**Safety in Construction**
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**Lecture-02**
**Introduction to Safety and Signs, Signals in Construction**

Yes, so, today's class we will continue with what we have discussed in the previous lecture. So, in the previous class we have discussed about lots of terminology on safety, accidents, injury, then ill health and so on and we also discussed is there a pattern on safety on accident. So, that also we have reviewed and seen. So, in continuation to that, so, accident is always considered as unexpected, unplanned and so on.

But it looks like there is a pattern on accident happening in many of the construction sites. So, in the same way a lot of researchers have also explored. Is there any reason behind accidents to happen? And accordingly, there are so many models and theories which has come in and which are collectively called as theory of accident causation. And the origin and the commonality between the 2 theories and not in any particular order.

So, the few theories are accident prone as theory wherein a person as such is responsible for an accident. For example, a person may be doing things fast and so on so, he may be every time getting hurt here and there. So, that is primarily reason for accident prone as theory given the same environment, same situation, only few workers are always accident prone.

That is what is accident prone theory. Then the other one is goals, freedom, alertness theory and adjustments stress theory. And here one theory is on positive side which is a goal freedom alertness and the other one is on the negative side, which is called adjustment stress. So, given complete freedom to the workers and if they know how to do their work and you encourage them and motivate them, then obviously, they can come up with better ideas on accident prevention and so on and safety can be really curtailed and managed.

Adjustments stress talks about the pressure you give on to the workers in terms of schedule and the internal pressure which the worker has maybe in terms of any ill health in the family or some medical issues or death of someone in the family. So, that can always have a mental

stress which is going on into the worker. So, when that is settled, then obviously the accidents can be controlled.

Another one is distractions, primarily the hazards prevailing in the construction site can be a major distraction as to should I focus on the hazard or should I get my task done. So, this dilemma can always be either you go slow on productivity or you maintain your productivity and thereby you are getting an accident. And there are a lot of other theories like systems model epidemiological model and Rasmac's work behaviour model, potential accident subject model, Bird's domino model and so on.

Now, we are going to talk mainly about Bird's domino model because I feel that is very close to many of the accidents which happen in construction sites.

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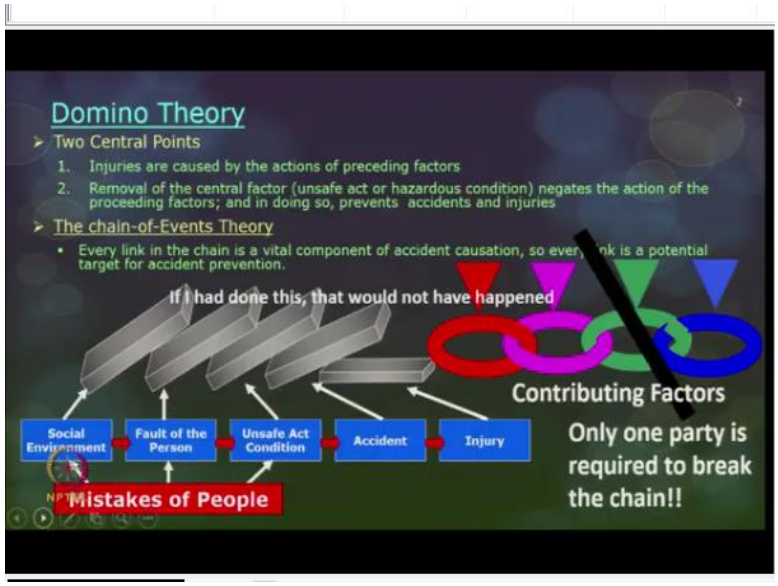


So, this theory is actually it is a commonality features are there between 2 theories which exist in our accident causation. One is domino theory and the other one is chain of events theory, to me both have a lot of similar features. For example, in dominoes theory, maybe there are a lot of packs of cards and something triggered, something and as a result, you get a series of events and an accident has happened.

Another one is chain of events theory where there are a lot of these oval links which we call interlinked factors, which are all called chains and as a result, something happened and an accident happened. Even in domino pack of card if one pack is, if one card is removed, the accident could need have occurred. And the other cards would have been standing in position.

Same way even in the chain, all links are primarily called as vital components for accident causation and if any one link is broken, then obviously the accident can be stopped or controlled. So, each pack of card, each card and in domino is also a vital factor same way each link here is also a vital factor. So, both talks about the same thing, so accident number normally what happens is people just see only on the final result.

The final result can be either a malfunction equipment or it can be a worker who has messed up with something in the workplace or maybe he did not wear a PPE whatever it is. So, you actually corner down on some issues which is primarily what is called as a direct cause of accident. But if you look at the background there would have been so, many indirect causes or basic causes, which may trigger this direct cause in a way direct cause are those which are in a way linked to the unsafe acts.

Because some as I told in the previous class itself some worker is involved in an accident even if it is an equipment malfunction, still some worker has gone and started operating a faulty equipment. So, there is some human intervention in any accident if you look at and if you do accident investigation also you may be pointing out on someone as a result of any injury that has happened.

So, this is on unsafe acts, if you do look at indirect causes, it can be unsafe conditions or it can be some other means of management and so on to make you understand better, I can give a small example here. So, in one construction site, there was a worker who did not wear proper PPE and something fell on his head when he was working in the site and there was a major injury.

Now, this, what happened is when the case was really analyzed in the peripheral level, it was found out that the worker did not wear a proper PPE, so violation of safety norms and practices. So, the worker was actually cornered for the accident and it was considered it was his mistake that the accident happened, but now, if you look at the background reasons and so on.

So, this worker was not given a proper orientation and our training session wherein he was aware where to collect his PPE, whom to approach for faulty PPE and if there is any issues

with the PPE whom to really to report and so on. So, he was not given a proper training and orientation. So, there were so many unknowns for him and which resulted in due course of time, when he started working on in the construction site, he stopped wearing a proper PPE at all.

And if you look at the management side, there were some thefts and misuse with the PPE. So, they made all the workers to fill a very lengthy form on collecting a PPE and far surrendering a PPE. So, which the workers were really reluctant to do and after some time, they thought it is like a nuisance or an unnecessary work to be done and hence, they stopped collecting a PPE itself. So, misuse of PPE the management wanted to correct.

So, they did approach but that approach was not in favour to the workers or they did not like that approach and as a result, many of the workers in the same side stop wearing a PPE. So, if you see, so, these issues are all can be seen as one, one link in the chain or it can be viewed as a pack in the domino cards. So, this is primarily the theory behind accident causation and which I feel many of the accidents that happen in sites are not just one factor it may be so many other linked factors as a result accident is happening in our site.

So, injuries are generally caused by actions of proceeding factors and removal of 1 or 2 factors which can be unsafe act or hazardous condition can always negate the action of preceeding act factors and in doing so can prevent the accidents and injuries. So, even in the chain of events theory, every link in the chain is a vital component of accident causation and hence every link is a potential factor for accident prevention.

So, you have to think about it. Some of the examples, some of the issues can be social environment, fault of the person, unsafe act or unsafe conditions, the actual injury and so on. So, always during accident investigation, never look at only the final issue behind you have to have a broad view on what really happened in the accident occurred.

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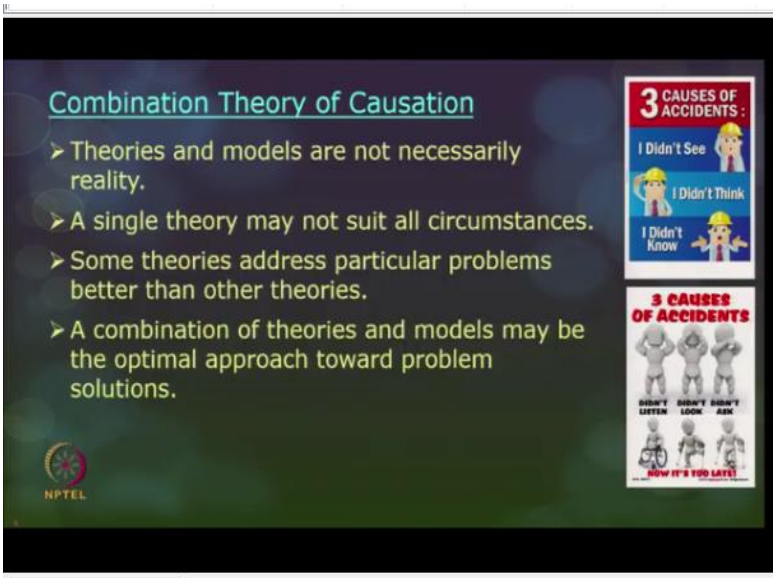


And just a summary of all the theories of accident causation, many of the theories and models are not necessarily the reality because in reality you may have something very different. You may analyze all the theories come up with them some solutions and observations and that may not be happening in reality because reality is ultimately different and any single theory will not suit for all the circumstances of any construction site.

And hence many of these theories have their own drawbacks. Although the theories stand good under certain circumstances and these theory fails under many other circumstances. Because most of the theories address only particular problems rather than a generalized set of a construction industry and it cannot be applied to all construction scenarios also. So, in a way you may have to have combinational approach maybe 2 or 3 theories in hand to look at a problem and the solution.

But the better issue more than this is better to be visible with your sense organs, in the sense see everything clearly and listen to everything properly, think what is going on in and around you and also react to what is happening and try to understand what is happening in the site. So, it is instead of saying I did not see, I did not think and I did not know it is a very good poster on accident causation, it is better to listen, to see and then think before you do not even have any time to react and it becomes too late for you to react.

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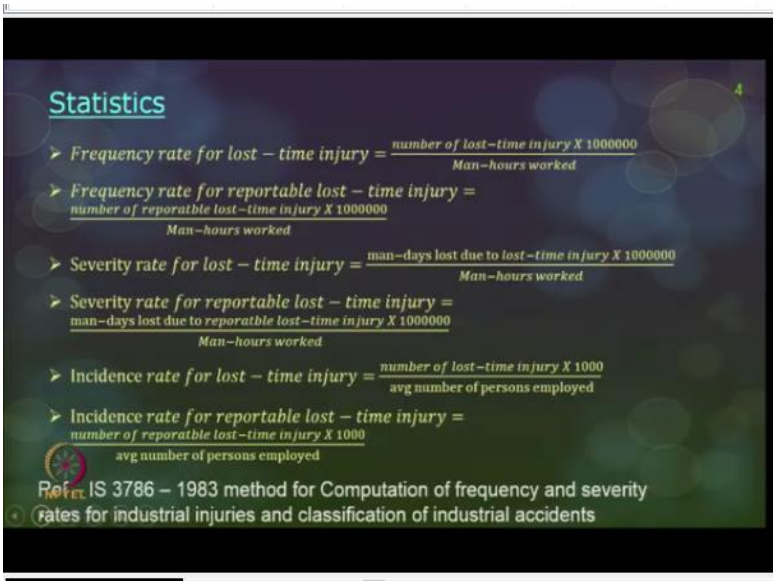


Now, if you look at all these accidents, every industry maintains some sort of statistics on all the accidents. And there are so many statistics available again, these statistics are different from each other under different perspective and they are all collected for different reasons. And a few of them are for selecting the safe contractor, few of them are to understand for a company's perspective, whether the safety is improved or not.

If they want to have a new safety policy in place and they wanted to know how the safety performances in the construction site then they do all these statistics analysis. And few of the statistics which are offered in the IS code are given here. One is frequency rate for last time injury and reportable last time injury and the other one is severity rate for last time injuries and reportable last name injury and the third one is incident rate for last time injuries and same for reportable lasting injury.

Frequency rate as the name implies, it talks about number of accidents which happened, severity rate talks about the impact of these accidents. So, primarily it is measured in terms of mandates and the incident rate also talks about what is the total number of people to the average number of workers employed. So, all these 3 indices are used in construction for different purposes.

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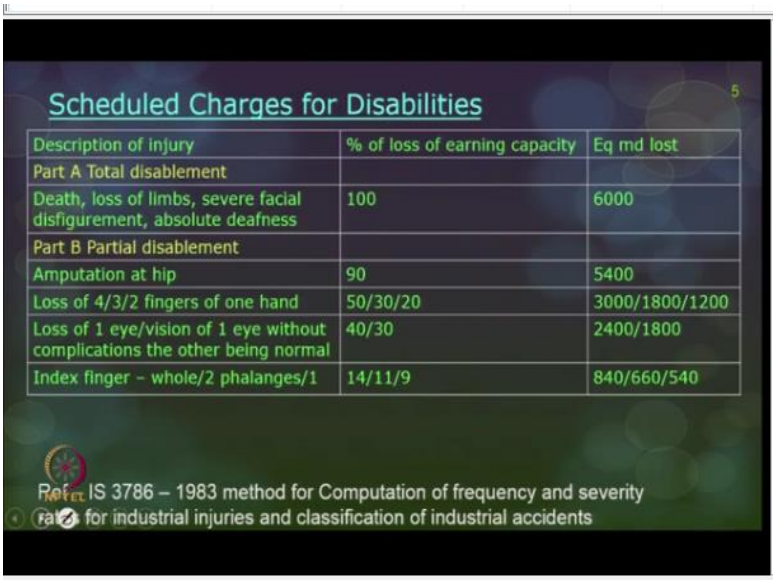


Now, if you look at how are these mandays calculated? Now, this is where you should be really thinking about how our life of a workers is calculated in terms of some numbers. So, this is also given in the IS code which is primarily called scheduled charges for disabilities, if you see here there are 2 parts, total disablement and partial disablement. So, death, loss of limbs or severe facial disfigurement, absolute deafness.

And all these are considered as 100% loss of earning capacity which implies the worker is no longer fit enough to earn and after the accident has happened. And the equal and mandays lost is taken us 6000 only. So, this is how the calculations are done even today. And part B is on partial disablement amputation at hip is taken as 90% loss, loss of 4 fingers is considered as 50% loss.

Loss of 3 fingers in one hand is considered as 30% loss, loss of 2 fingers is considered as 20% loss and accordingly the equal and mandays is calculated as 3000, 1800 and so on. Loss of 1 eye wherein the other is completely normal, it is considered as 40% hearing loss and accordingly the mandays is lost is calculated. And even in the finger is it a whole finger or 2 phalanges or 1 phalanges and accordingly the rate of earning capacity is calculated and equal on mandays lost is calculated. So, this is an IS code through which the claims, compensation and also the severity of the rates are all calculated.

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Now, the real last question is whose responsibility is safety? It looks like there are so many interlinked factors, so many people are involved. That is what we have seen. That is what the theory also says. So, whose responsibility is safety? Primarily, it is a worker's responsibility because they are the one who is the victim, they are the one who gets injured or is it somebody else.

Safety is everyone's responsibility that is what you have to understand here. The accidents of primary concern are those in which the personal injuries are sustained primarily it goes on to the workers level, but keep in mind, the workers are the one who are the ones who get injured and the decisions of how the workers should act in the construction site and how they have to perform the tasks are given by a decision maker who are the owners and who may not get injured at all.

So, that is ironical statement here. So, injuries are generally sustained by persons who do not want to get injured, that is injuries occur even though people really do not want to be involved in accidents, but normally know they could not take many steps to avoid them, they are not a decision maker, that is where is the real scenario in construction or other industries also.

Injured ones are the employees and the decision makers are the ones who are not injured are the employers. So, many of the safety standards available, they say it is a moral and legal obligation of employers to provide safety to their employees and it is an employer's duty to

take care of their employees and to provide them a safe system or place of work to provide them good machinery and plant which are safe to use.

And also, competent supervision and suitable training so that they can work safely in the sites and also there should be a caring selection of fellow employees. So, the motto of any construction project should be safety is everyone's responsibility and not only the workers responsibility.

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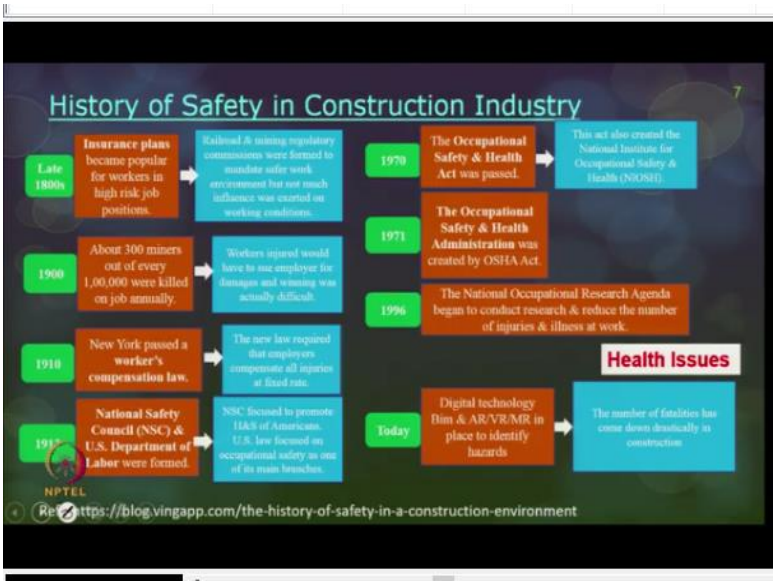


Now, if you see the history in the last class, I have also told you that there is an improvement in the number of fatalities. So, when did safety come into practice or existence and what is the history behind safety in construction industry and one in the late 1800s, insurance plans became popular? And this is not on every country, this is primarily in few developed countries only for workers in high-risk job positions.

And only in 1900, so 300 miners out of every 1 lakh people employed by killed on the job manually and hence, the safety became a very serious concern. And in 1910, there was a worker's compensation law, which was passed by New York and after then the OSHA act came in the OSHA act was passed in 1970. This is primarily to safeguard the lives of American workers, because there were so many death and fatality with a lot of workers in America.

And as a result, OSHA act was a first act which came into practice for safeguarding on health and safety well being of the workers. And in after then health issues came in and today, we

have lots of digital technology, which we can also foresee and what are the hazards and how many safety programs can be implemented, what can be effective, what will go wrong. So, we can all have so many virtual models and digital technology in place using BIM, AR or VR and so on with which we can have a lot of improvements in safety are really possible these days. And if the real motive is to cut down on zero accidents in the site, I think it is doable in any construction site.

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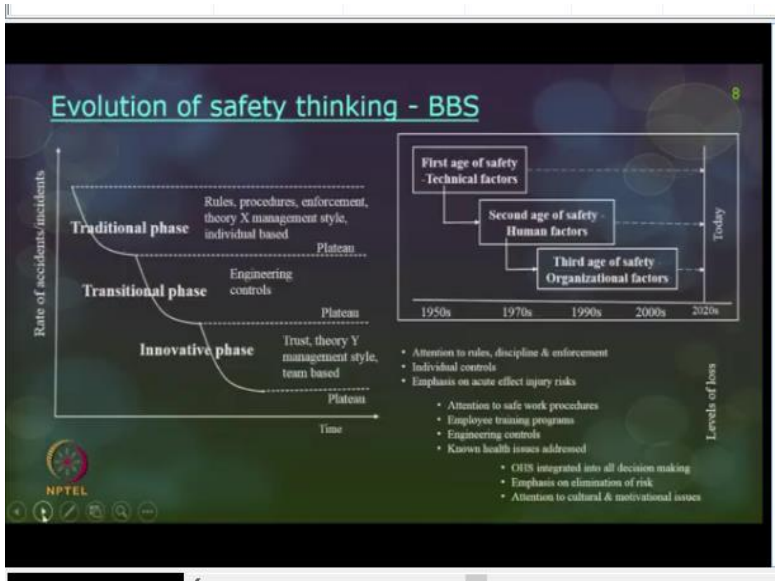


Now, how is this evolution, researchers have also talked about how this evolution of safeties there are it is also called behaviour based safety. So, this has 3 phases. The first one is traditional phase and then we have transitional phase and then the innovative phase. Traditional phase is primarily the first age of safety, so which is primarily towards 1950s to 70s. And primarily, it is on technology only.

After the in the second age of safety came in lot of human factors were there. So, attention to safe work procedures, employee training programs, engineering controls and health issues were all addressed this happened in 1970s to 1990s and so on. Then the third age that is primarily an organizational factor and this is primarily called innovative face and wherein mutual trust, organizational issues and OHS integrated into decision making, emphasis on risks and so on elimination of risks by including safety.

So, all these came into existence. Now safety is an embedded part of the whole lifecycle of a project and not viewed as a technical factor. So, this is the trend with which the safety has been improved and it is there right now.

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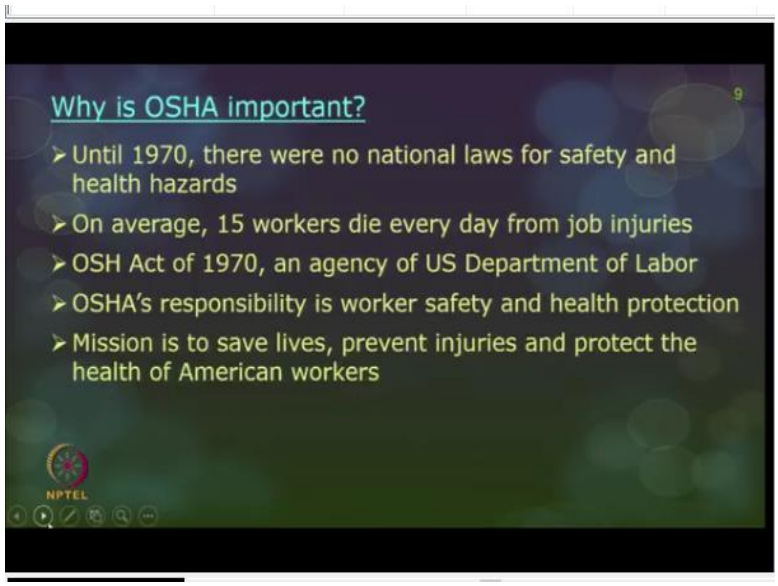


Now, let us talk about the different standards which are available. So, I am not going to talk about all the standards, but only the few famous standards are OSHA, OSHA is nothing but occupational safety and health act, which is developed by the United States of America and then we have OSHAS. OSHAS is nothing but same occupational safety and health assessment series that is followed by British Standard, that is primarily a British Standard.

And then we have ISO, which is primarily an international standardization for organization. There also, we have a standard which came in recently. And we also have BoCW act, which is primarily for Indian scenario. So, these 4 I am going to give a small idea on what are these different acts. And most of the guidelines, which I will be covering in this particular course will be primarily from IS codes and innovates BoCW act mixed together.

And also on OSHA act, which is the American standards and others are all very generic. So, I will be covering a lot of parts from this OSH act and IS codes. So, until 1970, as I told you, there were no national laws for safety and health hazards. And this occupational safety and health act came in 1970 and it became implemented only in 1971. Prior to that, on average, researchers have reported at least 15 workers were dying every day due to job injuries.

And this OSH act is also covering other sectors, not only construction. And it is an agency of US department of labour, so main responsibility of OSHA is worker safety and health protection. And the mission is to save lives, prevent injuries and protect the health of American workers.

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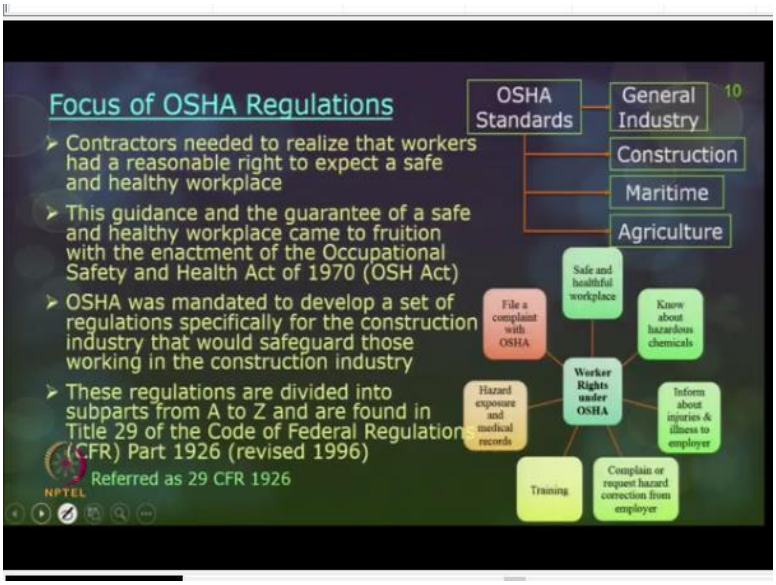


That was a main motive behind when OSHA came in and OSHA standards are generally applicable for 4 groups. One is general industry, other one is construction, third one is maritime and the last one is agriculture. And here, worker rights under OSHA, so they know about different hazardous chemicals. They inform about injuries and illnesses to the employer. They can complain or request hazard correction from the employer.

They can also get training from the OSHA and hazard exposure and medical records, file a complaint with OSHA and also safe and healthy workplace and a healthy workplace. So, these are all the different rights under OSHA act. Contractors needed to realize that workers had a reasonable right to expect a safe and healthy workplace. So, the OSHA was mandated to develop a set of regulations specifically for the construction industry that would safeguard those who are working in the construction industry.

And as such, these regulations were divided into sub parts from A to Z and also additional sub parts are also there and they are found in title 29 of the code of federal regulations which is in short form referred as a 1926 CFR. So, this is how the OSHA guidelines came in. And these guidelines were revised in 1996 as well.

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So, what all it covers in construction, so it covers asbestos workers, bricklayers, carpenters, cement masons, construction workers, electricians, elevator constructors, glaciers, iron workers, then operating engineers, painters, pile drivers, pipe fitters, plumbers, roofers, stonemasons, almost every side of the construction trade workers are taken into consideration and accordingly the subparts were formulated.

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If you look at the 29 CFR regulations, you will see all the subparts here. So, many of the operations which I will be covering. So, I will be using most of the sub parts and in a way, I would have covered almost all of the sub parts and additional IS codes in this particular course. Subpart A general, B interpretations and C talks about general health and safety provisions.

D is on occupational health and environment controls, then subpart E is primarily on personal protective and life saving equipment, then F is on fire protection and prevention, G is on sign, signals and barricades. H is on material handling storage and disposal, I is on tools, hand and power, J on welding and cutting, K electrical, L scaffolds, M fall protection, N helicopters, hoists, elevators and conveyors.

And O is on motor vehicles and mechanized equipment, P excavation, Q concreting, R steel, S underground construction, caissons, cofferdams and so on, T demolition, U blasting and use of explosives, then V is on power transmission, W is on rollover protective structures and overhead protection, X is on stairways and ladders, Y diving, Z is on toxic and hazardous substances.

AA is on confined spaces and CC is on cranes and derricks. So, almost every part of construction is covered in these OSHA regulations.

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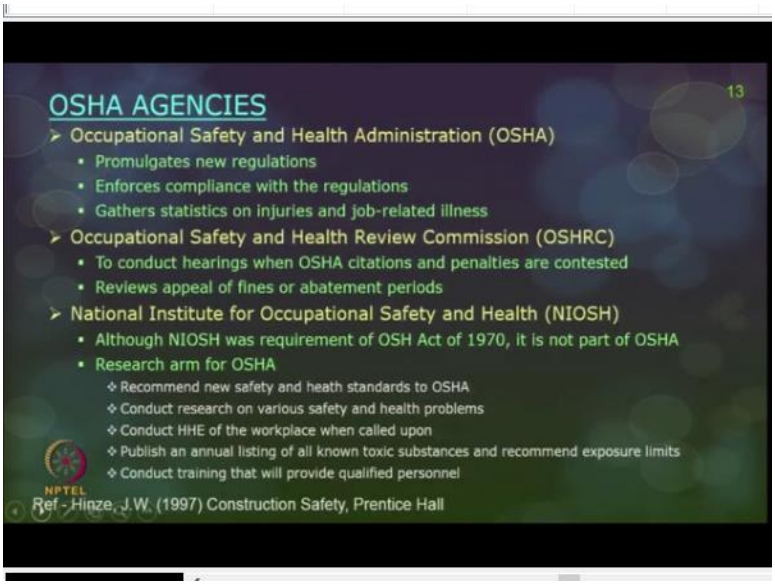


OSHA agencies: So, how is this occupational safety and health act operates or is functional, it functions with the help of 3 bodies, which are called as agencies. One is an administration arm; other one is primarily reviews arm and review place and the third one is primarily a research arm. So, the administration arm is primarily called OSHA and colloquially we start calling the OSH act as if it is OSHA only. So, OSHA is primarily occupational safety and health administration.

So, there are many duties or jobs which the OSHA does, it promulgates new regulations, enforces compliance with the regulations, gather statistics on injuries and job-related illnesses. And the second arm is nothing but occupational safety and health review commission. That is primarily to hear cases, to conduct hearings on OSHA citations and finalities were contested.

It also reviews appeals on files and also on abatement or the correction periods. And the other one is a research arm and the research arm is not part of OSHA, but it also supports the OSHA act. Although the national NIOSH was a requirement of OSHA, but it is not part of the OSHA it is a research for OSHA. As a result, it helps for recommending new safety and health standards to OSHA.

Conducts various research works on safety and health problems, conduct hazard analysis of the workplace when called upon and also published a sandbar listing of all known toxic substances and recommends exposure limits, conduct training for the qualified personnel.

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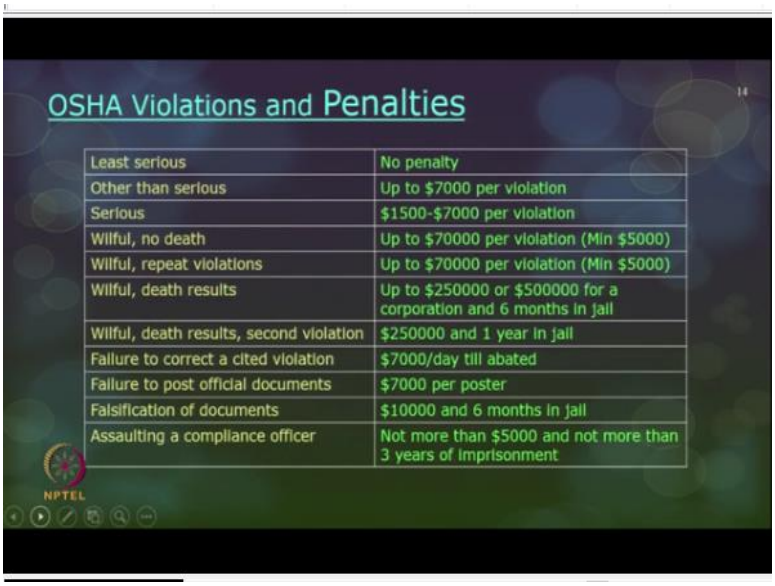


So, these are the different ways with which the OSHA act works. Then also there is something which you should understand about violations and penalties. And as a result, the OSHA act was very popular and it could, the accidents were really controlled and minimized as a result of the heavy penalty imposed on all the violations. So, leads to serious no penalty other than serious up to 7,000 dollars per violation.

Then serious 1500 to 7,000 dollars per violation, wilful, no death or repeat violations up to 70,000 dollars per violation and wilful death results. So, up to 2 lakhs 50,000 dollars or even 5 lakh dollars for a corporation and 6 months in jail. Wilful death results second violation, so same fine amount, but 1 year in jail. So, if you see here, the penalties or the fines imposed on any citation of OSHA was really high and the number of accidents were managed and it was controlled. Falsification of documents 10,000 dollars 6 months in jail, a failure to post official documents 7,000 dollars per poster, failure to correct cited (29:05) violations 7000 dollars per day till abated.

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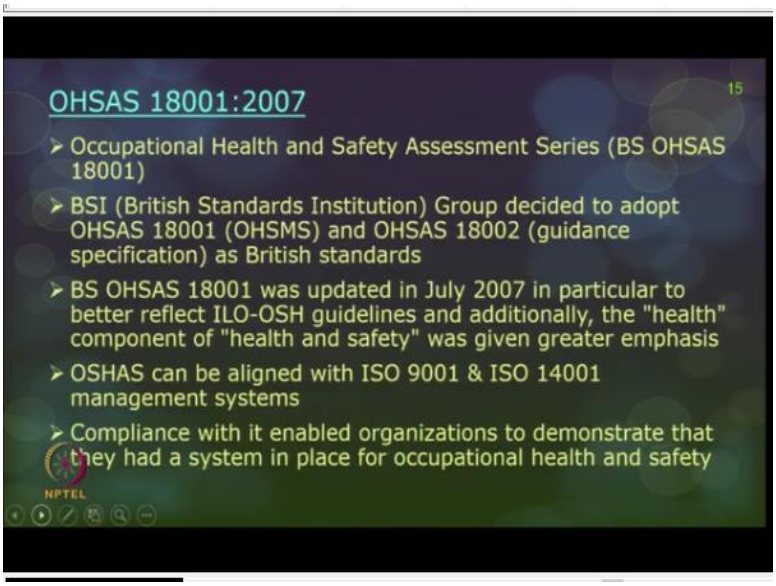


Now, we will move on to OHSAS 18001 and this is 2007 is a latest series. So, as I told OHSAS is nothing but occupational health and safety assessment series. And it is also in short form referred as BSOHSAS 18001. So, BSI which is nothing but the British Standards Institution group decided to adopt OHSAS which is 18001 and the OHSAS 18002 as one of the British standards in implementing occupational safety and health in the construction stream.

And this can be really aligned with ISO 9001 which is on quality management systems. And ISO 14001, which is primarily on environmental system. So, compliance with OHSAS 18001 enabled organizations to demonstrate that they had a system in place for occupational safety and health.

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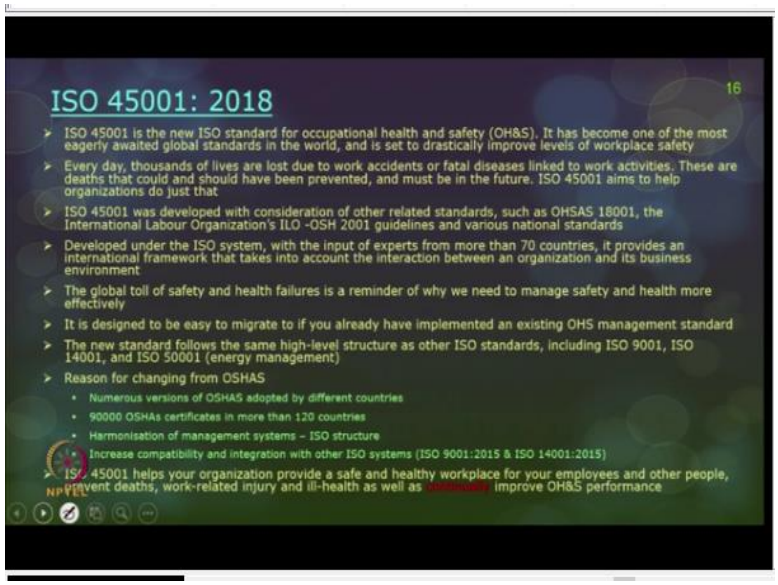


Our next is ISO 45001. So, since many countries had their own national policies for implementing occupational safety and health, ISO came forward in having a global policy or international standard for occupational safety and health. So, this was launched in March 2018. And till March 2021 many of the organizations including OHSAS 18001 can all easily get migrated to ISOs, you can easily migrate and then get a certification on ISO.

And it is easily doable they also have a very broad framework on how to migrate from any national scheme to ISO scheme. So, ISO 45001 is a new ISO standard for occupational safety and health. It has become one of the most eagerly awaited global standards in the world towards occupational safety and health in the site. So, every day 1000s of lives were lost and or even fatal diseases were which were all linked to the work activities, maybe the job site injuries and there were deaths, which could not have been prevented.

So, all these were taken into consideration and ISO is actually a global policy on any system of plays and health and safety, not really on construction. So, ISO 45001 was developed, keeping in mind all the relevant standards on safety, including OHSAS 18001 and also the international labour organization which is ILO-OSH 2001, but still, it is not an updated standard it is primarily a new standard.

But many of the principles developed which were already available in these standards were also considered into ISO 45001. Now, if you see what are the main differences between ISO standards and other standards is obviously the ISO 45001 has a high-level structure with which it can easily include or link with ISO 9001 which is a quality standard and the ISO

14,001 which is the environmental standard and ISO 50001 which is our energy management systems.

So, reasons for bringing in an ISO several versions of OHSAS are out there are developed and also there needs to be a harmonization or a same language which has to be spoken by different countries. So, as a result ISO came into existence and if you look at many of these policies are maybe the comparison from OHSAS and ISO 45001. Both have a common feature in that they look at continuous improvement on health and safety in the construction site.

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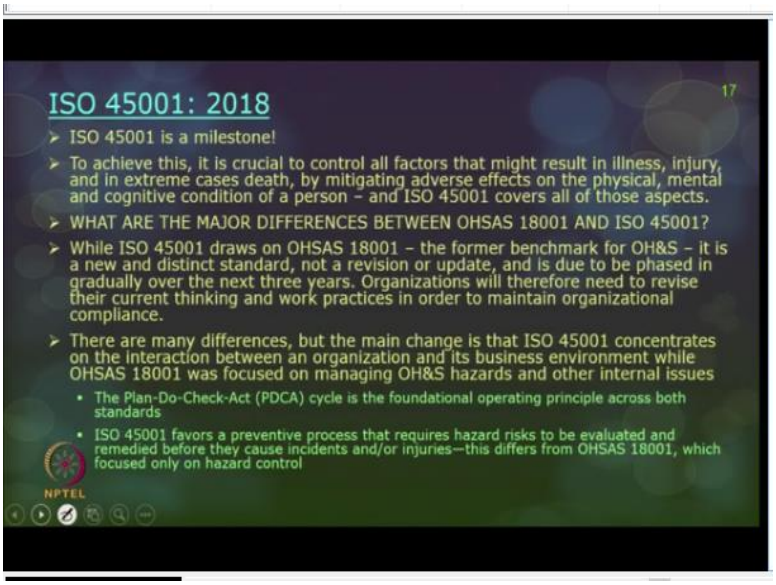


So, the next one is BoCW act and again if you look at this is primarily an Indian Act, which is primarily towards welfare of Indian workers. And it saw primarily towards focused on construction workers only. And before this act there were almost like several skilled and unskilled workers who were injured or died in the construction site, as a result of poor safety practices. And we all know construction sector is totally labour intensive.

And most of these labourers were unskilled and many of these labourers are unorganized and they tend to work under inhuman and pitiful side conditions or job conditions. It may be even their living place, it may be even their way of lifestyle or education or whatever basic necessities they need on food, water and shelter and so on. It was a very pathetic situation under which they were living in.

To address all these inhuman working conditions and poor health and safety standards for the workers who are working in real estate industry the government of India brought in the building and other construction workers act which is also called as BoCW act which came in 1996.

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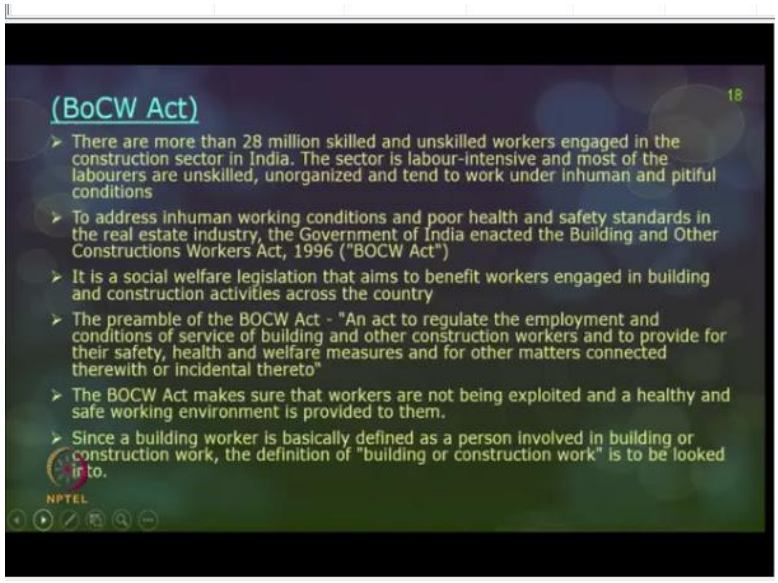


So, it is a social welfare legislation that aims to benefit workers, engaged in building and construction activities, working across the country. It applies to all the states and the preamble of the BoCW act is an act to regulate the employment and conditions of service of building and other construction workers and to provide for the safety health, welfare measures and or other measures.

There with or incidental there too and here any worker who is working in a building or construction site are all referred as building or construction worker and this act provides all the safety and guidelines for them.

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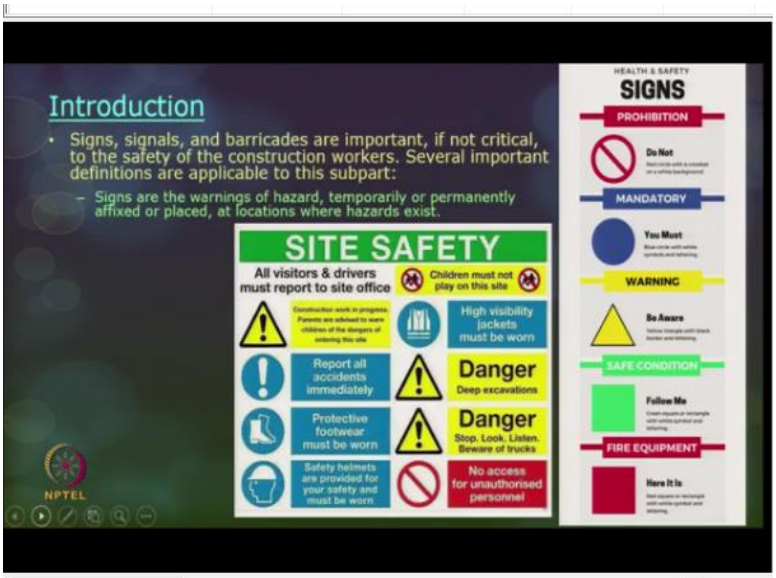


And accordingly, it also talks about the accommodation all safety standards, what are the rights for the workers. So, it talks about so many issues and it is a very big act if you are interested you can download and go through on your own. And there are a lot of IS codes which are focused on specialized topics that anyway I will cover it up along with the each of the topics.

Now in continuation with this some, I will also be discussing about signs, signals, tags and barricades, these are the 4 things which are required in a construction site, PPE also will be covered that will be covered little later. Now, if you see what are these and when a proper training and orientation is given to the worker why are all these necessary? So, these signs, signals, tags and barricades are some sort of communication to the workers or it is primarily a reinforcement to the worker what or unlike an alarm to the worker as to what they should do when they are in the side premises.

So, first now, let us start with the signs. Signs again there are so many types of signs, signs are nothing but sign boards even when you cross a road on the traffic you may see a lot of sign boards there, but you will see on different colors and background, different shapes also, that is primarily because they are of a different category. Signs are generally warnings of hazard.

It may be temporary or permanent, fixed or placed where the locations of hazards do exist and accordingly, we have primarily 4 types and the last type is like 2 categories. One is prohibition which comes in a red circle and a cross line. Other one is which says do not do

this. Red circle with the cross bar on a white background and a black pictogram that says do not do this particular task here.

The next one is mandatory. Mandatory always has a blue background with a white circle on the outer edge and it says how you should behave in a particular workplace. So, it has white symbols and white lettering. Next is warning. Warning comes with a triangular signboard it has a yellow background and a black edge and the pictures are all in black pictogram. So, it only cautions you and then say be aware.

So, yellow triangles with black border and black lettering. The next one is fire fighting and emergency first aid escape routes. So, the fire fighting comes with the red color and the emergency first aid issues all come with a green color. So, here the fire fighting is primarily red with the white background and white pictogram. The other one is a green background same with the white pictogram and white lettering.

Now, let us start seeing one after the other. So, this is a common picture on any side safety if you see here a lot of colors, a lot of different symbols are there, from now one you will understand what are the purposes of all these.

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So, number one is prohibitory signs. A sign which shows prohibition behavior, so likely to increase or maybe to cause danger, you are not supposed to do something there. So, what are the features of the prohibitory sign and white background under black pictogram**?** For examples do not touch, the water is not drinkable, no entry only authorized personnel are

allowed to enter. Do not use mobile phones inside, no cameras and no smoking's, these are all some of the examples of prohibitory signs.

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The next one is warning sign. So, warning sign as I said it primarily shows a sign giving a warning of a hazard or a danger. And the shape is primarily, it is a triangular shape and it has a black pictogram with a black edge on the corners and also it has a yellow background. And the shape and all are given in the IS code you can go through the IS code which I will put it in the end as a reference.

So, this shows danger on electric shock risk, danger on high voltage, danger on harmful fumes, danger fire risk, LPG highly flammable liquid and also flammable liquids. So, there is a caution on hot, caution on automatic door, so all these are primarily a dangerous or a warning to just want the workers who are going to use a particular premise.

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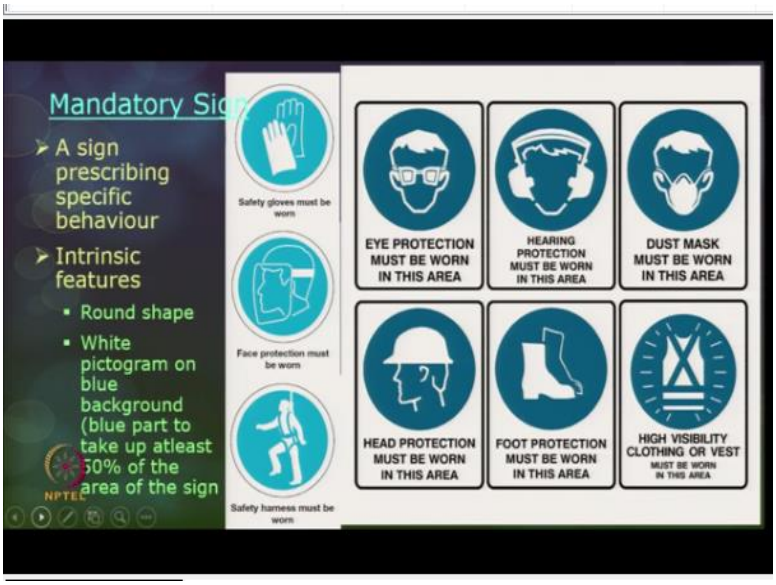


The next one is on mandatory signs, a sign prescribing a specific behaviour. So, as I told this is primarily a blue background with white edge the outer circle is white, completely blue background and it has a white pictogram and white lettering if required. For example, eye protection must be worn, hearing protection is compulsory here, it has to be worn.

Dust mask has to be worn in this area, head protection must be worn in this area, foot protection is required, high visibility clothing is required, safety harness must be worn, face protection must be worn, safety gloves must be worn. So, these are all different mandatory symbols.

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Now, the next one is fire fighting and first aid sign. As I told that this has the shape of a rectangle or square both are allowed, but the rectangle also can be in any form the width can

be smaller or larger, on the same way the length can be smaller or larger ok, and the green one is generally is a first aid or emergency escape signs and the red ones are primary for fire fighting signs.

So, only thing is the colour alone on the background is different, in fire fighting you have red colour, in first aid and emergency escape signs you have green colour. Otherwise, pictogram is white and the lettering is also white here. Examples are fire bucket, fire hydrant, fire hose reels, then ladder and emergency fire telephone and all these are examples of fire fighting signs. Fire assembly point, first aid, structure and emergency route direction on how to proceed in case of an emergency which has happened all in green colour.

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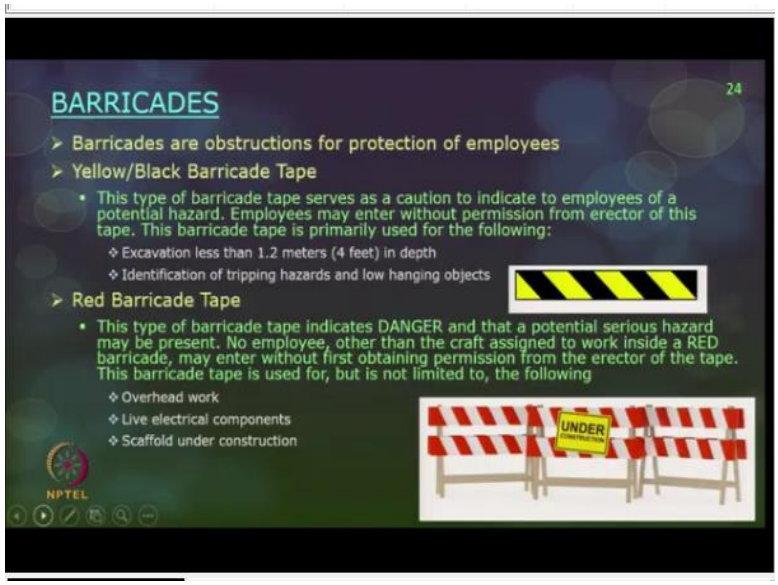


Now after the signs, next we will talk about barricades. Barricades are primarily to protect the entry of some people into the side premises it can be public, it can be selected workers. So, it is primarily an obstruction, so only selected people are allowed to enter some premises and that is primarily done by barricades. Again, barricades are of 2 types, one is yellow black barricade type, other one is a red and white barricade type. In the yellow black barricade type, it is only for a caution and it is only to indicate the employees of some potential hazard.

So, by getting prior permission the employees may still enter the particular zone but they have to be cautious or they are warned of something which is there in the inside the premises. For example, excavation less than 1.2 metres depth, defecation of tripping hazards or maybe low hanging objects and so once. So, if these hazards are generally there then that is yellow barricade tape on the barricades.

The other one is a red barricade type. So, this type of barricade indicates a danger and it shows a strict warning sign and they are completely prohibited. No employee or other than the craft assigned to work are only allowed inside a red barricade entry and otherwise you have to get a prior permission for entering such barricade types. Examples can be any overhead work live electrical components are seen there.

Scaffold under construction and for all these works you put actually red barricade type. Accident prevention tags, and the first one we have seen signs, again it is primarily on different locations to communicate something to the workers. Next one is on barricades primary to restrict the movement of people entering some closed area in the construction site. The third one is on tags; this is also stationary not a movable one.

But the tags are used to give some message to a worker. So, tags are accident prevention tags are used as a temporary means of warning.

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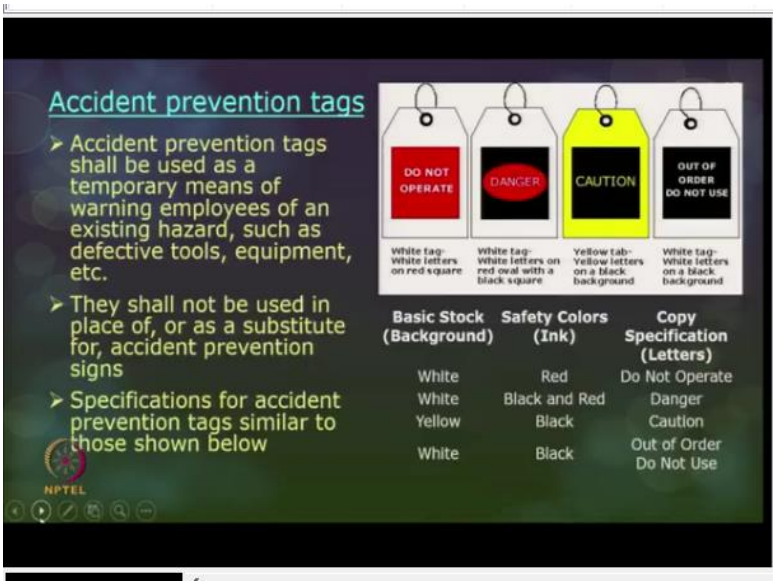


Employees of an existing hazards such as defective tools, equipment and so one and they shall not be used in place of or substitute for accident prevention signs. Again, this also comes with different colours and background and generally for any caution it comes with yellow and black and you can see the picture here and if it is for any danger, it either comes with the white background and red pictogram showing the symbol on danger.

Otherwise, do not operate sorry under precautionary sign it comes with the red background completely red background do not operate. Out of order not to use that is primarily on equipments which they hang it on to the equipment when the equipment is at fault.

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The next one is signals. Signals are generally mobile communication to the workers, in the sense they are movable communication to the workers, when operations are such that sign, signals, barricades do not provide the necessary protection on to the workers, then in addition to that you also can give signals, just like how you do traffic signals. But these are none of them are replacing the other, they are all in addition to the other.

Because each one has different purposes for which it is available in the sites. Signalling is generally used by flag men who have a visible bright shining visible garments and accordingly it done by the flaggers or the flag man and these flag men the west which there wear should be visible even at night. So, that the vehicles can be able to see the flag man and his directions.

Other forms of signals most of the signals are done by flagman only, some of the examples here are stop or it can be used a slow or slow down or to alert the traffic for moving in the direction and so one. Hand signal, so it is primarily a movement or position of the arms or hands and this is primarily used for heavy equipment like for crane operation, most probably on crane operation and for the other equipment movement in the sites.

Verbal communications are also possible it is a pre-determine spoken message communicated and by either using an artificial voice or an already recorded voice you can still communicate and here they may have only one word for the communication stop, exit or something so which has a clear sentence message that you may have to evacuate the structure for message called exit.

Acoustic signal a sound signal which is transmitted through the devices, it can be again with the help of human or artificial voice. A best example for acoustic signal is a fire alarm, with the fire alarm is very clear to the workers that there is a fire which has according the construction site and they have to evacuate.

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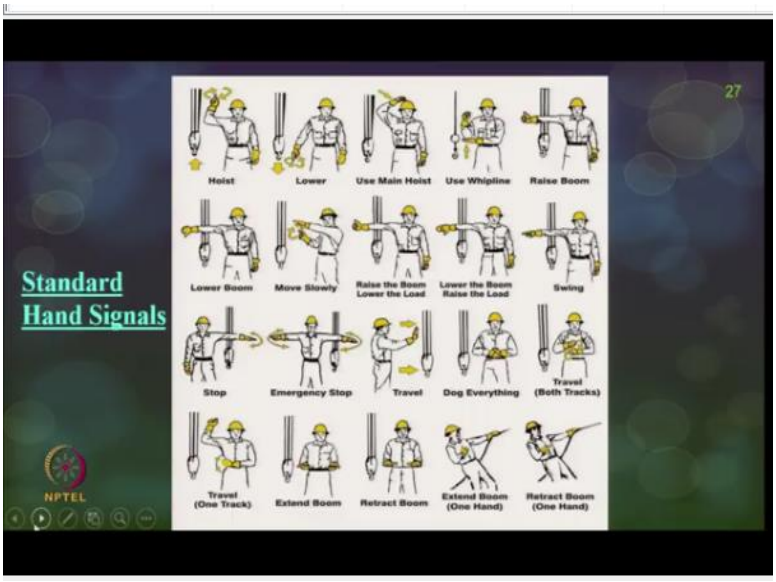


And these are the different pictures on the standard hand signals for the crane operation and while discussing on the crane operation we will see this in detail.

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And these are the various references from where I have picked up this lecture material. Thank you.