Sudan University of Science and Technology

College of Graduate Studies

Accidents and Hazards in Construction of Bridges

الحـوادث والمخـــاطر في تشييد الكباري

(Aldubaseen Bridge)

A thesis Submitted in Partial fulfillment of the Requirement for the Degree of Master of Science in Civil Engineering (Construction Management)

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2015

الآيـــــــــــــة

قال تعالى:

(الَّذِي جَعَلَ لَكُمُ الأَرْضَ فِرَاشاً وَالسَّمَاء بِنَاء وَأَنزَلَ مِنَ السَّمَاء مَاء فَأَخْرَجَ بِهِ مِنَ الثَّمَرَاتِ رِزْقاً لَّكُمْ فَلاَ تَجْعَلُواْ لِلّهِ أَندَاداً وَأَنتُمْ تَعْلَمُونَ)

صدق الله العظيم

سورة البقرة الأية[22]

الى الملاك في الحياة ...الى معنى الحب ...والى معنى الحنان والتفاني ...إلى بسمة الحياة وسر الوجود ... الى من كان بدعائها النجاح وحنانها بلسم الجراح ...إلى أغلى الحبايب.

الأم الحبيبه

الى من كلله الله بالهيبة والوقار... الى من علمنا العطاء بدون إنتظار ...الى من يحمل اسمه بكل إفتخار...نرجو من الله أن يمد في عمرك لترى ثماراً قد حان قطافها بعد طول إنتظار

الأب العزيز

الى من انار طريقي وساندني في الحياة ،،، الى نصفي الآخر

زوجـــــــي

إلى من تحلو بالإخاء وتميزوا بالوفاء... إلى ينابيع الصدق الصافي ...إلى من معهم سررت وبرفقتهم في دروب الحياة الحلوة والحزينه سرت

إلى الإخوة ورفقاء الدرب

الشكر والعرفان

كل الشكر والتقدير لمن وقف معي وساندني في إتمام هذا البحث والشكر موصول إلى استاذي الدكتور

عـــصام أبـــــكر اسحاق

الذي بذل قصارى جهده لأن يرى هذا البحث النور ..

والشكر موصول ايضاً إلى كل الاساتذة بقسم الهندسة المدنية وإلى إدارة الجامعة واسرة المكتبة وإلى كل شخص امدنا بمعلومة سائلين الله أن يجعل كل هذا في ميزان حسناته .

المستخلص

الحوادث والمخاطر التى تواجة العمال اثناء تشييد الكباري تؤدى الي خسائر مادية وبشرية تؤثر سلبا علي حياة العمال .

تهدف الدراسة الي التعرف علي انواع الحوادث والمخاطر التى تواجة العمال اثناء تشييد الكباري .

وكيفية جعل بيئة العمل سليمة وصحية وايضا تناول بعض الحوادث التى تحدث باستمرار اثناء تشييد الكباري .

تم جمع المعلومات عن طريق الاستبيان من مدير ومهندسين وعمال كبري الدباسين

وقد بلغ حجم العينة 50 شخصا .اوضحت النتائج ان الحوادث الاكثر حدوثا هى حوادث السقوط من السقالات وعمليات اللحام دون وقاية والسقوط من السلالم والحوادث بسبب اعطال في الناقلات والمعدات . كما اوضحت الدراسة ان الحوادث الاكثر خطورة علي حياة العمال هى السقوط من السقالات والانزلاق من السطح وحوادث الكهرباء واللحام دون وقاية

واوضحت الدراسة ايضا علي ان للحوادث تاثير علي شركات التشييد من حيث خفض الانتاجية واضطرابات في انجاز العمل والاجراءات التصحيحية لمنع تكرار الحوادث ودفعيات مطالبات اصابات العمل والحوادث وكل تلك التاثيرات لها اثر علي تكلفة وزمن المشروع

اوصت الدراسة علي • تأكد من أن العمل لا يؤثر سلبا على صحة العاملين.

• الحافظ على السلامة جزءا بالغ الأهمية من الأنشطة اليومية للعمال.

• تحسين الروح المعنوية والإنتاجية.

• تكريم ومكافأة ممارسات العمل الآمنة

• كلما يحدث انتهاك ا لقواعد السلامة، وينبغي تنفيذ:

•المخالفة الاولي - التحذير اللفظي والتعليم الصحيح المتعلق بانتهاك السلامة و تدوينها في ملف الموظفين

•المخالفة الثانية - تحذير مكتوب بنسخة وضعها في ملف الموظفين.

• المخالفة الثالثة - تسلم اثنين من التأنيب مكتوبة في أي فترة 12 شهرا قد يؤدي إلى تعليق.

• المخالفة الرابعة - الفصل من العمل

• المخدرات والكحول السياسة

العديد من أرباب العمل على إنشاء برامج تعاطي المخدرات. قد تتطلب هذه البرامج اختبار ما قبل التوظيف ، وكذلك كشف عشوائي لدوري للمخدرات أو الكحول "

• تحديد برامج الصحة والسلامة اللازمة لجميع عمليات العمل، أي السلامة الكهربائية، الوقاية من السقوط، الأماكن المغلقة، وحماية الجهاز التنفسي، والحق في المعرفة، الخ

• زيارة مواقع العمل بانتظام لتقييم تنفيذ وفعالية البرامج تنطبق على مكان العمل

•تعيين الأشخاص المؤهلين الأكفاء .

• تحديد مناطق "الخطر المرتفع" التشغيل وتحديد أولويات التفتيش .

ABSTRACT

Incidents and risks which face workers during the construction of bridges leading to material and human losses negatively affect the lives ofworkers .

Study aimed to identify the types of incidents and risks which face workers during the construction of bridges

And how to make sound and healthy work environment, as well as dealing with some of the incidents that occur during the construction of bridges and

Information was collected through a questionnaire, engineers and workers from the Director of major aldubaseen

The volume of the sample 50 people

The results showed that the most common accidents are accidents fall from scaffolding and welding without prevention and falling from the stairs and accidents due to breakdowns in tankers and equipment

As well as the study showed that the most serious incidents on the lives of workers are falling from scaffolding that emanates from the roof and electrical welding without prevention

Study also indicated that the impact of the incidents Construction companies in terms of reduced productivity and disturbances in the work of corrective actions to prevent the recurrence of incidents claims work injuries and accidents and all those influences have an impact on the cost, time, and the project

Recommendedby the study to make sure that the work does not negatively impact on the health of the workers

Safety is very important part of the everyday activities of workers.

Improve morale and productivity.

Honoring and rewarding safe work practices

Whenever there is a violation of safety rules, should be the implementation of:

•First offense - verbal warning proper education on the violation of safety and codified in the file of staff

•Second offense - written warning with a copy placed in the file of staff.

Thirdcontravention .Recognizes the two written reprimands in any period of 12 months may lead to suspension.

Fourth offense -Expulsion of the work

Drug and Alcohol Abuse Policy

Many of the employers to establish programs of drug abuse,these programs may require a test before recruitment, as well as the roles of random drugs or alcohol,"

The health and safety programs for all of the work, any electrical safety, prevention of fall, closed areas, and protection of the respiratory system, and the right to knowledge, etc.

Visit work sites on a regular basis to assess the implementation and effectiveness of the programs apply to the workplace

• Appointment of persons qualified for

Identifying areas of "high risk" operation, and the prioritization of inspection

List of figures

List of table

CHAPTER 1

1.1 INTRODUCTION

Construction industry has the maximum rate of injury and death Some studies reflect that high percent of accidents happening in construction can be get rid of it, avoided or minimized by selecting the best designs and planning in every project, and therefore safety research at design and planning stage will give a significant effect on accidents minimizing and cost delay related to safety issues. It is also one of the most dangerous industries. More construction workers are Killed, injured or suffer ill health than in any other industry every year more Than a thousand workers are killed and over 800 000 workers are injured, many Seriously with all having to take time off work,although there has been a Steady decline in the incidence of both fatal and non-fatal accidents since 1994,The estimated 1 200 workers killed at work in construction in 2001 clearly Shows that much has still to be done The effect on workers' health is also of serious concern. It is difficult to be Precise about the true scale of the health problem, but all studies indicate the Problem is huge. Every year many thousands of workers suffer fromOccupationally acquired diseases,these include musculoskeletal disorders Noise induced hearing loss, skin diseases, and other diseases as a consequence Of exposure to harmful substances,many construction workers are exposed to Asbestos leading to potentially fatal asbestos related diseases.

There are many causes of accidents on a construction site. Many are often attributed to some form of negligence and may involve unsafe work areas,

misuse of tools and equipment, and failure to use protective equipment. The following discusses the nine most common examples of construction site accidents.

Unsafe Working Areas - Injuries due to slip and falls are among the most common on a construction site. Unsafe conditions include uncovered holes or trenches and exposed stakes and rebar's (which implement hazards to those working or walking above them).

Falling Hazards - A common injury that occurs when a worker near an open-sided floor focusing on his work, steps backwards or to the side without looking. Another falling hazard occurs on stairwells with no guardrails. In this kind of accident, workers frequently land on their heads or shoulders.

Misuse of Stepladders - This is one of the leading causes of injury and long-term disability in Washington. An injury can occur when a worker falls from a tipped-over stepladder. Another accident that can occur with stepladders is when tools are left on the top platform. When someone moves the ladder, the tools fall on someone's head. Using household ladders on a construction site can also lead to accidents, as these types of ladders cannot take the weight and stress of a construction worker with tools.

Roof Construction Falls - The number one cause of death in construction occurs where no fall protection is provided. Falls can occur when anchors (designed to provide fall arrest with an attached lifeline) are not properly attached or more than one lifeline is on a single anchor.

Scaffolding Problems -scaffolding accidents still occur through unsafe access to scaffolds and tools and other materials falling off scaffolding and injuring workers.

Collapsed Excavation Walls and Trenches .

Power Tool Accidents - These accidents are frequently caused by not using appropriate eye and ear protection.

Lifting/Body Straining - The number one cause of injuries, disability claims and medical costs in construction are soft tissue injuries-strains, sprains and chronic injuries. These are a result of lifting with the back instead of using the legs and not using panel lifters when carrying sheets of drywall, plywood, or siding.

Vehicle Accidents - Forklift accidents are responsible for workers' deaths each year in Washington. A common accident occurs when turning or maneuvering the forklift with the load raised Another dangerous construction site vehicle is the dump truck. A frequent accident involves the dump truck backing up and hitting a pedestrian.

As you can see, a construction site can be quite dangerous. However, many of these accidents can be avoided through common sense and protective measures. Prevention begins with adequate awareness and a properly maintained working environment that is safe and secure, we hope the report will be useful to promote good practice throughout the constructionof bridges in Sudan by all those involved with the industry. We also hope it will encourage organizations to get involved in initiatives to improve Safety and health in construction.

Role of OSHA: The Occupational Safety and Health Administration (OSHA) is an agency of the Department of Labor (URL 7). It was created by the Congress with the Occupational Safety and Health Act of 1970 with the aim to “assure safe and healthful working conditions for working men and

women by setting and enforcing standards and by providing training, outreach, education and assistance". OSHA is responsible to inspect construction sites, investigate construction accidents, and enforce standards and regulations to reduce construction accident impacts

1.2 Problem Statement

Construction works at bridges always face accidents and injuries related to the work, that affecting the companies productivity and manpower health and safety.Thus represent a big problem because they lead to big losses in both physical and manpower components.Work performance as well as efficiency will negatively be affected. Construction accidents can be caused by a variety of reasons, and different disciplines involved in a construction project may all be responsible. In the planning phase, owners may fail to consider potential site safety issues, and pay little attention to safety management. In the design phase, designers and architects may neglect all possible safety-related design codes or not be able to eliminate all possible factors. In the construction phase, contractors may fail to be cautious about site safety risks or report problems in time, and workers may do their job carelessly. ..

1.3 Objectives of research

1. Accidents and Hazards in construction of bridges

2.Bridges construction can be Developto be a Safer and healthier environmentfor someone to work in

3. Gathering together collection of very different individual case studies

1.4 Hypothesis address

Most frequent accidents Information

The most serious incidents on the lives of workers

Information for company

The economic impact of site accidents on the construction companies

1.5Scope and Limitation of Study

1.5.1 Spatial Limitation

This study was confined in bridges and construction sites located within the state of Khartoum only.

1.5.2 Temporal Limitation

This study was completed during 2015.

1.5.3 Human limitations

The targeted respondents were persons who are very well about the construction works and in particular at sites accidents, such as project manager. Engineers and labors in ALDBASEEN Under-construction Bridge.

1.6 Significance of study

This research derives its significance from the importance of his theme the accidents and hazards in the construction of bridge.

CHAPTER 2

LITERTURE REVIEW AND SCIENTIFIC BACKGROUND

2.1 Cause study:Dubaseen bridge

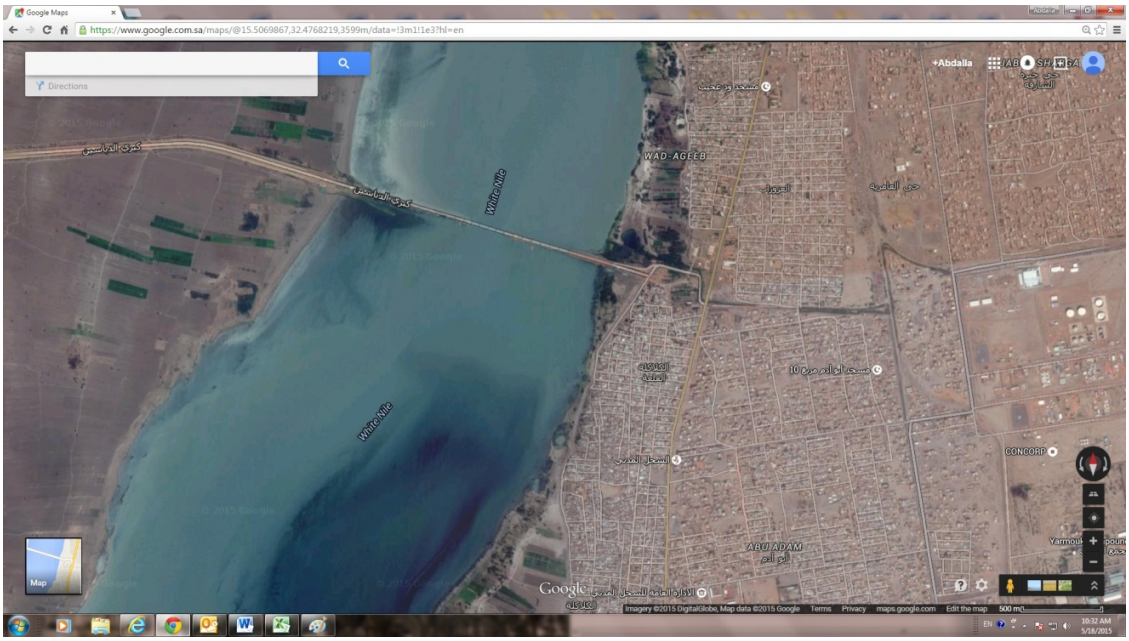


Figure 2.1: Aldubaseen Bridge

Aldubaseen bridges or alozwzab, Draft work to be done by the Government of the State of Khartoum, work has begun in 2005 that the project is completed in 2008 and has gained great importance, it is real crossing linking the new international airport in central Khartoum

Linking aldubaseen bridges between Khartoum at the beginning (Alkalakla) of the Omdurman at the end of Alsalha

A contract has been signed with Turkish company to create aldubaseen bridge then Totty bridge, two projects in one contract..

Cost of Aldubaseen Bridge about $35 million.

The project consultant company shslr Blanc German supervision fees 4% of the value of the contract

Aldubaseen bridges is longest bridges in Sudan 1650 meters, and 3 lanes for each direction the distance between the pillars (cans) 60 meters

The complexity of the system construction alternate to the mega bridge properties (basement concrete structure and the structure of the top of iron) and magnitude, as well as to the lack of experience of the company executing lead to difficulties in implementation...

Technical problems have arisen in striking at the beginning of the compilation of iron structure and through welding it is very complex and difficult .

The German advisory alerts the company owner (the Ministry of Engineering Affairs) technical problems and intensified disagreements between the parties to the project, the contractor and advisory owner)., which slowed the work in the project and then full stop

The Ministry has appointed a Sudanese company to verify the conformity of welding specifications Implemented on-site, the Sudanese company contracting with a Turkish company to do this procedure.

The report came out many of the technical errors and administrative process that accompanied the welding، the recommendations to improve future performance and make recommendations for treatment.

New Company did not continue for long worked for nearly a year was completed in which a small fraction of the concrete and remained a problem of railways and the settlement with the contractor old place and stopped the contractor of the project. And stop work again

In 2011 A contracts was signed with the completion of the project company targht Urban Development Sudanese Company and started to work effectively at the beginning of 2012.

The contract with the company in solidarity with Sudanese Chinese Company to the implementation of the iron structure.

Was changed completely old design and modifications to the work carried out .

Span engineering consultancy was appointed) to supervise the work of origin basement concrete substructure and appointed nywtk engineering consultancy company to oversee the iron work and top superstructure. The contractor and the appointment of an Egyptian consultant to design work، so that the number of companies that entered in project contracting companies 4 and 5 advisory companies

2.2Type of accidents in construction of bridges

Accidents at construction sites can often result in serious injuries or death from defective.The causes of construction injuries are numerous and varied. While some of these causes are easy to spot, others are less obvious. Familiarizing yourself with common injury types will help you avoid injury and identify any injuries you may have already suffered. Below, you'll find explanations of some of the most common construction injury types

2.2.1 Exposure to radiation, chemicals, and lead paint.(1)

- Asbestos exposure
- Asphalt fume exposures
- Burns
- Carbon monoxide poisoning
- Compressed gas injuries
- Toxic chemical exposure
- Unprotected welding operations
- Silicaexposure

Health effects of silica (Pam Susi, CPWR) (2)

- Silicosis
- Lung cancer
- Chronic obstructive pulmonary disease (COPD) –dust related, may not be specific to silica
- Autoimmune disorders
- Rheumatoid arthritis
- Scleroderma
- May increase susceptibility to TB

2.2.1.1Blood lead levels–health effect

- Background blood levels in general population in US now at 1-2 ug/dl (vs. 10-15 ug/dl in late 70s)
- Unlike many metals (e.g. zinc, manganese) which are essential at very low concentration, lead has no value whatsoever and is toxic at low doses

- Principle health effects at low doses–cardiovascular (heart and strokes); kidney (renal), cognitive (brain), reproductive

Figure 2.2.1Silica continues to be a problem(Pam Susi, CPWR) (2)

Figure 2.2.1 Exposurecreated from adjacent operation(Pam Susi, CPWR)(2

2.2.2 Equipment-Related Accidents(3)

Heavy machinery is present at most construction sites, and when it isn't maintained or used properly, an accident can result. Incidents involving cranes have made the news in New York in recent years, and crane accidents frequently involve workers who were not operating the crane. Forklifts can also become dangerous when they are overloaded or have not been kept in good operating order. They can also pose a hazard when operators haven't been properly trained. Pneumatic tools like nail guns are another source of Brooklyn construction accidents, as are power tools such as drills and saws. However, even simple hand tools can result in serious injury if not maintained and used in the right way

- scaffolding
- power tools
- hoists
- derricks
- cranes

Neglect on the part of employers to maintain the cranes, and operators overloading, or unbalancing loads, cause crane injuries. Not only do crew and employers endanger their own lives when not paying attention, but they can turn an entire construction site into a danger zone, within seconds.Crane operators require intensive training and extreme focus. By communicating plans, identifying potential risks and providing solutions, barricading the work area, and ensuring the ground area is suitable to safely handle the entire structure; accidents can be prevented

- conveyors
- woodworking tools
- Ladders
- winches
- trucks
- graters
- boilers
- tractors
- bulldozers
- forklifts
- back hoes
- heavy equipment

Backovers and Crushed –Between

Workers are at risk of being run over by large trucks backing out of construction sites. They are also sometimes crushed between large vehicles and walls or concrete. These types of accidents can be related to supervisor neglect in controlling a work site

- scrapers
- pressure vessels
- gas detectors
- other types of construction equipment

2.2.3Falls

Falls from heights are the leading cause of injury in the construction industry. In the OSHA Handbook (29 CFR), fall protection is needed in areas and activities that include, but are not limited to: ramps, runways, and other walkways; excavations; hoist areas; holes; formwork; leading edge work; unprotected sides and edges; overhand bricklaying and related work; roofing; precast erection; wall openings; residential construction; and other walking/working surfaces.

The height limit where fall protection is required is not defined. It used to be 2 meters in the previous issue of Work at Height Regulations. It is any height that may result in injury from a fall. Protection is also required when the employee is at risk to falling onto dangerous equipment.

Fall protection can be provided by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, and warning line systems.

All employees should be trained to understand the proper way to use these systems and to identify hazards. The employee or employer will be responsible for providing fall protection systems and to ensure the use of these systems.

Employees on construction sites also need to be aware of dangers on the ground. The hazards of cables running across roadways were often seen, until cable ramp equipment was invented to protect hoses and other equipment which had to be laid out

The construction industry has consistently been one of the most treacherous jobs in Alabama. Alabama construction accidents injure thousands of workers every year. In fact, construction workers account for one in five workplace deaths in the United States. Construction workers often work at high elevations and on inclines, and must use both hands and rely on their balance to work. In most jobs in the construction industry, there is little room for error and mistakes can be deadly. When companies cut corners on safety or fail to properly train workers, or when workers are injured from using dangerous or defective equipment, injured workers may be entitled to compensation for their injuries. Injuries from construction accidents may be very serious and cause permanent disability.

Falling Object

Construction workers are at risk of being struck by objects from above, for example, tools used above the worker or construction materials that aren't properly secured. Brain and spinal injuries can occur, even if you're wearing appropriate safety equipment such as hardha.

Case 1 and 2(Fatality Assessment and Control Evaluation (FACE) Project

New Jersey Department of Health (4)

Case #1: A 26-yr-old construction laborer fell through a temporary wooden "catch platform" 75 feet to the ground during a bridge renovation project. The victim stepped down from a steel structural I-beam onto one of the wooden planks, which broke under his weight.

Case #2: An ironworker fell through wooden boards of a temporary walkway at a construction site. The victim was carrying lumber on a bridge deck during a resurfacing job. The planks he was walking on gave way, and he fell 96 feet and struck a concrete barrier on the ground. He was 45-yr old.

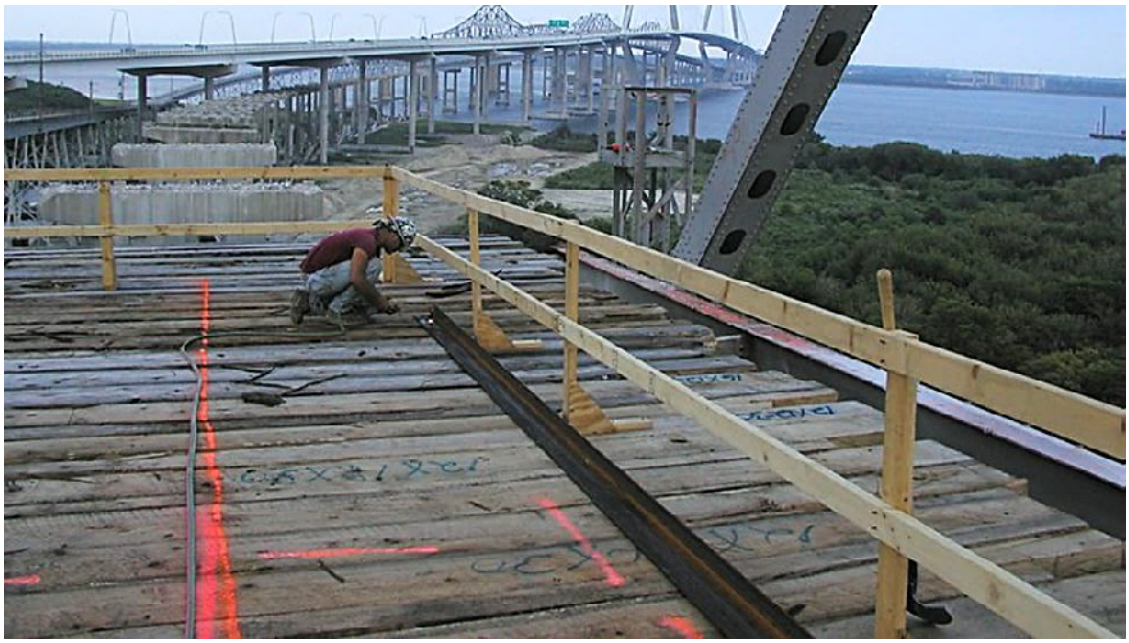


Figure2.2.3 two construction worker fall to their death through temporary wooden bridge platform Photo credit: C. Frank Starmer and Sparky Witte from http://oldcooperriverbridge.org

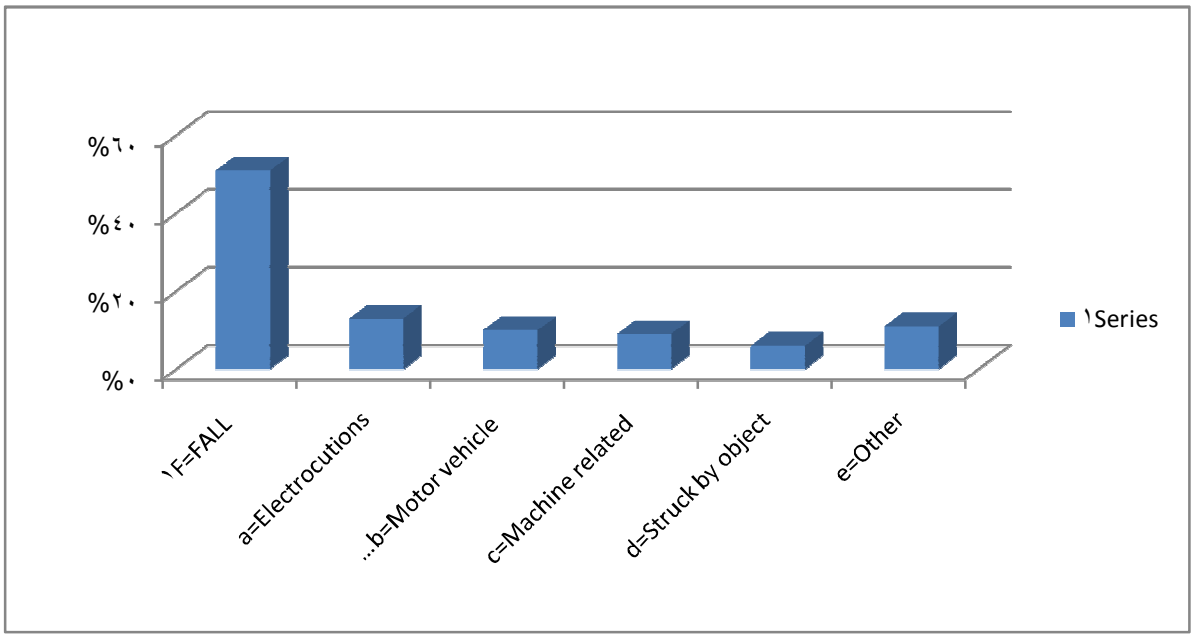
Case # 3(5)

Ten men killedof the twelve men who fell to the water, two survived. One of them was the foreman of the stripping crew, Slim Lambert. "As I was falling, a piece of lumber fell on my head. I was almost unconscious. Then the icy water of the channel brought me to," said Lambert. He was twenty-six at the time and, fortunately, a strong swimmer. He struggled to free himself from the tangles of the net underwater. Lambert suffered a broken shoulder, several ribs, and neck several vertebrae, but he lived to tell the tale. In a single catastrophe, the project's near-perfect safety record was obliterated

CONSTRUCTION FATALITIES (4)

New Jersey, 1999-2012

Total = 315



F=FALL	51%
a=Electrocutions	(13%)
b=Motor vehicle Accidents	(10%)
c=Machine related	(9%)
d=Struck by object	(6%)
e=Other	(11%)

2.2.4Negligence-Related Accidents:(1)

A negligently maintained and managed construction site can result in a number of different accidents.

- Electrocutions.

A common onsite hazard, exposed electrical wiring poses a threat to crew and people passing by the site. Electrocution is avoidable if all wires are correctly labelled, moved away from high traffic areas, electricity is switched off, the correct insulation is used, and construction crew are made aware of where power lines are laid.

- Fire may result from accidental spraying of gasoline, any stored material under the

Bridge catching fire, overturned vehicles, lightning, or vandalism

- Fire, combustion, and respiratory problems.
- Explosions

  A leading cause of construction site deaths, explosions are often due to negligence or inefficient electrical wiring. Granted, there are incidents of leaking gas, which may fall outside the perimeters of human error, but with routine maintenance and safety checks these issues can be addressed.
- Pipe burst.

2.2.5 Accidents related to weathers(1)

- accidents due to earthquakes
- accidents due to heavy winds, tornados, and hurricanes
- Wind gusts
- Extreme hot and cold weather conditions
- Underwater diving hazards

Figure2.2.5 show the accidents due to weather in Schoharie Creek Bridge(Andrzej S. Nowak) (6)

2.1.6 High noise level.(1)

- Hearing loss is a pervasive problem for all construction trades
- The average 25 year old carpenter has the hearing of a 50 year old
- Over 3500 powered hand tools in use in construction
- Generators, compressors and industrial settings create large background sound levels

2.2.7 Fear of heights and dizziness

This fear leads to fell down which creates incidents might developed to loss or injuries. Common deal with such cases is to give pre-info to explain the hazards and safety equipment to be used during the job (Ex, safety belts).

2.2.8 Repetitive Motion Injuries, Heat Stroke, and Other Overexertion

Due to the hard physical labor required for construction work, employees in this industry often have injuries related to overexertion, including:

■Repetitive motion injuries

■Muscle and joint damage due to overuse

■Heat stress in hot conditions that can lead to brain, heart, or kidney damage or death

■Hypothermia or frostbite resulting in the loss of fingers, toes, and parts of the face in cold climates

High Lead Levels

Unsafe construction sites and work practices can lead to work exposures to lead. Construction workers represented 16% of elevated blood lead concentration cases in 2002-2008.

2.3Workplace hazards(7)

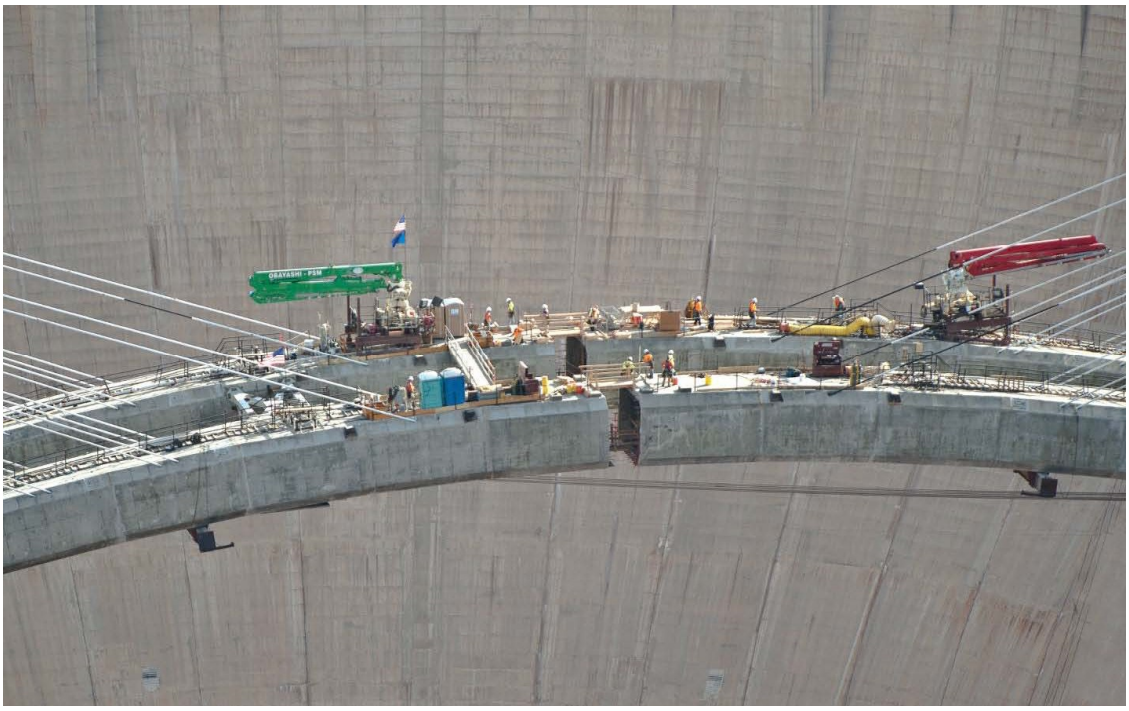


Figure 2.3: ROAD& BRIDGE CONSTRUCTION hazard (9)

2.3.1 Work provides many economic and other benefits, a wide array of workplace hazards also present risks to the health and safety of people at work. These include but are not limited to, "chemicals, biological agents, physical factors, adverse ergonomic conditions, allergens, a complex network of safety risks," and a broad range of psychosocial risk factors

- Machines are also often involved indirectly in worker deaths and injuries, such as in cases in which a worker slips and falls, possibly upon a sharp or pointed object. The transportation sector bears many risks for the health of commercial drivers, too, for example from vibration, long periods of sitting, work stress and exhaustion. These problems occur in

Europe but in other parts of the world the situation is even worse. More drivers die in accidents due to security defects in vehicles. Long waiting times at borders cause that drivers are away from home and family much longer and even increase the risk of HIV infections

- Confined spaces also present a work hazard. The National Institute of Occupational Safety and Health defines "confined space" as having limited openings for entry and exit and unfavorable natural ventilation, and which is not intended for continuous employee occupancy. Spaces of this kind can include storage tanks, ship compartments, sewers, and pipelinesConfined spaces can pose a hazard not just to workers, but also to people who try to rescue them
- Noise also presents a fairly common workplace hazard: occupational hearing loss is the most common work-related injury in the United States, with 22 million workers exposed to hazardous noise levels at work and an estimated $242 million spent annually on worker's compensation for hearing loss disability. Noise is not the only source of occupational hearing loss; exposure to chemicals such as aromatic solvents and metals including lead, arsenic, and mercury can also cause hearing loss

- Temperature extremes can also pose a danger to workers. Heat stress can cause heat stroke, exhaustion, cramps, and rashes. Heat can also fog up safety glasses or cause sweaty palms or dizziness, all of which increase the risk of other injuries. Workers near hot surfaces or steam also are at risk for burns. [20] Dehydration may also result from overexposure to heat. Cold stress alsoposes a danger to many workers. Overexposure to cold conditions or extreme cold can lead to hypothermia, frostbite, trench foot, or chilblains
- Electricity poses a danger to many workers. Electrical injuries can be divided into four types: fatal electrocution, electric shock, burns, and falls caused by contact with electric energy
- Vibrating machinery, lighting, and air pressure (high or low) can also cause work-related illness and injury. Asphyxiation is another potential work hazard in certain situations. Musculoskeletal disorders are avoided by the employment of good ergonomic design and the reduction of repeated strenuous movements or lifts. Ionizing (alpha, beta, gamma, X, neutron), and non-ionizing radiation (microwave, intense IR, RF, UV, laser at visible and non-visible wavelengths), can also be a potent hazard

2.3.2 Biological and chemical hazards

- Bacteria
- Virus
- Fungi
- Mold
- Blood-borne pathogens
- Tuberculosis

- Chemical hazards[edit] Heavy metals
- Solvents
- Petroleum
- Fumes (noxious gases/vapors)
- Highly-reactive chemicals
- Fire, conflagration and explosion hazards:
- Explosion
- Deflagration
- Detonation
- Conflagration

2.3.3 Psychosocial hazards

Employers in most OECD countries have an obligation not only to protect the physical health of their employees but also the psychological health. Therefore as part of a risk management framework psychological or psychosocial hazards (risk factors) need to be identified and controlled for in the workplace. Psychosocial hazards are related to the way work is designed, organized and managed, as well as the economic and social contexts of work and are associated with psychiatric, psychological and/or physical injury or illness[23] Linked to psychosocial risks are issues such as occupational stress and workplace violence which are recognized internationally as major challenges to occupational health and safety.[24]

According to a survey by the European Agency for Safety and Health at Work, the most important emerging psychosocial risks are:

- Precarious work contracts
- Increased worker vulnerability due to globalization
- New forms of employment contracts
- Feeling of job insecurity
- Aging workforce
- Long working hours
- Work intensification
- Lean production and outsourcing
- High emotional demands
- Poor work-life balance

2.3.4 Types of Medical Conditions Caused by Construction Injuries

The construction injuries described above can lead to medical conditions including:

■Amputation of a finger, toe, or limb

■Broken bones or fractures

■Burns for fires, explosions, or electrocutions

■Cuts or lacerations from exposed nails, tools, machinery, etc.

■Death, in which case the construction worker's family should consider a wrongful death claim to be compensated the loss of their loved one

■Eye injuries or loss of vision from being impaled by objects, such as shrapnel from grinding metal, can also lead to loss of vision, or dangerous chemicals or gases

■Shoulder, knee, or ankle injures such as sprains or overuse damage

■Loss of hearing from the loud noises on construction sites or failure to wear hearing protection while using machinery like a jack hammer

■Paralysis and other spinal cord injuries, especially from falls

■Post-Traumatic Stress Disorder (PTSD) from the experience of a traumatic accident, such as when fellow workers are also injured or killed

■Toxic exposure to chemicals, such as from welding jobs

■Head or traumatic brain injuries (TBI) often from falls or having objects dropped on a construction worker on the job site

2.4 Study about rate of accidents in world bridges from (Construction Industry Safety History book) (8)

Projects of thepast:

1883 Brooklyn Bridge

1914 Panama Canal

1936 San Francisco-Oakland Bay Bridge

1937 Golden Gate Bridge

2.4.1:1883 Brooklyn Bridge

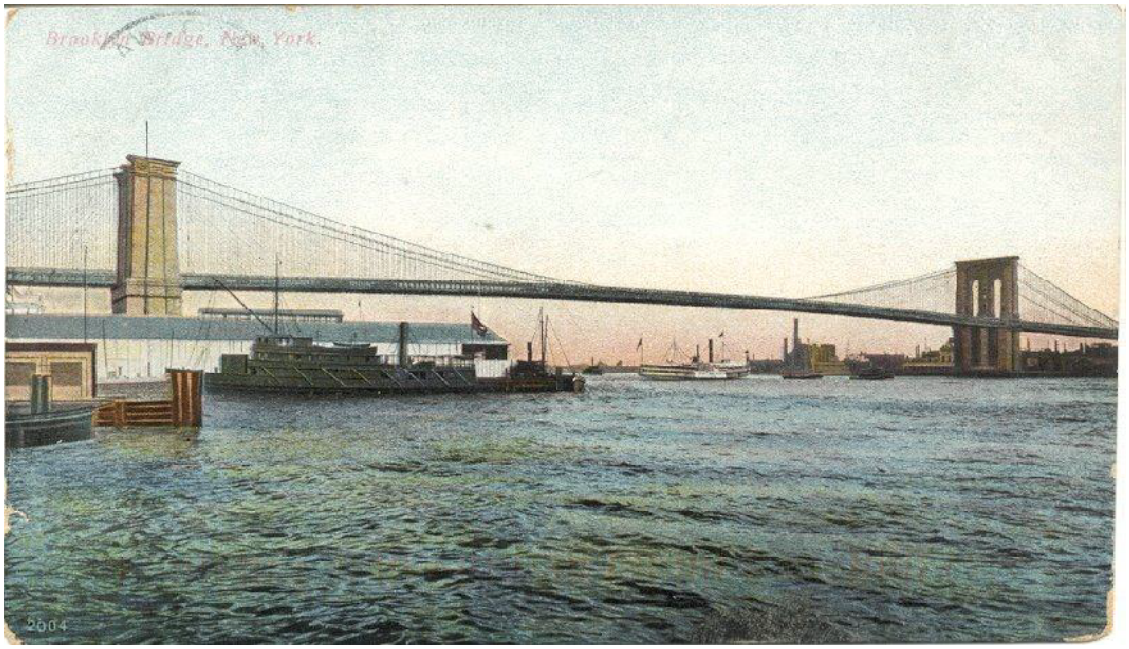


Figure2.4.1: 1883 Brooklyn Bridge

- Construction started ……. January 3, 1870
- Opened to traffic …… May 24, 1883
- Total length of bridge and approaches …… 6,016 feet
- Width of bridge ……..… 85 feet
- 27 people died during construction

2.4.2: 1914 Panama Canal

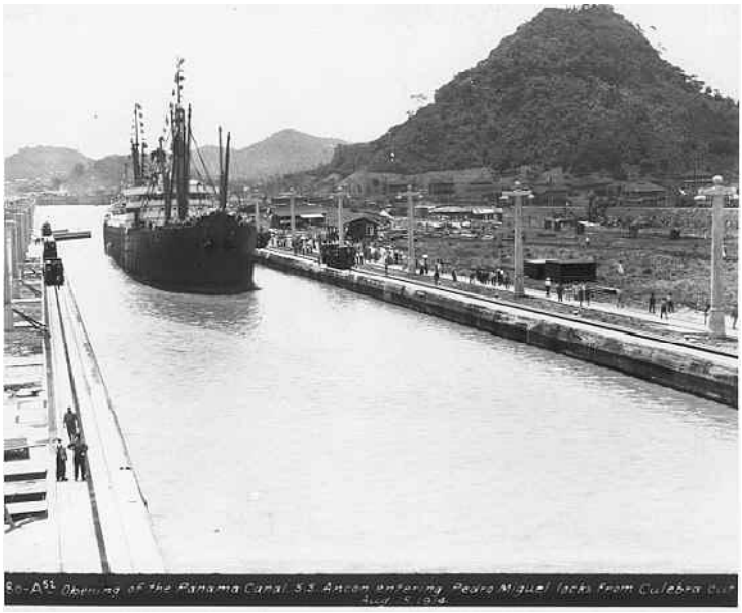


Figure2.4.2:1914 Panama Canal

- The French Began Construction in 1878
- United States bought the rights and took over construction in 1904
- Over 80,000 men worked on this project
- They excavated 262 million cubic yards
- Canal is 51 miles long
- Around 20,000 workers died during the first twenty years of construction
- After the United States took over 5,609 additional workers died

SPORT ON THE CHAGRES

One of the diversions very popular among the sporting members of the canal staff was alligator hunting. The upper waters of the Chagres could usually be relied upon to produce excellent sport, though these great reptiles are found in all the principal streams on the Isthmus

Figure 2.4.2:1914 Panama Canal

2.4.3: 1936 San Francisco- Oakland Bay Bridge

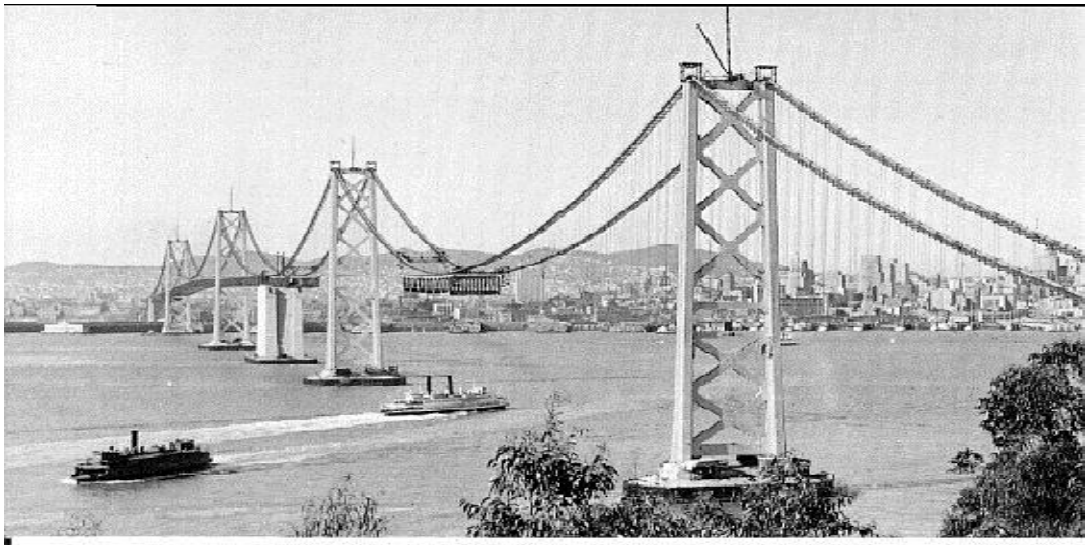


Figure 2.4.3: 1936 San Francisco- Oakland Bay Bridges

Begin Construction: May 1933

Complete Construction: October 1936

Bridge Type: Suspension – Tunnel – Cantilever/Truss

Cost: $78 Million ($3.46 Billion Today)

Total Manhours: 54,850,000

Construction Fatalities: 24

2.4.4: Golden Gate Bridge 1937

Figure 2.4.4: Golden Gate Bridge 1937

Length: 1.7 Miles

Width: 90 ft

Tower Height above Water: 746 ft

Construction Begin: Jan 1933

Construction End: May 1937

Cost: $27,000,000 ($1.2 Billion Today)

Construction Fatalities: 11

2.5 Recordable Injury Rate

- An incidence rate of injuries and illnesses may be computed from the following formula:

(Number of injuries and illnesses X 200,000) / Employee hours worked = Incidence rate

2.6 Lost Time Injury

The number of lost days away from work

- The Lost Time Injury and Illness rate (the number of injuries and illnesses that result in one or more lost work days per 100,000 hours worked.
- Illnesses include infections, allergy, mental health and respiratory.

2.7 General Industrial Accidents

Lack of proper Personal Protective Equipment Account for:

- 84% of head injuries
- 60% of eye injuries
- 77% of foot injuries
- 99% of face injuries

Personal Protective Equipment Includes:

Hardhats

Safety boots

Hearing Protection

Safety Eye Wear

Harnesses

Gloves

2.8 Slips and Trips at Work

About Slips and Trips in the Workplace Slips and Trips account for many of the accidents which occur in workplaces each year even though they are one of the simplest types of accidents at work to avoid.

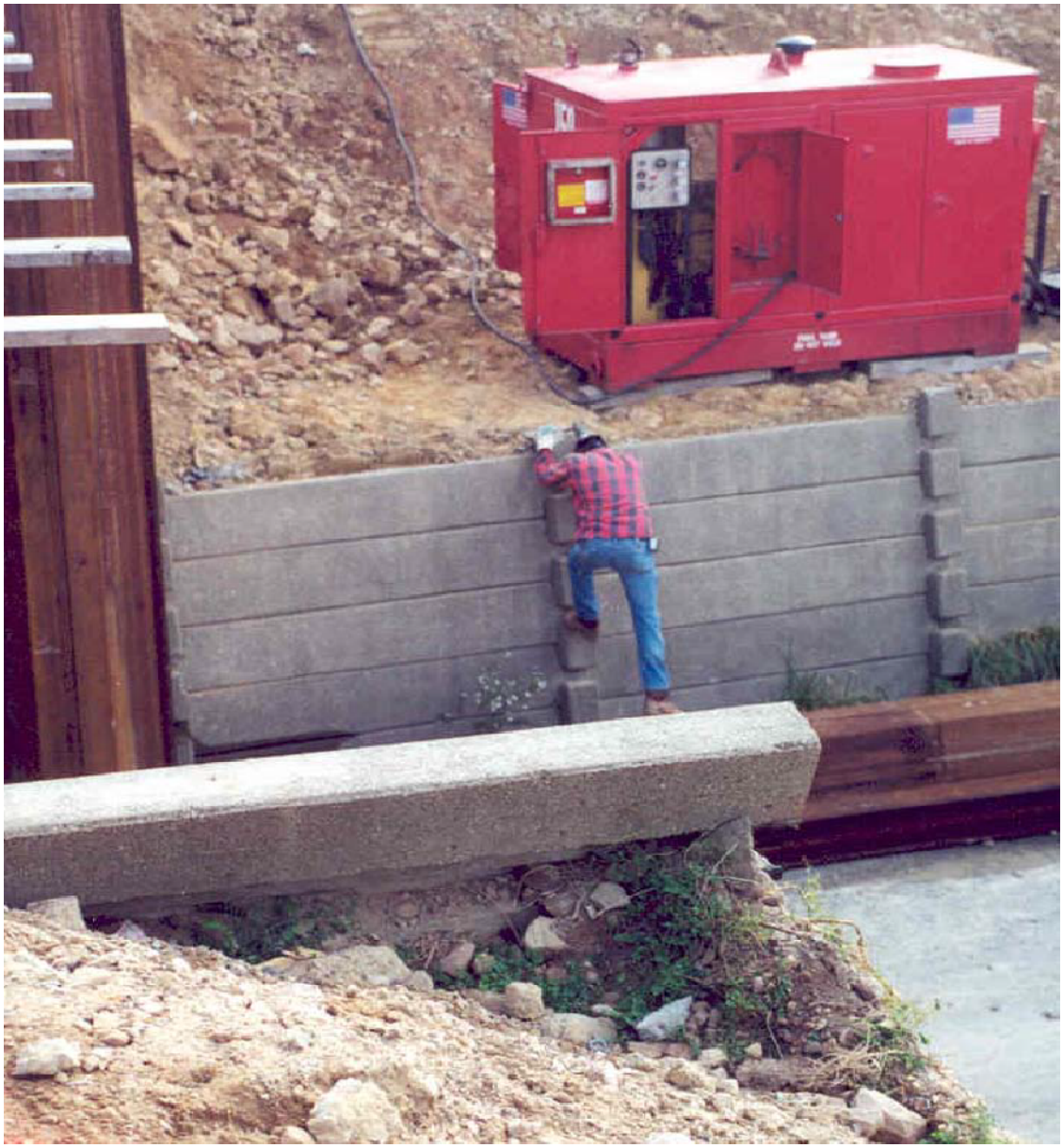


Figure 12:Slips, Trips, or fall (9)

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Research Methodology

The study had been conducted through several phases namely literature review, data collection, data analysis, discussion and conclusion. A literature review was conducted encompassing all various means available to obtain the widest range of the relevant information from books, papers, previous researches and websites related to accident and hazard in construction of bridges

3.2 Data collection

A Questionnaire was used to obtain the data needed for research because it is one of the most important tools to collect the primary data and use it to achieve the purposes of research.

The data collection is based on 50 returned questionnaires Distributed to ALDBASEEN Under-construction Bridge. And construction sites in the state of Khartoum

The targeted respondents were persons who are very well about the construction works and in particular at sites accidents

3.3 Questionnaire Design

3.3.1 Part1:

The first part of the questionnaire was about the most frequent accidentsInformation

- Falling from scaffolding accident
- Electrocution
- Falling from stairs
- Machinery such as Cranes, Conveyors and Tractors
- Collapse of walls
- Fire due to materials stored or gasoline
- Accidents due to earthquakes and lightning
- Accidents because of a maintenance or inspection
- Falling in deep excavations
- Respiratory problemdue to combustion
- Dive in the water
- Welding operations unprotected
- Accidents because of the hot and cold weather conditions
- Accidents because of breakdowns in tankers, equipment and machinery
- Sliding surface
- Fear of heights
- Noise and its effect on hearing
- Poor health, vision and hearing, anxiety and fear
- Exposure to radiation, chemicals and paint containing lead
- Burst pipes
- Asphyxiation

3.3.2 Part2:The most serious incident son the lives of workers:

- Falling from scaffolding accident
- Electrocution
- Falling from stairs
- Machinery such as Cranes, Conveyors and Tractors
- Collapse of walls
- Fire due to materials stored or gasoline
- Accidents due to earthquakes and lightning
- Accidents because of a maintenance or inspection
- Falling in deep excavations
- Respiratory problem due to combustion
- Dive in the water
- Welding operations unprotected
- Accidents because of the hot and cold weather conditions
- Accidents because of breakdowns in tankers, equipment and machinery
- Sliding surface
- Fear of heights
- Noise and its effect on hearing
- Poor health, vision and hearing, anxiety and fear
- Exposure to radiation, chemicals and paint containing lead
- Burst pipes
- Asphyxiation

3.3.3 Part3: The Economic Impact of Site Accidents on the Construction Companies:

The aim of this part is to identify and quantify the economic impacts of bridges accidents on the construction in state of Khartoum

This part consists of 13 economic impacts on construction companies by site accidents are as follows:

- Loss of productivity
- Disruption of current work
- Training costs for new workers
- Damages to plant, equipment, completed work
- Corrective actions to prevent re-occurrence of accident
- Deterioration of the efficiency of the team
- Expenditures on emergency equipment
- Costs of workman's compensation insurance
- Increase of Medical payments
- Costs of rescue operations and equipment
- Payments of injury or death claims
- Legal fees for defense against claims
- Increased insurance cost

3.3.4 Data analysis

The first part of the questionnaire was analyzed using statistical analysis to obtain

The most frequency accidents in bridges construction. And used yes or no mode to determine this accidents

The second part of the questionnaire was analyzed using statistical analysis to obtain andshow the mostserious incidentson thelives of workers and also used yes or no mode to determine this accidents

The third part of the questionnaireto determine if the companies had insurance policy toward the workers, had a department of occupational safety or it had a safety program or no

The four part of questionnaire was answered by choosing if they it highly agree, agree, is neutral, disagree, or highly disagree. This range used a 5-point scale. For example, a highly agree answer Indicates the highest effect and a value of 5 was attached to it, while a highly disagree answer has the lowest effect and a value of 1 was given to it.

Relative Important Index (RII) was used to determine the ranking of the economic impacts of bridges accidents in construction by using the following expression:

$$\boldsymbol{RII} = \frac{\sum_{i=1}^{5} \boldsymbol{aixi}}{\boldsymbol{5 \times N}}$$

Where:

ai is a constant expressing the weight of the *ith* response.

Xi is the frequency of the *ith* response of the total responses for each cause.

I is the response category index where ***i***= 1,2,3,4 and 5 respectively.

N is the total number of respondents.

RII value is ranged between 0 to 1.

CHAPTER 4
RESULTS ANALYSIS AND DISCUSSION

4.1 Type of The most frequent accidents

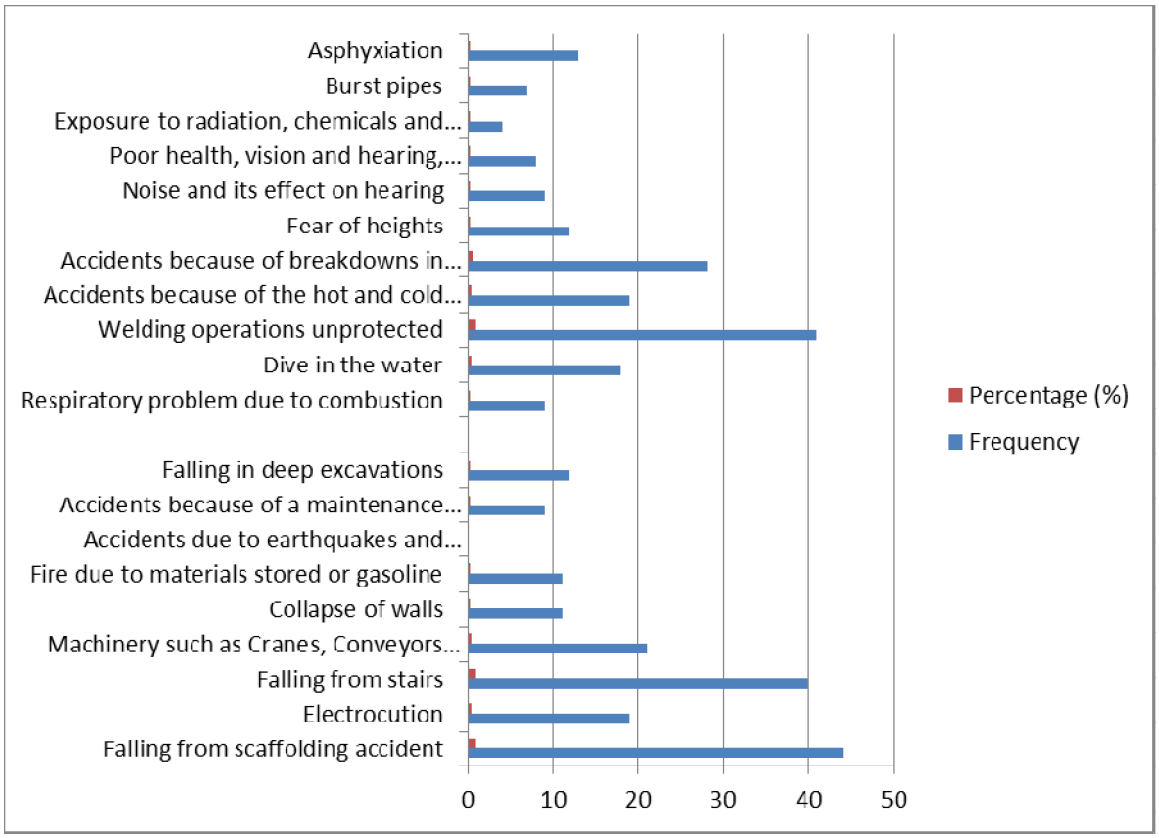
Table 4.1 show information of the most frequent accident in the bridge construction .

The most frequent accidents areFalling from scaffolding accident (88%) , Welding operations unprotected (82%) , Falling from stairs (80%) , Accidents because of breakdowns in tankers, equipment and machinery(56%) and Machinery such as Cranes, Conveyors and Tractors(42%).

Table 4.1 show information of the most frequent accident in the bridge construction

	Frequency	Percentage (%)
• Falling from scaffolding accident	44	88%
• Electrocution	19	38%
• Falling from stairs	40	80%
• Machinery such as Cranes, Conveyors and Tractors	21	42%
• Collapse of walls	11	22%
• Fire due to materials stored or gasoline	11	22%
• Accidents due to earthquakes and lightning	0	
• Accidents because of a maintenance or	9	18%

inspection		
• Falling in deep excavations	12	24%
• Respiratory problem due to combustion	9	18%
• Dive in the water	18	36%
• Welding operations unprotected	41	82%
• Accidents because of the hot and cold weather conditions	19	38%
• Accidents because of breakdowns in tankers, equipment and machinery	28	56%
• Fear of heights	12	24%
• Noise and its effect on hearing	9	18%
• Poor health, vision and hearing, anxiety and fear	8	16%
• Exposure to radiation, chemicals and paint containing lead	4	8%
• Burst pipes	7	14%
• Asphyxiation	13	26%



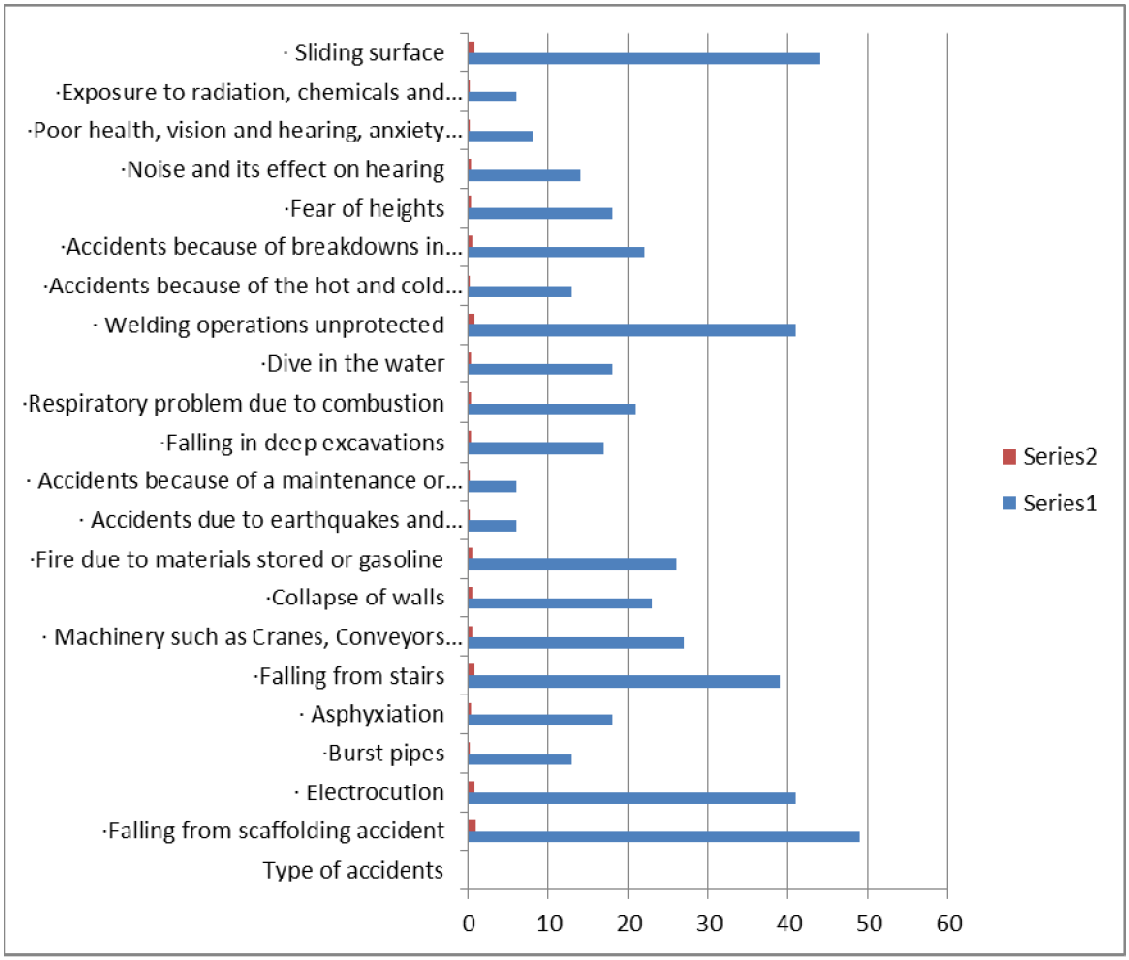
4.2 Type of the most serious incident son the lives of workers there are

Falling from scaffolding accident 98%, sliding surface88%,Electrocution82%, Welding operations unprotected 82%,Falling from stairs 78%

Table 4.2 Type of the mostserious incidentson thelives of workers

Type of accidents		
• Falling from scaffolding accident	49	98%
• Electrocution	41	82%
• Burst pipes	13	26%
• Asphyxiation	18	36%
• Falling from stairs	39	78%
• Machinery such as Cranes, Conveyors and Tractors	27	54%
• Collapse of walls	23	%46
• Fire due to materials stored or gasoline	26	52%
• Accidents due to earthquakes and lightning	6	12%
• Accidents because of a maintenance or inspection	6	12%
• Falling in deep excavations	17	34%
• Respiratory problem due to combustion	21	42%
• Dive in the water	18	36%
• Welding operations unprotected	41	82%
• Accidents because of the hot and cold weather conditions	13	26%
• Accidents because of breakdowns in tankers, equipment and machinery	22	44%
• Fear of heights	18	36%

• Noise and its effect on hearing	14	28%
• Poor health, vision and hearing, anxiety and fear	8	16%
• Exposure to radiation, chemicals and paint containing lead	6	%12
• Sliding surface	44	88%



4.3 The Economic Impacts of Site Accidents in Construction bridges

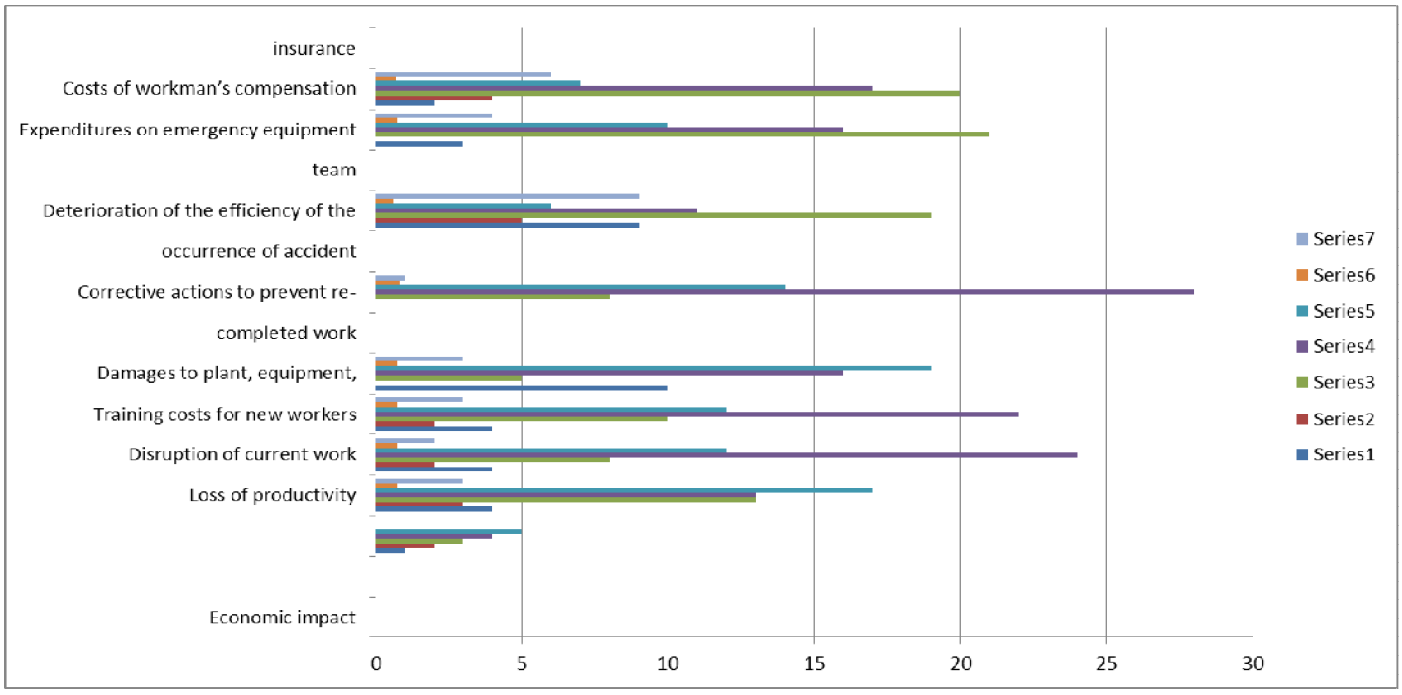
Table4.3. the Ranking of the Economic Impacts of Site Accidents in Construction Companies Analysis of the questionnaires showed that the loss of productivity was ranked as the highest economic impact with RII (0.82) Corrective actions to prevent re-Occurrence of accident and Increase of Medical payments ,Disruption of current work (0.75),Loss of productivity (0.74),Training costs for new workers (0.74),Damages to plant ,equipment

Completed work(0.74) , Expenditures on emergency equipment (0.72), Increased insurance costs(0.71),Costs of work man's compensation insurance (0.69),Costsofrescueoperations and equipment (0.65),Payments of injury or death claims(0.64),Deterioration of the efficiency of the team and Legalfeesfordefenseagainstclaims (0.60).

Table4.3. the Ranking of the Economic Impacts of Site Accidents in Construction of bridge

Economic impact	**Lowest effect 1**	**Disagree 2**	**Neutral 3**	**Agree 4**	**Highest effect 5**	**RII**	**RANK**
Loss ofproductivity	4	3	13	13	17	0.74	3
Disruptionofcurrentwork	4	2	8	24	12	0.75	2
Trainingcosts fornewworkers	4	2	10	22	12	0.74	3
Damages toplant,equipment, completedwork	10		5	16	19	0.74	3
Correctiveactions topreventre-occurrenceofaccident			8	28	14	0.82	1

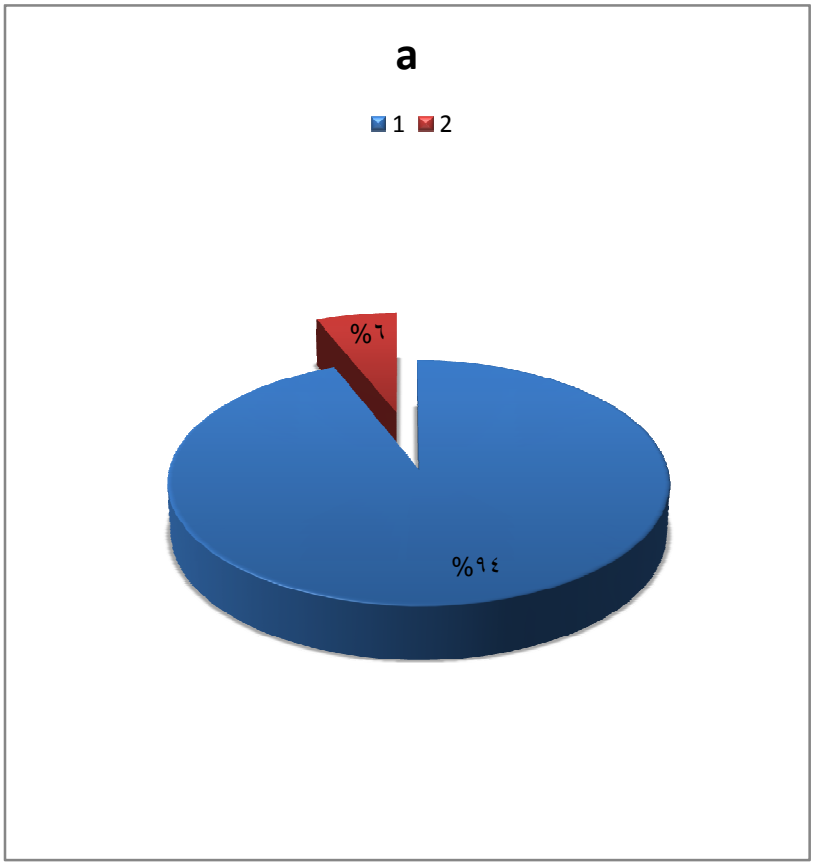
Deteriorationoftheefficiencyofthe team	9	5	19	11	6	0.60	9
Expenditures onemergencyequipment	3		21	16	10	0.72	4
Costsofworkman's compensation insurance	2	4	20	17	7	0.69	6
IncreaseofMedicalpayments	2	2	10	11	25	0.82	1
Costsofrescueoperations and equipment	3	1	34	4	8	0.65	7
Payments ofinjuryordeathclaims	4	3	29	6	8	0.64	8
Legalfeesfordefenseagainstclaims	4	5	32	4	5	0.60	9
Increasedinsurancecosts	2	5	17	16	10	0.71	5



4.4 The Insurance Policy toward the Workers in the Construction Companies

The insurance policy toward the workers in construction companies, Analysis of the questionnaires showed that (94%) have insurance policy toward the workers and (6%) doesn't have any insurance policy toward the workers

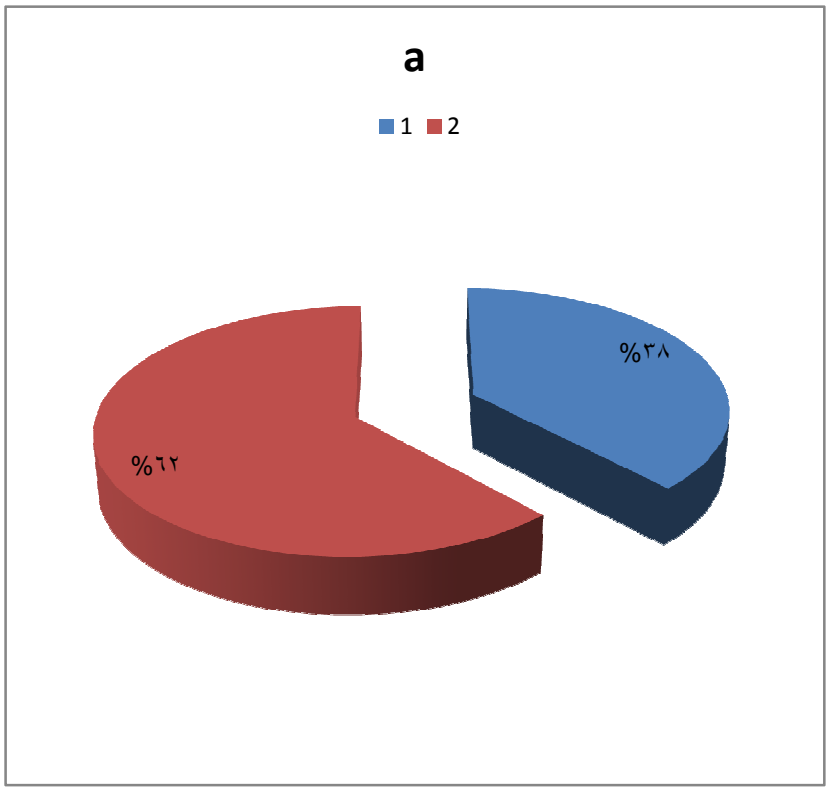
a	94%	6%



4.5 Companies have Department of Occupational Safety in Construction Companies

The department of occupational safety in companies of Khartoum state, Analysis of the questionnaires showed that (38%) of construction companies have department of occupational safety and (62%) doesn't have

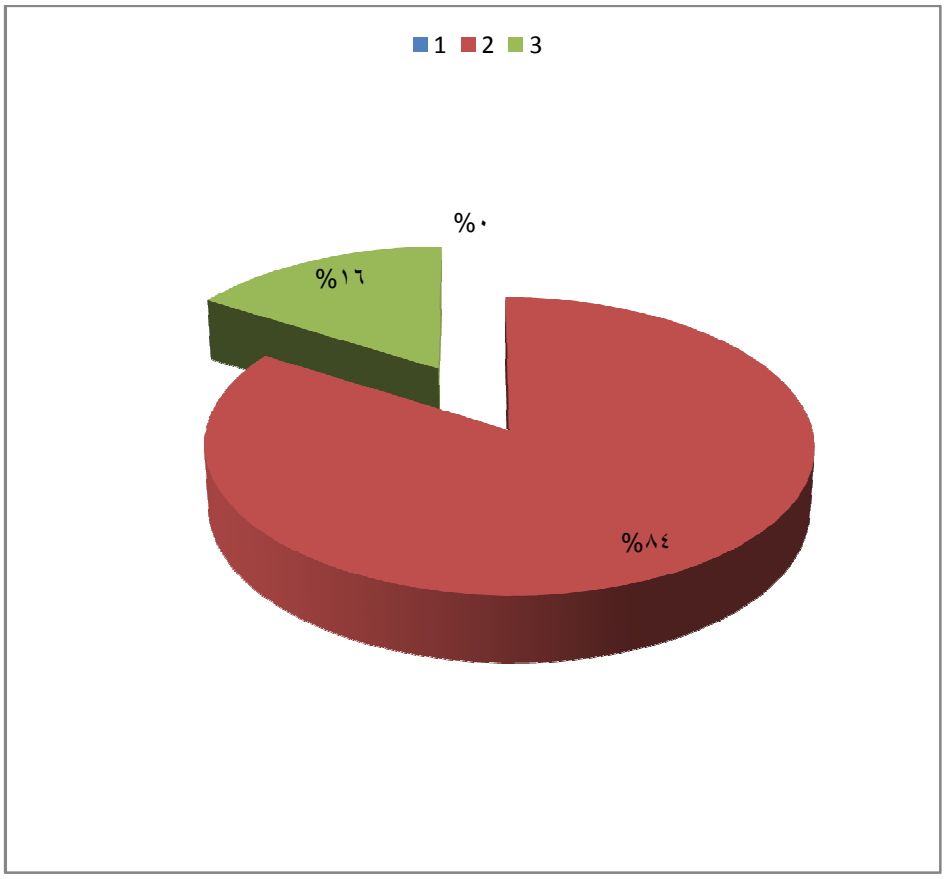
a	38%	62%



4.6 The Safety Program in the Construction Companies

(84%) of the companies have safety program and (16%) doesn't have any safety program

a	84%	16%



CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions:

- Thestudywasconductedinordertodeterminethe accidents and hazards in construction of bridges that affecting many factors related to the work productivity as well as labors health and life. Concerning this study found that the most affecting factor falling from scaffolding accident 98%,sliding surface 88%, Electrocution 82%, Welding operations unprotected 82%, Falling from stairs 78%
- The most frequent accident areFalling from scaffolding accident (88%) , Welding operations unprotected (82%) , Falling from stairs (80%) , Accidents because of breakdowns in tankers, equipment and machinery(56%) and Machinery such as Cranes, Conveyors and Tractors(42%).
- The Ranking of the Economic Impacts of Site Accidents in Construction CompaniesAnalysis of the questionnaires showed that the loss of productivity was ranked as the highest economic impact with RII (0.82) Correctiveactions topreventre-Occurrenceofaccident and IncreaseofMedicalpayments, Disruptionofcurrentwork (0.75), Loss ofproductivity (0.74), Trainingcosts fornewworkers (0.74), Damages toplant,equipmentcompletedwork (0.74), Expenditures on emergency equipment (0.72), Increasedinsurancecosts(0.71), Costsofworkman's compensation insurance (0.69), Costsofrescueoperations and equipment (0.65), Payments ofinjuryordeathclaims (0.64),

Deteriorationoftheefficiencyofthe team and
Legalfeesfordefenseagainstclaims (0.60).

- The insurance policy toward the workers in construction companies, Analysis of the questionnaires showed that (94%) have insurance policy toward the workers and (6%) doesn't have any insurance policy toward the workers .
- The department of occupational safety in companies of Khartoum state, Analysis of the questionnaires showed that (38%) of construction companies have department of occupational safety and (62%) doesn't have .
- (84%) of the companies have safety program and (16%) doesn't have any safety program
- Construction companies should concentrate on how to reduce the hazards and accidents on construction of bridges

5.2 Recommendations

The study therefore recommends that:

- Ensure that the work does not impair the health of employees.
- Keep safety a paramount part of the workers' daily activities.
- Improve morale and productivity.
- Recognize and reward safe work practices
- Whenever a violation of safety rules occurs, the following enforcement policy (or something similar) should be implemented:
- FIRST OFFENSE - Verbal warning and proper instruction pertaining to the specific safety violation. (A notation of the violation may be made and placed in the employee's personnel file.)

- SECOND OFFENSE - Written warning with a copy placed in the employee's personnel file.
- THIRD OFFENSE - Receipt of two written reprimands in any 12-month period may result in suspension.
- FOURTH OFFENSE - Dismissal from employment.
- Drug and Alcohol Policy

  Many employers establish substance abuse programs. These programs may require pre-employment testing for illegal drug use, as well as random periodic drug or alcohol testing for "safety sensitive" job functions. Testing also may be required for those involved in a workplace death or injury event, or other "for cause" reasons
- Identifying necessary safety and health programs for all work operations, i.e., electrical safety, fall protection, confined space, respiratory protection, Right-to-know, etc.
- Regularly visiting worksites to assess the implementation and effectiveness of programs applicable to the worksite
- Competent/qualified persons
- Identify "high hazard" areas of operation and determine inspection priorities.

5.3 Recommendations for Future Studies:

Bridge Failure and Safety Engineering

Study of sites effecting on labors health

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.OSHA Letter of Interpretation Regarding Catch Platforms: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=27373

."Catch Platforms" Must Comply with Scaffold Standard. Laborers' Health & Safety Fund of North America:

http://www.lhsfna.org/index.cfm/lifelines/february-2009/osha-catch-platforms-must-conform-with-scaffold-standard/

.OSHA's Fall Prevention Campaign: Plan-Provide-Train: Three simple steps to preventing fall: https://www.osha.gov/stopfalls/

.CPWR—The Center for Construction Research and Training: The mission of CPWR is to promote the maintenance and improvement of safe and healthy working conditions for workers in the construction industry through research and training.

a. http://www.cpwr.com/ -- Home page

b. http://stopconstructionfalls.com/ -- The website for The Campaign to Prevent Falls in Construction, a joint effort by government-labor-management to address the top cause of construction industry fatalities.

.Fatality Assessment and Control Evaluation (FACE) Program: FACE conducts investigations of fatal occupational injuries. *FACE Investigation Reports* inform employers and workers of commonly occurring hazardous operations and work practices and provide recommendations to prevent these injuries in the future. The following websites provide interested users with access to the full text of hundreds of FACE reports indexed by industry or cause of fatality:

. NIOSH FACE Program: http://www.cdc.gov/niosh/face/inhouse.html

. State FACE Reports: http://www.cdc.gov/niosh/face/stateface.html

.NIOSH Campaign to Prevent Falls in Construction: Facts – Falls Killhttp://www.cdc.gov/niosh/construction/stopfalls.html

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8. Construction industry safety history CSTM 102

9. Contact Information David E. Fosbroke NIOSH Division of Safety Research Morgantown, WV (304) 285-6010dFosbroke@cdc.govJennifer E. LincolnNIOSHDivision of Safety Research Morgantown, WV(304) 285-6010JELincoln@cdc.gov

.Role of OSHA ((http://failures.wikispaces.com/Construction+Accident+Overview?responseToken=4aafbe75e01a11a0891ba234d182b7b4)

English

Questionnaire

I. Most frequent accidents Information

Type of accidents	frequent	%
• Falling from scaffolding accident		
• Electrocution		
• Falling from stairs		
• Machinery such as Cranes, Conveyors and Tractors		
• Collapse of walls		
• Fire due to materials stored or gasoline		
• Accidents due to earthquakes and lightning		
• Accidents because of a maintenance or inspection		
• Falling in deep excavations		
• Respiratory problem due to combustion		
• Dive in the water		
• Welding operations unprotected		
• Accidents because of the hot and cold weather conditions		
• Accidents because of breakdowns in tankers, equipment and machinery		

• Sliding surface		
• Fear of heights		
• Noise and its effect on hearing		
• Poor health, vision and hearing, anxiety and fear		
• Exposure to radiation, chemicals and paint containing lead		
• Burst pipes		
• Asphyxiation		

II. The mostserious incidentson thelives of workers

Type of accidents	frequent	%
• Falling from scaffolding accident		
• Electrocution		
• Falling from stairs		
• Machinery such as Cranes, Conveyors and Tractors		
• Collapse of walls		
• Fire due to materials stored or gasoline		
• Accidents due to earthquakes and lightning		
• Accidents because of a maintenance or inspection		
• Falling in deep excavations		
• Respiratory problem due to combustion		

• Dive in the water		
• Welding operations unprotected		
• Accidents because of the hot and cold weather conditions		
• Accidents because of breakdowns in tankers, equipment and machinery		
• Sliding surface		
• Fear of heights		
• Noise and its effect on hearing		
• Poor health, vision and hearing, anxiety and fear		
• Exposure to radiation, chemicals and paint containing lead		
• Burst pipes		
• Asphyxiation		

1. Does the company have any insurance policy toward the workers?

Yes ☐ NO ☐

2. Does the company have department of occupational safety?

Yes ☐ NO ☐

3. Is there a safety program in the company?

Yes ☐ NO ☐

IV. Theeconomicimpactofsiteaccidentsontheconstructioncompanies:

	Highly	Agree	Neutral	Disagree	High
Loss ofproductivity					
Disruptionofcurrentwork					
Trainingcosts fornewworkers					
Damages toplant,equipment,					
Correctiveactions topreventre-					
Deteriorationoftheefficiencyofthe					
Expenditures					
Costsofworkman's compensation					
IncreaseofMedicalpayments					
Costsofrescueoperations and					
Payments ofinjuryordeathclaims					
Legalfeesfordefenseagainstclaims					
Increasedinsurancecosts					

1.الحوادث الاكثر حدوثا	نعم	لا
1. حوادث السقوط من السقالات		
2.حوادث الصعق بالكهرباء		
3.حوادث السقوط من السلالم		
4.حوادث الالات مثل الرافعات والناقلات والجرارات		
5.حوادث انهيار الجدران		
6.حوادث الحريق بسبب المواد المخزنة او البنزين		
7.حوادث بسبب الزلازل والبرق		
8.الحوادث بسبب وجود صيانة او تفتيش		
9.الوقوع في الحفريات العميقة		
10.مشاكل في الجهاز التنفسي بسبب الاحتراق		
11.حوادث الغوص في الماء		
12.حوادث عمليات اللحام دون وقاية		
13.حوادث بسبب الظروف الجوية الباردة والساخنة		
14.حوادث بسبب اعطال في الناقلات والمعدات والالات		
15. حوادث الخوف من المرتفعات		
16. حوادث الضوضاء وتاثيرها علي السمع		
17. ضعف الصحة والبصر والسمع والقلق والخوف		
18. حوادث التعرض للاشعاعات والكيماويات والطلاء المحتوي علي الرصاص		
19. .حوادث انفجار الانابيب		
20. .حوادث الاختناق لعدم وجود تهوية		

الحوادث الاكثرخطورة علي حياة العمال	نعم	لا
1. حوادث السقوط من السقالات		
2.حوادث الصعق بالكهرباء		
3.حوادث السقوط من السلالم		
4.حوادث الالات مثل الرافعات والناقلات والجرارات		
5.حوادث انهيار الجدران		
6.حوادث الحريق بسبب المواد المخزنة او البنزين		
7.حوادث بسبب الزلازل والبرق		
8.الحوادث بسبب وجود صيانة او تفتيش		
9.الوقوع في الحفريات العميقة		
10.مشاكل في الجهاز التنفسي بسبب الاحتراق		
11.حوادث الغوص في الماء		
12.حوادث عمليات اللحام دون وقاية		
13.حوادث بسبب الظروف الجوية الباردة والساخنة		
14.حوادث بسبب اعطال في الناقلات والمعدات والالات		
15.حوادث الانزلاق من السطح		
16.حوادث الخوف من المرتفعات		
17.حوادث الضوضاء وتاثيرها علي السمع		
18.ضعف الصحة والبصر والسمع والقلق والخوف		
19.حوادث التعرض للاشعاعات والكيماويات والطلاء المحتوي علي الرصاص		
20.حوادث انفجار الانابيب		
21.حوادث الاختناق لعدم وجود تهوية		

معلومات عن الشركة

1. هل تقوم الشركة علي تامين عمالتها

نعم ☐ لا ☐

2. هل يوجد قسم سلامة مهنية في الشركة

نعم ☐ لا ☐

3. هل يوجد برنامج سلامة في الشركة

نعم ☐ لا ☐

التأثير الاقتصادى للحوادث علي شركات التشييد

اسم الحادث	اوافق بشدة	اوافق	محايد	لا اوافق بشدة	لا اوافق
يؤدي الحادث الي خفض الانتاجية					
اضطرابات في انجاز العمل					
تكاليف اضافية في تدريب العمال البدائل او الجدد					
الاضرار التى تلحلق بالاجهزة والمعدات والاعمال المنجزة					
الاجراءات التصحيحية لمنع تكرار الحوادث					

تدهور كفاءة فريق العمل بسبب الحادث					
الانفاق الزائد علي معدات الطوارئ					
تكاليف تامين العمال المصابين					
زيادة المصروفات الطبية					
تكاليف عمليات الانقا					
دفعيات مطالبات تعويض اصابات العمل والحوادث					
الاتعاب القانونية ضد الدفاع عن المطالبات					
زيادة تكاليف التأمين					