IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

RISK ASSESSMENT AND CONTROL MEASURES AT ELEVATED METRO CONSTRUCTION SITES

Submitted by

Vikrant Kumar, M.E.- Industrial Safety Engineering Student, Department of Aeronautical Engineering, Excel Engineering College (Autonomous) Komarapalayam, Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai-Tamil Nadu

Guided by

Mr. M. Nambi Rajan, M.E., Assistant Professor, Department of Aeronautical Engineering, Excel Engineering College (Autonomous) Komarapalayam, Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai-Tamil Nadu.

ABSTRACT

Globally construction industry is growing with fast-track projects, infrastructure and real estate. The construction industry has the largest no of injuries as compared to other industries Thus, reducing accidents and determining construction risks are extremely important. Metro construction is one of infra structure project of construction industries. Metro construction is of two types underground metro site and Elevated metro site. In underground metro, work performed below ground level where as in elevated metro work performed above ground level. Underground metro preferred where density of people and traffic congestion is high. Cost of underground metro is far greater than elevated metro.

These days metro construction demand has been increased in cites due to increase of population & traffic congestion in cities. Elevated metro construction is challenging work due to work in middle of traffic, so high risk factor exists. Safety plays major role in the elevated metro construction work, various steps and documentation will be done for maintaining the safety in the elevated metro construction work to avoid the accident. Accidents degrade the market value of the company image, so safety plays an important role in the elevated metro construction project.

One of the essential steps for elevated metro construction safety management is Hazard Identification and Risk Assessment, since the most unmanageable risks are from unidentified hazard. This study aims to prepare HIRA for most accident-prone activities in elevated metro construction work and provide its control measures.

To achieve this, aim several visits were done for identification of hazards and risks involved in it for major activities carried out at elevated metro station construction work at MML project, Mumbai. The outcome of the study of this study will help the organization in improving safety by adding those control measures in safety plans and will help in reducing accident rates Also, to increase knowledge of partners in elevated metro rail projects through training and awareness programs.

Keywords: Hazard identification, Risk Assessment, severity, likelihood, Risk rating.

CHAPTER 1

INTRODUCTION

1.1 GENERAL CONSTRUCTION

Construction is often the largest employer in any country. It has been well documented that a large number of accidents occur in the construction industry. In modern society, the construction industry has been defined as a dangerous profession. The Construction industry of India is an important indicator of the development as it creates investment opportunities across various related sectors. The construction industry has contributed an estimated ₹ 3607 billion in the fourth quarter of 2023 to the national GDP. There is around 9% of share in national GDP of India 2023-24. The sector is labor-intensive and, including indirect jobs, provides employment to more than 71 million people. Globally construction industry is growing with Fasttrack projects, infrastructure and real estate. Metro construction is one of infra structure project of construction industries. These days metro construction demand has been increased in cites due to increase of population and congestion of traffic in cities. Metro construction is challenging work due to work in middle of traffic, so high risk factor exists. Safety plays major role in the metro construction work. Construction industry has the largest no of injuries as compared to other industries. It is a high hazard industry that comprises a wide range of activities involving construction, alteration, and/or repair. Examples include residential construction, bridge erection, roadway paving, excavations, demolitions, and large-scale painting jobs. Metro construction workers engage in many activities that may expose them to serious hazards, such as falling from rooftops, unguarded machinery, being struck by heavy construction equipment, electrocutions, silica dust, and asbestos. The below table shows the statistic of accident occurred in India in various activity carried in construction industry.

Table 1.1 - Incident statistics

Cause	Percentage
Fall of person	45%
Fall of objects	12%
Hit and Run	10%
Electrocution	9%
Collapse	3.5%

1.2 METRO CONSTRUCTION

This introductory chapter begins with a review of some of the transport problems faced by cities around the world. It then studies the Singapore model, where sound land transport policies have helped establish an efficient and extensive transport network. This is followed by discussions of urbanization in India and the country's urban transport policy. Metro construction site is generally of two types underground metro and Elevated metro. In underground metro, work performed below ground level where in elevated metro work performed above ground level. Underground metro preferred where density of people and congestion of traffic is high. Cost of underground metro construction is far greater than elevated metro construction.

1.3 ELEVATED METRO CONSTRUCTION

Elevated metro system is a rapid transit railway with tracks above the street level viaducts or other elevated structures. Land is precious if not rare and the acquisition or demolition of buildings can stall a project. The elevated alignment also negotiates existing obstacles like road crossings, road flyovers, railway bridges, and even sometimes another elevated metro.

Basic Sequence of elevated metro works are:

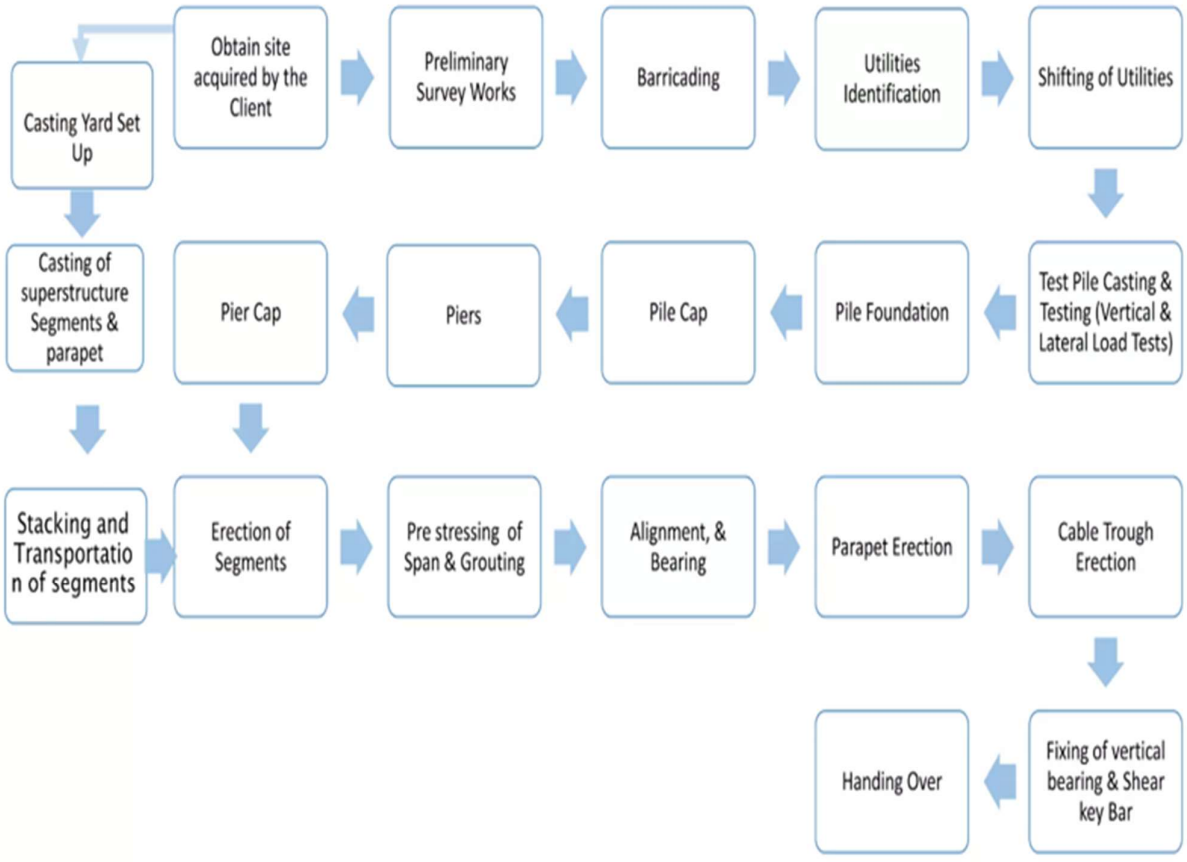


FIGURE 1.1: SEQUENCE OF ELEVATED METRO PROCESS

1.3.1 BASIC STRUCTURE OF ELEVATED METRO:

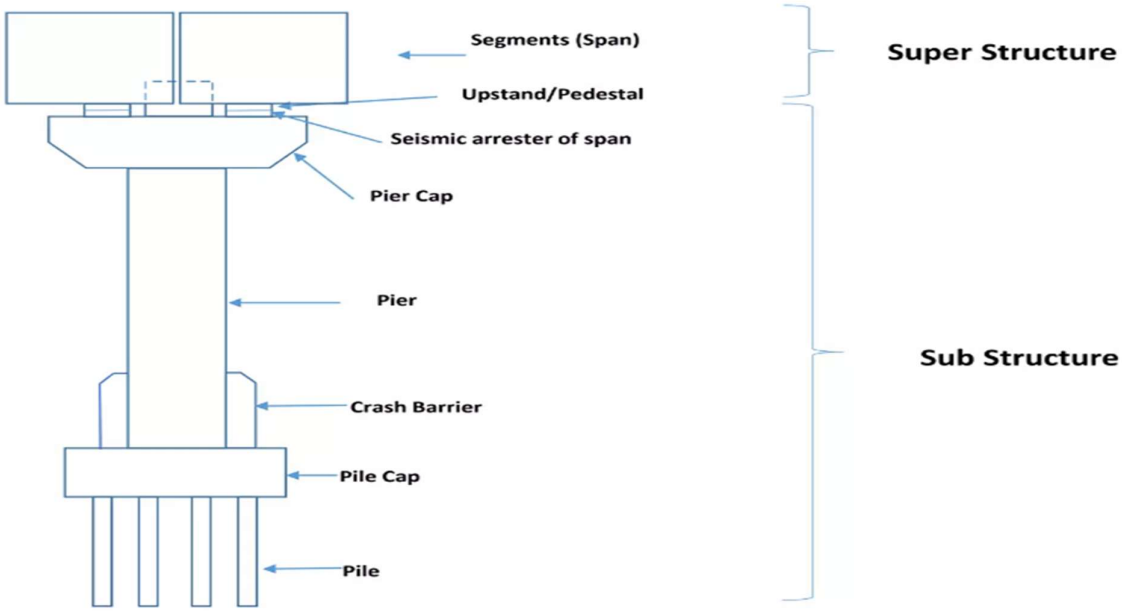


FIGURE1.2: BASIC STRUCTURE

Elevated project, offers ideal scope for personal injury and dangerous occurrences, making on-site health and safety a major priority within the organization. One of the essential steps for construction safety management is Hazard Identification and Risk Assessment, since the most unmanageable risks are from unidentified hazard.

1.4 HAZARD IDENTIFICATION AND RISK ASSESSMENT

A core challenge faced by emergency managers is how to prevent, prepare, mitigate, respond and recover from a myriad of hazards. Several questions arise when faced with this challenge:

- What hazards exist in my area?
- How frequently do they occur?
- How severe can their impact be on the community, infrastructure, property, and the environment?
- Which hazards pose the greatest threat to the community?

A Hazard Identification and Risk Assessment (HIRA) assist emergency managers in answering these questions. It is a systematic risk assessment tool that can be used to assess the risks of various hazards.

There are three reasons why a HIRA is useful to the emergency management profession:

- It helps emergency management professionals prepare for the worst and/or most likely risks.
- Allows for the creation of exercises, training programs, and plans based on the most likely scenarios.
- Saves time and resources by isolating hazards that cannot occur in the designated area.

1.4.1 BASIC TERMINOLOGIES

- **INCIDENT:**

It can be defined as any event that gave rise to an accident or has the potential to lead to an accident.

- **ACCIDENT:**

It can be defined as an undesired event giving rise to death, ill health, damage or other loss.

- **INJURY (WORK INJURY):**

It can be defined as any injury suffered by a person which arises out of and in the course of his employment.

- **HAZARD:**

It can be defined as any source or situation with a potential for harm in terms of injury or ill health or damage to property or damage to the work place environment, or a combination of these.

- **RISK:**

It is the combination of the likelihood and consequence(s) of a specified hazardous event occurring.
Risk= Likelihood * Consequence(s), where

Likelihood is an event likely to occur within the specific period or specific circumstances and consequence is the outcome of the event such as injury or effect on health of people or damage to property or environment or any combination of these outcomes.

- **HAZARD IDENTIFICAITON:**

It is the process of recognizing that a hazard exists and defining its characteristics.

1.5 CONSTRUCTION ACTIVITIES AT ELEVATED METRO SITES

1.5.1 EXCAVATION

In construction, excavation is used to create building foundations, reservoirs. Several different processes are used in excavation, including trenching, digging, dredging, and site development. These processes will require unique techniques, tools, and machinery to get the job done right.

1.5.2 PILING

Piling is the process of driving or boring pile foundations into the ground beneath a building that is under construction. These piles transfer loads from the structure to the ground, helping to support it. Pile foundations are often used where the ground is too weak to underpin the structure.

1.5.3 FORMWORK

Formwork is the structure, usually temporary, used to contain poured concrete and to mold it to the required dimensions and support until it is able to support itself. It consists primarily of the face contact material and the bearers that directly support the face contact material.

1.5.4 WORK AT HEIGHT

Working at height remains one of the biggest causes of fatalities and major injuries. Common cases include falls from ladders and through fragile surfaces. 'Work at height' means work in any place where, if there were no precautions in

1.5.5 LIFTING OPERATIONS

Lifting operations in construction occur during transportation of material from the storage place to the place where it is being processed, and during the processing of materials. A load includes any material or people that are lifted or lowered by lifting equipment

1.5.6 HOT WORKS

Hot Work is defined as cutting, welding, soldering and brazing operations for construction/demolition /maintenance/repair activities that involve the use of portable gas or arc welding equipment.

1.5.7 ERECTION WORKS

Erection involves positioning, aligning and securing the components on prepared foundations to form a complete frame. Safe erection of structural construction depends on proper and timely planning.

1.5.8 CONCRETE WORK

Concrete is easy to work with, versatile, durable, and economical. By taking a few basic precautions, it is also one of the safest building materials known. Relatively few people involved in mixing, handling, and finishing concrete have experienced injury.

1.5.9 BRICK/BLOCK WORK

Brick masonry is construction in which uniform units ("bricks"), small enough to be placed with one hand, are laid in courses with mortar joints to form walls. Bricks are kiln baked from various clay and shale mixtures. The chemical and physical characteristics of the ingredients vary considerably. The problem relating to the structural safety of outer brick cavity walls, more specifically end walls of flats, has been a topic of discussion. The risks of end walls collapsing are underestimated by building owners.

1.5.10 CHIPPING WORK BY MACHINE

In Construction industry there are many activities require chipping work (e.g. Concrete chipping, wood chipping etc) which is one of the critical activities. It is done manually in case if the work is small, for huge chipping work various kind machines are used which so requires more precaution while handling it. If it has not done in safe way it may cause fatality, severe injury and property damage with economic losses.

1.5.11 PAINTING WORK

The painting operations generally include the primer coat, under coat and finishing coat to get the final finish as desired. First Primer Coat: It is applied to provide adhesion between the paint film and the surface.

1.6 OBJECTIVE OF STUDY

To prepare a risk assessment at elevated metro construction site with the use of Quantitative risk assessment system. Depending upon the risk rating values analyzed control measures are to be suggested.

1.7 APPLICATION OF THIS STUDY

- Residential Building Project
- Commercial Building Project
- High Rise Buildings
- Railway station construction Projects
- Metro Projects, etc

CHAPTER 2

LITERATURE REVIEW

2.1 SCOPE

A review of the literature was done to ensure that a methodology was chosen which will useful to get information related to activities in elevated metro site and how to identify the hazards, procedures to be carried out for Hazard Identification and Risk Assessment in elevated metro site.

2.2 REVIEW

The following are the brief review of the work carried out by different researches in the field of Hazard Identification and Risk Analysis (HIRA).

Carpignano et al. (1998) applied quantitative risk analysis (QRA) for drawing conclusion concerning serious accidental events with the occurrence frequency and the consequences. The QRA approach they selected was based on reservoir analysis and management systems (RAMS) such as preliminary Hazard Analysis (PHA), Failure Mode Effect and Critical Analysis (FMECA), Fault Tree Analysis (FTA), Event Tree Analysis (ETA).

Bell and Glade (2003) have done a risk analysis focusing on risk to life. They calculated landslide risk and occurrence of potential damaging events as well as the distribution of the elements at risk and proposed the following approach for risk evaluation:

RISK = HAZARD X CONSEQUENCE X ELEMENT OF RISK.

Qureshi (1987) had done a Hazard and Operability study (HAZOP) in which potential hazards are identified by looking at the design in a dynamic manner. To identify the nature and scale of the dangerous substances, to give an account of the arrangements for safe operation of the installation, for control of serious deviations that could lead to a major accident and for emergency procedures at the site, identify the type, relative

likelihood and consequences of major accidents that might occur; and to demonstrate that the manufacturer (operator) has identified the major hazard potential of his activities and has provided appropriate controls.

S.Gokul Raj and N.Shivasankaran, in their research paper entitled "Hazard Identification and Risk Assessment in Deinking Plant, published in International Journal of Research in Aeronautical and Mechanical Engineering demonstrates the effective analysis HIRA to identify and assess all hazards of De-Inking plant in paper industry. A hazard identification and risk assessment (HIRA) is a structured and systematic examination of a planned or existing process or operation in order to identify and evaluate problems that may represent risks to personnel or equipment, or prevent efficient operation.

By using this analysis, he had assessed the hazards in the De-Inking plant. Deinking is the industrial process of removing printing ink from paper fibers of recycled paper to make deinked pulp. The key in the deinking process is the ability to detach ink from the fibers.

Samaneh Zolfagharian and Aziruddin Ressang, in their "Risk Assessment of Common Construction Hazards among Different Countries" published in Sixth International Conference on Construction in the 21st Century (CITC-VI) says that The construction industry has the largest number of injuries compared to other industries. Thus, reducing accidents and determining construction risks are extremely important. One of the essential steps for construction safety management is hazard identification, since the most unmanageable risks are from unidentified hazards. This paper aims to rank the risk of construction hazards. To achieve this aim, the frequency and severity of accidents from the most common hazards at construction sites, were assessed. The data for this study were collected using a web survey. The questionnaire was sent to 300 safety professionals including safety managers, safety officers, and safety experts who were randomly selected from 20 countries. Of those, 76 completed responses were returned. The results reveal that there is no significant difference in severity and frequency of accidents between the studied countries. It was also found that a lack of safety-forward attitudes, a lack of awareness of safety regulations, poor safety awareness of project managers, and a lack of knowledge are the hazards with the most risk in construction projects. The outcome of this study can help organizations and managers prepare proper safety plans and also to increase the knowledge of partners in construction sites through training and awareness programs.

CHAPTERE 3

METHODOLOGY

3.1 RISK ASSESSMENT

Risk assessment is a process of evaluating the risks to safety and health from hazard at work. In mathematical term, risk can be calculated by using the equation, Risk = Likelihood x Severity. Where Likelihood is an event likely to occur within the specific period or in specified circumstance and, Severity is outcome from an event such as severity of injury or health of people, or damage to property.

Risk occurs when a person is exposed to a hazardous situation. Risk is the likelihood that exposure to a hazard will lead to an injury or a health issue. It is the measure of the probability and potential severity of harm or loss.

Risk assessment forms crucial early phase in the disaster management planning cycle and is essential in determining what disaster measures should be taken to reduce future losses. Any attempt to reduce the impact of disaster requires an analysis that indicates what threat exist, their expected severity, who or what they may affect, and why. Knowledge of what makes a person or a community more vulnerable than another added to the resources and capacities available determines the step we can take to reduce their risk.

Risk assessment is carried out in series of related activities which build up a picture of the hazard and vulnerabilities which explains disaster events.

3.2 PROCESS OF HIRA

1. Classify the work activities;
2. Identify hazard;
3. Conduct risk assessment (analyze and estimate risk from each hazard), by calculating or estimating,
    a) Likelihood of occurrence and
    b) Severity of hazard;
4. Decide if risk is tolerable and apply control measures (if necessary).

Flowchart of HIRA Process:

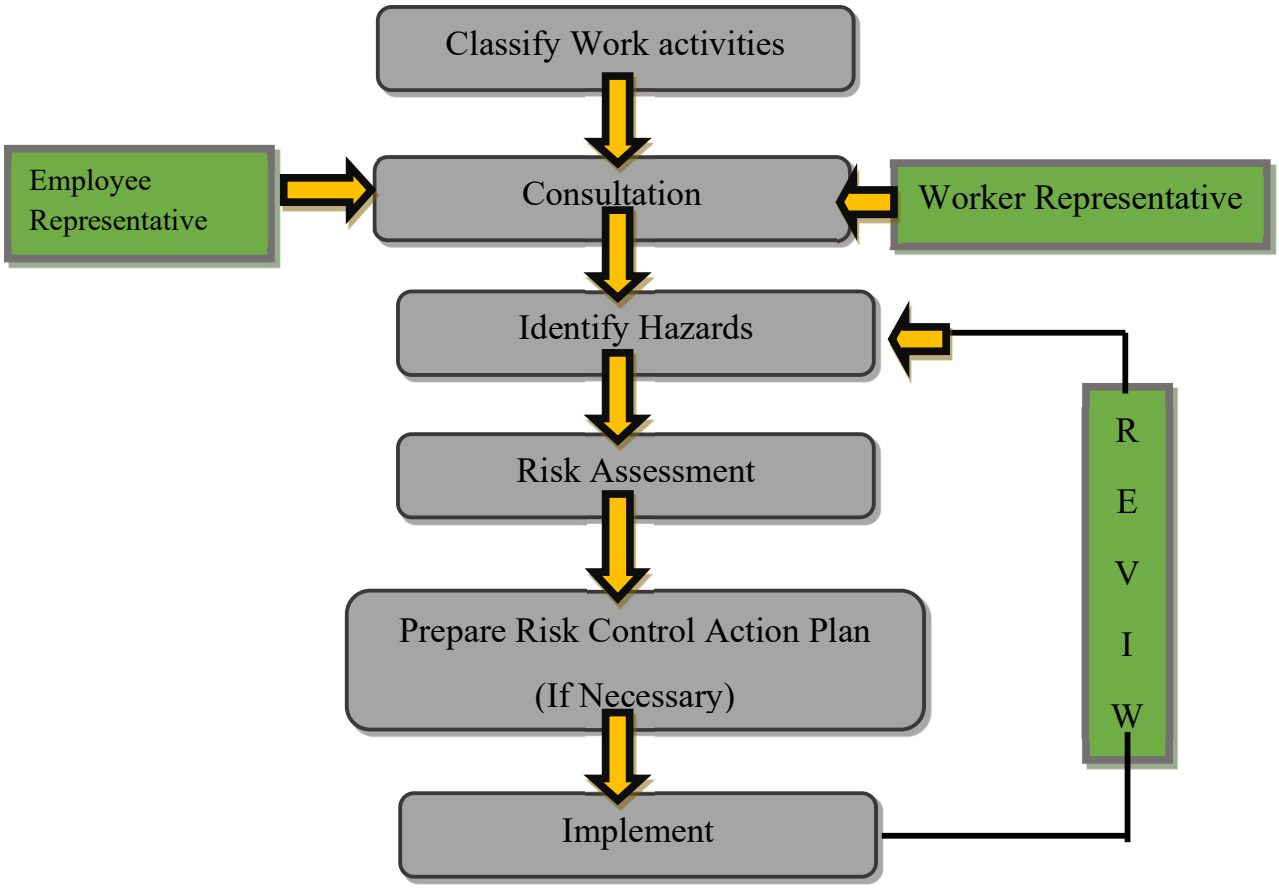


FIGURE 3.1: FLOW CHART OF HIRA

3.2.1 CLASSIFY WORK ACTIVITIES

Classify the work using following criteria-

- Geographical or physical area within/Outside premises;
- Stages in casting/service process;
- Not too big e.g. building;
- Not too small e.g. fixing a nut;

3.2.2 HAZARD IDENTIFICATION

Hazard can be divided into following groups,

1. Gravity Hazards.
2. Temperature Hazards.
3. Fire/Explosion Hazards.
4. Electrical Hazards.
5. People Hazards.

Hazards in a workplace can arise from a number of sources including;

- Poor workplace design;
- Hazard tasks being performed in the workplace;
- Incorrect installation, commissioning, use, inspection, maintenance, services, repair, or alteration of plant in the workplace; and

- People being exposed to hazardous substances, dangerous goods, processes or environment.

The hazard identification process is designed to identify all situations where people may possibly be exposed to injury, illness and disease arising from all sources including the above.

Prior to introduction of any plant, substances, processes or work practices in the workplace, it is essential for the hazard identification process to be carried out to identify whether there is any potential for injury, illness or diseases associated with such introduction.

A hazard identification process will have been carried out on any plant, substances, processes or work practices that have potential to cause a risk to health and safety that currently exist. Employees should familiarize themselves with the potential hazard and any eliminating or minimizing requirements.

Employees undertaking hazard identification should have the necessary training, or experience, or should seek assistance.

Mechanical Hazards including, but not limited to:

- "Drawing in" Points.
- Shearing points.
- Impacts and crushing areas.
- Cutting areas.
- Entanglement areas.
- Stabbing points.
- Abrasion areas.
- Flying particles.
- Any protrusions which could cause injury.

Non-Mechanical Hazards including, but not limited to:

- Ergonomic hazards including manual handling.
- Electrical shocks and burns.
- Chemical burns, toxicity, flammability.
- Noise.
- Vibration.
- Radiation.
- Mist, Dust, Fumes.
- Suffocation.
- Engulfment.
- Biological hazards, viral.
- Slipping, tripping and falling hazards.
- Falling objects.
- Working in very hot or cold conditions.

A Hazard Identification process and form must be repeated:

- Before any alteration to plant or any change in the way plant is used or a system of work associated with plant, Including a change in the location of plant;
- Before any alteration is made to objects used in the workplace or to systems of work which include a task involving manual handling, including a change in the place where a task is carried out;
- Before plant is used for any other purpose than for which it was designed;
- Before an object is used for another purpose than for which it was designed if that other purpose may result in the person carrying out hazardous manual handling;
- If new or additional information about becomes available; and
- If an occurrence of a Musculoskeletal Disorder is reported by or on behalf of an employee.

3.2.3 RISK ASSESSMENT

It can be done by qualitative, quantitative or semi quantitative method. A qualitative analysis uses words to describe the magnitude of potential severity and the likelihood that severity will occur. These scales can be adapted to suit the circumstances and different descriptions may be used for different risks. In this project quantitative risk assessment technique was adopted. Risk assessment process is as shown in figure below.

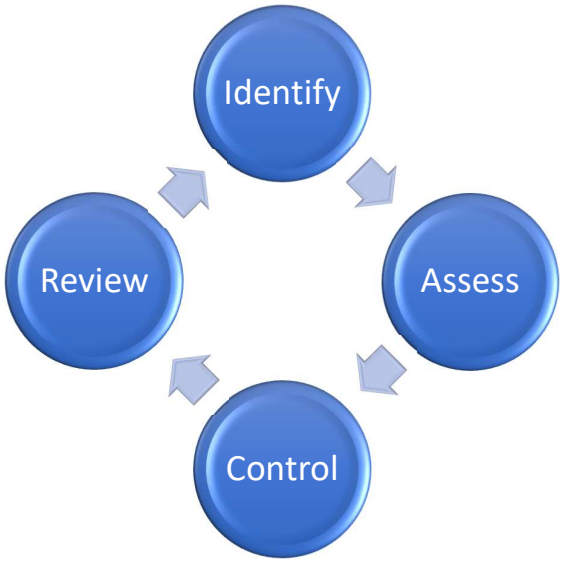


FIGURE 3.2: RISK ASSESSMENT PROCESS

3.2.4 CONTROL

Control is the elimination or inactivation of a hazard in a manner such that the hazard does not pose a risk to workers who have to enter into an area or work on equipment in the course of scheduled work. Hazards should be controlled at their source, along the path to the work, through the use of PPE, is the least desirable control.

3.2.5 MONITOR AND REVIEW

Hazard identification, risk assessment and control are an on-going process. Therefore, regularly review the effectiveness of your hazard assessment and control measures. Make sure that you undertake a hazard and risk assessment when there is change to the workplace including when work systems, tools, machinery or equipment changes. Provide additional supervision when the new employees with reduced skill levels or knowledge are introduced to the workplace.

3.3 METHODOLOGIES FOR RISK ANALYSIS

The objective of risk analysis is to produce outputs that can be used to evaluate the nature and distribution of risk and to develop appropriate strategies to manage risk. Event or issues with more significant consequences and likelihood are identified as “Higher Risk” and are selected for higher priority mitigation actions to lower the likelihood of the event happening and reduce the consequences if the event were to occur.

Qualitative methods use descriptive terms to identify and record consequences and likelihood of the events and resultant risk. Quantitative methods identify likelihoods as frequencies or probabilities. They identify consequences in terms of relative scale (orders of magnitude) or in terms of specific values (for e.g. Estimate of cost, number of fatalities or number of individuals lost from a rare species.)

For both qualitative and quantitative method it is important to invest time in developing appropriate rating scales for likelihood, consequences within the scope of the exercise should be considered when developing rating scales.

3.3.1 QUALITATIVE RISK ASSESSMENT METHOD

Qualitative approach to risk assessment is the most commonly applied. Qualitative risk assessment methods are quick and relatively easy to use as broad consequences and likelihood can be identified and they can provide a general understanding of comparative risk between risk events, and the risk matrices can be used to spate risk events to risk classes (ratings).

A logical systematic process is usually followed during a qualitative risk assessment to identify the key risk events and to identify the consequences of the events occurring and the consequences of the occurrences.

TABLE 3.1

A QUALITATIVE METHOD FOR THE CLASSIFICATION OF RISK

Likelihood		Very Likely	Likely	Unlikely	Highly Unlikely
Severity	Fatality	High	High	High	Medium
	Major	High	High	Medium	Medium
	Minor	High	Medium	Medium	Low
	Negligible	Medium	Medium	Low	Low

TABLE 3.2

RISK RATING

Low Risk
Medium Risk
High Risk

TABLE 3.3

RISK LIKELIHOOD TABLE FOR GUIDANCE

Step -1: Assess the likelihood				**Step – 2: Assess the consequences**		
L1	Happens every time we operate	Almost certain	Common or repeating occurrence	**C1**	Fatality	Catastrophic
L2	Happens regularly (often)	Likely	Known to have occurred "has happened"	**C2**	Permanent disability	Major
L3	Has happened (occasionally)	Possible	Could occur or "heard of it happening"	**C3**	Medical/hospital or loss time	Moderate
L4	Happens irregularly (almost never)	Unlikely	Nor likely to occur	**C4**	First aid or no loss time	Minor
L5	Improbable (never)	Rare	Practically impossible	**C5**	No injury	Insignificant

Quantitative approaches are best used as a quick first pass exercise where there are many complex risk issues and low risk issue need to be screened out for practical purposes.

Qualitative approaches have some short comings as compared with more quantitative approaches. Key criticisms are that qualitative methods are imprecise it is difficult to compare events on a common basis as there is rarely clear justification of weightings placed on severity of consequences and the use of emotive labels make it difficult for risk communicators to openly present risk assessment findings.

3.3.2 SEMI QUANTITATIVE METHOD

Semi-quantitative approaches to risk assessment are currently widely used to overcome some of the shortcomings associated with qualitative approaches. Semi- quantitative risk assessments provide a more detailed prioritized ranking of risk than the outcomes of qualitative risk assessment. It takes the qualitative approach a step further by attributing values or multipliers to the likelihood and consequences groupings. Semi quantitative risk assessment may involve multiplication of frequency levels with a numerical ranking of consequences. Several combinations of scales are possible.

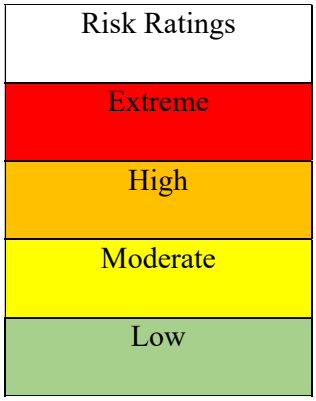
Table 3 shows an example of semi quantitative risk matrix where the likelihood and consequences have been assigned numbered levels that have been multiplied to generate a numeric description of risk ratings. The values that have been assigned to the likelihoods and consequences are not related to their actual magnitudes but the numeric values that are derived for risk can be grouped to generate the indicated risk ratings. In this example, extreme risks events have risk ratings greater than 15, high risk are between 10 and 15 and so on.

TABLE 3.4

EXAMPLE OF A SEMI-QUANTITATIVE RISK RATING MATRIX

Consequences	Likelihood: 1 Rare	2 Unlikely	3 Possible	4 Likely	5 Almost Certain
5 Catastrophic	5	10	15	20	25
4 Major	4	8	12	16	20
3 Moderate	3	6	9	12	15
2 Minor	2	2	6	8	10
1 Negligible	1	2	3	4	5

Risk = Low Moderate High Extreme



An advantage of this approach is that it allows risk rating to be set based on the derived numeric risk values. A major drawback is that the numeric risk values may not reasonably reflect the relative risk of events due to the possible orders of magnitude differences within the likelihoods and consequences classes.

In many cases the approach used to overcome above drawbacks have been to apply likelihood and consequences values that more closely reflect their relative magnitude, but which are not absolute measures. The semi quantitative risk matrix shows the relative risk values that would be derived by replacing the qualitative descriptions of likelihoods and consequences with values that better reflect their relative order of the magnitude and provides more realistic relativity with each class.

CHAPTER 4

RESULTS & DISCUSSION

4.1 SITE DETAILS

The details of the project site is as shown below Table

TABLE 4.1

DETAILS OF PROJECT SITE

Name Of the Project	**Mumbai Metro Line 4/ CA11 Package**
Developers	Tata Projects Ltd.
Location	Mulund Fire Station to Majiwada Station
Cost of the project	600 Crores
Starting Date of Project	April 2018
Expected Completion date	December 2024
Safety Budget	Near about 2% of Project Cost
Number of Safety Officers	16
Total Number of workers	700

4.2 HIRA REPORT

- **HAZARD:**

Hazard is defined as the source of situation that potentially harm in terms of injury, illness, property damage or environmental loss or combination of both.

- **RISK:**

Risk is defined as the combination of likelihood of occurrences due to hazards and the severity of injury, illness, property damage and environmental losses.

Risk = Severity x Likelihood

Severity: This is the seriousness of the harm that could result from contact with a hazard.

It is rated as shown in Table Below.

TABLE 4.2

SEVERITY RATING

Severity	Rating	Description
Catastrophic	5	Death and/or sever destruction
Critical	4	Serious illness, injury, Disability and significant property damage.
Serious	3	Lost time injury and property damage.
Minor	2	Minor injury and/or property damage.
Negligible	1	No injury and/or property damage.

Likelihood/Probability: This is the chance that a hazard will cause harm.

It is rated as shown in below Table

TABLE 4.3

LIKELIHOOD RATING

Probability	Rating	Description
Most Likely	5	Workers are frequently at risk
Probable	4	The hazard is likely to cause harm
Occasional	3	Workers are occasionally at risk
Remote	2	The hazard could cause harm, but is unlikely to do so
Improbable	1	The hazard is unlikely to cause harm

Risk Coding: This is based on the outcome of the risk factor obtained from the multiple of probability and severity it is to be illustrated in below table.

TABLE 4.4

RISK CODE

Risk Factor	Risk Level	Risk Code
11-25	High	H
05-10	Medium	M
01-04	Low	L

4.3 HIRA FOR DIFFERENT ACTIVITIES:

Depending upon the site observation for below selected activities HIRA is prepared as shown in following Tables.

No	Activity	Hazard	Risk Involved	People at risk	Assessment			Control measures	Re-assessment		
					P	S	RL				
xcavation											
	Excavation	Deployment of unfit excavator and incompetent operator	Excavation / Trench collapse due to equipment failure	Workmen/ Staff/ Visitors/ Public	5	4	20	• Working area shall be barricaded with warning tapes & signages. • Certificate of conformance and maintenance records for plant and machinery shall be reviewed at procurement stage. Risk Assessment shall be done for each plants / equipment incorporating installation & operational EHS risks. • Check all excavation equipment and issue green card before allowing onto site. • Maintain excavation equipment / plant with approved spare parts and fittings not alternative non-approved spare parts and fittings. • Equipment shall be operated by licensed and approved operators only.	1	4	4
		Inadequate supports and inappropriate sequence of excavation techniques	Excavation / Trench collapse	Workmen/ Staff/ Visitors/ Public	5	5	25	• Excavation / design shall include the method of shoring / supporting the excavation. • All excavations shall be inspected by a competent person before start of day's work or after adverse weather conditions. • Excavations shall be designed by a competent engineer. The competent excavation supervisor / engineer shall prepare a method statement for excavation of underground services incorporating the requirements Excavations. • Temporary makeshift shoring shall not be permitted, equipment used to shore excavations shall be fit for purpose and designed for the purpose employed	1	5	5
		Deployment of unfit excavator and incompetent operator and unprotected excavation pit	Fall / topple of excavator or dumper into excavated pit or run over on people working or moving on site.	Workmen/ Staff/ Visitors/ Public	3	5	15	• Ramp / approach road shall be constructed as per norms and designated for safe movement of vehicle. • Pedestrians and vehicles shall be segregated, intersections shall be signaled / warned /banks man provided for safe cross overs. • Excavated pit shall be hard barricaded. Warning lights and signs shall be installed. • A banks man shall be provided to help the drivers to make the maneuvers during loading or unload of materials.	1	5	5

	Voids due to erosion by stagnated water	Excavation Trench or soil collapse	Workmen/ Staff/ Visitors/ Public	4	4	16	• Geotechnical' survey shall be carried out prior to commencement of works. • Voids shall be identified and filled backfill and compacted or pumped with concrete. Alternatively,	1	4	4
	Contact with existing services	Electrocution/Fire / Explosion	Workmen/ Staff/ Visitors/ Public	5	4	20	• Acquire current utility drawings and details. • Carry out survey to confirm depth and line of existing utilities (utilize suitable survey equipment relevant to the scope and scale of the work. Survey equipment may include ground radar, cable avoidance tools and accessories (CAT & Genny). • Dig sufficient trial pits to locate underground services and expose it for mechanical excavation where necessary. • Mark the line of underground services to ensure visibility to all persons working in the vicinity • Prepare method statement for excavation of underground services. • Where possible, underground electrical services shall be de-energized prior to excavations. • Where services are to be re-routed, no work shall commence until services are confirmed as de-energized / inert. • Permits shall be secured in advance from the relevant utility / local authority prior to excavation in the vicinity of existing underground services.	1	5	5
	Excavation in the vicinity of or underneath existing structures	Collapse of existing structure	Workmen/ Staff/ Visitors/ Public	4	4	16	• No excavation work shall be carried out in the immediate vicinity of or underneath existing structure until the impact of the work on the existing structure is determined by a competent engineer. • Underpinning requirements shall be determined by a competent structural engineer. • Where possible, the structure shall be evacuated for the duration of the works as an additional safety measure. Closely monitor the behavior of structure during excavation.	1	4	4
	Water seepage / flooding into excavation	Soil collapse	Workmen/ Staff/ Visitors/ Public	4	4	16	• Plan for suitable de-watering system based on the ground water table level and soil strata. Where the water pressure is high, use total dewatering methods. • Make provision for continuous dewatering using pumps, have standby pumps and night shift operation.	1	4	4
	Lack/ Improper of access & egress, Taking Shortcuts	Slip, Trip and Fall, Delaying in rescue the injured person	Workmen/ Staff/ Visitors/ Public	3	4	12	• Minimum two Safe means of access shall be provided to every working excavation pit.	1	4	4

	Piling related works	Unidentified underground utilities	Damage to underground utilities, electrocution,	Workmen/ Staff/ Visitors/ Public	5	4	20	• Concerned departments Clearance/authorization shall be taken. • Manual Cross trenching shall be done before commencing the work till a depth of 2.5m by insulated crowbars. • Client clearance shall be taken on RFI prior to commence the job. • Implement contents of permit system to work @ height.	1	4	4
		Unprotected bore holes	Fall of person in the bore hole	Workmen/ Staff/ Visitors/ Public	4	4	16	• Bore holes shall be covered with jallies or rebar mesh. • Safety harness to be used while working near bore hole while placing or removing polymer pipe	1	4	4
		Flying chips/particles, Hand Arm Vibration (Pain in limps), Noise emission, Dust emission.	Flying particles ingress into the eye, Pain in limps and white finger, Noise induced hearing loss, hyper tension, increase in blood pressure and anger, Irritation in lungs and breathing problems, Fatal/ serious injury, Electrocution	Workmen/ Staff/ Visitors/ Public	4	4	16	• Working area shall be barricaded with warning tapes & signages. • PPE's like safety goggles, hand gloves, Helmet, nose mask, reflective jacket, ear plugs and shoes shall be used. • Job rotation shall be done regularly to avoid workmen getting Tired. • Buddy system shall be followed • AVR (Active Vibration Reduction) attached power tools shall be used. • Hand gloves shall be used • Electrical power tools shall be used with adequate safety precautions i.e., ELCB, Earthing, IP44 Electrical equipment, cable routing and double insulated portable power tools shall be used at site. • Pneumatic power tools also will be using at site with proper coupler arrangements and valves. • Water sprinkling shall be done before chipping the piles. • ELCB shall be provided in all electrical panels.	1	4	4
		Corrosive nature of cement slurry, Flying particles, Manual handling	Eye and Skin allergy, Musculoskeletal injuries to the workers	Workmen/ Staff/ Visitors/ Public	3	3	9	• MSDS of the grouting materials shall be displayed. • COSHH Briefing shall be conducted for workmen and engineers. • PPE's like Helmet, rubber Hand gloves, nose mask and gum boot shall be used while working with cement slurry. • Goggles shall be provided to workmen to avoid the contact of cement slurry coming in contact with eyes. • Eye wash bottles with fresh water shall be made available along with the first aid box at the site location. • Safe methods of manual lifting should be briefed to the workforce through toolbox talk& HIRA briefing.	1	3	3

	Deployment of unfit rig and crane engaged for piling, lifting of cage and other materials, Marching or positioning of rig on unstable or loose ground	Structure collapse, toppling of piling rig & crane, falling of rebar cage	Workmen/ Staff/ Visitors/ Public	4	4	16	• Third party certificate shall be ensured for crane and tools & tackles. • Visual inspection shall be carried out before using tools & tackles. • Competent &experienced operator shall be deployed in cranes. • Lifting area shall be barricaded and sign boards displayed. • Area lighting shall be ensured. • Signal man and riggers shall be available. • Lifting and piling Permit system shall be followed. • The girder system shall be placed in a manner that the center of gravity coincides with the center of the pile. • HT strands shall be fixed to the girder system using required numbers of wedges and bearing plate of approved capacity. • The initial locking of each and every stand shall be checked properly. • Piling rig shall be marched or positioned on well compacted surface and if required piling rig marching permit shall be followed.	1	4	4
	Failure of Hydraulic jack or falling of jack due to unsecured base, oil spillages	Slip & trip hazards, Person stuck between structures, caught in between	Workmen/ Staff/ Visitors/ Public	4	4	16	• Working area shall be barricaded and unauthorized persons should not be allowed. • Hydraulic jacks shall be placed on firm surfaces. • Hydraulic jacks and power packs shall be inspected and certified by competent person. • All hydraulic hose connections shall be check for leakages. • Whip arrester shall be provided in All hydraulic hose connections. • Operation shall be done by experienced, competent operator and competent supervision. • Pressure gauges shall be checked. • Load shall be applied on the piles as per the method statement. • Green card shall be pasted on the machine for indicating safe use. • Oil spillages shall be cleaned immediately if any. • Permit system and checklists shall be followed. • Briefing shall be given to all workforce. • Do not exceed the maximum PSI capacity of each Hydraulic Ram. • Do not operate a Ram beyond its maximum range of travel. • Stay alert. Do not use the jack while Tyred or under the influence of drugs, alcohol, or medication.	1	4	4
	Materials scattered around the excavation pit, Unmanned Vehicle reversing, unsecured materials	Slip trip hazard, Electrocution, fall of workmen & Materials, collapse of soil on excavated pit, hit of vehicle	Workmen/ Staff/ Visitors/ Public	3	5	15	• Suspend all outdoor work activities during rain • Ensure all lifting activities are suspended and all cranes are safely parked, tower cranes must be left on free slew position. Apply the wheel locks / storm locks for Gantry cranes.	1	5	5

							• Check all temporary works / formwork are secured properly. • Outdoor welding activities shall be suspended even if it's mild drizzling. • All the equipment lying on the platform at higher elevation should be secured by ropes and lashing to reduce the effect of strong winds. • Provide stay anchors at adequate strength to the structures like Pile rigs, Gantry cranes and other high rise structures with approved design			
		Workers performing hot work such as welding, cutting, brazing, soldering, and grinding are exposed to the risk of fires from ignition of flammable or combustible materials in the space, and from leaks of flammable gas into the space, from hot work equipment, Defective Tools, Radiation from UV / IR Rays (Flash Eye), Non using of NRV	Electrocution, Burns/Eye injury, Flash Back Fire & Explosion.	Workmen/ Staff/ Visitors/ Public	4	5	20	• Ensure the welding equipment (torch, cable, electrode holder, transformer, generator, cable connector, plugs, sockets etc) are free from defect and earthed as needed. • Monthly inspection should be carried out to all electrical equipment and green card system will be implemented. • Wear safety goggles whenever necessary. • Workmen should wear required P.P.E (safety helmet, Safety goggles, Hand gloves, Safety Shoe, Face shield). • Wear long sleeved coverall /Boiler Suit, leather apron, welder's hood. • Provide flash back arresters on both cylinder side and torch side. • Healthiness of flash back arresters, regulator and pressure gauges will be ensured. • Soap water solution to be used to check the leakages in hose and joints. • Use the trolley for moving of cylinders. • Keep cylinder in upside position while in use. • Keep fire extinguishers nearer to working area. • Avoid storing cylinders of oxygen within 20 feet of cylinders containing flammable gases	1	5	5
	Working near vicinity of public	Unmanned reversing vehicle, no segregation of public and workplace	Hit by moving vehicles (internal & external)	Workmen/ Staff/ Visitors/ Public	4	5	20	• Develop Traffic Risk Assessment Plan (TRAP) and identify vulnerable areas and specific measures • All personnel should wear PPE's & reflective jacket for high visibility. • Barricading should be fixed first with retro reflective's and blinker lighting as per requirement. • Sufficient Traffic Marshal shall be deployed and they shall be adequately trained. • Marshal's With red flag or Baton light, reflective jackets shall be engaged. • Adequate Road signage shall be displayed as per IRC. • Clear Identification with signage shall be placed in case if Footpath, Bus Stop, Lamp Post, New • Traffic Signal post is relocated. • Manage rash night traffic by placing ZIG ZAG barrier, placing Impact Protection Vehicles and any other best means.	1	5	5
		Unmanned pedestrian crossing	Hit by vehicle while vehicle / person crossing.	Workmen/ Staff/ Visitors/ Public	5	4	20	• Designate road cross areas, take preference to existing zebra crossings. Avoid curve/bend areas for road crossing. • Employ traffic marshal to support people to cross roads. • Educate site team on safe behavior on road.	2	4	8

								• Where possible, install convex mirror on blind spot areas.			
		Unprotected work area against fall of materials	Falling of hand Tools or material	Workmen/ Staff/ Visitors/ Public	4	4	16	• Safety net to be placed to prevent the small materials falling • Barricading should be provided to restrict the movement of persons • Use tools bags to carry hand tools and use tag lines to secure while using.	1	4	4
		Unauthorized entry in work area	Fall of person, material fall on unauthorized person, person hit by vehicle	Workmen/ Staff/ Visitors/ Public	4	4	16	• Barricading should be provided to restrict the unwanted movement of persons. Employ security where necessary to restrict unauthorized entries. • Signage's shall be placed to restrict the Unauthorized entry in work area	1	4	4
		Noise	Long term health issues hearing loss, not able to hear the Warning alarm or vehicle reversing horn it may lead to accident	Workmen/ Staff/ Visitors/ Public	4	3	12	• Excessive noise producing machine shall provide with mufflers/silencers to suppress the noise level. • Provide ear muff if the noise exceeds 75db • Plan to execute noisy activities according to the surrounding conditions. • Noise/sound level monitoring.	1	3	3
		Dust pollution	Long term health issues respiratory disease	Workmen/ Staff/ Visitors/ Public	4	3	12	• Water to be sprayed before and during the operation to control the dust generation. • Use dust mask where the area generates the dust. • Dust area shall be confined to prevent the flying of dust. • Unauthorized entry shall be restricted.	1	3	3
	WORKING ON / NEAR LIVE RO	Speed of traffic Two-way traffic Curvy roads Multi-Junctions Restricted access to site Roundabout Faulty equipment using by road users Drowsy driving by road users	Person hit by Vehicle Collision of vehicles Fire Toppling of vehicle and its associated risk (Spillage of flammable items Gases, spread of loaded materials Vehicle entering into the site premises and hit our structures (Temporary/ permanent) Vehicle fell into the excavated pit inside the site premises.	All Staff, All workmen, Public	5	5	25	• Advance warning signage's (Men at Work, take diversion, Lane closed, Road closed, Narrow Road Height Restrictions etc.,) shall be provided from 50m in advance. • Advance warning zone shall be provided with water filled barrier or traffic cones or any other means of soft barricade. • Transition zone with minimum15m distance from traffic marshal shall be provided with buffer and protected with concrete crash barrier, 1m wheel mounted barricades, 2m high barricades etc., to withstand the impact of vehicle in case of hit. • Working zone shall be protected with 1m barricaded with 1m wheel boards. • Termination zone shall be protected with 1m wheel boards or water filled barrier, traffic cones. • Traffic Marshal with appropriate aids such as whistle, Red& Green flags, Baton lights for dark hours shall be deployed at transition zone with protection arrangements against from either public vehicle and as well our construction vehicle. • Area shall be well illuminated for better visibility to traffic users. • Rope lights/ blinkers and retro reflective stickers shall be provided on barricades which are provided for permanent and as well temporary diversion boards & other arrangements for better visibility and warning to road users. • Diversion sign shall be provided for every island of barricades to warn the road users. • Traffic permission shall be obtained for road closing from traffic authority • Defensive driving training shall be imparted to all our drivers and operators.	2	5	15

A D	Overspeed of road users Using mobile phone while driving Influence of alcohol/drunk and drive Signal jumping Ignored the traffic rules Ignored the traffic warning sings Unauthorized person driving the vehicle Road/lane diversion without advance warning/transition zone Poor illumination at diversion point and work area Unauthorized parking and Parking at accident prone area						• Regular briefing shall be done to all our drivers/operators about traffic rules and instructed to obey the same strictly. • Speed limit shall be followed as prescribed by the traffic authority for respective road. • Influence of alcohol shall be checked frequently by using the breath analyzer. • Authorized person shall only be engaged for driving the vehicle. • Traffic shall be diverted for erection in such a way that alternate driveway is provided prior to closing the lane for erection. • The diversion plan to be daily briefed by the Traffic Manager to the traffic marshals prior to start of the diversion activities. • Traffic marshals under the Traffic manager to guide the traffic to the alternate lane while closing the original lane for erection. • In some cases, based on the lane width and the traffic density, traffic shall be stopped for the duration when girder with the trailer in traveling on the opposite lane till it enters the lifting area and the area is closed with 1m wheel mounted and manned by marshals. • Unauthorized parking shall not be allowed at accident prone area and if required inform to local traffic police for removing the vehicle. • Pile cap area shall be protected with 2m barricades towards traffic entering side and opening shall not be permitted adjacent to the pile cap excavation. • Speed limit signage shall be installed at regular intervals. • Construction vehicle shall be deployed at site after obtaining the fitness tag. • All drivers and operators shall be undergone the eye test before deployment at site. • All drivers and operators shall be possessing the authorization card after obtaining the trial test from P&M team. • Only trained and certified traffic marshal shall only be deployed at site. • Traffic marshal shall stand well behind concrete crash barrier/ Prominently visible for protection against accidental hit by high speed vehicles on the road. • High visibility of traffic marshal shall be ensured in the form of area illuminations well as use of good PPE. • If Impact protection vehicle is positioned on the road, it should be clearly visible to approaching drivers with warning blinkers/chevron diversion marker erected on the vehicle.			

	WORKING ON OR NEAR TO THE ELECTRICITY/HT OH SERVICES.	Contact with existing OHT Electrical lines contact with vehicles / materials / direct contact	Electrocution, Electric shock leading to fall of person from height, fire, bursting of vehicles	Workmen/ Staff/ Visitors/ Public	4	5	20	• Demarcate the RED ZONEs in drawing and physically giving minimum 3metres clearance or high based on voltage rating. Display warning signs & Posters • If any activity to be performed where sufficient clearance is not there, then such electrical installation shall be re-routed or shutdown until work is completed. • Overhead services present a contact risk for hydraulic arms and crane jibs. Hydraulic arms may be limited utilizing the on-board computer of modern equipment or using chains to limit reach. • The overhead line may also be protected with a steel 'goalpost' to prevent passing vehicles with elongated loads from contacting the overhead lines • Highly visible warning / hazard signage shall be posted where there is a danger for underground or overhead electrical services. • Use of traffic marshals	1	5	20
		Excavation or piling work commenced at area of Unidentified utilities	Damage to underground utilities and trailing cables	Workmen/ Staff/ Visitors/ Public	4	5	20	• Pile boring should be commenced after diverting the identified cable • Piling permit shall be followed before commencement of work. • Piling work shall be carried out as per approved method statement. • Utility clearance shall be obtained for both underground and overhead from authority or engineer.	1	5	5
		Damage to underground services like Electrical cable, telecommunication cables, water & sewer pipe lines, gas pipe lines, oil pipelines, etc	Electrocution, Electric shock, Electrical fire	Workmen/ Staff/ Visitors/ Public	4	5	20	• Obtain service drawings from Client / Public Agencies (PWD, Municipality, EB, Telephone) and verify the presence of UG services • Survey the site to identify presence of cable / utility markers • Use electronic detectors to identify UG utilities • Do trial pits to positively verify the service location, depth and identity. Obtain work permits and clearance from the concerned authorities before commencing trial pits. • Presence of underground services shall be mentioned in piling work permits and customer permits and necessary controls shall be stipulated and duly complied. • Excavation, piling or any other activities below ground shall only be commenced after clearance and re-routing of existing underground services	1	5	5
	WORK ADJACENT TO	Unauthorized person operating the plant and vehicle, operating the plants without obtaining the clearance from authorities	Collision and toppling of vehicle, caught in between, contact with rotating parts	Workmen/ Staff/ Visitors/ Public	3	4	12	• The Activity EHS Risk assessment shall include the interface with operating plant & facility and develop risk mitigation measures. • Strictly adhere to the operating plant procedures, protocols while working in their vicinity and never by-pass safety norms and permit procedure in any circumstances. • Never attempt to modify equipment facility or structure without design approved and risk assessment. • Obtain necessary clearance and work permits while executing close to operating plant. Report abnormalities / • outcomes to customer promptly and seek assistance where necessary	2	4	8

		Working adjacent to railway services, person crossing the track	Due to collision and toppling of vehicle, Person hit by train, Electrocution, Electric shock	Workmen/ Staff/ Visitors/ Public	3	4	12	• Cordon off the work area effectively to prevent movement of people near railway services • Implement work permits to work close to the railway lines • Shutdown electrical lines and other railway services while working directly on/ above railway lines with necessary permits and approvals. • Employ Traffic marshal whenever work is executed near railway lines or at unmanned crossing	2	4	8
		Modification/ Alteration without design approval, Substandard arrangements	Collision and toppling of vehicle, Failure or collapse of structures	Workmen/ Staff/ Visitors/ Public	3	4	12	• Never attempt to modify equipment facility or structure without design approved and risk assessment. • Obtain necessary clearance and work permits while executing close to operating plant. Report abnormalities • Outcomes to customer promptly and seek assistance where necessary	2	4	8
	WORKING OVER AND ADJACENT TO WATER	Unprotected leading edge above the water, Failure to use or anchor the harness Falls of person into water	Falls of person into water and risk of drowning	Workmen/ Staff/ Visitors/ Public	4	3	12	• Edge protection will be provided where practicable. • Safety lines and harnesses will be worn where edge protection cannot be provided. • Where there is fast flowing water, make provision of grab lines downstream. • Gangways and areas near water will be kept clear of obstructions. • Suitable lighting (54 lux) will be provided at edges adjacent to water. • A rescue boat or other means of prompt rescue will be available when necessary. • Where there is fast flowing water, make provision of grab lines downstream. • Life jacket shall be provided to all those working over the water. • Activities at edges shall not be performed on rough wind times / dark hours. • Caution board must be displayed with proper information. • Emergency Rescue team should be designated.	1	3	3
		Sinking of floating vessel/barge	Risk of drowning, serious injuries and person stuck between objects in the water	Workmen/ Staff/ Visitors/ Public	3	4	12	• Check the condition of vessels against corrosion, ensure sufficient anticorrosion measure taken. • Mark the Safe Working Load on every barge taking the dead weight of vessel and fill water into account. Also mark the appropriate allowable dip with respect to SWL. • A rescue boat or other means of prompt rescue shall be available when necessary. • Life jacket shall be provided to all those working over the water.□	1	4	4
		Flash flood	Drowning and washing away	Workmen/ Staff/ Visitors/ Public	3	4	12	• Constant contact with meteorological / local department to reach flood alerts. • Erect warning signage. • Establish Emergency Siren system for quick evacuation. Conduct frequency drills.□	1	4	4
		Toppling of floating vessel /barge to	Risk of drowning, serious injuries & person stuck between objects	Workmen/ Staff/ Visitors/ Public	3	4	12	• Mark the allowable level difference allowable while working on floating vessels and make such warning level more visible to operator and signal man. • Stop operations when more water oscillation / vessel dipped on one side until it is stabilized.	1	4	4

		Oil spillage into water body	Water pollution	Workmen/ Staff/ Visitors/ Public	3	4	12	• Employee suitable re-fueling methods to avoid oil spillages. Promptly remove the empty containers • Never keep the drums/barrels/containers in open condition, always ensure lid on. • Activity plan should be made according to high tide /low tide. • Use spill trays, maintain equipment oil leak free	1	4	4
	EMERGENCY OUTBREAK AND ACTIVITIES DURING & AFTER EMERGENCY	Wrong or inadequate momentary action to onsite emergencies such as medical, fire, soil collapse etc and emergency rose due to operating facility and other agency activity leading to delay in evacuating people, safe guarding equipment / property	Delaying of rescuing the person will lead to critical condition or threatening of life, property damage	Workmen/ Staff/ Visitors/ Public	4	5	20	• Prepare and implement emergency response plan that shall address all potential emergencies and reference shall be made Risk Assessment. • Declare emergency and take control over the emergency situation with order of priority i,e • People, Property and Environment (PPE) • Identify key emergency response team and train them on responses for each of the identified emergencies. • Establish and communicate emergency contact details to all stakeholders • Impart awareness training to project personnel as part of EHS Induction and regular briefing. • Rehearse the mock emergency periodically and review the effectiveness of response and update the emergency response plan.	1	5	5
		Unauthorized or incompetent person engaged for rescue operation to save the life or property	Attempting to save people or property and endangering own life due to lack of skills	Workmen/ Staff/ Visitors/ Public	1	4	4	• Incident controller or Section In charge (initially) to take control over the emergency site and ensure people skilled engaged for rescue works. • Quickly prepare and implement plan for carrying out rescue operation at critical sites like clearing soil collapse, clearing water logs, equipment collapse.	1	4	4
		Unauthorized or incompetent person engaged for rescue operation to save the life or property, using of Substandard rescue kits or arrangements	People entering into Hazardous/ affected zone and endanger own life like water logs, presence of toxic chemicals, flammable atmosphere.	Workmen/ Staff/ Visitors/ Public	1	4	4	• STOP and prevent people entering into affected area unauthorized. • Make rehabilitation plan assessing the risk & mitigations. Brief the plan to team before commencement. • Carryout necessary inspection and testing and approval safe for entry with appropriate precautions. • Not to start any electrical installations, machines etc without inspection and verification.	1	4	4
		Working in emergency affected area without taking the safety precautions	Risk of life who involving the rescue operation	Workmen/ Staff/ Visitors/ Public	1	4	4	• Conduct risk assessment to identify and address the potential hazards and carry out necessary inspections and testing to declare affected area safe for use partially or totally. • No work shall be commenced until the affected area is declared safe for partial or full operations.	1	4	4

TEMPORARY WORK-FORMWORK SYSTEM	Unstable Temporary and Formwork system	Collapse of temporary structures and form work	Workmen/ Staff/ Visitors/ Public	4	5	20	• Formworks systems shall be appropriate to the structure and shall be specified during the procurement phase and basic design shall be done before procurement. • Traditional systems may not be appropriate to the structure and L&T formwork systems shall be used. • Formwork shall be constructed with recommended components and accessories and as per the approved scheme drawing and standard operating procedure. Alternative components and accessories shall not be used unless it is accepted by formwork design cell. • Components and accessories from different formwork systems shall not be mixed unless approved by the Competent DESIGN cell. • Formwork and supporting false work shall be designed to meet loading and stability requirements. Formwork designs shall be submitted to the project manager for review and approval. • Formwork systems shall be designed to resist adverse environmental conditions such as high winds • Formwork systems shall be inspected by a competent person prior to concrete pours. Records of such inspections shall be maintained.	1	5	5
	Formwork erecting and dismantling by incompetent persons	Formwork collapse Work cessation Personnel falls from height and falling objects	Workmen/ Staff/Visitors/ Public	4	4	16	• A Competent Supervisor for formwork shall be appointed • Formwork shall be erected / dismantled by competent persons. This may require additional instruction when specialized formwork systems are used. • Formwork inspection program shall be developed to check the installation/dismantling are carried out as per the scheme drawing and sequence of operations. • Formwork erection and dismantling should be barricaded with display board to restrict the unauthorized entry.	1	4	04
	Improper rigging and lifting arrangements, Lifting of excess weight by crane, Substandard lifting gears, tools & tackles, faulty or unfit crane using for lifting, unauthorized or incompetent operator engaged for operating the lifting equipment	Fall of formwork systems while lifting	Workmen/ Staff/Visitors/ Public	4	4	16	• Many prefabricated formwork tables and shutters are designed to be lifted to the next slab level. Only forms with certified lifting points shall be lifted using a crane and chains slings • Specialist flying table systems may be lifted with a C hook • Formwork shall be supported temporarily until secured as per drawing, tying with reinforcement rods using binding wires is insufficient. • Exclusion zone shall be demarcated while lifting and fixing formwork. • If necessary install a tag line to guide the formwork during lifting operation. • During lifting operation the area should be barricaded to unauthorized entry. No one should be allowed to stay under suspended load. • Authorized operator engaged for operating the lifting equipment. • Safe rigging and lifting shall be done under the lifting supervisor.	1	4	4

							• 3rd party certificate must be obtained for all lifting tools and tackles. • Before commencement of lifting, Fit for use shall be obtained from P&M for lifting equipment • ASLI shall be installed to monitor the lifting load with radius and SWL and never over load the lifting equipment.			
		Unsafe and substandard access, inadequate working platform, unprotected leading edge, non-availability of fall arrestor system	Persons falling from formwork and falling objects	Workmen/ Staff/Visitors/ Public	4	4	16	• Safe access and working platform provision shall be made in the scheme drawing itself. Workmen shall safe access the shutter base and top to carry out fixing/dismantling works in safe manner. • Fall arrest equipment shall be utilized by formwork carpenters and lifelines deployed during the installation of formwork decking. • Pre-fabricated decking systems shall be installed by trained workers and edge protection installed at the earliest opportunity. Persons installing edge protection shall wear and utilize fall arrest equipment with suitable anchor points. • Access to formwork decks and shutters shall be through designed in handholds in specialist shutter systems or via scaffold systems or ladders. Form workers shall not use the waling as a ladder and work platform without fall restrain equipment.	1	4	4
		Loose and rolling materials stacked on floor edges, unprotected floors	Objects falling from formwork	Workmen/ Staff/Visitors/ Public	4	4	16	• Catch nets and crash decks shall be installed where parallel working presents a hazard • Exclusion zones with signage shall be installed around formwork in progress were practically • Toe guard shall be provided around the form work floor. • Loose materials and rolling objects never allowed to stack on edge of the form work. • Materials shall be stacked at least 1.5m away from the floor edges and material shall be stacked in ZIG-ZAG manner to avoid sliding and it should not be more than 1m height.	1	4	4
	Work at Height	Unprotected leading edges	Fall of objects	Workmen/ Staff/Visitors/ Public	4	4	16	• Install edge protection (ideally guardrails at 1m with mid-rail and toe-boards). Ensure fall protection (Life line) is provided for those installing guardrails • Install catch nets to protect parallel works /pedestrian routes/Live traffic on road. • Install crash decks over entrances / access routes where there the risk of falling objects is significant. • Install signage and illumination / lighting where necessary to highlight and warn of hazard of floor opening or leading edges. • Implement contents of permit system to work @ height and ensure pre-task verification & briefing is conducted for the activity before start of work. • Perform Housekeeping before start of work & remove all loose materials form the edges. • Secure all tools and tackles & remove all scraps generated in the work and brought downstairs.	2	4	8

	Unprotected opening / holes / Shafts	Fall of person and fall of materials	Workmen/ Staff/Visitors/ Public	4	4	16	• Cover open holes / shafts with a crash deck or install guardrail and toe-boards around holes / slab openings with catch nets. • Install warning signs and adequate lighting arrangement for night. • When necessary to remove hole covers/protections to execute specific works, after completing the job it is mandatory install again all the covers/protections.	2	4	8
	Lack of access or unsecured access to workplace	Fall of person, ladder and other access arrangements fall on person, Slip, trip and fall	Workmen/ Staff/Visitors/ Public	4	4	16	• Provide safe means of access to every work place and inspection area. Install hand railing with toe board to protect against fall of person and materials. • Unusable / unsafe access shall be adequately protected against any willful movement of people. • Access shall be made of ladders / staircases (temp / permanent). • Use of rope ladders is discouraged. • Man baskets shall be used for any emergency cases only. • Maintain good housekeeping in the working area and keep the access free of materials or tools. • Provide adequate illumination all through the approach way to work location at night.	2	4	8
	Use of substandard work platforms	Fall of person and fall of materials	Workmen/ Staff/Visitors/ Public	4	4	16	• Scrap or substandard materials shall not be used to construct temporary guardrails and or platforms • Guardrails shall be fit for purpose, sturdy enough to resist the impact of a falling / tripping man, and shall include a hand rail and mid rail. Toe boards shall be included where there is a risk of falling objects. Handrails shall be at least 1m high • Work platforms shall be bespoke platforms or constructed of rated scaffold boards. Work platforms shall include handrails, mid rails and toe-boards. Where guardrails cannot be installed due to space restrictions, fall arrest / restrain systems shall be utilized (harness / lifeline etc) • Single jollies should not be used as a platform to stand and work.	2	4	8
	Using of Faulty and unfit equipment, Unauthorized operation, incompetent operator, unauthorized entry into the working area,	Falls of person and fall of materials from mobile elevating work platforms	Workmen/ Staff/Visitors/ Public	4	4	16	• Elevating platforms shall be maintained in accordance with the requirements set out in line with manufacturer's guidance manual. Use safety checklist to issue green card on monthly basis. • Operators shall check all equipment using daily checklist prior to use. • High level of operational discipline shall be exercised. Like firm ground, leveled equipment base, not moving the equipment while bucket in elevated position, no simultaneous operation, operator not leaving machine when people on bucket etc • Operators shall wear restrain safety lanyards in line with the requirements • Only trained, competent persons shall be permitted to operate a mobile elevating work platform (MEWP) or mast climber work platform (MCWP). This shall include all other telescopic / hydraulic man lifting devices. Operator authorization card shall be issued and displayed on equipment.	2	4	8

							• Working area shall be barricaded around to prevent any accidental fall of tools, objects. • Emergency keys shall be made available with the machine to down the bucket, if struck due to any mechanical fault of equipment.			
	Using of Substandard ladder access, design error, Unsecured ladder, defective ladder	Fall from ladders	Workmen/ Staff/Visitors/ Public	4	4	16	• Ladders shall be used only as access within a scaffold system where they a clamped /tied on and checked on a weekly basis as part of the scaffold inspection • Ladders / step ladders shall only be acceptable for short duration work or inspections when used as a work platform. Short durations work shall be no longer than 30 minutes. • 3 point contact with ladder shall be ensured. • Ladders / step ladders shall be manufactured to recognized standard. Fabrication of ladders on site shall meet standard requirements. • Ladders / step ladders are often unstable, outriggers may be required or an additional worker must foot and steady the ladder. • Defective ladders must be immediately removed from service and promptly tagged not to use. • Ladder tops must rest against a firm structure. • Ladders must extend about one meter (three feet) above a safe landing or parapet wall. • The base of a ladder's side rails must rest on a firm, level foundation.	2	4	8
	Erection of Substandard scaffold arrangements, design error, Unsecured Scaffold, defective materials using for scaffold erection, Improper access and inadequate working platform, Scaffold erected by incompetent person, Unstable ground surface, unauthorized entry into work area, Substandard access arrangements	Person Fall from Scaffolds, Falling of scaffold pipes	Workmen/ Staff/Visitors/ Public	4	4	1616	• Scaffold shall be provided with a safe means of access and / or a safe working platform. Scaffold shall be erected / dismantled in accordance with the requirements set out in L&T formwork manual and HSE Manual. • Competent / experienced scaffolders shall be engaged for erection and dismantling of scaffold. • Scaffold working platforms shall include hand rail and mid rail and where there is a danger of falling objects, toe boards shall be included • Removal work platforms and fall protection are to be used by scaffolders during the erection / dismantling process. • Install hard roof where access through scaffold is provided or public movement area. Install catch nets when scaffold is erected more than 6m height. • Keeps the scaffold working platforms clean of debris. • Alterations to scaffolds must only be carried out by persons who are competent to do so. • Follow Scaffold Tagging System.	2	4	8

	No access and no working platform arrangements	Fall from Steel girder during de-slinging	Workmen/ Staff/Visitors/ Public	3	4	12	• The base of a ladder's side rails must rest on a firm, level foundation and secured. • Install fall protection (Life line) must be provided on the top of steel girder for de slinging. • Provide adequate illumination all through the approach way on steel girder at night. • Workmen shall be fit to work at heights. • Safety harness & rope grab arrestors shall be thoroughly checked before engaging the workmen to work at height. • Safety harness & rope grab arrestors should be third party certified. • Stable pole arrangement shall be provided on the steel girder at every 2m to tie the life line rope.	2	4	8
	Scaffold erection not meeting the design requirements	Collapse of scaffolds	Workmen/ Staff/Visitors/ Public	4	4	16	• Scaffold systems shall be erected in accordance with the approved scheme drawings. The manufacturer's guidelines and use of approved components and accessories shall be incorporated in scheme drawings. • Lateral support is essential when least base to height ratio is more than 2.5 or height exceeding 4m. There shall be 1 lateral tie at every 25m2 scaffold elevation area. • Scaffold shall be checked at frequent interval not later than 7 days to ensure safety condition and scaffold tag system shall be implemented through competent scaffolding foreman/Engineer. Scaffold shall be visually inspected before every use and after any adverse weather effects. • Do not overload the scaffolding with materials and keep the platforms clean of debris. • Do not secure any load to any part of scaffold. • Alterations to scaffolds must only be carried out by persons who are competent to do so. • Follow Scaffold Tagging System.	2	4	8
	Lack of, or use of, substandard fall arrest / fall restraint equipment or installation by incompetent persons	Fall of person and fall of objects	Workmen/ Staff/Visitors/ Public	4	4	16	• Fall arrest equipment and accessories used on L&T projects shall be of approved PPE specification, make and model. No other brands/materials shall be used. • Worker shall be trained to use the fall arrest equipment in line with the requirements. • Shock / energy absorbers shall not be utilized without suitable clearance • Lifelines shall be of 8mm for single worker and 12mm steel wire rope if 2-3people anchors their harness. It shall be fitted with the correct number of clips for the intended loading. PP / Nylon rope shall not be used for static lifelines • Where necessary lifelines and anchor bolts used as lanyard anchors shall be tested prior to use.	2	4	8
	Drop or fall of tools, machines	Falling objects	Workmen/ Staff/Visitors/ Public	4	4	16	• Secure all tools & machine while working at height using tool bags and tag lines. • Tool box, scrap box shall be used to collect /store materials and throwing of materials must never be allowed.	1	4	4

		Contact with existing overhead services	causing a electrocution	Workmen/ Staff/Visitors/ Public	4	4	16	• Where possible, electrical services shall be de-energized prior to start work. • Where services are to be re-routed, no work shall commence until services are confirmed as de-energized / inert • Permits shall be secured in advance from the relevant utility / local authority prior to start work in the vicinity of existing services	1	4	4
		Unsafe use of equipment by incompetent persons	Crane failure / fall and toppling of lifting materials	Workmen/ Staff/Visitors/ Public	3	4	12	• Qualified / competent operator shall be engaged, P&M circular shall be adhered. Operator shall be trained by manufacturer / authorized trainers. • Unauthorized operations shall be prevented effectively. Operator authorization system shall be implemented; they shall be issued with duties / responsibility of safe operations. • A competent lifting supervisor shall be appointed to manage all lifting operations	1	4	4
		Using of Unfit or old crane, outrigger not extended, marching the crane with load, unprotected lifting zone from personnel movement, engaging incompetent or unauthorized signal man and riggers	Failure of crane while lifting loads	Workmen/ Staff/Visitors/ Public	3	4	12	• Crane shall be thoroughly inspected prior engaging at site. GREEN Card system shall be followed. The TPI shall be done at site and records maintained. • Hired cranes shall not be older than 15years. Own crane shall be refurbished/approved for use by central P&M. • Crane shall be checked on daily basis and recorded. Outrigger to be fully extended. • Cranes when de-rated, de-rated load chart shall be displayed to avoid miscommunication. • Crane shall not be moved while holding heavy load. • Demarcate the lift zone suitable to warn the people around. Restrict unauthorized entries. • Authorized signal man should be deployed for signaling for lifting the load.	1	4	4
		Using of Damaged or uninspected or substandard lifting tools and tackles, overload the lifting capacity	Slings breakage/ failure	Workmen/ Staff/Visitors/ Public	3	4	12	• Lifting equipment and accessories shall be fit for purpose, tested for its capacity, certified by competent person, carry valid color code and pre-inspected before every use. • Slings/belts shall be protected against sharp edges. • Slings shall be protected against welding current by insulating hooks / insulation packing etc. Only competent riggers / slingers shall be permitted to work on site. Evidence of valid training shall be submitted prior to appointment	1	4	4
	Cranes & Lifting	Overloading of crane	Crane and its structure failure, toppling of crane	Workmen/ Staff/Visitors/ Public	3	4	12	• Lift plan shall be done considering all loads, site and other parameters. • Trail lift shall be performed on empty condition to check the conditions like load capacity, obstructions etc • ASLI shall be installed on cranes, it shall cutoff crane movement when overloaded. • No lift shall be performed unless its exact weight is known. Never lift the loads from water/fluid without considering the buoyancy load.	1	4	4

								• Weight of lifting gears, spreader pieces, crane hook and fall ropes shall be considered while calculating the total weight to be lifted. • Smooth operation shall be ensured to avoid any jerk / shock loads acting on crane. When load is lifted from resting place, crane shall be allowed to relieve jerk/shock loads before raising further.			
	Excessive wind	Uncontrolled movement of load hitting structures.	Workmen/ Staff/Visitors/ Public	3	4	12	• Lifts shall be performed under calm weather condition only. • During adverse weather conditions In consultation with IMD, Lifting/erection shall be planned	1	4	4
	Collision of lifting equipment/loads	Failure of lifting equipment, falling of lifting loads, toppling of lifting equipment	Workmen/ Staff/Visitors/ Public	4	4	16	• A lifting plan, complete with a schedule of common lifts shall be prepared, at an early stage. • Anti-clash precautions shall be designed and implemented	1	4	4
PRECAST ELEMENTS & LIFTING	No coordination in between the operators, Incompetent operator/rigger and signal man, varying the lifting speed and travelling speed	Failure of gantry crane, Falling of loads	Workmen/ Staff/Visitors/ Public	3	4	12	• Gantry cranes shall be operated with synchronized movement and with single remote only. • Both crane operators shall be positioned at their cabin during operator. Only designated staff / • Workmen with assigned duties, fully aware of the associated risk, shall be present in an organized manner. • Lift & movement area shall be cordoned off and no staff / workmen who are not required for the work shall be present around the area. • Periodical Inspection. Pre briefing to all concern workforces. • Auto synchronization shall be done for gantries which are using for tandem lifting	2	4	8
	Improper positioning of crane, incompetent operators/ riggers/ signalman, incorrect load distribution, No load visibility to the operators	Failure of mobile crane while doing tandem lifting of loads	Workmen/ Staff/Visitors/ Public	4	4	16	• Same configuration cranes are best suit for tandem lifting. If same configuration cranes unavailable, study shall be done to map the similar configuration i.e. type/ make/ model/ • Configuration/ winch speed/ breaking efficiency. • The crane capacity shall be de-rated by 25% while engaged in tandem lifting. • The signaling shall be best synchronized through 1 main signaler giving command to both crane operators after receiving signals from his deputy signaler positioned at required locations. • Only designated staff / workmen with assigned duties, fully aware of the associated risk, shall be present in an organized manner. • No staff / workmen who are not required for the work shall be present in the area.	2	4	8

							• Crane position layout starting from unloading of heavy load from trailer to ground, moving load close to erection spot, final position of crane for lifting and sequential operation of cranes shall be • Determined and incorporated in Lift Plan.			
	Two different speed of lifting and travelling of gantry crane while tandem lifting	Falling of load while shifting with gantry	Workmen/ Staff/Visitors	3	4	12	• Traveling of Gantry crane shall be ensured in synchronizing manner. Movement shall be in minimum travelling speed. Ensure that safe gape from stacked girder is maintained during traveling with load. Center of gravity of Gantries with load shall be ensured.	1	4	4
	Using of Substandard, Overload, damaged lifting accessories, Improper rigging arrangements, Usage unknown capacity of lifting accessories, In-correct load calculations, engaging incompetent riggers/lifting supervisor/ signalman	Fall of load and failure of lifting accessories and lifting appliances	Workmen/ Staff/Visitors	3	5	15	• Approved and Checked mac alloy bars their nuts and plates to be used for lifting of lifter. Carry out pre-use inspection and ensure that Lifting bars, lifter, plates and nuts are original with valid identification number and free from defects and damages. • Lifting of Lifter to be done with gantry crane' and slings of suitable capacity. Lifter shall be handled under experienced rigging foreman supervision only. Check that the lifting inserts are in their correct location and the interruptions are cleaned out while preparation for lifting. • Macalloy bar dia shall match with hole provided to avoid excessive play. • Original Macalloy plate and nuts shall be used for fastening with macalloy bar. Macalloy bar shall be tightening from upper side to required torque. • Only authorized person shall be available with working area. • Precast element shall be lifted up to 100-500mm from pedestal/casting bed to check the condition of lifting arrangement to avoid any slip/free falling of load. Rectification shall be done in case any unsafe condition. • Checks for verticality of lifting bar and tightness before lifting as part of lift inspection. • Verify dimensions in accordance with the design drawings. • Operator shall be positioned in such way that; the lifting activities shall be clearly visible to the operator. • Lift plan shall be done considering all loads, site and other parameters. • Trail lift shall be performed on empty condition to check the conditions like load capacity, obstructions etc • ASLI shall be installed on cranes, it shall cutoff crane movement when overloaded. • No lift shall be performed unless its exact weight is known. Never lift the loads from water/fluid without considering the buoyancy load. • Weight of lifting gears, spreader pieces, crane hook and fall ropes shall be considered while calculating the total weight to be lifted.	1	5	5

								• Smooth operation shall be ensured to avoid any jerk / shock loads acting on crane. When load is lifted from resting place, crane shall be allowed to relieve jerk/shock loads.			
	VEHICLES, TOOLS, PLANT AND EQUIPMENT	Using of Damaged/ Faulty/ Sub-standard/ un-inspected equipment,	Failure during operation e.g. during cutting, grinding, drilling etc	Workmen/ Staff/Visitors/ Public	3	5	15	• Certificate of conformance and maintenance records for plant and machinery shall be reviewed at procurement stage. Risk Assessment shall be done for each plants / equipment incorporating installation & operational EHS risks. • Thoroughly check the incoming items to issue Green Card when found safe to use and recheck on monthly basis. Issue RED CARD for unfit plat / equipment; ensure it is quarantined from usage. Ensure GREEN CARD tools/ equipment are only used at site • Maintain handheld / static plant and power tools with approved spare parts and fittings not alternative non-approved spare parts and fittings	1	5	5
		Using of unguarded machinery, Ignoring the provision of guards, by passing the guarding and interlocking system, neglect to use the guarding arrangements	Entanglement with unguarded/ machinery/flying of materials	Workmen/ Staff/Visitors/ Public	3	5	15	• Suitable guards shall be installed for all rotating parts of machines and protect the area where flying materials hazard like bar cutting machine. The guard shall not interfere with operation. • Critical parts guard shall be interlocked to ensure no work is executed without replacing the guard • Flying material area shall be sufficiently hazard/fenced to ensure no entry into such place.	1	5	5
		Sub-standard vessels, using of improper welded vessels, storing of excess pressure, mal-functioning of pressure gauges & valves, Using of in-correct capacity of vessels	Bursting of vessels due to excessive pressure / vacuum	Workmen/ Staff/Visitors/ Public	3	4	12	• Pressure / vacuum vessels shall be designed/purchased conforming to standard. It shall be tested to 1.5times the working pressure before put on use and re-tested as prescribed frequencies. • Pressure gauges, safety relief valves shall be checked for its working condition on daily basis. • Vessel / pumps shall be firmly mounted on base and secured against accidental fall. • Use appropriate capacity ISI marked hoses, Use single length hoses without any joints.	1	4	4
		Operation of plant, tools & equipment by incompetent persons, keys positioned	Failure of plant & equipment, malfunctioning of equipment	Workmen/ Staff/Visitors/ Public	4	4	16	• Only trained, experienced operators shall be permitted to use hand held plant & power tools • Authorization system shall be followed for all power tools / equipment, plants. Unauthorized operation shall be totally prevented, keys shall be secured placed. • Operator shall be adequately trained to ensure they aware about the safe handling, daily pre-use checklist verification, safe operation, emergency procedures and Dos & Don'ts.	1	4	4
		Non acoustic equipment, uncovered plant and equipment, Uncovered machine, poor maintenance equipment	Excessive noise led to long term ill health –	Workmen/ Staff/Visitors/ Public	3	4	12	• Noise assessments shall be carried out across the project site focusing on frequently used plant, tools and equipment. • Acoustic enclosures to be provided in equipment to control noise level.	1	4	4

			Hearing loss, Indirect accident eg. Vehicle hit while reversing					• Workers exposed to continuous noise in excess of 85dB shall be required to wear hearing protection of at least SNR (Sound noise reduction) +30. Where national regulations or client requirements exceed this requirement, the higher requirement shall be implemented			
	HOT WORKS & FIRE	Excess load in the electrical power cable, Multiple power tapping, Insertion of loose wires, Sub-standard electrical cables, Damaged cables	Over Heating & Burning of welding cables, Electrocution, Fire	Workmen/ Staff/Visitors/ Public	3	5	15	• Cable is checked for its tightness by the welder/ Helper before starting the job. • Welding cables should be routed through cable stand. • Reeling of welding cable should be avoided during welding operation. • Fire extinguisher shall be placed near to the welding operation. • VRD provided welding machine shall be used. • Always welding operator shall ensure that VRD is "ON" when operating of welding machine. • All workmen shall be aware about VRD usage in the welding machine.	1	5	5
		Improper earthing to the parts to be welded	Electrocution	Workmen/ Staff/Visitors/ Public	3	5	15	• Return earth is given through the welding lead only and no rebar should be used for return path.	1	5	5
		Keeping welding machine open to sky and water enter into the machine	Electrocution	Workmen/ Staff/Visitors/ Public	4	5	20	• Shed must be provided for the all electrical machine. • Work area shall be maintained dry condition and area free from water stagnation and wet conditions.	1	5	5
	STORAGE AND HANDLING OF EXPLOSIVE, FLAMMABLE	Flammable materials transport direct open sun light, Transport by using plastic barrels, leakage and spills of flammable materials over the vehicle, Smoking and other hot activities near flammable stacking area and transportation vehicle, Diesel/petro drum and cylinders rolls down on ground for shifting or transportation, cylinders lying on ground, stacking near to other flammable materials	Fire & explosion during transportation	Workmen/ Staff/Visitors/ Public	4	4	16	• Only trained, competent persons shall be permitted to handle explosives. • Material should be placed in approved container and properly secured through approved and licensed explosive vehicle. It shall meet all legal requirements of non-conductive body, danger signage, emergency contacts etc. The driver shall be licensed and thoroughly trained. • Permits required to carry explosives, explosive van, route plan and possessing explosives shall be valid and should be within the stipulated conditions must be duly complied with. • Detonators and boosters shall not be placed in same container. Other ignition material should not carry out with explosion material. • Material should not be kept in open sunlight area. • No person shall be allowed to smoke, carry matches, lighters, any other flammable material and electrical equipment near to the explosive. Mobile phones shall not be carried near the storage, handling area of explosive. • Transportation of explosive shall not be carried out during thunderstorm or when is expected. • Explosives shall not be carried out in the pockets or folds of clothing by any person.	2	4	8

							• A record with the explosive material transported must be accessible during transportation. The vehicle to transport the explosive materials should be provided with at least 2 fire extinguishers and ground connection. • The explosives should be transported to the blasting area in original containers and should remain in its original packaging until the time of use. • It is not allowed to transport the explosive materials to the location where they will be used while there not finishing the drilling operations. • The vehicles to transport explosives shall be inspected daily before start to be used. • Only authorized personal shall be allowed in the vehicles that carry the explosive material. • Vehicles transporting explosives should not be allowed park in public areas, repair shop, garage or similar places.			
	Explosion due to improper storage of explosive material	Fatal/serious injuries. Damage to equipment and material.	Workmen/ Staff/Visitors/ Public	4	4	16	• Storage container shall be of approved design or storage magazine shall be done as per regulations and valid license is available. • Explosive and detonators shall not be kept in same place or handled together. • Material should not keep in open sunlight area or on floors. It shall be kept on wood floor only. • Vehicle or container carrying explosive shall not be kept unattended. • No person shall be allowed to smoke, carry matches, lighters, any other flammable material and electrical equipment near to the explosive. Mobile phones shall not be carried near the storage, handling area of explosive. • A record should be maintained with all explosive material stored. • An area up to a distance not less than 8m on all sides should be kept free of vegetation, debris or combustibles.	1	4	4

MANUAL HANDLING OF MATERIALS	Mishandling of flammable material/Chemicals. Diesel and petrol stored in water bottle and cane	Fire, chemicals splashing into eye and other body parts, workmen drink the flammable liquid mistakenly	Workmen/ Staff/Visitors/ Public	3	4	12	• All the containers shall be labeled. • Harm full chemicals shall be stored separately and danger sign. • MSDS of the chemical are available at store and Explained to the store's personnel. • Store the combustible materials separately. • No naked fire is allowed in stores. • Well Ventilation, • Designate the exclusive storage area for storing flammable materials separately away from other storage. • Construct Store shed in such a way it is fully closed with one entry only, ventilated. • Placing fire extinguishers • Usage of flame proof electrical fittings. • Usage of hand pumps for withdrawal of oil. • Unauthorized entry is prohibited. • Adequate illumination provided.	1	4	4
	Excessive Stacking height, overload the materials on rock, stacking of loose materials	Trip and fall of materials from heights	Workmen/ Staff/Visitors/ Public	3	3	9	• Restrict the height of the rack to 1.5m. • Manual shifting of Material on heights shall be done as per approved design arrangement. • Catch net arrangement shall be provided at the both sides of material shifting arrangements. • During shifting of materials to heights, materials shall be tied at least 500mm away from the edge of the materials. • Rope used to shift the materials shall be free from cuts. • Inter Connect all the racks at top. • Usage of appropriate stools & stands. • Lightweight materials are stored at top & secured, while the heavy materials at waist level. • Secure the unstable materials like rollers, lean members etc and keep in rack.	1	3	3
	Wrong body posture during manual handling of materials	Back pain, Minor fracture, Shoulder injury	Workmen/ Staff/Visitors/ Public	3	3	9	• Proper supervision and ergonomics. • Workmen shall be trained on manual handling techniques. • All workmen shall wear PPE's (Safety shoes, Cotton hand gloves, and Shoulder pad and safety helmet). • Maximum use mechanical machinery for handling of materials. • Only 50 kg shall be allowed to handle the material by single person.	1	3	3

		Lack of coordination between group during manual handling of materials	Fall of materials, fall of person and slip, trip and fall	Workmen/ Staff/Visitors/ Public	3	3	9	• Designate the leader in the team to coordinate the group for handling the material. • Load shall be equally shared between the groups of workmen. • Manually transportation of gas cylinder shall be prohibited at site.	1	3	3
	Removal of barricade board sa	Availability of Overhead underground utilities (Power line, Gas line, Communication Line, Water Line, Storm water drain, sewer line etc.,) and Trees and its branches)	Electrocution, damage of underground utilities, Gas leakages, Water flooding, damage of trees, traffic jam due to water/sewers stagnation	Workmen/ Staff/Visitors/ Public	5	5	25	• All overhead power lines shall be identified and diverted • Underground utilities mapping shall be done and diverted wherever required. • Gas pipes shall be marked at site and MGL contact numbers shall be displayed. • Adequate number of pumps shall be ensured if in case of water flooding. • Sufficient Traffic marshals with blinkers shall be ensured to control traffic jam. • All live trees shall be protected and prior permission shall be obtained if any tree needs to be cut. • Permit system shall be followed.	1	5	5
		Improper compaction of surface	Toppling of crane and other vehicle	Workmen/ Staff/Visitors/ Public	5	5	25	• Crane shall be positioned on firm ground surfaces only. • If the area identified as backfilled, MS plate shall be provided. • Crane outriggers shall be fully extended while placing the crane.	1	5	5
		Unprotected work area from public vehicle movement	Vehicle hit to public/ pedestrians and vehicle collision	Workmen/ Staff/Visitors/ Public	5	5	25	• Working area shall be cordoned off. • Traffic barriers, cones and traffic marshals shall be ensured • If required traffic diversion shall be done, alternative routes shall be identified. • Unauthorized entry sign boards shall be displayed.	1	5	5
		Material stacked on access	Obstruction for crane and trailer position	Workmen/ Staff/Visitors/ Public	4	4	16	• Clear and safe access should be ensured all the times. • Working area shall be maintained without any obstructions. • If materials exist, all materials shall be shifted prior to placing the crane	1	4	4

nd Area preparation for placing of crane	Inadequate area illumination	Not able to identify the Work area hazards	Workmen/ Staff/Visitors/ Public	4	4	16	• Minimum 55 lux shall be maintained at the working area. • Backup DG shall be ensured to overcome power failures. • Dedicated electrician shall be deployed at the working area.	1	4	4
Protruding rebar's of board anchoring	Slip, Trip and Fall, Bursting of Vehicle Tyres	Protruding rebar's of board anchoring	Workmen/ Staff/Visitors/ Public	4	4	16	• All protruding rebars shall be removed. • If removing nails is not possible, nails to be cut with minimum tolerance to avoid trip hazards, bursting of vehicle Tyres.	1	4	4

Pier cap loading from stacking yard to trailer	Improper access to reach the pier cap top for slinging	Fall of person	Workmen/ Staff/Visitors/ Public	5	5	25	• Aluminum ladder shall be used to climb over the pier cap and trailer. • Pier cap loading area shall be maintained obstruction free.	1	5	5
	Improper slinging and rigging	Detachment of load, fall of lifting frame and pier cap, toppling of crane	Workmen/ Staff/Visitors/ Public	5	5	25	• Competent riggers, signal man and lifting supervisor shall be deployed. • Safe rigging procedures shall be followed. • Load shall be secured firmly to avoid free falling. • Crane working radius and SWL shall be ensured. • Capacity of the crane shall be always considered. • Lifting frame should be tested by approved third party. • Defective tools & tackles should not be used. • Walkie-talkie shall be used for signaling if required.	1	5	5
	Using of Defective and substandard lifting tools	Fall of load due to Failure/ damage of tools and tackles	Workmen/ Staff/Visitors/ Public	5	5	25	• All lifting tools & tackles shall be inspected by approved third party and TPI certificates shall be available. • Visual inspection shall be carried out for tools & tackles for each lifting work by lifting supervisor/Riggers. • Color coding shall be ensured. • Defected tools and tackles shall be cut and removed from site. • Make shift arrangements shall not be entertained. • Permit system shall be followed.	1	5	5
	Using of unfit gantry crane	Collapse of gantry crane, struck with load	Workmen/ Staff/Visitors/ Public	5	5	25	• Gantry crane capacity shall be considered and third-party inspection shall be carried out. • Maintenance shall be carried for the gantry crane as per schedule. • Daily operator inspection checklist shall be followed. • Green tag shall be ensured for the gantry crane. • Gantry crane track shall be maintained obstruction free. • Permit system shall be followed.	1	5	5
	Person working/ standing under the suspended load	Load can fall on to the person	Workmen/ Staff/Visitors/ Public	5	5	25	• Lifting area shall be cordoned off. • No unauthorized entry sign boards shall be displayed. • All workmen shall be educated on tool box talks not to stand under suspended loads.	1	5	5
	Inadequate illumination during night time	Obstruct the operator and others visibility in the work area	Workmen/ Staff/Visitors/ Public	4	4	16	• Minimum 55 lux shall be maintained at the working area. • Backup DG shall be ensured to overcome power failures. • Dedicated electrician shall be deployed at the working area. • No work shall be allowed during power cut.	1	4	4
	Engaging of Unauthorized gantry operator, rigger, signal man and lifting supervisor	Fall of load, gantry run over or hit, toppling of gantry, struck onto another object	Workmen/ Staff/Visitors/ Public	5	5	25	• Only authorized gantry operators, riggers, signal man, lifting supervisors shall be engaged in the activity. • Authorization card, identity card shall be used to the gantry operators, riggers, signal man, lifting supervisors. • Gantry crane key should be available with operators during shift change / do not leave the key in the cabin. • End stopper shall be fixed on both sides of track to avoid de-railing.	1	5	5

	Unauthorized person entry into the gantry movement area/ unprotected lifting zone	Gantry rail hit or run over the person	Workmen/ Staff/Visitors/ Public	5	5	25	• Proximity sensors shall be fixed on gantry crane all the four sides. • Lifting area shall be cordoned off. • No unauthorized entry sign boards shall be displayed. • All workmen shall be educated on tool box talks not to stand under suspended loads.	1	5	5
	No visibility of lifting zone to the operator	Load and gantry struck with another object and person	Workmen/ Staff/Visitors/ Public	5	5	25	• Minimum 55 Lux shall be ensured in the working area. • During adverse weather condition, gantry crane shall be stopped. • Lifting zone shall be maintained obstruction free without any hindrance to the activity.	1	5	5
	Over speed and defective railing arrangements of gantry	Derailing of gantry crane	Workmen/ Staff/Visitors/ Public	5	5	25	• Maximum 5Km/hr speed allowed for gantry crane operation. • Gantry crane shall be inspected in proper intervals and recorded. • Alcohol test shall be carried out for operators specially on night shifts, weekends.	1	5	5
Transportation of Pier cap	Pier cap loaded on inadequate capacity of trailer	Trailer structure may failure	Workmen/ Staff/Visitors/ Public	5	5	25	• Trailer capacity shall be ensured with respect to the weight of pier cap. • Vehicle age criteria shall be considered while engaging the trailer. i.e Own vehicles- 10 years, hired-5 years.	1	5	5
	Inadequate or sub-standard securing arrangements	Toppling of trailer and load	Workmen/ Staff/Visitors/ Public	5	5	25	• Pier cap shall be secured on trailer by using ratchet belts. • Defective ratchet belts should not be used. • Rash driving should not be allowed. • Adequate securing arrangements shall be made on trailer bed as required.	1	5	5
	Using of Defective trailer	Vehicle collision/ person hit by trailer due to brake failure, bursting of Tyres etc.,	Workmen/ Staff/Visitors/ Public	5	5	25	• All trailer documents shall be submitted to P&M dept. & verified. • Inspection tag shall be displayed on trailer. • Operator should check the vehicle condition on daily basis and daily operator inspection checklist shall be followed. • Tyre condition, Tyre pressure should be ensured during daily inspection.	1	5	5
	Unauthorized driver	Vehicle collision/ person hit by trailer	Workmen/ Staff/Visitors/ Public	5	5	25	• Driver should possess valid driving license and competency certificate. • Do not leave the key during shift change.	1	5	5
	Unmanned reversing	Vehicle collision/ person hit by trailer	Workmen/ Staff/Visitors/ Public	5	5	25	• Reverse horn shall be ensured in the trailer. • Banksman/marshal shall be deployed to monitor the reversing vehicle.	1	5	5
Positio	Placing the crane un-compacted surface/ SWD/Drainage/ Uneven surface	Collapse of crane while lifting the load	Workmen/ Staff/Visitors/ Public	5	5	25	• Crane shall be positioned on firm ground and level surfaces only. • If the area identified as backfilled, MS plate shall be provided. • Crane outriggers shall be fully extended while placing the crane. • Padding shall be provided where the ground level differs. • Drainages shall be marked and crane should not be placed above drainages.	1	5	5

ning of crane	Outriggers placed on ground without padding arrangements	Collapse of crane due to settling of crane	Workmen/ Staff/Visitors/ Public	5	5	25	• Area shall be levelled to place the outriggers. • Padding shall be provided to place the outriggers. • Crane outriggers shall be fully extended while placing the crane. • MS plate shall be used wherever required.	1	5	5
	Crane placed on live road without precautions	Collision with outside vehicle, public	Workmen/ Staff/Visitors/ Public	5	5	25	• Live road shall be diverted with warning sign boards. • Water barriers, traffic cones shall be used for traffic diversion. • Marshal shall be deployed with blinkers. • Adequate illumination shall be ensured. • Unauthorized person shall not be allowed in the working area.	1	5	5
	Non availability of swing area barricade	Crane hit by person and vehicle	Workmen/ Staff/Visitors/ Public	4	5	20	• Crane swing area shall be barricaded minimum 6m from the crane. • Barricades shall be readily available in the work area prior to start the activity • No one should be allowed to work/move on crane swing area. • Other vehicles shall not be allowed in the crane working area.	1	5	5
Installation of Access Tower to erection of brackets	Tower erected on un-compacted/ uneven surface	Extending stair tower access up to pier cap top	Workmen/ Staff/Visitors/ Public	5	5	25	• Only trained workforce shall be deployed for stair tower erection. • Firm ground surface shall be ensured / Beams shall be used to erect the stair tower. • Spindle jack shall be used to place the stair tower footings. • Permit system shall be followed. • Inspection checklist shall be followed.	1	5	5
	Using of defective materials	Structure collapse	Workmen/ Staff/Visitors/ Public	5	5	25	• Defective materials should not be used while erection. • All stair tower parts shall be visually checked for defects before erection. • Defective materials shall be removed from site.	1	5	5
	Inadequate supports, bracing and tying arrangements	Structure collapse, falling of person from height	Workmen/ Staff/Visitors/ Public	5	5	25	• Stair tower shall be secured adequately with the pier to prevent falling. • Bracings shall be ensured in each levels and secured. • Cross supports shall be provided by using clamps. • Wire ropes with clamps shall be used to secured the stair tower with external loads. • Lock pins/couplers shall be ensured in each levels. • Inspection tag shall be provided.	1	5	5
	Using of red tagged scaffolds	Structure collapse, falling of person from height	Workmen/ Staff/Visitors/ Public	4	4	16	• Red tag scaffolds should not be used without rectification. • Red tagged scaffold shall be certified by competent scaffold inspector before commencement of work and the tag shall be replaced with green tag.	1	4	4
	Using of Access tower without handrails	falling of person from height	Workmen/ Staff/Visitors/ Public	4	4	16	• Handrails shall be provided in both sides of stairs. • Handrails shall be fixed firmly and secured.	1	4	4
	Inadequate width of platform, edge protection and fall protection	falling of person, materials from height	Workmen/ Staff/Visitors/ Public	5	5	25	• Adequate width of the platform shall be ensured. • Gaps shall be checked to avoid man, material falling. • Toe guards shall be ensured in the platform. • Safety net shall be covered on stair tower to avoid falling hazards. • Lighting shall be provided on stair tower during night shifts.	1	5	5

Installation of brackets	Using of defective hydra	Vehicle collision/ person hit by hydra due to brake failure, bursting of tyres etc.,	Workmen/ Staff/Visitors/ Public	5	5	25	• 2nd generation hydra shall be allowed at site. • Hydra crane shall be inspected by third party and certificate shall be obtained. • All hydra documents shall be submitted to P&M dept. & verified. • Inspection tag shall be displayed on hydra. • Operator should check the vehicle condition on daily basis and daily operator inspection checklist shall be followed. • Tyre condition, tyre pressure should be ensured during daily inspection.	1	5	5
	Improper rigging arrangements while lifting the brackets	Detachment of load, toppling of hydra	Workmen/ Staff/Visitors/ Public	5	5	25	• Competent riggers, signal man and lifting supervisor shall be deployed. • Safe rigging procedures shall be followed. • Load shall be secured firmly to avoid free falling. • Crane working radius and SWL shall be ensured. • Capacity of the crane shall be always considered. • Lifting frame should be tested by approved third party. • Defective tools & tackles should not be used. Walkie-talkie shall be used for signaling if required.	1	5	5
	Using of defective lifting tools	Fall of load due to Failure/ damage of tools and tackles	Workmen/ Staff/Visitors/ Public	5	5	25	• All lifting tools & tackles shall be inspected by approved third party and TPI certificates shall be available. • Visual inspection shall be carried out for tools & tackles for each lifting work by lifting supervisor/Riggers. • Color coding shall be ensured. • Defected tools and tackles shall be cut and removed from site. • Make shift arrangements shall not be entertained. • Permit system shall be followed.	1	5	5
	Lifting the brackets without using the tag line	Load hit with other objects, man and machinery	Workmen/ Staff/Visitors/ Public	4	4	16	• Guide rope shall be used with minimum 20mm dia. • Sufficient length of guide rope shall be used. • Guide rope shall be ensured prior to start the lifting activity. • Damaged guide rope shall not be used.	1	4	4
	Improper installation method/ de-slinging without securing against fall of brackets	Falling of brackets from height	Workmen/ Staff/Visitors/ Public	5	5	25	• Brackets shall be secured with Macalloy bars before de-slinging. • Spanners and other tools shall be secured from falling. • Only trained workforce shall be deployed. • Illumination level shall be ensured. • Toolbox talk shall ensure the same.	1	5	5
	Fingers Caught in between brackets and pier	Cut and abrasion injury, Permanent disability	Workmen/ Staff/Visitors/ Public	5	5	25	• Activity sequence shall be followed. • All workers shall be provided with cut resistance hand gloves. • Only trained workforce shall be engaged in the activity.	1	5	5
Installation of hy	Sub-standard securing arrangements	Falling of hydraulic jacks from height	Workmen/ Staff/Visitors/ Public	5	5	25	• Hydraulic jacks, hydraulic pumps shall be third party inspected and TPI certificate shall be available. • Hydraulic hoses shall be connected firmly to avoid leakage. • Hydraulic jacks shall be secured from falling from height. • Oil leakages shall be cleaned immediately.	1	5	5
	Fingers caught in between the brackets and jacks	Cut and abrasion injury, Permanent disability	Workmen/ Staff/Visitors/ Public	5	5	25	• Activity sequence shall be followed. • All workers shall be provided with cut resistance hand gloves. • Only trained workforce shall be engaged in the activity.	1	5	5

	dr a ul ic ja c k s o n br a c k	Parking on live road without barricade the area	Vehicle hit to public/ pedestrians and vehicle collision	Workmen/ Staff/Visitors/ Public	5	5	25	• Working area shall be cordoned off. • Traffic barriers, cones and traffic marshals shall be ensured • If required traffic diversion shall be done, alternative routes shall be identified. • Unauthorized entry sign boards shall be displayed.	1	5	5
		Inadequate visibility to the operator due to poor illumination	Obstruct the operator and others visibility in the work area	Workmen/ Staff/	4	4	16	• Minimum 55 lux shall be maintained at the working area. • Backup DG shall be ensured to overcome power failures. • Dedicated electrician shall be deployed at the working area. • Activity shall not be carried out during power cut.	1	4	4
		Trailer parked on steep road, failure to provide stoppers on tyres	Trailer run over the public, workers, Trailer hit with the equipment.	Workmen/ Staff/	4	4	16	• Trailer shall not be parked on steep road. • Wedge stoppers shall be provided on trailer tyres. • Trailer driver shall be instructed about the risk involved.	1	4	4

ets Pier cap loaded trailer parking on erection spot to unload	Person taking rest under the trailer/ persons sleeping on vehicle access	Trailer run over the workers	Workmen/ Staff/	4	4	16	• No one shall be allowed to take rest at site, access and under any vehicle. • Workmen rest room shall be provided at site. • All workers shall be instructed to take rest at workmen rest room only.	1	4	4
Lifting	Unauthorized entry into the lifting zone	Falling of pier cap on public, workmen	Workmen/ Staff/Visitors/ Public	4	4	16	• Lifting area shall be cordoned off. • No one shall be allowed to stand/work under the suspended load. • No unauthorized entry sign boards shall be displayed. • All workmen shall be instructed on tool box talks.	1	4	4

a n d e r e c t i o n o f p i e r c a p	Inexperienced lifting supervisor, riggers and signal man and operator	Fall of load, toppling of crane, struck onto other object	Workmen/ Staff/Visitors/ Public	5	5	25	• Only authorized crane operators, riggers, signal man, lifting supervisors shall be engaged in the activity. • Authorization card, identity card shall be used to the crane operators, riggers, signal man, lifting supervisors. • Only signal man will give signal to the crane operator. • Permit system shall be followed.	1	5	5
	Using of defective lifting beam, tools and tackles	Fall of load due to Failure/ damage of tools and tackles	Workmen/ Staff/Visitors/ Public	5	5	25	• All lifting tools & tackles shall be inspected by approved third party and TPI certificates shall be available. • Visual inspection shall be carried out for tools & tackles for each lifting work by lifting supervisor/Riggers. • Color coding shall be ensured. • Defected tools and tackles shall be cut and removed from site. • Make shift arrangements shall not be entertained. • Permit system shall be followed.	1	5	5
	Failure of lifting hooks and using of sub-standard Mac-alloy bars	Fall of load due to lifting hooks failure and Mac-alloy bars failure	Workmen/ Staff/Visitors/ Public	5	5	25	• Lifting hooks and Mac-alloy bars shall be inspected by approved third party and TPI certificates shall be available. • Mac-alloy bars manufacturer test certificate shall be submitted. • Lifting hooks shall be tested by di-penetration test. • Visual inspection shall be carried out for each lifting work by lifting supervisor/Riggers. • Color coding shall be ensured. • Defected lifting hooks & mac-alloy bars shall be cut and removed from site. • Make shift arrangements shall not be entertained. • Permit system shall be followed. • Erection area shall be barricaded and no unauthorized entry sign boards shall be displayed.	1	5	5
	Using of unfit cranes	Crane collapse, toppling of crane, Falling of loads.	Workmen/ Staff/Visitors/ Public	5	5	25	• All crane documents shall be submitted to P&M, EHS dept. • Crane inspection tag shall be ensured. • TPL Vehicle aging norms shall be considered. • Crane capacity shall be considered with respect to the load and third-party inspection shall be carried out. • Maintenance shall be carried for the crane as per maintenance schedule. • Daily operator inspection checklist shall be followed. • Permit system shall be followed.	1	5	5
	Overload the crane	Crane collapse, toppling of crane, Falling of loads.	Workmen/ Staff/Visitors/ Public	5	5	25	• Crane capacity shall be considered with respect to the load and third-party inspection shall be carried out. • SWL and working radius shall be ensured as per the load chart. • Lifting plan shall be prepared and Permit system shall be followed. • Crane inspection tag shall be ensured. • Competent lifting team shall be engaged.	1	5	5
	Extend the boom while lifting	Crane boom collapse	Workmen/ Staff/Visitors/ Public	5	5	25	• Boom limit switch & hoist limit switch shall be checked. • Safe working load shall be checked as per the load chart for the particular boom length before extending the crane boom. • Crane operator should aware of the load calculation and load chart.	1	5	5
	Unauthorized person operates the crane	Vehicle collision/ person hit by crane	Workmen/ Staff/Visitors/ Public	5	5	25	• Crane operator should possess valid driving license, operator competency certificate. • Do not leave the key in cabin during shift change. • Unauthorized person should not be operating the crane under any circumstance.	1	5	5

	Inadequate illumination on lifting zone	Obstruct the operator and others visibility in the lifting zone	Workmen/ Staff/Visitors/ Public	4	4	16	• Minimum 55 lux shall be maintained at the working area. • Backup DG shall be ensured to overcome power failures. • Dedicated electrician shall be deployed at the working area. • Activity shall not be carried out during power cut.	1	4	4
	Poor maintenance of crane, hydraulic system, electrical system	Fire, Mechanical failures, short circuits.	Workmen/ Staff/Visitors/ Public	4	4	16	• Maintenance of crane shall be ensured as per the maintenance schedule. • All hydraulic hoses shall be connected firmly. • Oil leakages shall be cleaned immediately inside the crane. • Bare electrical cable connections not allowed in the crane. • Fire extinguishers, first aid box shall be ensured in operator cabin.	1	4	4
	Excessive wind while lifting activity	Crane boom collapse, toppling of crane	Workmen/ Staff/Visitors/ Public	5	5	25	• Anemometer shall be fixed in the crane to monitor the wind speed. • Crane booms shall be kept in down position during excessive wind. • No lifting activity permitted during excessive wind situations.	1	5	5
Rebar fixing for stitch concreting	Improper manual lifting arrangements for rebar	Repetitive strain injury, musculoskeletal disorders	Workmen/ Staff/Visitors/ Public	4	4	16	• Manual handling techniques shall be adopted in the activity. • Team lifting shall be exercise if the load is heavy/lengthy. • Steel rods shall not be projected from body more than 1.5m while shifting. • Shoulder pad and hand gloves shall be provided to the workers. • Person should not allow to carry more than 45Kg	1	4	4
	Rebar Stacking on edge of the platform	Falling of rebar from height, cut injury, trip hazard	Workmen/ Staff/Visitors/ Public	4	4	16	• Rebar should not be stacked at the edge of the platform. • Toe guards shall be ensured. • Stacking of excessive rebar prohibited. • Catch nets shall be fixed wherever required.	1	4	4
	Improper access from pier cap top to inside the pier	Fall from height, lack of approach	Workmen/ Staff/Visitors/ Public	4	4	16	• Aluminum ladder shall be used with required length. • Ladder shall be tied/anchored firmly. • Damaged ladders shall not be used.	1	4	4
Fixing of stressing fra	Using or erection of Defective design, insufficient capacity of frame, damage or sub-standard stressing frame	Structure collapse, falling of pier cap from height	Workmen/ Staff/Visitors/ Public	5	5	25	• Stressing frame shall be fabricated as per the approved design with rated capacity. • Damaged stressing frame should be removed from site and not used anymore. • Stressing frame shall be inspected by approved third party and inspection certificate shall be obtained. • Cleaning shall be done to the stressing frame after completion of concreting.	1	5	5
	Improper rigging and handling of frame	Detachment of load, Fall of frame	Workmen/ Staff/Visitors/ Public	5	5	25	• Competent riggers, signal man and lifting supervisor shall be deployed. • Safe rigging procedures shall be followed. • Frame shall be secured firmly to avoid free falling. • Lifting tools and tackles should be tested by approved third party. • Color code shall be ensured. • Walkie-talkie shall be used for signaling if required.	1	5	5

me	Failure of Lifting hook	Detachment of load, Fall of frame	Workmen/ Staff/Visitors/ Public	5	5	25	• All lifting hooks shall be tested by di-penetration test. • Stressing frame shall be inspected by approved third party.	1	5	5
	Lifting and marching of stressing frame by using hydra	Vehicle collision/ person hit by hydra due to brake failure, bursting of tyres etc., Detachment of load, toppling of hydra	Workmen/ Staff/Visitors/ Public	5	5	25	• 2nd generation hydra shall be allowed at site. • Hydra crane shall be inspected by third party and certificate shall be obtained. • All hydra documents shall be submitted to P&M dept. & verified. • Inspection tag shall be displayed on hydra. • Operator should check the vehicle condition on daily basis and daily operator inspection checklist shall be followed. • Tyre condition, tyre pressure should be ensured during daily inspection. • Competent riggers, signal man and lifting supervisor shall be deployed. • Safe rigging procedures shall be followed. • Load shall be secured firmly to avoid free falling. • Capacity of the hydra crane shall be always considered. • Defective tools & tackles should not be used. • Visual inspection shall be carried out for tools & tackles for each lifting work by lifting supervisor/Riggers. • Color coding shall be ensured. • Banksman/marshal shall be deployed to monitor the reversing. • Guide rope shall be used to control the stressing frame while lifting.	1	5	5
	Inadequate edge protection and working platform	Falling of man from height	Workmen/ Staff/Visitors/ Public	4	4	16	• Handrails, mid rails with toe guards shall be provided. • Adequate working platform shall be provided with enough space. • All handrails, mid rails shall be fixed firmly. • External load should not be provided on hand railing.	1	4	4
Installation of stran	Unprotected platform against falling of strands and other loose materials	Falling of materials from height	Workmen/ Staff/Visitors/ Public	4	4	16	• Toe guards shall be ensured on platform • Catch nets shall be provided just below the platform. • Unwanted materials, waste and other loose materials shall be removed from platform. • Hand tools shall be tied with body while working on site.	1	4	4
	Impaling hazards while cutting the strands and Releasing of strands from bundle	Cut injury, punching	Workmen/ Staff/Visitors/ Public	4	4	16	• All hand tools and power tools shall be handled with care. • Sharp edge of tools shall be protected safely while working. • Tools should not be left on the platform. • Horse play shall not be entertained. • Cut resistance hand gloves shall be provided to the workers.	1	4	4

d s a n d o t h e r a c c e s s o r i e s	Shifting of strands bundle without using tag lines	Hit with man, materials and other objects	Workmen/ Staff/Visitors/ Public	4	4	16	• Tag lines shall be used while shifting strands. • Unauthorized entry should be avoided. • Only competent workers shall be deployed to the activity.	1	4	4
Stressing of Pier cap	Impaling hazards while improper locking arrangements in the stressing cones	Fall of material, oil spillage, hit by fast moving object	Workmen/ Staff/Visitors/ Public	5	5	25	• Chain pulley block used for lifting stressing jack shall have proper latch, third party certificate. • All the wedges shall be clean and fixed properly. • Hydraulic jack shall be periodically inspected and shall have a valid third-party certificate. • Ply boards shall be erected to catch any flying strand or wedge. • Workmen shall be instructed not to stand in front of the strand. • TBT shall be conducted prior to start work.	1	5	5
Stitch Concreting	Placing of boom placer on uneven or un-compacted surface	Collapse of boom placer due to settling	Workmen/ Staff/Visitors/ Public	5	5	25	• Boom placer shall be positioned on firm ground and level surfaces only. • Area shall be levelled to place the outriggers. • If the area identified as backfilled, MS plate shall be provided. • Boom placer outriggers shall be fully extended while placing the crane. • Padding shall be provided where the ground level differs. • Drainages shall be marked Boom placer crane should not be placed above drainages.	1	5	5
	Concrete hose struck on access tower	Access tower collapse, concrete hose damage	Workmen/ Staff/Visitors/ Public	4	4	16	• Concrete hose shall be maintained away from the stair tower and tagline shall be used. • Stair tower shall be maintained without any obstructions. • Concrete hose shall be inspected for cracks with proper intervals. • Adequate supports, cross bracings shall be provided to the stair tower.	1	4	4
	Sub-standard electrical installation, failure to use the Electrical safety devices, using of defective equipment	Electrocution, fire	Workmen/ Staff/Visitors/ Public	5	5	25	• All electrical connections shall be routed through ELCB. • Bare wire connections shall be avoided. • Sockets shall be used for cable connections. • Double core wire shall be used for electrical connections. • ELCB, Earth pit inspection shall be conducted on monthly basis. • Dedicated electricians shall be deployed site.	1	5	5

Grouting of stressing port	Unguarded and unfit cement slurry stirring equipment	Caught with the rotating parts, Electrocution	Workmen/ Staff/Visitors/ Public	5	5	25	• Guards shall be provided in all rotating parts of the machinery. • Electrical connections shall be ensured for damages. • Emergency stopper shall be provided. • Only authorized person shall operate the cement stirring equipment. • Rubber hand gloves shall be provided to the workers.	1	5	5
	Spill of concrete on public road users	Slip hazard, Soil contamination		4	4	16	• Bund wall shall be made at both sides barricading board bottom area. • If concrete spilled on road, it should be cleaned immediately with water. • Marshal shall be deployed to guide the traffic flow.	1	4	4
Concreting of anchorage portion	Inadequate edge protection and inadequate protection against falling of loose materials	Falling of man from height, falling of materials	Workmen/ Staff/Visitors/ Public	5	5	25	• Handrails, mid rails with toe guards shall be provided. • Adequate working platform shall be provided with enough space. • All handrails, mid rails shall be fixed firmly. • External load should not be provided on hand railing. • Catch nets shall be provided below the working platform • Toe guards shall be ensured on platform • Unwanted materials, waste and other loose materials shall be removed from platform. • Hand tools shall be tied with body while working on site.	1	5	5

	Dismantling of sides shutters	Inadequate edge protection and inadequate protection against falling of loose materials	Falling of man from height, falling of materials	Workmen/ Staff/Visitors/ Public	5	5	25	• Working area shall be barricaded. • Unauthorized entry shall be restricted. • Shutters shall be hanged with crane before de-shuttering. • Workers shall be provided with double lanyard safety hardness. • Only competent workforce shall be deployed. • Tag lines shall be used. • Permit system shall be followed.	1	5	5

Shuttering, Concreting and de-shuttering of bearing pedestals	Inadequate edge protection and inadequate protection against falling of loose materials, Flying of piece of plywood	Falling of man from height, falling of materials	Workmen/ Staff/Visitors/ Public	5	5	25	• Handrails, mid rails with toe guards shall be provided. • Adequate working platform shall be provided with enough space. • All handrails, mid rails shall be fixed firmly. • External load should not be provided on hand railing. • Catch nets shall be provided below the working platform • Toe guards shall be ensured on platform • Unwanted materials, waste and other loose materials shall be removed from platform. • Hand tools shall be tied with body while working on site. • Tag lines shall be used. • Permit system shall be followed	1	5	5
Dismantling	Failure to follow the sequence of dismantling	Falling of man from height, falling of materials	Workmen/ Staff/Visitors/ Public	5	5	25	• Dismantling sequence shall be followed. • Load shall be hanged on crane before unsecure the load. • Competent workforce shall be deployed. • Working area shall be barricaded. • Catch nets shall be provided. • Permit system shall be followed. • Tag line shall be used.	1	5	5

of Stressing frame/ Dismantling of brackets	Un-barricaded lifting zone	Vehicle hit to public/ pedestrians and vehicle collision	Workmen/ Staff/Visitors/ Public	5	5	25	• Working area shall be cordoned off. • Traffic barriers, cones and traffic marshals shall be ensured • If required traffic diversion shall be done, alternative routes shall be identified. • Unauthorized entry sign boards shall be displayed.	1	5	5
	Failure of lifting tools, tackles and lifting hooks	Fall of load due to Failure/ damage of tools and tackles	Workmen/ Staff/Visitors/ Public	5	5	25	• All lifting tools & tackles shall be inspected by approved third party and TPI certificates shall be available. • Visual inspection shall be carried out for tools & tackles for each lifting work by lifting supervisor/Riggers. • Colour coding shall be ensured. • Defected tools and tackles shall be cut and removed from site. • Make shift arrangements shall not be entertained. • Permit system shall be followed.	1	5	5
	Failure to use tag line	Load hit with other objects, man and machinery	Workmen/ Staff/Visitors/ Public	4	4	16	• Guide rope shall be used with minimum 20mm dia. • Sufficient length of guide rope shall be used. • Guide rope shall be ensured prior to start the lifting activity. • Damaged guide rope shall not be used.	1	4	4
	Improper rigging and slinging arrangements	Detachment of load, fall of lifting frame, toppling of crane	Workmen/ Staff/Visitors/ Public	5	5	25	• Competent riggers, signal man and lifting supervisor shall be deployed. • Safe rigging procedures shall be followed. • Load shall be secured firmly to avoid free falling. • Crane working radius and SWL shall be ensured. • Capacity of the crane shall be always considered. • Lifting frame should be tested by approved third party. • Defective tools & tackles should not be used. • Walkie-talkie shall be used for signaling if required.	1	5	5

	Dismantling of tower access	Failure to follow the sequence of dismantling	Falling of man from height, falling of materials	Workmen/ Staff/Visitors/ Public	5	5	25	• Dismantling sequence shall be followed. • Competent workforce shall be deployed. • Stair tower shall be dismantled from top. • Supports and anchoring of stair tower shall be ensured in all stages of dismantling. • Working area shall be barricaded. • Permit system shall be followed. • Tag line shall be used.	1	5	5
	Bar Cutting & Bending	Electricity, Unauthorized operation,	Electrocution, caught in between rotating parts,	Workmen/ Staff/Visitors	4	5	20	• All cable joints should be made by sockets only. • All DB used should be IP44 type with body earth. • Electrical cable should be routed through cable stand or undergrounded. • Secondary earthing to be done for all electrical appliances. • Earth resistance must be checked on regular basis. • Rubber mat shall be provided at all PDB's, DB's etc. • Fire extinguisher shall be provided at all DB's. • All electrical appliances shall be connected through RCCB distribution board • Competent electrical persons shall inspect the PDB's, DB's on periodic basis. • Unauthorized person must not handle electrical connections. • Machine operators shall be identified and name shall be displayed. • Platform shall be provided to place the machinery. • Inspection tag shall be provided to the machinery. • Toolbox talk shall be conducted to the workforce. • Housekeeping shall be ensured around the machines all the time. • Separate scrap storage area shall be identified. • Cut resistance hand gloves shall be provided to the workers. • Materials storage not allowed inside the bar bending machine. • Clear and safe access shall be ensured. • Illumination level shall be maintained.	1	5	5

	Rotating parts of the machinery,	caught in between rotating parts,	Workmen/ Staff/Visitors	4	4	16	• Guarding should be available for rotating parts. • Loose clothing should be avoided. • Caution signs shall be displayed at bar bending & cutting Machine. • Emergency stopper shall be ensured in both sides of bar bending machines.	1	4	4
Rebar cage fabrication	Exposing Sharp edges, Manual handling	Cut injury on hand, Occupational diseases,	Workmen/ Staff/Visitors	3	3	9	• Proper housekeeping shall be maintained. • Any spillage shall be cleared off immediately using soak foam/saw dust.	1	3	3
	Improper Access	Trip and fall	Workmen/ Staff/Visitors	4	3	12	• Rubber hand gloves should be used while using chemicals. • In case of eye splash, immediately rinse off with water. • Medical attention shall be availed if ingested accidently. • Containers shall be sealed after use/removing required quantity. • Before using the Hazards of chemical (releasing agent and de-bonding agent – MSDS) shall be discussed in TBT. • Dedicated storage area shall be identified.	1	3	3
Alignm	Fall of structure	Caught in between loads	Workmen/ Staff/Visitors	4	4	16	• No hot work shall be allowed in the vicinity at the time of applying releasing agent. • Fire extinguisher shall be available at the site. • MSDS for De-bonding agent should be followed. • MSDS briefing should be done to the workforce.	1	4	4

	ent of forms and stressing ends, survey	Vehicle maneuvering	hit by/against	Workmen/ Staff/Visitors	4	4	16	• Inspected and appropriate hand tools shall be used. • Competent workmen shall be deployed for formwork fixing and jacking of internal shutter. • Inspected lifting tools & tackles shall be used to fix stressing ends and other parts. • Proper locking of the outer web shall be ensured using heavy duty turn buckles/hinges. • Shear Keys and anchor cone fixing shall be done by competent person. • Special care shall be taken while matching the parts to avoid any pressed-in injury. Shall be done in competent supervision. • Appropriate platform (1000 mm width) with handrails, mid-rails, toe-guards and for working (Laying, compacting & finishing) shall be provided. • Suitable safe access should be provided • Any incidental hot work shall be carried out with proper permit to work procedure.	1	4	4
	Rebarc	Failure of strong back under load	Falling of load	Workmen/ Staff/Visitors	4	4	16	• Dispenser should be used for storage of strands to avoid damage and avoid impaling hazards • Multiple time usable Wedges with desired size should be used. • In front of Stressing area GI barricade boards should place and entry should be restricted. • Pre- stressing checklist/permit should be obtained.	1	4	4

	aging and placing in mould.	Failure of gantry crane, failure of lifting tools and tackles, fall of loose objects	Falling of load	Workmen/ Staff/Visitors	4	3	12	• Routine inspection shall be carried out on roads • Suit shall be cleaned before to exit from yard. • If any spillages observed, it should be cleaned immediately.	1	3	3
	Inserting strands	Slippery surface, Scattered materials	Slip & Trip	Workmen/ Staff/Visitors	4	5	20	• Provided & installed audible reverse horn • Use good conditioned Vehicle/regular maintenance • Daily operator checklist shall be ensured. • Inspection tag shall be followed.	1	5	5
		Contact with de-bonding agent.	Irritation, dermatitis or allergic reaction, inhalation of hazardous fumes, ingestion	Workmen/ Staff/Visitors	4	5	20	• Only authorized & Valid license holder should drive the Vehicle. • Authorization card shall be issued. • Operator shall attend the defensive training.	1	5	5

	and de-bounding tube wax based de-bonding agent	Flammable Material	Fire	Workmen/ Staff/Visitors	4	5	20	• Before engaging the vehicle, Green card should be obtained • Periodical maintenance must be done.	1	5	5

Inner and outer shuttering and De-Shuttering	Slipping of jack, turn buckles	Crush, pressed in, cut, hit by, body strain	Workmen/ Staff/Visitors	4	5	20	• Depute helper with each Transit mixer/Equipment's • Without helper vehicle should not be allowed to enter into the site • Speed limit should be followed as per site rules	1	5	5
Concreting by Boom placer	loose soil and materials etc.	Collapse of soil and material	Workmen/ Staff/Visitors	3	5	15	• Inspection of ground • Hard barricade should be provided 2m away from the excavation pit and material should not be stacked inside the barricade	1	5	5
	Placing the Boom placer near edge of excavation	Toppling of Boom placer	Workmen/ Staff/Visitors	3	5	15	• Extend outriggers fully • Provided safe access for concrete delivery Trucks • Hard barricade should be provided 2m away from the excavation pit	1	5	5
	Overhead HT or site distribution power line	Electrocution	Workmen/ Staff/Visitors	4	5	20	• Area should be free from HT or site distribution power line unless take appropriate safety measures against OHT line. • Obtain permit for working in the vicinity of live OHT line	1	5	5
	Untrained Boom placer operator	Body parts Injury due to hit to the nearby workmen by Flexible hose at the discharge end of concrete pipeline	Workmen/ Staff/Visitors	4	3	12	• Use tagline for controlling the flexible pipe sway movement • Visibility of the operator should be made to the pouring point or otherwise proper signaling should be followed	1	3	3

	Poor illumination at concreting pouring points	Body parts injury due to Fall of person from different level	Workmen/ Staff/Visitors	4	3	12	• Provided adequate illumination i.e., more than 65lux	1	3	3
Concreting compacting	Contact with wet concrete	irritation, dermatitis or allergic reaction, inhalation of fumes, ingestion,	Workmen/ Staff/Visitors	3	3	9	• Appropriate PPE shall be used to avoid direct contact with skin and eye. • Proper communication shall be maintained between all workmen. • Hazards of Cementations material shall be discussed in TBT. • Eye splashes shall be immediately attended. Medical help shall be availed. • MSDS for Cement should be followed. • Task briefing should be done prior to start the concrete.	1	3	3
	Vibrations	White finger	Workmen/ Staff/Visitors	3	4	12	• Waste concrete shall be collected immediately. • All access/egress shall be clear. • Job rotation shall be maintained to prevent white finger and body strain	1	4	4
	poor connection for shutter vibrator	Electrocution	Workmen/ Staff/Visitors	4	5	20	• Proper connections should be made for shutter vibrator and only through IP44/standard panel boards.	1	5	5

Cleaning concrete pipeline by ball passing after concrete pour	Untrained and inexperienced person engage for pipeline cleaning	Concrete material with ball forcibly ejects out which may cause severe injury to workmen	Workmen/ Staff/Visitors	3	4	12	• Depute authorized person • Ball catcher to be fixed at the discharge Send of the pipe. • Adequate warning prior to ball passing • Prompt coordination & supervision • Keep all people away from the discharge end.	1	4	4
Shifting of	Failure of gantry crane and its auxiliary equipment's under load.	Fatal, Crush injury, body parts injury. Caught in between	Workmen/ Staff/Visitors	4	5	20	• Gantry crane and its auxiliary tools should be in good condition and 3rd party tested. • Safe distance shall be maintained from any suspended load. • No workman shall be allowed to work under suspended load at any time. • Directional movement shall be made smoothly and deliberately; rapid movements shall be avoided in any direction. • Authorized person should operate the gantry. • Dedicated signal man will be deployed.	1	5	5

Hydraulic jack & positioning into the Macalloy bar	Failure of wire rope, tools & tackles	Sever injury, and fatality	Workmen/ Staff/Visitors	4	5	20	• All the wire ropes, tools & tackles shall be checked for valid Third party certified. • Inspection of Wire rope, tools and tackles shall be carried out before commencement of job. • Sling protection should be provided at sharp edge. • Adequate capacity of the wire ropes, web slings, tools & tackles should be selected for the job. • Adequate tag line should be used for controlling of material	1	5	5
	Improper Signaling	Damage to property, body part injury and fatal	Workmen/ Staff/Visitors	4	3	12	• Dedicated and trained signal man with unique identification of PPE's should be engaged for the job. • Clear Visible communication should be maintained between Operator and Signalman	1	3	3
	Untrained and inexperienced person engage for lifting operation	Objects hit the person	Workmen/ Staff/Visitors	4	3	12	• Competent persons for the job should be engaged for all lifting operations. • No person is allowed to stand below or nearby suspended load.	1	3	3
	Improper Access	Trip and fall	Workmen/ Staff/Visitors	4	3	12	• Walking area to Approach should be clear. • Work has should be stopped during adverse weather condition.	1	3	3
	Caught in-between load during packing & alignment	Cut Injury & Fracture	Workmen/ Staff/Visitors	4	4	16	• All personal are wearing correct PPEs like safety helmet, Hand gloves, shoes etc. • Trained and experienced workmen are deployed for this job and Periodical training for the workmen is being provided. • Adequate illumination installed for the area. • Competent supervision is ensured during positioning of material. • Adequate firm packing material is being used for placing below the load. • Dedicated signal man shall be engaged for the job.	1	4	4
		Eye injury and Body part injury	Workmen/ Staff/Visitors	4	4	16	• Whip check shall be used at the hose pipe joint connection • Hydraulic Jacks and their gauges shall have appropriate service records, valid calibration certificates and third-party certificates.	1	4	4
	Damaged/Leaked hose connection	Exceeds limit leads to Sever injury to workmen	Workmen/ Staff/Visitors	3	3	9	• All personal must wearing correct PPEs like safety helmet, Hand gloves, Goggles, shoes etc. • Competent operator and workmen should be engaged for De-stressing activity. • Unauthorized persons should not be allowed at De stressing activity.	1	3	3
Installation of stra	Unprotected platform against falling of strands and other loose materials	Falling of materials from height	Workmen/ Staff/Visitors	4	4	16	• Provide MS sheet/plywood to arrest the strands in case of ejecting from girder • Catch nets shall be provided just below the platform. • Unauthorized person shall not be allowed into work premises.	1	4	4
	Impaling hazards while cutting the strands and releasing of strands from bundle	Cut injury, punching	Workmen/ Staff/Visitors	4	4	16	• All hand tools and power tools shall be handled with care. • Sharp edge of tools shall be protected safely while working. • Tools should not be left on the platform. • Horse play shall not be entertained. • Cut resistance hand gloves shall be provided to the workers.	1	4	4

nd s and other accessories	Shifting of strands bundle without using tag lines	Hit with man, materials and other objects	Workmen/ Staff/Visitors	4	4	16	• Tag lines shall be used while shifting strands. • Unauthorized entry should be avoided. • Only competent workers shall be deployed to the activity.	1	4	4
Stressing of Girder	Impaling hazards while improper locking arrangements in the stressing cones	Fall of material, oil spillage, Hit by fast moving object	Workmen/ Staff/Visitors	5	5	25	• Chain pulley block used for lifting stressing jack shall have proper latch, third party certificate. • All the wedges shall be clean and fixed properly. • Hydraulic jack shall be periodically inspected and shall have a valid third party certificate. • Ply boards shall be erected to catch any flying strand or wedge. • Workmen shall be instructed not to stand in front of the strand. • TBT shall be conducted prior to start work.	1	5	5
Grouting of stressing port	Unguarded and unfit cement slurry stirring equipment	Caught with the rotating parts, Electrocution	Workmen/ Staff/Visitors	5	5	25	• Guards shall be provided in all rotating parts of the machinery. • Electrical connections shall be ensured for damages. • Emergency stopper shall be provided. • Only authorized person shall operate the cement stirring equipment. • Rubber hand gloves shall be provided to the workers.	1	5	5
	Spill of concrete on public road users	Slip hazard, Soil contamination	Workmen/ Staff/Visitors	4	4	16	• Bund wall shall be made at both sides barricading board bottom area. • If concrete spilled on road, it should be cleaned immediately with water. • Marshal shall be deployed to guide the traffic flow.	1	4	4

De-stressing strands.	Untrained and inexperienced person engage for operating power pack, Blown out of the concrete	Impaling hazard	Workmen/ Staff/Visitors	4	4	16	• De stressing shall be applied gradually and evenly to tendons. • No person should stand in direct line of the jack or stressed strands. • "NO MAN ZONE" signage shall be prominently displayed at all appropriate locations. • Before De stressing commences, adequate Retain barricades should be erected at both ends of tendons. • No person shall move in-between the bay beds.	1	4	4
	Poor electrical cable joints for Power pack	Electrocution, cut injury or amputation	Workmen/ Staff/Visitors	4	5	20	• All cable joints should be made by male & female couplers. • All DB used should be IP44 type with body earth.	1	5	5
Core cutting	Vibration	Joint and circulatory damage	Workmen/ Staff/Visitors	3	3	9	• The core drill is fitted with anchor bolts arrangement in accordance with the manufacturer's specifications. • The drill machine is solidly fixed with movement of the mast.	1	3	3
	Dust	Respiratory disease, eye injury	Workmen/ Staff/Visitors	4	4	16	• Feed pressure water into the hole to bring up slurry and keep the hole saw bit cool. • Workers shall wear safety goggles and nose mask when cutting concrete.	1	4	4
	Electrical cable damage	electrocution	Workmen/ Staff/Visitors	4	5	20	• The power supply is protected by a residual current circuit breaker (RCCB). • All electrical equipment has separate body earthing. • The power supply is taken through IP44 standard panel board. • Double insulated cable is being used. • Proper sleeve arrangement or sockets shall be provided at cable joints. • Electrical cables shall be taken through the cable stand arrangement.	1	5	5
	Wet, slippery surface	Sprain, Minor injury	Workmen/ Staff/Visitors	3	3	9	• Slurry and waste concrete cores are being removed from the workplace immediately to prevent slip and trip hazards. • Proper housekeeping is maintained • Waste material generated from the core cutting shall be collected in waste bin after completing of holes.	1	3	3
	Work at height	Cut, head injury, Impact (whole body)	Workmen/ Staff/Visitors	3	4	12	• All floor openings on the work platform are covered. • Safety harness is worn by persons with either tag line or independent life line with fall arrestor system. • Safe access is provided to all areas and all ladders are correctly installed and secured. • Working platform and ladder is inspected by competent person. • Erect barricades if necessary and signs shall be placed at the job location.	1	4	4
	Untrained workmen	Contact with moving parts	Workmen/ Staff/Visitors	4	4	16	• Appropriately experienced and trained workmen are to be engaged. • Operators of core cutting machine are to be trained regarding the hazards associated with machine. • Wear appropriate PPE	1	4	4

	Noise	Hearing loss	Workmen/ Staff/Visitors	4	3	12	• Hearing protection to be worn whenever machine is operating. • Warning signs placed as necessary	1	3	3
Shifting of U-Girder from casting bed to stacking bed	Failure of gantry crane and its auxiliary material under load	Fatal, Crush injury, body parts injury. Caught in between	Workmen/ Staff/Visitors/ Public	4	5	20	• Gantry crane and its auxiliary tools should be in good condition and 3rd party tested. • Safe distance shall be maintained from any suspended load. • No workman shall be allowed to work under suspended load at any time. • Directional movement shall be made smoothly and deliberately; rapid movements shall be avoided in any direction. • Authorized person should operate the gantry. • Dedicated signal man will be deployed. • Cut off Sensors should be placed on gantry movement in 3m from the gantry to avoid run over on personnel	1	5	5
	Using of Defective and substandard lifting tools	Fall of load due to Failure/ damage of tools and tackles	Workmen/ Staff/Visitors/ Public	5	5	25	• All lifting tools & tackles shall be inspected by approved third party and TPI certificates shall be available. • Visual inspection shall be carried out for tools & tackles for each lifting work by lifting supervisor/Riggers. • Color coding shall be ensured. • Defected tools and tackles shall be cut and removed from site. • Make shift arrangements shall not be entertained. • Permit system shall be followed.	1	5	5
	Using of unfit gantry crane	Collapse of gantry crane, struck with load	Workmen/ Staff/Visitors/ Public	5	5	25	• Gantry crane capacity shall be considered and third-party inspection shall be carried out. • Maintenance shall be carried for the gantry crane as per schedule. • Daily operator inspection checklist shall be followed. • Green tag shall be ensured for the gantry crane. • Gantry crane track shall be maintained obstruction free. • Permit system shall be followed.	1	5	5
	Person working/ standing under the suspended load	Load can fall on to the person	Workmen/ Staff/Visitors/ Public	5	5	25	• Lifting area shall be cordoned off. • No unauthorized entry sign boards shall be displayed. • All workmen shall be educated on tool box talks not to stand under suspended loads.	1	5	5
	Inadequate illumination during night time	Obstruct the operator and others visibility in the work area	Workmen/ Staff/Visitors/ Public	4	4	16	• Minimum 55 lux shall be maintained at the working area. • Backup DG shall be ensured to overcome power failures. • Dedicated electrician shall be deployed at the working area. • No work shall be allowed during power cut.	1	4	4
	Engaging of Unauthorized gantry operator, rigger, signal man and lifting supervisor	Fall of load, gantry run over or hit, toppling of gantry, struck onto another object	Workmen/ Staff/Visitors/ Public	5	5	25	• Only authorized gantry operators, riggers, signal man, lifting supervisors shall be engaged in the activity. • Authorization card, identity card shall be used to the gantry operators, riggers, signal man, lifting supervisors. • Gantry crane key should be available with operators during shift change / do not leave the key in the cabin. • End stopper shall be fixed on both sides of track to avoid de-railing.	1	5	5
	Unauthorized person entry into the gantry movement area/ unprotected lifting zone	Gantry rail hit or run over the person	Workmen/ Staff/Visitors/ Public	5	5	25	• Proximity sensors shall be fixed on gantry crane all the four sides. • Lifting area shall be cordoned off. • No unauthorized entry sign boards shall be displayed. • All workmen shall be educated on tool box talks not to stand under suspended loads.	1	5	5

	No visibility of lifting zone to the operator	Load and gantry struck with another object and person	Workmen/ Staff/Visitors/ Public	5	5	25	• Minimum 55 Lux shall be ensured in the working area. • During adverse weather condition, gantry crane shall be stopped. • Lifting zone shall be maintained obstruction free without any hindrance to the activity.	1	5	5
	Over speed and defective railing arrangements of gantry	Derailing of gantry crane	Workmen/ Staff/Visitors/ Public	5	5	25	• Maximum 5Km/hr speed allowed for gantry crane operation. • Gantry crane shall be inspected in proper intervals and recorded. • Alcohol test shall be carried out for operators specially on night shifts, weekends.	1	5	5
	Excessive wind while lifting activity	Crane boom collapse, toppling of crane	Workmen/ Staff/Visitors/ Public	5	5	25	• Anemometer shall be fixed in the crane to monitor the wind speed. • Crane booms shall be kept in down position during excessive wind. • No lifting activity permitted during excessive wind situations.	1	5	5
	Hit by u girder and gantry crane	Body Parts Injury	Workmen/ Staff/Visitors/ Public	4	4	16	• Trained and competent workmen shall be deployed. • Tag line should be provided to control Girders movement. • Safe distance shall be maintained from any suspended load. • No one shall be allowed to ride on the hook or suspended load. • Directional movement shall be made smoothly and deliberately; rapid movements shall be avoided in any direction.	1	4	4
	Fall of object	Fatal/ Body parts Injury	Workmen/ Staff/Visitors/ Public	4	5	20	• Ensure that lifting load should be within the SWL • Keep suspended load within the center of gravity on the hook • Lifting hook should be free from defects and NDT test to be done for all the hook • No workman shall be allowed to work under suspended load at any time. • Un-authorized entry to the area shall be strictly prohibited. • Safe distance shall be maintained from any suspended load.	1	5	5
Removal of existin	Hose coming out if not tighten properly	Hit by a pressure hose pipe.	Workmen/ Staff/Visitors/ Public	4	5	20	• Only 3rd party certified compressor should be used. • Hose to be fit correctly to the machine. • Air compressor should have good foundation and structure and it should be NDT tested. • Compressor belt should not have slippage. • All pressure switches, regulators, gauges, unloader valve, trap, flow control valve should be check prior to start the operation. • Ensure before starting the compressor	1	5	5

	g c o at in g b y Gri t Bla st in g u si n g ai r c o m pr es s or	Rebounding abrasive dust, Noise generation	Exposure to dust. Entry of smaller or fine particles to respiratory track.	Workmen/ Staff/Visitors/ Public	3	4	12	• Specially designed respirators with continuous air supply to be worn covering head neck and shoulders. Ear plugs to be used. • Operation to be carried in enclosed place. Open place to be avoided or should be covered to prevent dust / airborne dust.	1	4	4

	Using of Electrical power to all the above activity	Poor cable joints, damaged cables, improper power tapping, failure to use the safety devices	Electrocution	Workmen/ Staff/Visitors/ Public	4	5	20	• All MDB/FDB/PDB should be used IP44 standard only • Double insulated cable must be used • Avoid cable joints and damaged cables unless otherwise proper sleeve arrangements should be done for cable joints • System earthing and separate body earthing should be provided for All electrical DB'S and electrical power operated machine • Power tapping should be made with industrial plug top • Authorized person only should be done all the electrical activities	1	5	5
	Removal of barricade bo	Availability of Overhead underground utilities (Power line, Gas line, Communication Line, Water Line, Storm water drain, sewer line etc.,) and Trees and its branches)	Electrocution, damage of underground utilities, Gas leakages, Water flooding, damage of trees, traffic jam due to water/sewers stagnation	Workmen/ Staff/Visitors	5	5	25	• All overhead power lines shall be identified and diverted • Underground utilities mapping shall be done and diverted wherever required. • Gas pipes shall be marked at site and MGL contact numbers shall be displayed. • Adequate number of pumps shall be ensured if in case of water flooding. • Sufficient Traffic marshals with blinkers shall be ensured to control traffic jam. • All live trees shall be protected and prior permission shall be obtained if any tree needs to be cut. • Permit system shall be followed.	1	5	5
		Improper compaction of surface	Toppling of crane and other vehicle	Workmen/ Staff/Visitors	5	5	25	• Crane shall be positioned on firm ground surfaces only. • If the area identified as backfilled, MS plate shall be provided. • Crane outriggers shall be fully extended while placing the crane.	1	5	5
		Unprotected work area from public vehicle movement	Vehicle hit to public/ pedestrians and vehicle collision	Workmen/ Staff/Visitors	5	5	25	• Working area shall be cordoned off. • Traffic barriers, cones and traffic marshals shall be ensured • If required traffic diversion shall be done, alternative routes shall be identified. • Unauthorized entry sign boards shall be displayed.	1	5	5

ard sand Area preparation for placing of crane	Material stacked on access	Obstruction for crane and trailer position	Workmen/ Staff/Visitors	4	4	16	• Clear and safe access should be ensured all the times. • Working area shall be maintained without any obstructions. • If materials exist, all materials shall be shifted prior to placing the crane	1	4	4
	Inadequate area illumination	Not able to identify the Work area hazards	Workmen/ Staff/Visitors	4	4	16	• Minimum 55 lux shall be maintained at the working area. • Backup DG shall be ensured to overcome power failures. • Dedicated electrician shall be deployed at the working area.	1	4	4
	Protruding rebar's of board anchoring	Slip, Trip and Fall, Bursting of Vehicle tyres	Workmen/ Staff/Visitors	4	4	16	• All protruding rebars shall be removed. • If removing nails is not possible, nails to be cut with minimum tolerance to avoid trip hazards, bursting of vehicle tyres.	1	4	4
U Girder loading on trailer fro	Improper access to reach the U girder top for slinging	Fall of person	Workmen/ Staff/Visitors	5	5	25	• Aluminum ladder shall be used to climb over the U girder and trailer. • U girder loading area shall be maintained obstruction free.	1	5	5
	Improper slinging and rigging	Detachment of load, Fall of lifting frame and U Girder, toppling of crane	Workmen/ Staff/Visitors	5	5	25	• Competent riggers, signal man and lifting supervisor shall be deployed. • Safe rigging procedures shall be followed. • Load shall be secured firmly to avoid free falling. • Capacity of the crane shall be always considered. • Lifting frame should be tested by approved third party once in 03 months. • Defective tools & tackles should not be used. • Walkie-talkie shall be used for signaling if required.	1	5	5
	Using of Defective and substandard lifting tools	Fall of load due to Failure/ damage of tools and tackles	Workmen/ Staff/Visitors	5	5	25	• All lifting tools & tackles shall be inspected by approved third party once in 03 months and TPI certificates shall be available. • Visual inspection shall be carried out for tools & tackles for each lifting work by lifting supervisor/Riggers. • Color coding shall be ensured. • Defected tools and tackles shall be cut and removed from site. • Make shift arrangements shall not be entertained. • Condition of lifting tools and tackles shall be ensured before issuing the Permit and ensured free from damage.	1	5	5

m st a c ki n g y ar d	Using of unfit gantry crane	Collapse of gantry crane, struck with load	Workmen/ Staff/Visitors	5	5	25	• Gantry crane capacity shall be considered and third-party inspection shall be carried out. • Maintenance shall be carried for the gantry crane as per schedule. • Daily operator inspection checklist shall be followed. • Green tag shall be ensured for the gantry crane. • Gantry crane track shall be maintained obstruction free. • Permit system shall be followed.	1	5	5
	Person working/ standing under the suspended load	Load can fall on to the person	Workmen/ Staff/Visitors	5	5	25	• Lifting area shall be cordoned off. • No unauthorized entry sign boards shall be displayed. • All workmen shall be educated on tool box talks not to stand under suspended loads.	1	5	5
	Inadequate illumination during night time	Obstruct the operator and others visibility in the work area	Workmen/ Staff/Visitors	4	4	16	• Minimum 55 lux shall be maintained at the working area. • Backup DG shall be ensured to overcome power failures. • Dedicated electrician shall be deployed at the working area. • No work shall be allowed during power cut.	1	4	4
	Engaging of Unauthorized gantry operator, rigger, signal man and lifting supervisor	Fall of load, gantry run over or hit, toppling of gantry, struck onto other object	Workmen/ Staff/Visitors	5	5	25	• Only authorized gantry operators, riggers, signal man, lifting supervisors shall be engaged in the activity. • Authorization card, identity card shall be used to the gantry operators, riggers, signal man, lifting supervisors. • Gantry crane key should be available with operators during shift change / do not leave the key in the cabin. • End stopper shall be fixed on both sides of track to avoid de-railing.	1	5	5
	Unauthorized person entry into the gantry movement area/ unprotected lifting zone	Gantry rail hit or run over the person	Workmen/ Staff/Visitors	5	5	25	• Proximity sensors shall be fixed on gantry crane all the four sides. • Lifting area shall be cordoned off. • No unauthorized entry sign boards shall be displayed. • All workmen shall be educated on tool box talks not to stand under suspended loads.	1	5	5
	No visibility of lifting zone to the operator	Load and gantry struck with another object and person	Workmen/ Staff/Visitors	5	5	25	• Minimum 55 Lux shall be ensured in the working area. • During adverse weather condition, gantry crane shall be stopped. • Lifting zone shall be maintained obstruction free without any hindrance to the activity.	1	5	5
	Over speed and defective railing arrangements of gantry	Derailing of gantry crane	Workmen/ Staff/Visitors	5	5	25	• Maximum 5Km/hr speed allowed for gantry crane operation. • Gantry crane shall be inspected in proper intervals and recorded. • Synchronization shall be done for both the gantries in case of tandem lifting. • Alcohol test shall be carried out for operators specially on night shifts, weekends.	1	5	5
T ra n s p or ta ti o n of	U Girder loaded on inadequate capacity of trailer	Trailer structure may failure	Workmen/ Staff/Visitors/ Public	5	5	25	• Trailer capacity shall be ensured with respect to the weight of U girder. • U girder loading shall be done on the fabricated frame fixed with trailer. • Vehicle age criteria shall be considered while engaging the trailer. i.e Own vehicles- 10 years, hired-5 years. • The route of transportation shall be pre-decided and all approvals from the concerned authorities shall be taken prior to the transportation of U-Girder from precast yard up to the erection locations. • The transportation of U girders shall commence only after getting the confirmation from erection location that the site is ready for erection. • Squad team with red flags shall be deployed while transporting the U girder throughout the length of travel. • Trial run will be carried out with skeleton frame/structural steel frame (max length of U girder) once before the commissioning of work	1	5	5

U Girder	Inadequate or sub-standard securing arrangements	Toppling of trailer and load	Workmen/ Staff/Visitors	5	5	25	• U Girder shall be secured on trailer by using ratchet belts. • Suitable rubber packing shall be provided on trailer and below Girder support location to absorb vibration from vertical movement • Defective ratchet belts should not be used. • Rash driving should not be allowed. • Road transport lashing checklist shall be followed.	1	5	5
	Using of Defective trailer	Vehicle collision/ person hit by trailer due to brake failure, bursting of tyres etc.,	Workmen/ Staff/Visitors	5	5	25	• All trailer documents shall be submitted to P&M dept. & verified. • Inspection tag shall be displayed on trailer. • Operator should check the vehicle condition on daily basis and daily operator inspection checklist shall be followed. • Tyre condition, tyre pressure should be ensured during daily inspection.	1	5	5
	Unauthorized driver	Vehicle collision/ person hit by trailer	Workmen/ Staff/Visitors	5	5	25	• Driver should possess valid driving license and competency certificate. • Do not leave the key during shift change.	1	5	5
	Unmanned reversing	Vehicle collision/ person hit by trailer	Workmen/ Staff/Visitors	5	5	25	• Reverse horn shall be ensured in the trailer. • Banksman/marshal shall be deployed to monitor the reversing vehicle.	1	5	5
Positioning of crane	Placing the crane un-compacted surface/ SWD/Drainage/ Uneven surface	Collapse of crane while lifting the load	Workmen/ Staff/Visitors	5	5	25	• Crane shall be positioned on firm ground and level surfaces only. • If the area identified as backfilled, MS plate shall be provided. • Crane outriggers shall be fully extended while placing the crane. • Padding shall be provided where the ground level differs. • Drainages shall be marked and crane should not be placed above drainages.	1	5	5
	Outriggers placed on ground without padding arrangements	Collapse of crane due to settling of crane	Workmen/ Staff/Visitors	5	5	25	• Area shall be levelled to place the outriggers. • Padding shall be provided to place the outriggers. • Crane outriggers shall be fully extended while placing the crane. • MS plate shall be used wherever required.	1	5	5
	Crane placed on live road without precautions	Collision with outside vehicle, public	Workmen/ Staff/Visitors	5	5	25	• Live road shall be diverted with warning sign boards. • Water barriers, traffic cones shall be used for traffic diversion. • Marshal shall be deployed with blinkers. • Adequate illumination shall be ensured. • Unauthorized person shall not be allowed in the working area.	1	5	5
	Non availability of swing area barricade	Crane hit by person and vehicle	Workmen/ Staff/Visitors	4	5	20	• Crane swing area shall be barricaded minimum 6m from the crane. • Barricades shall be readily available in the work area prior to start the activity • No one should be allowed to work/move on crane swing area. • Other vehicles shall not be allowed in the crane working area.	1	5	5

Work at height	Unsafe access	falling of person from height	Workmen/ Staff/Visitors	4	4	16	• Access shall be provided by Cherry picker/Man lift. • maximum two persons allowed to use the cherry picker/man lift in the same time. • Users shall be provided with full body harness and lanyard shall be anchored with the handrails. • Cherry picker/man lift legal documents shall be submitted to P&M, EHS dept. • Third party inspection shall be done for Cherry picker/man lift. • Operator should possess valid driving license with Identity card, competency and training certificate. • Outriggers/Jacks shall be fully extended if applicable. • Inspection tag shall be provided to the vehicle. • User should be familiar with the hand signaling.	1	4	4
	Inadequate width of platform, edge protection and fall protection	falling of person, materials from height	Workmen/ Staff/Visitors	5	5	25	• Adequate width of the platform shall be ensured. • Handrails, mid rails shall be provided firmly. • Gaps shall be checked to avoid man, material falling. • Toe guards shall be ensured in the platform.	1	5	5
	Inadequate anchoring arrangements for fall protection during U girder erection	Falling of person from height	Workmen/ Staff/Visitors	5	5	25	• PPE rope will be tied end to end of girder flanges in 2 or 3 layers for edge protection. • Anchoring of safety harness will be done in the exposed steel of the shear key.	1	5	5
Placing of bearing and steel plate	Usage of defective power tools, flying particles	Electrocution, cut injury	Workmen/ Staff/Visitors	5	5	25	• Guard shall be ensured in all rotating parts of the power tools. • All electrical cables shall be routed through ELCB. • Inspection tag shall be ensured. • Appropriate PPE's shall be used. • Skilled workmen shall be deployed for the activity.	1	5	5
	Using of defective crane	Vehicle collision/ person hit by crane due to brake failure, bursting of tyres etc.,	Workmen/ Staff/Visitors	5	5	25	• Crane shall be inspected by third party and certificate shall be obtained. • All crane documents shall be submitted to P&M dept. & verified. • Inspection tag shall be displayed on the crane. • Operator should check the vehicle condition on daily basis and daily operator inspection checklist shall be followed. • Tyre condition, tyre pressure should be ensured during daily inspection.	1	5	5
	Improper rigging arrangements while lifting the bearing & steel plate.	Detachment of load, toppling of crane	Workmen/ Staff/Visitors	5	5	25	• Competent riggers, signal man and lifting supervisor shall be deployed. • Safe rigging procedures shall be followed. • Load shall be secured firmly to avoid free falling. • Crane working radius and SWL shall be ensured. • Capacity of the crane shall be always considered. • Lifting frame should be tested by approved third party. • Defective tools & tackles should not be used. Walkie-talkie shall be used for signaling if required.	1	5	5
	Using of defective lifting tools	Fall of load due to Failure/ damage of tools and tackles	Workmen/ Staff/Visitors	5	5	25	• All lifting tools & tackles shall be inspected by approved third party and TPI certificates shall be available. • Visual inspection shall be carried out for tools & tackles for each lifting work by lifting supervisor/Riggers. • Color coding shall be ensured. • Defected tools and tackles shall be cut and removed from site. • Make shift arrangements shall not be entertained. • Permit system shall be followed.	1	5	5

		Lifting the bearing, steel plate without using the tag line	Load hit with other objects, man and machinery	Workmen/ Staff/Visitors	4	4	16	• Guide rope shall be used with minimum 20mm dia. • Sufficient length of guide rope shall be used. • Guide rope shall be ensured prior to start the lifting activity. • Damaged guide rope shall not be used.	1	4	4
		Improper installation method/ de-slinging without securing against fall of bearing, steel plate.	Falling of bearing, steel plate from height	Workmen/ Staff/Visitors	5	5	25	• Bearing, steel plate shall be secured firmly before de-slinging. • Spanners and other tools shall be secured from falling. • Only trained workforce shall be deployed. • Illumination level shall be ensured. • Toolbox talk shall ensure the same.	1	5	5
		Fingers Caught in between bearing and pedestal	Cut and abrasion injury, Permanent disability	Workmen/ Staff/Visitors	5	5	25	• Activity sequence shall be followed. • All workers shall be provided with cut resistance hand gloves. • Only trained workforce shall be engaged in the activity.	1	5	5
	Installa	Sub-standard securing arrangements	Falling of jacks from height	Workmen/ Staff/Visitors	5	5	25	• Jacks shall be placed near the pedestals and avoid keeping on edge of the pier caps. • If possible, Jacks shall be tied with rope to avoid falling from height.	1	5	5

	tion of mechanical jacks on pier cap for maintaining the levelling of U-Girder	Fingers caught in between the pier cap, U-girder and jacks	Cut and abrasion injury, Permanent disability	Workmen/ Staff/Visitors	5	5	25	• Activity sequence shall be followed. • All workers shall be provided with cut resistance hand gloves. • Only trained workforce shall be engaged in the activity. • Wooden sleeper or other suitable means of protection arrangements shall be provided to protect workmen in case of failure of jacks.	1	5	5

U Girder loaded trailer parking on erection spot to unload	Parking on live road without barricade the area	Vehicle hit to public/ pedestrians and vehicle collision	Workmen/ Staff/Visitors	5	5	25	• Working area shall be cordoned off. • Traffic barriers, cones and traffic marshals shall be ensured • If required traffic diversion shall be done, alternative routes shall be identified. • Unauthorized entry sign boards shall be displayed.	1	5	5
	Inadequate visibility to the operator due to poor illumination	Obstruct the operator and others visibility in the work area	Workmen/ Staff/Visitors	4	4	16	• Minimum 55 lux shall be maintained at the working area. • Backup DG shall be ensured to overcome power failures. • Dedicated electrician shall be deployed at the working area. • Activity shall not be carried out during power cut.	1	4	4
	Trailer parked on steep road, failure to provide stoppers on tyres	Trailer run over the public, workers, Trailer hit with the equipment.	Workmen/ Staff/Visitors	4	4	16	• Trailer shall not be parked on steep road. • Wedge stoppers shall be provided on trailer tyres. • Trailer driver shall be instructed about the risk involved.	1	4	4
	Person taking rest under the trailer/ persons sleeping on vehicle access	Trailer run over the workers	Workmen/ Staff/Visitors	4	4	16	• No one shall be allowed to take rest at site, access and under any vehicle. • Workmen rest room shall be provided at site. • All workers shall be instructed to take rest at workmen rest room only.	1	4	4
Lifting and erere	Unauthorized entry into the lifting zone	Falling of U girder on public, workmen	Workmen/ Staff/Visitors	4	4	16	• Lifting area shall be cordoned off. • No one shall be allowed to stand/work under the suspended load. • No unauthorized entry sign boards shall be displayed. • All workmen shall be instructed on tool box talks. • Traffic diversion plan shall be provided for each erection work separately section wise and obtain approval before commencement of activity	1	4	4
	Inexperienced lifting supervisor, riggers and signal man and operator	Fall of load, toppling of crane, struck onto another object	Workmen/ Staff/Visitors	5	5	25	• Only authorized crane operators, riggers, signal man, lifting supervisors shall be engaged in the activity. • Authorization card, identity card shall be used to the crane operators, riggers, signal man, lifting supervisors. • Only signal man will give signal to the crane operator. • Permit system shall be followed.	1	5	5

ction of U Girder	Using of defective lifting beam, tools and tackles	Fall of load due to Failure/ damage of tools and tackles	Workmen/ Staff/Visitors	5	5	25	• All lifting tools & tackles shall be inspected by approved third party and TPI certificates shall be available. • Visual inspection shall be carried out for tools & tackles for each lifting work by lifting supervisor/Riggers. • Color coding shall be ensured. • Defected tools and tackles shall be cut and removed from site. • Make shift arrangements shall not be entertained. • Permit system shall be followed.	1	5	5
	Failure of lifting tools & Tackles	Fall of load due to lifting tools & tackles failure	Workmen/ Staff/Visitors	5	5	25	• Lifting tools and tackles capacity shall be considered with respect to the lifting load. • All lifting tools & tackles shall be inspected by third party. • Visual inspection shall be done for tools and tackles before every lift. • Visual inspection shall be carried out for each lifting work by lifting supervisor/Riggers. • Color coding shall be ensured. • Defected lifting tools and tackles shall be cut and removed from site. • Make shift arrangements shall not be entertained. • Permit system shall be followed. • Erection area shall be barricaded and no unauthorized entry sign boards shall be displayed.	1	5	5
	Using of unfit cranes	Crane collapse, toppling of crane, Falling of loads.	Workmen/ Staff/Visitors	5	5	25	• Minimum each 400T capacity crane shall be engaged in the U girder erection work. • All crane documents shall be submitted to P&M, EHS dept. • Crane inspection tag shall be ensured. • TPL Vehicle aging norms shall be considered. • Crane capacity shall be considered with respect to the load and third-party inspection shall be carried out. • Maintenance shall be carried for the crane as per maintenance schedule. • Daily operator inspection checklist shall be followed. • Permit system shall be followed.	1	5	5
	Overload the cranes	Crane collapse, toppling of crane, Falling of loads.	Workmen/ Staff/Visitors	5	5	25	• Tandem lifting shall be adopted for the U girder erection work. • SWL shall be reduced at least 25% while load calculations for tandem lifting. • Crane capacity shall be considered with respect to the load and third-party inspection shall be carried out. • Minimum each 400T capacity crane shall be engaged in the U girder erection work. • SWL and working radius shall be ensured as per the load chart. • Pre lift checklist shall be prepared and Permit system shall be followed. • Crane inspection tag shall be ensured. • Competent lifting team shall be engaged.	1	5	5
	Extend the boom while lifting	Crane boom collapse	Workmen/ Staff/Visitors	5	5	25	• Boom limit switch & hoist limit switch shall be checked. • Safe working load shall be checked as per the load chart for the particular boom length before extending the crane boom. • Crane operator should aware of the load calculation and load chart.	1	5	5
	Unauthorized person operates the crane	Vehicle collision/ person hit by crane	Workmen/ Staff/Visitors	5	5	25	• Crane operator should possess valid driving license, operator competency certificate. • Do not leave the key in cabin during shift change. • Unauthorized person should not be operating the crane under any circumstance.	1	5	5
	Inadequate illumination on lifting zone	Obstruct the operator and others visibility in the lifting zone	Workmen/ Staff/Visitors	4	4	16	• Minimum 55 lux shall be maintained at the working area. • Backup DG shall be ensured to overcome power failures. • Dedicated electrician shall be deployed at the working area. • Activity shall not be carried out during power cut.	1	4	4

		Poor maintenance of crane, hydraulic system, electrical system	Fire, Mechanical failures, short circuits.	Workmen/ Staff/Visitors	4	4	16	• Maintenance of crane shall be ensured as per the maintenance schedule. • All hydraulic hoses shall be connected firmly. • Oil leakages shall be cleaned immediately inside the crane. • Bare electrical cable connections not allowed in the crane. • Fire extinguishers, first aid box shall be ensured in operator cabin.	1	4	4
		Excessive wind while lifting activity	Crane boom collapse, toppling of crane	Workmen/ Staff/Visitors	5	5	25	• Anemometer shall be fixed in the crane to monitor the wind speed. • Crane booms shall be kept in down position during excessive wind. • No lifting activity permitted during excessive wind situations. • Gluing of wedge plates shall be done with extra support of wooden packing provided near the pedestal area for additional safety precautions.	1	5	5

	Restoration of erection area	Oil leakage/ spillage of muds, unsecured barricade boards, failure to restore the barricade, unwanted materials lying on the road, unprotected or unauthorized parking of construction equipment	Skidding of bike riders, falling of barricade on road, public vehicle may enter into the construction area, impaling hazards, vehicle collision	Workmen/ Staff/Visitors	5	5	25	• If any oil leakage and mud spillage observed on road, it should be cleaned before allowing the traffic. • Barricade boards shall be restored and ensured with adequate securing arrangements. • Before allowing the traffic, all materials shall be stacked within the barricade in proper manner. • Before allowing the traffic, our construction vehicle shall be parked within barricade or else barricade around the vehicle to avoid endangering to the public road users. • Adequate illumination shall be ensured after work completion too for traffic users. • Vehicle shall be parked at adjacent side of the road with adequate precautions (Barriers, warning signs, retro reflective warning signs of parking etc.,).	1	4	4

	PRECAUTIONTOBETAKENBEFOREMONSOON	Unattended loose materials, using of damaged cables, improper cable routing, Sub-standard electrical installations, unprotected excavation pit, uncleaned drains, un-compacted ground surface, uncovered drinking water tank, water stagnation, inadequate illumination,	Electrical Shock, Electrocution, soil collapse, soil sliding, Vehicle collapse, drowning, Mosquito breading	Workmen/ Staff/Visitors/ Public	5	5	25	• Check no loose material (i.e. any scraps in the form of GI Sheet, wooden planks, nut & bolts pieces of pipes etc.) is left unsecured and kept at height. • Check all power/welding cables for joints and provide standard insulations if required. Tie all loose cables firmly and remove all unused cables. • Lay all power cables/welding cables over head or under the ground as applicable to avoid its contact with water. • Ensure proper earthing of all equipment's and electrical appliance. • Keep all the outlets and installations at a higher elevation and arrange sheds for all electrical outlets (Panel Boards, Ext. Boards, Welding Machines, Winch Machines etc.). • All the electrical loads will be routed through ELCBs / RCCBs and MCBs / Rated fuse wires. Ensure the functioning of ELCBs/RCCBs at 30 mA and below by inspection through ELCB tester. • Disconnect computers and other delicate electronic equipment. Consider attaching surge protectors to such equipment. • Slopes of all embankment areas shall be thoroughly protected from rain cuts & all excavated pit slopes are to be protected. • Protect the edges of the excavated pits. Keep the excavated earth away from the pits. • Heavy vehicles shall not be allowed near the excavation edge. • All drains shall be checked for any clogging and cleared in advance. Ensure to provide additional/ temporary drains for easy discharge of sudden runoff water. • Make approach roads compacted. The road surface should not have potholes and should not be uneven. Provision of edge markers to be ensured. • Provision of parking the vehicles and earth moving equipment's to be made at a compacted location. • Cover the drinking water tank very carefully. Drinking water should not be contaminated by other sources of water. • Pest control measures should be ensured. • Arrange sufficient lights for night work and also keep few battery-operated lights in working condition. • Use of Diesel operated de-watering pumps should be mandatory in place of electrical operated pumps. • Sufficient number of rest shelter as per site condition must be ensured. • Preplan monsoon specific PPE requirements like raincoat, gum boots, electrical hand gloves etc. so that it would be available by time. • Ensure all materials are kept over compacted area. • All high mast equipment shall be properly earthed or mast shall be lowered to the ground level in case if rain or storm is expected to come. • Monsoon emergency Team shall be identified and readily available to cater the onsite or offsite emergency situation in Monsoon period. • Local Meteorological department should be liaised on daily basis together weather forecast. Weather updates can be accessed from http://www.imd.gov.in/. Also, dial Toll Free Number 1800 180 1717 for IVRS based Weather Information on Landline phones.	1	5	5

DURING THE RAIN AND THE STORM	Unprotected electrical devices and equipment's, workmen engaged for height during rain, lifting and erection activity carrying out during rain, contact with metal objects, working at elevated location, work in the vicinity of power lines,	Electric shock, Electrocution, Slip, trip and fall from height, failure of lifting appliances during rain, contact with electrical parts and induction range, burn injury due to lightning	Workmen/ Staff/Visitors/ Public	5	5	25	• Switch off the power supply. • Protect all electrical equipment's from water entering it. • Restrict all work at height activities. • Restrict all lifting and erecting activities. • Avoid using the telephone / mobile phones, except on emergency cases. • Avoid in contact with metal objects or under wide & open areas such as fields and open yard. • Stay off hilltops and other high points of land like trees telephone poles and electrical poles. • In case of thunderstorm, get to the lowest point of ground you can, and kneel or squat to minimize your contact point. • Stay away from downed power lines. • Try to get inside a shed. Flying debris can cause injury. • Evacuate the employees/Workers from the risky areas when any catastrophe is noticed. • Don't take rest under any crane.	1	5	5
AFTER THE RAIN AND THE STORM	Power line snapped and fallen onto the vehicle, try to rescue the person in unsafe manner, without checking power restoration, without inspection allowing for height work, allowing workmen to work in the pool of water	Electric shock, Electrocution, fall of person, scaffold collapse, drowning of workmen	Workmen/ Staff/Visitors/ Public	5	5	25	• If the power line has fallen on any vehicle while you're in it, don't touch anything metal and stay inside until professional help arrives. • Never try to help someone trapped by a power line. You endanger your own safety. Inform concern authority. • Always check all power supply sources first for any damage before starting any job. • If power lines and poles are down in yard or in the site, always treat them as if they are energized and dangerous. Never touch them! Stay away. Call the electrician to report the location so that repairs can be done as soon as possible. • Be alert for damaged plugs and cords on electrical appliances and fixtures. Don't touch or use them if they are damaged. • No height work immediately after a heavy rain or storm. • Scaffolding must be inspected by site engineer along with Quality and EHS person before use. • Stay away from metal fencing (Metal fences could become electrified by a downed wire. Be very careful, especially after a storm). • Clear the water bodies where rain water is accumulated on the existing IR track operation to prevent malfunctioning of IR signals (as applicable).	1	5	5
EL	Short circuit	Fire		3	5	15	• Check for Water Ingress before switching On	1	5	5

	ELECTRICAL	Leakage of current to the outer surface of machineries	Electric shock and Electrocution	Workmen/ Staff/Visitors/ Public	5	5	25	• Proper body earthing to discharge leakage currents	1	5	5
		Malfunctioning of ELCB/RCCB and earthing arrangements			5	5	25	• Periodic inspection and testing	1	5	5
		Cable joints			5	5	25	• To be replaced with continuous cables or to be connected by Male/Female plugs.	1	5	5
		Using power tools during rain			5	5	25	• To be avoided or usage to be restricted to covered areas	1	5	5
		Welding in wet condition		Workmen/ Staff/Visitors/ Public	5	5	25	• Welding to be restricted to dry components & under shed	1	5	5
		Obstacles to reach electrical installations	Increase the severity of victim		3	5	15	• Housekeeping and Making access obstacle free	1	5	5
		Ingress of water into cable joints, electrical machineries and installations	Electric shock/ Electrocution		5	5	25	• Electrical machineries and installations to be kept under shed and shutdown of all electrical machines to be ensured for drying out the same in case water entered inside.	1	5	5
		Moisture atmosphere inside electrical installations and machineries		Workmen/ Staff/Visitors/ Public	5	5	25	• Shutdown of all electrical machines and dry it out	1	5	5
		Earth pit without identification and inspections			5	5	25	• Identification and regular inspections	1	5	5
		Increase of induction zone of high tension lines			5	5	25	• Prevention of Soil fillings below OHE lines	1	5	5
	EXCAVATION	Unprotected excavation from soil sliding	Person trapping in sliding soil	Workmen/ Staff/Visitors/ Public	4	4	16	• Slopes shall be protected by safety nets	1	4	4
		Hidden cracks	Soil Collapse		4	4	16	• Whole excavated area to be inspected thoroughly after rainfall	1	4	4
		Entry of runoff water inside pit	Soil Erosion/Sliding/ Collapse		4	4	16	• Entry of runoff water to be avoided by making proper drains around the pit	1	4	4
		Unwanted excavated pits	Drowning of workmen/water stagnant		3	4	12	• Unwanted excavated pits shall be backfilled	1	4	4
		Fall of persons, vehicles or materials inside pit	Drowning /hit by pile rebar/workmen hit by falling materials	Workmen/ Staff/Visitors/ Public	3	4	12	• No materials shall be kept close to the excavation edges and vehicle/person movement to be avoided near the edge by doing hard barricading well away from the edge and display warning tape & red light	1	4	4

	Unintended/unauthorized entry to the pit	Fall of person /drowning/hit by pile rebar.		3	4	12	• All unintended entry points to be closed	1	4	4
TRAFFIC MANAGEMENT & SITE VEHICLE MOVEMENT	Slushy road condition	Vehicle collision/vehicle skidding	Workmen/ Staff/Visitors/ Public	4	4	16	• Periodic checking of Vehicles (Vehicles carrying loose earth to have a sealed rear flap)	1	4	4
	Increase in braking distance	Vehicle collision		3	4	12	• Driver needs to be trained for defensive driving	1	4	4
	Skidding	Major injury		4	4	16	• Slow Driving, Avoid muddy roads	1	4	4
	Invisible puddles and ditches	Vehicle collision/fall of two wheelers/toppling		4	4	16	• Avoid un known routes and place bright caution boards on known areas	1	4	4
	Poor visibility during shower and lesser level of illumination	Vehicle collision /hit road users	Workmen/ Staff/Visitors/ Public	3	4	12	• Vipers and parking lights should be maintained Healthy	1	4	4
	Fragile excavation edges (a threat for heavy vehicles and locomotives)	Collapse /Toppling of vehicle		3	4	12	• Barricading with indicative tapes and keep away from excavation edges	1	4	4
WATER LO	Invisible trench /ditches/drains/pits	Vehicle collision /fall of two wheelers	Workmen/ Staff/Visitors/ Public	3	4	12	• Placing of bright Warning signs	1	4	4
	Overflowing drains or chocked drains	Water stagnant/traffic congestion/drowning		4	4	16	• Removing and cleaning of drains	1	4	4

GGING	Obstacles to reach temporary sheds	Drowning		3	4	12	• Housekeeping and Making access obstacle free	1	4	4
	Collapse of excavations wall and formation of unseen cave-ins	Person entrapping in pit/adjacent road collapse	Workmen/ Staff/Visitors/ Public	4	4	16	• Step cutting/benching during excavation and use of sand bags to protect Excavation pit walls	1	4	4
	Accumulation of water inside pit	Soil collapse/drowning		4	4	16	• Continuous dewatering to be ensured.	1	4	4
WORKATHEIGHT	Unbalance due to high wind speed	Fall from height	Workmen/ Staff/Visitors/ Public	3	4	12	• No work to be undertaken when speed of wind is high	1	4	4
	Unbalance due to slippery surface	Fall from height		4	4	16	• No height work immediately after a heavy rain or storm	1	4	4
	Unbalance due to panic during retreat / evacuation.	Fall, slip & trip		3	4	12	• Specific DYNAMIC HIRA TALK for maintaining Calm during Emergency	1	4	4
	Scaffold collapse (bad ground, high wind, vehicle infringement)	Fall of scaffolding on site team & road users	Workmen/ Staff/Visitors/ Public	4	4	16	• More frequent checks on scaffold bases and supports	1	4	4
	Roof works (improper roof sheet fixing and stacking)	Flying of roof sheet in heavy wind		3	4	12	• Ensure no loose sheets are remaining	1	4	4
LIFTINGAPPLIANCES	High mast and booms conducting lightning arcs	Electrocution	Workmen/ Staff/Visitors/ Public	4	4	16	• High boom equipment to be stopped during lightning time and boom to be lowered at ground level if possible	1	4	4
	Slippery brake shoes (e.g. tyre mounted crane)	Hit & collision		4	4	16	• Maintenance checks to be more frequent	1	4	4
	Rusting of unpainted parts due to moisture	Collapse of load	Workmen/ Staff/Visitors/ Public	4	4	16	• Periodic painting	1	4	4
	Un-insulated control levers	Failure of levers		3	4	12	• Metal levers to be properly insulated	1	4	4

	Soft ground condition	Toppling	Workmen/ Staff/Visitors/ Public	4	4	16	• Use metallic plate sufficient thickness & also compact the ground	1	4	4
	High wind situation (affecting booms / mast /jibs / towers)	Toppling		4	4	16	• High boom equipment to be stopped during High-speed wind situation	1	4	4
LIGHTNING	Rest sheds near tall structures	Electrocution	Workmen/ Staff/Visitors/ Public	4	4	16	• Prevent movement of personal outdoors during lightning	1	4	4
	Taking shelter near tall metallic structure or trees			4	4	16	• Ensure shelters and structures are earthed for lightning protection	1	4	4
	Toppling of trees			4	4	16	• Avoid movement near trees during high-speed wind condition	1	4	4
	Tall structures without proper grounding as per statutory guidelines		Workmen/ Staff/Visitors/ Public	4	4	16	• Grounding of tall structured shall be ensured as per statutory guidelines	1	4	4
	Lightning strikes			4	4	16	• No loitering in the open area	1	4	4
SERPENTS AND VENOMOUS INSECTS	Un Known Hideouts	Snake & insect bite	Workmen/ Staff/Visitors/ Public	3	4	12	• Storage spaces to be kept clean and well ventilated	1	4	4
	Corners			3	4	12	• To be open and visible	1	4	4
	Risk of Insect bites			3	4	12	• Make noise while accessing remote, dark and dry corners. Pest control to be done before entering into abandoned places having threat of insects.	1	4	4
	Cement go-downs			3	4	12	• Proper protection and ventilation	1	4	4
	Sprinkling of repellents		Workmen/ Staff/Visitors/ Public	3	4	12	• Periodical use of Carbolic acid & naphthalene balls	1	4	4
	Availability of anti-venom aids			3	4	12	• To be ensured as part of First aid kit or Tie up with local medical shop / hospital for storage.	1	4	4
	Poor illumination			3	4	12	• Sufficient illumination shall be ensured in all working areas. • Emergency illumination system at site.	1	4	4

	HEALTH AND WATERBORNE DISEASES	Low quality Drinking water due to contamination	Illness & affected by diseases	Workmen/ Staff	2	3	6	• Drinking water to be distinctly identified, Containers need to be cleaned and kept covered. • Drinking water sampling.	1	3	3
		Unhygienic Sanitation		Workmen/ Staff/Visitors	2	3	6	• Frequent maintenance of sewage lines, toilets. • Anti lava sprays, regular cleaning.	1	3	3
		Unavailability of rain protection suits, gumboots, etc.			2	3	6	• Make monsoon specific PPE requirements fulfilled by doing prior planning. • No work without adequate rain protection.	1	3	3

Earthwork-Excavation Levelling by Man & machinery	Using of faulty Equipment	Person hit by vehicle, vehicle collision, Run Over, Fire	Workmen/ Staff/ Public	3	5	15	• Before commencement of work SSE and P&M Engr. check the fitness of equipment with respect to safety aspects. • Only equipment's which are fit are allowed for deployment. • Daily pre-use checklist shall be followed operator and P&M engineer shall be verified the same on regular basis	1	5	5
	Unauthorized operator	Person hit by vehicle, vehicle collision & Toppling, Run Over,	Workmen/ Staff/ Public	3	5	15	• Get operator's certificate & check validity of the license before engaging work. • Operator Identity system shall be followed	1	5	5
	People resting under vehicle.	Run over	Workmen/ Staff/ Public	3	5	15	• Delay mechanism should place & Maintain mechanism well and good. Providing rest shed for the workmen. • Helper must be provided for all the construction vehicle and he shall inspect before starting the vehicle and guide the vehicle while reversing.	1	5	5

	Damage to underground electrical, Telecom cables and water services.	Contact with electrical power, Utility damage	Workmen/ Staff/ Public	3	5	15	• Get the clearance from concern dept. (Govt. Or Client) & Work permit system to be followed. • PPE'S must be worn by all personnel against electric shock. • Expose the utilities manually with power off / insulated materials before giving clearance. • Follow Excavation clearance permit system. • Look for route markers Make trail pits in case of doubt. • Look for warning tapes/ cable covering mats/ concrete saddles/ sand padding. • Adhere strictly to manual excavation in case of presence of underground cables. • Competent supervision • Provide related warning signs • Consult with local authorities • In case of any damage occurred immediately inform to concerned authority to avoid the emergency situation/ more consequences	1	5	5
	Overhead lines	Contact with electrical power	Workmen/ Staff/ Public	3	5	15	• Erecting goal post with warning signs. • Restricting the vehicle movement by fencing. • Line clearance to be obtained for particular section form authority & it must be in written form • Consider the induction range of power lines and keep off away for men/material • Survey straps shall only be used non-conductivity materials(wood/fiber)	1	5	5
	Vehicle movement near the edge of excavation	Toppling of vehicle into excavation pit and fall onto workmen	Workmen/ Staff/ Public	3	5	15	• Provide hard barication with min clearance of 2m from the excavated pit. • Ensure adequate illumination, & danger lighting. • Post reflective warning signs & blinkering lights to highlight deep excavation • Deploy trained banks man. • While excavation work, safety cones and waterfilled barriers to be provided on road side to avoid any mis-happening • Ensure the stability of traffic barricade boards and ensure minimum distance to barricade boards from edge of the excavation	1	5	5
	Walking / Working near the edge of excavation	Fall of person into the excavation pit	Workmen/ Staff/ Public	3	5	15	• Keep away from the edge of the excavation. • Provide barrier at least 1m away from the edge of excavation • Provide warning sign boards for deep excavation and warning tapes. • Ensure the safe access availability or otherwise access shall be closed at inside the barricade • Public entry will be prohibited into construction premises.	1	5	5
	Excavated soil, boulders, stones and other loose materials stacked on edge of the excavation	Fall of objects (stone, boulder, soil barricade boards etc.) into excavated pit	Workmen/ Staff/ Public	4	4	16	• Competent operators. No entry into the pit during excavation. • No materials shall be stacked at edge of the pit. Min 1.5m clearance shall be given and at the same time soil shall not be dumped on barricade boards. • Ensure the stability of traffic barricade boards and ensure minimum distance to barricade boards from edge of the excavation	1	4	4
	Dust	Air Pollution	Workmen/ Staff/ Public	4	3	12	• Sprinkle water at regular interval according to weather conditions • Use dust mask and goggles. • Cleaning work shall be done at regular interval at road side and inside the site. • Wheel washing facility shall be provided or manual cleaning shall be done and ensuring that vehicle before entering into public road shall be cleaned	1	3	3
	Congested work site; too many persons working in the pits or trenches.	Hit by objects & Tools, Slip, Trip and Fall, fall of person while ingress and egress	Workmen/ Staff/ Public	4	3	12	• Train for safe use of hand tools, and safe manual working procedures. • Strict supervision, Provide adequate no. of emergency access so that workmen can access it and reach out of excavation. • Allow only minimum required number of persons to work at the same time. • Ensure illumination level more than 55Lux	1	3	3

	Earth moving equipment operation and reversing	Person hit by vehicle/ Run Over	Workmen/ Staff/ Public	3	5	15	• Keep distance of minimum 5 M between two equipment's while in use. • Use only authorized equipment's and deploy experienced operators. • Check for overhead lines, ensure safe overhead distance can be maintained otherwise suspend the activity. • Provide trained banks men. • Ensure vehicle having safe worthiness certificate. • Ensure the availability of reverse horn and its audible level.	1	5	5
	Un-noticed hazard area	Fall of person, contact with energized equipment & Moving machinery etc.,	Workmen/ Staff/ Public	3	4	12	• Ensure illumination level more than 65lux • No entry sign boards shall be provided. • Barricade the area and controlled access shall be provided. • Hazardous area shall be isolated from personnel movement.	1	4	4
	Vehicle parking at inclined surface, no hand brake	Run over, Toppling, Collision of vehicle	Workmen/ Staff/ Public	3	5	15	• Barricading with Tape & Hard Barricade with reflective signage. • Provide vehicle stopper, put the hand brake while loading the vehicle • Driver shall be staying on vehicle cabin only • Helper shall be stand on rear of the vehicle and monitoring the loading • Speed limit as per our site premises to be followed	1	5	5
Dumping	Over loading of vehicles, Flying of Materials on the road	Bursting of tyres, failure of vehicle structure	Workmen/ Staff/ Public	3	4	12	• Restriction on load limits with the capacity of the vehicle. • Loading above the body height is avoided. • Soil shall be covered with plastic tarpaulin and tied on each corner • If any spillages on road side immediately clear	1	4	4
	Reversing of the vehicles	Run over, person hit by vehicle, vehicle collision	Workmen/ Staff/ Public	3	4	12	• Reverse horn shall be provided. • Trained banksman shall be deployed at dumping sites. • Ensure compliance through inspections	1	4	4
	No segregation of access for personnel and vehicle movement	Run over, person hit by vehicle	Workmen/ Staff/ Public	4	4	16	• Un-authorized persons and visitor should not be allowed with in the critical area. • Ensure the reverse horn for vehicle • Traffic marshal and helper shall be monitoring the personnel movement	1	4	4
	Entering into the public roads	Public hit by construction vehicle, Vehicle collision with public	Workmen/ Staff/ Public	4	4	16	• Post adequate signage to caution upcoming vehicles. • Trained traffic marshal shall be deployed. • Defensive driving training shall be imparted to drivers.	1	4	4

Manual Excavation and GSB laying	Lack of access Stack of material/ earth	Fall of person and fall of materials	Workmen/ Staff/ Public	4	4	16	• Material / earth shall be stacked 1.5m from the edge of the excavation. • Access ladder shall be so place, that workmen is able to access it at 15m reach. • Ensure excavation pit free from cave in, cracks and water seepages • Restrict the vehicle movement near be excavation pit while person working on pit	1	4	4
	Defective ladder	Fall of person	Workmen/ Staff/ Public	3	4	12	• Monthly inspection of ladders shall be done and discarding / removing the defective ladders from use if any. • Site Inspection should be carried out regularly.	1	4	4
	Using of hand tools for excavation without insulation	Contact with electrical supply	Workmen/ Staff	4	5	15	• Please refer the Method statement and risk assessment of Utility identification activity.	1	5	5
Backfilling	Unfit or faulty equipment's, unmanned vehicle reversing, Unauthorized driver/operator	Run over, Person hit by vehicle, Vehicle collision	Workmen/ Staff/ Public	4	5	20	• Area of the backfilling shall be cordoned with safety barricading tape • One signalman shall be posted to prevent the person coming in the backfilled area • All the workers associated with the backfilling shall wear safety helmet. Safety shoes and safety reflective vest and other PPEs required • Only authorized operator has been engaged. • Unauthorized entry restricted. • Condition of Vehicle is being checked on a periodical basis. • Reverse Horn are provided to all the vehicles. • Closed Supervision are ensured. • Prohibit people from sleeping or taking rest in the site • While reversing the vehicles at work site helpers should guide the vehicle and workmen on the ground. • Area lighting shall be ensured with min. 55lux.	1	5	5

	Unfit or faulty equipment's, unmanned vehicle reversing, Unauthorized driver/operator, Vehicle plying near the edge of the excavation, non providing of stoppers or wedges	Toppling of vehicle		4	5	20	• Back door lock of the dumper must be opened before unloading. • All vehicles shall be kept away at least 2 mtr. Away from the excavated edge. • Adequate Stop blocks shall be provided on the surface to prevent operating vehicles from falling accidentally into the excavation pit. • Helper must be engaged to guide the dumper.	1	5	5

Shifting of material from site to site (By using hydra crane & trai	1.Unauthorized operating of vehicle 2. Carrying unauthorized passengers 3. Inadequate space for access/ egress 3. Intoxicated drivers	Person hit by vehicle, vehicle collision, Run Over,	Workmen/ Staff/ Public	3	5	15	• Area survey to be done before moving of crane • Medical fitness of crane operator shall be checked. • Designated persons are only allowed to travel in the cabin of trailer, crane • The space for access and egress should be proper, clear and adequate	1	5	5

ler)										
Manual material handling	1.Improper stacking of material 2. Body injury	Dislodge of improper stacked material Pinching of legs/hands while handing of materials	Workmen/ Staff/ Public	3	5	15	• Materials to stacked properly in order to avoid dislodge • Use of hand gloves during materials handling. All mandatory PPEs shall be used at site. • Prior checking of belt slings or wire rope slings, D – shackles etc.	1	5	5
Gas cutting activity	1. Improper unloading process 2. Improper storage of cylinders	Damage of cylinder resulting fire. Sudden fall of untied cylinders. Hand or leg injury Fire, burn injury while using at site	Workmen/ Staff/	3	5	15	• Cylinders should be kept at upright directions only. • Providing flash back arrester each side of gas cutting sets. • Keep fire extinguisher available ready at site	1	5	5

	Welding activity	1.Improper electric connection 2. Welding fumes 3. Welding spark	Electrocution Health Hazard Fire Hazard	Workmen/ Staff/	3	5	15	• Welding goggles shall be provided to welders for eye protection. • Area shall be cleared of flammables and combustibles before commencing welding. • Cables need to be checked along with plug.	1	5	5
	Grinding activity	1. Breaking of grinding wheel 2. Poor electrical connection 3. Cover of grinding wheel	Electrocution Struck by dislodged grinding wheel	Workmen/ Staff/	3	5	15	• All the grinding machines shall be used with wheel guard • Check expires date of grinding wheel and use approved product of wheel	1	5	5

	Work in confined space	1.Insufficient Illumination 2.Presence of Toxic gases 3.Confined space 4. Less presence of oxygen	Health hazard Difficult to work with tools under less illumination Tough to rescue during untoward incident if any Less supply of air for respiration	Workmen/ Staff/	3	5	15	• Sufficient illumination should be provided • Confined area work permit will be used • Portable blower to be used for sufficient air supply • Portable gas monitoring gadgets are to be used in order to determine any toxic gases	1	5	5

	Staying at Camp/ Accommodation	Respiratory illness caused by COVID-19 Infection that may lead to fatality)	• Transmission of COVID-19 through gatherings, walking by or simply being in the same room with the person who's experiencing symptoms of COVID-19 (fever, cough, difficulty in breathing) • Transmission through droplets from a close contact with a possible COVID-19 infected person. • Transmission of COVID-19 through usage of common drinking water station such as igloo/water dispenser. • Unsensitized things such as door knobs, tables, chairs, floors room or welfare facilities. • Lack of sufficient numbers of cleaners and cleaning materials. • Lack of awareness on how to protect yourself against the infection of COVID- 19.	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Nearby Public	5	5	25	• Reporting employees who are showing symptoms such as fever or high body temperature, coughing, difficulty of breathing or chest pain. Sending them to camp clinic or report as per Guidelines of IMA & WHO guidelines immediately. • Body temperature monitoring through Thermal Scanner or other devices to monitor the body temperature of each employee at camp/accommodation. • Awareness and implementation of Quarantine Guidelines of IMA & WHO. Guidelines immediately. for all employees who came back from vacation. • Implementing safe distancing (at least 2meter) on camp/accommodation, workplace area, Mess Hall, Rest Shelters and other Welfare Facilities to avoid spreading of the virus. - No Hand Shake. • Suspension of meetings/gatherings for certain period of time. • Conduct regular housekeeping and sanitation for all area. • Provision of Hand Sanitizer / Alcohol /Hand Wash Materials. Including proper sanitation/pest control and cleaning/disinfecting of camp premises and welfare facilities. • Provide sufficient numbers of cleaners to cover all area and sanitize all parts of the camp/accommodation. • Provision of adequate PPE's (N95 face mask & disposable hand gloves). • Conduct awareness on how to protect yourself against the infection of COVID19 through campaign (posters, distribution of brochure, HSE Messages). • Communicating and implementing COVID-19 Guidelines of IMA & WHO. guidelines immediately. • Implement self-quarantine (staying inside their respective room and only going out for necessary activities) for all employees at camp/accommodation. • Provision of individual bottled drinking water to avoid usage of common water containers that can cause transmission of the coronavirus. • Helpline number for Maharashtra 020-26127394 or contact site administrative office or medical team if you feel any symptoms.	1	5	5

	2. Transportation from camp to site and vice versa using transportation vehicle	Health Hazard (Respiratory illness caused by COVID-19 Infection that may lead to fatality)	• Transmission of COVID-19 through gatherings or simply being in the same place/area (entrance or exit gate) with workers who's experiencing symptoms of COVIDH 19 (fever, cough, difficulty in breathing) • Transmission through droplets from a close contact with a possible COVID-19 infected person. • Unsensitized parts of the Log-in/Log-out devices such as biometrics. • Lack of awareness on how to protect yourself against the infection of COVID19	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Nearby Public	5	5	25	• All drivers have been given awareness to follow strict precautions on personal hygiene, including proper hand wash procedures and provision of portable sanitizer. All Bus and Car vacant seats must be present, which forms a space between passengers. • No Hand Shake • Conduct regular housekeeping and sanitation for all transport vehicle (company owned or personal). • Provision of adequate PPE's (N95 face mask & disposable hand gloves). • Conduct awareness on how to protect yourself against the infection of COVID19 through campaign (posters, HSE Alerts, HSE Messages). • Communicating and implementing COVID-19 Guidelines. • Reporting employees who are showing symptoms such as fever or high body temperature, coughing difficulty of breathing or chest pain. Sending them to camp clinic or report as per Guidelines of IMA & WHO. Guidelines immediately. • Ensure the elimination of all types of bacteria and viruses inside the bus, cars and to obtain the highest levels of protection in the seats and bus handles and its internal facilities. • Suspension of work for 14 days or deploy skeletal force (reducing numbers of employees at work) in order to continue with the operation. • Additional transport vehicle shall be provided to prevent overcrowding maintain the social distancing inside the vehicle. • Transportation can be done in two rounds if required. • Helpline number for Maharashtra 020-26127394 or contact site administrative office or medical team if you feel any symptoms.	1	5	5

such as passenger bus and cars										
Entering and leaving the project site	Health Hazard (Respiratory illness caused by COVID-19 Infection that may lead to fatality)	• COVID-19 through gatherings or simply being in the same place/area (entrance or exit gate) with workers who's experiencing symptoms of COVID-19 (fever, cough, difficulty in breathing) • Transmission through droplets from a close contact with a possible COVID-19 infected person. • Unsensitized parts out devices such as biometrics. • Lack of awareness on how to protect yourself against the infection of COVID-19.	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Nearby Public	5	5	25	• Reporting employees Reporting employees who are showing symptoms such as fever or high body temperature, coughing, difficulty of breathing or chest pain. Sending them to camp clinic or report as per Guidelines of IMA & WHO. Guidelines immediately. • Alcohol based hand sanitizer or hand washing facility for hand hygiene is available at all offices and workplace. • Body temperature monitoring through Thermal Scanner or other devices to monitor the body temperature of each employee entering in the workplace. • Cover mouth/nose when coughing or sneezing either with paper tissue or inner elbow and dispose of used tissue paper in the waste bin. • Awareness and implementation of Quarantine Procedure (Guidelines of IMA & WHO. Guidelines immediately for all employees who came back from vacation. • No Hand Shake Policy. • Conduct regular housekeeping and sanitation for all access/egress points. • Provision of adequate PPE's (N95 face mask & disposable hand gloves) and training on appropriate use. • Conduct awareness on how to protect yourself against the infection of COVID19 through campaign (posters, HSE Alerts, HSE Messages). • Communicating and implementing COVID-19 Guidelines of IMA & WHO. Guidelines immediately. • Suspension of work for 14 days or deploy skeletal force (reducing numbers of employees at work) in order to continue with the operation. • Helpline number for Maharashtra 020-26127394 or contact site administrative office or medical team if you feel any symptoms. • Displaying awareness material for emerging infections and preventive measures like hand hygiene and cough etiquette • Continuous update for the triage staff especially in the event of emerging / re-emerging infections of public health importance including Identification of suspected case as a clinical syndrome and if there is any epidemiological factors and management algorithm.	1	5	5

Routine Site Activities	(Respiratory illness caused by COVID-19 Infection that may lead to fatality)	• Transmission of COVID-19 through, meetings/gatherings, walking by or simply being in the same room with the person who's experiencing symptoms of COVID-19 (fever, cough, difficulty in breathing)	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Near By Public	5	5	25	• Prior to commencing the work all offices, handles, walk way, Table, store daily use materials to be sanitized. • Reporting employees Reporting employees who are showing symptoms such as fever or high body temperature, coughing, difficulty of breathing or chest pain. Sending them to camp clinic or report as per Communicating and implementing COVID-19 Guidelines of IMA & WHO. Guidelines immediately. • Body temperature monitoring through Thermal Scanner or other devices to monitor the body temperature of each employee entering the site. Awareness and implementation of Quarantine Procedure for all employees who came back from vacation. • Implementing safe distancing (at least 2 meter) on workplace area, Mess Hall, Rest Shelters and other Welfare Facilities to avoid spreading of the virus. • No Hand Shake Policy. Suspension of meetings/gatherings for certain period of time. • Suspension of Toolbox Talk and Awareness Training Sessions for a certain period of time. • Conduct regular housekeeping and sanitation for all area. Provision of Hand Sanitizer / Alcohol / Hand Wash Materials. Including proper sanitation/pest control and cleaning/disinfecting of welfare facilities, as well as vehicles/equipment's used at site. • Provision of adequate PPE's (N95 face mask & disposable hand gloves). • Conduct awareness on how to protect yourself against the infection of COVID19. • Suspension of work for 14 days or deploy skeletal force (reducing numbers of employees at work) in order to continue with the operation. • Provision of individual bottled drinking water to avoid usage of common water containers that can cause transmission of the coronavirus.	1	5	5
Housekeeping	Health Hazard (Respiratory illness caused by COVID-19 Infection that may lead to fatality	• Transmission of COVID-19 through Gatherings, walking by or simply being in the same activity area with the person who's experiencing symptoms of COVID-19 (fever, cough, difficulty in breathing) • Transmission through droplets from a close contact with a possible COVID-19 infected person. • Transmission of COVID-19 through usage of common drinking water station such as igloo/water dispenser. • Unsensitized part of the offices, welfare facilities and equipment's that is being used by several workers. • Lack of awareness on how to protect yourself against the infection of COVID-19.	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Near By Public	5	5	25	• Reporting employees who are showing symptoms such as fever or high body temperature, coughing, difficulty of breathing or chest pain. Sending them to camp clinic or report as per Communicating and implementing COVID-19 Guidelines of IMA & WHO. Guidelines immediately. • Body temperature monitoring through Thermal Scanner or other devices to monitor the body temperature of each employee entering the site or at camp. • Implementing safe distancing (at least 2 meter) on workplace area, Mess Hall, Rest Shelters and other Welfare Facilities to avoid spreading of the virus. • Suspension of meetings/gatherings for certain period of time. • No Hand Shake Policy. • Conduct regular housekeeping and sanitation for all area. Provision of Hand Sanitizer / Alcohol / Hand Wash Materials. Including proper sanitation/pest control and cleaning/disinfecting of offices, workplace area, welfare facilities, as well as vehicles used at site. • Provision of adequate PPE's (N95 face mask & disposable hand gloves). • Conduct awareness on how to protect yourself against the infection of COVID19 through campaign (posters, distribution of brochure, HSE Messages). • Communicating and implementing COVID-19 Guidelines of IMA & WHO.	1	5	5

	General	Health Hazard (Respiratory illness caused by COVID-19 Infection that may lead to fatality	• Transmission of COVID-19 through Gatherings, walking by or simply being in the same activity area with the person who's experiencing symptoms of COVID-19 (fever, cough, difficulty in breathing) • Transmission through droplets from a close contact with a possible COVID-19 infected person. • Transmission of COVID-19 through usage of common drinking water station such as igloo/water dispenser. • Unsensitized part of the offices, welfare facilities and equipment's that is being used by several workers. • Lack of awareness on how to protect yourself against the infection of COVID-19.	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Nearby Public	5	5	25	• Adequate information to be given all the employees through emails, display posters, notices etc. • All receiving materials to be kept in isolate places for certain hours as per specification of materials to reduce the risk of contact and impact of virus and disease. In Site store area a separate isolated area will be provided, Cleaning and Disinfection operation will do to receiving materials at site. • To limit closer contact avoid shaking hands and hugging etc. until such time the situation becomes normal. Handshaking high five or first bumps should be strictly avoided in offices and site. • Pre-appointment is mandatory for those who would like to visit offices and site; travel history of the visitors for the last 14 days to be verified to ensure they didn't travel outside the country past 14 days or they are not coming from countries where COVID-19 outbreak is reported. • All visitors to submit a self-declaration at site receptions and security gates in order to facilitate access where in details like infection symptoms, travel histories, purpose of visit etc. to be revealed. Self-Declaration form is available at all security gates. • Employees coming from vacation must observe a 14days house quarantine prior to resume their works. • Daily disinfection of high touch surfaces to be ensured. This may include prayers rooms, dining halls, rest areas, bio- metric scanners, personal computers, photocopy machines, mobile phones and other office stationaries. • Provision of adequate PPE i.e Surgical masks, Gloves, Gum boots etc. to the cleaners and ensure it proper use during cleaning and disinfect operation. • A detailed training to be conducted with cleaners, to ensure the proper cleaning is to be done without any failure. • Employees must be encouraged to report any changes with their health conditions like head ache, breathing difficulties, fever, cough, or Tiredness if any to their immediate supervisors. • Employees' health monitoring is mandatory prior to send them to work, employees suspected with symptoms as explained above must be send to isolated immediately and • Avoid unhygienic conditions, maintain good personal hygiene and wash hand with soap and water frequently. Use alcohol-based hand sanitizers (Not Anti-bacterial) is highly recommended. • Do not wear a face mask if you are not a health professional or you to do not have symptoms of virus infection or you are not dealing with an infected person. • Travel advisories from authorities to be checked and complied prior with travel abroad. • Mass gathering like TBT's, evacuation drills, workshops, training etc. is strictly forbidden to be conducted. • Employee's break times should be scheduled in different shifts to avoid the mass gathering. • Employees must be encouraged to maintain the safe distance (at least 1 meter) with other co-worker to minimize the risk of virus impact. • Minimum travel and time duration tasks should be given to drivers and supervisor should be keep in touch with all drivers all the times. • All Employees must be encouraged to; o Regularly wash their hands, especially after sneezing or coughing. (use of hand sanitizer) o Avoid touching their eyes, nose or mouth. o Follow cough/sneeze hygiene practices (cough or sneeze in a tissue or their elbow/sleeves) and discard used tissues appropriately in the dustbin, do not reuse tissues. o Drink plenty of water, maintain a healthy diet and do not smoke. • Employees of all ages must be encouraged to take all preventive measures as they all can be infected by the new coronavirus (2019-nCoV). Older people and the people with	1	5	5

							pre-existing medical conditions (such as asthma, diabetes, and heart disease) appear to be more vulnerable to becoming severely ill with the virus.			
Staying at Camp/ Accommodation	Respiratory illness caused by COVID-19 Infection that may lead to fatality)	• Transmission of COVID-19 through gatherings, walking by or simply being in the same room with the person who's experiencing symptoms of COVID-19 (fever, cough, difficulty in breathing) • Transmission through droplets from a close contact with a possible COVID-19 infected person. • Transmission of COVID-19 through usage of common drinking water station such as igloo/water dispenser. • Unsensitized things such as door knobs, tables, chairs, floors room or welfare facilities. • Lack of sufficient numbers of cleaners and cleaning materials. • Lack of awareness on how to protect yourself against the infection of COVID- 19.	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Nearby Public	5	5	25	• Reporting employees who are showing symptoms such as fever or high body temperature, coughing, difficulty of breathing or chest pain. Sending them to camp clinic or report as per Guidelines of IMA & WHO guidelines immediately. • Body temperature monitoring through Thermal Scanner or other devices to monitor the body temperature of each employee at camp/accommodation. • Awareness and implementation of Quarantine Guidelines of IMA & WHO. Guidelines immediately. for all employees who came back from vacation. • Implementing safe distancing (at least 2meter) on camp/accommodation, workplace area, Mess Hall, Rest Shelters and other Welfare Facilities to avoid spreading of the virus. - No Hand Shake. • Suspension of meetings/gatherings for certain period of time. • Conduct regular housekeeping and sanitation for all area. • Provision of Hand Sanitizer / Alcohol /Hand Wash Materials. Including proper sanitation/pest control and cleaning/disinfecting of camp premises and welfare facilities. • Provide sufficient numbers of cleaners to cover all area and sanitize all parts of the camp/accommodation. • Provision of adequate PPE's (N95 face mask & disposable hand gloves). • Conduct awareness on how to protect yourself against the infection of COVID19 through campaign (posters, distribution of brochure, HSE Messages). • Communicating and implementing COVID-19 Guidelines of IMA & WHO. Guidelines immediately. • Implement self-quarantine (staying inside their respective room and only going out for necessary activities) for all employees at camp/accommodation. • Provision of individual bottled drinking water to avoid usage of common water containers that can cause transmission of the coronavirus. • Helpline number for Maharashtra 020-26127394 or contact site administrative office or medical team if you feel any symptoms.	1	5	5

	2. Transportation from camp to site and vice versa using transportation vehicle	Health Hazard (Respiratory illness caused by COVID-19 Infection that may lead to fatality)	• Transmission of COVID-19 through gatherings or simply being in the same place/area (entrance or exit gate) with workers who's experiencing symptoms of COVIDH 19 (fever, cough, difficulty in breathing) • Transmission through droplets from a close contact with a possible COVID-19 infected person. • Unsensitized parts of the Log-in/Log-out devices such as biometrics. • Lack of awareness on how to protect yourself against the infection of COVID19	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Nearby Public	5	5	25	• All drivers have been given awareness to follow strict precautions on personal hygiene, including proper hand wash procedures and provision of portable sanitizer. All Bus and Car vacant seats must be present, which forms a space between passengers. • No Hand Shake • Conduct regular housekeeping and sanitation for all transport vehicle (company owned or personal). • Provision of adequate PPE's (N95 face mask & disposable hand gloves). • Conduct awareness on how to protect yourself against the infection of COVID19 through campaign (posters, HSE Alerts, HSE Messages). • Communicating and implementing COVID-19 Guidelines. • Reporting employees who are showing symptoms such as fever or high body temperature, coughing difficulty of breathing or chest pain. Sending them to camp clinic or report as per Guidelines of IMA & WHO. Guidelines immediately. • Ensure the elimination of all types of bacteria and viruses inside the bus, cars and to obtain the highest levels of protection in the seats and bus handles and its internal facilities. • Suspension of work for 14 days or deploy skeletal force (reducing numbers of employees at work) in order to continue with the operation. • Additional transport vehicle shall be provided to prevent overcrowding maintain the social distancing inside the vehicle. • Transportation can be done in two rounds if required. • Helpline number for Maharashtra 020-26127394 or contact site administrative office or medical team if you feel any symptoms.	1	5	5

such as passenger bus and cars										
Entering and leaving the project site	Health Hazard (Respiratory illness caused by COVID-19 Infection that may lead to fatality)	• COVID-19 through gatherings or simply being in the same place/area (entrance or exit gate) with workers who's experiencing symptoms of COVID-19 (fever, cough, difficulty in breathing) • Transmission through droplets from a close contact with a possible COVID-19 infected person. • Unsensitized parts out devices such as biometrics. • Lack of awareness on how to protect yourself against the infection of COVID-19.	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Nearby Public	5	5	25	• Reporting employees Reporting employees who are showing symptoms such as fever or high body temperature, coughing, difficulty of breathing or chest pain. Sending them to camp clinic or report as per Guidelines of IMA & WHO. Guidelines immediately. • Alcohol based hand sanitizer or hand washing facility for hand hygiene is available at all offices and workplace. • Body temperature monitoring through Thermal Scanner or other devices to monitor the body temperature of each employee entering in the workplace. • Cover mouth/nose when coughing or sneezing either with paper tissue or inner elbow and dispose off used tissue paper in the waste bin. • Awareness and implementation of Quarantine Procedure (Guidelines of IMA & WHO. Guidelines immediately for all employees who came back from vacation. • No Hand Shake Policy. • Conduct regular housekeeping and sanitation for all access/egress points. • Provision of adequate PPE's (N95 face mask & disposable hand gloves) and training on appropriate use. • Conduct awareness on how to protect yourself against the infection of COVID19 through campaign (posters, HSE Alerts, HSE Messages). • Communicating and implementing COVID-19 Guidelines of IMA & WHO. Guidelines immediately. • Suspension of work for 14 days or deploy skeletal force (reducing numbers of employees at work) in order to continue with the operation. • Helpline number for Maharashtra 020-26127394 or contact site administrative office or medical team if you feel any symptoms. • Displaying awareness material for emerging infections and preventive measures like hand hygiene and cough etiquette • Continuous update for the triage staff especially in the event of emerging / re-emerging infections of public health importance including Identification of suspected case as a clinical syndrome and if there is any epidemiological factors and management algorithm.	1	5	5

Routine Site Activities	(Respiratory illness caused by COVID-19 Infection that may lead to fatality)	• Transmission of COVID-19 through, meetings/gatherings, walking by or simply being in the same room with the person who's experiencing symptoms of COVID-19 (fever, cough, difficulty in breathing)	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Nearby Public	5	5	25	• Prior to commencing the work all offices, handles, walk way, Table, store daily use materials to be sanitized. • Reporting employees Reporting employees who are showing symptoms such as fever or high body temperature, coughing, difficulty of breathing or chest pain. Sending them to camp clinic or report as per Communicating and implementing COVID-19 Guidelines of IMA & WHO. Guidelines immediately. • Body temperature monitoring through Thermal Scanner or other devices to monitor the body temperature of each employee entering the site. Awareness and implementation of Quarantine Procedure for all employees who came back from vacation. • Implementing safe distancing (at least 2 meter) on workplace area, Mess Hall, Rest Shelters and other Welfare Facilities to avoid spreading of the virus. • No Hand Shake Policy. Suspension of meetings/gatherings for certain period of time. • Suspension of Toolbox Talk and Awareness Training Sessions for a certain period of time. • Conduct regular housekeeping and sanitation for all area. Provision of Hand Sanitizer / Alcohol / Hand Wash Materials. Including proper sanitation/pest control and cleaning/disinfecting of welfare facilities, as well as vehicles/equipment's used at site. • Provision of adequate PPE's (N95 face mask & disposable hand gloves). • Conduct awareness on how to protect yourself against the infection of COVID19. • Suspension of work for 14 days or deploy skeletal force (reducing numbers of employees at work) in order to continue with the operation. • Provision of individual bottled drinking water to avoid usage of common water containers that can cause transmission of the coronavirus.	1	5	5
Housekeeping	Health Hazard (Respiratory illness caused by COVID-19 Infection that may lead to fatality	• Transmission of COVID-19 through Gatherings, walking by or simply being in the same activity area with the person who's experiencing symptoms of COVID-19 (fever, cough, difficulty in breathing) • Transmission through droplets from a close contact with a possible COVID-19 infected person. • Transmission of COVID-19 through usage of common drinking water station such as igloo/water dispenser. • Unsensitized part of the offices, welfare facilities and equipment's that is being used by several workers. • Lack of awareness on how to protect yourself against the infection of COVID-19.	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Nearby Public	5	5	25	• Reporting employees who are showing symptoms such as fever or high body temperature, coughing, difficulty of breathing or chest pain. Sending them to camp clinic or report as per Communicating and implementing COVID-19 Guidelines of IMA & WHO. Guidelines immediately. • Body temperature monitoring through Thermal Scanner or other devices to monitor the body temperature of each employee entering the site or at camp. • Implementing safe distancing (at least 2 meter) on workplace area, Mess Hall, Rest Shelters and other Welfare Facilities to avoid spreading of the virus. • Suspension of meetings/gatherings for certain period of time. • No Hand Shake Policy. • Conduct regular housekeeping and sanitation for all area. Provision of Hand Sanitizer / Alcohol / Hand Wash Materials. Including proper sanitation/pest control and cleaning/disinfecting of offices, workplace area, welfare facilities, as well as vehicles used at site. • Provision of adequate PPE's (N95 face mask & disposable hand gloves). • Conduct awareness on how to protect yourself against the infection of COVID19 through campaign (posters, distribution of brochure, HSE Messages). • Communicating and implementing COVID-19 Guidelines of IMA & WHO.	1	5	5

	General	Health Hazard (Respiratory illness caused by COVID-19 Infection that may lead to fatality	• Transmission of COVID-19 through Gatherings, walking by or simply being in the same activity area with the person who's experiencing symptoms of COVID-19 (fever, cough, difficulty in breathing) • Transmission through droplets from a close contact with a possible COVID-19 infected person. • Transmission of COVID-19 through usage of common drinking water station such as igloo/water dispenser. • Unsensitized part of the offices, welfare facilities and equipment's that is being used by several workers. • Lack of awareness on how to protect yourself against the infection of COVID-19.	Office Staff Site Staff Sub-Contractor Employee, Operators, Drivers, Helpers, Workers, Visitors, Nearby Public	5	5	25	• Adequate information to be given all the employees through emails, display posters, notices etc. • All receiving materials to be kept in isolate places for certain hours as per specification of materials to reduce the risk of contact and impact of virus and disease. In Site store area a separate isolated area will be provided, Cleaning and Disinfection operation will be done to receiving materials at site. • To limit closer contact avoid shaking hands and hugging etc. until such time the situation becomes normal. Handshaking high five or first bumps should be strictly avoided in offices and site. • Pre-appointment is mandatory for those who would like to visit offices and site; travel history of the visitors for the last 14 days to be verified to ensure they didn't travel outside the country past 14 days or they are not coming from countries where COVID-19 outbreak is reported. • All visitors to submit a self-declaration at site receptions and security gates in order to facilitate access where in details like infection symptoms, travel histories, purpose of visit etc. to be revealed. Self-Declaration form is available at all security gates. • Employees coming from vacation must observe a 14days house quarantine prior to resume their works. • Daily disinfection of high touch surfaces to be ensured. This may include prayers rooms, dining halls, rest areas, bio- metric scanners, personal computers, photocopy machines, mobile phones and other office stationaries. • Provision of adequate PPE i.e Surgical masks, Gloves, Gum boots etc. to the cleaners and ensure it proper use during cleaning and disinfect operation. • A detailed training to be conducted with cleaners, to ensure the proper cleaning is to be done without any failure. • Employees must be encouraged to report any changes with their health conditions like head ache, breathing difficulties, fever, cough, or Tiredness if any to their immediate supervisors. • Employees' health monitoring is mandatory prior to send them to work, employees suspected with symptoms as explained above must be send to isolated immediately and • Avoid unhygienic conditions, maintain good personal hygiene and wash hand with soap and water frequently. Use alcohol-based hand sanitizers (Not Anti-bacterial) is highly recommended. • Do not wear a face mask if you are not a health professional or you to do not have symptoms of virus infection or you are not dealing with an infected person. • Travel advisories from authorities to be checked and complied prior with travel abroad. • Mass gathering like TBT's, evacuation drills, workshops, training etc. is strictly forbidden to be conducted. • Employee's break times should be scheduled in different shifts to avoid the mass gathering. • Employees must be encouraged to maintain the safe distance (at least 1 meter) with other co-worker to minimize the risk of virus impact. • Minimum travel and time duration tasks should be given to drivers and supervisor should be keep in touch with all drivers all the times. • All Employees must be encouraged to; o Regularly wash their hands, especially after sneezing or coughing. (use of hand sanitizer) o Avoid touching their eyes, nose or mouth. o Follow cough/sneeze hygiene practices (cough or sneeze in a tissue or their elbow/sleeves) and discard used tissues appropriately in the dustbin, do not reuse tissues. o Drink plenty of water, maintain a healthy diet and do not smoke. • Employees of all ages must be encouraged to take all preventive measures as they all can be infected by the new coronavirus (2019-nCoV). Older people and the people	1	5	5

								with pre-existing medical conditions (such as asthma, diabetes, and heart disease) appear to be more vulnerable to becoming severely ill with the virus.			

CHAPTER 5

CONCLUSION

The first step for emergency preparedness and maintaining a safe workplace is defining and analyzing hazards. Although all hazards should be addressed, resource limitations usually do not allow this to happen at one time. Hazard identification and risk assessment can be used to establish priorities so that the most dangerous situations are addressed first and those least likely to occur and least likely to cause major problems can be considered later.

From the study carried out in the metro station construction site and the risk rating which were made and analyzed shows that the number of high risks in working at height. And some activities show medium to low rating. The high risks which were present at metro station site was height works which can be reduced by taking all the precautions as mentioned in HIRA prepared. Also, workers are to be educated for the same precautionary measures by providing safety training at a specific interval of time.

REFERENCES

- Bell, R. and Glade, T., "Quantitative risk analysis for landslides- Examples from Bildudalur", NW-Iceland, Natural Hazards and Earth System Sciences, Vol.4, 2003, pp. 117-131.
- Carpignano, A., Priotti, W. and Romagnoli, R., "Risk analysis techniques applied to floating oil production in deep offshore environments", International Society of Offshore and Polar Engineers, Vol.1, 1998, pp. 253- 258.
- S.Gokul Raj, N.Shivasankaran, "Hazard Identification and Risk Assessment in Deinking Plant, International Journal of Research in Aeronautical and Mechanical Engineering, ISSN (online): 2321-3051.

- M.SaravanaKumar, Dr.P.SenthilKumar, "Hazard Identification and Risk Assessment in Foundry", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X, PP 33-37.
- Samaneh Zolfagharian, Aziruddin Ressang, "Risk Assessment of Common Construction Hazards among Different Countries", Sixth International Conference on Construction in the 21st Century (CITC-VI) "Construction Challenges in the New Decade" July 5-7 2011, Kuala Lumpur, Malaysia.

SP 70: 2001, "Handbook on Construction safety practices", Bureau of India