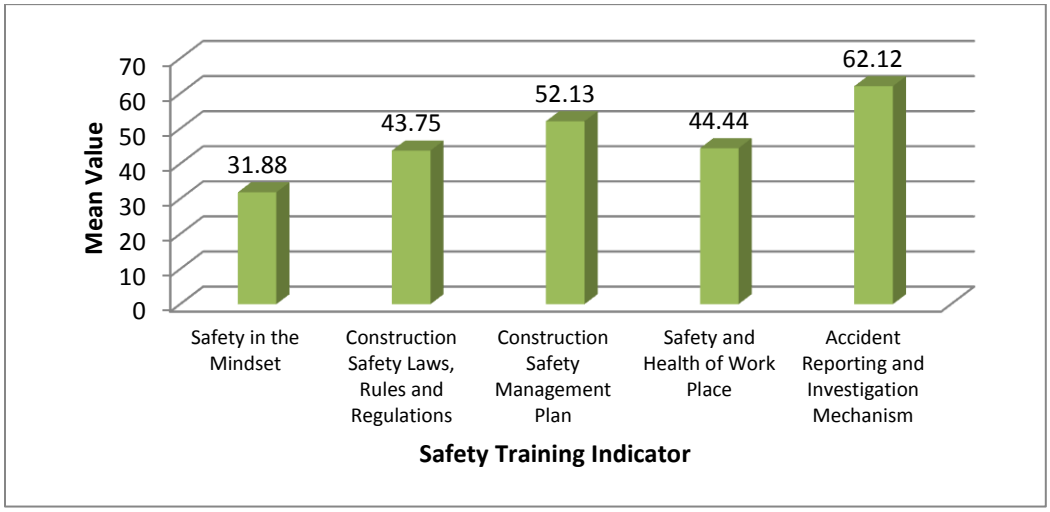

Figure 4.18: Safety Training Indicators – Supervisors

The results show that workers give preference to accident reporting aspect of the indicator of accident reporting and investigation mechanism whereas they lack in investigation aspects of this indicator. However, safety in the mind-set is being given the least preference along with construction safety management plan. The perception of workers regarding safety training indicators is graphically represented in Figure 4.19.

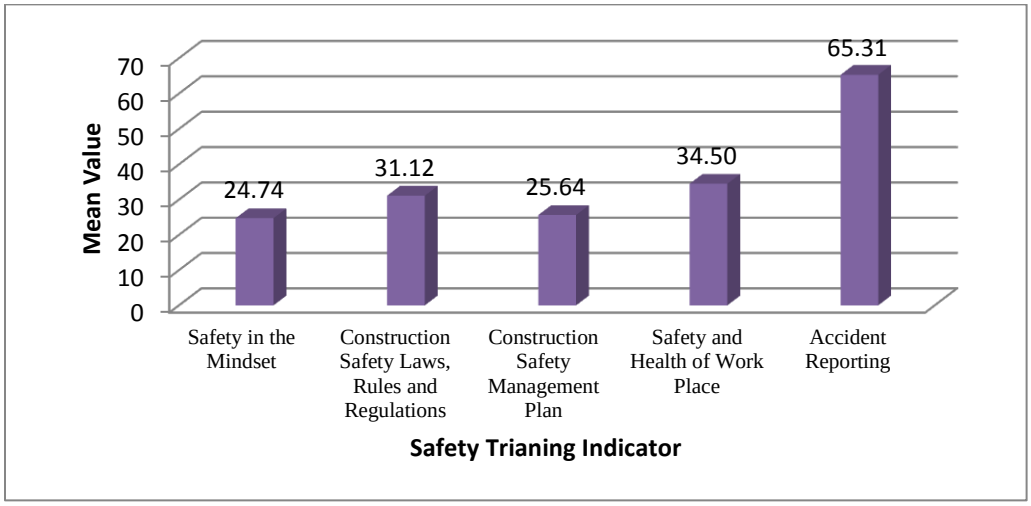

Figure 4.19: Mean Values of Safety Training Indicators – Workers

4.8 SAFETY TRAINING OPTIONS

In order to find out the preferred training option for the training of top management, middle management, supervisors and workers; the respondents were asked regarding their view point. To answer this question, the most important aspects which respondents were required to keep in mind were the educational and socio-economic background of the trainees, their mental horizon, time they can spare and level of training they need for a project. The results are shown in succeeding paragraphs.

4.8.1 Safety Training Options – Top Management

Different respondents suggested different training options for top management. The

respondents were given the choice to select more than one training options which in their perception were best suited for top management. The frequencies of responses are shown in Figure 4.20. Most of the responses (86) were received for a training option which suggests to *'include construction safety in syllabi at professional institute'*, followed by *'special training courses'*, *'include general safety in syllabi at school level'* and *'on job training'*.

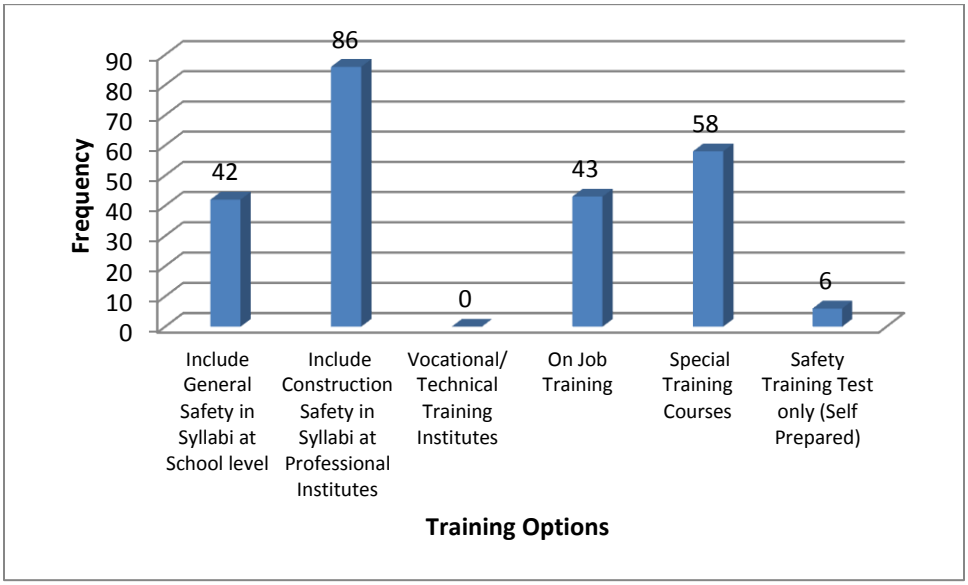

Figure 4.20: Responses for training options - Top Management

4.8.2 Safety Training Options – Middle Management

Different respondents suggested different training options for middle management. The respondents were given the choice to select more than one training options which in their perception were best suited for middle management. The frequencies of responses are shown in Figure 4.21. Most of the responses (82) were received for a training option which suggests to *'include construction safety in syllabi at professional institute'*, followed by *'special training courses'*, *'include general safety in syllabi at school level'* and *'Safety Training Test only (Self Prepared)'*.

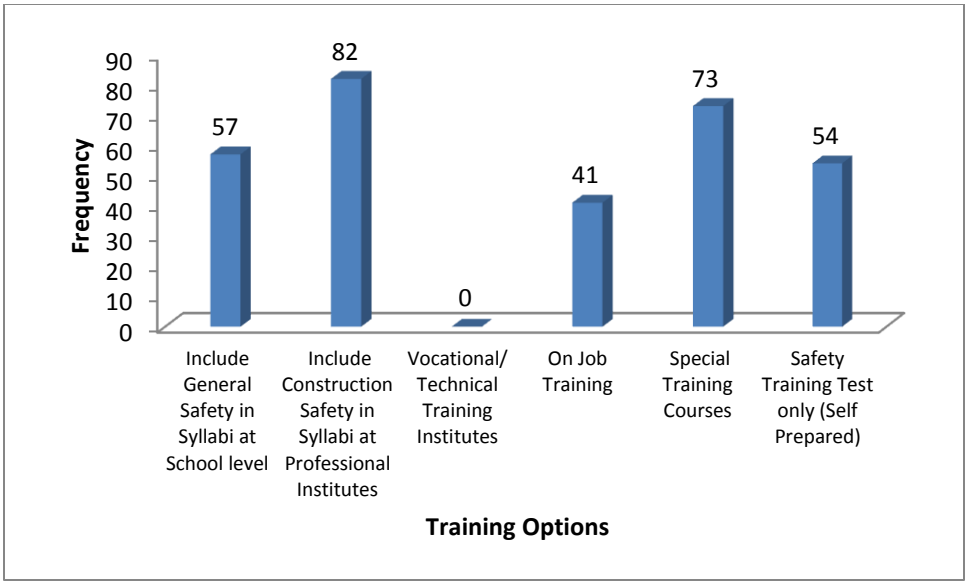

Figure 4.21: Training options- Middle Management

4.8.3 Safety Training Options– Supervisors

Different respondents suggested different training options for supervisors. The respondents were given the choice to select more than one training option which in their perception was best suited for supervisors. The frequencies of responses are shown in Figure 4.22. Most of the responses (86) were received for a training option which suggests 'On Job Training', followed by 'special training course', 'Vocational/ Technical Training Institute', 'Special Training Course' and 'Safety Training Test only (Self Prepared)'.

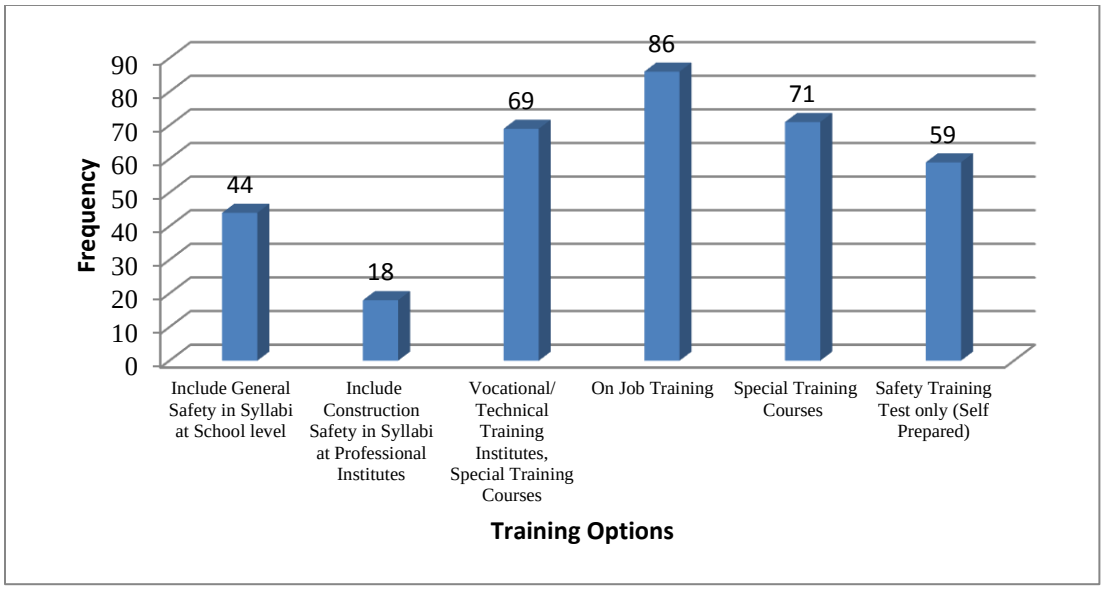

Figure 4.22: Responses for training options – Supervisors

4.8.4 Safety Training Options – Workers

Different respondents suggested different training options for workers. The respondents were given the choice to select more than one training options which in their perception were best suited for workers. The frequencies of responses are shown in Figure 4.23. Most of the responses (88) were received for a training option which suggests 'On Job Training', followed by 'special training course', 'Vocational/ Technical Training Institute', and 'Include General Safety in Syllabi at School level'.

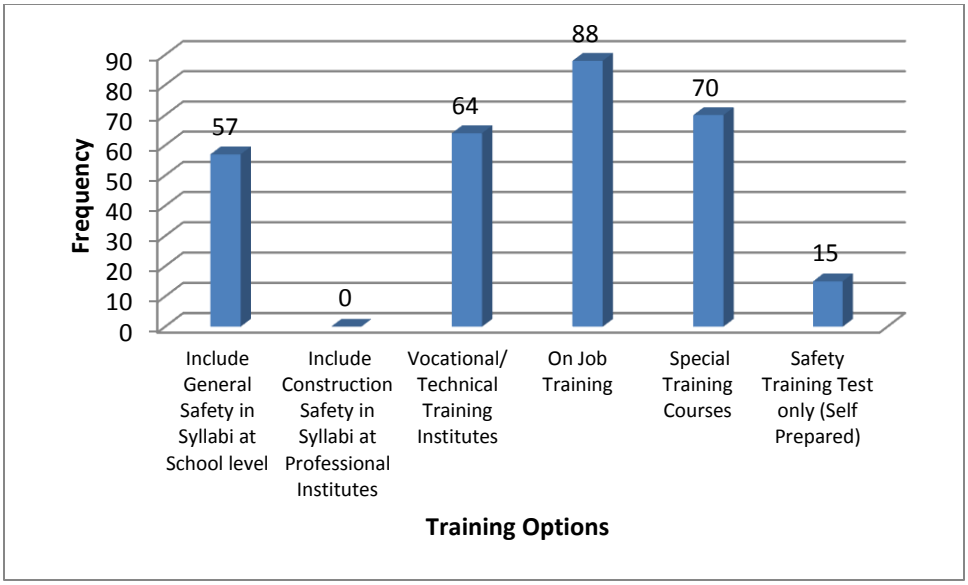

Figure 4.23: Responses for training options – Workers

4.8.5 Comparison of Safety Training Options

The Figure 4.24 summarizes the respondents' preferences of training options for top management, middle management, supervisors and workers. Comparison can be made that which training option is best suited for which tier of management including workforce on a project.

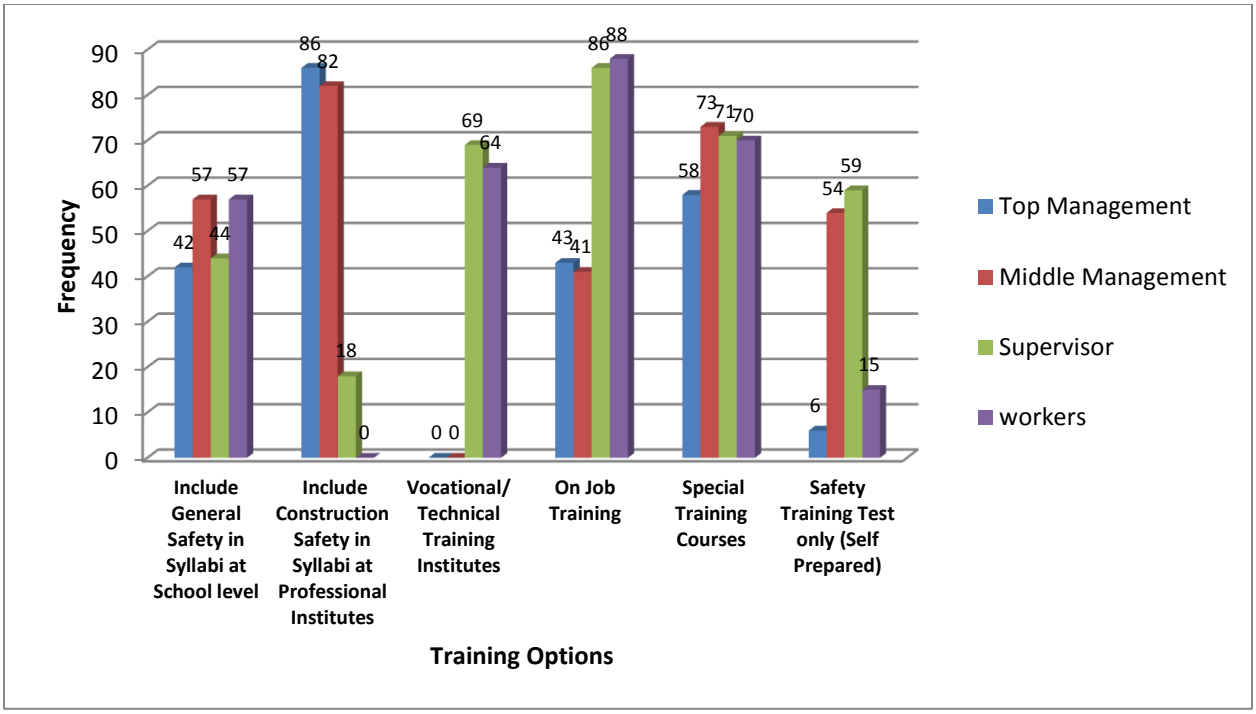

Figure 4.24: Comparison of training options

4.9 TRAINING DELIVERY METHODS - COMPARISON

The respondents were asked to recommend training delivery methods which would be most appropriate for training of various tiers of management and workers in a construction organization. The respondents were given the choice to choose more than one methods of delivery best suited for a particular tier of management or workers. The results show that respondents' recommendations are almost unanimous for lectures to be an appropriate delivery method for all the tiers of management including workers (see Figure 4.25). For top management, most of them have preferred seminars, lectures and conferences as appropriate delivery methods. For middle management, the preferences have been given to lectures, case studies, seminars and conferences whereas case study is last in the row. For supervisors, the preferences have been given to field visits followed by lectures and films, tapes or videos. For workers, maximum number of respondents has chosen films, tapes or videos followed by lectures.

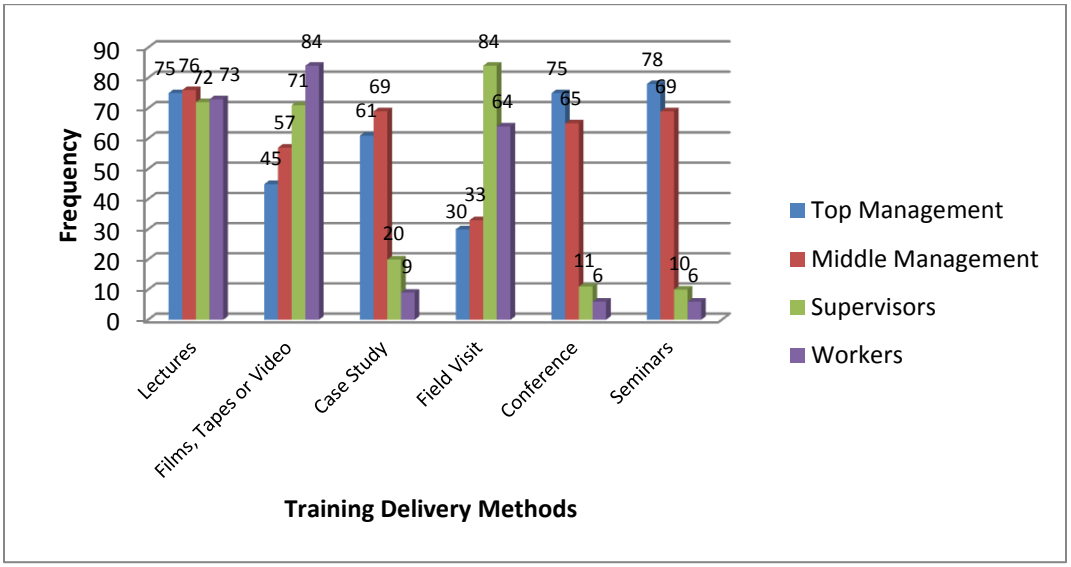

Figure 4.25: Comparison of training delivery methods

4.10 FREQUENCY DISTRIBUTION OF RESPONDENTS' ANSWERS

Figure 4.26 exhibits the frequency distribution of 98 respondents' answers which show conformance of safety practices. The scores entered by the respondents range from 0 to 4 i.e. range of conformance for a safety practice is from never/ not applicable (0 score) to almost always (4 score). Frequency distribution of answers show that for various safety practices only 18% respondents rated a score of 0 (never/ not applicable), 29% rated a score of 1 (seldom), while a score of 2 (sometimes) is rated by 21%, score of 4 (often) by 16% and score of 5 (almost always) was rated by 16% respondents. It means that conformance for safety practices is towards negative side which indicates that there is great need to improve safety performance through training in CI in Pakistan.

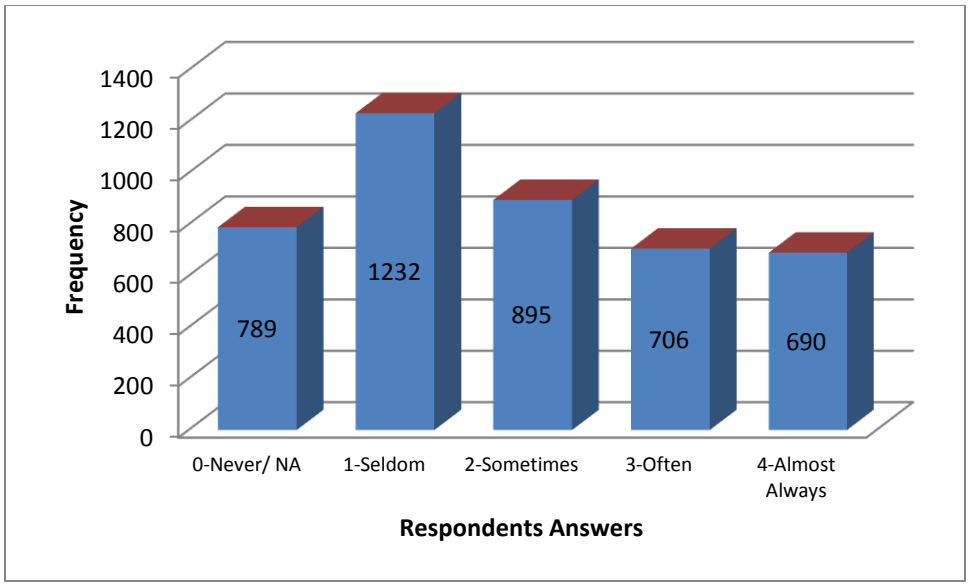

Figure 4.26: Frequency distribution of respondents' answers

4.11 DISCUSSION ON RESULTS

4.11.1 Overall Safety Perception

Overall safety perception is 47.15% which is quite less and indicates that a holistic effort is required to impart safety training in the CI in Pakistan. Five (5) safety training indicators which were developed from the literature review were equally assessed and compared for the determination of safety perception with each other. Among them '*accident reporting and recording mechanism'* is comparatively better perceived in the industry as compared to the others with mean value of 62.07%. '*Construction safety management plan'* is far behind at 38.46% (lowest perceived). Since all the mean values are quite less, hence safety training for improving the safety perception and implementing the safety practices is the dire need of the industry. The detailed discussion on each of the indicator is given below:-

a. Safety in the mindset

Mean value of 44.57% indicates that safety has not gained enough importance in the minds of the construction stakeholders. The top and middle management have comparatively better safety perception in the mindset i.e. 60.45% as compared to supervisors and workers (see Table 4.22). More training is required to inculcate safety in

the mindset at workers and supervisory level as they have less safety awareness in their minds (31.88% for workers and 24.72% for supervisors).

b. Safety laws, rules, and regulations

Mean value of 45.03% which is still at lower side indicates that safety laws, rules and regulations are either do not exist or rarely followed. The top and middle management has satisfactory conformance level (68.37%) to provide safety laws, rules ad regulation and have considerable knowledge (conformance is 64.03%) about them (see Table 4.22). However, the top management is not fully committed to implement the safety rules and regulations very strictly (conformance is 59.44%). Similarly, at supervisor's level, the conformance level for knowledge and commitment to implement these rules is quite low i.e. 36.48%. However, supervisors are moderately committed to know the methods to implement safety rules and regulations (conformance is 51.02%). Workers are not committed to either follow or know the safety rules (conformance is 31.12%) which may be because of lower value for safety in the mindset. Special safety training for management in general and supervisors and workers in particular are required for awareness and importance of safety laws, rules and regulations.

c. Construction safety management plan

The results show that conformance for safety management planning is lowest (mean value is 38.46%) among all the indicators. It depicts that safety management planning is very deficient in organizations and requires due cognizance. Conformance to prepare and implement any safety management plan is not very encouraging among all the tiers i.e. top management, middle management, supervisors and workers (see Table 4.22). The results also show that top management has very little interest (39.29%) in incorporating OSHA or other safety organizations recommended safety plans within their organizations. Moreover, results show that top management is least interested (23.72%) to organize any safety training in their organizations. However, they want to include safety related clauses (62.50%) in the contract documents. Workers and supervisors have very bleak concept of any kind of safety management plans. No kind of incentive for safe behavior is planned at the management level (24.74%). Hence there is a need of training for all the stakeholders in the organization for knowing the efficacy and importance of

safety management plan.

d. Safety and health of work place

Mean value of 45.6% is the highest among all other training indicators and show that all stakeholders have reasonably good perception of safety and health of work place. However, the value itself is not very encouraging and depicts that there is a lot of room for improvement. Discussion on results will be done in succeeding paragraphs (see Table 4.22).

1) Safety against major causes of accidents

The results show almost equal conformance by top management (41.07%), middle management (41.84%) and supervisors (41.58%) to safeguard against major causes of accidents; whereas the workers have less conformance (38.01%) for this indicator.

2) Housekeeping

The results show that top management gives better consideration (56.12%) to housekeeping of construction sites, offices and residential area as compared to other tiers of management. Middle management and supervisors show considerable conformance to regularly check housekeeping, whereas workers willingness to ensure cleanliness of sites and residential area without any orders is quite low i.e. 30.61%. Workers are required to be educated and need reasonable training in this area.

3) First aid

The results show that top and middle management have better conformance to provide first aid to affected for which they make necessary provisions in the management plan and documents. However, supervisors have quite less ability (45.66%) to keep and make appropriate use of first aid boxes. Workers level of training to provide first aid is also not very encouraging (35.97%).

4) Personnel protective equipment (PPE)

The result shows that top management has reasonably good commitment (53.83%) to provide PPE to the working parties. However, the management shows very less interest (36.22%) to train workers in use of PPE. Middle management/ supervisors show slightly low (46.68%) commitment for use of PPE by themselves and by all the working parties. A question was asked in the survey as if the supervisors ensure the

use of PPE forcefully; and the conformance percentage was quite low (38.27%). Initially it appeared to be good as it showed that workers willingly use PPE but actually it was not the case which was clarified by a second question specially designed to remove the ambiguity. Second question was asked that whether or not workers consider PPE as an effective accident preventing tool and use it willingly for their own safety and the percentage was quite low (33.42%). Hence, it is concluded that neither workers willingly use PPE as accident preventing tool nor supervisors force them for their use.

e. Accident reporting and recording mechanism

The mean value of 62.07% represents that accident reporting and recording mechanism indicator have the best conformance for safety in the CI. Management's commitment to have written accident reporting mechanism, reports compilation and investigating the causes of accidents is quite encouraging. However, supervisor's ability to compile the reports (recording) is towards lower side (46.68%) and requires attention and training to improve upon this area. It is quite encouraging that supervisors and workers do not try to put accidents and near misses under the carpet and report the incidents in time. It naturally help in proper investigation of accidents.

The results of Kruskal Wallis and Mann-Whitney tests (see Tables 4.5 to Table 4.20) show that the contractor have comparatively better conformance for safety and is more inclined towards carrying out safety training than owners. However, contractors are not able to do it in true spirits owing to many reasons like client's low attention towards safety and safety training being a non- paid item in BOQ.

4.11.2 Preferred Training Options

The results show that respondents have almost unanimous preference to include general safety in syllabi at school level for all the tiers of a construction organization (see Figure 4.24). It can be concluded that general awareness about safety is must from childhood. Most of the respondents have chosen to include construction safety in syllabi at professional institutes for top and middle management. It reflects that any type of top and middle management in CI should have construction safety knowledge. It would help to enhance the safety performance of the CI

when safety practices will be enforced from top to bottom levels. For supervisors and workers, most of the respondents have chosen on-job training followed by special training courses and vocational/ technical training institutes. It reflects that portfolio of duties for supervisors and worker is quite vast and they cannot simply rely on institutional learning only; but have to take special courses and must get multi-directional experience through on-job training.

4.11.3 Preferred Training Delivery Methods

The respondents were asked that which delivery method is most appropriate for various tiers of management including workers. The respondents, while answering this question must have kept in mind that an effective training delivery method should have an inherent capability to impart more training in shortest possible time, compatible to the mental horizon of the trainees and deliver the main concepts of intended training easily and precisely.

The results show that lectures must be a part of training delivery method for all the tiers of management including workers (see Table 4.25). While making safety training programs for top management, preference should be given to seminars, lectures and conferences; as top management require a broad brush of safety training and does not require going in nitty-gritties. For the training program of middle management, preferences should be given to lectures, case studies, seminars and conferences. Since supervisors are required to know safety concerns related to their jobs/ duties in quite details and must have a real time experience of safety duties, problems and solution strategies, therefore for supervisors' training program, preference should be given to field visits followed by lectures and films, tapes or videos. Similarly, for training program of workers, the training should be made interesting, effective and comprehensive by making maximum use of films, tapes or videos and lectures.

4.12 SUMMARY

Statistical analysis in detail has been discussed in this chapter. Conformance for 5 safety training indicators has been analyzed using MS Excel and SPSS-19 so as to assess the safety training needs of CI in Pakistan. Data was collected from PEC registered construction companies. Out of 5 safety training indicators, the indicator of *'Accident Reporting and Investigation Mechanism'* has the highest conformance value (62.07%) whereas *'Construction Safety Management Plan'* has the lowest conformance value (38.46%).

Cronbach's Coefficient Alpha value (0.978) has confirmed suitability of data for further analysis. The results of Shapiro Wilk test has shown non-normality of data; hence non-parametric test (Kruskal Wallis) was perfomed to assess the perception difference of clients, consultants and contractors regarding safety conformance for various safety training indicators in the CI in Pakistan. Moreover, Mann-Whitney test was performed to assess the difference of perception between two groups of stakeholders.

To infer about the population mean, the non-parametric test Wilcoxon Signed Ranked was performed. As per this test the population means at 95% confidence interval for different safety training indicators for CI in Pakistan were inferred. Overall population mean for safety training indicators came out within the range $40.3 \leq \mu \leq 49.8$.

Perception of top/ middle management, supervisors and workers regarding safety training indicators was evaluated and discussed in detail. Moreover, preferred safety training option and delivery methods for workers, management and supervisors were also discussed which may be incorporated in Pakistan's CI.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The important findings of this study are appended below:

a. Safety training indicators to find safety training needs in CI in Pakistan are followed at only 47.15 % which is not satisfactory. Hence, this low value indicates that safety training is required to be carried out to enhance safety performance of CI in Pakistan.

b. The training indicator of safety in the mindset is followed at 44.57% which is also quite low and indicates that safety awareness training should be carried out to inculcate safety in the mindsets.

c. The low value (45.03%) of safety laws, rules and regulations indicator shows that neither comprehensive safety rules/ laws are available in CI in Pakistan nor they are being followed in true spirit.

d. The training indicator of safety management planning has a mean value of 38.46% which is the lowest among all the indicators. It depicts that safety management planning is extremely deficient and requires due cognizance.

e. Though mean value of safety and health of workplace is second best (45.6%) as compared to other training indicators but is still not very encouraging. It indicates that more improvement through training is required in this area.

f. The mean value of 62.07% represents that management including workers show best commitment for the training indicator of accident reporting only. However, the recording and investigation mechanism is lacking among all the stakeholders.

g. Conformance for Training Indicators by various tiers

1) Top and middle management show better conformance for accident reporting and investigation mechanism (compliance for top management is 62.5% and for middle management is 61.36%). Top and middle management show least conformance for construction safety management plan (compliance for top management is 36.26% and

for middle management is 40.76%).

2) Supervisors show better conformance (62.12%) for accident reporting in a timely manner and have relevant knowledge of construction safety management plan (52.1%). However, supervisors show least conformance for safety in the mindset (31.88%).
3) The workers show better conformance (65.31%) for accident *reporting* aspect in accident reporting and investigation mechanism whereas lack in *investigation* aspects. The workers show least commitment for safety in the mindset (24.74%).

h. Preferred Training Options

1) 50% of the data shows that general safety should be included in the syllabi at school level for all the tiers.
2) More than 80% of the respondents agree for construction safety training for the top and the middle management at professional institute level.
3) Bulk of the respondents demands construction safety training at vocational/ technical training institutes for supervisors and workers i.e. 69 responses for supervisors and 64 for workers.
4) More than 80% of respondents emphasize on-job training for worker and supervisors whereas less than 50% for management level.
5) 50% and more respondents say that safety training test should be conducted for middle management and supervisors. Few responses for conducting test for top management and workers were received.

i. Preferred Training Delivery Methods

1) Lectures must be a part of training delivery method for all the tiers of management including workers as more than 70% of the respondents are of the same opinion.
2) While making safety training programs for top management, preference should be given to seminars, lectures and conferences.
3) For the training program of middle management, the preference should be given to lectures, case studies, seminars and conferences.
4) For supervisor's training programs, the preference should be given to field visits supplemented by lectures and films, tapes or videos.

5) For training program of workers, the training should be made interesting, effective and comprehensive by making maximum use of films, tapes or videos and lectures.

j. Most of the respondent's organizations (56%) do not allocate any budget for the safety training.

k. Tool box meetings are mostly not held (46.94%).

l. Construction managers were given maximum responsibility (31%) for conducting the safety training in the organization.

m. Contractors are found comparatively better followers of safety training indicators which have been proved by Kruskal Wallis Test.

n. The priority to conduct safety training to avert accidents in building projects is as under :

1) Fall of individual from height.
2) Electric shocks.
3) Struck by an object/ machinery.
4) Others (toxic Gas, lack of Oxygen, poor personal health, fire, drowning etc.).
5) Caught in between the plants, confined place.

o. The priority to conduct safety training to avert accidents in road projects is as under:

1) Struck by an object/ machinery.
2) Fall of individual from height.
3) Caught in between the plants, confined place.
4) Electric shocks.
6) Others (toxic Gas, lack of Oxygen, poor personal health, fire, drowning etc.).

5.2 KNOWLEDGE CONTRIBUTION

This research study is an important effort to identify the construction safety training needs of CI in Pakistan. It may be helpful for the stakeholders of CI who want to assess the weaknesses in the safety practices being followed in their organizations. It will also provide guideline to training institutes and professional colleges of civil engineering to revise their syllabi and methods of training. This effort will definitely contribute towards producing better trained workforce which in turn will enhance the safety performance of the CI in Pakistan.

5.3 RECOMMENDATIONS FOR FUTURE RESEARCH

a. A case study should be conducted on a construction project undertaken in NUST or other educational institution by conducting proper safety training and benefits should be analyzed in terms of cost and time.
b. The study may be repeated with a larger sample size to include the views of workers regarding safe practices and all types of construction projects to validate the results of this study.

REFERENCES

Abdelhamid, T. S., and Everett, J. G. (2000). "Identifying Root Causes of Construction Accidents".*Journal of Construction Engineering and Management*, 126(1), 52-60.

Adams, O.A., 1992. Management training needs of Nigerian indigenous contractors and their preferred delivery systems, Unpublished PhD Thesis, University of London, London.

Ahmed, S. M., Kwan, J. C., Ming, F. Y. W. (2000). "Site Safety Management in Hong Kong". *Journal of Management in Engineering*, 16(6), 34-42.

Ali, T. H. (2006). "Influence of National Culture on Construction Safety Climate in Pakistan". *Doctor of Philosophy*, Griffith University, Gold Coast Campus.

Arumugam, E., and Thirumurthy, A. M. (2007). "Benchmarking Studies on Safety Management in Construction Industries of India". *Master of Science Dissertation.*

Awan, T. 2001. "Occupational Health and Safety in Pakistan" Asia Labour update Report No.39.

Barbazette, J. (2006). Training needs assessment: Methods, tools and techniques, p. 5. San Francisco: Pfeiffer.).

Broad, M.L. & Newstrom, J.W. (1992). *Transfer of training.* Reading, MA: Perseus Books, p. 5.

Brown, J. W. 2002, "Training needs assessment: A must for developing an effective training program". Public Personnel Management, 31(4), 569-578.) p. 569.

"Career Guide to Industries", US Department of Labor Statistics (2011).

Choudhry, R. M. (2007). "Exploratory Study of the Safety Culture in Construction". *Doctor of Engineering Dissertation*, Tsinghua University.

Choudhry, R. M., and Fang, D. (2008). "Why Operatives Engage in Unsafe Work Behavior: Investigating Factors on Construction Sites". *Safety Science*, 46(4), 566-584.

Choudhry, R. M., Fang, D., and Ahmed, S. M. (2008). "Safety Management in Construction: Best Practices in Hong Kong". *Journal of Professional Issues in Engineering Education and Practice*, 134(1), 20-32.

Choudhry, R. M., Fang, D., and Rowlinson, S. (2008). "Challenging and Enforcing Safety Management in Developing Countries: A Strategy". *International Journal of Construction Management*, 87-101.

Choudhry, R. M., Fang, D., and Lingard, H. (2009). "Measuring Safety Climate of a Construction Company". *Journal of Construction Engineering and Management*, 135 (9), 890-899.

Cohen, J. M. (2002). "Measuring Safety Performance in Construction".*Occupational Hazards*, 64(6), 41 – 44.

Cohen, A. & Colligan, J. (1998). "*Assessing occupational safety and health training: A literature review"* (NIOSH Publication No. 98-145). Washington, DC: U.S. Department of Health and Human Services, CDC, NIOSH.), p. 22.

'Construction Industry Digest' by OSHA, OSHA2202-09R 2011.

'Construction Site Safety Handbook for Public Works Program', Work Bureau, 2000, Government of Hong Kong

'Construction Worker Safety Pocket Guide' by OSHA, OSHA 3252-05N 2005.

Cooper, M., & Philiphs, R. (1994). Validation of a safety climate measure. *In Proceedings of the Annual Occupational Psychology Conference* , 3-5.

Cormack, D., (2000).*"The Research Process in Nursing"*.4th edition, Blackwell Science.

Cox, S.J. and Cheyne, A.J.T. (2000), "Assessing Safety Culture in Offshore Environments". Safety Science, 34, pp. 111-129.

Davies, V. and Tomasin (1990).*'Construction Safety Handbook'*, Thomas Telford, UK.

Dillman, D. A. (2000). "Mail and Internet Surveys: The Tailored Design Method". *New York: John Wiley & Sons, Inc.*, 178-180.

Eich, W. 1996 "Safety Practice of Large Constrution Firm." Master's thesis, University of Washington, Seattle, WA.

Factories Act-1934."*Chapter -3, Health and Safety".*

Farooqui, R. U., and Ahmed, S. M., (2007)."Developing Safety Culture in Pakistani Construction

Industry - An Assessment of Perceptions and Practices among Construction Contractors".*In 4th International Conference on Construction in the 21st Century (CITC-IV) Australia*.

Farooqui, R. U., Arif F., and Rafeeqi, S. F. A. (2008) "Safety Performance in Construction Industry of Pakistan". *In 1st International Conference on Construction in Developing Countries (ICCIDC-I)*, 74-87.

Farr, J.V. and Sullivan Jr., 1996.Rethinking training in the 1990s. Journal of Management in Engineering, 12(3), 29 – 31.

Fellows R., and Liu A. M. (2003). *'Research Methods for Construction'*. 2nd edition, John Wiley & Sons.

'GoP Labor Policy (2010)'. http://www.eobi.gov.pk/announcement/labour+poilcy+2010.pdf

Health and Safety Training, A brief guide, Leaflet INDG 345 (rev1), published 11/12 by Health and Safety Executive (HSE), UK.

Hinze, J., and Harrison, C. (1981). "Safety Programs in Large Construction Firms". *ASCE, Journal of the Construction Division*, 107(3), 455-467.

Hinze, J. W. (2006). "*Construction Safety"*, Second Edition, Alta Systems, Inc, P-235, 87-90 & 235-249.

Hinze, J. W. (1997). "*Construction Safety"*, Prentice-Hall, Inc.

Hinze, J. W. (2002). "*Safety Plus: Making Zero Injuries a Reality", Construction Industry Institute, Research Report 160-11, The University of Texas at Austin.*

Hinze, J. W. (2003). "An Evaluation of Safety Performance Measures for Construction Projects".*Journal of Construction Research*, 4(1), 5-15.

Holt, John Allan St. (2005). "*Principles of Construction safety*".

Huang, X. (2003)."The Owner's Role in Construction Safety".*Doctor of Philosophy Dissertation*, University of Florida.

Huang, X. and Hinze, J. (2006)."Owner's Role in Construction Safety". *Journal of Construction*

Engineering and Management. 132 (2), 164-173.

http://www.hse.gov.uk/pubns/indg345.pdf & http://en.wikipedia.org/wiki/NEBOSH#Accredited_Course_Providers

http://www.kensaibou.or.jp/english/activity/training_activities.html & http://www.kensaibou.or.jp

http://www.safeworkaustralia.gov.au/sites/SWA & (http://en.wikipedia.org/wiki/Safe_Work_Australia)

ILO Statistics (2005), "Facts on Safety at Work". http://www.ilo.org/wcmsp5/groups/public/dgreports/dcomm/documents/publication/wcms_067574.pdf

K.T. Odusami, O.S. Oyediran and A.O. Oseni, Training Needs Of Construction Site Managers, *Emirates Journal for Engineering Research, 12 (1), 73-81 (2007).*

Kartam, N. A. (1997). "Integrating Safety and Health Performance into Construction CPM" *Journal of Construction Engineering and Management*, 123(2), 121-126.

'Labor Laws in Pakistan'; http://www.labourunity.org/labourlaws.html

Li, C.C. (2007). "The Proficient SPSS Statistical Analysis in Practice and Application, CHWA".

Masood, R. and Choudhry, R.M. (2011). "Measuring Safety Climate to Enhance Safety Culture in the Construction Industry of Pakistan". *CIB W099 Safety and Health in Construction Conference in Washington, D.C., USA.*

Mayeana Kamara. (2010). The Effectiveness Of Safety Training, Master's Thesis, New Jersey institute of Technology.

McClelland, S. (1993). "Training needs assessment: An "open systems" application". *Journal of European Industrial Training, 17*(1), 12-17

McMeel, K. 1979, "The Effect of Foremen on Safety on Super Projects." Unpublished Master's report, University of Missouri.

'Ministry of Professional and Technical Training';http://moptt.gov.pk/

Mohamed, S. and Ali, T. (2005). "Safety Behaviour in the Construction Industry in Pakistan". *Proceedings of the 4th Triennial International Conference, Rethinking and Revitalizing Construction Safety, Health, Environment and Quality*, Port Elizabeth, South Africa, 64-75.

National Occupational Health & Safety Commission, Australia (1999) "OHS Performance Measurement in the Construction Industry-Development of Positive Performance Indicators".

National Safety Council Statistics (2007). http://www.nsc.org/Pages/Home.aspx

Naoum, S. (2007). *'Dissertation Research and Writing for Construction Students'*. 4th edition.

Occupational Safety and Health Administration (OSHA) Regulations (Standards-29 CFR) http://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=1926

Occupational Safety and Health Administration (OSHA), Training Requirements in OSHA Standards and Training Guidelines, US Department of Labour

Occupational Safety and Health Information Manual for supervisors in the NSW CI by Work Cover NSW, 1999

Occupational Health and Safety Information Manual for Supervisors in the NSW Construction Industry Prepared by Work Cover, in consultation with industry, as part of Work Cover's Year 2000 Best Practice Program Work Cover, 1999.

Oppenheim, A. N. (1992). *'Questionnaire Design, Interviewing and Attitude Measurement'*, Pinter Publishers Limited, London.

Ogunlana, S.O., Thapa, S., and Dey, P.K., 2002. Assessing engineering training needs, methods and effectiveness (94-102). In: Ogunlana, S. O. (ed.), Training for construction industry development, Rotterdam: CIB publication.

"Pakistan Engineering Council".*'List of Licensed Contractors-2013(category wise)'*.

Raheem, Adeeba A., Jimmie W. Hinze and Choudhry R.M. (2011). "Comparative Analysis of

Construction Safety in Asian Developing Countries". 6th *International Conference on Construction in the 21st Century (CITC-VI)*

"Construction Challenges in the New Decade" July 5-7 2011, Kuala Lumpur.

Rossett, A. (1987). *Training needs assessment, P-15t.* Englewood Cliffs, NJ: Educational Technology Publications.

Rowlinson, Steve (2003). *'Construction Safety Management Systems'.*

Rowlinson, Steve (2004), Construction Safety Management Systems, "Health & Safety Training and Education: A Case of Neglect?"

Saqib, M., Farooqui R.U, Saleem, F. and Lodi S.H. (2010)."Developing Safety Culture in Pakistani Construction Industry - Site Safety Implementation and Safety Performance Improvement".*2nd International Conference on Construction In Developing Countries (ICCIDC-II),* 376-383.

Saunders, M., Lewis, P., and Thornhill, A. (2007). *'Research Methods for Business Students'*. 4th edition. London: Prentice Hall.

"SBP Annual Report", http://www.sbp.org.pk/reports/annual/arFY11/Sector_Studies.pdf

Suazo, G. A., and Jaselskis, E. J. (1993)."Comparison of Construction Codes in United States and Honduras".*Journal of Construction Engineering and Management,* 119(3), 560-572.

Tauha Hussain Ali, (2006). Influence of National Culture on Construction Safety Climate in Pakistan. PhD Thesis, Griffith University.

Teo, E.A.L., and Ling, F.Y.Y. (2005). "Developing a Model to Measure the Effectiveness of Safety Management Systems of Construction Sites". *Building and Environment*, 41(11), 1584-1592.

Teo, E.A.L., Ling, F.Y.Y., and Chong, A.F.W. (2004). "Framework for Project Managers to Manage Construction Safety". *International Journal of Project Management*, 23(4), 329-341.

http://www.vividpk.com/about-viosh.html

Whiles, A. (1999). "Workplace training: The learning curve". *Occupational Health and*

Training, 10. p. 10.

www.ilo.org & http://www.ilo.org/sector/Resources/training-materials/ WCMS_161706/ lang--en/ index.html

www.cosha.org.cn & http://english.gov.cn/2005-10/20/content_80531.html).

Zahoor, H. 2012, "Benchmarking the Current State Of Construction Safety Practices in Pakistan". *Masters Dissertation thesis, NUST.*

Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journals of Applied Psychology* , 96-101.

APPENDIX-I

NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY, ISLAMABAD

QUESTIONNAIRE

Subject: **Study of Safety Training Needs for Construction Workers, Supervisors, Middle Management and Top Management**

General Information about the Respondent	
Personal Details:	
Name: (Optional)	
Name of Company:	
Telephone: (Optional)	
Email: (Optional)	
Please Encircle Appropriate Category for Each Question Below	
Age (years)	1. Under 18 2. 18-25 3. 25-35 4. 35-50 5. 50+
Profession	1. Architect 2. Civil Engineer 3. Construction/ Technical Supervisor 4. Safety Supervisor 5. Other
Position/Appointment	1. Lower Management 2. Middle Management 2. Top Management 4. Owner 5. Other

General Information about the Respondent	
You belong to which stakeholder organization?	1. Owner 2. Contractor 3. Consultant 4. Subcontractor
Experience in Construction Industry (years)	1. 0-5 2. 6-10 3. 11-15 4. 16-20 5. 20+
Education	1. Primary/ Secondary 2. Certificate/Diploma 3. Bachelor's Degree 4. Master's Degree 5. Doctorate

Keeping in view your experience, please prioritize the under mentioned causes due to which most of the accidents have occurred in your construction projects, irrespective of their nature i.e. minor, major, fatal, near misses:- (Please mark in priority order i.e. I,II,III,IV,V)

S/No	Causes	Priority	
		Building/Infrastructure	Roads/ Highways
1	Fall of individual from height		
2	Struck by an object/machinery		
3	Caught in between the plants, machinery, objects, confined space		
4	Electrical shocks		
5	Others (Toxic Gas, lack of Oxygen, poor personal health, fire, drowning etc.)		

Study of Safety Training Needs for Construction Workers, Supervisors, Middle Management and Top Management								
Safety Training Indicators *Please encircle one box best suited with the practices of your company*		**Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**	**NA**
1. **Safety in the Mindset** *(Safety Importance, inclination towards safety, indoctrination of safety concepts in the minds etc)*							
01	Is Top and Middle Management Committed to Implement Safety Culture?						
02	Do Supervisors give preference to safety over the progress?						
03	Does Behavior of the workers show their inclination and acceptance towards safety culture?						
2. Construction Safety Laws, Rules and Regulations							
01	Do some Safety laws, rules or regulations in some form exist in the organization?						
02	Does Top and Middle Management know the safety laws, rules or regulations?						
03	Is Top Management willing to implement the safety rules and regulations strictly?						
04	Do Supervisors know the methods to implement these rules and regulations?						
05	Do Supervisors actually know these rules and regulations?						
06	Are workers legally bound to follow the safety rules and regulations?						

	Safety Training Indicators *Please encircle one box best suited with the practices of your company*	Never	Seldom	Sometimes	Often	Almost Always	NA
07	Do workers actually follow these rules?						
3.Construction Safety Management Plan *(To include Management and Employee responsibilities, Safety Policies, Plans, Committees, Inspections, Audits, Training for Employees, Selection and Control of Subcontractor, Contract Documents etc)*							
01	Is Safety Management Plan of some kind influenced from OSHA or some other Safety Organization prepared in the organization before start of any project?						
02	Do Top and Middle Management implement Safety Management Plan in true spirits?						
03	Is Safety Induction Training conducted for new employees or before start of work on new job/ site?						
04	Is Refresher Training in Safety conducted periodically?						
05	Do selected Subcontractors show good safety performance?						
06	Are few Construction Safety related clauses included in contract documents?						
07	Can Middle Management/ Supervisors recognize the potential hazards for accidents before undertaking any activity as well as project?						
08	Do Middle Management/ Supervisors possess the knowledge of safety before undertaking a project?						
09	Do Supervisors understands the plan and able to implement it?						
10	Do Workers know relevant safety measures before starting any activity?						
11	Do Workers possess ample knowledge of Construction Safety before employment?						
12	Is there any Reward and Punishment Programme for Safe and Unsafe Behaviour respectively?						

	Safety Training Indicators *Please encircle one box best suited with the practices of your company*	Never	Seldom	Sometimes	Often	Almost Always	NA
4.Safety and Health of Workplace							
4a. Safety Against Major Causes of Accidents(Falls, Struck by, Caught in between, Electrical Shocks, and Others Incidents)							
01	Does Top Management provide ample resources and opportunities to prevent against Major Causes of Accidents?						
02	Does Middle Management effectively establish a culture and strategy to implement the preventions against Major Causes of Accidents?						
03	Do Supervisors understand, implement and supervise the safety measures against Major Causes of Accidents?						
04	Do Workers follow the safety instructions to prevent against Major Causes of Accidents?						
4b. Housekeeping							
01	Does Top Management give due consideration to the Housekeeping of construction sites, offices and residential area?						
02	Do Middle Management/ supervisory staff regularly checks the house keeping						
03	Do Workers willingly ensure cleanliness of sites and residential area without any orders?						
4c. First Aid							
01	Is Top Management concerned to immediately provide first aid to the affectees?						
02	Does Middle Management make provisions to provide first aid to work force?						
03	Do supervisors keep and make appropriate use of the first aid boxes?						
04	Is work force trained enough to effectively provide first						

Safety Training Indicators *Please encircle one box best suited with the practices of your company*		Never	Seldom	Sometimes	Often	Almost Always	NA
	aid to the affectees?						
4d. Personnel Protective Equipment (PPE)							
01	Does Top Management willingly provide PPE to the working parties?						
02	Do the Middle Management/ Supervisors ensure the use of PPE by all the working men including themselves?						
03	Do the supervisors ensure the use of PPE forcefully?						
04	Are the Workers effectively trained enough to use the PPE?						
05	Do Workers consider the use of PPE as effective accident preventing tool and willingly use them for their own safety?						
5. Accident Reporting and Investigation Mechanism							
01	Does a written accident reporting and investigation mechanism exist?						
02	Does Top Management give top priority to accident compilation and investigation?						
03	Is Middle Management concerned over investigating the causes of accidents and near misses?						
04	Can Supervisors compile the accident report effectively?						
05	Do supervisors report the incidents in time?						
06	Do workers report the accidents in time and cooperate in investigations?						

Training Delivery Option. To achieve the above mentioned training needs, which delivery option is preferred for following stakeholders(Tick more than one if required)							
Stakeholder	**Options**						
	Include *General Safety* in Syllabi at School level	Include *Construction Safety* in Syllabi at Professional Institutes	Vocational/ Technical Training Institutes	Safety Training Tests only (self-prepared)	On Job Training	Special Training Courses	N A
Top Management							
Middle management							
Supervisors							
Workers							

Training Methods. Irrespective of all above training needs, which training method is preferred for following stakeholders(Tick more than one if applicable)							
Stakeholder	**Method**						
	Lectures	Films, Tapes or Videos	Case Study	Field Visit	Conferences	Seminars	N A
Top Management							
Middle management							
Supervisors							
Workers							

Information about the Construction Organization of the Respondent

(Encircle the Most Appropriate Option/ Category in the Following Questions)

1. Average Annual Turnover(In Million Rupees)

   1. 1– 10 2. 10 – 100 3. 100 – 1000 4. >1000 5. NA

2. Area of Operation (More than one choices can be marked)

   1. Project and Design 2. Air ports 3. Buildings
   4. Pipe Lines 5. Industrial Facilities
   6. Infrastructure Facilities 7. Canals and Irrigation Facilities
   8. Tunnel Works 9. Highways/ Transportation Facilities
   10. Dams and Head woks 11. Others

3. Major Client of Organization:-

   1. Public Sector 2. Private Sector 3. Public and Private Both

4. Average Number of Employees (Including Construction Sites and Offices);

   1. 10 – 100 2. 100 – 500 3. 500 – 1500 4. >1500

5. Geographical Operation Location of the Organization

   1. All in Country 2. All Abroad 3. Spread in the Country and Abroad

6. How much amount is allocated in project budget for Safety Training?

   1. No budget allocated 2. Less than 1%
   3. 1-2% 4. 2-4%
   5. 4-6% 6. More than 6%
   7. NA

7. Frequency of the Tool box meetings

   1. Daily 2. Twice a week 3. Weekly
   4. Fortnightly *(once in 15 days)* 5. Never held 6. NA

8. Which of the following post-accident safety response mechanism is usually followed on site*?*(Select more than one, if applicable)
    1. Immediate organizational level action is taken (investigation, penalization, etc.)
    2. Preventive actions are taken for avoiding similar occurrences in future
    3. Only the accident is reported (no further action taken)
    4. Only the site/ project manager decides the response mechanism
    5. Safety Training is carried out later in that particular field of accident
    6. NA

9. Who is responsible for the Safety Training of employees in Sub- Contractor's Organization?
    1. Employees (themselves)
    2. Field Supervisor
    3. Construction Manager (site)
    4. Project Director (office)
    5. Safety Officer
    6. Training never conducted
    7. NA

10. Any Suggestions to Introduce, Educate, Enforce or Improve Construction Safety Training System in Construction Industry of Pakistan

    _____
    _____
    _____
    _____
    _____

Thanks for your Co-operation