

**Safety in Construction**  
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**Module No # 03**  
**Lecture No # 14**  
**Struck by and Caught-in between**

Welcome to this course and in today's class, we are going to talk about the third hazard. In the fatal 4, we have discussed about fall hazards, concreting, demolishing as in operations with regards to fall hazards. Then we have discussed about cave-ins, excavation is where we will see cave-ins tremendously. And along with cave-ins we have also discussed confined spaces as a part of tunneling operations. So now in continuation with that serious now the next one is struck by or caught-in between.

There is a slight difference between struck by and caught-in between which is what we will see today. And again 1 or 2 operations where this is seen tremendously will be material handling and crane operation. So, material handling and piling we will discuss in today's class. And crane handling with the hazards with regards to cranes, and safe operations with cranes we will discuss in the next lecture. So now what is struck by?

Now there are 2 terms which comes in together. 1 is struck by and other 1 is struck against and again in same way it is caught in or caught- in between. The terms are little familiar to you if you translate exactly, you get the same meaning. So accordingly, we will now discuss what is it.

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## Struck-by/against Accidents

- Struck-by injuries are produced by forcible contact or impact between the injured person and an object or piece of equipment
- When a worker's injury results from being struck against object, it is referring to a worker hitting an object. For example, a worker may be injured if they run into an overhead pipe, corner, vehicle or another person
- Falling object, Flying object, Rolling object, swinging object

**STRUCK BY OBJECT**

2012-2015  
**FALLING OBJECTS**  
15,553 workers injured  
214 permanently disabled  
17 dead

And the pictures will also help you to understand what is the struck by and struck against? Struck by injuries are produced by forcible contact or impact between the injured person and an object or a piece of equipment. When a worker's injury results from being struck against an object, it is referring to a worker hitting on an object. So, worker will not go and hit for example they are instances when the worker is hitting against an object.

For example, a worker may be injured if he is running over into an over head pipe or corner or vehicles or with another person and so on. Struck by are generally with regard to falling objects, flying objects, rolling objects which are on the floor. And starts with out when you do irregular striking of objects than it starts rolling away and with regard to material movement in the site, swinging all these can be resulting in a struck by accident okay.

So, hooks, all this lifting rig, rigging operations which we will elaborately see in the next class are all examples for struck by accidents. Now what is caught in? According to OSHA caught-in or between hazards are defined as injuries resulting from a person.

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## Caught-in/between Accidents

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- According to OSHA, caught-in or - between hazards are defined as: Injuries resulting from a person being squeezed, caught, crushed, pinched, or compressed between two or more objects, or between parts of an object
- Caught-in/between hazards are caused when a worker is compressed between or gets caught in equipment or objects. It also includes when a worker is killed by getting caught, struck or crushed from materials, equipment or a collapsing structure










Maybe he squeezed in-between or caught or crushed or compressed between 2 or more objects okay. So especially with the vehicle movement or when the vehicle is in the operation you try to you know repair or do something. Then you accidentally you get caught- in or between these hazards okay. So caught in or between hazards, caught in is caught between 2 things, and between is in between 2 objects for example a wheel and a wall.

The worker's leg is caught in or caught between or caused when a worker is compressed between or gets caught in equipment or object. It includes when a worker is killed by getting caught, struck or crushed from material, equipment or even from a collapsing structure.

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## Safety in material handling and transportation

- Transportation and material handling are involved in
  - Carriage of raw materials like CA and FA from the quarries/procurement site to the place of work
  - Carriage of structural steel, cement, bricks etc from their respective places of production to the site of work
  - Carriage of fabricated steel products from the place of fabrication to site of work
  - Carriage of all consumables, diesel, paint, timber, glass, etc
- All the above items and many more that may be required for construction work, are needed to be loaded, unloaded and handled manually or by mechanical means (loading, transportation, unloading)
- Causes of accidents during transportation and material handling work
  - Mechanical fault in the vehicle used
  - Operator is inattentive or inexperienced
  - Operator takes chances while negotiating through narrow space or crowd
  - Wrong handling of heavy material or hazardous material
  - Stacking of material in unsafe stacks not in stable equilibrium

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Especially in a disaster, collapsing can happen. Now as I told so we will discuss about the caught-in between and struck by or struck against hazard with regard to material handling in the construction sites. There are so many materials which are handled in a construction site. So, whenever material we talk about material handling it includes loading so primarily loading on to the truck, handling in the site primary you know fabrication and you know then unloading in the site.

So loading, handling, unloading, disposal and storage okay and usage so all this primary will be, comprising in terms of material handling. So, material handling is a common term which we generally use to cover up all these different tasks with regard to materials. Now what are the materials which, are generally handled in the site. So, there are lot of raw materials and also processed materials.

Raw materials include coarse aggregate, fine aggregate, cement, structural steels, bricks etc. So, it can be some of them for example, steel can be in an assembled form, from a fabricated shop or it can be assembled in the site. So, there can be so many different sorts of material which are generally you know moved or used in the construction site, during the progression of the construction work.

And apart from this you also have carriage of lot of consumable items like diesel, paint, timber, glass and so on which are also used and consumed in the process. Now all these above items and many more that may be required for construction work has to be loaded, unloaded, handled manually or either mechanically by using equipment's disposal, usage and also the scrap. So, throwing away the scrap so all these are primarily part of material handling steps.

So, what are the different causes of accidents during transportation and material handling work? Any mechanical, this is generalized okay with which will suit any material any equipment with which you are handling the materials. Mechanical fault in the vehicle, operator is inattentive or inexperienced. Operator takes chances while negotiating through narrow space or crowd wrong handling of heavy material or hazards material.

Or stacking of material in unsafe stacks and not in equilibrium when you are piling up the material it should be tapering on the top. You should pile it up like that so that it is not actually

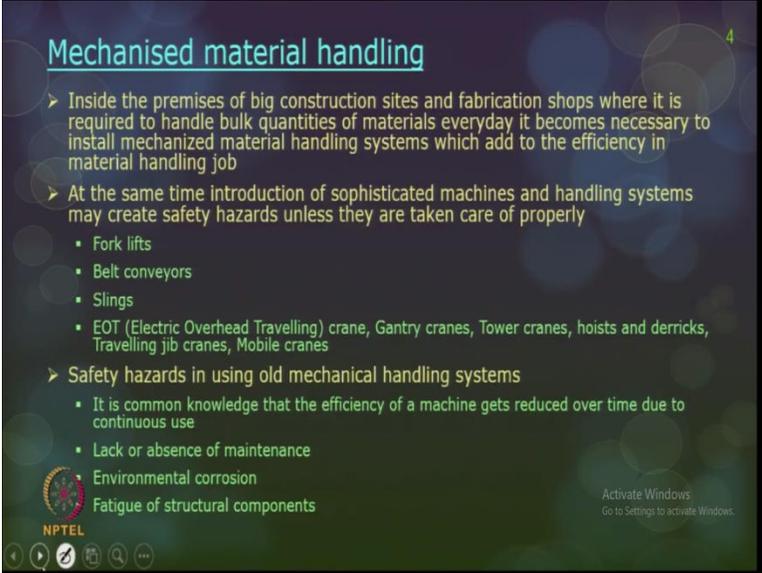
know falling off or it should be towards the centre. And the equilibrium has to be maintained so that it will not be staggering and falling down. Manual ways of handling are still seen in many construction sites because of 1 advantage maybe I can say there are 2 advantages.

There are surplus numbers of unskilled workers who are in the site. With whom you can actually know do a very cheap and economical way of material handling in construction sites. The other advantage is manual handling is in a way safer compared to mechanical way of handling. When you say mechanical work of handling you can think of forklifts, you can think of crane or even any other excavating equipments that are available in the site.

Through which you can still handle the materials in the site. And in some construction site conveyer belts are also used for carriage of materials. For especially for cement, concrete and so on. So, lots of these equipments are mechanized means of material handling are all feasible in construction site. Which will be faster, quicker you can also ignore or eliminate the ergonomics hazard or may be the works are exposes to cement, handling the cement or concrete.

So, you can eliminate all those ergonomics hazard and other know chemical hazards with regard to those substances.

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**Mechanised material handling**

- Inside the premises of big construction sites and fabrication shops where it is required to handle bulk quantities of materials everyday it becomes necessary to install mechanized material handling systems which add to the efficiency in material handling job
- At the same time introduction of sophisticated machines and handling systems may create safety hazards unless they are taken care of properly
  - Fork lifts
  - Belt conveyors
  - Slings
  - EOT (Electric Overhead Travelling) crane, Gantry cranes, Tower cranes, hoists and derricks, Travelling jib cranes, Mobile cranes
- Safety hazards in using old mechanical handling systems
  - It is common knowledge that the efficiency of a machine gets reduced over time due to continuous use
  - Lack or absence of maintenance
  - Environmental corrosion
  - Fatigue of structural components

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You can still eliminate, but the 1 issue is you have to be very careful on when it comes to safety precautions. Inside the premises of big or large construction sites and fabrication shops you may have to handle lot of bulk quantities of materials every day. When, it becomes necessary to

install mechanized material handling system, which will add to the efficiency in material handling job. I told the pros and cons of material handling manually and also the mechanical means.

So, introduction of sophisticated machines and handling the system may create safety hazards unless they are taken care of properly. And they are so many ways with which materials are handled. For example, forklifts, belt conveyors, slings, lot of crane types starting from the electric overhead travelling crane which we call EOT cranes, gantry cranes, tower cranes, hoist and derricks travelling jib cranes, mobile cranes and so on.

Safety hazards in old, when you have pretty old mechanical machine for handling the material. So, this machine may get you know efficiency may be lost over period of time because of wear and tear and continuous usage that you may have to take care. Lack of, absence of maintenance primarily you have to you know keep the machine in good condition till it is operational. Environment corrosion okay may be rust and other issue can be you know spoiling the usage of the machine progressing.

Then fatigue of structural component because of wear and tear and over loading on the material handling. The equipment or structural components may get weekend and fatigue so as a result cracks and it may also break. The major hazards associated with the material handling especially in a mechanical way are.

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**Hazards Associated with Materials Handling**

- Using mechanical equipment to move and store materials increases the potential for employee injuries
- Improper operation of equipment
- Accumulated materials or clutter
- Unsafe conditions of materials or containers
- Flammability or toxicity of some materials
- Weight of materials
- Binding ties or other devices that secure bundles or bound materials
- Falling objects
- Lifting, pushing, pulling, or otherwise manually moving large, heavy items
- Improperly stacked materials
- Struck by or caught in-between hazards
- Contact with objects and equipment
- Transportation incidents
- Exposure to harmful substances or environments

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The slide features a background image of a yellow forklift in a warehouse, carrying a large stack of white sacks. The text is overlaid on a dark, semi-transparent background.

So, using mechanical equipment to move and store material increases the potential for employee injuries okay although it is faster, quicker, productivity may be enhanced and so on. But there is lot of opportunity for a worker to get hurt. So, these are the different ways in which a worker may get hurt. Improper operation of equipment, accumulated materials are cluttering, so you should be having a proper housekeeping.

Unsafe condition of material containers okay you should know how to stack different types of materials. We will be discussing shortly on how to stack different type of materials. When it comes to flammability or toxics materials available then you should be handling it very safely as per safety norms. Weight of the material so as seen in the picture so not overloading of too much of material on to the, so you should know what is the equipment safe load and what is the safe lifting load of the processors?

May be using slings or may be the hook you should know what is the maximum safe load material can be handled. Binding ties or other devices that secure bundles or bound materials, falling objects, lifting, pushing, pulling or otherwise manually moving large or heavy items, even though mechanical mean of handling is there. Still, you may also have to do little of lifting, pushing and you know pushing the material into the equipment.

Improperly stacked materials and the one which is very common and for what we are discussing is struck-in or struck-by and caught-in between hazards. Contact with objects and equipment, transportation of incidents and accidents exposure to harmful substances and environments. So generic; safety measures on with regard to PPEs, fencing, barricading when the manual handling is going on and all we not discussing.

I am not covering because we have enough covered in our earlier apart of the lectures. So, all those generic precautions, safety precautions still is valid for these 1 or 2 remaining topics as well.

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## Hazards Associated with Materials Handling

- Using mechanical equipment to move and store materials increases the potential for employee injuries
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Main causes of hazards with regard to the forklifts. So now we are going to discuss about forklifts and conveyer belts. So, forklift the main hazard is forklift overturning primarily we call it as tipping or overturning. Forklift striking the workers on foot may be a blind spot or maybe the driver could not see the worker is standing so the forklift striking workers on foot is a very common hazard.

And the person crushed by the forklifts again due to blind spots or person falling from forklift may be forklift is not primarily meant for passenger travel. If somebody is trying to you know load onto the forklift than you have falling from forklift and object or materials falling on to the workers primarily a fall hazard so these all are the different forklift hazards. Driving a forklift, so only a skilled operator is supposed to operate.

And whenever there is an obstructed vision in the passage of the forklift you should have a by-stander worker or a person who is away from the forklift to help or channelize the movements of forklifts in the construction sites. Travel path, approaching people, elevated platform and all when, the rising or lowering of forks, safe distance between the other materials and other machinery in the site. So, all these are generic precautions when you are driving a forklift.

And especially when the forklift is drove along a grade or ramp you should be extremely cautioned and no turns when you are going on a slope. No turns, tilting and raising load are also not allowed there and point load up the incline. Operating speed especially when you are turning

you should be going on a proper speed. You should maintain all the safety norms and the speed with which you have to go in a construction site.

Avoid collisions whenever there is a wet or slippery floor you should be cautioned on those floors because you are also carrying weight along with forklift. Especially when you are ascending or descending or whenever there is an obstructed vision so you should be very careful in reducing this speed of with which your forklift is moving in the site. Avoid excess weight and also more than excess weight you should also center the weight and see to that the center of gravity is maintained.

Use of dock boards for loading and unloading, so dock boards are nothing but they are like the stops as seen in the figure okay. They are like the stops primarily used for loading and unloading so you should be securing the portable dock boards and also there should be handholds for easy handling of these dock boards. When you are exiting the lift or entering the lift you should be very cautious in in in putting the forklift in normal neutral position and then you should be doing.

And when you are loading and unloading also the forklift should be in a proper position. Riding the forklift, no extra passengers are allowed even there is an exception for unloading or for movement of these materials. Then a seat should be provided for extra passengers and otherwise no extra passenger is allowed inside a forklift. Avoid struck by or crushed by, do not jump from an over turning forklift.

Stay with the forklift truck only and hold on firmly especially when it is about to overturn and try to get down from the direction opposite to the overturn so that your safely away from the forklift. Some of the posters are given here for safe forklift safety. Never pass loads over peoples so when there are people movements you should not be you know moving the forklifts in that position. Pedestrian are not allowed to cross there should be no crossing over with the pedestrian crossing and the forklift crossing.

No passengers on the load or even on the bare forklift and lift workers only in an approved work platform so this we have discussed earlier also. So, forklift is not like a suspended scaffold for the workers to work unless it is meant for and designed for that so that adequate safety

precautions are all maintained. For example, there is a guard rail and all you know provided for the forklift so that the worker is able to work.

If the load is blocking a view, you should have spotter to guide you as to how to proceed in the safer direction. So, forklift safety again so always keeps it slow and whenever you are moving in a, congested sites and face your load up hill. And when you are going downhill you should travel in a reverse. So always the load should be pointed only in the upward direction. Do not travel or turn with the raised loads.

So always the load should be lowered when you are lowering or travelling because it may also tend the forklift to tip over. Be careful of rare end swings. So all this we have discussed all this here. So these are some of the precautions with regard to forklifts.

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**Safety Precautions with conveyors**

- When using conveyors, workers may get their hands caught in nip points where the conveyor medium runs near the frame or over support members or rollers
- Workers also may be struck by material falling off the conveyor, or they may get caught in the conveyor and drawn into the conveyor path as a result
- Precautions
  - Install an emergency button to stop the conveyor at the employee's work station
  - Prohibit employees from riding on a materials-handling conveyor
  - Provide guards where conveyors pass over work areas to keep employees from being struck by falling material
  - Install emergency stop cables that extend the entire length of continuously accessible conveyor belts so that the cables can be accessed from any location along the conveyor
  - Ensure that appropriate personnel inspect the conveyor and clear the stoppage before restarting a conveyor that has stopped due to an overload
  - Cover screw conveyors completely except at loading and discharging points

The slide includes two images: on the left, a 3D diagram of a conveyor belt system with red circles highlighting nip points between rollers and the frame; on the right, a photograph of a large conveyor belt at a construction site with a pile of material at its discharge point.

Now lets us discuss about conveyors, when using conveyors workers may get their hands caught in. This is a common hazard we see in many of the conveyor belt accidents. Where the conveyor medium runs near the frame or over support members so when the works are trying to load or unload the material. Especially on to the conveyor belt, their hands getting in caught between the conveyor belt and the load.

The workers also may be struck by the material falling of the conveyor when the conveyor is not loaded with the material. In any stable or stacked way manner then obviously, you may have rolling over objects okay which may fall on or struck the worker. Or they may also get caught in

the conveyor and drawn into the conveyor path as a result the conveyor belt is moving in a little more than a normal speed.

Precautions install an emergency buttons to stop the conveyor at the employer's work station and prohibit the employees from riding on and materials handling conveyor. Provides guards where the conveyors pass over the work area to keep employees from being struck by or falling materials. Install emergency stop cables that extend the entire length of continuously accessible conveyor belt so that the workers can you know try to stop whenever it is required.

Ensure appropriate personnel inspect the conveyor and clear the stoppage before restarting the conveyor that has stopped previously due to an overload. And this is primarily called a screw conveyor so this screw conveyor has to be completely covered. Screw conveyors are used for handling cement in the construction site. And especially in loading and unloading or discharge points this screw conveyors has to be completely covered to prevent all the hazards.

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**Safety while stacking materials**

- Stacking materials can be dangerous if workers do not follow safety guidelines
- Falling materials and collapsing loads can crush or pin workers, causing injuries or death
- Precautions
  - Stack lumber no more than 16 feet high if it is handled manually, and no more than 20 feet if using a forklift
  - Ensure that stacks are stable and self-supporting
  - Do not store pipes and bars in racks that face main aisles to avoid creating a hazard to passers-by when removing supplies
  - Stack bags and bundles in interlocking rows to keep them secure
  - Stack drums, barrels, and kegs symmetrically
  - Block the bottom tiers of drums, barrels, and kegs to keep them from rolling if stored on their sides
  - Place planks, sheets of plywood dunnage, or pallets between each tier of drums, barrels, and kegs to make a firm, flat, stacking surface when stacking on end
  - Chock the bottom tier of drums, barrels, and kegs on each side to prevent shifting in either direction when stacking two or more tiers high
  - Paint walls or posts with stripes to indicate maximum stacking heights for quick reference
  - Observe height limitations when stacking materials;

Stack loose bricks no more than 7 feet in height (When these stacks reach a height of 4 feet, taper them. When masonry blocks are stacked higher than 6 feet, taper the stacks back one-half block for each tier.)

The slide includes several diagrams: a stack of lumber, a stack of bags/bundles, a stack of drums/barrels/kegs with chocks, and a stack of bricks being tapered. A small number '8' is in the top right corner.

Safety while stacking materials so stacking materials can be a very serious potential for struck by or falling objects or caught-in between hazards. So, safety materials can be dangerous if the workers do not follow safety guideline. They should know how to stack cement how to store your cement bags or fine aggregates or even bricks in the constructions site. If they do not follow the safety norms than obviously you are going to have any of the hazards.

Falling materials and collapsing loads can crush or pin workers, causing injuries or death. Precaution, some of the precautions I have picked out so they are too many precautions for all of the material available in the IS code and in the OSHA subparts you can go through it later. Stack lumber no more than 16 feet high if it is handled manually and not more than 20 feet if it is handled using a forklift.

Ensure the stacks are stable and self-supporting. Do not store pipes and bars in racks that face main aisles to avoid creating a hazard to passerby and when removing the supplies. Always when you are stacking the material you should always allow movement of the worker without disturbing the stacked loads. Stack bags and bundles in interlocking loads rows to keep them secure and also there are lots of norms.

It should not be known touching the godown say the materials godown on any of the corners not even till the roof level or you know it is actually known leaning on to the roof level or to the side walls. All these are not safe when you are stacking cement these precautions are all available in the IS code. You should have a plank or some support an elevated support so that and you start stacking your cement bag so that water or any wet substance is not damaging the cement.

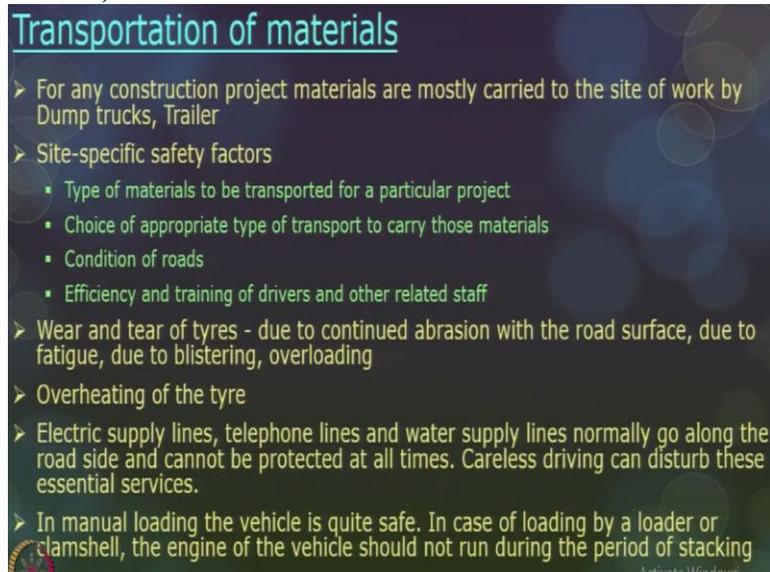
Stack drums, barrels and kegs symmetrically, and block the bottom tiers of drums, barrel and kegs to keep them from rolling off if they are stored on their sites. And place planks sheets of plywood damage or pallets between each tier of drum, barrels and kegs to make a firm, flat stacking surface when you are stacking on ends. And check the bottom tier of drums, barrels and kegs to prevent shifting in either direction especially when you are storing 2 or more tiers high.

Paint walls or post with stripes to indicate the maximum stacking limited so that it is easy to you know identify for quick references, you need not check the height each and every time. Observe height limitations when stacking materials and when you are putting lot of post or painting it. So that it is very visible, as to what is the maximum limited of stacking the material. And stack loose bricks not more than 7 feet height and more than 4 feet high you should start tapering down.

So, after 4 feet you should start tapering leaving half a brick and width so that it is not actually falling down and creating a struck by fall hazard. Transportation of material, so during

transportation also there are lot of precautions you may have to follow. So, this transportation can happen most often in a site by with the help of dump trucks or trailer.

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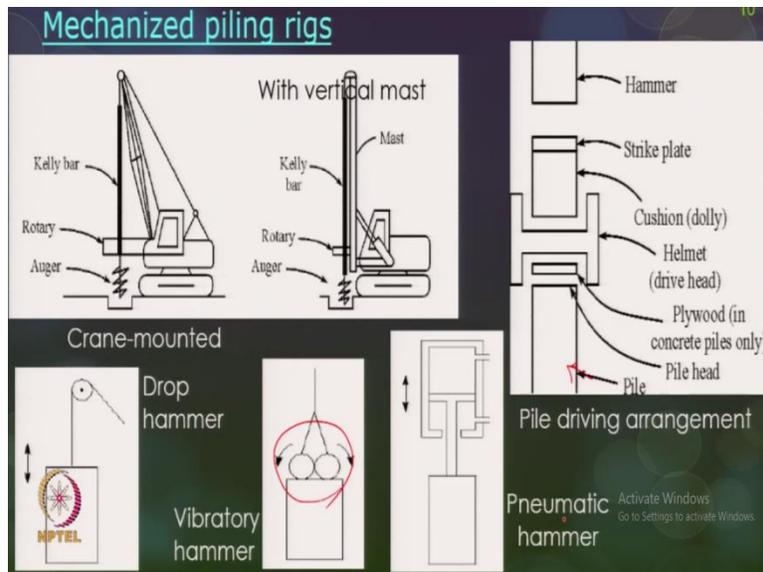


Site specific safety factors you should always think of what is the of types materials to be transported. Choice of appropriate transport so depends on the type of material also, condition of the road and efficiency and training of drivers. So, these will decide the load limit and the type of material and the choice of the equipment as well for transporting materials. You should also note down of wear and tear of tires.

So, wear and tear can happen due to continuous abrasion with the road surface because the wheels are moving along the road. So, there can be friction which can happen and also due to fatigue especially when you are loading up the trucks or your trailers too much more that the normal capacity. The equipment may have lot of fatigue, blistering, overloading, over heating of tires can also happen.

And when you are moving along electric supply lines telephone lines and water supply lines these may come along the road side and you should be knowing that they are not protected always. So, you cannot be taking care of those protection, so you should be you know carefully driving when you are transporting the material along the road.

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And when you are handling the equipment using equipment like clamshell or any other cranes or something, you should also keep in mind of the overhead clearance with the electrical power lines and so on that also has to be checked. Now next operating is primarily called piling so we will discuss about pile driving equipment. So mechanized piling rigs so this is primarily a crane mounted piling rig.

Which is used to drive a pile beneath the soil for foundation and this is primarily the pile driving arrangement. You have a hammer okay and this is a strike plate there is a cushion or a dolly their and there is a helmet beneath. And plywood in case of concrete pipes and then you have the pile head and the, which we call as the pile cap and the pile which is primarily driven inside.

And there are some many types of hammers available single head, double head, drop hammers and so on there are lot of varieties available. So, drop hammer has this mechanism you have a heavy load and with the number of beats on to the pile, the pile is driven into the soil. Vibratory hammer with the help of vibration which try to know displace the soil and move the pile into the soil. The other one is a pneumatic hammer.

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### Pile Drivers/Piling Rig

- Pile drivers shall not be erected in dangerous proximity to electric conductors
- If two pile drivers are erected at one place these shall be separated by a distance at least equal to the longest leg in either rig
- No pile-driving equipment shall be taken into use until it has been inspected and found to be safe.
- Pile drivers shall be firmly supported on heavy timber sills, concrete beds or other secure foundation
- Pile driving equipment in use shall be inspected by a competent engineer at regular intervals not exceeding three months
- Defective parts of pile drivers shall be repaired by only competent person
- All bolts and nuts which are likely to be loosened due to vibration during pile driving shall be checked regularly and tightened
- When not in use the hammer shall be in dropped position and shall be held in place by suitable means
- Motor gearing, transmission, electrical wiring and other dangerous parts of hoisting appliances should be provided with efficient safe guards
- When loads have to be inclined they shall be adequately counter-balanced; and the tilting device shall be secured against slipping
- Adequate precautions shall be taken to prevent a pile driver from overturning if a wheel area is
- Adequate precautions shall be taken to prevent the hammer from missing the pile
- **NOTE:** Necessary, long piles and heavy sheet piling should be secured against falling



Now we will discuss about the Pile drivers, and this is a complete crane mounted pile setup. Pile drivers should not be erected in dangerous proximity primarily close to electric conductors and so on. Because when the load is most of these parts are made up of galvanized steel so you may have electric shocks and electrocution may happen. So, you have to be very careful that it is not you know in close vicinity of electric power cables and so on.

Adequate clearances should be maintained when you are doing a pile driving operation. If 2 pile drivers are erected at one place close to each other. And these should be separated by a distance of at least equal to the longest leg in the either rig. No pile driving equipment shall be taken into use unless it is inspected and certified that it is safe for use, you should not be using it. And the pile drivers shall be you know, firmly supported on heavy timber stills or concrete beds so that there is proper stable foundation.

And the pile driving equipment in use shall be inspected by a competent engineer at regular intervals but not more than 3 months before that the inspection should have been done. And during inspection if any defective parts identified, they also should be repaired and again inspected by the same competent person. All bolts and nuts which have come loose because of the vibration due to the pile driving mechanism all should be checked regularly and tightened.

When not in use, the hammer shall be in drop position and not in the hanging position and shall be kept in place by a suitable means. You can think of any place of means of setting the hammer you know in a proper rest position. Motor gearing, transmission, electrical wiring and any other

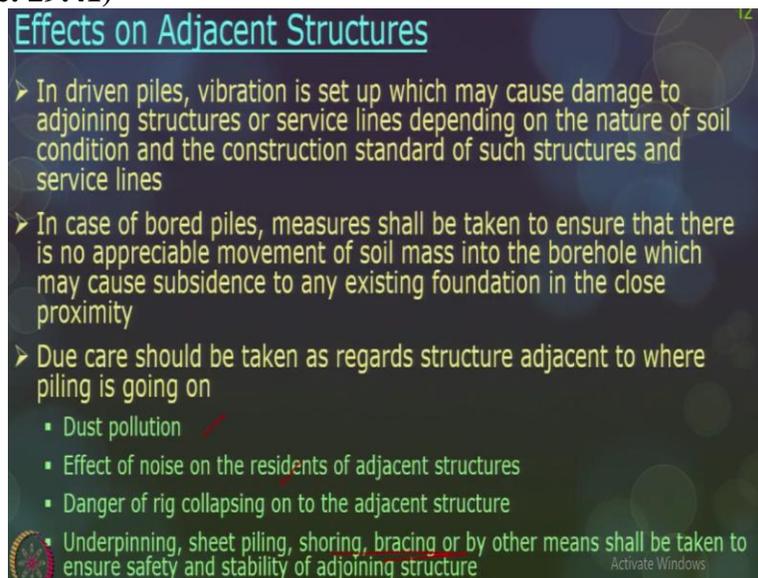
dangerous parts of these hoisting appliances should be provided with proper safe guard so that it is not you know creating a struck by or an, other hazards.

When loads have to be inclined, they shall be adequately counter balanced so that the tipping of the piling equipment does not happen. Adequate precautions should be taken to prevent a pile driver from over turning. May be even when a wheel breaks or unstable soil conditions or it can may be a wrong positioning of the pile so there can be tipping over of hazard, so that has to be taken care of. And adequate precaution should be taken to prevent the hammer from missing the pile.

So, this point load, first you have to fix the hammer onto the pile so that center of place okay that has to be maintained before you start driving the pipe. If necessary long piles and heavy sheet pilings should be secured against fall hazards. Effects on adjacent structures when you are doing the pile driving operation sometimes you know these vibrations or even the blow can be lot of hazards creating to the neighboring structures.

Starting from dust starting from noise all these PPEs workers have to wear and you have barricade the structure completely, especially when you are doing the piling operation.

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**Effects on Adjacent Structures**

- In driven piles, vibration is set up which may cause damage to adjoining structures or service lines depending on the nature of soil condition and the construction standard of such structures and service lines
- In case of bored piles, measures shall be taken to ensure that there is no appreciable movement of soil mass into the borehole which may cause subsidence to any existing foundation in the close proximity
- Due care should be taken as regards structure adjacent to where piling is going on
  - Dust pollution
  - Effect of noise on the residents of adjacent structures
  - Danger of rig collapsing on to the adjacent structure
- Underpinning, sheet piling, shoring, bracing or by other means shall be taken to ensure safety and stability of adjoining structure

In driven piles, vibration is set up which may cause damage to adjoin structures or even service lines depending on the nature of soil condition and the construction standard of such structures and service lines. When you are doing bore piles measures should be taken to ensure that there is

no appreciable movement of soil mass. Into the bore hole or which may also cause, you know subsidence or to any existing foundation which is in the very close vicinity of the pile which is driven.

So due care should be taken primarily because of the dust pollution, noise with the residents of adjacent structures, then danger of the rig collapsing on to the adjacent structure. So underpinning, sheet piling, shoring, or bracing all these can be thought of as a safety precaution to prevent a adjacent structure.

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The image shows two OSHA Quick Cards. The left card is titled "OSHA QUICK CARD Top Four Construction Hazards" and lists four categories of hazards: Falls, Struck-By, Caught-In/Between, and Electrocutions. Each category includes specific prevention tips and is accompanied by a small icon. The right card is titled "OSHA QUICK CARD Safe Forklift Operation" and provides safety guidelines for forklift use, including wearing seatbelts, not exceeding rated loads, and proper maintenance.

**Recap**

**OSHA QUICK CARD**

**Top Four Construction Hazards**

The top four causes of construction fatalities are: Falls, Struck-By, Caught-In/Between and Electrocutions.

**Prevent Falls**

- Wear and use personal fall arrest equipment.
- Install and maintain perimeter protection.
- Cover and secure floor openings and label floor opening covers.
- Use ladders and scaffolds safely.

**Prevent Struck-By**

- Never position yourself between moving and fixed objects.
- Wear high-visibility clothes near equipment/vehicles.

**Prevent Caught-In/Between**

- Never enter an unprotected trench or excavation 5 feet or deeper without an adequate protective system in place; some trenches under 5 feet deep may also need such a system.
- Make sure the trench or excavation is protected either by sloping, shoring, benching or trench shield systems.

**Prevent Electrocutions**

- Locate and identify utilities before starting work.
- Look for overhead power lines when operating any equipment.
- Maintain a safe distance away from power lines; learn the safe distance requirements.
- Do not operate portable electric tools unless they are grounded or double insulated.
- Use ground-fault circuit interrupters for protection.
- Be alert to electrical hazards when working with ladders, scaffolds or other platforms.

**OSHA QUICK CARD**

**Safe Forklift Operation**

Forklift operators and employees working around these operations are at risk of hazards such as collisions, falls, tip-overs, and struck by conditions. Ways to prevent these hazards include:

**Forklift Operations**

- Always wear a seatbelt when the vehicle has one.
- Never exceed the rated load and ensure it is balanced.
- Place the forklift in neutral and set the parking brake before raising the load.
- Keep a safe distance from platform and ramp edges.
- Be aware of other forklifts in the work area.
- Have clear visibility of the work area when loading and operating a forklift.
- Use the grab bar and proper footing to enter the lift.
- Use lights, mirrors, and horns.
- Watch for pedestrians and observe the speed limit.
- Do not use the forks to lift people.

**Safety Training**

- Only trained workers may operate a forklift.
- Ensure operators are trained on types of trucks in use.

**Forklift Maintenance**

- Remove from service any forklift found to be in unsafe operating condition.
- Perform preventive maintenance according to the manufacturer's recommendations.
- Keep forklifts in clean condition; free of lint, excess oil, and grease.

Recap, so we have discussed about, struck by and caught-in between hazard. So never position yourself between moving and fixed objects. Wear high visibility cloths near equipment or vehicle so that the driver is able to see you properly. Caught-in or between never enter an unprotected trench. Unprotected trench is also one of the caught in hazard. Excavation 5 feet or deeper without an adequate protective system in place it can be sloping, shielding or trenchers.

Some trenchers under, 5 feet deep may also need such a system. Then, next forklift operation, so forklift operation always wear a safe seat beat when the vehicle has one. Never exceed the rated load and ensure it is always forklift is balanced. Place the forklift in neutral and set it in parking brake before raising the load. Keep a safe distance from platform and ramp edges. Be aware of other forklifts which are operational in the work area.

Have clear visibility of the work area when loading, and operating a forklift. Use a grab, bar and proper footing to enter the forklift. Use lights mirrors and horns while moving in the site. Watch for pedestrians observe the speed limit especially while you are going ascending, descending or when you are on a wet floor. And when you are loading and unloading maintain all the safety norms. Do not use forklifts to lift people.

And always trained workers should only operate a forklift. Maintenance, remove from service any forklift found to be in unsafe operating condition. And always keep the forklifts in clean condition, free of lint, excess oil, grease especially on glass mirrors and so on.

**(Refer Slide Time: 32:30)**

**Recap**

**Struck-By Hazards**

There are many different ways struck-by accidents can occur, but the most common involve:

- Vehicles and cranes
- Falling or flying objects
- Constructing concrete and masonry walls

**Falling and Flying Objects**

- Falling objects often present a hazard when working near cranes, scaffolds, materials handling operations, and stacked materials. Follow these safety precautions to avoid injury.
- Avoid working underneath loads being moved.
- Barricade hazard areas and post warning signs.
- Inspect cranes and hoists to see that all components, such as wire rope, lifting hooks, chains, etc., are in good condition.
- Do not exceed lifting capacity of cranes and hoists.
- Wear a hardhat.
- Secure tools and materials to prevent them from falling on people below.
- Use toeboards, screens, or guards on scaffolds to prevent falling objects, or
- Use debris nets, catch platforms, or canopies to catch or deflect falling objects.
- Stack materials to prevent sliding, falling, or collapse. Bags of materials should be loaded neatly by stepping back the layers and cross-tying the bags at least 1/3 of the way up.
- Do not store materials on scaffolds or runways.
- Use plastic chutes and barricades as appropriate to keep personnel from being struck by discarded rubbish and waste materials.

**Caught-In and Caught-Between Hazards**

There are many different ways caught-in and caught-between accidents can occur, but the most common involve:

- Trenching
- Unguarded machinery
- Equipment

**Equipment**

Powered industrial trucks (forklifts), cranes, and other heavy equipment can pose caught-between hazards at the workplace. Here are some examples:

- Heavy equipment (an overturn, and if the operator isn't wearing a seatbelt or the vehicle isn't equipped with ROPS, he or she can be caught between the truck and the ground.
- Operators can run the equipment into pedestrians, pinning them between the vehicle and the wall or stacked materials.
- If loads are not properly loaded or secured to equipment, the loads can fall off the truck onto workers, pinning them between the fallen load and the ground or other materials.
- Workers unsafely riding on equipment can fall off and get run over.

To prevent these types of accidents:

- Wear a seatbelt when operating equipment if it is equipped with one.
- Operate equipment that has ROPS, as appropriate.
- Do not ride equipment that is not safely equipped for passengers.
- Make sure all loads are properly secured and within the rated capacity of the heavy equipment.
- When operating equipment, be aware of pedestrians in the area.

Recap again, so struck by and caught in hazards, Struck by hazard main common ones are vehicles and cranes. Cranes we will see in the next lecture. Falling or flying objects constructing of masonry and concrete walls. Caught in or between primarily trenching unguarded machinery and equipment primarily forklifts cranes and so on.

**(Refer Slide Time: 32:54)**

## References

- 29 CFR 1926 Subpart H Material handling, storage, use and disposal
- IS 7969: 1975 Safety code for handling and storage of building materials
- IS 4082:1996 Stacking and storage of construction materials and components at site – Recommendations
- 29 CFR 1926 Subpart O Motor Vehicles, Mechanized Equipment, and Marine Operations
- IS 5121:1969 Safety Code for Piling and other Deep Foundations

And these are the references which I have used for making this material ready. Thank you.