Bulk Material Transport and Handling System
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Lecture - 17
Stackers and Reclaimers: Classification and Selection Criteria

So, we have been discussing about bulk solid handling and transportation. So, today we will be introducing another topic that is stacking blending and reclaiming. So, this stacking blending and reclaiming it is one of the important unit operations in many, industry particularly in the mineral industry where you need to form different types of stockpiles. Now, as you have seen; that your raw materials being transported from the mines to the end user like thermal power station or steel plant.

They will have to be kept for certain time for keeping a buffer stock or for sometimes you will have to blend different type of raw materials to get a particular product. So, once you stock, it then how will you take it back and then how exactly the quality or the products the necessity for the blending will be made. So, for that today I will be just introducing what are the machines used in it in our subsequent class.

We will be going further into what we exactly need to control in this operation of stacking and reclaiming. And thus, stacking and reclaiming operations how it impacts on the quality of blending.

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So, with this today we will be just introducing you the main type of stackers and reclaimers how they are classified, what are different types there. So, that you can just briefly you should be able to explain the functions of stackers and reclaimers, will not go to the deeper into their constructions and operations today just to have a introduce introductions on the different types of stacker and reclaimers.

As you can see here in these two figures, there is a cool stockpile is being formed. Now see this is an open area you are forming a stock of coal by means of a stacker this is a machine you can see here there was the material is coming on a conveyor belt from that conveyor belt it has come to this machines conveyor and then it is getting stacked. And there also you can see another that is from the stock piles this particular machine should be collecting the material.

And then putting into a conveyor belt to get it so, that is a reclaimer. So, when we say what is a stacker and reclaimer? That stacker is the machine which forms the stock piles reclaimer is the machine which collects the material from the stock piles and the stacker reclaimer is the machine which can do both the job by the same machine.

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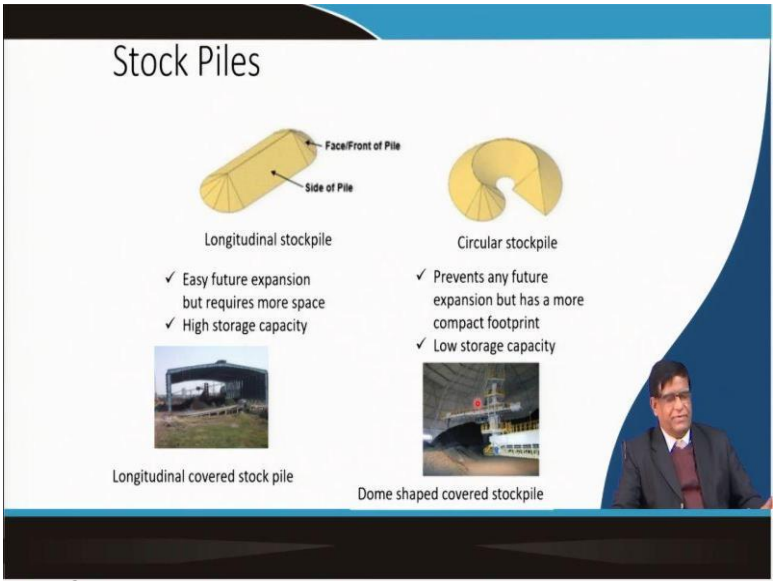

So, there are a bit different area in the sea near the port how the material will be collected from that say that the ship or barges and then they will be forming a stock piles. That stockpiles can be formed different way it could be a longitudinal type of stockpile as you can see it over here and you have got a stockpile of a circular nature you can see here this is a circular stockpile. So, stockpile can be either longitudinal or circular.

Now, here what happens? If your space is available, you can go on just stocking over here and you can get the material and that is your capacity of the area you can increase. Now, that such a stockpile can be within a shade or in the open air. But in a circular stockpile it can be also inside a dome type of structure and here you can go on stocking from one side and reclaiming from other side.

So, that means it will be continuously both the operations will be going over and there they have got a limited capacity depending on the space available over here.

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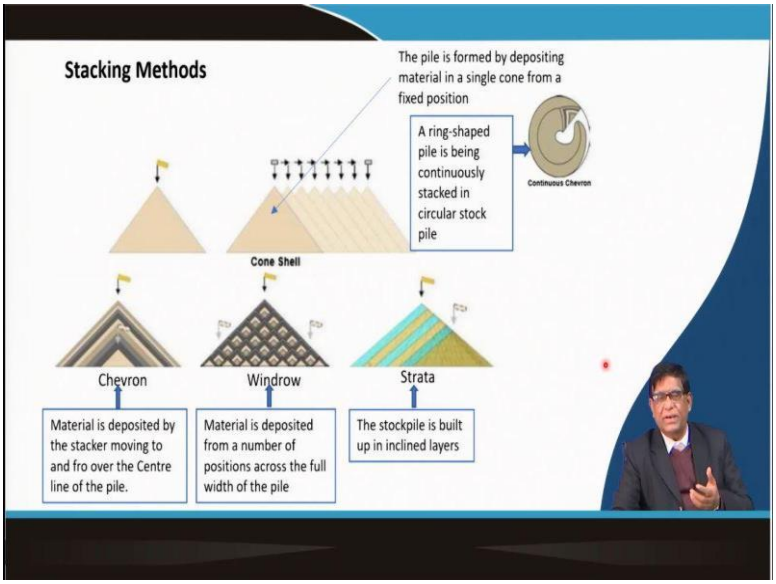

So, this stock piles that to form them there are different type of stock piles. We will be again discussing that why and where this type of stockpiles are used and made. But there all depends on the type of machines by which they are formed. So, that normally a stock is a just a triangular cone and then it will be going on if you put the material, it will be going on increasing by that it is called a chevron type.

You can see over here that the first cone a type of material the different colour you can think of a different type of material. So, that is chevron is formed just like that yours that main stacker the material are being dumped and then at an angle of repose they are getting deposited layer by layer on this top. Now, if you collect it across distance then they can blend, now it will that what quality of material you will be getting as a blended quality will be depending on.

How and where from you start collecting? That because everywhere it is not a uniform thing. Similarly, the other one is we can have that these are the different number of stocks have been formed like this and then on that you have put another one and then the ultimately you form an windrow. Here, you can see if you collect it over here there will be a little bit more uniform blending.

There is another one called your oblique layers are coming over that is called as different strata layers are coming of different material. And you can collect a strip if you collect a strip like this that it will be giving you a blending of this material and you will get a different quality and, in a ring, shaped stock piles in a circular stock pile.

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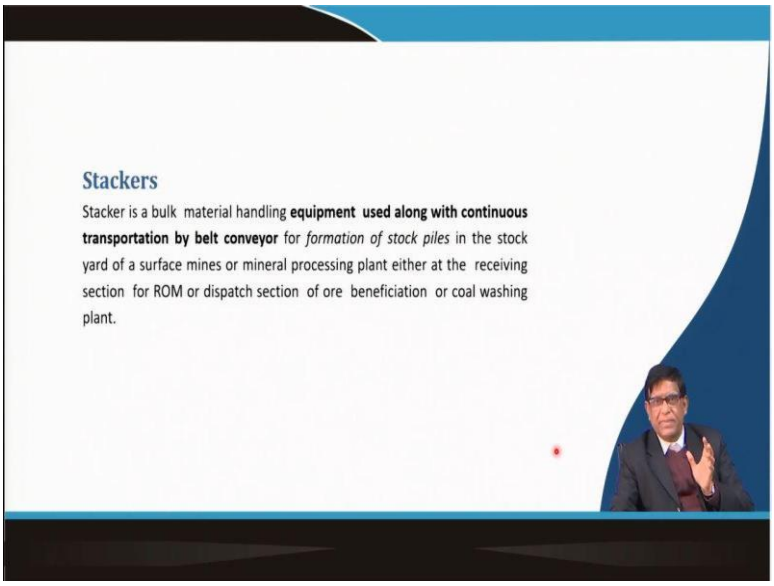

So, these are the different form of stockpile now how what type of equipment will be used for forming this tech stockpile now thing is that depends on how you are carrying the material. If you are bringing the material by a dump truck you just make a heap of material but many a times when you are thinking of getting three million four million ton and then mostly it will be coming by a continuous method.

So, this stockpiles that is your which is formed basically even if it is coming by truck or by your railway wagons, they will be going first to a hopper from that hopper it will be fed to a conveyor belt and then to a stock yard. So, the stock yards materials are continuously coming so you will have to take it from the conveyor belt. Now here you remember in our discussion of conveyor belt we discussed that the material when it is flowing through a; conveyor at the side how will you do and there we talked of a tripper.

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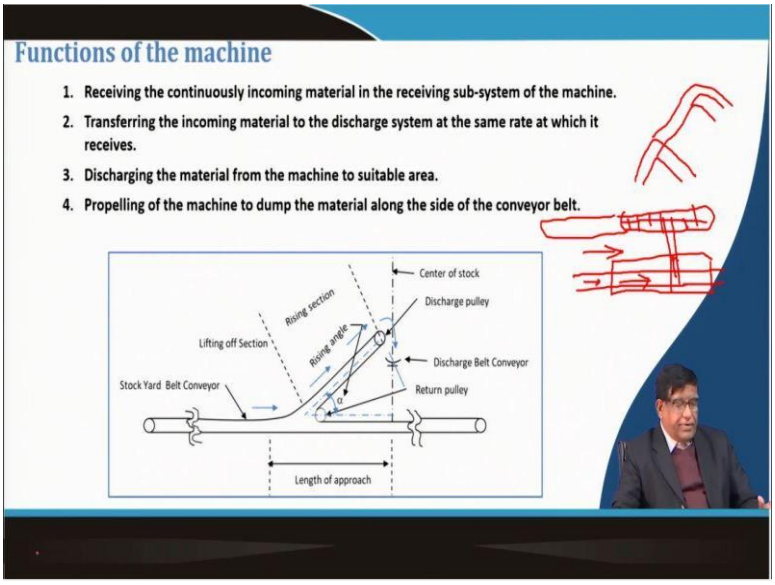

Now that tripper arrangements now, will have to be made into a stacker arrangement you may recall your that conveyor belt basic diagram you know that this conveyor belt it is coming there is a tipper portions over here and that the conveyor belt it goes at the side and then it will be discharging over here to another conveyor. So, that means if you are to form a stacker that is from the conveyor how the material will be brought to the stacker and then it will be taken to the sidewise to dump.

Now, for that you will have to have a receiving that the material from the conveyor belt you will have to receive over there and then it will have to transfer it to a conveyor belt and then from there it will have to be discharge. Now when you discharge there exactly what you may have you may have that discharge material will have to be stocked somewhere. So, that means if your conveyor belt is going like this and in this the material was flowing like here.

Now from here you will be having this stacker machine now in that stacker when you are putting into this machine here first that material will come over here and then it will get to another conveyor belt over here. So, that the material from this conveyor is getting transferred to this conveyor and then they will be forming a stockpile over here. Now, when they are forming a stockpile on this what is there that exactly the machine will have to go it is machine will be this machine will be travelling like this.

So, that this stock pile it can be forming from here to it can go that basically, the material was dumped like this and that dump material as your machine will be moving your this stock pile

will go on increasing. So, you start that your conveyor belt if it is raised and your this exactly the height will be increasing and you can form that pile like this. So, this is the way how your stockpile gets formed. Now from these machines that means from the conveyor belt how will you take it to the stacker.

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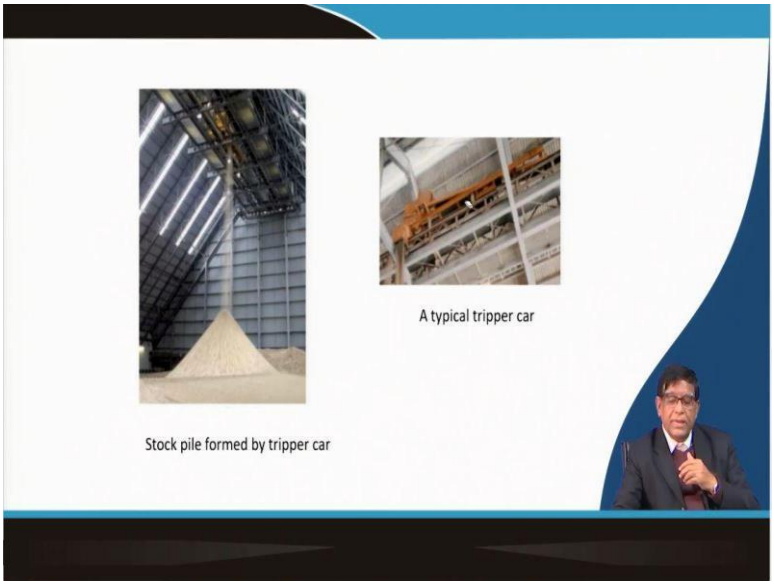

That depends on you are using a typical tripper car here you can see this particular thing here, when you are seeing into this stripper, it is discharging the material and the stockpile is getting formed.

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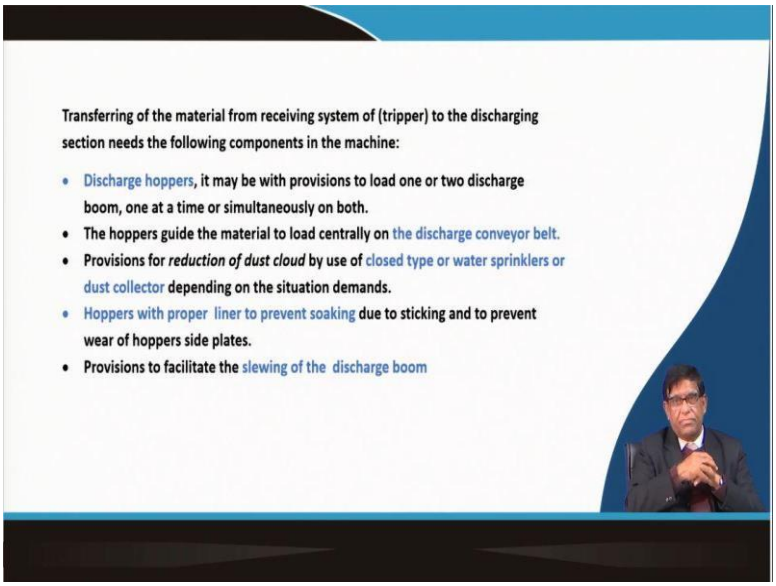

Now, that means what is happening here transferring of the material from receiving tripper to the another conveyor belt we put and then we are stockpiling it.

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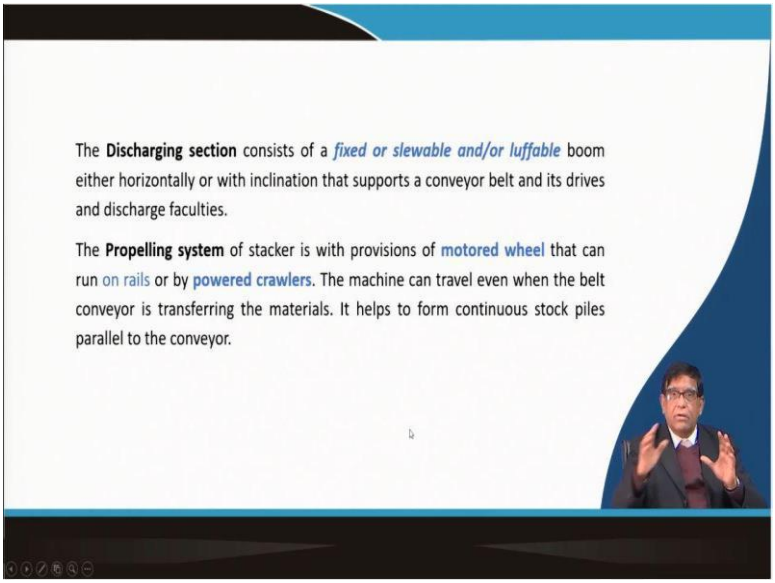

Now, this whole operation when it will take that it can be done by different type of machines. That machines it can be depending on that whether that boom by which the material is discharged it can give a swinging or it can give a laughing up and down depending on that and then how it is moving whether it can move on a rail or it can move on a crawler we can get a different type of stacking machines.

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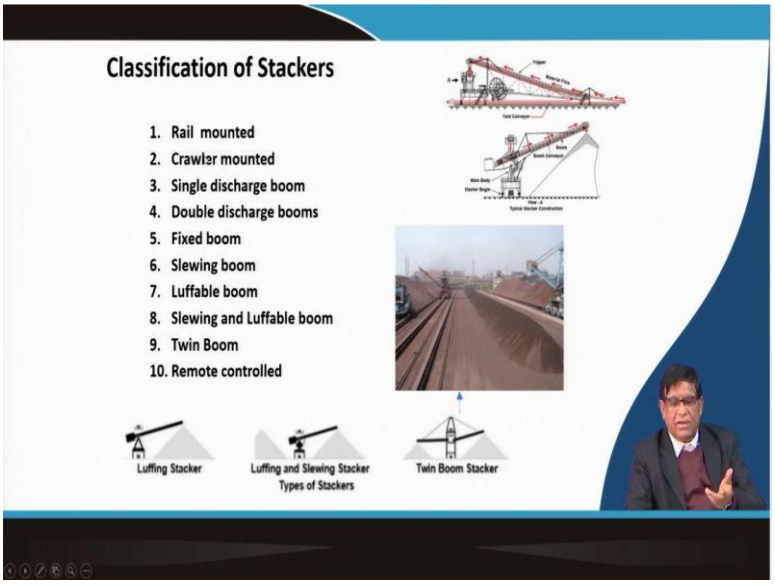

Say for example, that stacker you can see here on the conveyor belt there is a stacker machine it is forming this stock pile. Now, that is why if it is a rail mounted stacker or a crawler mounted stacker. So, this is you can see in this figure it is a rail mounted, on the rail that conveyor belt is there and this overall the material is getting transferred from here and then this could be only one boom or it can be having two booms, that means it can just a fixed type of two boom.

And then it is the material is transferred either to this one or to this one and depending on that it will form this or that same boom it can slew it can give your 360 degree swing if it is necessary and then you can put it over here in both sides. So, that is where you can see here a stacker can be of different type. So, this is the way now where you will be selecting that will be coming up depending on your type of material quantity.

Then the nature of your user the demands it at what rate lot of factors will be considered over there.

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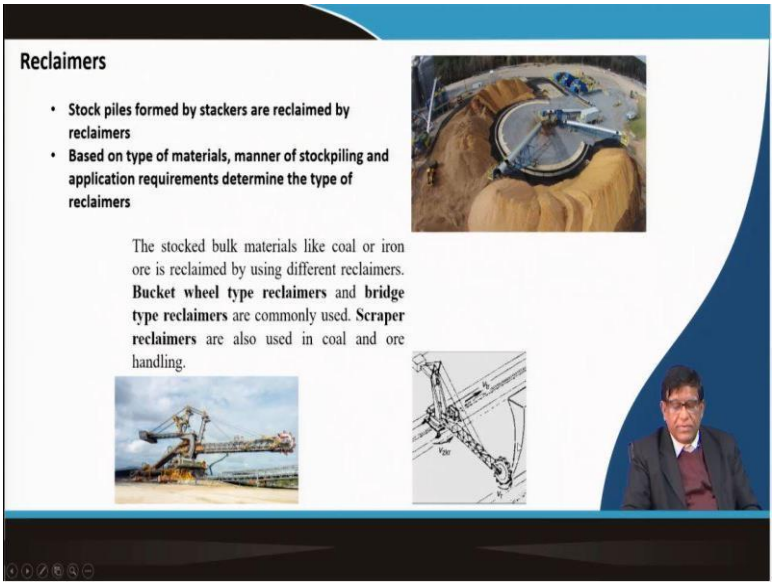

Now, coming to telling about the reclaimers, reclaimer is basically how you will be reclaiming it. If you are forming a circular here and then you start reclaiming from one side and then take the material to the other side. So, it maybe you are collecting it over here and then also reclaiming in a circular pile or this reclaimer can be a bucket wheel type reclaimer from the stockpile. It is collecting the material and sending back to the conveyor belt.

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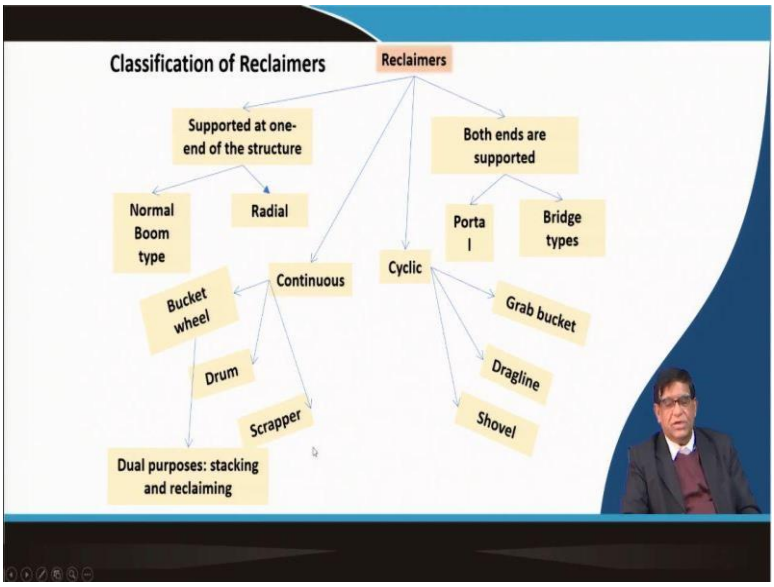

So, now this reclaimer also can be classified by as a supported one and structures or it can be at the both end structures. It can be a continuous type of reclaimer or it can be a cyclic type of reclaimer. It can have normal boom type or it can have a portal type and then there could be a bridge type there are radial type and this continuous can be a bucket wheel type can be a drum type, can be a scraper type, can be grab bucket type, drag line and shovel type of reclaimers are also there.

So, there is a wide type of and then there are reclaimer which can be used as a stacker also that one machine will do the both the job.

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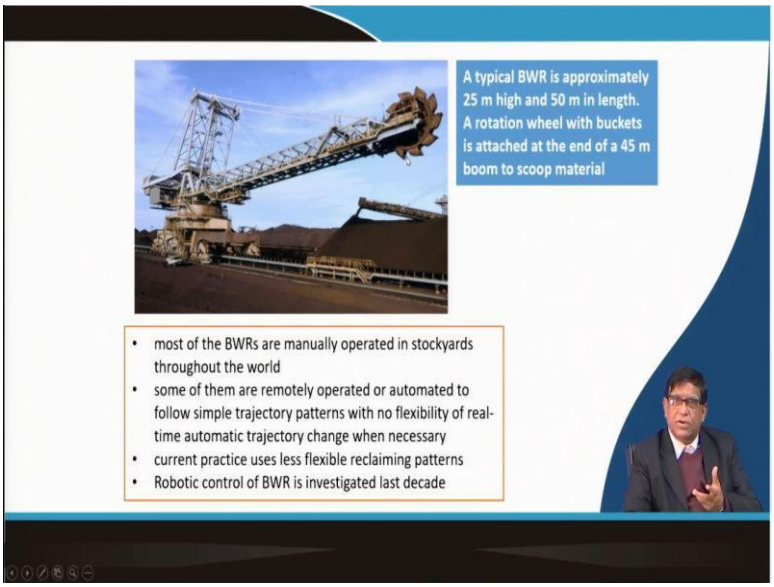

So, you can see here a typical bucket wheel reclaimer. In a bucket fill reclaimer, there will be a will and this will be having its own independent drive and there is a conveyor belt on this

boom this is called your cutting boom or receiving boom or that is your reclaiming boom. On that a conveyor belt is there from that conveyor belt the material is transferred to a hopper and from that hopper it comes to that exactly a main conveyor belt which will take the material away.

And that reclaimer which is standing on either there will be a rail boat sides and on that there the powered wheels are there and it can move around here. So, this longitudinal stockpile which is being formed and this machine will be going on collecting them and then that way your material supply will be continuing. So, it should be clear to you that this is a machine gigantic machines depending on the type of things.

The diameter of this diamond that your wheel it can be 5 to 10 diameter depending on what is the capacity you are handling.

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Now, you can see here a that how your bucket will reclaimer work and which can be used for your stacker purposes also. You can see that the board side of the conveyor there is the rail on that rail this wheel mounted this machine can move. And it has got this bucket will and this is your boom on which that your whole machine is working with it is supported on this powered wheel. So, that main conveyor belt it comes over here and from there it dumps the material.

And then it goes its returning like this, when it is in the form of that when it is to be taking the material from the conveyor belt or from this reclaimer conveyor belt to be given onto this. So, there can be you this boom which is it can receive or it can discharge. So, this is a you have seen the laughing operation the bucket will boom can go up and down that is now it is doing the slewing operation.

And this is the counterweight boom that counterweight boom is there for keeping the machine in balance. You can see here from the stock piles how it is reclaiming the material is getting collected from there, it is giving on to the conveyor belt of the boom. The material has been transferred and after that it gets complete one cut then it again gives that they keep on repeating the job.

That is the will that is loading or that is scooping or excavating or collecting then it is discharging then the material is coming into this. Now you can see from this animated figure that a reclaimer is how it works.

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So, that you can see sometimes a different type of reclaimer in which there is no bucket wheel over there. You can see that there is a bridge. This brace exactly can have different type of collecting system there could be a bridge type or can be a barrel type. In a barrel type that there will be a conveyor belt inside the barrel and then the material will be collected by rotating buckets or there could be number of bucket will connected over here these wheels can give a translatory motion on this boom.

And then they can collect the material and that is exactly supported at two end now this front hole area will be the your stockpile area as you can see here.

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This you see, it is supported over there and then it is forming as a bridge and the material which is collected over here. You can see that means stock is getting formed in front of this bridge now you just see with this animation these bucket wheels, which are there and now these two they will be giving a shaking you can see there are spikes. So, that the; wheel will be collecting the loose material so this machine will be self-propelled on the rail.

And will go to the stock pile once, it is there in the stock pile these two the front. They will be just losing the material over here and they will be falling and then this the bucket is

collecting the material the whole that bucket will ring it is giving a translatory motion it is going like that and all along the material is getting collected. So, this type of reclaimers are also there.

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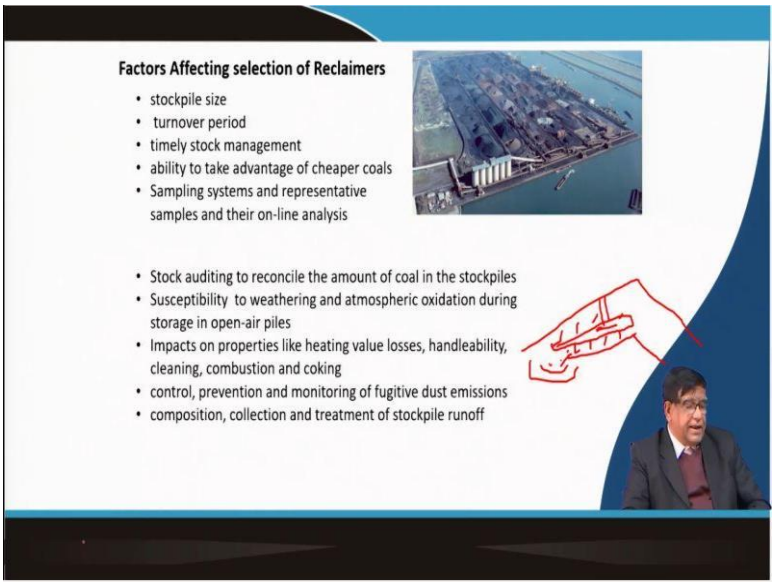

Now, whether what type of there you as you have seen there are different type of stackers different type of reclaimers but how will you select it as you can see here in the figure you are seeing a stock piles near it may be from the port that imported materials may be imported your coal are getting stocked over there and from there it will have to be reclaimed. We will have to study that how the operational management will be done there in which way you should stack.

So, that your time required is less, your energy required is less, manpower deployment requirement is less and there is a trouble-free operation. So, this is a system engineering approach is put over there in designing will be discussing those aspects later on but selecting that what type of reclaimer you will be using it will be having factors like your stockpile size that different type of reclaimer will be having different type of capacity.

I have not seen you can see about that there is a portal type of reclaimer the reclaimer will be having a chain conveyor with stacks and then it can collect at the bottom. So, there are different types of reclaimer system say it can be you can have a stock pile. On this stock pile if you are having a collecting system over here is say a conveyor belt is here and you just

have a machine mounted over here that there is a from here you hang a chain conveyor where there will be these stacks.

Now, if it moves like that this chain will be moving with the stacks over here. Then what will happen? From that stockpile material will be scrap down and from here it can give it to a hopper and the material will be coming on a conveyor belt and it will take it away. That type of device called your portal scraper or a scraper reclaimer. So, we will be having a different type of design because that what type will be giving you the best services will be depending on number of factors.

Your turn turnover period that is when you want to exactly even you will have to see that if you are to go for a very high costly equipment whether you will be getting the return on the investment or not because you your operation is only for say five years there is no point in the course of rupees will be spent over there for a machine to collect it over there. So, lot of economic analysis need to be made over there.

But at the same time when you are using a selecting a machine that what is the requirement if you are having a say 200-megawatt thermal power stations tear boiler size to that boiler how much rate the coal will have to be sent that. So, the reclaiming rate will be depending on the consumption rate over there and then you will have to do the matching or compatibility of the sizes.

So, that comes in your whole detail equipment selections when you go, we need to do that compatibility analysis. Then how sometimes what happens suppose you are having a Indian coal of a poor quality because their ash value and that calorific value is less but you have imported some high calorific value this coal say from Australia and now your thermal power stations they require a particular calorie.

So, how much from Indian one and how much from Australian coal you can blend together so that your product will be giving that particular calorific value and it can burn well in that particular boiler. So, that means you will have to blend it depending on that necessity you will have to again select your how what type of stacker and reclaimer you will be putting, what how do your coal flow to the stock yard will be managed there are a lot of issues can be done.

Then you will have to another things in your mind that is such an operations how will you do operation audit, that is whether the stockpiles which is being there is properly that quantity. And their volume are you specific managing well or not then you will have to take lot of safety other safety and environmental precaution. You know that these are all when you are taking coal or iron ore or limestones or anything they will be very fine particles also will be there.

So, the year they may get your suspended particulate matter and you will be getting lot of environmental complaints. So, how will you manage dust in this area? That is a big issue. Then in case of coal you will have to also see that is what is the that incubation period or for the spontaneous heating how the heat coal may get fire if it catch fire, it will be giving smoke and air pollutions and also you will be losing your coal.

So, that what should be the optimal size of stock you will be maintaining, those things need to be safe. Then sometimes what may happen during the raining season, there will be if the stockpiles you are not properly meeting that it will slide down and the material will go to the drain you will be losing a lot of material. So, that is why considering the weather conditions of your size you will have to design the stockpile.

So, that means designing the stockpile as well as determining or selecting the machine both will have to be done very carefully considering.

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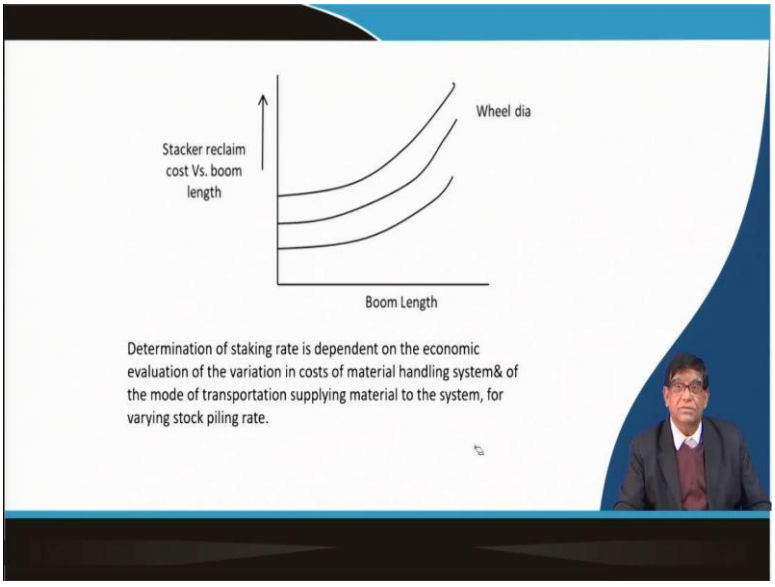

Now when you will be coming to a one particular machine that say as I said you have seen there is a stacker or the reclaimer with a long boom cutting boom. Then what should be the height of the machine what should be the length of the boom and what should be the diameter of this bucket will what should be the size of your bucket. These are the things to be done and all will have to be optimized for cost.

So, that is why as a transportation or bulk material handling engineer you will have to be able to develop this cost model. That means, how will you optimize the reclaiming operation how will you optimize the stacking operations? So, for that identifying the factors and understanding the operation of the machine. So, that you can give a good managerial solution so, that there will not be much this pilferage of money.

And that your you just do the right selection of technology for the right type of job. And that is why we will have to study in detail of each and every type of reclaimers. And then you will have to develop the mathematical model for selection of this machine. So, that is a area where you can take up work for your individual study. That how will you optimize or how will you exactly do the best selection or can we develop a type of a software or a some something decision support system for selecting a reclaimer.

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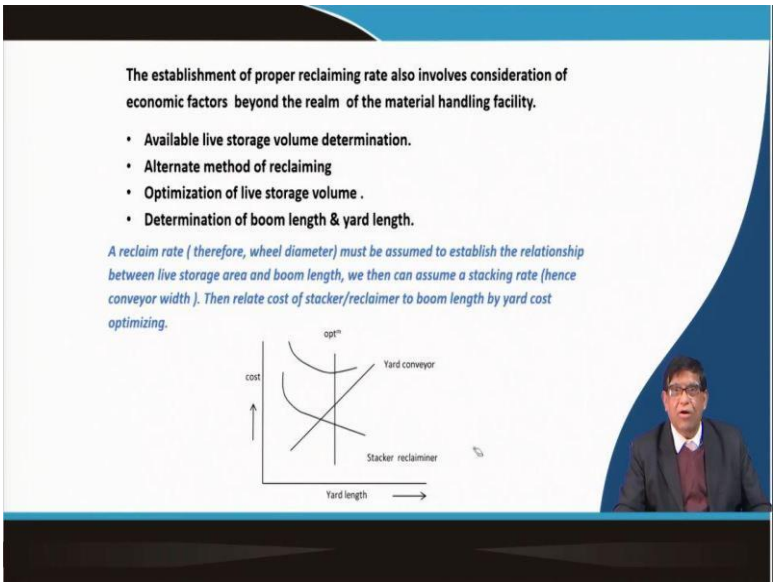

Or calculating the productivity of or the performance of a reclaimer. Similarly, that is another important thing is that space. You have got a limited space in the stockyard now that years how much length will be used by this taker and reclaimer and then in that exactly how much area will have to be managed because, the more area go then there will be more dust will be

generated then your controlling will be problematic and at the same time if you say of this type of reclaimer.

And then the stacker and reclaimer when it is in a stacker mode it may have to load on another conveyor it may go to another that how exactly it will turn over in an area because if this area is there you are forming a stack like this and then you are reclaiming like this. Now, that stacker will have to go to the other end the reclaimer will have to come to this end. So, that how the train turnover from one location to another option will be done.

So, this there is a type of arrangements to be made on the site. So, those activities exactly will be learning. So, as an introduction I tell you that we will have to optimize our reclaim rate by selecting proper equipment and properly organizing the job that is what call your stockyard layout. How will you design the stockyard layout?

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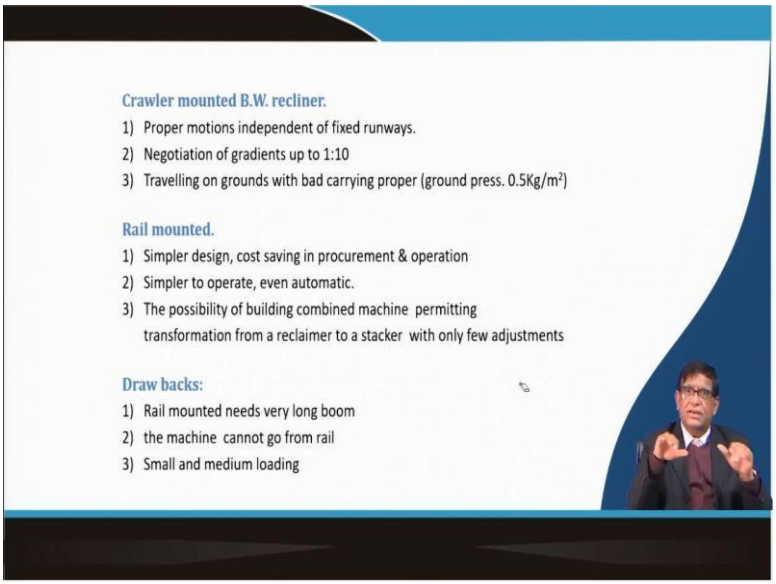

So, next other thing is as you have said number of different types you will have to make a list of the different types of machines and write down its advantages and disadvantages and then where it can be giving a better surface. If you can make a table like that then it you can make a criteria for deciding. So, whether a crawler mounted or this rail mounted if, it is a rail mounted then at what inclination it is there.

In a crawler mounted if you need to negotiate a little bit of higher gradient you may find ok crawler mounted one will not slip. But if you are putting a rail mounted one you will have to see that what type of braking system will have to be provided and there will be how much

risk will be there that the machine starts automatically moving out with that load. Similarly, if you are rail mounted, they may go in a faster that means if your rate of material coming you are using a very that is a small belt.

Your material is going very fast at that time your crawler also will have to move others say your stacker also will have to move very fast. So, for that is how will you make your stacker compatible with your conveyor belt because, convertible width will be dictating you what is the capacity the tonnage of the conveyor belt how much ton per hour it can carry and then, how much it will be transferring both the machines.

The capacity matching will have to be done that and the capacity matching will be telling you whether you can go for the railway rail mounted or by a crawler mounted. So, there are each of the type has got certain disadvantages. Say if you are having a crawler mounted the crawler also will have to move that steel crawler and whole machines total weight will be more when the total steel or the total weight is more when your total mass is more in a propelling your energy required for propel will be more.

So, that will be affecting in your cost so there are different type of problems are there with it. So, if unless and until it is demanded that we need to have a crawler mounted only will be going because scroller mounted will be easy for steering because railway rail mounted it will be always moving in a fixed one. So, if you are working in a different there are certain stock piles and all where exactly you it will not be suitable for your relay mounted.

Because suppose that a terrain, that soil is very there is a ground bearing pressure it may be sometimes if you are giving on a point load or a line load on a disk this may not withstand properly. You are that what type of slipper will be required in that rail to mount there if you use a crawler by the side because if you are using that because of the load of the machines your structures of the conveyor belt make a slides then the conveyor belt will giving a spillage.

So, that is why normally what is done in a rail mounted one on the same conveyor belt supporting frame you put the rail. But by that if there is a undulations because of the softness of the ground the conveyor belt may give a move and then the spillage from the belt will be

taking place. But if you use a crawler mounted one it will not disturb the movement of the conveyor belt by that its conveyor belt structures will not be getting any affected.

So, this way there are plus and minus of both the type it is as a learning exercise you will have to put down all the different types of stackers and the reclaimers note down from and collect from the net from the text books. And then particularly you refer to the bulk solid handling journal that is Trans tech Publications from Germany, Dave Publishes this journal that the bulk solid handling and also powder handling.

There are two very good journals of Trans Tech publications and if possible, you read from nineteen eighties on ward sometime you scan through if you get a opportunity to see in the national the digital library and there you will find that how these areas have been studied. And then how new machines and innovative machines have been developed.

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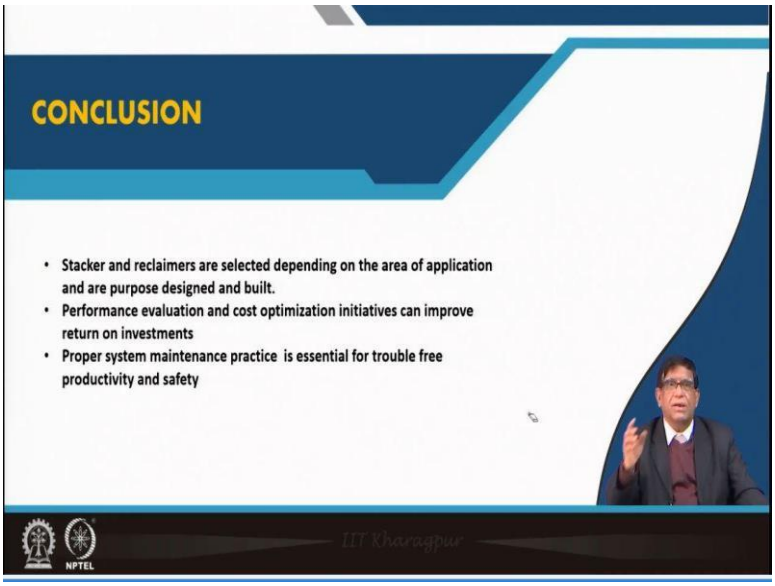

So, today I have given you a very brief introduction of this stacking and reclaiming and then there are machines used. I hope you will start preparing your document and then maintain in your portfolio.

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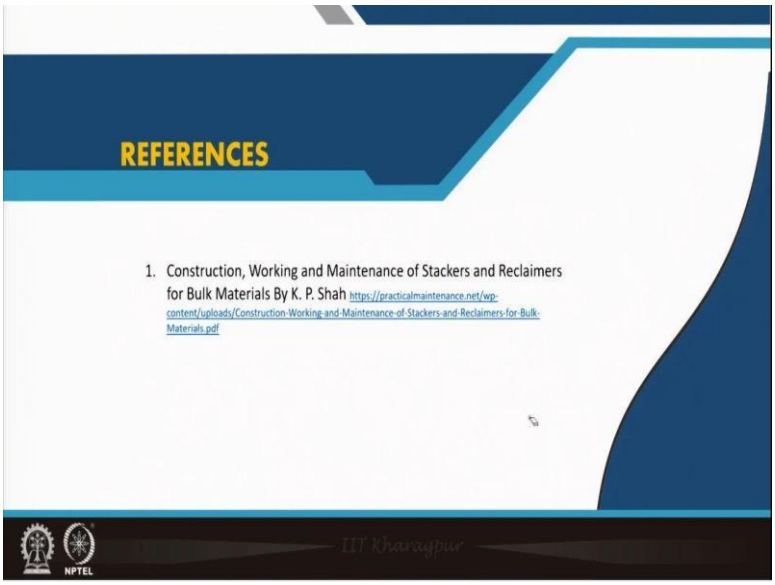

And there on this say K.P Shah, reference is very good this K.P Shah has given a very summary reference. But I hope that you study from the bulk solid handling and then some of the trends tech publications book. There are a lot of books available on stacking blending reclaiming, thank you very much.