Precautionary Measures And Safety Practices On A Construction Site To Prevent Disaster Ensuring Environmental Protection

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Abstract
Disaster on a working site is due to negligence of workers and poor safety practice. While working with heavy machinery and special instruments on a site, casual approach towards surrounding leads to an accident. Pile construction, a modern day technology, is a measure to provide adequate safety to structure by its load transfer mechanism to underlying strong strata. For achieving this driving of pre cast elements or in situ concreting is carried out which involves lot of machinery and man power. It is must for everyone to follow safety rules and practices to avoid accidents where people may lose their lives. Meticulous observation of instructions provided and careful follow up of safety rules leads to a good construction practise and accident free site where heavy duty instruments are involved. Everyone must follow all instructions to avoid a disaster. Any undue spilling of materials and unplanned excavation will harm the environment as well.

Key words: Disaster, Pile installation, Safety procedure, Heavy equipment, Hazardous material, Environment

1. INTRODUCTION
Building construction and construction technology has evolved like miracle in past few years. Innovation and modern construction techniques have not made constructions fast but safer as use of different software and highly precise machine has reduced the risk of building failures. With the use of technology, men has started loosing his concentration on work and becoming more dependent on developed methods as they are almost taking care of everything. But at this time men forgets that he is supposed to carry out some important work by himself and ignorance in the same can lead to disasters involving damage to machinery, property and possible death of human beings. One of major construction activity is construction site involving pile activities. As pile installation involves many people, heavy equipment and long time period activities, it is very much essential to observe safety practise at site, before and during the pile construction activities. Site supervisor needs to understand piling methodology and must take care of vehicles to be used in construction activities. Supervisor must fix possible site / space for equipments, material and people i.e. office

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cabin, parking for staff, tools, fencing, washout area, safe space of flammable materials etc. Space must be decided for material and equipment handling, material storage, equipment repairing and servicing, access for delivery vehicles and barge/floats or any other water borne bodies. Another important factor is stability of ground where work is to be carried out. A proper inspection of site is required for possible unstable ground conditions and underground hazards. There must be enough space to construct stable slopes if there is level difference on site. A stable ground will provide adequate support against load coming on it during installation of equipment under maximum applied load. Inspection of existing structure if any, should be carried out to check its possible usage in the proposed work. Due measures and instruments should be ready to prevent any environmental accident. An escape route in case of disaster should also be worked out. Overall a structural analysis should be carried out to complete the proposed work without any difficulty.

2.1 Safety Plan at Site

Proposed site for work should be analyzed with a view of safety concern. Duties must be allocated to respective person for different work. Hazard analysis should be carried out and broken into tasks. Possible underground hazard analysis should also be carried out. Measures to prevent accidents and injury to people working and damage to equipment should be taken care of. A chart should be prepared, showing overhead electric lines and underground water/waste water pipe lines, gas pipe lines to avoid breaking down of the same during excavation work (1). Source of men power, equipment and materials should be identified and contacted in advance to avoid last minute hustle. Possible risk analysis for surrounding traffic, people and environment should be carried out and possible measures should be taken. Pile construction work involves many activities simultaneously. A lot of vehicles, machinery, material and people are involved and there are a lot of chance to have collision between them in absence of proper guidelines or movement plans. There should be effective handling of traffic and movement control to avoid any mix up at site. Effective procedures should be in operation for proper transportation and assembly and disassembly of equipment. Checking of all equipment should be carried out if it is properly assembled and enough in number for completion of required task. There are possibilities that there are other works may be going in surrounding area. With a view to avoid any congestion with them a meeting should be planned with site supervisor or site in-charge to prevent clash or workers/instruments during construction work. It should also be seen that surrounding buildings and their owners are not disturbed by work carried out on site. A mechanism should be set to check if current work is being harmful to nearby structures (2). Effective measures should be taken to minimize extra noise and control vibrations. Clear signs should be displayed on periphery of site to prevent people and vehicles passing by the site to prevent accidents.

When a lot of activities are involved at a place, whatever care one takes, there are chances of accidents to happen. In case any unwanted event there should be effective management plan to deal with crisis. First thing that becomes handy in case of crisis is first aid box. First aid supplies should be well located and sign boards should be well displayed. If old first aid boxes are brought from other sites, they must be checked and filled with new and required medicines. At various locations on site, emergency phone numbers should be displayed so that any one can contact and get the help required. Fire officers should be invited for a site visit in case of works which are using flammable products. Instructions can be received from fire officers to deal with crisis. Easy access for ambulance and fire services should be planned in case of emergency. In case of medical facilities required, phone numbers and addresses of nearby hospitals should be readily available. Facility of Doctors on call should be arranged. Sing boards displaying contact details of person to be contacted should be well displayed in different areas of site (3) (4). In big projects, a small unit of people who can give first hand treatment should be allocated.

2.2 Overhead Electrical Lines

While working in populated area, where electricity lines does exist it is always safe to believe that power is running in those lines. It is essential to check every possible source of
power which may cause damage to any human or any instrument accidentally. One need to make sure of few certain checks before starting work on site.

Check all electrical lines assuming that they are carrying power unless it can be clearly seen cut down from the source. Local electricity Provider Company should be informed to send their representative to ensure that lines transferred / closed are not disturbing other supply. If is advisable to get a certificate from competent authority that power supply is not running in any lines, if possible. All lines should be marked clearly for the voltage passing through it, if any, and minimum ground clearance they required (5). All tall equipment like cranes etc., should be lowered or grounded while working with energized electricity lines. A warning line, devices or person/s should be allocated to look and provide necessary signal / instruction while moving instruments from one place to another (6).

2.3 Importance of Training
A training programme should be scheduled before the commencement of project to ensure that all staff, managers, office staff and workers, who are supposed to work on site become familiar with precaution and necessity of safety plan delivered and follow guidelines issued strictly to prevent any disaster on worksite. Make sure that all employees are trained for the job they are to perform or familiar with the same. Provide all people involved in work with properly working equipment which should also be in good condition. Make sure that everyone utilizes all personal safety equipment provided to them. Workers may be cautioned to pay fines or loosing job if found not observing safety rules and not using safety gears provided to them. Periodical checking on actual work site may be carried out to observe if people are following safety rules and using protective gears.

3. MATERIAL STORAGE and HAZARDOUS MATERIALS
There should be adequate supply of materials required for work carried out at site and should be stacked properly to prevent falling or rolling. Proper access should be provided for trailers carrying supply or moving unused material. There may be some hazardous material on site for specific use like treated wood. While working with timber products which are treated earlier, one should take care to minimize contact with bare skin by wearing protective clothing provided. Open body parts should be cleaned properly at the end of work and before eating anything. When treated timber is cut down, use essential personal protective equipment like gloves, goggles, skin care cream / lotion. With a view of protection of environment, proper collection of used fuel wastage should be ensured. This will ensure not only the proper disposal when required, it will also earn fame for the project going on.

3.1 Safety measures during Material Loading/Unloading
Loading and unloading of material at site is always very rapid as it may need people who are involved in other activities and may distract other activities on site and not really taken due safety precautions (7). Workers involved with loading and unloading should avoid standing behind the trailer sides where operator cannot see during loading and unloading of material to avoid any accidents caused by adjustment movements of trailer operator. Workers should not jump to climb or coming down from a flatbed trailer. Instead of jumping up and down ladders should be used. Do not stand in the way while piece of equipment is suspended when moving from one place to another place. Always take care not stand under a suspended load. During transportation of loads, it must be ensured to tie down properly to avoid shifting. Utilization of stanchions for material that could roll, such as rebar cages, pipe, augers, etc., is must. Sudden fall of these material can cause fatal accidents.

3.2 Equipment Safety
It is very important to take care of equipment which are being used on site. Similarly it is equally important to have precautions while working with these instruments. Utmost care should be taken while repairing or operating equipment. Never repair or make adjustments to any equipment when it is in use. Replace a protective cover properly if it is removed for inspection / service. Check connections of all hose pipes, electrical cords and attached tools before starting of equipment to ensure non entangled parts. Any storage of inflammable liquids on / near equipment should be banned. Safety precautions should be taken for all
employees against falling while working on heights. Proper ventilation for exhaust of Fuel-operated equipment must be ensured (8). Inspection of all equipment, all systems, computerized controls should be carried out daily for proper function.

4. PILE INSTALLATION
Pile installation is one most important activities to be carried out at site. A good number of people and equipment are involved in this. There are some general guide lines / instructions to be followed during installation of piles. Based on soil profile, pile type should be selected. Driving difficulties may also play an important part in selection of pile type at difficult sites. It can be pre-cast concrete, steel pipe, steel section, composite section or a timber pile. There can be more than one type for different structures at one site if required. Driving criteria must be fixed based on depth of pile or number of blows. People who have taken training for specific work should be employed as workers and only those should be allowed on site while these operations are carried out. No one is allowed to stand directly under the hammer or pile. Employees who are helping in operation should be in side or back side of the leads during pile installation. With a view to avoid accidents, instructions from the ground should be given to guide top of the pile under hammer. This will avoid climbing the leads for set up. Entry of all employees must be restricted during the pile hoisting operation. Hoisting of piling shall be secured properly before the starting of operation to prevent accidental detachment from the hoisting equipment’s rigging. Enough fuel should be in reservoir whenever diesel hammers are used to avoid unnecessary delay in work due to lack of fuel. It will waste time and workers will start moving here and there on site (9). All fittings of pile driving hammer should be well lubricated. Only one dedicated person should be singling the pile driving. It is general practice to steady the hanging leads by hand while setting up over a pile location to make sure that they drop and stab in ground when signalled. One should make sure to keep his body clear before the dead drop. To avoid safety hazards, one must ensure that no body part is under suspended hammer, leads or piles during pile driving. Plumb ness of pile should be checked every now and then. It should be re-plumb if required before the pile is driven too deep. Clear visible marks should be there on pile length to check driving length. It is really difficult to deal with overdriven piles if there is a case of same at site. Precautions must be taken during rolling or turning of piles to avoid accidents (10).

4.1 Precautions to be taken during
1) Access to Pile Leads
While piles are driven, No one should be on ladders or leads. To avoid accidents during climbing, leads should be cleaned periodically. When workers are working at a certain height fall protection during climbing must be placed and checked on regular basis. It should be made sure that all brakes are applied by operator in case of worker is required to climb driving lead. Necessary safety devices should be provided to worker as well.

2) Sheet Piling
If the sheet pile are driven using a top man, access to the top of sheets is achieved by aerial lift, ladder or suspended platforms from a crane. Person involved in this should were protection all the time and sufficient precautions against falling should be taken wherever possible. Person involved in work should not be allowed to ride a load block.

3) Pile Extraction
During pile extraction it must be observed that vibratory hammer’s suspension capacity should not exceed its rated capacity. If rated capacity is tested every now and then it may lead to damage and can cause accidents. If a crane is being used, pile should be extracted to the point from where it can be pulled out without use of hammer, then hammer should be disconnected and pulled piled should be laid in marked area for the same. A proper lift plan should be made with appropriate factor of safety for skin friction/ resistance for extraction of sheets or piles.

4) Jetting
Regular inspection of Jet pump for wear or damage is essential to avoid any accident prior to its use. Inspection of all lines / hoses for leaking or damage is required. Replace the line or repair it according to damage if found any. Instructions must be given to people to wear protection for eyes and ears while working near jetting during the time of operation. Face shields should be provided if required.
Surrounding area must be clear of excess mud/water to avoid slipping/tripping of workers / instruments.

5) Auguring
A secure connection must be ensured between the auger drive and pile leads. A prior inspection of auger drive, augers, leads, power supply, power supply lines for damage before starting of operation. Repair or replacement of damaged parts must be carried out. In any condition, a body part should not be exposed near rotating auger. Auger rotation must be stopped if it is required to clear debris. Employees not involved in work should be kept away.

6) Pile Cut Off
Before the starting of pile cut off, surrounding area must be clear. Remove all material which can catch the fire easily. If it is required to cut off excess pile material, attach lifting equipment and rigging, then cut the pile. Clear the cut off pieces to allow access of concrete trucks. In case of wood piles, proper cut off techniques should be used for trimming.

5. CONCLUSION
A site consist of many parallel activities running simultaneously. Almost all activities involve number of workers and heavy machinery. People working on site are casual and try to avoid wearing protection gears and fond of not observing rules. Overlooking of safety precautions may lead to disaster at site in which there are chances of losing lives of workers and harm environment. A site supervisor or site in-charge must follow decided / prescribed guide lines to carry out activities smoothly and without any accidents. Following practise should be carried out at site without fail for a successful completion of project.

1. Environmental protection should be ensured through proper training and awareness programmes.
2. Rigs should be firmed to base by proper means
3. Wire ropes to be used must be inspected and maintained during the project.
4. Person responsible for rig maintenance should be fully protected with necessary safety equipment.
5. Eye and ear protection should be must for all workers. People should wear gloves while working with wires.
6. Workers assigned for a particular job should remain present during operation. All others must stay clear from surroundings.
7. All workers should be given a proper training / revision for the work they are assigned.
8. Emergency should be dealt with calmly.
9. People to contact during an emergency should be known to number of people.
10. No instrument should be repaired while it is running
11. Clear and visible signs should be at site for different work and demarcation on ground for easy access.
12. Clear passage should be provided for vehicle movement.
13. All electric lines must be checked for power supply.
14. Adequate amount of required material / equipment / accessory should be ensured.
15. Proper disposal of waste should be managed.

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