

Safety in Construction
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Lecture-1
Introduction to Safety in Construction

Good morning. So, welcome you all to this course on safety in construction and this first class primarily will be an introduction class.

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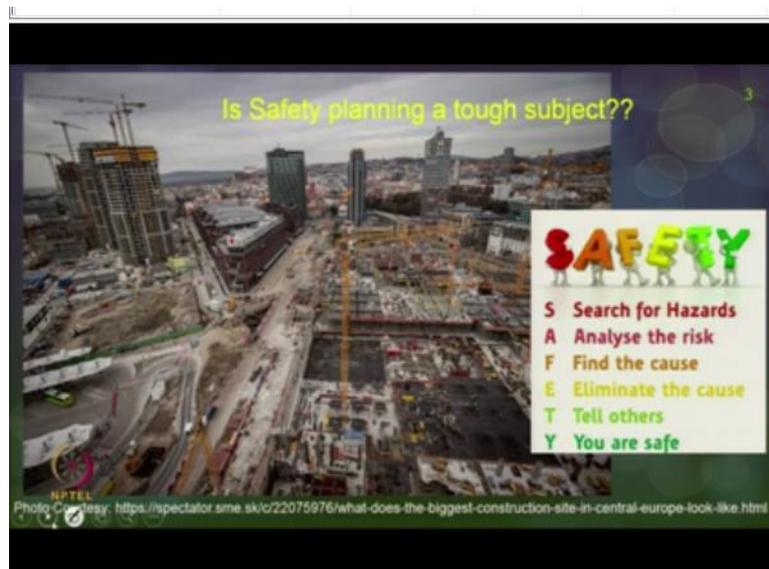
Then let us see how safety is seen as a concept in the construction industry. So, a lot of posters you would have seen these days in any construction site and few of the posters which clicked my attention I have copied here just to share an idea as to say what safety is all about. So, there is no particular order I will go in a random sequence. Safety is as simple as ABC. So, ABC stands for Always Be Careful.

So, with this poster, it is very simpler to understand what is safety. So, the only way in a construction site is a safety is a full-time job whether it is day or night and it is better to protect yourself and your co-workers because your actions may hurt anyone or even the equipment and rather than know just putting somebody into risk better to correct a friend. So, safety whether it is an accident, whether it is big or small, avoid all of the accidents. Like this you would have seen a lot of posters. There is no substitute for safety, work safe.

So, safety first make your workplace safe then before starting your job. So, all these you would have seen “No safety, no pain” and few of them which are very critical are “Safety protects people and quality protects jobs”. Always safety and quality travels together. If there is time availability, I will talk about quality productivity also in the due course of time. So, safety talks about caring of people and the workers along with the construction progress.

So, safety is primarily a state of fully conscious mind, and accident generally happens with an unconscious mind or in an absent state of mind. So, better to be alert every time when you are working on a construction site, then you can say it is not a very big task to do, it is actually simpler and easier. But there are some things which does not let safety to be achieved in construction practice that you will learn at the end of this course.

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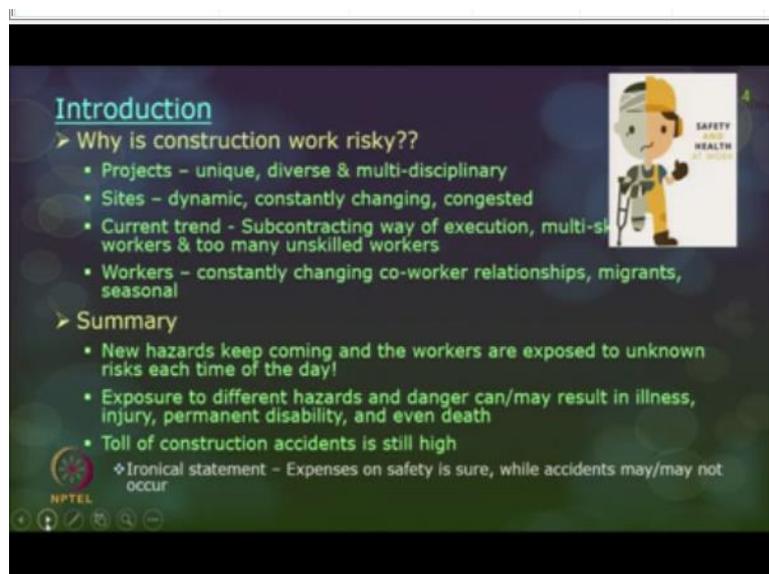
So, with this introduction, I would like to talk about what is safety. So, these days construction projects are all very complex, challenging, innovative and there is nothing like nowadays every contractor wants to bid internationally and get international projects. So, because it is really possible with the digital world which is existing even in construction sites. So, safety, it looks very similar with all these posters.

So, is safety really a tough subject? So, the first question that can come to your mind, seeing all the marvels of the recent projects, which are happening these days. For example, metro construction, airports and other infrastructure projects, it is looking very astonishing to see projects getting completed in a very massive scale and so on. But, if you look at other issues,

there is some negative issue going on as a result of accidents happening which is catching the attention of media personnel.

And claims, compensation which is creating a friction between the owner and contractor. So, all these are really happening. So, let us know more technically on what is the safety all about. Again, so, what safety is all about? So, very simpler definition search for hazards, analyze the risk, find the cause, eliminate the cause, tell others that you are safe. This is the safety poster which I clicked from one of the construction sites which caught my attention.

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So, let us talk about why in construction we are not able to achieve a safe environment compared to other sectors. For example, safety is a major concern in every sector, like aerospace or manufacturing side or anything else. But why in construction, it is so fuzzy and why in construction, it is not achieved even till date. There are so many factors which are unique factors as regard to construction projects alone.

And let us discuss few of them as such let us talk about the projects. So, most of these projects are unique. For example, if you do your manufacturing of a car, the same model of the car you may be manufacturing repeatedly. So, you know what are the hazards, you know what is the sequence of not complicating too much, you know what safety precaution will suit you best and so on.

The construction projects are unique. So, what happens is the learning you get in one project, you may not be able to apply maybe in the next 4 or 5 projects at least and that knowledge

and experience that you got in the learning of one project you may apply maybe after 5 or 10 projects only, that does not happen in other sectors and construction projects are always very diverse, you have so many engineers starting from architects, structural engineers, MEP engineers.

Then your consultants, vendor suppliers, so, many people come in and play their role. So, it is actually meeting different minds and at the same time getting the work progress done and at the same time, having a safe environment in place is quite challenging. And as a result, projects are most often multidisciplinary. Sites - most of the sites are dynamic as I told you, the projects are unique and hence sites are also dynamic.

For example, if you look at metro construction or maybe a tunnel construction or maybe even pipeline projects, you start in destination A and after a few weeks or months you may be in some other place as destination B. So, projects are dynamic as a result your soil conditions vary, your environmental situations vary, you are the constraints with regard to traffic and other all circumstances start changing and they are very dynamic from day to day.

And what about a stationed project wherein, we call it as a stationary project and only in one particular location the project is happening and most of these sites if you see are all very congested you get a very short space alongside your to be built structure and in that you have to plan and keep all your materials, your storage places and also station your workers and keep them there for the construction work.

So, what happens is when you are handling too many things and it is very congested site then where to and how to maintain safety, that is a very big question mark in many of the construction sites. The current trend in projects is primarily a sub contracting way of execution, most of the contractors for several reasons, maybe for want of completing the project earlier or maybe for want of specialized people to do the particular small portion of work. The contractors that bid the project, get the project awarded.

And then they break it down into smaller modules and outsource it to some subcontractors who have the expertise, equipment, skills, knowledge, the basic technology and they bring in the complete energy into the project. So, there is a good thing about it, but the one disadvantage here is this crew, the subcontracted crew are all new to the entire project work

zone and different crews are there and as a result, you may have to give adequate space for them to put up their equipment or the sequence of works.

And one contracting group should not be disturbing or interfering with another subcontracting group. So, all these happens and these contractors, they all have a lot of seasonal and migrant workers who come in and go for their own routine jobs, who are not permanent workers registered in any construction company. So, as a result, what happens there is a constant changing co-worker relationship.

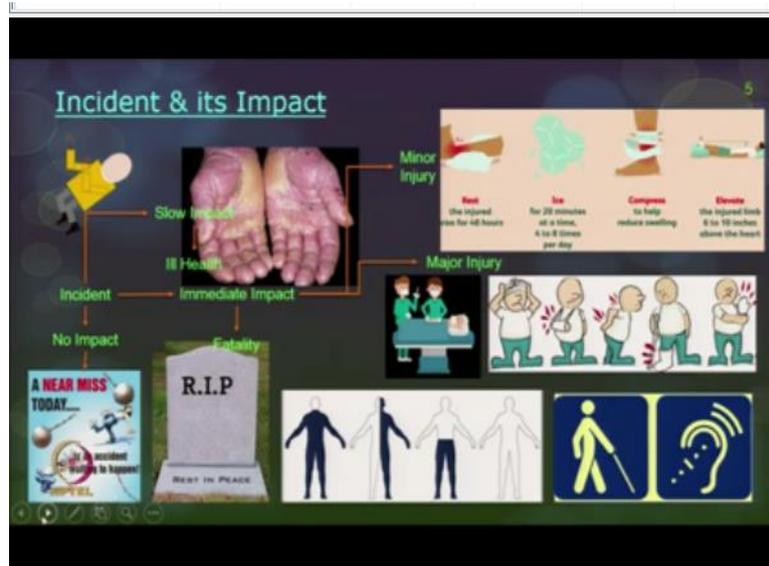
Today I may be working with some other crew and later on for want of job, for want of money, I may move on to another subcontracting group with a different co-worker and so on. As a result, what is the problem with the co-workers, as a result, every situation for you is new. You do not know whom to report to in case of any danger you have seen at the site, you do not know whom to ask for help.

You do not know whom to ask for any issues with regard to the construction work progress and so on. So, like this, there are some challenges and most of these risks are very, very specific to your construction, workplace and environment. So let me summarize this. We are improving on safety. Every construction site wants to be safe these days. Because right now, projects which are handled with the no accidents are all regarded are all rewarded and regarded as best projects.

So, every project site is taking care of maintaining safety and norms. But still hazards keep coming because projects are always challenging or innovative in nature. So, new hazards keep coming and thereby workers are exposed to several unknown hazards and risks each time of the day. So, exposure to these different hazards and danger can cause illness or injury or even a death.

So, the toll of construction accidents is still keeping on increasing and the other part is the projects are also challenging and innovative on one side and on the other side, accidents may or may not happen, but if you start allocating a budget on safety and try to promote safety, that budget is actually spent. So, that is one of the reasons why employers try to compromise and try to put down the budget as low as possible on safety compared to promoting safety in construction sites. That we will talk about cost part in the next week.

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So, now, let us talk about different terminologies that we have seen in today's class especially with the introduction so far. So, all these terms start with a common terminology called incident. So, what is an incident? Incident is nothing but anything that happened unexpectedly. For example, there may be a lot of material lying on the floor where the workers are passing by, they would have been passing by that area maybe for 10, 15 times at least.

Suddenly, one worker was about to slip and fall, that is primarily called incident wherein you do not expect that to happen, but it has happened. Even in day to day life, you may have seen several examples like this, you may have taken a glass of milk and it was about to fall. So, that is primarily called as an incident. And when this incident creates no impact, then it is primarily called a near miss.

Maybe in the worksite, the worker did not fall nor he got hurt himself nor he pushed down to some other worker and made him hurt. So, nothing happened no impact as such. So, that is primarily called a near miss, even in the same everyday example, I can tell you, the glass did not break, not the milk did not spill, nothing happened, you could grab the attention and keep the milk back in same place.

So, that is primarily called as near miss. Now, what are these near misses? These near misses are actually called as inexpensive wake up calls. So, something bad is going to happen tomorrow. So, you have to be alert that something is not good in a particular direction.

Maybe you change the cup size, so that the milk is not feeling hot or the heat of the milk on to the cup, maybe you change to another material as such or you do not pour too much of hot milk.

So, something is warning to the person in charge that there is a hazard happening and you are so lucky that nothing happened this particular round. Now, you can also see some immediate impact. So, any incident will trigger either no impact or there can be a visible impact. Now, let us go with the most unexpected impact to the least impact. So, the most unexpected impact maybe the worker fell.

And it was a hole or an opening close by. He fell down from nth floor and he fell off and he got died. That is primarily the least impact which construction site should not be attempting for. The other from the less serious impact let us move in that direction. The next one is major injury in interchangeably it is also spelt as accident. So, what is an accident? Maybe you get paralyzed or paralysis again, there are so many ways of paralysis.

As seen in this picture, either one side paralysis or complete body except the head paralysis like this there are so many medical terms available or either you get hurt very seriously that you either lose your hands or legs or any part of your limb or you become deaf or something like that. So, these are all part of examples of a major injury. Minor injury, maybe you get a fracture or a contusion or there may be a swelling in your organs.

So, something like that and where you will get recovered and then you are back to work. This is colloquially expressed as injury also. So, as such you have fatality as a first from the more severe impact, then major injury or an accident, minor injury or interchangeably it is also called injury and the other one is near miss. Then first aid cases are also there. First aid cases are not even visible in any construction site.

First aid cases, you go to the first aid center and get treated within 1 day or 2 days maximum, you return back to work. So, they are not that serious in any construction sites. And the other one is a slow impact, there can be hazards which can create slow impact onto the workers. So, slow impact for example, if you work continuously in concrete or you are handling cement, maybe you do not even wear a proper glove or something and then you start handling cement.

After some point of time, you may see lot of know cement dermatitis, that is primarily called cement semen dermatitis and these are all will not happen just in 1 day or 2 days, it happens maybe for several years down the line, maybe 3 to 5 years or some impact can even happen 10 years later on. So, these are all called as health issues. So, now, if you look at incident impacts, this is not triggered with an incident, but I am just categorizing everything together.

So, incident has either no impact which is called near miss, for immediate impact, you have a minor injury, major injury and fatality and a slow hazard impact we call it as a health issues and if you look at the history of safety, which we will discuss a little later. So, in the history of safety, so far people were worried about only the visible impacts, whatever we call it as a minor injury or a major injury and fatality that was what was really seen by these construction group.

So, they were treating lot of safety programs policies, etc. most often were focused only for safety issues in construction, these health issues started becoming a very big serious concern in construction sites, maybe from 2000 onwards only. Otherwise, safety was a long-time phenomenon, it was going on in many construction sites.

But right now, every policy or program also addresses health issues in it. So, safety and health are not like 2 different aspects. Safety and health nowadays go together in construction sites.

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Definitions

- Safety – absence of danger or a state of protection
- Incident – an unplanned and unwanted event which disrupts the work process and may cause injury or damage
- Near miss – incidents where no property was damaged or personal injury sustained, but given a slight change in time or position, damage and/or injury easily could have occurred, but didn't occur this round
- Accident – the National Safety Council defines an accident as an undesired event that results in personnel injury, loss of business opportunity or property damage
 - Accident is an incident plus its consequences
 - In reality, construction accidents are the result of negligence, needless and they can be easily avoidable
- Injury – cut, fracture, sprain, etc.

Not only an accident; a near miss and even an incident should also be investigated to achieve zero accidents in site

So, now, let us talk about the definitions. So, what is safety? Safety is always defined as an absence of a danger or a state of protection. So, then few of the terminology which we have seen in the previous slide, number 1 is incident. So, any incident is an unplanned or unwanted, unexpected, unfortunate, whatever you want you can keep, which disrupts the work progress and may cause an injury or damage.

So, based on the impact, one is near miss, incidents where no property was damaged, no personal injury sustained, but given a slight change in time or position, damage or injury easily could have occurred and did not happen this round because of the luck factor. Now, there are some things which has come in the definition. So, if you look at safety, most of the focus on safety is only on personal injury in the sense only on the workers injury.

But safety as such talks about it has to take care of equipment materials in the site, equipments available in the site and also on the personnel which implies workers on the site and other human beings on the site. So, but if you see, it just so happens colloquially, most of the safety norms and policies are primarily are towards workers, well being in the sites only.

Then next is accident. The National Safety Council defines an accident as undesired event that results in personal injury, loss of business opportunity or even a property damage. Loss of business opportunity in the sense maybe you lose 1 hand or 1 leg and you may not be fit enough to continue on some particular jobs and you may have restrictions in certain jobs that is finally referred as loss of business opportunity.

And the other one is property damage or maybe your structure, which you have partially considered would have got damaged or maybe equipment damage it can be anything. So, accident is nothing but some people write this as equation also, it is nothing but incident plus consequences, in reality, all construction accidents are result of negligence and they are needless.

They need not happen because of so, many issues, we will talk about that later and they can be easily avoidable provided you follow proper safety rules. First of all, you should know what are the hazards and you should know what are the safety precautions for the same and do not hesitate to follow all the safety precautions, then all accidents can be avoided. Even if

accidents happen in spite of all these because it is considered as unplanned, unwanted, unfortunate and so on.

Still the impact can be at least minimized, maybe a hammer fell on a worker's head, he did not wear a proper PPE, then it could have been a very serious injury to the worker compared to if he had a hardhat, it may be a slight head injury for the same worker. So, your impact on the accident can be really minimized. The next one is in injury. Injury can be any cut, fracture, sprain, etc. And not only an accident, a near miss and even an incident should all be investigated if you want to focus on zero accidents in construction site.

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So, this is primarily on safety permit. Now, if you talk about all these issues, so, these near misses, minor injury or major injury or fatality all happens as a result of some incident. So, that we have discussed in the previous class and this incident is of two issues, one is unsafe act, other one is unsafe conditions. So, now, if you see here in many of the construction site, as I told you, there may be 1 fatality or 2 fatality can happen in a construction site these days.

That is what statistics talks about major injuries in a normal construction site, we are not talking about complicated projects or complex projects and the regular construction site maximum 1 or 2 fatality happens these days. And if you look at major injury, there may be at least 30 to 40 of major injury as against 300 at least of minor injuries or near misses can be even to a lakh.

This is what is some of the thumb rule which happens these days in many of the construction sites. But if you see, is it really easy to document everything? It is not that easy to document all these issues which happens in the construction site, most probably the fatality goes into documentation, major injury goes into documentation. So, the visible iceberg. So, this can be compared to an iceberg.

So, if you see an iceberg, only the portion which is visible is very small compared to the iceberg which actually lies below the sea level. So, the 'n' lot of known the hazards which is still available in construction sites all goes documented, there could have been minor injury, near misses, whatever it is, but since it is not documented, they are all hidden. So, there can be chances of anything that can happen, if your luck is not in your favour.

So, the documented issues and which people always take care of is your fatality under major injury. Now, let us talk about this unsafe acts and conditions. So, what are these unsafe acts and unsafe conditions? Unsafe acts are primarily related to workers or human beings. Unsafe condition is maybe you wanted to do some substations in a hilly terrain or maybe some transmission lines in a hilly terrain, you cannot change the situation at all.

Hilly terrains have little more dangers. And these are primarily referred as unsafe conditions. So, what happens is so far, many of the people in construction, they think the safety is actually not emphasized or we are not able to bring to zero accidents in construction site because of the dangers in the unsafe conditions. But a lot of statistics were taken up in related to how the accidents happen, how many accidents were happened, what were the real reasons and so on.

And when it was completely analyzed, it was found 2% of all these accidents were acts of god which implies, acts of god refer to your cyclones, heavy rainfall or maybe tsunami or earthquake. All these are primarily referred as acts of god, fire is a manmade disaster and not a natural disaster. So, acts of god can be anything related to natural disaster. So, 2% of accidents are related to natural disasters.

And 98% of all these incidents which are happening in sites are can be prevented and they are preventable. And if you still go and zoom into the 98% of that 10% of these causes are due to unsafe conditions, which you cannot avoid or maybe you can take efforts to safeguard your

site that is possible, but you may have to spend money on that. And 88% of these accidents or incidents that happen in construction sites are primarily related to unsafe acts which implies to workers.

That is primarily a human tendency, maybe first time when you are crossing the road after you are grown up you will be very hesitant to cross a road, seeing the traffic on either sides and this and that and then you take so much time to cross a road. After you are used to crossing the road for several times then you know the hazard coming in. So, you cross the road even when traffic is moving on, that is primarily a human tendency.

So, what happens is most of these accidents which happens in construction sites, once the workers are very comfortable with what they are doing, they start doing it without even respecting the safety policies and norms. So, that is where 88% of these accidents happen. Now, what are these injuries which has to be reported or recorded so that it acts as a lesson for future projects to come.

So, actually one mistake you do you should have learning from that mistake. So, what all has to be reported, any death obviously has to be reported, the reason for death why it happened, where it happened, what really happened, what did the worker did not do? What precautions did the management not take? So, all these has to be reported, any accident which happens in the site, which implies your major injury has to be reported for sure.

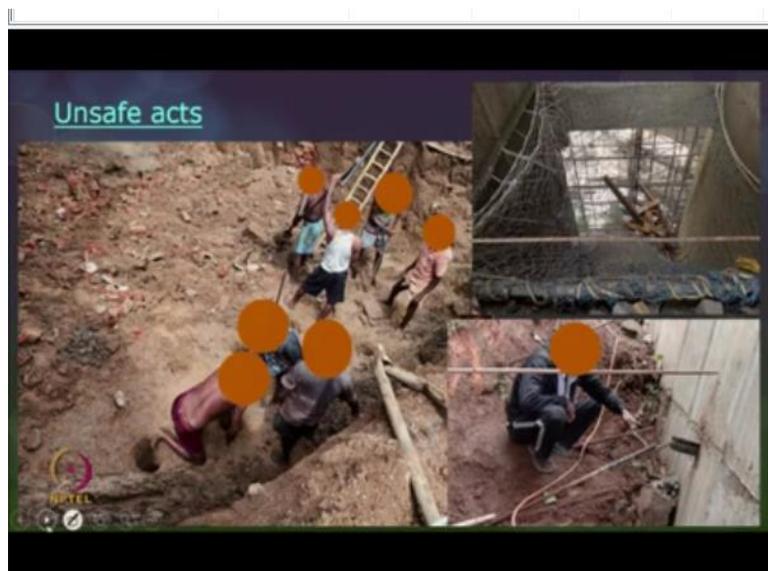
Minor injury yes, if possible and if you have a system in place wherein you can record all your minor injuries, yes, it also has to be reported. First aid cases, yes, including near misses also has to be reported if you want to have a complete packed zero accidents in construction site, near misses and first aid cases even though there are too many happening every day. But still there should be a policy of reporting and documenting everything and which should be I was just learning lesson to all the workers. The last but not the least, health issues also have to be reported these days.

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Now, let us talk about unsafe acts and conditions. And these are the two terms which has come, unsafe conditions, if you see this particular places is too hazardous and dangerous, no proper place for the workers to even stand and put up their settings and even safety precautions also, there is hardly any provision for safety precaution also to happen in this particular picture. Here also you cannot avoid working on these scaffolds and climbing up and doing all your construction progress work. So, this is finally an unsafe condition, but there could have been a provision for safeguarding the environment.

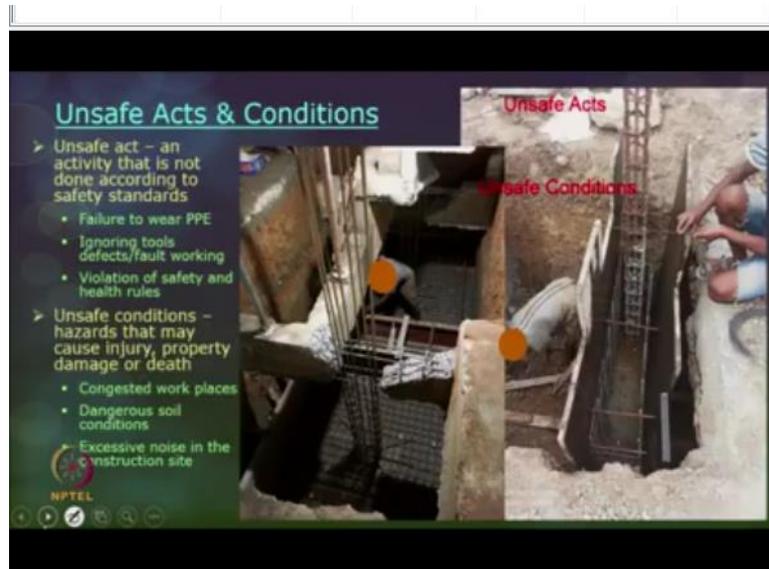
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The next is unsafe acts. Unsafe acts are primarily ignorance of any safety role. For example, in this first photograph, the workers are not even wearing a property PPE, not even a proper safety cloth or even a shoe or a hat for working in a construction site and if you see this picture safety net is only to safeguard a worker or any equipment or anything which falls

down and in this particular picture, it is actually used as like a dustbin to store all the unwanted materials.

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So, what is this unsafe act and unsafe conditions? Unsafe act it is an activity that is not done according to the safety standards, that is primarily called unsafe act. Examples can be failure to wear PPE that is a number one unsafe act in construction site. Ignoring the tools defects maybe today you were operating some equipment it did not work, you do not even take any precautions in reporting it to the management.

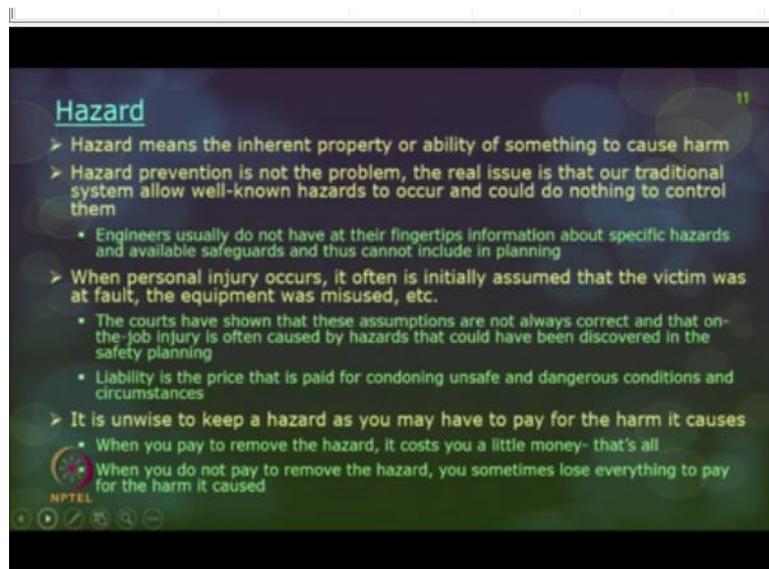
And still, you try to operate and try to complete your work or you do not know how to operate an equipment and you mess up with the functioning of the equipment. All these are examples of unsafe acts. Violation of health and safety rules, you have to wear all your PPEs like your shoes, your hard hats, gloves and then only work, you have to work accordingly only.

Even though if you are not comfortable you should not be removing the PPEs and then start working in a construction site. The next is unsafe conditions, hazards that may cause injury property damage or death primarily is called as an unsafe condition. Examples can be congested workplaces as I shown in the earlier photographs, dangerous soil conditions you would have done so many tests on the soil profile and you would have got a very clear report on what is the soil type, the status and so on.

And then when you start doing your work there could have been settlement, unexpected settlement or maybe your equipment could have sunk into the soil when you are placing the equipment. So, soil is always dangerous and a real mystery in a construction site, which can pose a lot of threats and dangers. Excessive noise in the construction site that is also an unsafe condition, you are working in a very big construction site.

And you are not operating any equipment or something but all around you, you have so many equipments which produce a lot of noise and there are a lot of equipments which produce noise above the permissible decibel levels. So, when you are in the midst of so many equipments and obviously your mind will not be at peace and concentrating on safety. So, this is an example for unsafe conditions.

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The next term which came all along together in the introduction was hazard. And many of these terms are used colloquially in so many places, but at least now you learn the different terms and try to put the proper terms when you are talking about a safety. Hazard means an inherent property or ability of something to cause harm, as such hazard is not dangerous. Because there are three types of hazard, one is that we will discuss when we are talking about hazard analysis as a safety program.

So, every hazard is not active and it will not create any harm. For example, there is an electrical wire which is passing along a line and an equipment also connected to it which was operating and so this is primarily an active hazard if you by mistake you slip or trip on to the

electric wire and you fall off it can create a lot of hazards. And let us also try complicating the issue and maybe it is lying along the floor, wherein curing is happening.

So, curing actually has water beneath, so then it is a very serious and active hazard. So, hazard as such has to be identified in any project. That is a number one issue if you want to have a complete safe construction site. Hazard prevention is not a problem. There is no problem in preventing a hazard but most of the time what happens is the contractors or engineers they are not having a fingertip information on all hazards happening in site and even though they have a fingertip information on all the specific hazards which are available in the site, still they do not have a proper idea on how to safeguard the site in spite of all these hazards.

So, hazard prevention is not a problem and the real issue is our traditional system allow well known hazards to occur and could do nothing to control them. One example I can tell is concrete construction. So, concrete construction, the real cast in situ construction or I would say cast in place construction which in right now in recently the terms are all wet construction and dry construction.

If you mix the concrete in the construction site, it is primarily referred as wet construction rather than you do prefabrication or you do panel construction or something else, you can do an alternate method or maybe you even do all your casting away from the construction site that is primarily referred as a dry construction you only bring those concrete stuffs and then start erecting an installation.

What happens when you are mixing the concrete in the congested construction site, you are actually encouraging all dust pollution, your noise in the construction site and concrete is not lightweight, it is very heavy weight, you actually have a lot of musculoskeletal disorders this that and so on. On the other hand, when you are operating it in a closed form or even a precast yard or something you may have a lot of equipments to handle all these substances.

And you need not be closely in contact with this hazard all the time. So, there are a lot of these known hazards which are known to the contractors and to the engineers, but still they could do nothing to control, why because cast in situ construction is really economical and

cheap and you get a lot of unskilled workers to help you in the construction site. So, they could do nothing when it comes to profit margin and other issues.

Engineers usually do not have at their fingertips, information about specific hazards and available safeguards and thus cannot include in planning although while designing itself you can really think about the way the construction will come up and you can really eliminate some of the hazards or at least during construction you can really think about the hazards in the construction sequences.

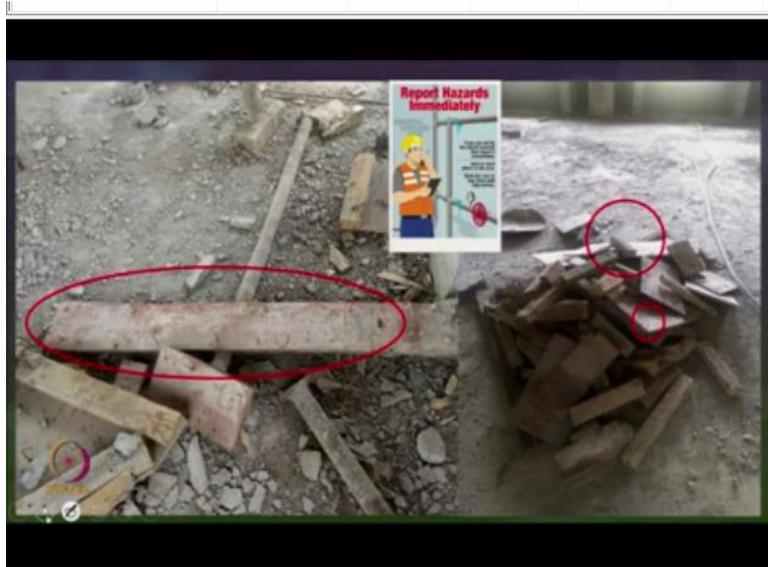
And you can try to safeguard and bring a lot of preventive measures and safety measures still some things are possible, but the decision primarily happens with regard to cost. And the other issue is sometimes the engineers and contractors also do not know how to manage safely. When personal injury occurs, often it is blamed on to the worker or maybe equipment.

Even if it is equipment, somebody is operating the equipment, so primarily it is generally pinpointed on to some worker or in the construction site. But if you see a lot of court proceedings and trials you would have come to know that many of this injury which has been sustained are primarily as a result of some hazard which could have been easily discovered in the planning stage itself.

But, that generally does not happen, because once the courtroom proceedings are over, it actually goes into the files and it is not open to the public to be kept as a lessons learned for other projects to happen. So, it is unwise to keep a hazard as you may have to pay for the harm it causes. But when you have to remove you have to pay, you have to spend a lot of money on it.

But if you do not try to remove thinking that you may have to spend money on it, you may have to pay maybe even more than what you have even anticipated. Sometimes you may have to lose everything to pay for the harm it cost.

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That is the real message behind hazard. So, report hazards immediately. For example, few hazards which are seen in the sites, if you see here there is a lumber which is kept along the side where workers are passing by and if you closely watch it, there are a lot of nails on the lumber which are all protruding. So, this can be a real punch hazard onto the worker's feet when they are passing by on that side. Same at least this is a well-lit ventilated place. If you see here there is no even proper illumination but there are a lot of protruding nails onto these lumbars.

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Some researchers have also identified the top hazards in a typical building project and few of them are fire, unsafe scaffolds, working platforms, open shafts and edges, unsafe electrical equipment, unsafe excavations, unsafe cantilever loading platforms, struck by foreign objects, falling objects, unstable or unsafe structural membranes, overloaded vehicle and forklifts,

unstable mobile crane, unsafe lifting operations, unsafe working at height, unguarded missionary and unsafe access or egress.

So, like this there are a lot of hazards which are still available in construction site and if you closely watch your project and take a note down of all these then you can actually think of a lot of corrective measures and preventive measures for accidents.

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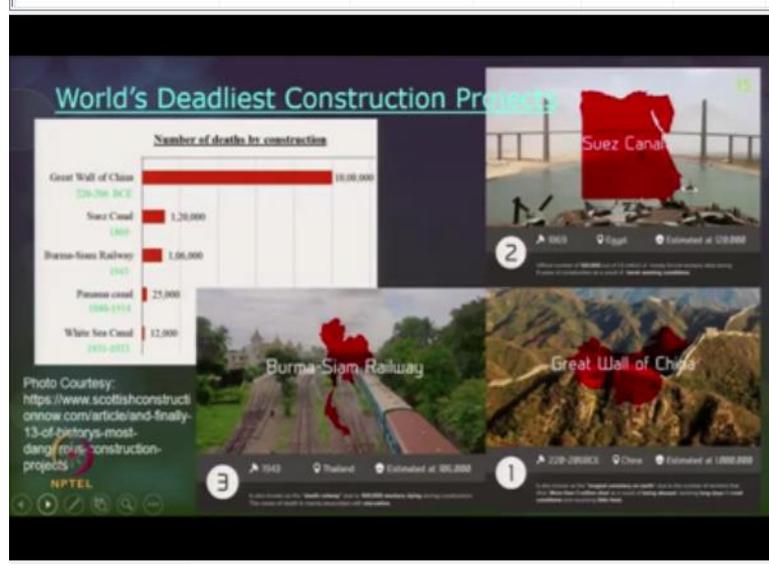
Now let us move on into the terminology. So, we have so far discussed about lot of terminology like fatality, major injury, minor injury, or incident near misses, unsafe acts, unsafe conditions, hazard. Now we will again move back to what is this fatality, major injury and minor injury and how it is in present scenario in the construction site. As I told this pyramid there are lot of numbers to the pyramid.

So, Heinrich has proposed for any one major injury there might be almost like 29 minor injury and 300 near misses. In a way it is 1 is to 30 is to 300. Lot of researchers have given different, different numbers and these numbers have come from different time or different point of time and from different group of construction projects also. So, if you want to know how many this number is quite necessary, because you have to think of safety precautions, how many safety programs.

And investment on safety primarily you do, based on some assessment on these numbers in your project. So, you may have to have an understanding on the number. So, accordingly the other ratios are 1 is to 100 is to 10,000, 1 is to 10 is to 600 like this, there are so many

numbers available. So, but understand always a pyramid has so many near misses compared to major injury. And so many minor injuries compared to major injuries and the same way to fatality.

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So, that pyramid is still existing. Now, let us talk about fatality, we will go again with the severe impact to the least impact. So, number 1 is fatality. If you look at projects which happened like 50, 60 years back and so on 1940s, 1930s or 1869 and so on, there are very famous projects, which are existing even today and they are all treated as wonders of the world.

But if you talk about safety and the number of fatalities that has happened so many projects are really considered as deadliest construction projects. Let us discuss about few of them, Great Wall of China, it had almost like 10 lakh death during the construction. This is only on reported case. So, Great Wall of China had many of the deaths during the construction was happening.

And the Burma Siam railway is actually treated as a death railway because so, many workers died when the railway construction happened, it is almost like 1 lakh, close to 1 lakh people died when the construction happened. Suez Canal again 1,20,000. So, like these projects, your earlier projects had so many deaths which happened and then onwards safety became a serious concern. And now if you see a lot of this fatality has been really cut down.

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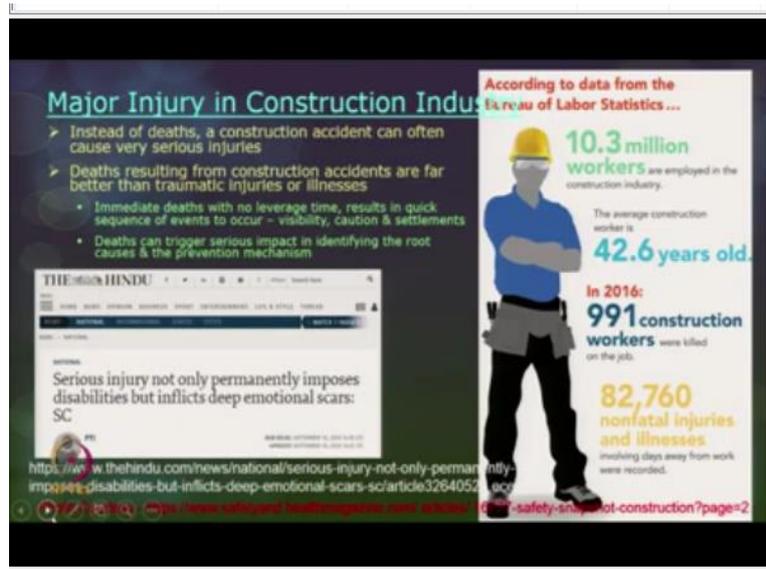
And today where are the fatalities in a construction project. If you look at the comparing with the other industry building construction is primarily special industry classification, 25% and heavy construction and other than building construction has 19%, special trades 56%, this is the statistics as given here. So, building construction and heavy construction are still having a high number as far as fatality is concerned.

And, if you look at comparing with other sectors, for example, transport or warehousing, agriculture, manufacturing and mining, construction is still ranking number three, construction is even hazardous than mining and manufacturing, that you should note down. So, this is a record as of 2018 on fatality. So, we have to still improve on fatality rates in construction.

Now, if you look at the trend, for example, the last 10 years trend, there was a steady decline in the fatality and again the rate of fatality has been increased. So, this is primarily a report which has been seen. So, 2016 onwards, let us see the fatality, a number of construction fatalities were 991, 70 it was 971, 2018 it is 1008 and so on. So, still it is a 3-digit and 4-digit number, which is oscillating between here and there.

There can be so many reasons, maybe there are so many fatalities which were not reported and the reasons were not identified, so it was not reported. So, there can be real reasons behind the fluctuations in the death rate. But you should still understand that fatalities are still happening in construction sites.

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So, which has to be cut down. Now, if you look at that is one infographic which says according to the data from labour, Bureau of Labour statistics, for 10.3 million workers who are employed in construction industry and 991 construction workers were killed on the job. That is what is the statistics we saw in the previous slide in 2016. For these 991, fatality, almost 82,716 non fatal injuries and illnesses have happened.

This is actually a combination of major injury and minor injury put together. So, what people generally say is more than a fatality major injury are real pain and major problem to the construction workers. Fatality, the worker is no more only his family suffers as a result of the loss of the worker. But when you talk about major injury, a person has to survive his remaining part of his life, either without his eyes or without his legs or without his hands.

And he has to be dependent on someone for the rest of his life, in order to go through his life. That is why major injury is treated very serious compared to even fatality. Instead of death, a construction accident can often cause very serious injuries and deaths resulting from construction accidents are far better than traumatic injuries or illnesses, what about coma or major brain injury and the person is on bed rest and so on.

These are all real serious pain and suffering compared to even a fatality. So, immediate deaths are somewhat advantageous as compared to all these major injury. Immediate death will create a lot of quick attention from the management side in terms of settlement, in terms of visibility, in terms of hazard removal, in terms of remedial measures, it brings serious comes in and quick settlements generally happen when deaths occur.

For major injury, nothing happens like that. Deaths can trigger serious impact and identifying the root causes. And what about the trauma of the accident, trauma for the worker will be like, he has to go ahead of that trauma is a very serious pain for the construction worker. This is also a recent article from Hindu which came in September 2020, serious injury not only permanently imposes disabilities, maybe you have to suffer with some loss of an organ, but it also inflicts deep emotional scars. The way the accident happened it goes like a trauma into the minds of the workers till he dies.

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Accident type	Description	Alternate Terminology
Short absence	< 5 days off work	Minor injury/injury/lost workday cases
Long absence	> 5 days off work and return to work on full duties	
Partial incapacity	5 or more days off work and return to work on reduced duties	Major injury/accident/restricted work cases
Full incapacity	Permanently incapacitated with no return to work	
Fatality		Fatality
First aid???		

Ref: Sun, ACS & Zou, PXW () Understanding the true costs of construction accidents in Australian construction industry

That is a very serious concern. So, you should try to remove accidents in construction sites. Now, let us talk about how these accidents are classified. So, far we know only about major injury, minor injury and fatality and in many construction sites, they talk about death, injury, only 2 classifications are there, but all accidents which are not resulting in death are not treated same.

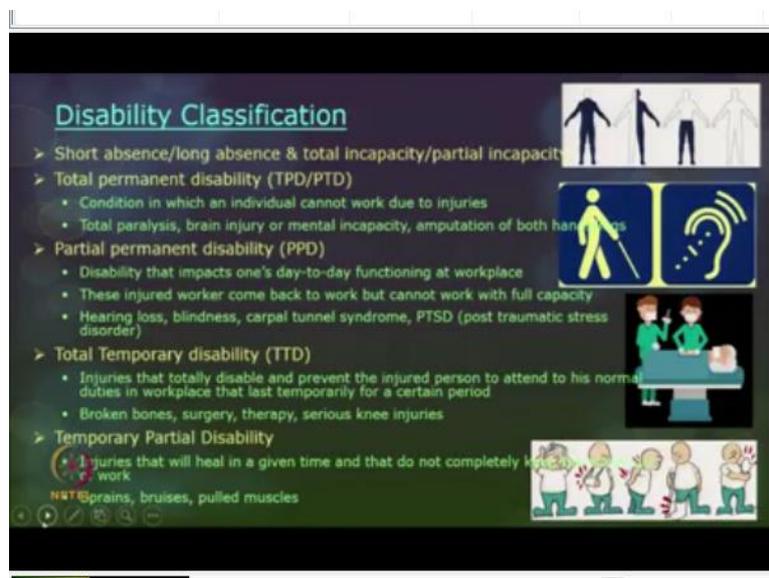
There are a lot of varying levels of impact. Now, let us talk about the non fatal injuries and their varying levels of impact. Accordingly, there are 2 terms which comes in one is absence, other one is incapacity or disability. Absence can be short absence or a long absence. Incapacity can be partial incapacity or a full incapacity. So, if you see short absence less than 5 days away from the work.

And then you come back to work, long absence more than 5 days of work, you are actually on leave and then you return back to work with full duties, resuming your full duties. Partial

incapacity, you take leave maybe a short term leave or a long term leave, but then you may come back to work, but on reduced duties. In the sense you may be starting slow into the work and getting fully embedded into the work culture.

Full incapacity, maybe you may have to switch over your job, maybe you are doing welding earlier, you got an eye injury, you lost your eyes, then you may not be able to do welding after this incident has happened. After you are recovered you come back maybe you will not even have any work to do, because you are fully not suitable for any job in the construction site.

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Now, let us talk about this disability classification. There are a lot of researchers have talked about so many terminologies. One is short absence, long absence, other one is total incapacity or partial incapacity. Now we will be discussing about permanent disability and total or partial. So, that is what we are going to talk about. So, total partial, permanent and temporary. Again, in the order of reverse total, permanent disability wherein worker is after the incident has happened.

So, now there are 2 scenarios, one is pre incident a worker was fine and fit, post incident what is this status. In a total permanent disability, he will be totally disabled and he is permanently disabled, there is no surgery or no alternate solutions provided for him to be fit enough to do any job in the construction site. So, a condition in which an individual cannot work due to injuries, examples can be total paralysis, brain injury, mental incapacity or amputation of both hands and legs.

Both hands or both legs or both together, then he is not fit enough to do any job later on. So, he is jobless after the incident has happened. The next one is partial permanent disability, partially he is disabled and permanently he is disabled. For example, loss of one eye. So, with another eye he can still manage and do some job. So, partially he is disabled so he can do some little risky job in the construction site, he may be employable but the loss of vision on one side is permanent.

Disability that impacts one's day to day functioning in the workplace, these injured workers generally go back to work, once their treatment is over and they are fully recovered they go back to work. But they cannot do the work with full capacity as they were doing before the accident has happened. Examples can be hearing loss, blindness, or post traumatic stress disorder and so on. The next one we will talk about is temporary disability.

First one is total temporary disability. So totally he will be disabled and the same time it is only for a short span of time. Injuries are totally disabled and prevent the injured person to attend to his normal duties in workplace that last temporarily for a short span of time. Maybe you had a surgery or you had a broken leg and you have to get it repaired and on therapy for that.

So, for that you may not be able to work, totally you are not eligible to work but it is only for a short span of lifetime, it may be for 1 week, maximum 10 days and then you may be joining your work but in total temporary disability what happens is you may have to slowly increase your workload and start getting embedded or engaged in new or work pressure. The next one is temporary partial disability, injuries that will heal in a given point of time and that do not know really make you incapacity, it is primarily called temporary partial disability.

For example, sprains, bruises with your leg sprain or maybe your leg bruises, you can still do some part of your construction work using your hands, or even with the pain in the legs still you may be able to do something or pulled muscles or maybe contusions. So, these are all maybe your capacity of work may be reduced from 100% to 50, 60 or 40. So, you may be able to work and it is only for a short span of time and then you can do your complete work later on.

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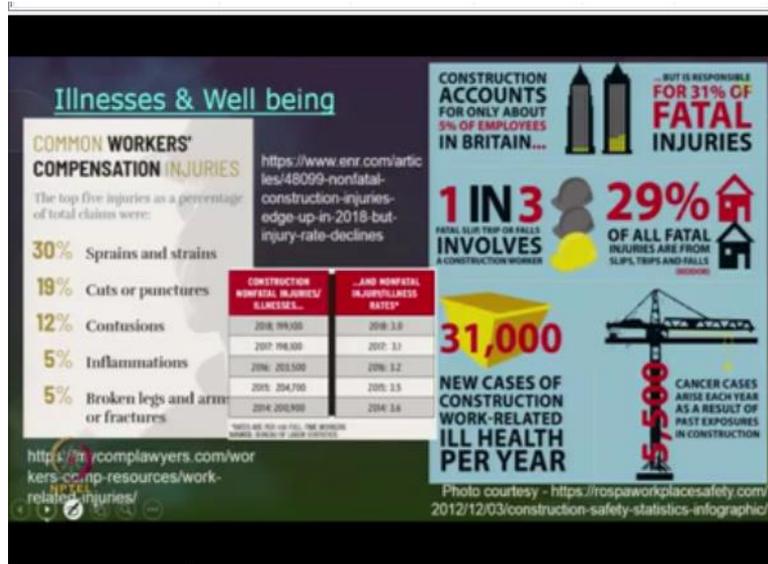
But all these are absence, some sort of productivity loss you will show in the construction site. So, any accident that happens in construction site, immediate impact if you see there is an absence maybe it is a short absence or a long absence immediately productivity loss happens in the construction site, that you have to keep in mind. So, now we will talk about minor injury.

So, previous slide we have talked about full capacity, disability and so on. Now, what are these minor injuries? Minor injury examples are all given here, laceration. For example, a worker has fallen down from nth floor onto the ground floor, maybe on to reinforcement and so on. And the reinforcement rod has pierced him in several places. So, it is all not a regular cut and sutures, but you may have irregular cuts and sutures.

So, it is primarily call laceration, punctures, the previous slide on hazard I would have shown you hazards that nail on the lumbers can be a real example for a puncture or a cut. Fracture, I think it is a very common term strains, crusher, sprains, dislocations because of all wrong lifting or maybe too heavy loads lifting and so on. Scratches or abrasions, which when you are handling reinforcement steel or something.

So, those are not having a smooth surface, if you handle with a bad hand then you may have a lot of scratches and abrasions, contusions, bruises or all internal bleeding which happens as a result of some accident which happened in the construction site. So, like these are all classified as a minor injury in construction.

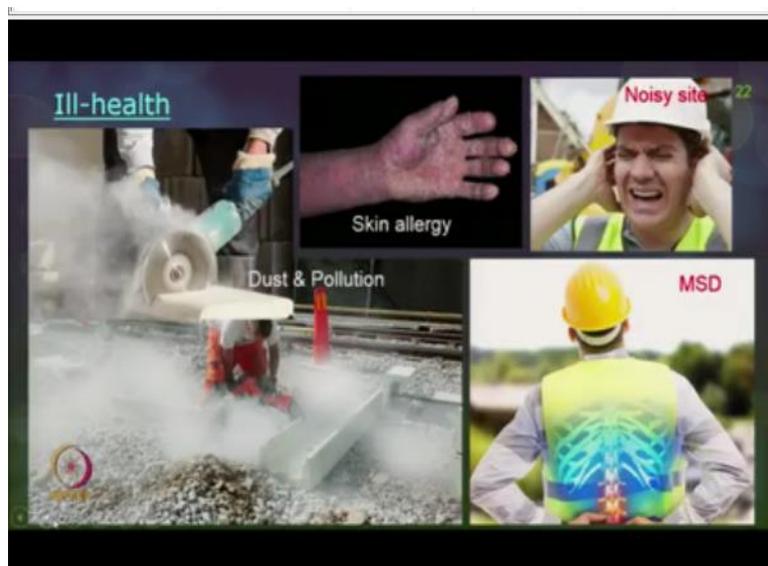
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So, if you look at the infographics on minor injury, so, construction accounts for 31% of fatal injuries and among all these fatal injuries, at least 31,000 cases are related to these ill health issues and so on. So, if you look at non fatal injuries and it can be injury or illnesses. So, if you see here are they in the trend from 2014 to 2018. So, it is primarily in terms of lakhs, 2 lakh something in 2014 and right now, in 2018 it is 1,00,099 something.

These many injuries and illnesses have been reported. If you look at compensation for the workers in terms of a minor injury 30% have been spent on sprains and strains, 19% compensation were primarily on cuts or punctures, 12% on contusions, 5%, on inflammations, 5% on fractures. So, that is where most of these compensations were paid to the workers on minor injury.

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Now, let us talk about ill health examples, the main example is dust and pollution. Any construction site you cannot avoid the dust and the pollution as a result of the dust. The other one is allergic reactions primarily because of cement. Every construction these days are dependent on concrete. So, skin allergy or dermatitis is the number one health hazard you may see.

The other one is noisy site, because of lot of equipments, heavy equipments handled in the construction site noise levels cannot be compromised in a construction site. So, over some point of time the hearing impact or hearing loss can generally happen if you do not take proper precautions. The other one is musculoskeletal disorders as a result of wrong lifting off loads, maybe you have to call a co-worker.

And get his helping lifting loads if the loads are too heavy, instead of that if you start doing wrong lifting and you may have all these musculoskeletal disorders. So, what are these adverse health effects? These adverse health effects are so many, we will talk about health issues in one after few classes. So, any change in body function or the structure of cells that can lead to disease or a health problem.

So, this can include a disease or change in the way the body functions, grows or develops. Effects on children, grandchildren and so on, some problems can be transferred to our heredity and decrease in lifespan, change in mental condition as a result of too much of stress or traumatic experiences on so on effects on the ability to accommodate additional stress. So, these are all the examples or issues with regard to health issues.

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Adverse health effect

- Any change in body function or the structures of cells that can lead to disease or health problems. It include
 - disease,
 - change in the way the body functions, grows, or develops,
 - effects on children, grandchildren, etc. (inheritable genetic effects)
 - decrease in life span,
 - change in mental condition resulting from stress, traumatic experiences, exposure to solvents, and so on, and
 - effects on the ability to accommodate additional stress.
- Factors that influence the degree of risk in exposure include:
 - what is the hazard in terms of its danger potential
 - how much a person is exposed to a hazardous thing or condition,
 - how the person is exposed (e.g., breathing in a vapour, skin contact), and
 - how severe are the effects under the conditions of exposure.

The effects can be acute (immediate) or chronic (delayed)
 Once the hazard is removed/eliminated, the effects may be reversible/irreversible

NPTEL

Factors that can influence so you have to talk about what is the hazard in terms of the danger potential? Is it an active hazard or an active health hazard or maybe dormant health hazard? Those all you may have to assess, how much a person is exposed to the particular hazard? Maybe he was operating some acid or something then how much time the person was exposed to that acid, that you may have to think about and how the person was exposed.

There are a lot of ways of getting these health hazards onto the workers. It can be through drinking or eating, it can be through maybe through skin contacts, it can be even through breathing along with the vapours, all these health hazards can enter your body and how severe are the effects? And for the effects there are now 2 issues, one is acute, other one is chronic.

For example, acute, maybe a splash of an acid immediately you see the impact of the acid attack that is primarily called immediate or acute. Other one is chronic. Very good example is asbestos or silicosis present in your construction site. They are delayed, in this sense they are called chronic. Now, the other issue which you have to again keep in mind is once the hazard is removed or eliminated or safeguarded, the effects can be reversible sometimes.

And some effects are not reversible. For example, if you start taking treatments and you start avoiding cement exposures or dust exposures on cement slowly and slowly you can be recovered, completely you can be recovered, but any solvents or explosives or something which has been on to the workers some of the effects are not reversible, they are irreversible. Now, what about the growth of construction industry?

So, far we have talked about all the terminologies with regard to accident starting from fatality, major injury, minor injury and near misses and also the ill health. Now, every time they issue came in construction projects today or not like how it was here earlier. So, what was the growth of the construction industry, let us not talk from too past, let us talk maybe from 40, 50 years down the line.

So, 1960 to present what has happened, from low rise building structures to a lot of skyscrapers and a lot of infrastructure projects in these days like metro or even your airports and so on. So, if you see that trend, several of these famous iconic or challenging mind-blowing structures, if you recall, in the world were built after 1980s only, only with few exceptions that were built before 1980s.

Otherwise, most of these structures all were built only in the recent past. So, there is a real challenge which is happening in the recent trend in the growth of construction industry, which is posing a lot of new hazards and new threats on safety into the construction sites. Now, if you talk about procurement, again traditional procurement was design, bid and then build.

But recently there are a lot of integrated procurement methods available. And digital practices also have come in and as a result you have so many new methods of project delivery starting from design build or PPP and so on, which has changed the scenario of the construction projects these days. And the other issue is traditionally time cost resource were the major concern in any project.

And compared to these days the construction goals are too many now okay, it starts from time, cost, quality safety, communication, HR management, integration then and so on. So, many issues are they, green building sustainability like this, there are a lot of issues which has been taking over construction in these days.

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From conventional construction methods right now, we are actually moving onto modular construction, design or digital design construction, prefabricated construction, DFMA concept or design for manufacture and assembly. So, like this, there are a lot of innovations which has happened compared to the conventional method of construction. So, labour intensive industry that has not changed too much still we are on the labour-intensive industry and because we have surplus unskilled workers.

So, as a result, we are not able to go too much into robotics or automation or maybe even 3D printing and so on. So, we are still not able to go there because all these workers will go unemployed. In 1980s onwards, offsite construction became very popular, that is what I referred recently as dry construction and wet construction. So, dry construction or otherwise called offsite construction, that concept came in as and it was very popular and supportive, because of quality can be maintained, safety need not be compromised, productivity can also be maintained.

So, as a result of that construction started to pick up its own popularity. Digital era also influenced the construction tremendously these days, BIM and other issues came in as a result, we are able to move into robotics or maybe even 3D printing or we are also able to use drones for lot of safety precautions, a lot of laser scanning and other issues all have been there in order to help the construction growth.

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Causes of construction accidents

➤ Human

- Human error, misjudgements, unsafe acts
- Relationship with colleagues
- Immigrants – diverse culture and language
- Insufficient safety training and education – common sense is not equivalent to safety education
- Worker's motives to derive short term benefits
- Fatigue

➤ Hectic schedule

➤ Economic consideration

- Developed and developing countries
- Method of payment to workers
- **LOW costs of accidents !!**

➤ Organizational factor

- Sub contracting
- Size of the companies – small & medium firms don't have facilities
- Temporary/seasonal workforce
- Designers and contractors in different silos

Insufficient data

Site condition & ergonomics

- Structural failures
- Lack of protective measures
- Weather



So, as a result projects, yes are always having a lot of change in the trend in these days. Now, let us start looking at what are the causes of construction accidents as a result of the growth in construction industry in the last 50, 60 years. Number 1, we will categorize it as human issues, human error, misjudgements, unsafe acts and so on. Relationship with colleagues because of subcontracting way of relationship you may be having lots of slower relationship with colleagues which may be a real reason for accidents.

Suppose if you have a lot of friends available and who are moving as a gang from one crew to another crew, obviously your friends will obviously tell you of the potential dangers in the construction workplace. Immigrants, as a result there may be a poster in the local language maybe in Hindi or something and the person who is an immigrant, he may not be able to read the language.

Then obviously, it is a he may not understand what is written there is diverse culture and language is also a reason for causes for accidents, insufficient safety training and education, most of these issues are common sense, you should always know that you should have a proper PPE when you are working in construction site, most of them are common sense, but still, that doesn't mean common sense is equal to safety education and so on.

So, there should be a proper training education on safety and workers should be reinforced on safety every now and then maybe in the toolbox meeting or during safety training and so on that should be happening every now and then. And the workers motive to derive short term

benefits. For example, incentives that is one office safety policy which is available in many of the construction sites and projects.

Incentives is primarily to reward a good behavior in a construction site. Now, what happens is just because a worker has to be safe working in the construction site with no accidents, he may get some incentive at the end, in order to receive that incentive, what happens is the hazards, the near misses or the accidents may be hidden by these workers in order to claim those benefits.

The benefits can be anything, it can be 1-month additional salary or something like that. So, in order to derive those short-term benefits, the hazards may be still put beneath the carpet and hidden. Fatigue, fatigue and hectic schedule, we can bring it together, you were a high pressure on finishing the project, not on the regular schedule, but literally tighter, a little less than the normal schedule that is primarily called hectic schedule that can really bring in accidents to construction sites.

So, sleepiness is a very big safety hazard if a worker has to be given enough time for sleep. And if it does not happen, then sleepiness is a real reason for a hazard in the construction site. The next is economic consideration developed and developing countries. Developed countries can actually spare lot of money on safety precautions. If you see some construction sites abroad, you would notice, how these construction sites are looking really different compared to our construction sites.

That is because of the economical growth rate. So, developed countries can obviously spend too much on construction safety issues compared to developing countries, but even with the limited availability of what we have still we can still maintain safety in the construction site. Method of payment to workers so only when certain amount of work has been completed then only the workers will get the wage that can obviously act a pressure onto the worker.

So, they have to finish something in the 1 week then they have to show the progress to the contractors and then only they can get their wage. So, this may be a real reason for safety or quality of the projects also. Low cost of accidents, these accidents are not less cost. They are actually cost too much for a contractor. But what happens is many of these unclaimed accidents are generally kept as low cost.

Some accidents are real serious concerns are in the public premises that may really catch attention of the media personnel and so on. Those accidents are really costly, but the otherwise the accidents paid to workers are not that much. The compensation paid to workers are not that much. That is a main reason why employees are not really willing to come forward to spend on safety issues.

Anyway, we will discuss this too much when we talk about the cost of safety and injuries in construction sites. The next one is on organizational factor, subcontracting that we have discussed enough. Size of the companies – small, medium firms, they do not have much facilities in the sense they do not have enough facilities to maintain safety nets to maintain large equipments with safe precautions and so on.

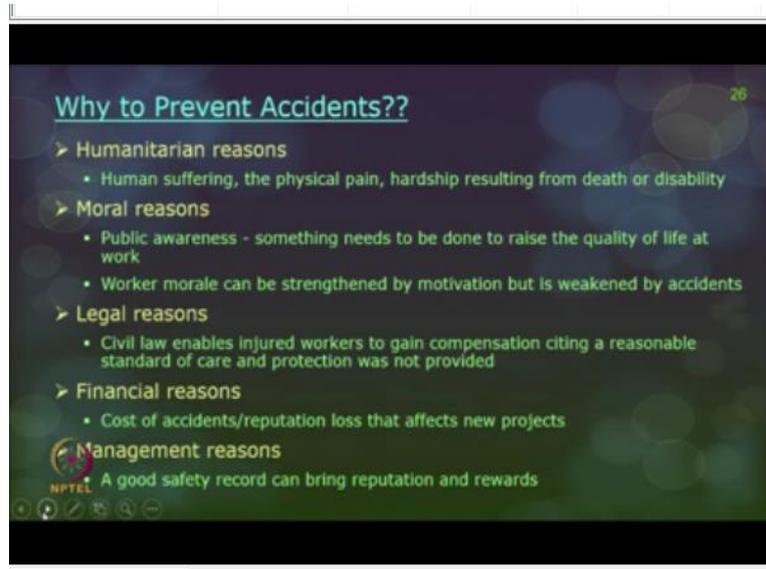
Obviously, they have to have turnover of money. So, with that money in rotation with the cost cash flow in rotation. So, they have to manage with what they have. So, the small and medium sized firms they generally suffer for safety issues. Other one is temporary or seasonal workforce and designers and contractors in different silos, it not only designers, contractors, most of the stakeholders in a project generally they try to focus on what they have to do.

And they try to understand what has to be done and they deliver and go off, they do not try to see what is the whole project all about and if I go ahead like this, will it be safe for others, if I go ahead different paths will it be safer than the original policy or process. That they do not try to see and sometimes a project top management also do not try to showcase the complete project to everyone.

Most of the time it is all kept confidential only, that is primarily called insufficient data. As a result of what hazards, I am going to put forth to another stakeholder without knowing that I may not be able to bring out a safe design or a construction practice that is obviously true. Site conditions and ergonomics, so structural failures, lack of protective measures, whether it is another issue.

So, when you have bad weather, for example heavy rainfall or heavy snow fall or maybe very hot summer, then you should be thinking of not having too much of productivity expected from the workers to happen in the construction sites.

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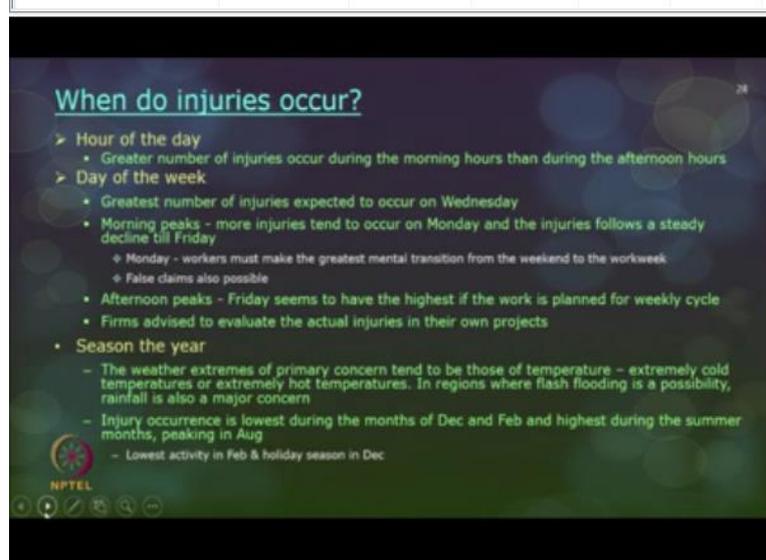


Now why to prevent accidents? There are again so many reasons, humanitarian reasons. The one which is not documented anywhere that is primarily a human suffering, this can be a physical pain, hardship resulting from death or disability without the loss of one earning worker in the family, the family has to suffer the loss and they have to go ahead with their lifestyles.

Then the physical pain, if there is a major injury and all these know there is no way to document and these should not happen so, an accident has to be prevented. Moral reasons, till date construction is always treated as very dangerous and so on. So, this awareness has to be also taken care of. So, the worker moral can always be strengthened with lot of other programs, safety programs in the construction site.

But still the workers have to have a positive feeling that sites are always safe, that is again another reason, legal reasons, civil law also enables injured workers to gain compensation, sighting a reasonable standard of care and protection was not provided. So, it is primarily an employer's duty of care, to give a proper safe site and safe place to the workers. The next is financial reasons, the accidents always can create a reputation loss to the owners and as a result, it may also affect new projects coming down the line. Management reasons, a good safety record can bring a lot of reputation as rewards to the workers.

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So, when do these injuries occur? Now, let us talk about when do these injuries occur and how these injuries also occur. Although that is no specific pattern on how these injuries occur, but if you see a lot of statistics shows that there is a pattern which is available in a construction site. And if you closely watch the pattern is also linked with some logic and some gut feel sense.

So, no hard and fast rules that tell when most injuries occur in a particular project. However, some generalizations can be made with the data accumulated by the department of labour and statistics. So, over a period of years some statistics are gathered and this can change from project to project and this is not a recent report also, this happened several years back. So, you may have to think about it.

And try to formulate statistics to create, so that you will have a new record on how the injuries are happening in your construction project site. Hour of the day, what happens is a normal construction site a project let us talk about regular site not the exceptional ones. So, regular project site, maybe the project starts at 8 o'clock in the morning and 8 o'clock the worker start reporting at the site.

And as soon as the workers start reporting, so they start reporting to the site supervisor, getting to know what their work is for the day and then they start collecting their equipment, tools and so on. And by the time they reach their constructions, workplace, it is close to 8:30

or sometimes, it may even be 9 o'clock, there is a small briefing or a safety precaution or some gathering to be happened.

And then they move to the site, it generally starts by work starts by 9 o'clock. As soon as the construction worker starts their work, the productivity of the worker is never at the maximum, it takes some time for the worker to start getting into the work, his mindset into the work place. And only by 10 o'clock or something only the work starts picking up. So, by 11 or something, he is on the close high productivity time, then they start thinking of a tea break and they disperse for tea.

After the tea break, they do not return back very immediately, they have a small chat, gossiping and so on and then they try to come back. And then they start to do something. But still, the productivity after the tea break is never high and then they disperse for lunch, after the lunch break the workers again, start resuming their work. And after some point of time, since they have to wind up the day's work, they try to increase the productivity, but the afternoon productivity is never as high as the morning productivity.

And they then try to finish up their work by 4, 4:30 they try to wind up, pack up all their tools, clean their workplace, do all the housekeeping and surrender all the materials equipment, PPE to the site supervisors and then they dispose of the site. If you see that trend in the particular whole day, the maximum productivity happens close to 10 to 11 o'clock in the morning break and in the afternoon, it is close to 2 to 3 or something.

But more injuries are generally reported on morning peaks only. So, close to 10 is or 11 is there are a lot of injuries which happened in the construction site. That is one of the main reasons why safety meetings or safety announcements all happened in the morning of the of the day, so that the workers are actually with the safety mindset or safety mood with that they start going to the work and safety is like a precaution on their head when they are doing their work and injuries are expected to be reduced.

Now let us talk about day of the week, again, we are talking about normal work culture and the exceptional cases 5 days a week. So, again, if you see the greatest number of injuries are expected to happen on Wednesday with the same style of hour of the days supposed to happen. It was very surprising, there were 2 peaks, morning peaks and afternoon peaks.

And in the morning peaks Monday mornings were expected to be reported as a high, on high number of accidents happening in the construction sites compared to afternoon peaks. There are also other reasons for a greater number of injuries on Monday mornings. Number 1 is the workers are generally not in a mindset to start their work on Monday, because after Friday, they have a 2 days break.

And there is a lot of mental transition required by the workers to move from the weekend to the work week culture and this needs some time. So, obviously with that mood, they are not in a mindset to do the work and there are accidents happening on Monday and the other reason is a number of false claims which happens, which we will discuss anyway in the workers compensation frauds.

What happen is these workers they do not have enough salary to meet their daily requirements, they are all low wage workers. And so, compensation generally takes a lot of time to be available for their hands. And what happens is some injuries if it is happened ahead of your worksite in the sense workers are generally compensated only when they are on the site, in the working hours.

Suppose if they are not in the site and they are off the side hours and any injury or accident happens then they are not eligible for a compensation. But since they do not have enough money to meet up their expenses, medical facilities on their own, what do they do is they try to pretend that they are fine. They try to hide the accident which has happened away from the construction site.

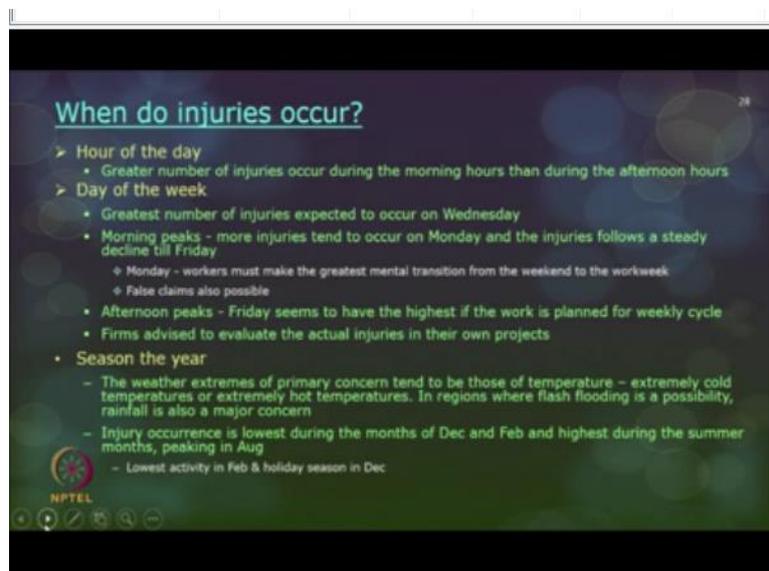
And then they come and report on Monday into the construction site. And then they try to project as if the accident has happened in the site on Monday, but it is also one of the reasons why Monday mornings are considered to be having a high number of claims on accidents. If you look at afternoon peaks, again Friday has similarly a highest peak, because most of these weekly wage workers they tried to surrender their work by Friday because they have to get their wages.

So, they have to finish showing some work progress in order to get their wages. So, when they are doing their works in a hurried manner and trying to finish their work completion, lot of accidents tends to happen. So, the reason is also logical to the same. So, firms are advised

to evaluate the actual injuries in their own projects and also to monitor these workers and to change the style of payment to these workers, then many accidents can be really coming down.

Season of the year, again extreme weathers are should be a real caution. When we talk about health hazards, we will talk about cold stress, heat stress and so on. So, extreme cold temperatures, extreme heat hot temperatures are generally a serious concern and you should give adequate breaks to these workers and not impose a hectic schedule on to the workers. And again, in term when rainfall is a major concern and is a possibility in some regions that rainfall also should be taken into consideration when the construction works are happening.

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So, recap, types of accidents in constructions sites. So far, we have talked about total disablement, partial disablement, vehicle related injuries, unsafe acts related injuries, all injuries related to the related to workers and misbehaviour in the construction site, unsafe condition related, location of injury whether the external organ injured or internal organs injured and so on.

Reasons for injury this we will see little later, actually from week 3 onwards you will have all the lectures arranged along these falls, caught-in or between cave-ins, struck-by, electrocution and so on. And the operation varies this hazard is seen to the maximum will also be covered alongside these hazards. We will see from week 3 onward, nature of injury again fracture, dislocation, sprains, strains and so on. So, with this I am stopping for today's class. Thank you.