Mining Machinery
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Module - 09
Lecture - 46
Belt Conveyor

Welcome. We have been discussing Mining Machinery and our current discussion is on transportation machinery. In our last few classes few have introduced you the basics of drum trucks, mining trucks in which we have discussed how it is used its oval and it is a cyclic method of mining, you use transportations with drum truck.

And today, we will be introducing the other transportation systems or transportation machines, that is used in continuous operations of surface mining.

In a continuous method of mining, you one of the most important and very that is your highly sophisticated also this. And indispensable piece of equipment is conveyor belts. So, belt conveyor, it is a mode of course the continuous transportations, when we talked of introduced about slurry transport or pneumatic transport, they also go continuously.

But in mining, there is a special place for belt conveyor and a belt conveyor technology. This is a quite advanced technology now, though it was introduced in the 18th century. Sometimes, it was a wooden conveyor belts were first introduced; then the with the demands and with the necessity, this technology has emerged as a very important technology in the transportation sector.

They are used not only you might have seen, this conveyer belt in the airports, where your luggage's are coming, where this is used for unit load transportations. But in our mines particularly, we are going to load this bulk materials.

So, in the bulk material transportation, this conveyor belt, they can be used in many forms and many types. They have got different advantages and disadvantages. They will have to be selected considering the important factors, then they will have to be operated and maintained.

So, for that, the basic principles of how the conveyor belt that is your what type of motor power will be required for a particular given load to be transported and then, how it will have to be maintained. All these things are necessary for to become a very good technology manager in modern mines.

So, with keeping that in mind, we will be in couple of lectures may be 3 or 4 lectures will be devoting to conveyor belt discussions. And today, I will introduce you this technology how it is there.

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So, our basic objective is today to just introduce this technology to you. Now, here, I would like to like you to see these pictures. You can see a conveyor belt transporting say coal here and then, you can see there is a belt on which the material is there and here, this picture may not be telling properly. But you can see that this conveyor belts are moving on some idlers.

This is a belt, general how it is there; but they sometimes use this whole thing can be mounted on a bridge type of things; it is a mobile system. This whole is that your latest structures you can see, it is supported on two transporting end and they can move along this bends, they are capable of moving.

And on that the material from the your point, it is going to the higher point that is our that is the way how the transportations can be carried out. This particular is position there in Kazagistan. Another one you can see, here that is we are having a systems as a bridge from this side the mining operation is carried out and that over burden is spreaded or given across the pit somewhere here. So, this is a cross pit conveyor that is your across the pit, how it is working.

Then, you can see also in the other figure a long distance of single flight conveyor is there and on which you have given a cover. So that rain, wind and all, they will not be having effect and it will be operating over there. So, that is a different type of conveyor belts are shown over here which are used in your mining industry.

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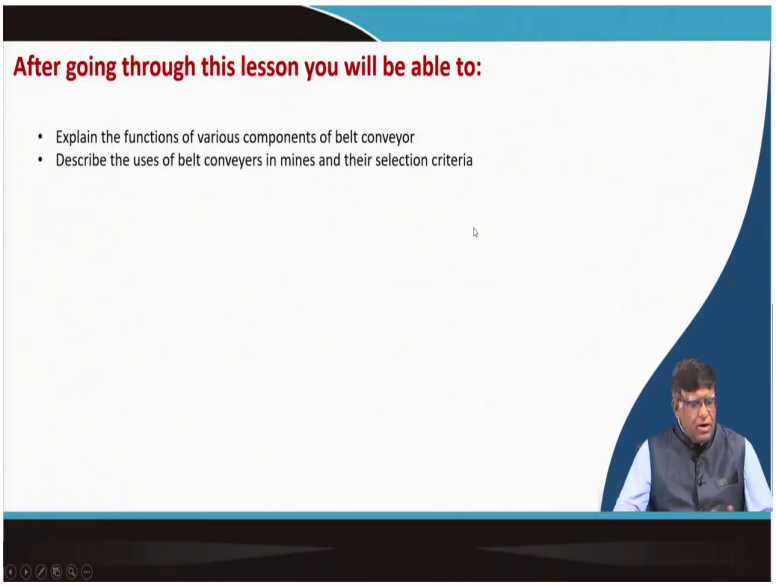

Now, if you our basic objective that after this class, you should be able to explain that what are the various components of a belt conveyor, and then, how it can be used; where it can be used, some of the points I will be speaking in between. So, I hope you will be noting it down.

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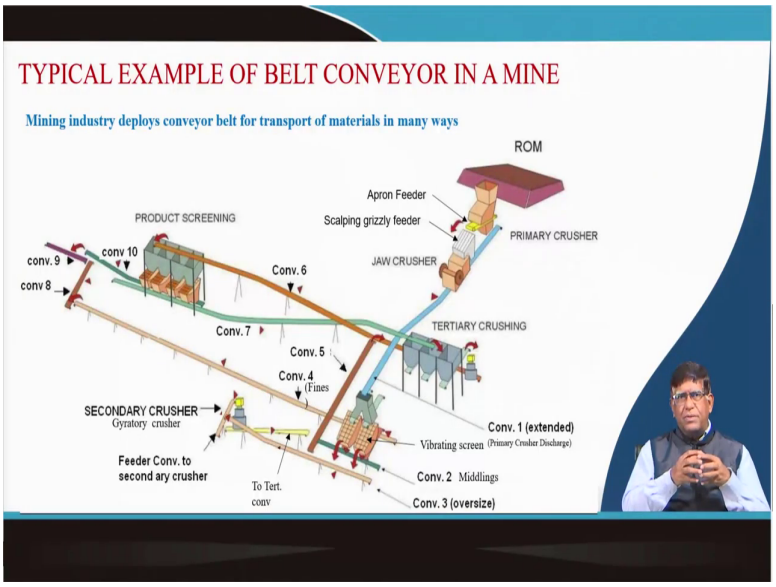

Now, before that, let us see one example that is your how that conveyor belt is exactly being used in a mine. You know in a mines say for example, in a metal mine, say your iron ore mine or you think of copper mine, gold mine, then they are always associated with a processing plant.

Because the ROM that run of mine, need to be processed means trust and screen and then they should be beneficiated so that the concentration of the valuable minerals is a level from where the metallurgical plant can extract.

So, that is why a material handling that is your crushing and screening and then washing and then improving them, there is a lot of process are there. So, from the mines to that processing

plant and from the processing plant to the user, a huge quantity of bulk material need to be transported.

This is an example you can see that from the run of mine, it can come and then, they will be just used through a they go to a primary crusher. From the mines, they will be coming to a onsite or it is a crushing plant, the truck will bring the material up to there. Then, the crushing plant will crush and then, through a feeder, called apron feeder, they will be giving it to another crusher that is from that this crush material will be given to a conveyor belt.

This is the conveyor belt number 1, where it comes, it will be then distributed by screening and that by the screening, it will be giving to a conveyor belt 2 and then from there, it is coming. The oversized material will be coming to a conveyor belt 3; undersized material will go to the another conveyor.

And then, this material in the from the tertiary crushing's also, the material will be going to another conveyor belt cheeks and then, that will be giving a product screening, there the higher size will be again brought by another conveyor to that tertiary screening.

That means, a your feedback is there the over size is again crushed so that the material comes. Like that ultimately, the fine one, they will be going to another conveyor number line. So, you can see in a mine and mine mining and processing, where 9 sets of conveyor belts are there for using it.

There could be any number of conveyor belt connected to one feeding to the another, that is a one is followed by the another; the whole conveyors will be operating in sequence and things are there. So, there are different ways how this conveyor belt will be placed.

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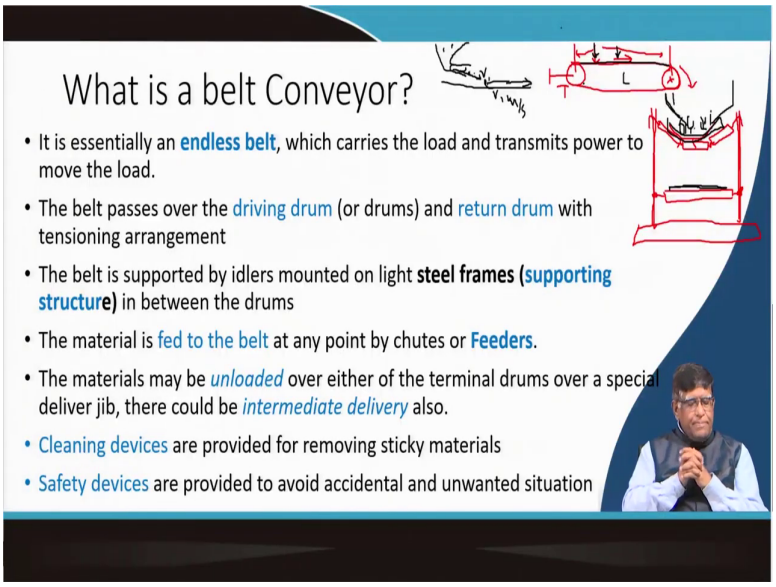

So, now you know that there is a conveyor belt is used. So, what is this conveyor belt is. So, basically what we say, this conveyor belt is a it is an endless belt. In an endless belt that is a it will be running over to this drums. Now, this endless belt, they are just running one drum is there which will be a driving drum, another drum will be there which is a your that is your return drum.

So, that means, basically you will be having two system like that. So, there will be one drum and there in there is another drum, over that you will be having a endless belt will be going like this and it is just going over here and then, this is forming that material. Now, here that one of them would be a driven drum. That means, this is connected to a gear box and then, to a electric motor and then, this is your return drum which can be connected to a system, where it will be doing the tensioning.

That means, that exactly the distance between this drum and this drum that is the length of this belt conveyor, this portion exactly is a can be increased so that this belt is in a tight conditions. Now, the material can be loaded anywhere over this conveyor belt and this will be carrying in this direction and the material will be discharged from here.

Now, this discharge, so that is a in a basically a conveyor belt is thus an endless belt and there is a driving drum and a return drum and these things will have to be placed on a supporting frame because this belt will have to be there. So, basically this conveyor belt when it will be this is suppose the belt, it will be supported on some rollers; there will be some this is a roller or what we say an idler.

There will be a set of three idlers making a arrangements like that we are making a troughing arrangement and in between this, we can have an universal coupling by which exactly they are forming a garland type of things. And then, these ones we can have a supporting, we can hang it from a supporting structures, we can have a steel frame.

This steel frame will be of some rod say this is this will be some steel frame will be supporting, we can keep these things over a skid or over a skid this type of things, we are supporting them and then, from here, we will be having another rollers which will be supported over here and this is supported on this frame.

We can say here, it is locked. We can having a bracket over here, it is fixed over here. Now, this is the belt which is your which you are having say this your this is the belt which is running over here to this drum, you can say this is the thickness of the belt and this will be this part exactly, this belt part is going like that and then, after returning this belt will be coming over here.

So, you can see that this conveyor belt which is there the material will be placed over here. So, this material will get discharged over here. So, this is exactly, now when you have to feed this material over here, you can feed the material at any places that is called you can

depending on the situation and this length, this length can be anything; it can be 5, 50 meter to can be 1 kilometer, can be 40 kilometers.

So, then only your this number of frames will have to be increased. This is will have to be aligned there other things which will be learning slowly. So, that means, basic systems will have to have a feeder, that feeder can be over at a top of it we can have a that is a structure which will be feeding the material over here and it will be guided by a shoot. So, this is an and then so that the material is guided on the conveyor belt.

So, on a this type of feeders can be of different type, only thing you should remember will be discussing those when will be discussing some of the conveyor calculations that the material which is getting falling on to the conveyor belt, they will have to come in the same direction of motion and if possible in the same speed.

That means, if you are loading on to this, this is your conveyor belt surface, then the material which will be coming and you can brought it somewhere here, we can have this your feeding shoot. So that if the material over here, it is falling and then it will get speeded up by the shoot and going in this direction.

If your this conveyor belt also moving in this directions, then if the conveyor belt is having at a velocity V 1 meter per second; then, your this is a conveyor belt is moving, this material which is coming if it also comes at V 1 that is the base conditions; that means, in the same direction at same speed so that whenever the material is striking over here, it is instantaneously started moving.

We will be discussing those things during our calculations of conveyor belt, but these materials which are coming over here that need to be that need to be unloaded or this portions will have to be that is your you will have to put this material in such a conditions that from there where it will go.

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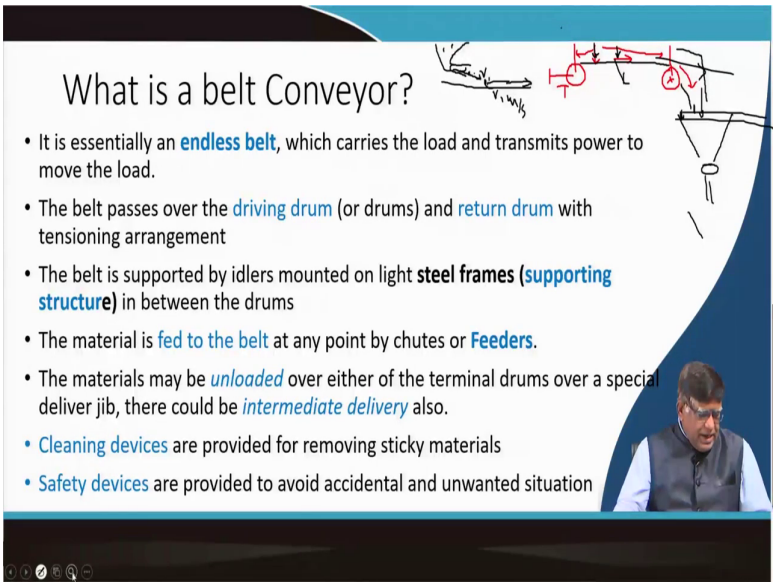

Because this material will have to you can make it you can have a hopper here. So, that this hopper and all will be guiding. So, that the material which will be coming as a projectile form, if it heat over here, they will be guiding this material down and it can go to a. It can go to a hopper below which we may have a casting plan that crusher and then below that, it can go or it can go to another conveyor belt here and this is carrying to the material in a different way.

So, the how the transportation system has been planned in your minds, depending on that you will have to use it. Now, that exactly it can be unloaded not only at the end, sometimes you can unload the material even from here. So, for that another arrangement called tripper is there so that from the side also you can trip the material to the side to dump it.

So, that will be different type of unloading either at the end or at intermediate point. Then, this is in a sticky material, clean material if it sticks to the belt, then your belt will be having a lot of weight to be carrying and that your belt performance will be going down. So, the conveyor belt will have to have some cleaning devices and also, it must have some safety devices. So that you can just stop it whenever required; it should not create any accident to the people operating.

So, that means, you will have to know how this conveyor belt is constructed; how it is operated; how it is a during the operations, you will have to see that there is a your during you are maintaining the proper safety of it.

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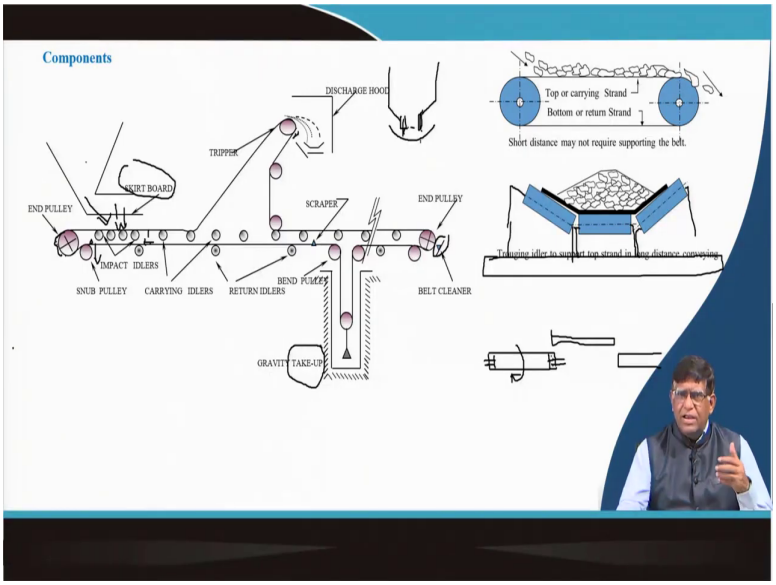

So, now I think you can understand that what is a belt conveyor. A belt conveyor is an endless belt, running at the two end pulleys and it is being fed material is say here, it is a material is

fed. Then, the material will be moving and then, material is heaped over a trough belt like this. So, now these conveyor belt, you need to know what are the main components that must have.

A schematic diagram is here. I hope you start drawing these things, while you are listening, you can start drawing over here. First you draw this two end pulleys over here and then, you keep another small pulley here, a little bit above here. So that this end at the belt when it is going, it is going little bit up like this. So, these two.

And now you draw this line and put one line like this and go it above here, bring it down and then, it is going. And then of course, we are showing a brake because this could be a very long and this is the things. So, you have drawn these things. I hope you are drawing on your piece of paper. Now, this is giving you the that black line, you are seeing is the conveyor belt. Now, let us see as I said there is a end pulleys.

These are the end pulleys; one of them could be a driving pulley, another will be your return pulley. Normally, you will be finding that the discharge end, we keep the driving pulley and we will know why it is so, later when will be doing the belt tension diagram and the location of the driving power.

But here at this point, you can remember that we will be generally the driving end will be a your this discharge, then will be the driving pulley. Now, you can see that you are giving the small this balls here are the exact that your sectional view of the rollers. This rollers which is exactly you your it is a roller is called idler, this will be a cylindrical surface. This is a cylindrical roller like this which will be having at the end that inside, it can be hollow.

At the end, there will be a bearing and then, there will be a shaft which will be exactly on which you can take the supports over here and then, in this hollow cell, here we are having the bearing over here and it can rotate like this that is it is free to rotate this bearing, when you are seeing the cross sectional view, you are seeing it here as a circle being shown.

Now, this you can see here very closely space circles, these are called impact idlers because when this material which will be fed this could be fed by even could be a shovel is given to a shoot or that the your dumper is unloading over here or from another conveyor belt, it is coming over here or from a shallow or bean or bunker, it is coming over here. Then, these material will be loading on to this conveyor belt. When they are falling over here, they will be giving an impact.

So, that impact is taken over this; otherwise, the belt will get damaged. So, we are having a cushioning effect by this idlers, they are specially made, we will discuss about that later. Now, there are some carrying idlers means at the load, where which is being carried, these idlers are called carrying idler and then, there is a return idler as in the previous drawing, I was drawing over there a return belt was moving on single idler. So, this is a single idler like that; that is a return idler.

So, carrying idlers are troughed idler for our material only bulk material purposes, they are in form of a three which can be a with a connected to form a garland or they could be separately, they can be having their own rackets and then, there they can be supported on separately over here like this and then, they have got individual support and in which they are independently rotating each other, there is no connected. And it is all these supports, they can be made on a plate form over here and then, this is there.

And there, even this three idlers that is this three idlers can be in one line like that or this is your the another idler can be a little bit of long. So, that is if you see a plan view of this three idlers here, they can be also in this form. So, that means, depending on whether your garland idlers or this; these idlers are placed like that.

Now, these end when it is going, you are having one idler here, the material is dropped here and this is called your tripper. If your intermittent that is not discharging at the end, we can discharge over here to another conveyor belt with a hood and then, this belt will be now returning over here; going over from the end pulley it comes.

Now, for keeping the tension of the conveyor belt, you are having a this is a tensioning arrangement. Tensioning arrangement is called take up. Take up means you are taking up the elongated or extension parts. So, if the belt elongates because of this weight, it will come down so that tension at this; why the tension is required?

Because this pulley suppose it is driving that belt is getting the drive of the drum or that that when the drum rotates, the conveyor belt get the motion by transferring by friction between these two. Now, if there is a gap or if it is a lose, then it will not be able to properly give the power transmission will not take place. So, that is why you will have to have a take up.

And then, this is a bend pulley; that means, wherever that conveyor belt is to take a turn, we are having some bend pulley. So, now, you have I think while you are listening, you have drawn the diagram. Now, once again, you check up what are the main components of a conveyor belt system, like you have got this end pulleys, you have got idlers.

Idlers are of different type, we are having here three types; impact idler, carrying idler and return idler and these idlers are supported on a supporting frame. You have seen little bit ago. Then, there is a tripper; the purpose of the tripper is to discharge the material intermittently or it will be giving.

Then, at the end, you note here, there is a belt cleaner. That means, when this material is coming up, sometimes we can have a cleaner here also. We can keep a cleaner here so that cleaner will be just like a brush, it will be there so that whatever the conveyor belt after discharging, it is just giving a brush. So, the your this side, the old material will be placed over here.

Now, there is another thing is you write down here that is when this material, if some material fall here into that return side; what will happen? These material will be carried like that now if this material goes and then, in trapped in between the pulley and this belt, then they will be creating this belt there will be coming as if some lump is coming over here, in between this material will get stuck up.

So, that is why you will have to have one scrapper arrangements so that if any material is coming from here, it will fall down at the outside. So, that is also a belt cleaning device, which is not shown in this figure; but you remember that there is a belt that is that sometime it is called plough or a scrapper by which you will be scraping these things.

Now, another word is written here skirt board; skirt board is nothing but the loading arrangements. So, in your conveyor belt, when your this is the thing will have to be loaded. So, your material is coming with that hopper and you are having something like this and then, you keep a this portions like this so that the material is guided and loading over here. Now, these portion, where exactly the material will be guiding, it is called your that is skirt board.

It is the job of this skirt board is to guide the material to the conveyor belt will be discussing when the detail of constructions of this units are there. I also request you will have to read some books on conveyor belt. The best one is that the book by Conveying Machines by Spivakovsky of Mir publication or that Anti carrel in mine transport also discusses about there.

But I will always say if you happen to go to your colleges or in the internet, you can find the Trans Tech publications that bulk solid handling journal. They are lot of articles, good articles on conveyor design and their constructions are there. Particularly, the if you look at the 80s; 80s journal of bulk material handling will give you the basic concepts of conveyor belt.

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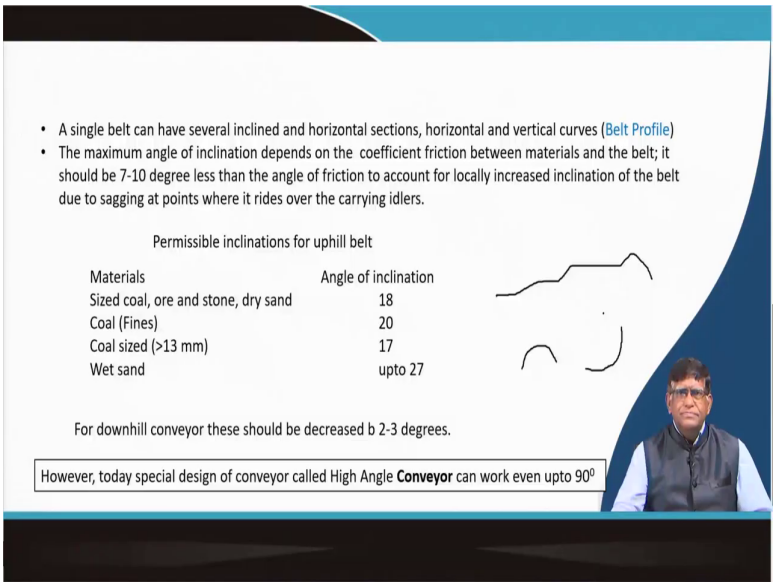

Now, coming to here, what a single belt can have a several inclined or horizontal sections? That means, that conveyor belt, what will be the profile; how it will be there. A single belt, it can also have difference; a belt can go as straight, then it can go inclined, then it can go again straight and it can go inclined. So, these things can be there. It can give a curve also.

Then, this curve can be a vertical curve; it can give a horizontal curve. So, this profiling of a conveyor belt can be of any sort that is why this is a piece of machines used in underground mine as well as in open cast mine as you can you have got the flexibility of designing to negotiate with the different situations.

Now, this inclinations which will be there that inclinations can be of different that is depending on the material which where there material and the belt. They are friction that will exactly affect the things your material otherwise you slip, that is why you cannot use in a very

high inclinations. But that is why the angle of inclinations, it to take the material uphill it should be very less.

Let us say for example, your sized coal and all, you cannot take it more than 18 degree; otherwise, the whole material will slide down. Now, if you are taking a downhill conveyor, at that time this will have to be a further reduced; otherwise, the whole material will go and hit the form. So, this was the problem because which the conveyor belt in the old days, earlier they were used only in a more horizontal type of transportations. But today, we have got high angle conveyor which can go up to 90 degree.

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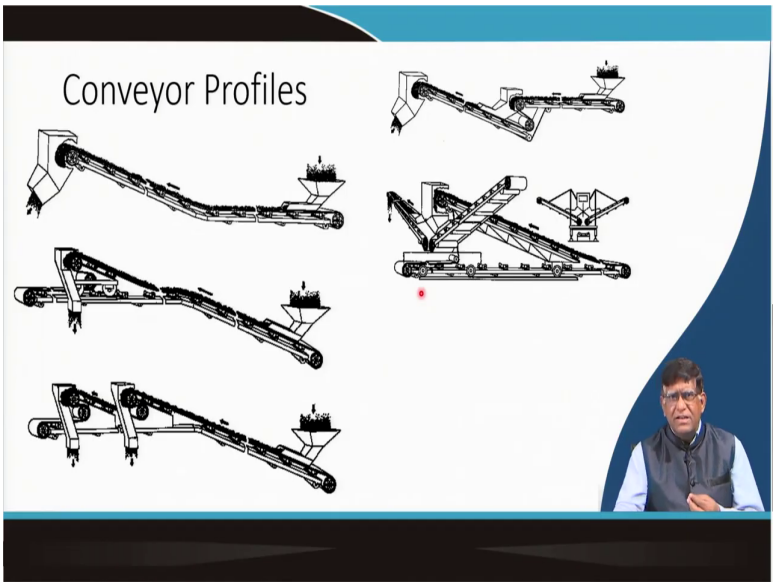

Now, if you see that profiles can be of different type. You can see here that how the loading is been done here and then, your this you can see with a horizontal, then inclined, then it is

going and it has reaches to this hood or hopper. Sometimes this is you can see this inclined part whole the thing, it is loaded on a inclined.

This skirt board, this skirt board is allowing the material to be loaded over here and then, this is going up and then, it has got a tripper car that tripper is making the material to discharge intermediately at any point. It can be this tripper can move over here. So, you can at any places here, here, here, you can unload the material. So, this is there.

You can have the same this conveyor belt, it is getting some portion are unloaded here, some portions are partial unloading is also possible. You can have this say one conveyor belt is going and then, from there, it is a intend one.

It is a same conveyor belt; it is without any turn. But here we are having another pulley so that extra drive is given. So, you can have that conveyor belt drive driven at number of pulleys. It can have a motor here to drive; it can have a motor here to drive; it can have a motor here to drive.

So, like that, depending on the load conditions you can design like this. Sometimes you want if you want to pile the material on this side of the conveyor or you want to pile this side of the conveyor can be distributed on a tripper by having a proper enhancements over here. So, this is also a tripper arrangements. So, that is in a bulk material handling which conveyor, we have got a huge opportunities of them.

Now, you will have to learn that in how exactly it functions; how it is designed and that design is a very simple mechanical engineering design, it will not be any difficult for you to learn.

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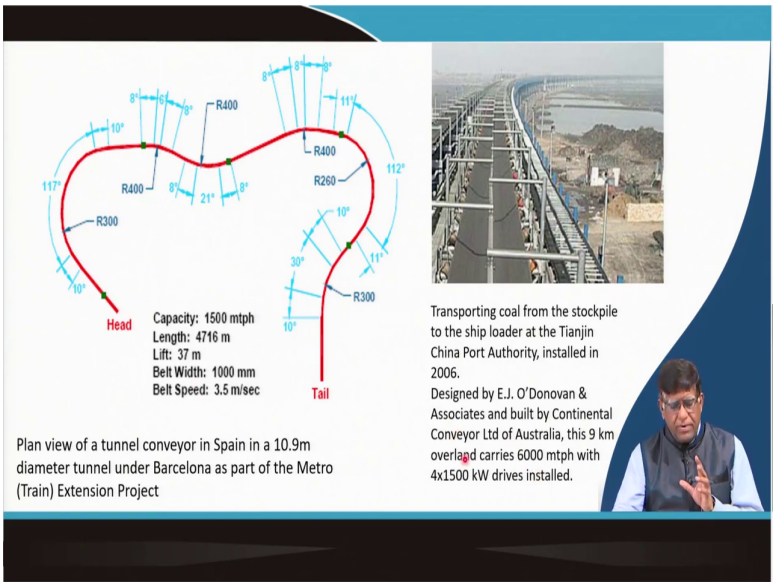

But then, you can see what in a modern day, how they are being used. So, just for to keep yourself a aware of the fact that there is a that is with a that is your 1500 the this capacity high capacity, that is your conveyor belt is there in a underground.

This railway metro railway network, what they have made, you can see. They have got 10 degree, 17 degree that is your the turning, they have made over here. They have got a gradient 8 degree, 6 degree; this different gradients and then there have all these things.

So, 10 that is your in a tunnel; this is in a 10.9 meter tunnel; this in Barcelona, this type of conveyor belt is there and then, with a 1000 millimeter belt moving at a speed of 3.5 meters taken, they have designed that you can see. There is a horizontal profile; there is a horizontal curve, vertical curve different gradient all are managed and designed in this.

Similarly, you can see here in China that is they have got you can see the horizontal curve of a conveyor belt; a trough belt conveyor having such a horizontal alright. So, that means, it is 6000 ton per hour; 6000 ton per hour, it is carrying that of course, this underground, it has it as the got the carrying capacity of 1500 ton per hour.

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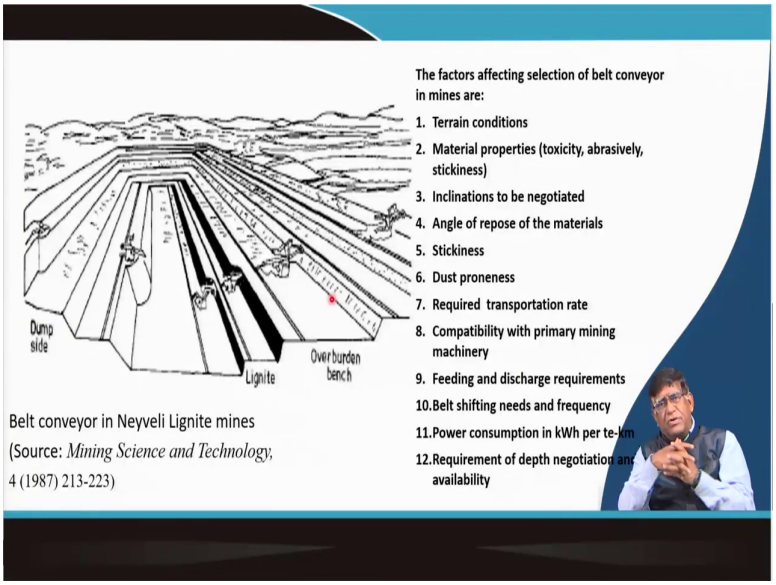

So, now this source that conveyor belt has got a huge things and in India, we are also proud of having a Indian mines with a more than 25, 35 kilometer of conveyor belt that Neyveli Lignite Corporation conveyor belt system which was introduced in the 50s. In the early 50s itself and today, in the our India, we are having a 2400 millimeter width; 2.4 meter width, this conveyor belt running and taking about more than 12000 ton per hour, the conveyor belt carry to work with a bucket will excavator.

You can see that what is the Neyveli lignite corporations mine that number of bucket will excavator is loading, this conveyor belt and this conveyor belt is going like that and all along it is going up to the surface.

So, that means, it is a dump site, it is the mining site. Mining is advances in this directions and the this conveyor belt is taking the material to the dump yard from different levels. So, this is a marvelous things. So, now when you are going to use such a conveyor belt in a mines that what are the factors that you will be selecting.

It is a very very important things that a how will you select a particular piece of machinery for a mine, your terrain condition is very very important. If there is a that is your terrain is not level, you will have to go up and down, there designing of that vertical and horizontal curve will be begging a new design engineering problem; nothing is impossible today engineers. Keep it in mind; come what may, we can do it.

The earlier, there are only horizontal conveyor belt. This type of difficult conditions could not be negotiated. But today, if the engineers want, they can do, they can design, they can make it. So, only the terrain conditions will have to look into why we need to do that so that we can get a trouble-free operations. It is not that difficulty. You will have to design accordingly.

Now, the material properties will have to be seen that whether it is a toxic property, abrasive property or that is having a stickiness; then, will have to incorporate some different designs. If it is a toxic, if it is going with the wind, then it will have to be kept under a cover so that it does not affect any environmental problem.

Similarly, that what is the inclinations to be negotiated; what is the angle of repose of material makes very bigger difference because if the angle of repose is less, then what will happen? The material will be flowing down say that type tensions stickiness will have to use a belt cleaner, then your dust proneness. Sometimes what happens?

During the caring, if the material vibrates amongst them self, they get pulverized in the wind it goes. So, we will have to have a covert type of things so that the wind does not come over there. Then, what we have to decide that what is our rate; that means, if you are giving the thermal power stations, the coal or ignite that what is the boilers capacity; how much exactly they need.

If they need 5000 ton per hour or they need 10000 ton per hour, depending on that will have to design that what will be the width and what will be the speed of that conveyor belt. Similarly, we will have to what type of machines is loading it; whether we are going to use it as a shovel and then, in pit crusher.

Shovel and dumper will be giving to the in pit crusher and then, it will be going just like in our Central Coal Fuel Limited of Coal, India, at people who are mines, they have got that system or will be having a that bucket wheel excavator which will be giving over there and it can take or as we shown in a continuous surface miner, they can have that is a along with the continuous surface miner, they will be discharging to a shift able conveyor belt and do it.

So, that means, if you have to do a shiftable conveyor belt, these belts are all shift able because this machines will be machine will be advancing in this direction that this conveyor belt which is on which this bucket is excavator is loading, it will have to when this block is been mined, if this block is mine d up to here. After that this BC will be going to cut next block. This conveyor belt have to be shifted.

Now, what will be the that is that shifting time your operation will be closed? So, how will you design that when it is to be shifted that is what is the frequency of safe thing. If you can have a very long strike length, go ahead at that time with a cutting the whole strike length so that your shifting frequency will be less.

So, these are the different things will have to see, then how much power is required and then how much depth; from what depth it will be negotiating, these things will have to be taken into considerations.

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Year	Installation	Length	
1989	Channar (Australia).	21 km	2 flight conveyor with 2 horizontal curves.A DIN friction factor = 0.0098 was recorded on the straight conveyor, and f= 0.0110 on the horizontally curved conveyor. This is a very low rolling resistance installation.[5]
1996	Zimbabwe Iron & Steel Co. (ZISCO) Zimbabwe.	16.5 km	with curves 500 t/h dry, at 4.25 m/s, U-frame roller supports with long idler spacing, world's longest troughed belt conveyor
1997	El Abra (Chile).	14 km	Copper mine ore transport
1998	Muja/Collie Power station (Australia)	14 km	With 3 flights, curved
1999	BHP DRI (Australia).	7 km	transporting material in both directions
2000	Ingwe (South Africa)	13.4 km	1,800 t/h of coal, Bateman Project Holdings Ltd supplied belt conveyor
2000	Phelps Dodge, Climax Molybdenum, Henderson Mine (Colorado, USA)	24 km	3 flight system , curved
2006	Curraugh North (Australia)	20 km	single flight with 4 horizontal curves
2006	Tianjin port authority China	9 km	6000 mtph with 4x1500 kW drives installed
2004	Alcoa Primary Metals, Texas, USA Sandown Mine, Rockdale, Texas	19,160	1088mtph, 914mm bet

So, you can see you can find out that what is the recent strand of development; how this has been used. You can see here from earlier of 500 meter is 1 kilometer; today, we are having 20 kilometer, 22 kilometers and also, there are more than 14, 40 kilometers as you say conveyor belt of different type at transport (Refer Time: 35:26) is 14 kilometer.

Now, Reliance, they have got in their session mines which is having about I think more than 40 kilometers, 16 kilometers length they are using. Similarly, a conveyor belt that which is carrying a material that is lime stone from Meghalaya to Bangladesh, Lafarge made a overhead try conveyor belt of a very long distance. So, these things are coming. You will have to do a little bit of study. So, know and make a table like this; how and the where they are using.

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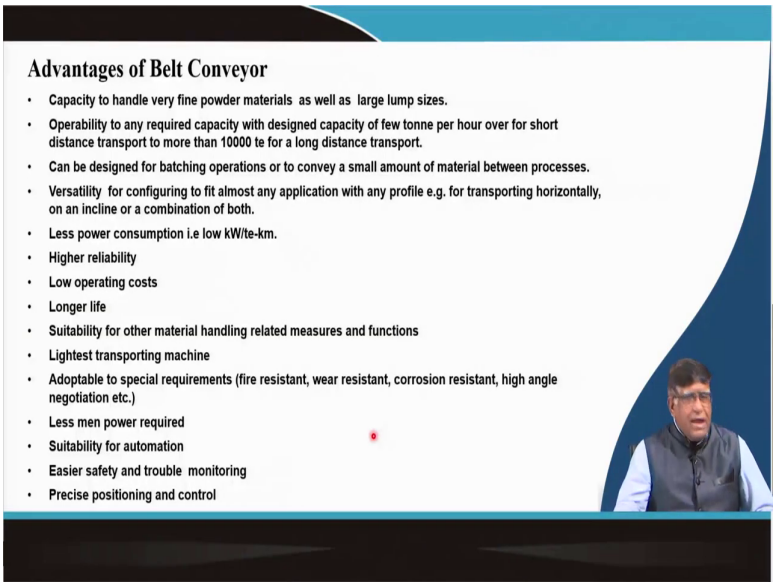

So, you need to know why conveyor belts are used because you will make a number of points, you can search the net. You can see from here also, we have talked that capacity to handle a very fine powder materials as well as very lump size.

Its applicability range is very high; it is a it can capacity you can have even few 100 tons per a hour or you have got 1000s of ton per hour. You can design that is your different batch operations can be carried out whether you can transporting horizontally curve and all can be negotiated.

Your power consumption is less; you do not depend on the diesel, the diesel is a very difficult. Because you burn, at that time also your fossil fuel you are burning and you are a giving carbon dioxide and gases; but if you are running with an electricity, you do not have

that problem of diesels and also, it is cheaper and then, it is very reliable and because there is no man and other things.

Only at the end, it is there; you need not have a large number of manpower to run the mines and then, it will not be creating so many dust as the drum truck makes in the mines. So, there are so many advantages over here and there you can automate it; you can without man also, you can do a lot of things.

You can do the weighting and measure how much is going; your whole management information system can be very easily incorporated. It is a your data can be collected, your maintenance and monitoring can be data driven, condition based maintenance. So, that means, high sophisticated technology can be easily applied. So, these are the advantage.

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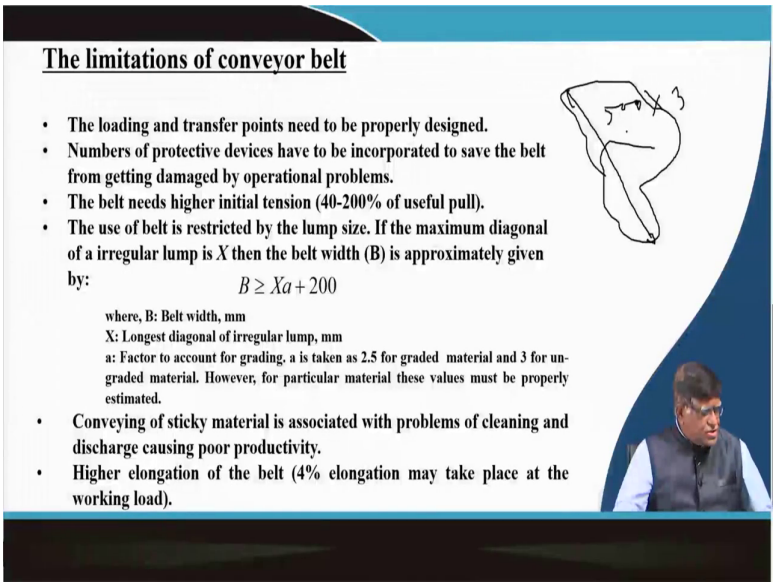

But there is a limitations also; particularly, if they are very rigid that is a loading point and reaches point, you cannot use just like truck, you can go anywhere and then dump anywhere, wherever you like you have got the flexibility. But these does not have the flexibility. It has got rigid points between which and then changing of that makes a lot of investment and the time which can be exactly need to be properly mitigate properly planned and done.

Similarly, your the that is your the belt conveyor, it can get damaged by anything because its continuously running. If somewhere heaviness small very of the pointed rock comes and get catch in between the your cleaner and the conveyor belt, the whole conveyor belt may cut it one go. So, it is a vulnerable to get damaged.

So, you need to be very vigilant and technically, technically capable and technically aware of that what type of problems come, then you can do it. So, this your more skill is required for running trouble free and maintain free. Similarly, it has got a very high initial tension will have to be given.

The belt will have to be kept under tension and if it is a very long distance to maintain that tension, you will have to have a adequate track take up devices, then you will have to have this the belt width; that means, if you are blasting, if the bolder big bolder is coming, you cannot carry it by conveyor belt that is a limitations.

This formula, you can remember that is your if B is the belt width that belt width must be greater than this your X a, that is your X is your longitudinal the this your this term because any lump, if it is coming any lump, this lumps may be of any regular sections and things like that. Now, whatever the longest distance that is your X.

So, now, if you are having this a X and then, this material you are loading on to the conveyor may be after screening or unscreening. If it is unscreening, then you will have to take this is exactly 3 multiply that suppose you are having a lump of say 500 millimeter. Now, if it is; if it is ungraded or unscreen material, multiply by 3; that means, your 1500 plus 200 that is your 1700.

So, that the belt width must be greater than 1700 millimeter. Now, during the operations, you cannot change the belt. If you are having a 1600 millimeter this a conveyor belt already put it over there, then what will have to do? If such type of big lump come, you will have to separate it out before loading into the conveyor; otherwise there will be problem.

And that is why you need to get an in pit crusher by which it will be crushing the big lumps and put it on there on to the conveyor belt. So, this is one of the limitations which you must know. There is a conveying sticky material is a problem, then higher elongations that is a conveyor belt may get elongated. So, at that time, you will have to adjust the take up system properly.

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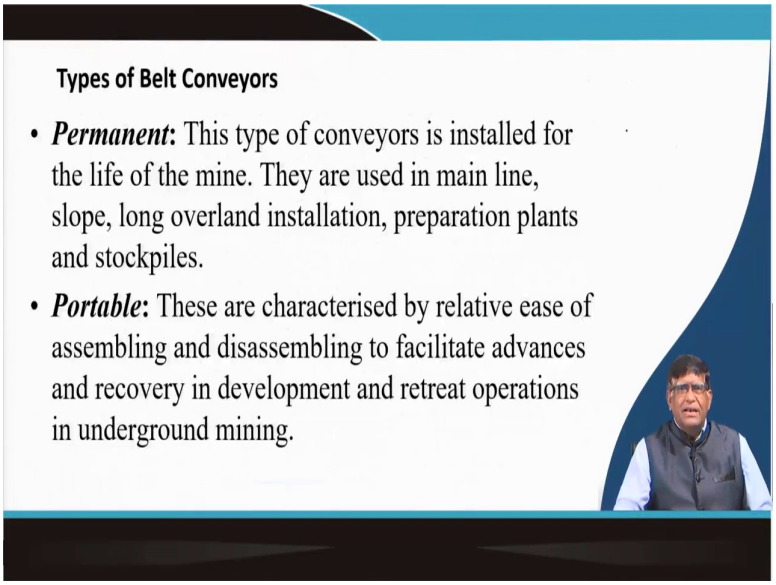

These are the limitations. There could be different type of conveyor belts which could be a permanent type, portable type, which could be a shiftable type, high angle.

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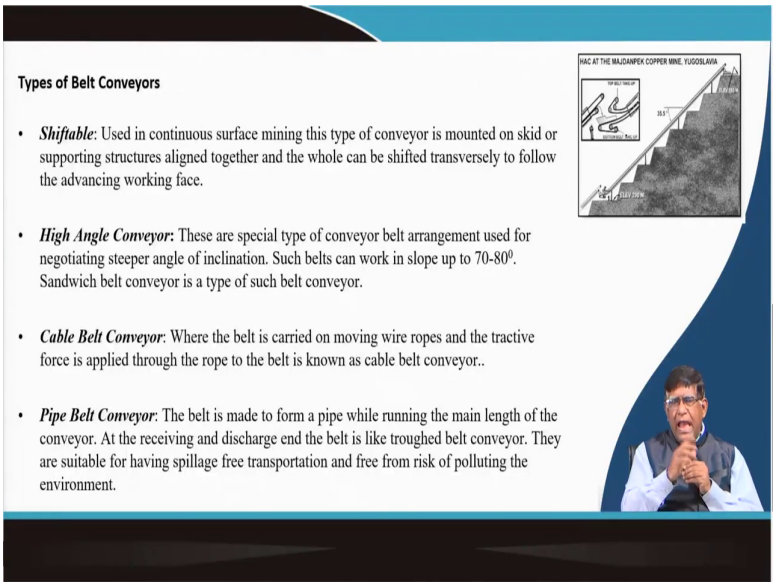

You can see in the figure how that high angle one conveyor is taking out over there, there are certain devices. I think you will be getting one practical class demonstrations of a in laboratory, how you are keeping at a high angle conveyor, you can see in our a demonstration class will be given I think within this course in one day.

And in cable belt conveyor, pipe belt conveyor, these are the different. The pipe belt conveyor is the latest addition in India which is been done in a 2006 onward. We can say it has come to India, though this technology is about more than 20 years old that pipe belt conveyor has got its popularity only recently in India.

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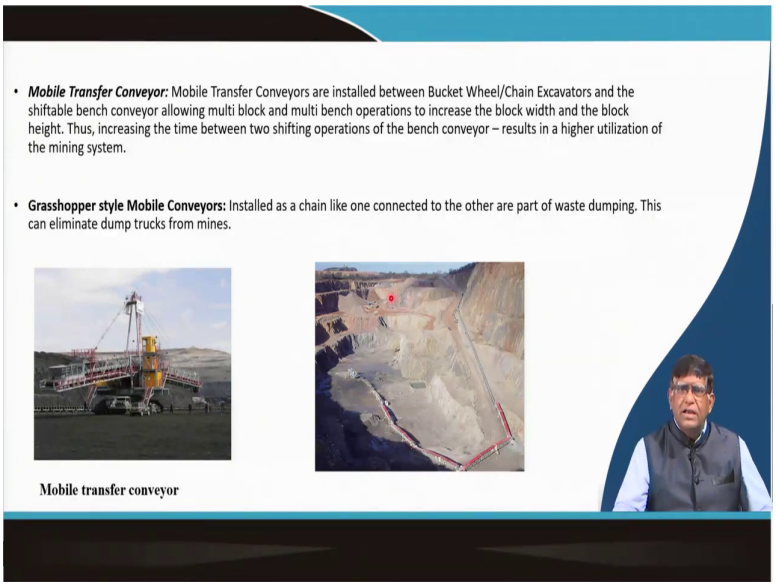

So, there are also mobile transfer conveyor say as you can see over here, there is a conveyor belts are mounted on a machine. You have got this two arm that is your machines will be loaded at to a one end and then, it will be unloaded on to a conveyor from the another end.

So, this is a exactly here, this hopper a conveyor belt can from the bucket wheel excavator can load it over here, the material will be conveyed from here and then, this will be loading on to the conveyor belt at the other end.

So, that is the way, how a mobile transfer conveyor work and also, there is a grasshopper style of conveyor. These are the grasshopper spins; these are small portable movable mobile conveyor; these are mobile conveyor. This small one unit, these units what you are seeing

over there in the figure, you can see that this particular unit 1, 2, 3, 4, 5 units you can see over here.

Individually, they have got their small steerable wheels. On the wheel, the whole thing is mounted, you can ride them and then you are putting it over there. And then this exactly here the shovel is working at this phase and then, a truck or a front end loader is putting the material on to a crusher and then, the crushers output is given to this series of mobile conveyors and they are taking these things up to here.

No need of maintaining hall road, no need of trucks; nothing is necessary. You put it over here and they will transport the material. This is a system which has been marketed by Matshow all over the world and has got a lot of potential in particularly in the small mines and queries.

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So, this belt conveyor which can be a flat belt or can be a trough belt. You can see here a flat type of belt and this is a trough belt, you can see in the belt, there are some they say a flight type of things are there so that the material do not slip. If you sometimes you can increase the inclinations by designing a special type of belt.

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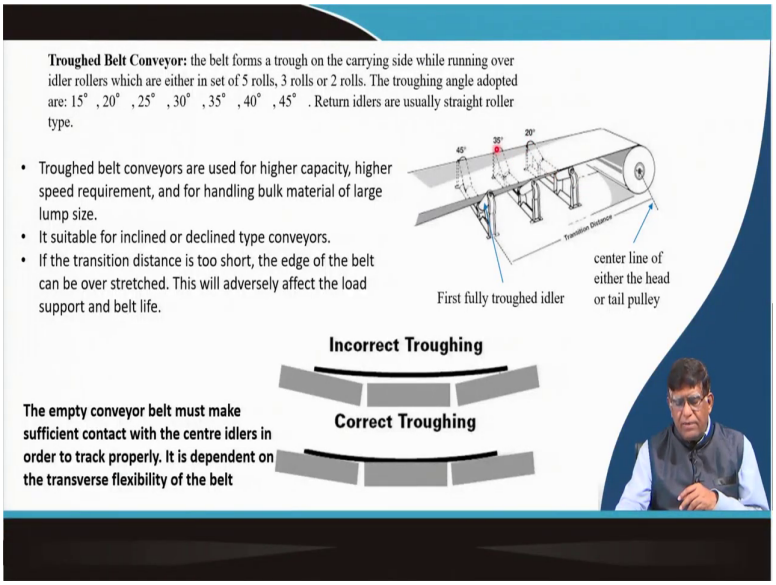

So, this is what is there in our belts system. Now, as you say the trough belt means it will go at a 45 degree that is at the end, it is a drum; there it is a flat belt. It is coming the first after some distance, you put a this at a 20 degree idlers are set, then you are setting at a 35 degree and then you are putting at a 45 degree.

And then the whole mean drive of the conveyor belt will be troughed at a 45 degree, that is the distance to which it will be made like this will be a 45 this distance is called transition

distance. That will depend what is the width of the belt; how much exactly you want to give a trough and then how much load it is coming, depending on that this distance is designed.

So, in a conveyable design, a lot of things need to be taken care of because if this is not done properly, the belt will get damaged. Quickly, if you make it here a 45 that means, the belt will be quickly getting over here. This transverse flexibility, it will be requiring so much that the belt may get damaged or it belt inner strength, it will be fed failing under fatigue very quickly.

So, that it is a trough belt conveyors are used for the higher capacity. In our mining industry, we are not using the flat belt. Only for the apron feeder, we use the flat; but there also many a time, we do not use the belt of rubber, we use a metallic belt that is your metallic strip as an apron feeder which is a flat type of bigger width.

We will be talking about or this is in a processing machinery more in that way, then your the transition distance, if it is too short, the edge of the belt can be over stretched and this will adversely affect the load support on the and the belt life. That is the both the way it is there. So, this is your troughing angle due left to be designed in properly so that this belt properly sit on to the conveyor belt that is your idlers.

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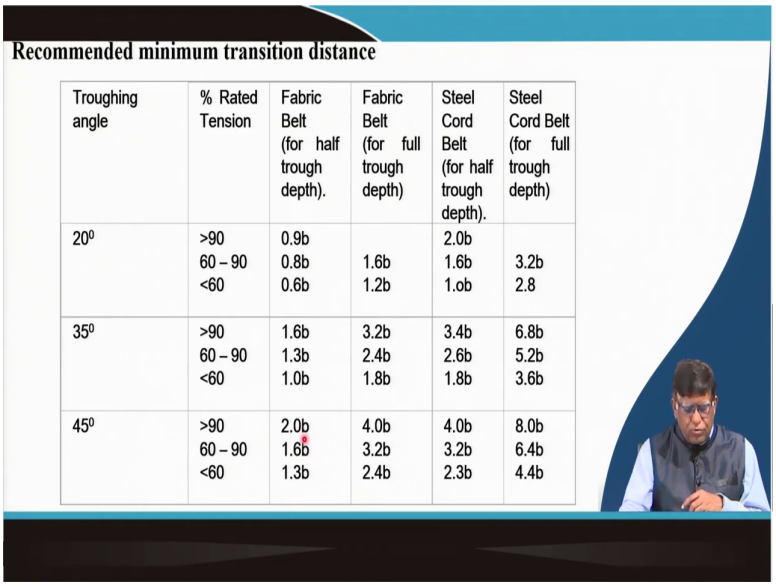

So, these are some of the issues which you can learn, but you can know that; that is your the what will be the different transition distance. If you are having a 45 degree, there the troughing distance for fabric belt or the steel cord belt depending on their the two that is if it is greater than 90 degree rated tension, then percentage tension, then you will get twice the belt. So, these type of table are available. The Conveyor Engineers Manufacturer Association, CEMA, they published a Hagon book.

You should try to see in the net, CEMA handbook of conveyor belt, you will get a whole lot of information's that is that Conveyor Engineers Manufacturers Association, CEMA. They give the handbook, they had standardized that how the conveyor belt for a trouble free and then, whoever manufacturers, they will be manufacturing its components and other things

expert that standard. So, if you are having a belt from one company, you can get the supporting components from other company also.

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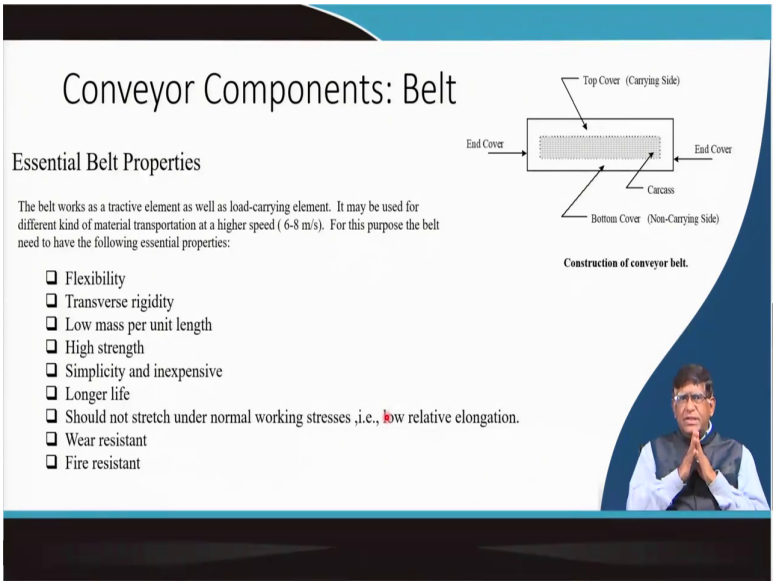

So, this standardization is very very important. So, now, coming to the component wise you may discuss maybe you will be following into the our next classes also that is our the essential property that belt will have to have, its flexibility, transverse rigidity, low mass per unit length, that is your high strengths, simplicity and inexpensively.

Long life should be stretched under normal should not stress under the normal working conditions; that means, the relative elongations should be less so that the tension remains there, then it should be wear resistant and fire resistant.

So, now, how will you make that belt to give this property? There are two types of belt, but before that you must know that the belt general construction is, it will be having 1 carcass. That is, inside that the main strength supporting with which give the strength to the belt is the carcass and then, there is a top cover and it is the bottom cover and the end cover.

Normally, a 2000 millimeter belt will be having a 16 millimeter of top cover, 8 millimeter of bottom cover or may be your 12 millimeter both side will be the end covers. So, inside that, this carcass which could be made of plies, number of fabric plies layer by layer that could be 3 ply, 7 ply, 18 ply, depending on how much load is coming on that.

Now, this plies are made of fabric which gives the main strength part and then, they will be layering with a in their rubber, that is your with a rubber layers are given over there so that they can get properly protected over there.

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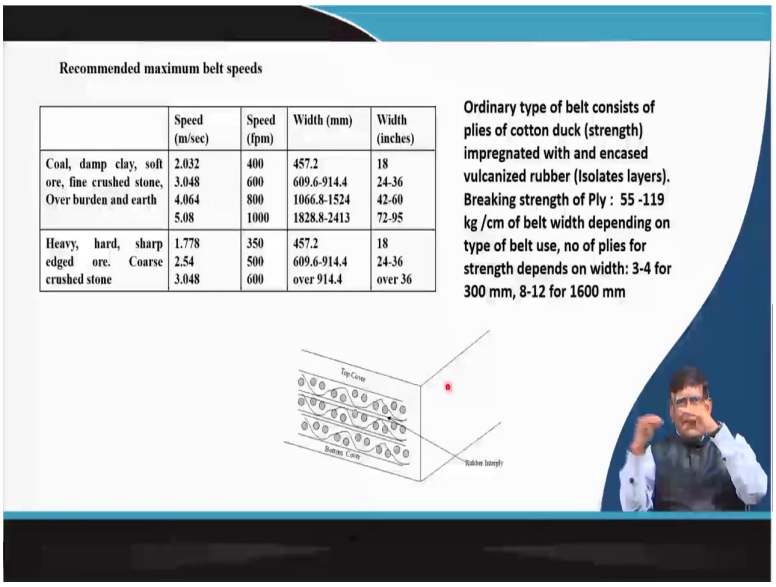

So, now this fabric can be also a solid woven. Now, what is that solid woven? You can see here that the fabric the this is the of course, the solid woven means exactly just like a block, you are having a longitudinal member, you are having a transverse member which are called warp and weft. Now, when did just like your cloth you make it, but now you have one layer, another layer in between that also you will be waving. When you wave like that, then it is called your solid woven fabric.

And the other type of your this that belt is a steel cord belt, where inside there will be a steel wire ropes. Now, that in a fabric, you are having number of plies. The most important that the belt will be performing how will be depending on what is the strength of that ply.

Now, it is expressed in the breaking strength per milli per unit width. So, that is it could be because a 55 to 119 kg of per centimeter that is the way how it is expressed in standard, we

will be calculating it how when will be knowing about the belt stress and all in the belt calculations, I hopefully we will be able to discuss those things.

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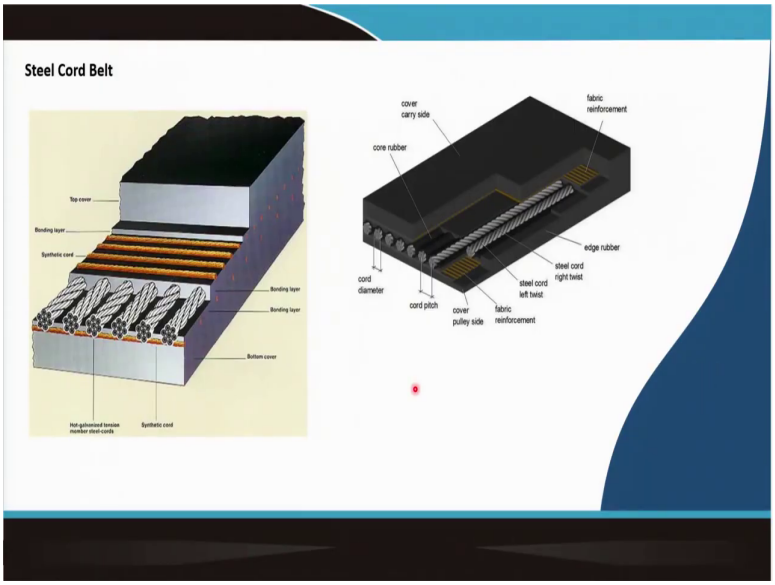

And then, the steel cord belt, you know it is having inside the wear ropes are there and above this top cover and bottom cove are there. So, now, the thing is what you need to know if this belt will be produced, coming from there the long strip of belt.

Now, how this two hand will be connected together to make it a endless belt. So, those are the things we will have to study and I hope this is giving you an introduction's of what is a conveyor belt and then, how this conveyor belt will be used in our mining industry.

But for that we will have to know; so, first things we will have to know how this two end will be connected together and then, how it will be driven. That is to drive it, what engineering

arrangements will have to be made; then we will have to know do a simple calculations that what will be the power requirement to drive a conveyor belt. Then, what are the different maintenance aspects that we will have to be done.

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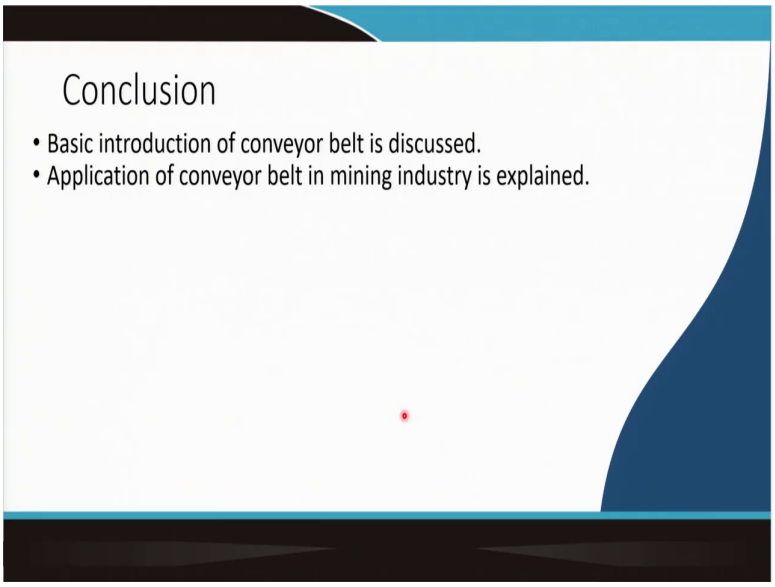

So, coming to this, we have today discussed about the only the basic introductions and I tried to tell you about that this piece of equipment is a not only in the mining industry. It is used in all other industry also; in food industry, you have got in chemical industry, you have got in the silk plants, you will be having this used in the thermal power stations wherever the bulk material is used, in the port, there this equipment is used.

And it has got a huge market and wide world-wide applications. Now, there you can develop your expertise in understanding and analyzing and then, how exactly you can monitor a

conveyor belt system. How on the conveyor belt, you will be having an online weighing system that is how much material is carrying; is it going as a under loaded or overloaded.

So, how a conveyor belt can be weighed; how much material is going or what type of arrangements, you can make on the testing the grade of the material that is if you are going a if you have the is it the proper material is going over there or not. The whole business objectives can be put over here in the conveyor belt itself and then, it will be exactly increasing your business performance.

So, for that, you will have to study on this particular piece of machinery a little bit more carefully and then, you will be able to prescribe and the whether it will how it will have to be selected and how will go ahead with this.

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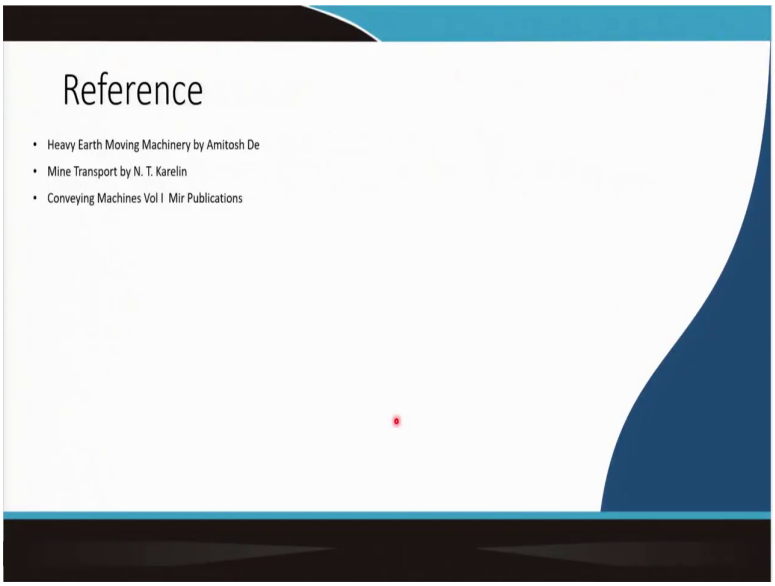

So, with that, we will be discussing this in coming classes.

Thank you.