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BUILDING CONSTRUCTION OCCUPATIONAL SAFETY AND HEALTH ASSESEMENT: - A CASE OF CONDOMINIUM SITE PROJECTS IN ADDIS ABABA

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Building Construction Occupational Health and Safety Assessment: - a Case of Condominium Site Projects in Addis Ababa

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I hereby declare that the work which is being presented in this thesis entitled "***Building Construction Occupational health and Safety Assessment: - A case of Condominium Site Projects in Addis Ababa***" is original work of my own, has not been presented for a degree of any other university and all the resource of materials used for this thesis have been duly acknowledged.

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This is to certify that the above declaration made by the candidate is correct to the best of my knowledge.

DR.IR Eshetie Berhan _____ _____

(Thesis Advisor) Signature Date

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Abstract

Construction industry has been recognized as one of the common hazardous industries in both developed and developing countries. Injuries and work related hazard on building construction sector present a major effect on the workers in the field, and resulting major influences on socio economic consequences. Hence the objective of this research paper is to finding out major safety and health related injuries & hazards in condominium building construction (40/60 and 20/80) schemes to reduce health related injuries and increases safety; so that 139 condominium building construction workers were included in the study with proportional allocation formula sampling techniques. The data has been composed through structured and pre-tested questionnaire and interviews; accordingly analyzed using descriptive statics with Microsoft Excel & SPSS Software.

The study result shows major injuries that have been identified from field survey falling from height 70% for 40/60 schemes and 65% for 20/80 schemes, injury due to manual handling 78% for 40/60 schemes and 51% for 20/80 schemes, injuries due to moving equipment 61% for 20/80 schemes and 52% for 40/60 schemes and finally health problem due noise 46% for 20/80 schemes and 48% for 40/60 schemes. The prevalence injuries among workers in condominium building construction were reported to be 48.9%; additionally injuries significantly associated with age, sex, educational level, experience and the type of occupation of the workers. Furthermore the study shows occupational injuries are common among construction workers, thus counter measures are recommended such as organized hierarchy department structure for occupational health and safety to decrease prevalence of injuries.

Key words: occupational health and safety, condominium construction, occupational injuries

Acronyms

AAHCPO	Addis Ababa Housing Construction Project Office
AASHDE	Addis Ababa Saving House Development Enterprise
BLS	Bureau of Labor Statics
ETB	Ethiopian Birr
ERA	Ethiopian Road Authority
GDP	Growth Domestic production
GTP	Growth and Transformation Plan
GRD	Great Renaissance Dam
HS	Health and safety
HSE	Health and Safety Excusive
ILO	International Labor Organization
MCP	Mega Construction Project
MOLSA	Ministry Of Labor and Social Affair
MOUWD	Ministry of Works and Urban Development
OHS	Occupational health and safety
OSHA	Occupational Safety and Health Association
ORCE	Oromiya Road Construction Enterprise
PPE	Personal Protective Equipment
PSCS	Project supervision construction stage
PSDS	Project Supervision Construction Stage
SPSS	Statistical Package for the Social Sciences
UN	United Nations
U.S.A	United States of America
WHO	World Health Organization

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CHAPTER ONE
PROBLEM AND JUSTIFICATION

1.1 Background and justification

1.1.1 Introduction

In modern construction industry the vital function of any government is to ensure workers' safety as Helen & Stephen, (2005) cited in (Ng'ang', et al., 2014). A safe workplace is basic issue for the ability to enjoy health, security, and the opportunity to achieve successes life. At construction sites safety and health can be achieved by provision of enough clean water, proper and enough sanitation facilities, health friendly environment, knowledge of handling of machines, plants and equipment and hygienic practices. The construction industry sector plays an important role in the GDP, in many developing countries, fundamental construction activities account for about 80% of the total capital assets Wubshet, (2004) cited in (fasil, 2017).

Health and safety standards on construction sites are set by the International Labor Organization (ILO) and are based on international conventions and recommendations on occupational health and safety (Day Safety & Work, 2015). There are about 330 million accidents annually as ILO estimated and around 160 million suffer due to work related diseases which result a total death of 2 million workers and loss of 4% of world's annual GDP (Abera.et al., 2017).

Although to economic growth of a nation the construction industry contributes through production of physical infrastructure buildings, roads, railways, ports, bridges and through the employment created in the process of construction it is faced with health and safety challenges as Okumbe, (2001) cited in (Ng'ang', et al., 2014). Construction site workers may be exposed to various hazardous elements and physical agents such as Asbestos, lead, silica dust, organic solvents, sewer gases, welding fumes, radiation, noise and vibration. Excessive exposures to these substances/agents may result in acute injury, chronic illness, permanent disability or even death. Loss of concentration at work and fatigue arising from poor health conditions may increase the risk of accidents as Perry, (2003) cited in (Ng'ang', et al., 2014). Construction work is featured by high labor turnover, constantly changing work environment and conditions on site, and different types of work being carried out simultaneously by several contractors. These features would further increase the health risks of workers.

The industry also involve and provides high employment opportunities, in Ethiopia, public construction projects shared an average annual rate of 58.2% of the capital budget between years 1997/98 and 2001/02 Wubshet, (2004) cited in (fasil, 2017). The construction industry in Ethiopia accounted for 4%-7.6% of the total GDP of the country in year between 2010/11-2013/14 as ministry of finance and economic development stated,("MOFED," 2014). From this we can see that the construction sector plays significant role in Ethiopian economic development. Construction industry is one of the sectors which able for the economy to worker on building, repairing, maintaining, modifying and demolish different houses, office, temples, airport, and tunnels, factories, hospitals, roads, bridges, stadiums, docks, and that transforms various resources in to constructed infrastructure necessary for adding economic value for the development of the capital city.

Construction in Ethiopia plays a great dominance role for economic, social and political as well as cultural affairs, inside the country specially in the capital city, Addis Ababa There has been growing population demand and mismatch for basic service, since there is a wide seek from rural area so that the city development surprisingly become wide horizontally without sufficient living environment.

In order to address this basic services and need, the Ethiopian government specifically the Addis Ababa city Administration construction bureau launched cost efficient condominium housing projects to provide decent shelter for middle- and low income groups .The sub division (20/80 and 40/60) housing strategy designed for the middle class and upper middle class respectively; (Tesfaye, & Getnet, 2015). According to World Bank report Ethiopia is the poorest economy per capital income of $783 which try to reach lower middle income status by 2025, (world bank, 2018). So that this condominium projects helps to minimize house backlogs and clear slums which reflects the percentage of the payment between government and lower and middle income resident of the city which aim to minimize construction costs. From this condominium projects (20/80 scheme) are mostly done at crest from the capital city and around the Oromiya region. Beside this, the projects like (40/60 scheme) condominium that accommodate many more people on a smaller land and tall buildings are done inside the town in order to reach exploding population. This high rise condominium building inside the down town helps for crating open spaces and easy accessibility of community services especially for sensitive issues like availability of transportation, water and other utilities. A high rise building defined as any

existing or new structure over 80ft National Fire Association, (2008) cited in (fasil, 2017). however, building construction projects have different challenges, according to Enshassi, (1997) construction work involves a serious of injury of risks, such as very long work heights (use of scaffolding, gangways and ladders), deep excavation underground work (use of explosives, earth moving machines), lifting (moving) of materials (use of overhead cranes, hoists), electrical shocks…etc. (Enshassi,1997).

As Lopez, (2001) classified construction as a high-risk industry since it has historically been recorded with much higher and unacceptable injury rates compared to other industries(Lopez-valcarcel, 2001). It is widely recognized that having high accident and injury rates results a consequence of absence from work, loss of productivity, permanent disabilities and even fatalities (Sewefy, 2009).

In the survey for risk assessment in building construction large portion of construction workers are unskilled laborers.it include about 5 to 10% of the workforce in industrialized countries. It also include over 90% of construction workers are male. In developing countries, the proportion of women employer in construction is higher and they tend to be concentrated in unskilled occupations. In some other countries, the work is left to migrant workers (specially the labor work part), and in others, the industry provides relatively well-paid employment sector and an avenue to financial security; ("enviroment clearance," 2018).

A review of Molla, (2013) information in Ethiopia regarding construction injuries information is rare, and very limited. Little functional attempts have been done in order to investigate the prevalence and associated factors so that pilot activities identified in important potential construction areas (Mola, et al., 2013).

There are a number of studies are done by different researchers however this paper specifically will works on building condominium construction projects (40/60 and 20/80) to address health and safety practices for corporate governmental and public projects in order to mitigate the injury and hazards. Which will have detailed information to improve safety, take lessen from pervious practices on building and infrastructure sites and to decrease the number of injury among the building construction projects for the future.

1.2 Statement of the research problem

In most Addis Ababa buildings construction injuries and safety issues are a major concern. Under this, different building construction projects are constructed by the government and private contractors. In worldwide for more than half of occupational injuries and deaths taking the responsibility were the industry of construction sector, according to the international labor organization stated that 270 million occupational accidents are recorded and this causes 2 million deaths per a year (Day et al., 2015). According to Dong, (2015) the impacts on health and safety of occupational hazard in building construction is 10 times lower in developing country than industrial countries (Dong.X, 2005). For example in USA the cost for occupational injuries was $177.2 billion by losing of 35million working days per year (Larsson & Field, 2002). So it implies a single injury in Ethiopia is 10 times higher cost impact than in United States. A review by Larsson, (2002) states power tools, work at heights, lack of coordination, Scaffold collapse, Trench collapse, Electric shock and arc flash/arc, blast un-proper use of personal protective equipment and repetitive task motion injuries are key determinants of the problem (Larsson & Field, 2002). In Ethiopia building construction injuries and safety issues are areas of focusing attention. The current building construction situation requires a high level of commitment which starts from each individual up to government; otherwise human being death rate increases rapidly. According to the Ministry of Labor and Social Affairs MOLSA,(2017) there are above 930 death per annual in construction industry; (for Instance in 2010 E.C there were 932 immediate death on construction sites in Addis Ababa) and more than a minimum of 110 building construction injuries per day from low to high level of fatalities; even if there are 537 safety inspectors (from this 38 are female) that check occupational work place safety (MOLSA, 2017). The safety inspectors inspect on average 40,000 construction project sites that are registered and licensed by the government and from this the one who supply construction materials by opening workshops are around 680 project sites (MOLSA, 2017). For example, the Addis Ababa saving houses development enterprise (AASHDE) was planning to build 75000 new condominium units; currently under construction there are about 33,253 condominium units in 12 sites but only 1,292 housing units are ready for delivery (Tesfaye & Getnet, 2015). Government widely focuses on merged residential problem solving building construction areas with low cost prize including both schemes (20/80 and 40/60). Since the selected areas are wide (for example 20/80 condominiums include above 50,000 unit scheme on one area) it helps to

shows the basic construction injuries and safety issues in different dimensions. The challenges of construction industry and safety issues in different projects and sites are unique; one of the most critical problems which cause number of death and injuries in the population, specifically on the residential building construction projects were due to they have large number of inexperienced, translate workers, fussing to communicate in common language and poor regulation and supervision of the Addis Ababa city administration. On the other hand the Ethiopian growth and transformation plan (GTP) has been targeted to make a successes on the safety sector; by planning to start a safety program for more than 5000 project sites but that doesn't achieved a good result. In parallel for occupational health and safety according to the labor law of MOLSA,(2017) a minimum of 144,000 ETB were given to immediate death per person and for other injuries it will increases depending on the fatalities so that for example in Addis Ababa per year a minimum of 134,208,000 ETB have been spent for insurance without including the fatalities that doesn't result death; which is not compeered with human life's MOLSA,(2017).

The main problem in Addis Ababa specifically on condominium building construction sector areas (40/60 and 20/80) injuries and death of life Therefore, this research will focus on examining of building construction injuries and safety management in order to investigate the major root causes contributing on the condominium building construction projects of 40/60 and 20/80.

Research questions

Question 1: What are the different types of occupational health and safety problems occurred in condominium building construction projects?

Question 2: what are the associated factors that are related with occupational health and safety in building construction?

Question 3: what remedial major should be done to reduce the problems of building construction injuries and safety issues?

1.3 General Objective

The general objective of the study focus on to finding out major safety and health related injuries and hazards in condominium building construction to recommend some management option to reduce health related injuries and increases safety.

1.3.1 Specific Objectives

The specific objectives are

1. To identify building construction injury patterns that exists in condominium building construction projects.
2. To assess condominium buildings safety management through by identifying injuries in the project sites.
3. To evaluate the existing condominium building construction injuries causes, in terms of duties competent authorized authorities, coordination and data handling methods.
4. To suggest possible strategies and counter measures that contributes to reduce the problems of building construction injuries and safety issues.

1.4. Scope of the study

The scope of this particular research includes examining, investigating and assessing building construction injuries and safety issues for condominium building construction projects that are governed by Addis Ababa Housing Corporation in Addis Ababa, Ethiopia. The building construction injury assessments to some extent were been discussed to evaluate the existing building construction injuries causes, in terms of duties competent authorized authorities and determine the major causes and contributing factors of building construction injuries and safety issues.

1.5. Limitation of the study

This research paper addresses only condominium projects that are governed by Addis Ababa housing corporation in two schemes i.e. 20/80 schemes and 40/60 schemes since the condominium project sites are vast information related to injuries and fatalities in terms of their number, type and distribution and other related factors made this study difficult. The data's that are available are more general, unorganized and uneconomical in terms of time and resources. It was also hard and tedious to convince the respondents about the aim of the study. However the researcher had made strong communication and commitment by find out short and possible ways with all participants of the research to complete the study.

1.6. Significance of the study

Fatalities and injuries in construction industry can be addressed and solved on a global scale that resulting in improvements which can be observed on a global scale. Therefore, solutions to fatalities and injuries on construction sites and adapting occupational health and safety may readily be practiced to other countries to generate further improvement; the significance of this research includes to improve the number of fatalities and injuries on building construction sites by covering general safety and health provisions and responsibilities of all participant from top to bottom level through clear understanding of occupational health and safety requirements. The other significance of the study is related to measures that should be followed by all project participants in order to provide comfortable and safe workplace which helps to protect them from fatalities and accidents; to ensure that there is well organized safety and health standard with in governmental structure that helps to increase safety and minimize injuries.

1.7. The organization of the Thesis

In this research paper the reports has five main chapter which contain the following description in chapter one the introduction part, background and justification, statement of the problem, research objectives and questions, scope and limitations of the study have been included. Chapter two is composed of the review of the relevant literature. Various books and journal articles were reviewed to base the study on existing literature, discuss relevant issues to build understanding of the subject matter. Chapter three contains the details of the research methodology and the steps used to gather and analyze data from which findings are drawn. Chapter four contains the analysis of the data gathered by means of data collection methods and instruments indicated in the methodology part. The last chapter discusses about summary, conclusion and recommendation. The references used in the study are listed at the end. Interview guide and questionnaire used are also included in the Appendix part.

CHAPTER TWO
REVIEW OF RELATED LITERATURE

2.1 Introduction

Building construction in its nature involves in different practices and activity, this chapter will provides the basic concepts & theories used for the research. In order to understand each and every processes and elements in building construction there is a need to understand the whole activity and system. Building construction injuries, accidents and sources of different hazards in construction sites helps to understand the flow of building construction safety practice, information regarding injury and the source number of death in the field. Beside this there are a lot of regulation guide which directly or indirectly affect the construction projects that influence on the safety performances. In addition, for understanding construction injury and safety practices prior studies will be discussed in different aspect.

2.1.1 Construction

According to safety health and welfare, (2005) it states the definition of construction is a high-risk activity, which must be managed starting from procurement, through the detail design process and to the end of the construction stage; every participant in a building project (any field of construction sector) must appreciate their role, from client, project supervisor design process (PSDP), project supervisor construction stage (PSCS), contractor, and employees ("defination of construction work," 2005).

The International Labor Organization categorizes the construction sector industry as government and private-sector; firms can erect buildings for habitation or for commercial purposes and public works such as buildings, roads, bridges, tunnels, airports or dams (International Labour office, 2018).

On the survey of bureau of labor statics (BLS) the construction industry once again topped list with 937 worker deaths. This number show that it is about 4% increase which was reported in 2014; however construction industry become forth highest fatal injury rate but its number of death is the highest from all industries for example agriculture, forestry, hunting and fishing had around 22.8% fatal injury rate; warehousing and transportation 13.8%; mining quarrying, and oil & gas extraction 11.4% and finally construction 10.1% injury rate (Jones.k, 2016). The Addis Ababa saving houses development enterprise (AASHDE) is targeting to build up 75,000 new

condominium buildings and 15,000 residential unit by new designs for the coming year this include increasing the number of buildings from 12 floor to 15 floor (Tesfaye & Getnet, 2015).

On the survey of Ethiopian ministry of urban development and construction the performance constraint can affect the construction industry with poor performance this factor determines weakness problem and constraints include (MCUD, 2012). This factor includes the following constraints. Low capacity and capability of the local contractors and consultants due to weak resource base and inadequate experience, inadequate and erratic work opportunities, inappropriate contract packaging of works which favors foreign firms in donor funded projects, low public investment in infrastructure projects and over dependence on donor funding, inefficient and non - transparent procurement Systems, corruption and financial mismanagement in public/private sectors, lack of supportive institutional mechanisms in terms of financial credit facilities, equipment for hire and professional development, unfavorable donor conditionality's which tend to marginalize local construction enterprises, poor working environment, including low standards of safety and occupational hazards on construction, sites Weak and non-facilitative policies and regulatory framework and low productivity and quality Low technological base (MCUD, 2012).

Construction on another way defined as any work connection with demolition or dismantling of addition to a building, erection, alteration, renovation, repair or a construction work means any work or any similar structure. It also include erection, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or the moving of earth, clearing of land, the making of excavation, piling, or any similar civil engineering structure or type of work. Construction site means a place of work where construction work is being performed and construction contractor is an employer who performs construction work (Hasan, et al., 2017).

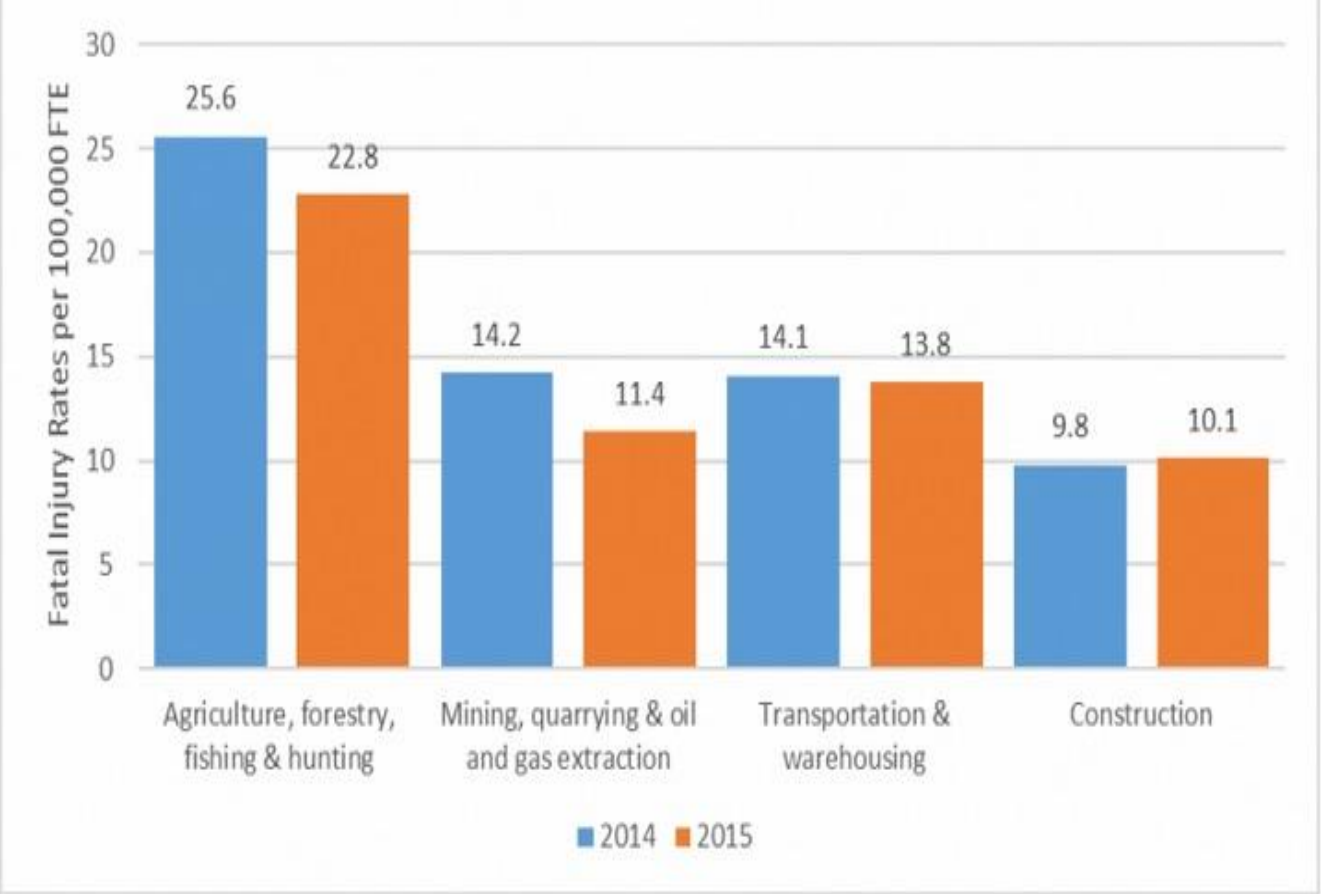

Figure 2.1 : Survey on fatal injury rate in construction & other industry (Jones.k, 2016).

2.1.2 Construction industry categorizations

According to Ethiopian ministry of urban development and construction it define the construction industry is a sector of the economy that transforms various resources constructed social economic and physical infrastructure for socio economic development.it include all processes in the physical infrastructure that are planned, designed, procured, constructed or produced, altered, repaired, maintained, and demolished; this include the following categories this are Buildings, Transportation systems and facilities which are airports, harbors, highways, subways, bridges, railroads, transit systems, pipelines and transmission and power lines and Structures for fluid containment, control and distribution such as water treatment and distribution, sewage collection and treatment distribution systems, sedimentation lagoons, dams, and irrigation and canal systems; underground structures, such as tunnels and mines (MUDC, 2012).

2.1.3 Construction Industry projects in Ethiopia

Table 2.1 : Ethiopian construction industry projects

Sector	Project	Description
Building	housing project	a program that aims to construct 4,500,000 Within five year in the capital city and creating employment opportunity for small and medium scale enterprise.
	university building projects	It was a program with an objective of constructing 13 university projects together with capacity development of domestic construction and consulting firms.
Road and Transport	Road Sector development Program	According to Ethiopian road authority a 13 years program that was planned to implement 38,080 Km of road together with capacity building of domestic construction and consulting firms. At the end of the 13 years the program was succeeded to accomplish 105% of its target 39,965km (ERA, 2016).
	Railway	In addition to road infrastructure the country has also identified potential railway corridors to connect the capital with major cities currently there are two active railway projects in Ethiopia: The Light Railway Transit in the capital and the Addis Ababa- Djibouti rail way that connects the capital to the port of Djibouti.
Energy	The Great Renascence Dam	Even if there are different challenges building up in the undertaking the construction of the great renaissance dam (GRD) it will expected to generate 6000GW.
	Gilgel Gibe I-III, Tekeze and Beles	These are hydropower projects constructed for the last two decades to generate 3,230 MW of electricity. Except Gilegel Gibe III all of these projects are completed some years back and started functioning.

Each construction site there is a unique in the sense that projects may require different equipment and skills; and projects are multitasked requiring a multidisciplinary approach (Debrah & Ofori, 2001) .

The Addis Ababa city administration is responsible for managing and controlling the Ababa city Administration construction bureau and the Addis Ababa saving houses development enterprise (AASHDE) which have their own responsibility on the construction sector which are in the construction bureau they plan control and construct the governmental servicing providing industry like highway, hospital, internal roads and young entertain stations on every sub city and woreda centers. On another hand the Addis Ababa saving houses development enterprise (AASHDE) is responsible for only governmental housing projects which only include the 40/60 and 20/80 scheme.

2.1.4 Injuries on Construction Sites

Construction workers are exposed to a wide difference of health injuries on the work place. Injury and exposure are not the same it differs from place to place, from job to job, by the day of occurrence, even by the hours and seconds of life time. They are intermittent and of short duration, but is likely to reoccur. A worker may not only encounter the primary hazards of his or her own job, but may also be exposed as a bystander to hazards produced by those who work nearby or upwind and its common in construction . This flow of exposure is a consequence of having many employers with jobs of relatively short duration and working alongside workers in other cases that generate other hazards.

The severity (measuring how harm each worker) of each hazard depends on the concentration and duration of exposure for that particular job. Bystander exposures can be approximated if one knows the trades of workers nearby construction workers are exposed to a wide variety of health hazards on the job ("enviroment clearance," 2018).

2.1.4.1 Primary hazards

Hazard: - is anything that can cause harm our risk but, only for specified purposes, this must be workplace generated (e.g. dangerous chemicals, electricity, working at heights from ladders, poor housekeeping), Authority of health and safety excusive (HSE) define hazard as any source of potential damage, harm or adverse health effects on something or someone under certain conditions at work (HSE, 2004). Basically, a hazard can cause harm or adverse effects (to individuals as health effects or to organizations as loss of property or equipment).

According to Anderson, (1999) the terms accident and injury refer to separate phenomena, mutually interrelated as (exposure and outcome) cause and effect (Andersson, et al., 1999). The

terms “accident” and “injury” are here-by used in accordance with the definition adopted at the first World Conference on Accident and Injury Prevention in 1989 by world health organization that is, an accident is an unintentional event which result or could result in an injury, whereas injury is a collective term for health outcomes from traumatic events. The survey of Rejda, (1992) defined an accident as a “sudden, unforeseen and unintentional” event, which may result in physical harm to a person and/or damage to a property. The use of the term “accident” in this thesis were bases on an event which cause physical harm or damage to the body resulting from an exchange, usually acute, of mechanical, chemical, physical, or other environmental energy that exceeds the body's tolerance (Rejda, 1992).

2.1.4.2 Injuries on Building construction Sites

Building construction is a sector that has different injuries and hazards, some of are working with power tools; work at heights, and lack of coordination. There are different contractor at single site, lack of standards or regulations among workers due to expertise and less regulation and enforcement than other sectors. The major reasons that are referred in different studies are as Chau, (2008) study its source was lack of education (Chau, 2008); on the survey of Zewdie, (2009) it states lack of health and safety programs working one biased gender (male) and again based on this review young workers and non-use of personal protective equipment’s are the causes of injuries (Zewdie, 2009).

From the finding of Tadesse, (2016) the prevalence of injury in Ethiopia among building construction employees was reported to be 38.3 % and when it compare from Egypt which have 8.4% and India 22.9%; this is due to lack of safety awareness, poor working condition, lack use of PPE and other different reasons respectively (Tadesse & Israel, 2016). Sources of relevant data shows that behind building construction sector there are a lot of injuries and safety issues that should be achieved in order to reduce the number of death and injuries form their root cause so that it not only health institution concern but also it must be over look by engineering aspect.

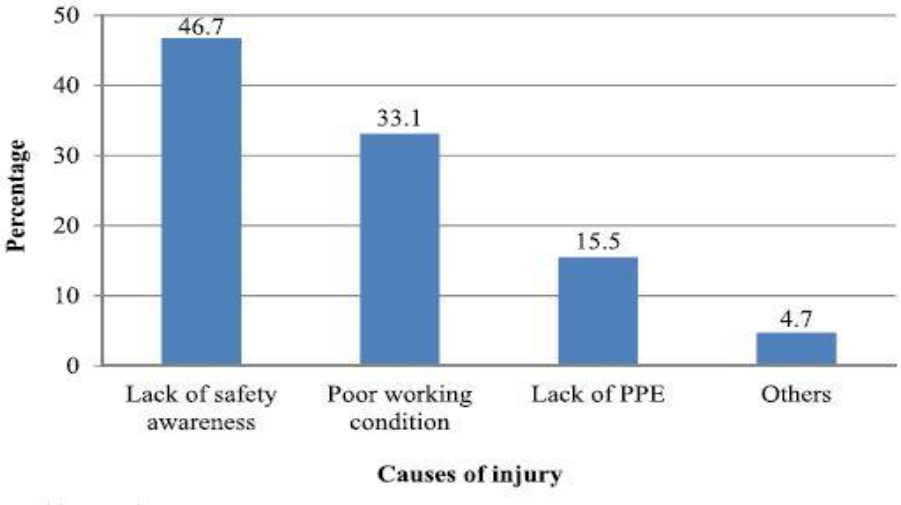

Figure 2.2 : Pervious survey on causes of injury in building construction (Tadesse & Israel, 2016).

On the other hand, a survey that was studied on Gonder which focuses on injuries among building construction sector results that total participants 38.7% of the workers experienced occupational injuries at least in once a year Molla, (2013) so that the finding was relatively higher than other countries like India which was about 22.92% and from this it states leading injuries hieratical level of percentage, this means were fall from ground level (21.3%), overexertion during lifting and carrying (20.6%), and fall from height (16.1%); the fall injuries together constitute about 37.4 % among the total injuries and on the review of finding justifies that in USA 23.2% were injured on Wednesday (Mola, et al., 2013).

As we have seen different construction injuries occur in different working area in undetermined condition this implies again we should have to focus on the sector of building construction in order to examine the root initiate of injuries, causes & consequences for this matter the condominium construction are convenient and vague, as we know there are number of basic house need with low cost prize so that government widely focus on merged residential problem solving building construction areas which are 20/80 and 40/60. Since the selected areas are wide (For Example 20/80 include above 50,000 unit scheme on one area) they help to shows the basic construction injuries and safety issues in different dimensions.

The researcher had try to conduct different literature survey, even if there are a number studies in building construction injuries and safety issues that have been studied (Tadesse & Israel, 2016); which focus on occupational injuries among building construction workers specifically at Addis

Ababa, the article reviewed list out the causes of injuries which are researcher under Public Health department at university of Gondar, the survey randomly select a construction site to collect data and analyze using software tool, the gap in here this research paper survey on specified on the title of Addis Ababa condominium project site in order to categorize the causes and injuries through activity of works to reach the root causes in engineering aspect. Additionally article that studied at Gondar by Molla, (2013) put types of injuries that occur statically which conclude by referring the causes from other literature, rather in here the research paper analyzed the injuries and its causes coherently using industrial engineering approach by finding out the causes of death, injuries and building construction safety issues and to identify the major injuries types on a specific project construction site (Mola, et al., 2013).

2.1.4.3 Highway infrastructure construction Sites

Today, the road sector is well organized in line with the decentralization policy of the Ethiopian federal government, Road construction takes place in a decentralized setting in which federal, regional and district governments hold the responsibility for maintaining and expanding the road network within their territories so that according to Ethiopian road authority the total length of the current Ethiopian road network is calculated on the basis of the road sector development Program 'Eleven Years Later' performance report the total length is an addition of 20,429km federal roads, 23,930 regional roads and 70,038km community roads (ERA 2008b:25-27); for the construction and maintenance of rural roads so that between 1990 and 1999, 50% of the newly constructed rural roads in Oromiya were implemented by the labor-based approach (ILO 2008:1-7, 40-41);However, in the construction period 2008/09, only four of the 26 Oromiya road construction enterprise (ORCE) construction projects were undertaken through the labor-based approach (Emmenegger, 2018).

On the survey of causes of delays in construction project it shows the top five severe delay causes are political situation, segmentation of the West Bank and limited movement between areas, award project to lowest bid price, progress payment delay by owner, and shortage of equipment (Mahamid, et al., 2012). As Figure 2.3 shows there are a lot of reasons to occur the delay in the road and infrastructure building construction industry.

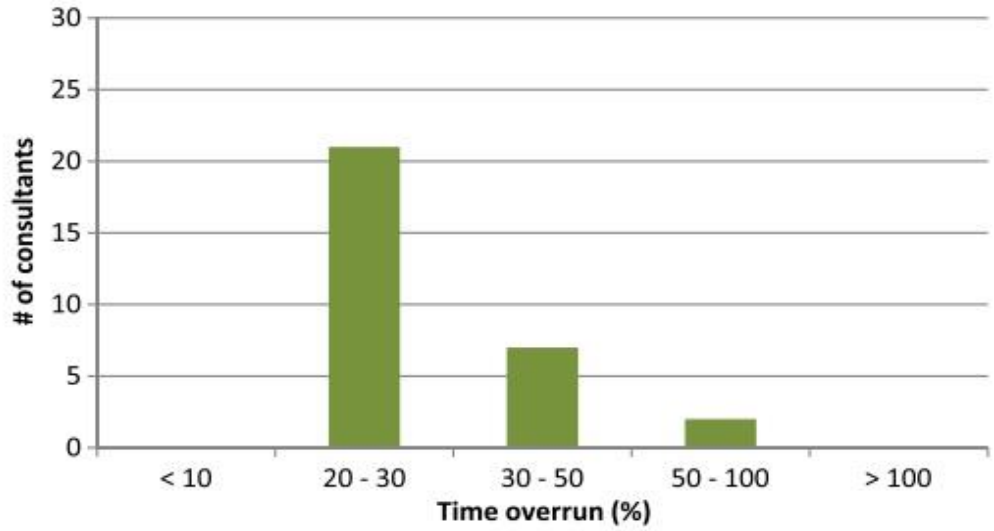

Figure 2.3 : List of delay in road construction (Mahamid.A et al., 2012).

2.1.4.4 Mega construction project Sites

Mega construction projects (MCPs) are huge investment projects aimed at supporting governments to achieve their social and economic development goals. This projects attract public and political attention due to their substantial influence on communities, environment and budgets as Van Marrewijk, (2008) & Capka, (2004) cited in (Ahmed & Othman, 2013). In addition, Mega construction projects (MCPs) are owned by governments and executed by large construction firms so that are risky undertakings that consume substantial amount of time, cost and requires highly trained design and construction professionals as well as skilled managerial teams and also these projects are characterized with the need for high design knowledge and technical skills; competent human resources and managerial capabilities as well as excessive cost investment. Conversely, developing countries experience shortage of many of these requirements, which obstruct the development of mega construction projects (Ahmed & Othman, 2013).

There are different mega construction projects that are built up with high capital investment cost specially in Ethiopia even if there are many challenges due to political and internal related cases from this the one of the famous mega project is the Great renaissance Dam beside this most developing countries have different mega projects that are under construction as Ahmed & Othman, (2013) survey it include construction of stadium, bridge, water infrastructure, railway

and Airport projects Figure 2.4 illustrates mega project of construction in developing country (Ahmed & Othman, 2013).

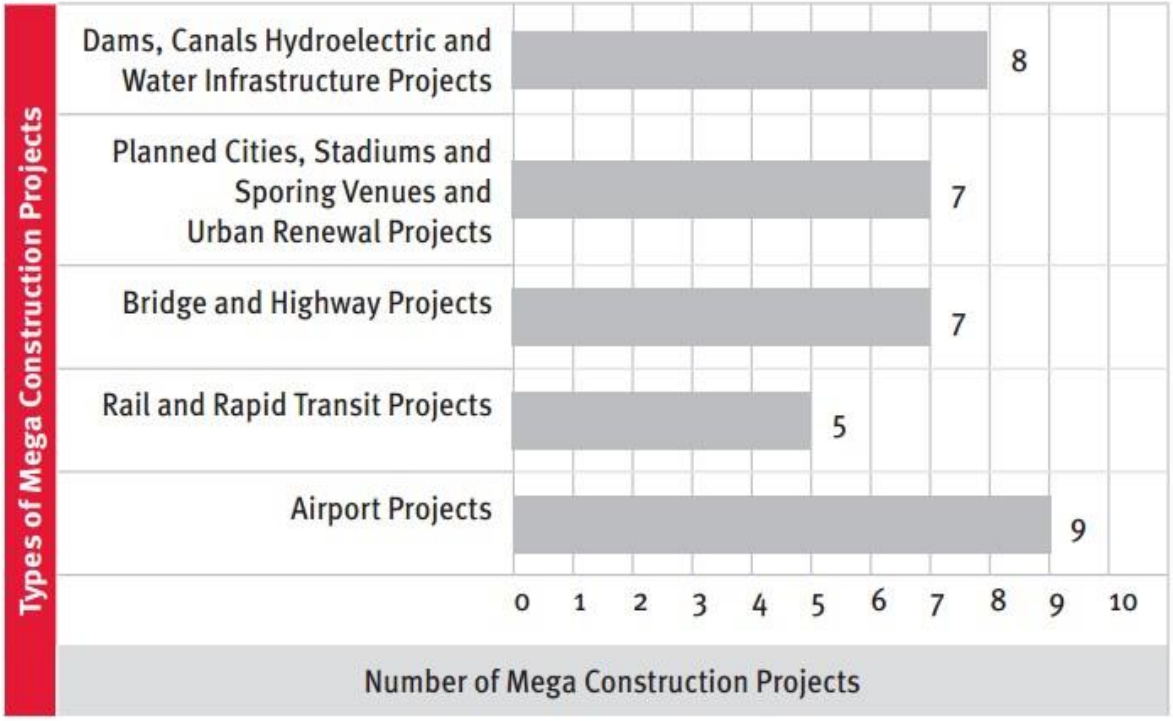

Figure 2.4 : Mega construction projects in developing countries (Ahmed & Othman, 2013).

When mega projects are built there are different challenges these challenges lead to loss of effort and responsibility as well as manage unforeseen events. In addition, poor quality front-end planning can deteriorate the whole quality management process and lead to delivering projects that do not meet client and user expectations (Ahmed & Othman, 2013). According to the survey of Ahmed & Othman, (2013) there are four major categorization of this are engineering challenges, human development challenges, managerial and political challenges and sustainability challenges; from industrial engineering point of view occupational safety and health is one of the major focusing area that should be worked in order to mitigate the number of injuries and death in the construction industry (Ahmed & Othman, 2013).

2.1.5 Construction injuries and safety rules and regulation

According to Safety, health and welfare, (2018) on construction sites a training manual Safe, healthy and comfortable working environment conditions are critical for human being. Employers need to have a written safety policy for their working company which stated out the

safety and health standards in order to achieve as an objective (International Labour office, 2018). The policy should name the senior executive (authorized party) who is responsible for seeing that the standard rules and obligations are achieved, and who has authority to allocate responsibilities to management and supervisors at all levels in order to see whether implemented or not.

As the survey of occupational safety and health administration, (2005) stated in the world around 6.5 million people work at approximately 252,000 construction sites across the nation on any random day; from this fatal injury rate for the construction industry is higher than all industry. Potential hazards for building construction includes fall (from heights), Scaffold collapse, Trench collapse, Electric shock and arc flash/arc ,blast improper use of personal protective equipment and repetitive task motion injuries (OSHA, 2005).

On the other hand, the Construction Industry Policy of Ethiopia, (2012) aimed An objective to create and enable efficient, sustainable development local industry which meets the demand for service in order to support social and economic achievement.in here the construction sector has showing its increased percentage level of from 4.3% in 1993 to 5.8% by 2002 by focusing the country GDP (MUDC, 2012).

The Federal Democratic Republic of Ethiopia constitution states that, the Civil Code (Proclamation # 165/1960) together with the Labor Code (Proclamation No 377/20003) is the general legal constitute for health and safety rules in Ethiopia. Under this there are number of articles which elaborate the proclamation.

Based on international agreement and convention there are national laws and regulations that have been drawn up by different United Nation (UN) organizations including the International Labor Organization (ILO) and the World Health Organization (WHO). The safety and health in construction convention (No.167), where adopted by ILO in 1988, which provides a foundation of law on which safe and healthy working conditions can be built safety, health and welfare on construction sites, a training manual, as cited in (fasil, 2017) .

2.1.6 Safety management in construction industry

Safety: - according to industrial Dictionary definition safety is a relative freedom from danger, risk, injury or threat of harm or loss of personal and/or property, whether caused deliberately or

by accident.it is also related to external threats, and the perception of being sheltered from threats. Davis states that freedom from any danger of risk is said to be safety (Davis, 1999). According to Lingard, (2005) safety defined as an absence of any harm or dangers that have a state of protection and condition not involving risks (Lingard, & Rowlinson, 2005). Construction environment condition should be self-explanatory and safe enough for the environment and participant to perform their particular duties and tasks safely (Jannadi, & Bu-Khamsin, 2002).

Safety Management can be defined as the management functions connected with the carrying on an industrial undertaking that relate to the safety of personnel in the undertaking, which includes the measuring, auditing or reviewing of the performance of those functions and the planning, developing, organizing and implementing of a safety policy.

Safety management system is mechanism in industrial undertaking system which provides a safety management.

2.2 Empirical Review

2.2.1 Injuries and Safety Management in Construction

As Enshassi, (2002) stated construction activity have serious concerns in government, health and safety stakeholders, safety and health researchers and professional for the last few decades (Enshassi, & Mayer, 2002). With regard to this health and safety legislation has been developed to ensure profitable construction business, and recently other many participants in different projects assume by taking high responsibility in order to manage risks associated with the construction projects. Injury and safety management in the construction industry has evolved from measures adopted in accident prevention to more systematic and proactive approaches to minimizing the risk of hazards in the industry. Past research has shown certain practices can lead to improved injury and safety performance and therefore constitute good health and safety practices. These researches are summarized with in the Table 2.2.

Table 2.2 : Research practices on injury and safety performance

Author and year	Finding	Gaps
Baldock et al., (2005)	The following factors are identified to improve safety and health measures associated in small scale business ✓ regulatory enforcement activity; ✓ use of external assistance with respect to health and safety issues; ✓ management training and experience; and, ✓ membership of trade/business association identify safety effective safety program in the construction sector and safety and health issues are related with the following safety	implemented in small business not in construction industry
Aksorn and Hadikusumo (2008)	performance measures this are ✓ accident investigations; ✓ jobsite inspections; ✓ job hazard analysis; ✓ safety inductions; ✓ safety record keeping; ✓ safety committees; ✓ safety incentives; and, ✓ control of subcontractor	it is difficult to identify in this paper the specific construction industry in order to make action with the performance measures characteristics
Gad (2002)	Identified factors that influence construction contractors on safety performance this factors include ✓ Growth in company size. Safety incentives were not necessarily associated with better safety performance. ✓ minimizing labor turnover; ✓ implementing employee drug testing; and ✓ Training with assistance of contractor association.	It analyses the contractor side safety & health management; but better involvement of all participant achieve best safety practice in the industry.

2.2.2 Health and safety performance factors in construction industry

There are different factors that influence on the performance at different construction projects this helps to decrease the level and the frequency of injury or any construction hazards. Once if you analyze the basic factors and if you manage the internal and external factors it is possible to predetermine the causes in early stage and protect the construction working environment from hazard; this factors include the project design, environmental condition, the project cost, the total

time to complete the project, rules and legal policy risk assessment methods. Table 2.3 illustrates a factor that causes injury and influence health and safety performance in the industry.

Table 2.3 : Factor for injury and influence on health and safety performance (literature sources)

Author and year	Factors in the construction industry	Safety and injury management practices
Hinze & Wiegand, (1992)	Design complexity	When designer aware to safety and construction hazards they become so conscious these consequences to reduce the number of injuries and help to remove the redesign cost and operating cost.
Brake & Bates, (2002)	Environmental whether condition	The environmental effects have directly or indirectly affects the health performance for example sign for heat stress causes are headache, fatigue, excessive thirst, profuse sweating, confusion, painful large muscle cramps and loss of consciousness and this lead to a serious heat cramps, heat exhaustion, or heatstroke, which if un-treated or sufficiently severe, may lead to death.
Levitt & Samelson, (1993)	The project expense	Cost will reduce and productivity will increase this is directly related to workers ability to be productive and to workplace in safety.
(Zou, et al., 2007),	Project schedule	Project duration have a very important role in the safety performance of the construction project in order to implement what have been planned.
(Shibani, et al., 2012)	Legal safety policy	In order to decrease the number of injury and accident legal policy or any related safety regulation must be accomplished by the top management. Since the commitments are well done there is improvement in the safety performance.
(Agwu, 2012)	Risk Assessment	The risk assessment depending construction companies have a better safety and health performance.
(Shi-bani, et al., 2012)	Report when Accidents are occur	The top management should give infancies to the area that have accident or injury areas and it should work continuously to reduce the number of hazards.
(Al-Kaabi, N.2003)	Personal Protective Equipment (PPE)	This personal equipment's could be the sources of the accident so that proper and working personal protective equipment should be used at project site.

2.2.3 Research works on construction industry

The researcher conducted a literature review from contents of articles published on the international journals and researches discussing about construction industry injuries and safety management in construction sites and projects were identified and analyzed. The literature sample comprises articles that were published in the international journals particularly focusing on the building and housing construction sites safety and health management. Table 2.4 illustrates the summery of the literature review that are conducted from different national journals and webpages.

Table 2.4 : Summary of literature review (literature sources)

Title	Author and year	Objective	Method	Findings	Gap
Construction Costs Analysis And Its Importance To The Economy	Renata, et al., (2015)	The paper presents a case of construction cost analysis for wooden energy efficient house that meets sustainable aspects	Analyzed high costs of the construction investment (energy efficient wooden house).	In the result of analysis of the construction investment costs for the efficient wooden house and its comparison with the costs of traditional construction investment on maintenance costs, it can be stated that additional cost resulting from the energy efficient house building is higher than costs of traditional construction investment (about 10%) and it can be treated as the investment in the energy efficient house solutions since it brings savings for home expenditures (5% annually).	Here in this research it analyses construction investment cost minimization Doesn't include safety management practice
a literature review on global occupational safety and health practice & accidents severity	Jilcha, & Kitaw, (2016)	In order identify existing gaps on workplace safety and health management and also to propose future research areas, adds value to existing electronic database through different integration result	a systematic literature review approach	Various characteristics of workplace safety and health problems were found emanating from the lack of operational activities of the employees, internal working environment and external environment those impose hazards on employee temporarily, permanently and on working environments. knowledge transfer mechanism and industrial topology factors	In this research try to differentiates the mechanisms in different occupational safety areas and generalize as a whole.
Common Construction Site Hazards in Nairobi County, Kenya	Kemei, et al., (2017)	to analyze the construction hazards and injuries in construction projects between 2010 to 2014	Questionnaire survey and analysis of secondary data from Directorate of Occupational Safety and Health (DOSH).	It try to identify the five administrative factors rated on a scaled of 0-5, were thought to contribute to accidents.	In this research list out and evaluate the hazards but the project sites are randomly selected which are in Kenya.

Prevalence of occupational injuries and associated factors among construction workers in Addis Ababa, Ethiopia	Hanna M et al., (2017)	to determine the prevalence of occupational injuries and associated factors among building construction workers	pre-tested & structured interview questionnaire and observational check list, SPSS version 20 statistical software	during the past 12 months giving an overall annual prevalence rate of 847 injuries per 1000 construction workers and (10.8%) were hospitalized	The data that are collected in here are randomly selected site and this paper helps to mitigate the number of injured person and get hospitalized
health and safety conditions at construction sites in Nairobi county, Kenya	Ng'ang', et al., (2014)	to determine factor that influence health and safety of worker in kasarani, Nairobi	Open and close ended questionnaires', interview and pilot testing	The study tells that water provided to construction workers was unsafe for drinking. This may pose the risk of water related diseases and also the study establish HIV/AIDs information to the workers was limited	In this research it establish in Kenya construction and health and related safety performance for worker in specified country
occupational hazards in construction industry: case studies from housing and construction workers at Addis Ababa, Ethiopia	Thewodros, (2016)	To evaluate occupational hazards and to describe factors affecting its happening among construction workers' in Addis Ababa housing and construction project sites**.**	Structured questionnaire based interviews, work environment observation were used to collect the data.	Workers were observed and implementation of basic occupational health and safety services is required together with regular supervision to ensure and promote work place safety.	In this research paper it have the same housing projects tittles on injures but it doesn't include the specified 40/60 and 20/80 project sites health management.
Analysis of accidents on building construction sites reported in Uganda during 2001-2005	Henry, et al., (2007)	Analyze the causes of accident on building construction in Uganda.	Interview	Form this research paper the findings are collapse of building elements and improper use of machinery are the most of fatalities and most of the influenced from this hazards are labor and this fatalities in around 37% increase annually on average.	From the percentage construction in East Africa is increasing rapidly so in Ethiopia we can predict how it goes increases with in a short period of time.

issues of Construction Health and Safety in Developing Countries: A Case of Jordan	Alkilani et al., (2013)	case study on the Jordanian construction industry and its H&S practices	Primary data was collected from field visits, expert interviews and semi-structured questionnaires. Supporting secondary data was collected from archival studies and related research literature.	The findings highlight that a lack of government commitment exemplified by regulation, policy and legal constraints that limit the operational efficiency of government departments responsible for Health & Safety management, thus hindering the development of good H&S practice	Safety practice is Jordan country help to predict and to study the relationship in government and its safety management practices concentration in Ethiopia.
Health hazards risk and safety practice in construction site (Review study)	Vitharana. et al., (2015)	To identify the health hazards, risks and causes of poor safety practices in construction sites. In addition, the differences in safety practices in both developed & developing countries and methods to improve construction site safety.	A systematic literature review approach.	By comparing health hazards**,** Health hazards in construction sites can be categorized into two: acute health hazards and chronic health hazards. Mostly reported acute health hazards are "workers fall from height" and "electric shocks", while mostly reported chronic health hazard is "exposure to hazardous substances".	Health hazards and chronic health hazards (construction site hazards) can influence the whole construction industry building so this will give emphasis to study depth on housing condominium site projects.

The State of Construction and Infrastructure in Sub-Saharan Africa and Strategies for a Sustainable Way Forward	Zawdie, & Langford, (2014)	To show the importance of the role of capacity building in construction as a basis for the development of sustainable infrastructure, and hence for the promotion of economic growth and poverty reduction in sub-Saharan countries.	explores the nature of the infrastructure problem in Africa and sustainability in infrastructure development by defining and explaining	capacity improvement to be realized through the process of knowledge and experience accumulation, and for domestic construction firms to be able to evolve to a position in which they would be able to effectively compete with international firms, national governments would need to put in place comprehensive capacity building programs	In this research paper the general concept on construction and building infrastructure have explored widely and so how it show the way to focus on sustainability infrastructure development.
Challenges of mega construction projects in developing countries	Ahmed, & Othman, (2013)	to identify, validate, and classify the challenges of delivering mega construction projects (MCPs) in developing countries	Case study and literature review approach	the identified challenges are the following categories engineering challenges, human development challenges, managerial and political challenges and sustainability challenges	In this paper it classify the challenges but it doesn't include which challenge categories list of the tasks and it generalize the mega projects by developing countries it doesn't state which country have the listed challenges.

A survey of work-related injuries among building construction workers in southwestern Ethiopia	Lette, etal., (2018)	Assessing the prevalence of injury and associated factors among building construction workers in southwestern Ethiopia.	Structured questionnaire by taking random sampling	The top five injuries were injured by object (36.9%), followed by lower back pain (35.6%), falling injury (23.5%), skin disorder (20.1%), and eye problem (18.2%). Working without personal protective equipment (PPE), absence of vocational training, khat chewing, and working overtime were significantly raised the odds of having work-related injuries among construction workers	It this research they give a hint to focus on what this paper to focus on that is on construction projects however there is a location gap difference and also there is no proposed solution.
Occupational Health and Safety Status of Ongoing Construction Work in Patuakhali Science and Technology University, Dumki, Patuakhali	Hasan, et al.,(2017)	finding out the major health and safety related hazards in construction side in PSTU and to recommend some management options to reduce health related hazards and increase safety	Interview and questionnaires	hazards in PSTU construction site is falling from height; hit by falling object; trips and fall; back pain; muscular pain (due to manual handling); health problem caused by chemicals, dust, noise; injury from fire and other disaster.	In this research the data collection method is selecting randomly from working environment.
Safety climate factors, group differences and safety behavior in road construction.	Glendon, & Litherland (2001)	To determine safety climate factor structure with in road construction organization and to investigate the relationship between safety climate and safety performance.	Observation measurement and modified safety climate questionaries'	No difference between two districts (construction and maintain) and also there is no relationship between safety climate and safety performance.	In here there is a gap in the sector in the construction industry and method used to analyses the data.

2.3 Research Gap

The researches were further examined and evaluated based on the following major construction industry activities on the sites this are, occupational safety and health factors on building construction worker, construction hazard and injuries in construction projects, challenges of construction projects in developing countries, analyzing building construction accidents in different projects and construction cost analysis

Accordingly, it has been found that most of the articles only focus on different construction injuries, analyzing accidents in different private building construction projects and also safety and health factors in construction works. Generally the topics or issues which are addressed in the literatures or articles but not fruitful are: construction and safety management mechanisms, injuries and hazard controlling approach for project sites (especially for wide housing construction projects like condominium), engineering aspect and root causes analysis for each and every accidents and hazards.

Another gap identified from the literature review is that generally there is shortage of research done on the building construction sector especially in Addis Ababa even have there are many building projects including condominium sites there are limited researches have been done.

CHAPTER THREE
RESERCH METHODOLOGY

3.1 Introduction

This chapter of the research were discusses in detail the general research design, research process, sample and sampling technique, sources, tools and procedures of data collection and method of data analysis employed for the study.

3.2 Research Design

In this research paper both survey and descriptive designs were be used in order to gather significant information from building project participant bodies including contractor and consultant management staff by use of questionnaires and/or interviews. In order to identify the injuries and safety measure descriptive design will be used as a helpful mechanism to evaluate the management practice in the project sites. In addition for the primary source of collecting data interviews are also will be used with different project site supervisor and manger in order to explain the detail information that are required. The prepared questionnaires are self-administered by the respondents to complete the relevant data. Additionally site visit and direct observation are also be a mechanism to identify tasks, accidents, working environment and other additional information.

3.2.1 Research Process

A systematic mechanism for collecting data, obtaining finding and to analysis and conclude the developed data a research process is basic guideline. This research process was set a structure of objectives that complement one another in order to ensuring objectives followed by the described flow to crate relation for the goals.

3.3 Population and Sampling method

3.3.1 Target Population

On this research paper which targeted condominium site projects which are constructed by Addis Ababa housing corporation that include 40/60 and 20/80 condominium sites. The studied population was based on the Addis Ababa housing construction project office, condominium projects which are currently constructed by Addis Ababa City administration on 9 active projects

for 20/80 project sites and 17 active projects for 40/60 project sites inside the city and around the border of Addis Ababa region.

3.3.2 Sample size

The required sample size was determined by using proportional allocation formula. For the calculation, 95% confidence level, 5% marginal error and 50% injury prevalence (because there was no previous study) were assumed.

The number of samples from each stratum was determined by using proportional allocation formula which is $n = (1.96^2.\sigma^2$ standard deviation)/ (error rate) ^{2} Lipsey, (1990) where n is sample size form finite population finally; simple random sampling technique was employed to select 150 sample sizes. But due to different reason the collected numbers of questionnaires are 139.

3.4 Study Location

The questionaries' were distributed to the 9 condominium project sites of 20/80 and 17 project site of 40/60 condominium projects around Addis Ababa and border regions located between Addis Ababa and crust of Addis Ababa and border of Oromiya region.

3.5 Sources and Tools/Instruments of Data Collection

In order to collect enough information in the study area there are different mechanisms have been used to collect data the major sources for primary data are interview and questioners. The questioners include open end questions to explain their evidences and ideas about the titled issues in detail. The main focus of the tools was to collect information about the current practices, major areas and factors that affect the performance of health & safety issues in condominium construction projects and to answer the research questions. Data were collected total of 150 workers in questionnaire and above 10 interviews. Workers are selected randomly. Selected workers are mixed group like as from consultant side, client side and the contractor side. Major health injuries and hazards, vulnerability, safety management practice displacement and the present safety condition were a major point to know from them through focuses grouped questions. In this regard key informants' were interviewed and questionnaires were also finalized. Observation techniques were also adopted to understand the major injuries and hazards, vulnerable zones and bad safety practices of this area due to construction work of this

condominium projects. In this research paper different methodologies were been used, the main sources are primary and secondary sources.

i) Primary data collection

In primary data collection, the researcher used the following methods: -

- **Visiting and site observation:** To see the site safety and how site workers interact and protect themselves from injuries on their duties so that the researcher can find the first step to examine the issues of safety and injuries.
- **Interview:** In this data collection method, structured interview questions has been prepared and conducted in different project site.
- **Questionnaire:** Under this data collection method, different questionnaires have been designed and distribute for, condominium project site workers (employers), supervisor and managers position in the site in order to collect quantitative data.

ii) Secondary data collection

In secondary data collection, the researcher was used the following methods to collect data's: -

- **Literature survey:** To understand the concepts and to consider the effort made by different researchers towards investigating and assessing on building construction injuries, occupational safety issues.
- **Different reports:** Different reports from building construction sectors, reports from ministry of labor and social affairs.

3.6 Questionnaire Design

The survey questionnaire design aim to achieve the answer for the research questions i.e. what are the weaknesses and strengths of building construction injuries and safety practices in buildings construction projects, what are the different types of injury in building construction and what should be done to reduce the problems of building construction injuries and safety issues specifically for 26 condominium projects. A survey questionnaire was sent to Contractors staff, Consultant & Client representative of condominium building construction projects. The survey questionnaire were used to gain insight into the conditions on projects and to evaluate the implications and compliance with the construction regulations by all parties concerned, the main focus being to assess the safety & health management in condominium construction projects and to get feedback how different factors affect the performance of health and safety on this

construction projects. This survey questionnaire uses a qualitative approach to gather the honest opinions of those partaking in the survey and is a quantitative means of obtaining data when responses was tallied and thereafter was analyzed. The questionnaire was composed five parts. The first part of the questionnaire gives about the Socio demographic characteristics and information regarding the respondents and the second part, which contained questions about the current Work place and behavioral characteristics information about the project sites. The third part includes Health and hazard related issues that survey on building construction injuries. The respondent answered in YES, NO form and if they said NO they selected reasons from the list or added the reason. The fourth part contained the Safety management practices in project sites for each condominium projects. The fifth and the last one contained a table format it is all about Safety and health performance factors evaluation for condominium project site including all the 40/60 and 20/80 scheme; the whole questionnaire content has been attached in the Annex part.

Table 3.1 : Population and response rate of project sites

Type of condominium projects	Active site projects on construction	Total number of blocks	Number of questionnaire distributed	Collected Questioner
40/60 condominium project sites	17	157	50	46
20/80 condominium project sites	9	738	100	96

3.7 Data Analysis

During this study, descriptive statics was the major technique of statically analysis through using Microsoft word and Microsoft Excel spreadsheet. The quantitative data collected from sample respondents who are working in the condominium project as contractors, as client and as consultant will be analyzed Using averages, percentages, tables and figures to answer injuries and safety measures, weaknesses and strengths of building construction injuries and safety practices in buildings construction projects. The qualitative data's will be finally gathered from general comments and interview and analyzed separately but presented in combination with the quantitative information.

3.8 Validity and Reliability

To clearly state the validity of the data acquired and to give strong depth the questionnaire has been initially piloted by few numbers of project managers to ensure consistency, clarity and relevancy, and cross-checking was done.

The data sources that have been gather are official and re checked from other secondary sources so that it will help to picture out the real world scenario specifically for this project sites. The secondary resources are research paper and articles from relevant journals and research institutes. Since it is well known that cross checking data helps to remove errors and to catch complete confidence over data.

3.9 Ethical Issues

In this study the ethical issues need to be considered in a scientific research were also considered. The study results depend on the data provided by the respondents and the qualitative data obtained from interview and the process is realistic and bias free. In addition, the researcher asked for consent of the interviewees and pledged to keep the confidentiality of the information gathered to conduct this study.

3.10 Research framework

Including the primary and secondary data collections as well as different mechanisms of the data analysis these research papers have general framework that contain the all the path and flows (see Figure 3.1).

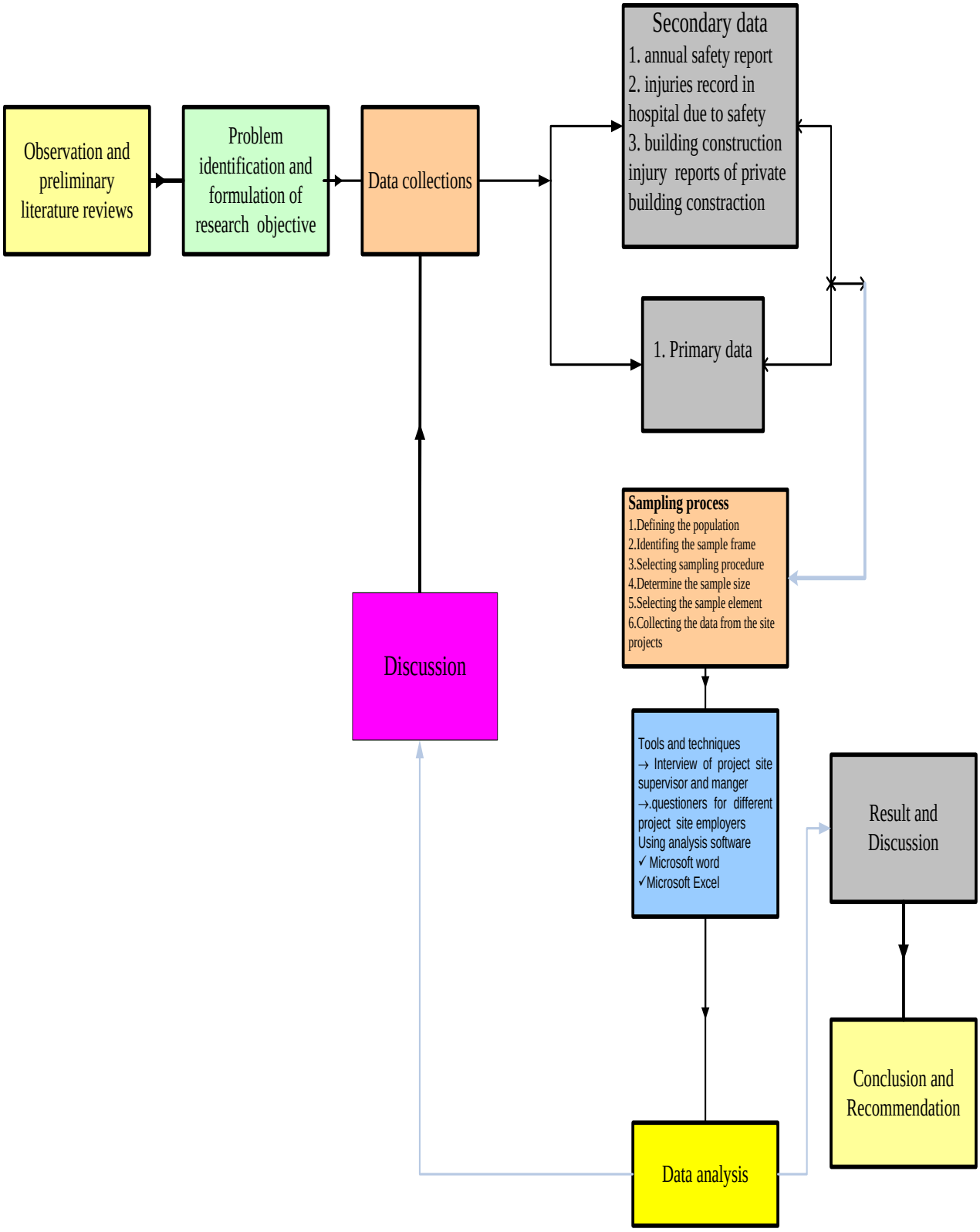

Figure 3.1 : Research framework

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1. Introduction

In this chapter the results of collected data from literature, interview and questionnaire ware presented and analyzed in three major sub parts. The topics discuses and emphasize for both condominium projects i.e. the 40/60 scheme and 20/80 scheme. The first category is 40/60 scheme and the second is for 20/80 scheme. Totally, 17 active project sites from 40/60 scheme and 9 project site for 20/80 condominium scheme. From each project site different contractor, project consultant officer and project client from Addis Ababa Housing construction project office were participated in the study which is located in Addis Ababa and around the boarder. During on the site visit detail observation were made and more than 10 interviews have been made that helps to identify the causes; form this majority of them are done in the site and the remaining interviews are done outside the site (governmental offices) including MOLSA and AAHCPO; this mechanism helps to make the data collection flexible. Figure 4.1 and Figure 4.2 shows the Location and percentage completion of housing of projects for both 40/60 & 20/80 schemes in Addis Ababa.

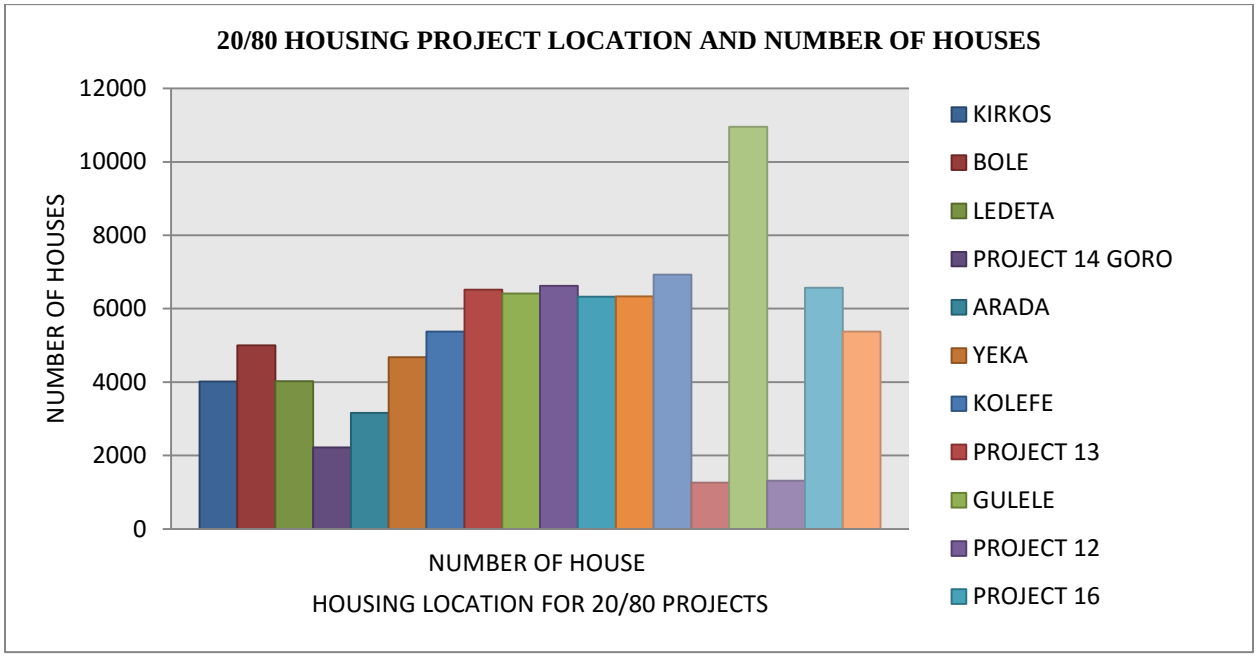

Figure 4.1 (A) number of house location for 20/80 project schemes

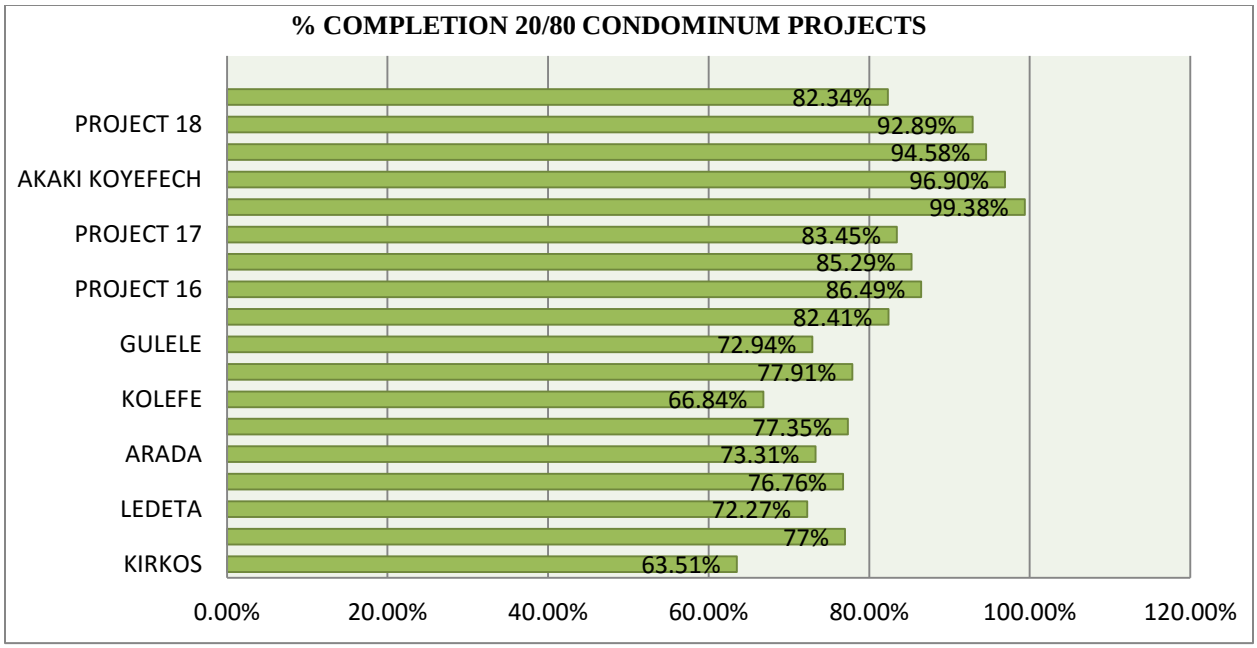

Figure 4.1 (B) percentage completions for 20/80 project schemes

Figure 4.1 (A & B): Number of house and percentages completion for 20/80 schemes

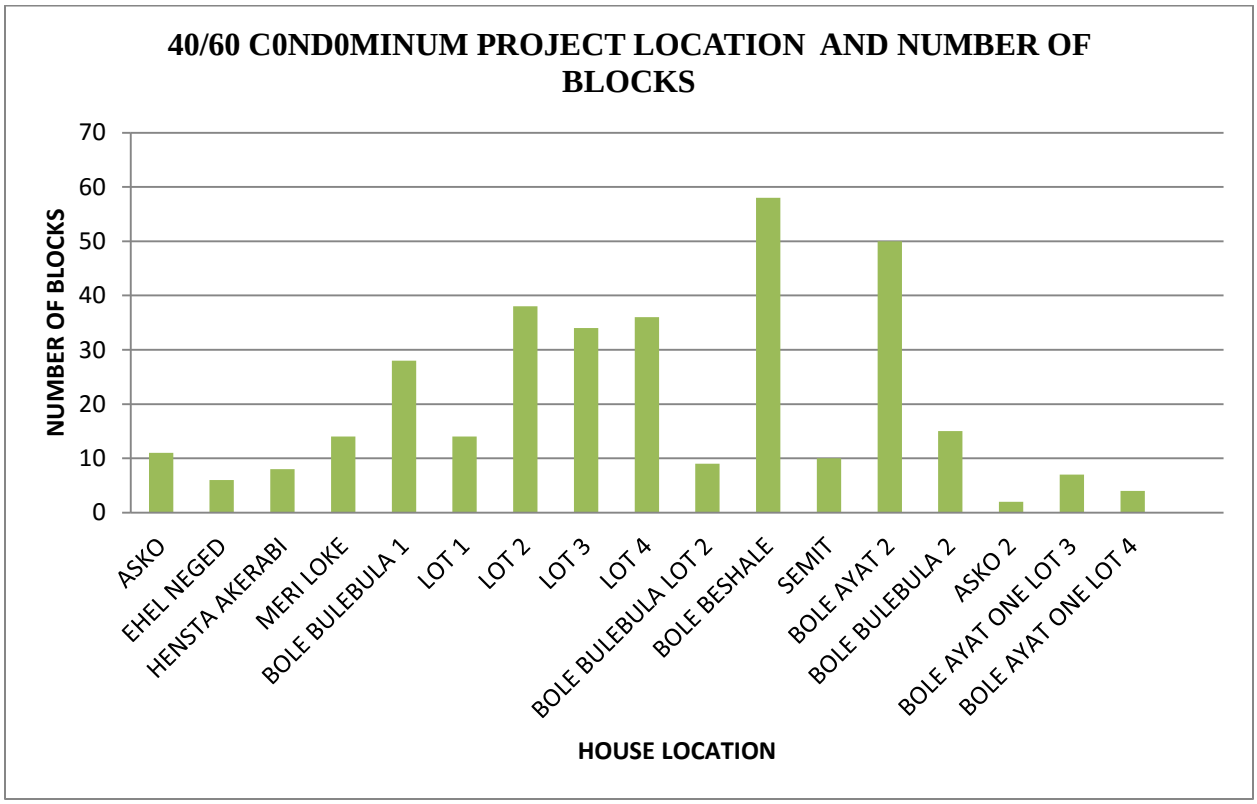

Figure 4.2 (A) house location & number of block for 40/60 project schemes

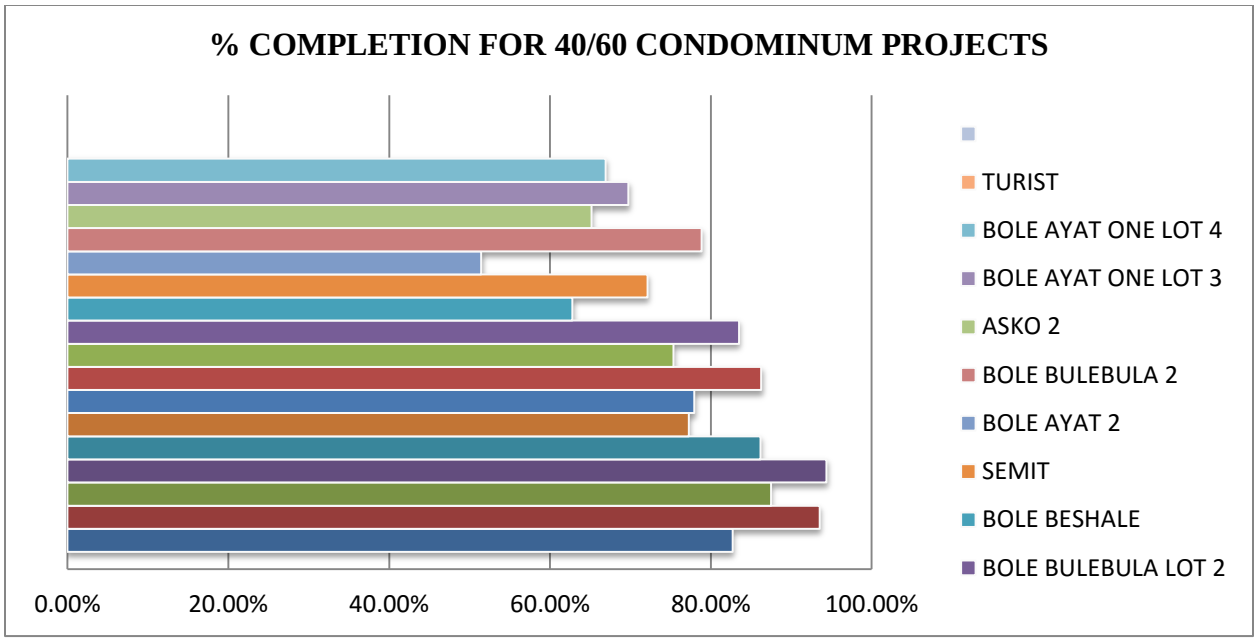

Figure 4.2 (B) percentage completions for 40/60 project schemes

Figure 4.2 (A & B): Number of blocks and percentages completion for 40/60 schemes

The data analysis have three parts the first parts discusses about the socio demographic characteristics & information regarding the respondents and work place and behavioral characteristics information about the project site and the second part health and hazard related issues that survey on building construction injuries and the last part is safety management practices and safety and health performance practices in condominium project sites. This is to reorganize the data in a systematic manner so that they are clear and unambiguous to be understood and hence to be analyzed. The methods of analyzing are by using averages, and percentages. Tables and charts are used because this method of data presentation is much more preferred among others, as it provides easier understanding and clearer picture of information to be delivered.

4.2. Socio demographic characteristics

This section presents the information regarding the respondent who participated in the study and form the result of collected data a total of 139 participants completed the questionnaire making rate of 92.6% and from this the majority were male that is 84.1% and the remaining respondents are female which is 15.8% .The majority, 72.6% of the employees belonged to the age group of 14-29 years and then after followed by the 30-44 years group in 12.6%. Regarding the educational level 13.6% of the respondent cannot read and write so that the data and language

regarding them are collected through recording and translating in to questioner form. The rest 25.17% can read and write, 24.4% attend elementary and 37.4% attend secondary level and above respectively. Half 50.3%, of the employs are daily labor and the rest half are 12.9% plasterer, 14.3% painter, 9% mason and 7% of other concerned bodies. In Table 4.1 all the socio demographic characteristics of the study participant were summarized.

Table 4.1 : Socio demographic characteristics and information of respondents

Variable	Characteristics	Number/frequency	Percent
Sex	Male	117	84.1%
	Female	22	15.8%
Age	14-29	101	72.6%
	30-44	16	12.6%
	45+	20	14.4%
Educational level	Can't Read and write	18	13.6%
	Read and write	35	25.17%
	Elementary	34	24.4%
	Secondary and above	52	37.4%
Occupations	Daily labor	70	50.3%
	Plasterer	18	12.9%
	welder/electrician	7	5%
	Mason	13	9%
	Painter	20	14.3%
	Other concerned body	11	7%
Month salary in birr	<=60	18	12.9%
	61-99	24	17.2%
	100-120	83	59.7%
	>120	14	10.07%
Work experience	6 month	49	35%
	7month-11month	61	43%
	1year- 2year	18	12.9%
	Above 2year	11	7.9%

4.3. Work place behavioral characteristics

In this section the paper describes about the work place behavioral characteristics information regarding to the project sites and the employees specifically working in the site that are directly or indirectly affected by injuries and hazards. These characteristics include employee pattern, about safety training and drug usage, understanding of occupational safety and health, reasons for not using personal protective equipment (PPE), and overview examination of health checkup periodically.

4.3.1 Employee pattern

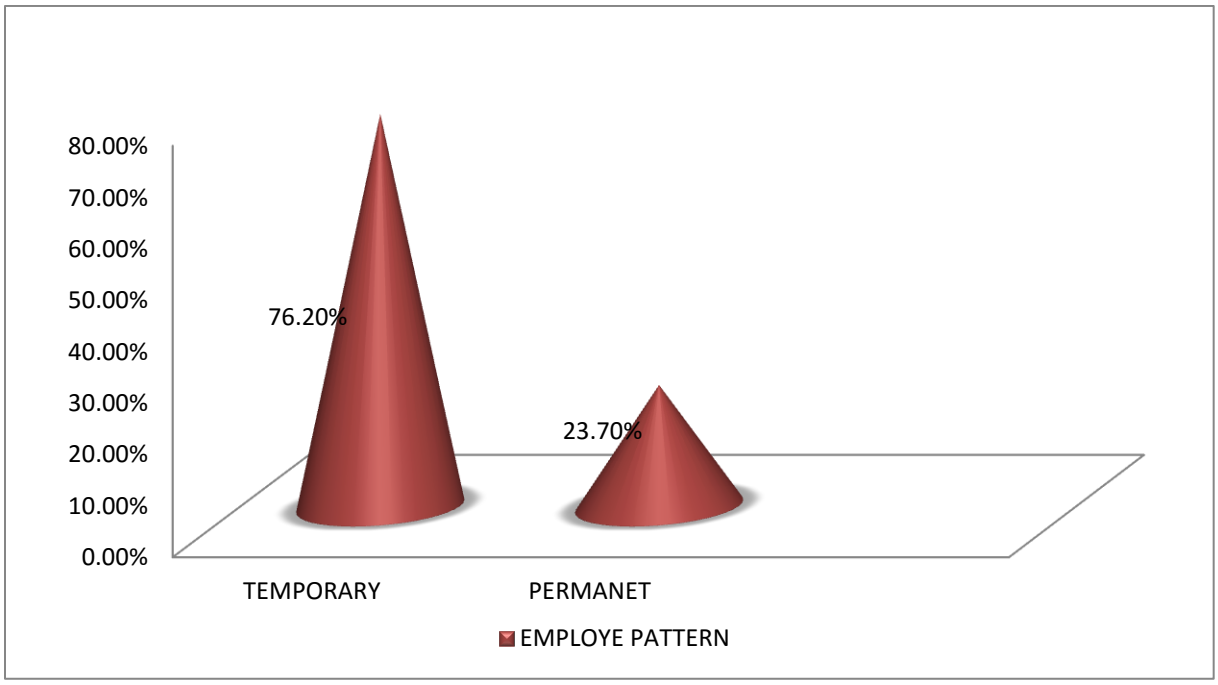

Figure 4.3 : Employee pattern

The above Figure 4.3 shows that 76.2% of the condominium project for both 20/80 and 40/60 scheme most of the employers are working temporarily, the remaining 23.70% are working permanently so that the local contractor should provide personal protective equipment (PPE) for temporary project site worker. Which implies that the information forwarded could be important as required in the study.

4.3.2 Understanding level of occupational health hazards

Understanding the concept of occupational health and safety as well as related hazard is an important input for analyzing the safety and health issues as a whole so that in the collected data there was an evaluation to the understanding of occupational health hazard.

From the Figure 4.4 we can understand that only 43.1% employees has recognize about occupational safety the remaining 56.83% have no awareness what does it mean by occupational health hazard and health/existence of occupational health hazards and safety pre condition. This implies there should be mechanisms to give more awareness to safety.

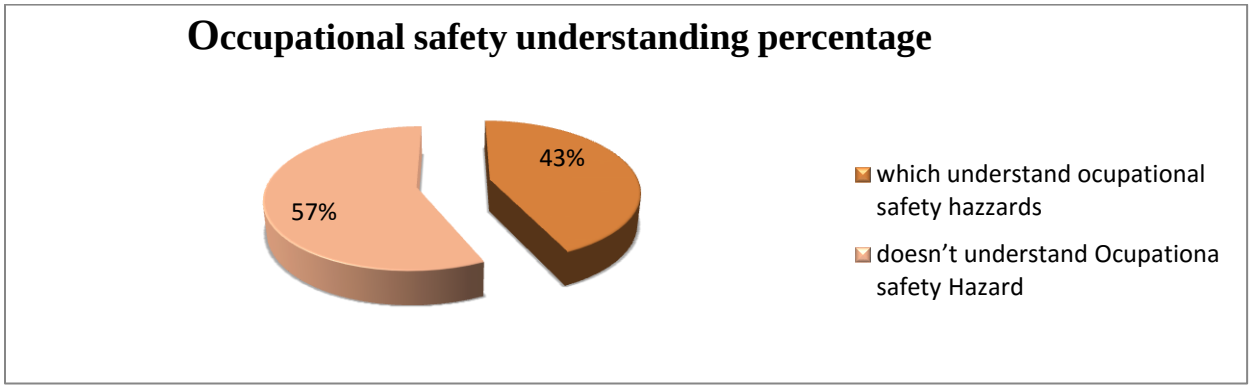

Figure 4.4 : Occupational safety understanding percentage

4.3.3 Personal protective equipment usage

Most easy thing that protect and decreases the number of injury and hazard by using personal protective equipment before harm employ's but from the collected data majority of the worker 88.4%, doesn't use personal protective equipment. The remaining 11.5% only use this personal protective equipment (PPE) this is due to the following reasons. From this reason the majority 86.3%, is due to no provision of personal protective equipment (PPE) and the rest 8.6% and 5.8% other reason and it doesn't give comfort during work respectively; see Figure (4.5).

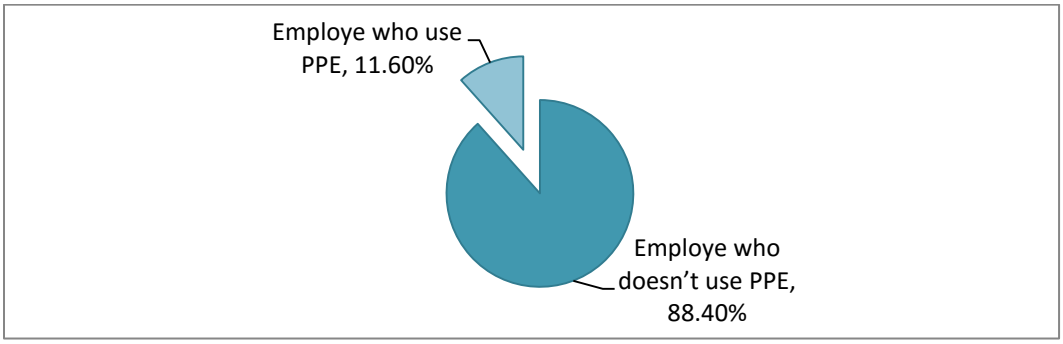

Figure 4.5 : Personal protective equipment usage

Relationship and reason that allocate the usage percentage for personal protective equipment (PPE) Figure 4.6 is as shown below.

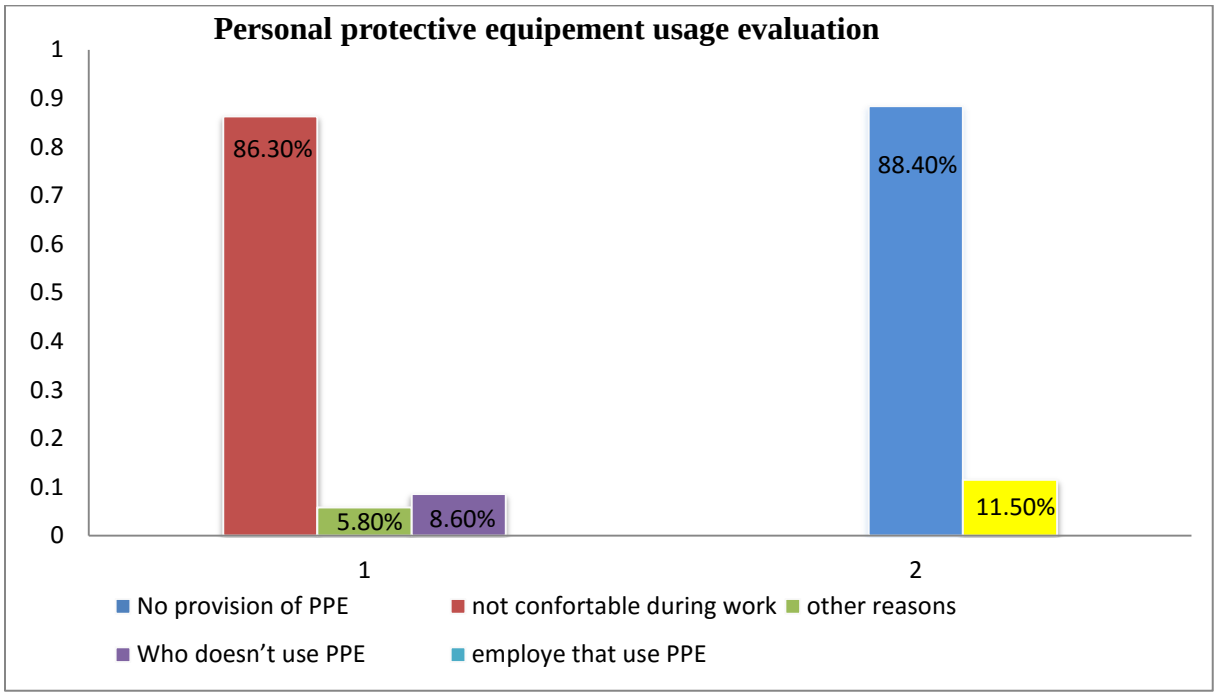

Figure 4.6 : Evaluation of personal protective equipment percentage

4.3.4 Periodic health check up

Even though it is well known that not only for construction worker but also for other industries making periodic health checkup is important in our day to day activity. Especially in this section the construction areas mostly covered by dust, chemicals, and other so many things so that in order to protect form injury or other related health problems making periodic health checkup is an important factor. From the collected data 91.36% of employee doesn't make periodic health checkup. The remaining 8.6% make health checkup (see Figure 4.7).

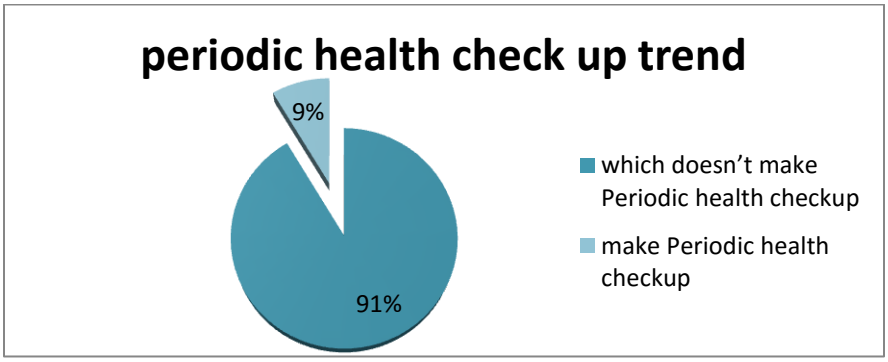

Figure 4.7 : Periodic health checkup trend

4.3.5 Safety training for construction workers

Safety training for construction employer is a key factor to decrease the level of the injury before reaching to the maximum level hence giving awareness for each and individual about safety and health issues, how can protect themselves from hazards and how to use personal protective equipment effectively. From the collected data majority 82%, doesn't take any safety training and doesn't know in this time a lot of people die due to occupational safety and health hazards related issue. The remaining 18% on the project site only have idea and take safety training by safety supervisor or safety officer. This safety training illustration in the project sites summarized in the Figure 4.8.

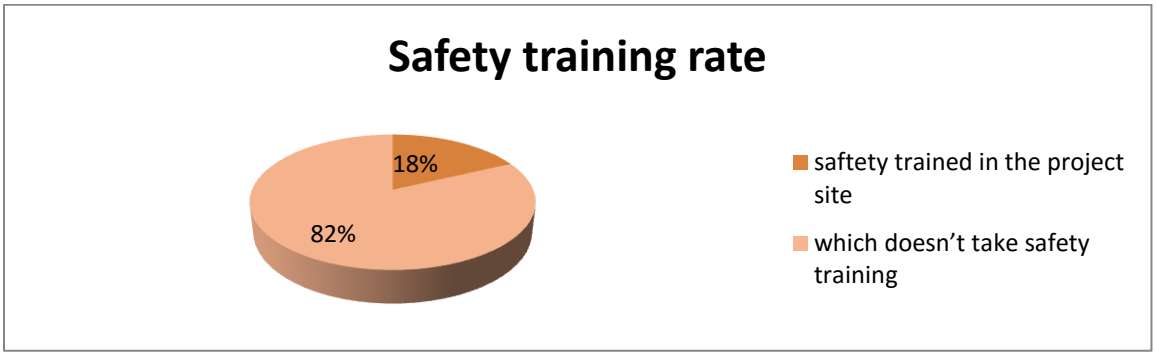

Figure 4.8 : Safety training rate

4.3.6 Job satisfaction level

Job satisfaction showed statistically significant association with occupational injury and also, according to the survey of Mola workers who did not undergo vocational training were 2.37 times more likely to have injury than those who underwent vocational training (Mola & et al., 2013).In the construction workers who reported current job satisfaction were 22.3% satisfy by their work. The remaining 77.7% doesn't satisfied by their job (Figure 4.9).

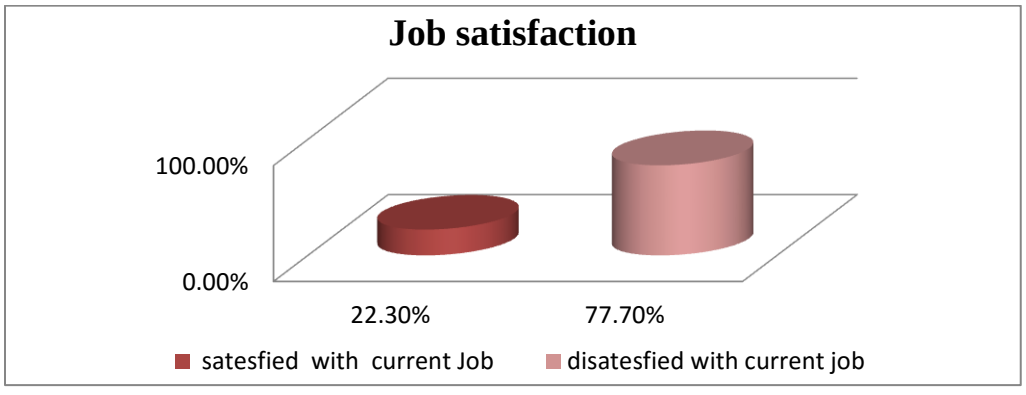

Figure 4.9 : Job satisfaction percentage

4.3.7 Using rate for Alcohol, cigarette and chewing khat

According to the definition in the survey of Tadesse, (2016) the definitions for cigarette smoker, Alcohol drinker and khat chewer is defined as follows. A person which said to be cigarette smoker is an employee who was smoking one cigarette a day for at least one year; an employee who drinks at least five drinks per week for men and two drinks per week for women for at least one year is said to be alcohol drinker; an employee is said to be khat user which uses a mild psychoactive substance three times a week for at least one year.(Tadesse & Israel, 2016) The data from the field survey shows that the majority 53.9% doesn't use any of these alcohols, cigarette and chat.

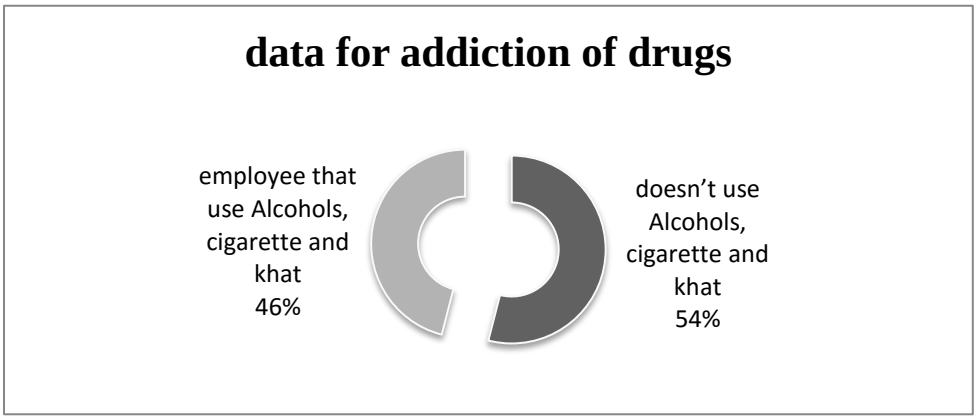

Figure 4.10 : Usage rate for alcohol cigarette and khat

4.4. Health and injuries information regarding the respondents

From the previous discussion that the majority 57% of condominium project site worker doesn't understand and haven't idea about occupational health and safety (see Figure 4.4). They didn't train well but some of them about 30%-40% understands little knowledge through the long time work experience. This implies the injuries that occur on the project sites have different perspectives

And categories these are ill-hazard health (death after a certain sickness time) and physical hazard injuries (direct physical injuries and death).during field survey on both scheme i.e. for 40/60 and 20/80 condominium projects that are governed by Addis Ababa Housing construction project office for each case the respondent witnessed different perception so that in order to make compare and contrast the percentage and the number of frequency the collected data summarized in Table 4.2 and Table 4.3 for each case separately.

Table 4.2 : Health and injury information for 40/60 scheme respondents

Type of Hazard	for 40/60 scheme condominium		
	Characteristics	Number/frequency	Percentage
falling from height	Yes	32	70%
	No	14	30%
	Sum	46	
Hit by falling objects trip and fall	Yes	27	59%
	No	19	41%
	Sum	46	
Injuries due to manual handling	back pain	36	78%
	muscular pain	7	15%
	no pain at all	3	7%
	Sum	46	
health problems due to chemical	Yes	3	7%
	No	43	93%
	Sum	46	
health problems due to Noise	Yes	22	48%
	No	24	52%
health problem due to dust	Yes	1	2%
	No	45	98%
injury due to moving equipment	cut by equipment	24	52%
	crashed/pushed by equipment	19	41%
	No injury at all	3	7%
health problem due to long bending and twisting	Yes	6	13%
	No	40	87%
injury due to fire disaster & earth work in excavation	Yes	0	0%
	No	46	100%
stress and bullying during work	Yes	14	30%
	No	32	70%
	Sum	46	

Table 4.3(A & B): Descriptive statistics for health and injury in condominium project sites

From the collected data on the Table 4.3 the descriptive statistics that have been measured using the help of SPSS software and the analyzed data show the mean and the standard deviation of each injury.

Type of Hazard	for 20/80 scheme condominium		
	Characteristics	Number/frequency	Percentage
falling from height	Yes	62	65%
	No	34	35%
	Sum	96	
Hit by falling objects trip and fall	Yes	54	57%
	No	40	43%
	Sum	94	
Injuries due to manual handling	back pain	49	51%
	muscular pain	26	27%
	no pain at all	21	22%
	Sum	96	
health problems due to chemical	Yes	6	6%
	No	90	94%
	Sum	96	
health problems due to Noise	Yes	44	46%
	No	52	54%
health problem due to dust	Yes	78	81%
	No	18	19%
injury due to moving equipment	cut by equipment	59	61%
	crashed/pushed by equipment	27	28%
	No injury at all	10	10%
health problem due to long bending and twisting	Yes	21	22%
	No	75	78%
injury due to fire disaster & earth work in excavation	Yes	0	0%
	No	96	100%
stress and bullying during work	Yes	37	39%
	No	59	61%
	Sum	96	

According to the data on the Table 4.2 the leading injuries in the 40/60 condominium scheme project sites are injuries caused by due to manual handling; from this manual handling the majority 78% is injured in their back pain, 15% muscular pain and the rest 6.5% participants have no pain due to manual handling.

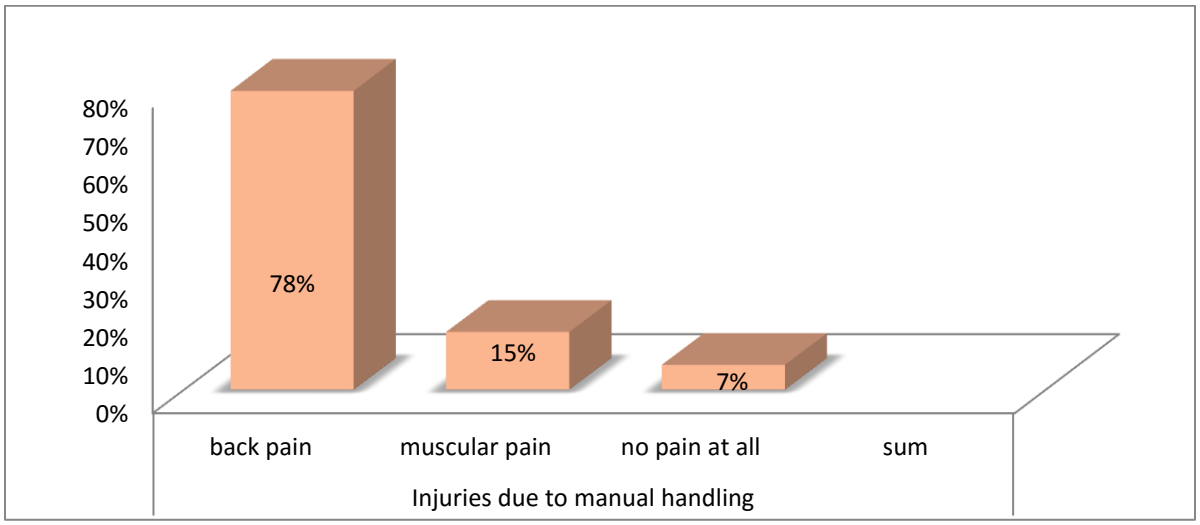

Figure 4.11 : Injury percentage for manual handling

After manual handling (Figure 4.11) the second major cause for injuries and hazards on 40/60 scheme construction site is falling from height (Figure 4.12). people and object and other things falling from one point to other destination so the study find out that the second leading causes for occupational injuries in condominium project sites with rate of 70% and the remaining 30% doesn't affected by falling from height.

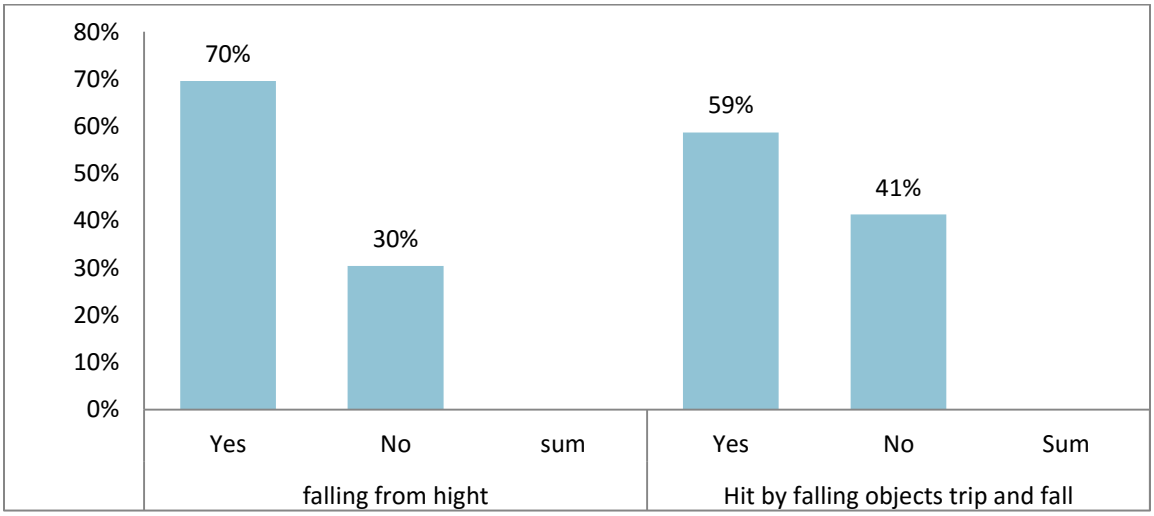

Figure 4.12 : Injury percentage for failing from height

The remaining causes for the condominium 40/60 project sites are injuries due to moving equipment's specifically injuries that have causes of cut by equipment 52%, crashed/pushed by equipment 41.3% and health problem related to dust 47.8% (see Figure 4.13).

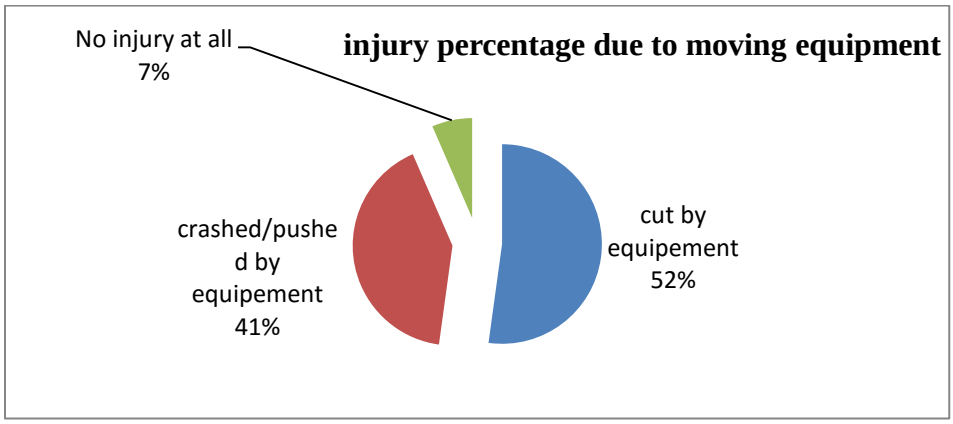

Figure 4.13 : Injury percentage for moving equipment

Injuries and health problems caused in condominium 40/60 project sites scheme due to dust in work place are 48%, physical and mental stress or bullying during on work 30.4% and health problems due to twisting and bending have a low percentage of 13.1% .The above all data that has been analyzed for 40/60 scheme see (Figure 4.14).

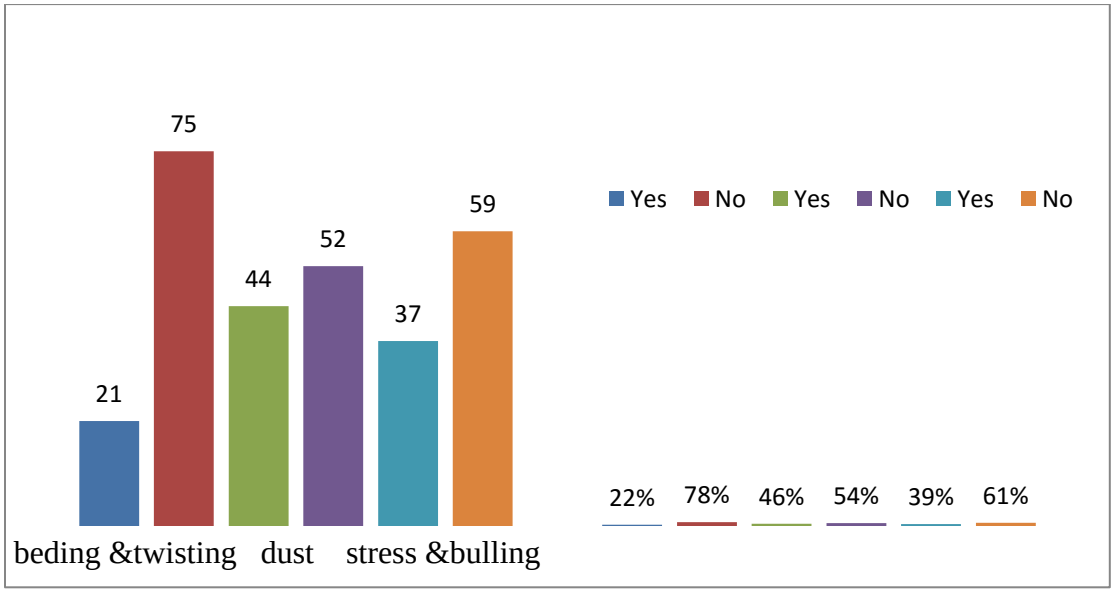

Figure 4.14 : Percentage of other causes of injuries

From the Table 4.3 we can see that leading injuries in the 20/80 condominium scheme project sites health problem that are caused by due to Noise take the highest which is 81%, falling from height 65%, injuries that caused due to moving equipment /cut by equipment/ 61%, injuries that

occur during falling of objects/hit by falling objects/or trip 57%, stress and bullying during work 39%, injuries that caused due to moving equipment /crashed or pushed by equipment/ 28% and health problem that occur due to long bending and twisting take 28% from the total respondent.

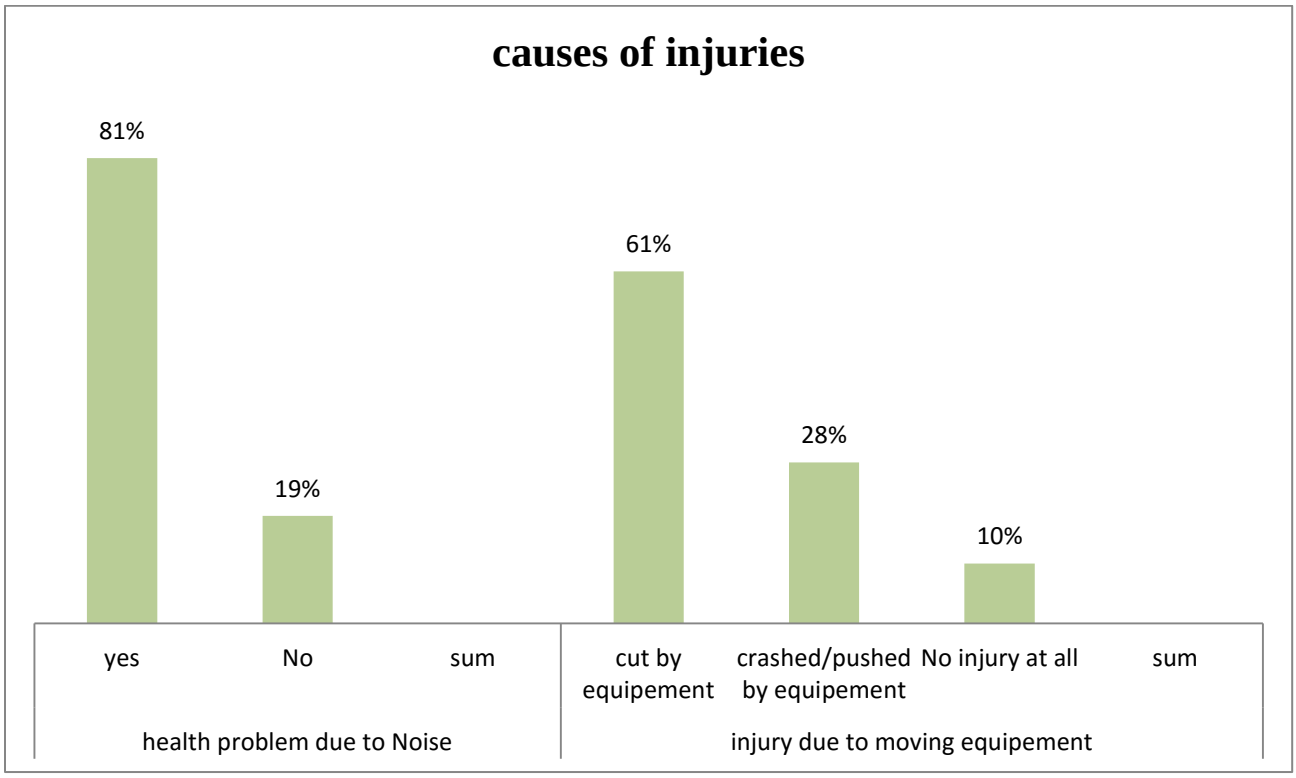

Figure 4.15 : Noise, crush and cut by equipment percentage

It is well known that noise is unnecessary sound which presents physical stress in the condominium project site of 20/80 scheme. The effects of noise exposure to workers health include tinnitus, annoyance, and hypertension, sleeping disorder, hearing impairment and hearing loss. These causes reduce the hearing performance of employees the common one is the sites are operation of jack hammer, rock breaking, powered electric machine and tools and vibrator and nail guns during concrete work. Due to so many reasons many people injured in the consequence of moving equipment and site machinery tools. These activities include chisels, saws, drilling and grinding machine, screwdrivers, knives and hammers. From hand tools the most injuries caused due to improper maintains of tools and misusage of equipment's. Due to crash injuries there is serious of effects in health. This includes starting from to become disabling up to head and brain injuries, fractures, back and internal injuries.

On the other hand the most common workplace hazard that contribute to over of a fourth of all injuries in condominium 20/80 project sites are trip and slips which results a series injury of musculoskeletal injuries and broken of bones.as a result this slips and trips causes fall from height. The reason behind or as a cause of this trip and slips are construction materials are scattered randomly everywhere, due to poor lighting, wet floor, very large and heavy materials being carried, due to reduction of one's balance and inappropriate footwear is worn.

Occupational health issue also include work related stress for the construction site because of having to do too much work at the same time, working for long time, and other internal and external personal problems. Work related stresses also include biological stresses exposed to disease.

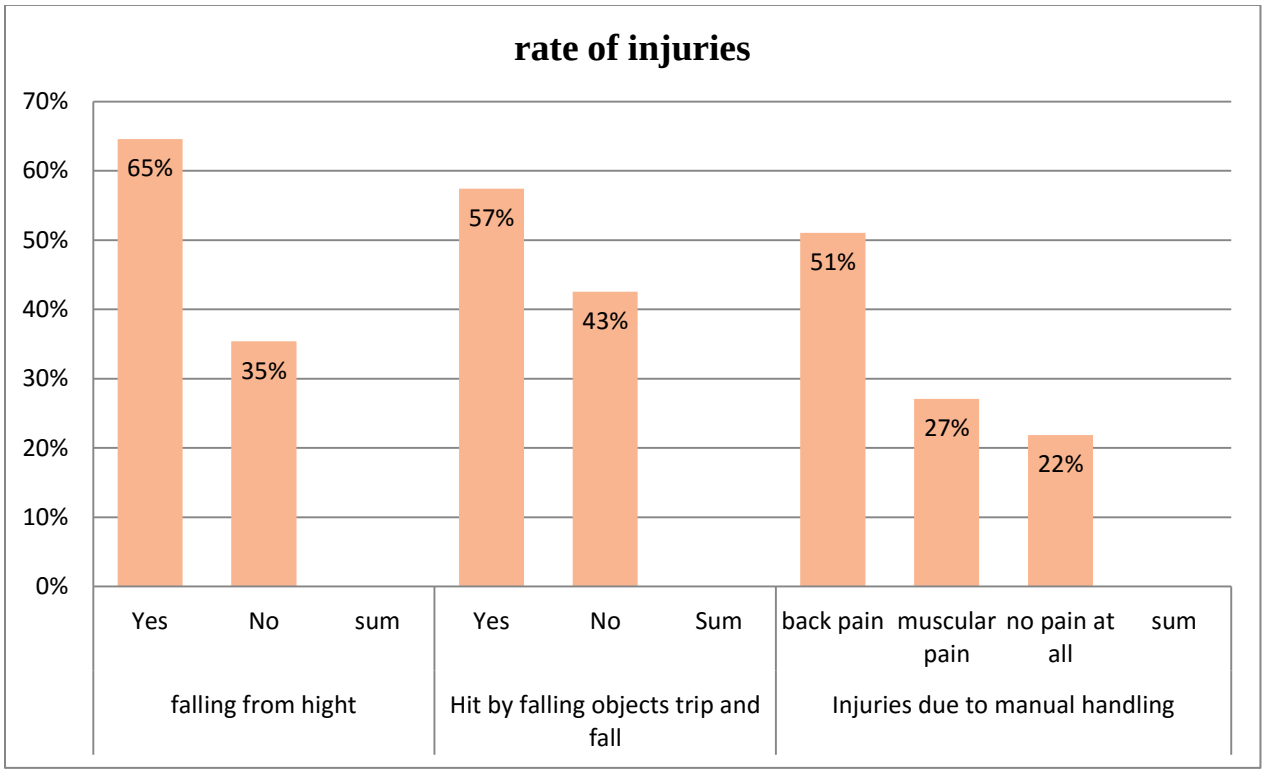

Figure 4.16 : Rate of injuries for 20/80 schemes project sites

According to the respondents data participants for 20/80 and 40/60% scheme there is 6.25% health problems due to chemical, temperature also have effect on site both very cold and very hot temperature may cause less serious type illness. There is no injury due to cover by earth work during excavation; and also there is no injury due to fire and disaster. On building the most common hazard is dust; depending on the dust type its result to health have different effects.

Chemical properties and physical properties of material and equipment are finally leads to health hazard.

4.4.1: Factors associated with injuries

To summarize the factors that remained statistically significant relation with the number of injury crosstab and multivariate regression analysis have been used in order to determine the odd ratio/crude ratio factors and the results were presented through AOR (adjusted odd ratio) & CI (confidence interval) so that the prevalence injury among workers in condominium building construction were reported to be 48.9% [95 % CI: (36.2, 41.9)]. In table 10 the association between injuries and different factors has been listed.

Table 4.4 : Factors associated with injuries in condominium project sites

Case Processing Summary						
Description		Number of frequency	Yes /for injury/	No/for injury/	Crude OR 95%CI	Adjusted OR 95%CI
Age	14-29	101	87	14	1.00	
	30-44	16	11	5	1.48(0.95,2.60)*	1.18(1.20,3.37)*
	45+	20	11	9	3.27(0.3,0.82)*	2.64(1.08,7.27)*
Sex	Male	117	92	23	2.37(0.3,0.7)*	2.17(1.50,3.37)*
	Female	22	17	5	1.00	1.00
Occupations	daily labor, plasterer &painter	70	58	12	0.57(0.3,0.7)*	0.41(0.2,0.7)*
	welder/electrician	18	4	12	1.00	1.00

The result from the analysis of multivariate logistic regression analysis on the case summery Table 4.4 shows the prevalence of condominium building construction injury significantly associated with age, sex and the type of occupation of the worker. Workers that are found in the level of above 45 years age range were 2.64 times more likely to be injured than the upper/young/ class i.e. 14-29 years age range [AOR: 2.64, 95% CI :(1.08, 7.27)] the reason behind this might be work experience, physical strength & concentration. whereas there is no statistical significance were found with 14-29 age range and 30-44 age range [AOR: 1.18, 95% CI: (1.20, 3.37)].on the other similar view occupational injuries are significantly related to gender this implies that males were 2.17 times more likely involvement in injury than females.[AOR: 2.17, 95% CI: (1.50, 3.37)]. It is commonly understandable that hard works are done by males depending on the work characteristics. Safety management practices and safety and health performance practices similarly the types of works are significant association with the

number of injuries this implies workers who work as daily labor and related tasks were 0.41 times more likely injured[AOR: 0.41, 95% CI: (0.2, 0.7)] with relative to other related tasks/jobs.

4.4.2 Health, safety training and resources

In this section information regarding on current safety management practices and safety and health performance practices on the project sites are presented and analyzed from the collected data and other primary as well as secondary data resources. The presented data have three major categories this are health and safety training and resources, upper management project supervision, commitments and involvement, and finally governmental organization follow up, communication and accidents reporting.

Table 4.5 : Data describing Health, safety training and resources

Description	40/60 scheme project sites		20/80 scheme project sites	
	Yes	No	Yes	No
Safety supervisor availability on the site	11%	84%	93%	7%
Suitable layout for health and safety aspects	62%	26%	61%	28%
Site review for health and safety aspect periodically	20%	75%	33%	63%
Health and safety implementation and written regulation	73%	16%	71%	9%
Reason for "No"				
lack of awareness of participants	13%		52%	
lack of human resource and budget	57%		30%	
bad location selection	21%		11%	
doesn't have any enforcing law	9%		4%	
there is no contractual obligation	0%		3%	
Other reason	7%		21%	

From Table 4.5 we can see that for both condominium schemes 40/60 and 20/80 the respondent witnessed their project sites haven't a safety supervisor and 11% for 40/60 and 7% for 20/80 schemes are only available.62% of respondent witnessed that the project sites are suitable layout for health and safety aspects, more than the half of the respondents i.e. 75% for 40/60 and 63% for 20/80 witnessed on their project site there is no periodically site review for health and safety aspect and above 70% of both project site schemes agreed that there is health and safety implementation and written regulation. The reasons behind for not availability of safety supervisor, layout aspect, and periodical site review of safety aspect, and health and safety implementation /written obligations are witnessed by the respondents 13% on the 40/60 scheme

and 52% on 20/80 scheme due to lack of awareness of participant, 57% on the 40/60 scheme and 30% on 20/80 scheme due to lack of human resource and budget allocation.21% for 40/60 scheme and 11% for 20/80 reason out that there is bad layout selection which doesn't consider health and safety aspects. For both scheme below 10% of participant witnessed reason out which doesn't have any enforcing law and there is no contractual obligation to apply this safety requirements. The remaining below 30% of participant has other reasons.

4.4.3. Top management project supervision, commitments and involvement

Table 4.6 : Data describing for upper management concerns

Description	40/60 scheme project sites		20/80 scheme project sites	
	Yes	No	Yes	No
project site mangers provide right tools and personal protective equipment PPE	4%	94%	8%	90%
availability of first aid tool kit in your project sites	27%	61%	43%	51%
construction site have comfortable facilities like toilet, shower and canteens	17%	72%	34%	62%
fatalities and injuries on the projects site reported by the concerned body	5%	92%	12%	83%
Reason for "No"				
lack of awareness of participants	30%		37%	
lack of human resource and budget	25%		38%	
due to consultant carelessness	21%		10%	
Doesn't have any enforcing law	8%		6%	
Other reasons	16%		9%	

Table 4.6 shows that the top management project supervision, commitments and involvement in the project site and so that above 90% project site managers of both scheme do not provide right tools and personal protective equipment (PPE). In 40/60 scheme condominium project sites 61% and in 20/80 scheme condominium sites more than half 51% for respondents replayed that first aid tool kit is available. The remaining 43% for 20/80 scheme and 27% for 40/60 scheme witnessed that there haven't first aid tool kin on the project sites. For the comfortable facilities like toilet, shower and canteens the respondents witnessed that 34% for 20/80 and 17% for 40/60 the facilities are available. The rest 62% for 20/80 and 72% for 40/60 scheme projects doesn't have comfortable facilities. In both project schemes more than 80% of fatalities and injuries didn't reported by the concerned body; less than 15% of the fatalities and injuries are reported by

the concerned body. As a reason the participant answered that 30% for 40/60 and 37% for 20/80 were due to lack of awareness; 25% for 40/60 and 37% for 20/80 were because of lack of human resource and budget. Less than 20% for both scheme witnessed as a reason were consultant carelessness. Less than 10% of both schemes respondents state as a reason there is no enforcing law to apply this safety aspects. Other related reasons have been confirmed that they are below 10%.

4.4.4. Governmental follow up, communication and accidents reporting

Table 4.7 : Governmental and organizational communication and accidents reporting

Description	40/60 scheme project sites		20/80 scheme project sites	
	Yes	No	Yes	No
Project site coordination to ensure wellbeing of workers	22%	73%	17%	79%
Mechanism to give circular discussion/safety training	7%	85%	4%	90%
Top management support in safety and health practices during construction	3%	92%	9%	81%
Top management Monitor health and safety performance of the project site	4%	89%	6%	89%
Top management allow budget for health and safety to adequate	2%	92%	8%	74%
Reason for "No"				
Top management commitment	69%		77%	
lack of awareness of participants	26%		20%	
lack of human resource and budget	51%		63%	
No health safety policy law at all	13%		9%	
Doesn't have any enforcing law	4%		13%	
There is no contractual obligation	0%		3%	

From Table 4.7 the description tells about governmental organization follow up and the communication flows as well as the accident reporting mechanisms in the project sites. Above 70% of both project scheme respondents witnessed that there is no project site coordination to ensure wellbeing of workers. More than 85% participant answered there is no mechanisms to make circular discussion or related safety training in the project sites of both schemes. Above 90% for both schemes the top management doesn't support workers in safety and health practices during construction. More than 89% the top management for both schemes doesn't

monitor and control health and safety performance of the project sites. For 20/80 scheme 74% and 40/60 scheme 92% of respondents witnessed the top management doesn't allow adequate budget for health and safety. The remaining less than 10% only have fulfilled this budget constraint. The behind reasons for this organizational communication and reporting problem for 20/80 scheme 77% and 40/60 scheme 69% were top management's commitment problems. More than half 50% of both scheme respondents witnessed that lack of human resource and budget problem take the second higher level reason. 26% of 20/80 scheme and 20% of 40/60 scheme respondent's reason out lack of awareness by participant take the next level. Less than 10% level includes safety policy and contractual obligation.

4.5 safety and health performance factor evaluation in condominium project sites

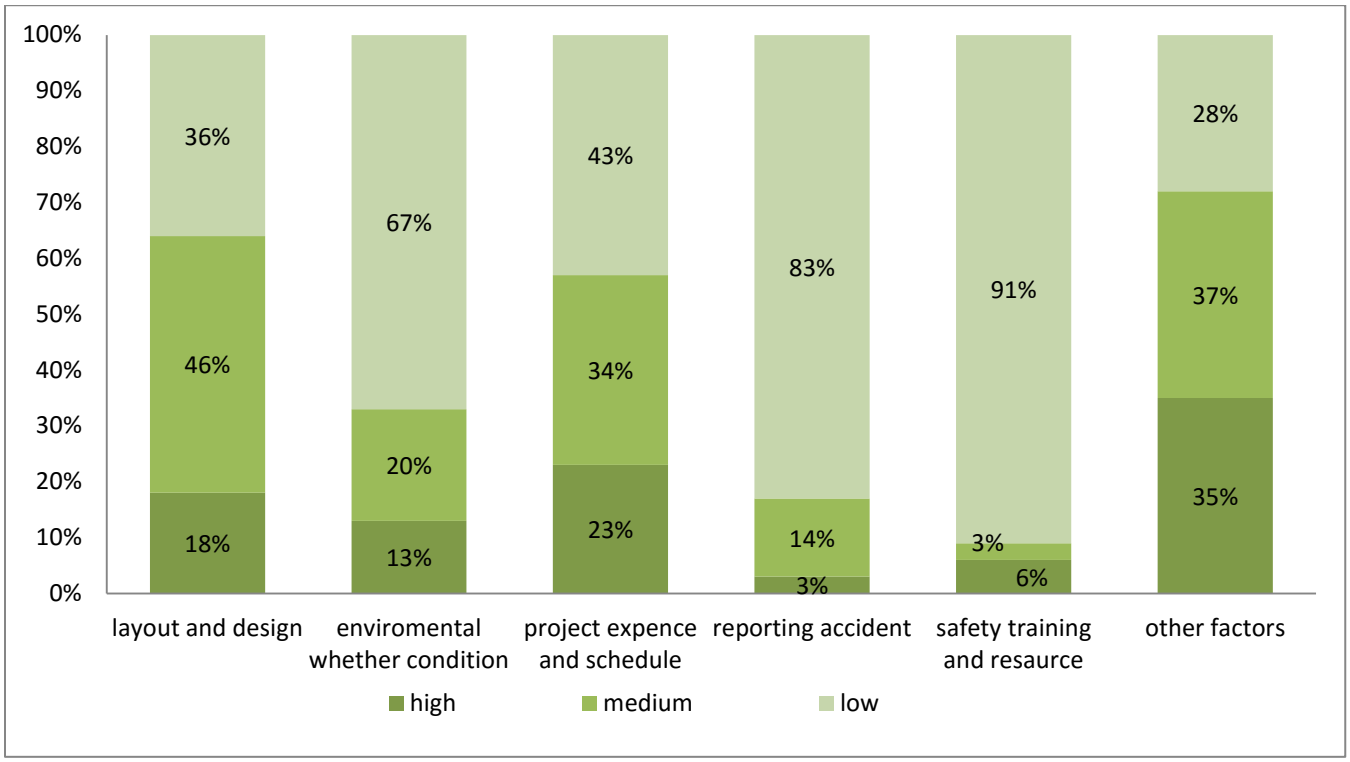

Figure 4.17: safety and health performance factor evaluation in condominium project sites

From the Figure 4.17 we can see that the level of safety and health performance evaluation factor and above 90% of the coordinator and upper management witnessed that due to the lack of safety resources and safety training highly affects the performance of safety and health of the project sites in both schemes; due to this there are many number of injuries and hazards. In the project

sites from the total less than 15% injuries have been only reported; the remaining 85% injuries and fatalities were didn't reported and recorded; so that the exact number of injuries cannot be easily determined. In here a well-organized data recording mechanisms should be available in order to know the number of injuries and to make an interlink that decide as result to insure and protect employees from hazard.

Environmental whether condition on the other hand have its own contribution to health and safety performance; since very cold or very hot temperatures could result dangers to workers health since very hot environment is heat stroke and can be fatal if it does not get medical attention (Hasan et al., 2017).in the project site 67% of the sites have influenced by the whether condition of the sites. On the other hand that related to this factor is the layout and the design factor; according to the project coordinator and supervisor 36% witnessed that very low consideration of layout and designing factor. In the site more than 40% affected by the project expense and schedule even if condominium projects are designed for lower and middle income level residents.

4.6 Identified Problems and Remedial Measures

4.6.1 Summary of Identified problems

It is well known that the construction industry is hazardous industry relative to other related sector as mentioned in the literature review it have very high number of death and injuries including poor health and safety enactment. On this research paper building construction fatalities and injuries on condominium projects have been summarized for scheme 40/60 and 20/80 that are governed by Addis Ababa housing construction project office under the city administration.

Most the fatalities and injuries found on the survey study were caused due to for major parts this are due to falling from height, noise, manual handling and moving equipment. There are also large numbers of injuries that are not recorded since those were considered as treated by first aid and traditional treatments. Safety and health data are very important so that the injuries and fatalities should be recorded using proper technology but in any of the project sites or offices there is no data recording and awareness creation offices to give and promote about safety.

To summarize the factors that remained statistically significant relation with the number of injury crosstab and multivariate regression analysis have been used in order to determine the odd

ratio/crude ratio factors and the results were presented through AOR (adjusted odd ratio) & CI (confidence interval) so that the prevalence injury among workers in condominium building construction were reported to be 48.9% [95 % CI: (36.2, 41.9)]. In table 4.5 the association between injuries and different factors has been listed.

From the analysis of multivariate logistic regression analysis on the case summery table 10 shows the prevalence of condominium building construction injury significantly associated with age, sex and the type of occupation of the worker. Workers that are found in the level of above 45 years age range were 2.64 times more likely to be injured than the upper/young/ class i.e.14-29 years age range [AOR: 2.64, 95% CI :(1.08, 7.27)] the reason behind this might be work experience, physical strength & concentration. whereas there is no statistical significance were found with 14-29 age range and 30-44 age range [AOR: 1.18, 95% CI: (1.20, 3.37)].on the other similar view occupational injuries are significantly related to gender this implies that males were 2.17 times more likely involvement in injury than females.[AOR: 2.17, 95% CI: (1.50, 3.37)].

It is commonly understandable that hard works are done by males depending on the work characteristics. Safety management practices and safety and health performance practices similarly the types of works are significant association with the number of injuries this implies workers who work as daily labor and related tasks were 0.41 times more likely injured[AOR: 0.41, 95% CI: (0.2, 0.7)] with relative to other related tasks/jobs.

The major injuries that have been identified from field survey falling from height 70% for 40/60 schemes and 65% for 20/80 schemes, injury due to manual handling 78% for 40/60 schemes and 51% for 40/60 schemes, injuries due to moving equipment 61% for 20/80 schemes and at 52% for 40/60 schemes and finally health problem due noise 46% for 20/80 schemes 48% for 40/60 schemes. The reasons behind these injuries were analyzed form the observation and interview using causes identification mechanism fishbone diagram see Figure 4.18.

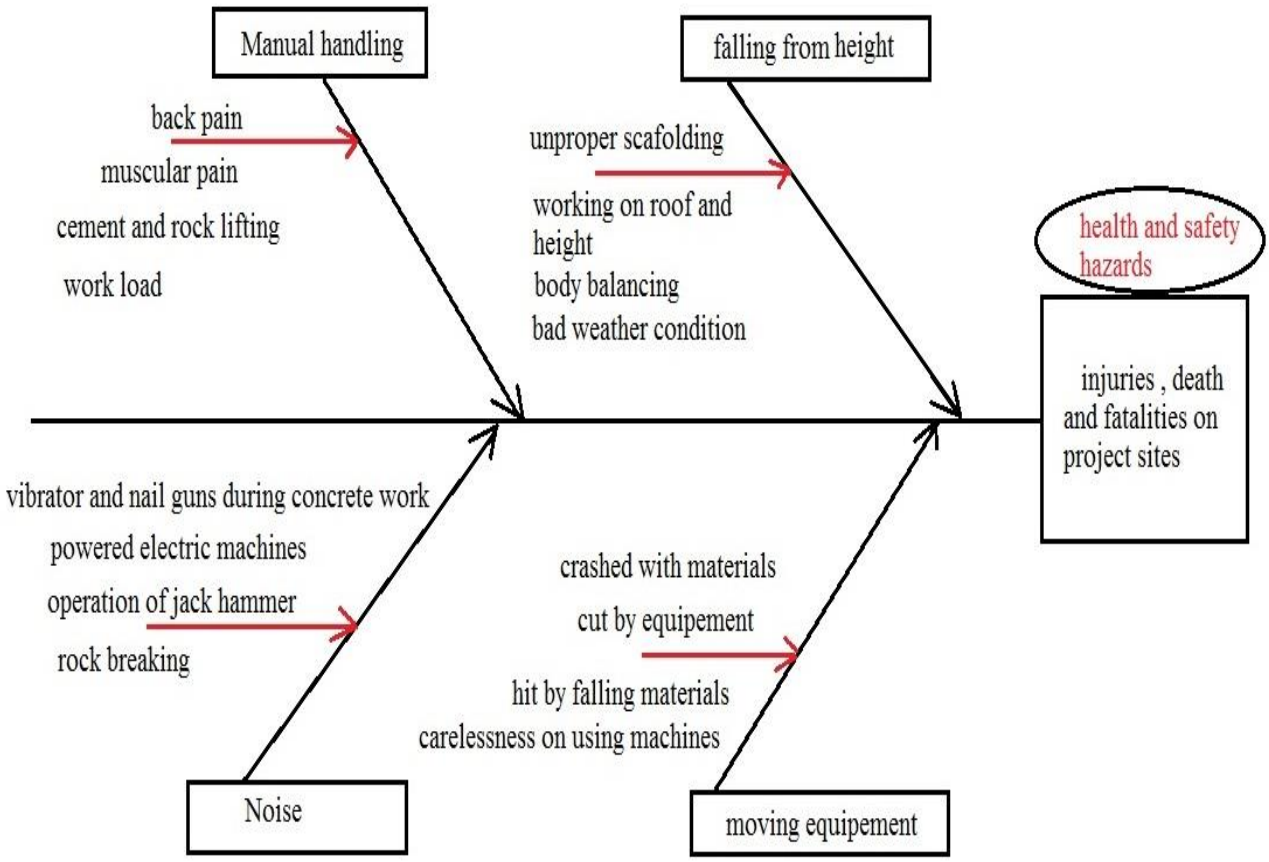

Figure 4.18 : Cause identification for health and safety hazards

For the above major causes of injuries and fatalities the contribution of each and individual especially the upper management, governmental and organization take the highest level so that from the field survey the findings show that the critical points to summarized in to three major categories. The first one is government/organizations including the entire three construction heads (client, contractor and consultants) role in health safety training and resources; this implies including availability of safety supervisor, layout aspects, regulation and implementation of safety rules, periodical review of safety and health aspects. Majority 85% of the project sites doesn't have safety supervisor and around 30% of the project coordinator witnessed that the layout doesn't consider health and safety aspect. More than half 69% the project sites doesn't have periodical site review with respect to health and safety view; the major reason that maintained for this are lack of human resource and budget constraint, lack of awareness of project participant and bad site location. The second part is related to top management project supervision, commitments and involvement in the project site which contain project resources

and materials as a whole. Above 93% in the both schemes project sites Personal protective equipment and right tools were not been provide for workers because of different reasons. Form this the major reasons is due to contractors didn't register their employees in to insurances since the majority are temporary workers however contractor companies that have been register on government or private insurance organization must pay member ship premium cost. In the insurance organization the cost for the premium member ship is directly related to the number of injuries. Contractor companies that do/don't fulfill personal protective equipment and other important resources for safety but that have small number of injuries were an advantage of discount on the membership premium costs but in the opposite contractor companies that do/doesn't fulfill safety resources or material and also that have high number of injuries were pay high payment for member ship premium cost relative to the previous. These insurance policies have impact on occupational safety; indirectly it contributes to increase the number of injuries. More than 55% of the project sites were hasn't proper first aid tool kits. Majority 65% of the project sites doesn't have comfortable facilities like toilet, shower canteens.88% on the construction project sites or other related offices the fatalities and injuries didn't reported and recorded in proper manner. The reasons behind this are lack of resources and budget, lack of awareness of participant in the sites and consultants carelessness. The third part focuses on governmental follow up, communication and accident reporting; in here above 75% project sites haven't coordination to ensure wellbeing of workers and 87% haven't any mechanism to give circular discussion/safety training. Majority around 90% of the top management doesn't support for workers in health and safety practices during construction, doesn't monitor health and safety performance of the site and doesn't allow proper budget and resources for health and safety aspects. From the factor evaluation graph of Figure 4.17 we can see that lack of safety training and resources (including personal protective equipment) take the major contribution factor around 91%.unorganized reporting mechanisms for the fatalities and injuries on the sites is the second factor and environmental/whether condition take the third rank (see Figure 4.17).

4.6.2 Remedial Measures

Since it is well acknowledge that the building construction industry is very complex and risky in its nature all the characteristics performance can be affected directly or indirectly with this entire safety project factor. In this research paper through literature review, survey questionnaire and

interview there are a lot of identified problems that causes injury which are an implication of poor health and safety practices as well as non-compliance to occupational health and safety rules in the condominium projects. In general strong remedial measures should be taken to reduce the number of injuries and to increase safety.

The Addis Ababa city administration should establish organized hierarchy department for occupational health and safety which really care about construction safety management. Inside the department hieratical structure which may contain construction administration, technical management and facility management. All the internal departments have their responsibility to operate occupational safety and health details. In Figure 4.19 the Remedial measures on hierarchical structures were located for better health and safety management implementation.

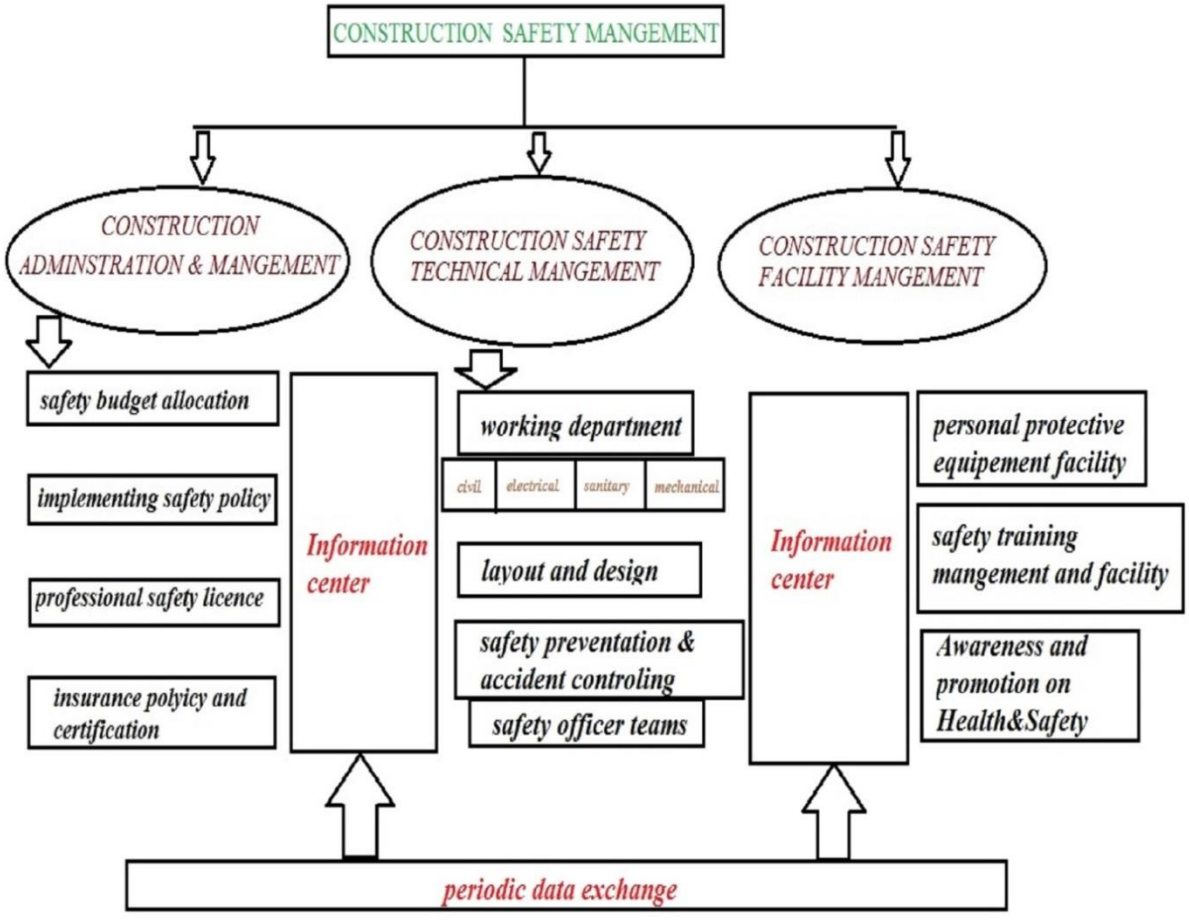

Figure 4.19 : Remedial hierarchy structure for better occupational health and safety (source own)

The client of the projects which are Addis Ababa Housing Corporation, different project contractor, subcontractors and consultants should visit the project sites with the view of health and safety aspect in order to provide training, different courses, to set & implement legislation, enforcing law and evaluations performance for the project sites safety practices officially.

CHAPTER FIVE
CONCLUSION AND RECOMENDATION

5.1 conclusions

This study aimed to determine the current major safety and health related injuries and hazards in condominium building construction, factors associated with injuries by focusing on identifying injury patterns that exists in condominium building construction projects in terms of duties competent authorized authorities, coordination and data handling methods. The study revealed major injuries that have been identified on condominium building construction are falling from height, injury due to manual handling, injuries due to moving equipment and health problem due noise. The prevalence of this injuries were associated with modifiable and preventable factors like PPE, lack of safety training, age, job satisfactions and the type of work. Most condominium construction workers have no idea about occupational health and safety.

In general for our country causes of construction injuries are the following; lack of unskilled employers, poor working condition, lack of safety awareness, different communication languages, lack use of safety resources and personal protective equipment.

From the view of safety management practices and performance factors on the project sites there is no project safety plan, well organized safety policy, involvement & commitment of upper management/government body from client side/ and no providers for health and safety resources. Furthermore there are no mechanisms to reporting injuries and record data, more carelessness on to train, to supervise workers and very law awareness creation on occupational health and safety issues. These shows problem on hierarchy/structure occur at all level regarding safety issues.

For the above major causes of injuries and fatalities the contribution of each and individual especially the upper management, governmental and organization take the highest level.

From the field survey the findings shows that the critical focusing areas from government and private organizations including the entire three construction heads (client, contractor and consultants) that should need strong work are health, safety training and resources, top management project supervision, commitments and involvement in the project site and finally governmental follow up, communication and accident reporting.

Therefore due to these so many problems the remedial measures were set to reduce the severity of injuries on different project. Based on the hierarchy structure the project sites should have to start the possible ways and techniques necessary to reduce.

5.2 Recommendations

Since it is well acknowledge that the building construction industry is very complex and risky in its nature all the characteristics performance can be affected directly or indirectly with this entire safety project factor. In this research paper through literature review, survey questionnaire and interview there are a lot of identified problems that causes injury which are an implication of poor health and safety practices as well as non-compliance to occupational health and safety rules in the condominium projects. In general a strong several recommendations are suggested here to reduce the number of injuries and to increase safety.

The Addis Ababa city administration should establish organized hierarchy department for occupational health and safety which really care about construction safety management. Inside the department hieratical structure which may contain construction administration, technical management and facility management. All the internal departments have their responsibility to operate occupational safety and health details. The recommended hierarchical structures were located for better health and safety management implementation (see Figure 4.19).

The client of the projects which are Addis Ababa Housing Corporation, different project contractor, subcontractors and consultants should visit the project sites with the view of health and safety aspect in order to provide training, different courses, to set & implement legislation, enforcing law and evaluations performance for the project sites safety practices officially.

In order to monitor health and safety information developing different mechanisms should be made for contractor and subcontractors by reviewing the pervious background reports, audit and inspections from bid level up to different level of contract agreements.

The other important aspect to be recommended is employing cost-effective and innovative solutions to building construction injuries data reporting and monitoring, such as location based information systems, establish better communication with clinics and hospital to gather injury information and for controlling the newly coming injuries either they are easy level or hard level.

It is also possible to reduce construction injuries by using different building construction safety resources such as personal protective equipment, first aid tool kits, comfortable fatalities etc.

5.4 further research works

Research can be made on evaluation and implementation for occupational health and safety and some other important areas to be seen with respect of health and safety aspects in order to reduces injuries and increases safety this area includes:

- The efficiency evaluation of safety and health management system
- Data handling and management system for construction industry
- Safety network design and implementation in Ethiopia

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APPENDIX A

ADDIS ABABA UNIVERSITY

SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING

STREAM OF INDUSTRIAL ENGINEERING

Building Construction Occupational health and Safety Assessment: - A case of Condominium Site Projects in Addis Ababa

Dear Participant

This MSC thesis research questionnaire is designed to assess the practice of construction of health & safety management in condominium projects in Addis Ababa. The objective of the study paper is examination of building construction injuries and safety management for condominium building construction industry. The information obtained will be used for academic purpose only; all information and feedbacks will be kept strictly confidential. Your experience and educational background in the construction industry will greatly contribute to the success of this study and I believe this kind of study will be an input for the development of Ethiopian construction industry. So, I am kindly requesting you to respond each and every question.

Thank you,

Yonatan Leykun

Email: yonatanleykun55@gmail.com

This questionaries' paper has five main parts this are

- ✓ **Socio demographic characteristics and information regarding the respondents**
- ✓ **Work place and behavioral characteristics information about the project sites**
- ✓ **Health and hazard related issues that survey on building construction injuries and**
- ✓ **Safety management practices in project sites.**
- ✓ **Safety and health performance factors evaluation**

❖ **You are not obliged to answer any of the questions which you do not want to.**

Part one

Socio demographic characteristics and information regarding the respondents

Mark "X "on the space provided/thick the appropriate and/or choose from the list and circle.

1) Sex male ☐ female ☐

2) Age A) 14-29 B) 30-44 C) 45+

3) Educational level
- A) cannot read and write ☐
- B) Read and write ☐
- C) Elementary ☐
- D) Secondary and above ☐

4) Occupation
- A) daily laborer ☐
- B) Plasterer ☐
- C) welder/electrician ☐
- D) Driller/operator ☐
- E) Carpenter ☐
- F) Mason ☐
- G) painter ☐

5) Month salary in Birr per day
- A) <=60 ☐
- B) 61-99 ☐
- C) 100-120 ☐
- D) > 120 ☐

6) Work experience
- A) 6 month ☐
- B) 7 month- 11 month ☐
- C) 1 year - 2 year ☐
- D) above 2 year ☐

Part Two

Work place and behavioral characteristics information about the project sites

1) Employ Pattern A) Temporary ☐

B) Permanent ☐

2) Do you have ever heard about occupational health and safety?

Yes ☐ No ☐

3) Did you use Personal protective equipment (PPE) during on your work?

Yes ☐ No ☐

4) Which of the following is your reason for question number three if your answer were No?

A) No provision of PPE ☐

B) Not give comfort during work ☐

C) Others ☐

5) Do you have periodic health checkup?

Yes ☐ No ☐

6) Did you have been take safety training or safety advice by safety officer about your work/Job?

Yes ☐ No ☐

7) Are you satisfied with your Job?

Yes ☐ No ☐

8) Did you use any of the following? /please use "x" for each if your answer is more than one/

A) Smoking cigar ☐

B) Chawing chat ☐

C) Drinking Alcohols ☐

Part three

Health and hazard related issues that survey on building construction injuries

1) During work did you injured fall from height/scaffoldings or very long step ladders?

A) Yes ☐ B) No ☐

2) During on work did you hit by falling object, trips and fall?

A) Yes ☐ B) No ☐

3) When you are doing work is there any of the following injuries due to manual handling?

A) Back pain ☐ B) muscular pain ☐ C) no pain at all ☐

4) Have you ever been injured because of chemical in work place?

A) Yes ☐ B) No ☐

5) Have you ever been injured because of dust in work place?

A) Yes ☐ B) No ☐

6) Have you ever been injured because of noise in work place?

A) Yes ☐ B) No ☐

7) When you are in work is there any of the following injuries due to moving equipment?

A) Cut by equipment ☐ B) crashed/pushed by equipment ☐ C) no injury at all ☐

8) Have you ever been injured because of too long bending or twisting in work place?

A) Yes ☐ B) No ☐

9) Have you ever been injured because of fire and disaster in work place?

A) Yes ☐ B) No ☐

10) During excavation of basement and trenches have you been covered by earthwork?

A) Yes ☐ B) No ☐

11) Do you feel bullying and stress when you are in work?

A) Yes ☐ B) No ☐

Part four

- **Safety management practices and organizational related questions**
- **Thick the appropriate and/or choose from the list and circle and it have been allowed to select more than one answer.**

1) Did the site have safety officer?
   A) Yes B) No if your answer is No
   Reasons 1) lack of awareness 2) lack of human resource and budget 3) others
2) Does the site suitable layout for health and safety aspects?
   A) Yes B) No if your answer is No
   Reasons 1) bad location selection 2) doesn't have any enforcing law 3) others
3) Does the sites review frequently and periodically the health and safety aspects?
   A) Yes B) No if your answer is No
   Reasons A) there is no contractual obligation B) lack of awareness of participants C) doesn't have any enforcing law D) others
4) Does the site construction have health and safety implementation and written regulation as a whole? A) Yes B) No if your answer is No
   Reasons 1) lack of awareness 2) lack of human resource and budget 3) others
5) Does the project site coordinate health and safety policy with other parties to ensure wellbeing of workers? A) Yes B) No if your answer is No
   Reasons A) Not a standard practice B) lack of awareness of participants C) doesn't have any enforcing law D) others
6) Is there any mechanism to give awareness to the site worker about health and safety procedure? A) Yes B) No if your answer is No
   Reasons A) Top management commitment problem B) lack of awareness of participants C) doesn't have any enforcing law D) others
7) Is there any mechanism to give circular discussion/ safety training or related Broacher or orientation to the site worker about health and safety procedure? A) Yes B) No if your answer is No
   Reasons A) Budget constraint B) lack of awareness of participants C) No health safety policy law at all D) others

8) Does the top management support workers participation in safety and health practices during construction? A) Yes B) No if your answer is No

   Reasons A) Top management commitment problem B) lack of awareness of participants C) doesn't have any enforcing law D) others

9) Does the top management Monitor health and safety performance of the project site?

   A) Yes B) No if your answer is No

   Reasons A) Top management commitment problem B) lack of awareness of participants C) doesn't have any enforcing law D) others

10) Does the top management allow budget for health and safety to adequate?

   A) Yes B) No if your answer is No

   Reasons A) Top management commitment problem B) lack of awareness of participants C) doesn't have any enforcing law D) others

11) Is there any first aid tool kit in your project sites?

   A) Yes B) No C) available but not properly in use if your answer is No

   Reasons A) there is no budget constraint B) lack of awareness of participants C) doesn't have any enforcing law D) others

12) Did the project site mangers provide right tools and personal protective equipment PPE?

   A) Yes B) No if your answer is No

   Reasons A) there is no budget constraint B) lack of awareness of participants C) doesn't have any enforcing law D) others

13) Does the construction site have comfortable facilities like toilet, shower and canteens?

   A) Yes B) No if your answer is No

   Reasons A) there is no budget constraint B) lack of awareness of participants C) doesn't have any enforcing law D) others

14) Is there any manual of instruction how to use personal protective equipment and/or first aid tools?

   A) Yes B) No if your answer is No

   Reasons A) there is no budget constraint B) lack of awareness of participants C) doesn't have any enforcing law D) others

15) Does all fatalities and injuries on the projects site reported by the concerned body?

   A) Yes B) No if your answer is No

Reasons A) due to consultant carelessness B) lack of awareness of participants C) doesn't have any enforcing law D) others

Part five

- **Safety and health performance factors evaluations in project sites**
- **It is only for site manager and safety supervisor**

Factor description	**Degree of factor measurement use 1=high 2=medium and 3=low**			**Remark**
Design complexity				
Environmental whether condition				
The project expanses				
The project schedule				
Legal safety policy				
Reports when accidents are occur				
Personal protective equipment				
Others				