Introduction to Mineral Processing
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Lecture - 34
Industrial Screening (Contd.)

Hello, welcome back. So, we are discussing about the factors which affect the screen performances. So, that is the screen performance means is the screen efficiency. Now, there is another thing that is the screen capacity. So, let me discuss briefly. That is what are the factors that affect the screen capacity and how do I select screens even for straight screens, the simplest of the screens.

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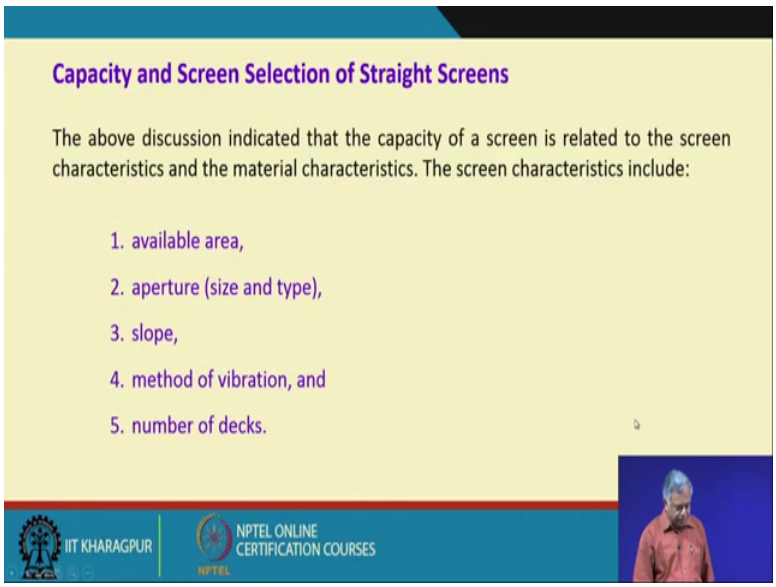

So, the capacity of a screen is related to the screen characteristics and the material characters, material means, what material we are trying to feed. So, what are those characteristics? That is what we are going to discuss here. That is the screen characteristics include that we have already discussed that what is the available area that is the what are the total surface area of a screen you have given and that means, what is the length and what is the width. And out of that number 2 is the aperture, that is what type of apertures, of what sizes and what type. Type means whether it is circular opening, whether it is rectangular opening, whether it is your say square opening. So, all these affect your capacity of the screen.

And what size, as I said that if it is for fine sizing the efficiency drops down if you want to increase the capacity. So, you have to reduce the capacity manifold when you are dealing with very fine particle sizes. But if you have coarser sizes like you are trying to screen at say suppose your 100 millimetre maybe you can have a different or feed rate your capacity may be very high, but the same screen if I want to do it at hundred micrometer you have to reduce the feed rate or you have to reduce the capacity manifold because there will be the problem of your reduction in the available aperture area because of particle clogging.

Then what is the slope? So, if we increase the slope naturally your capacity will increase because the material will pass through the screen surface very fast, but at the expense of your quality of your product that is your efficiency. Then method of vibration how you are vibrating so that means, what type of profile what type of flow profile that is creating for the material on top of the screen surface that I will show you in some kind of your say sketches. And how many number of decks are there? If you have only a single deck or we have a multiple deck that is your can I have double deck or you can have 4 deck your screens so that means, at your with the using the same space you are having four different screens that is like your it is synonymous to your what you did it in the laboratory sieving operation that is you stack the your different sieves from coarse to fine. So that means, I can have your coarse coarsest screen on the top finest screen in the bottom in between I can have two screens also.

So, how many number of decks you have. So, more number the decks capacity has to be reduced because it will require more residence time for the particles to finally, decide that where I will go and then how you are taking out the material from each deck surface that is also a design constraint.

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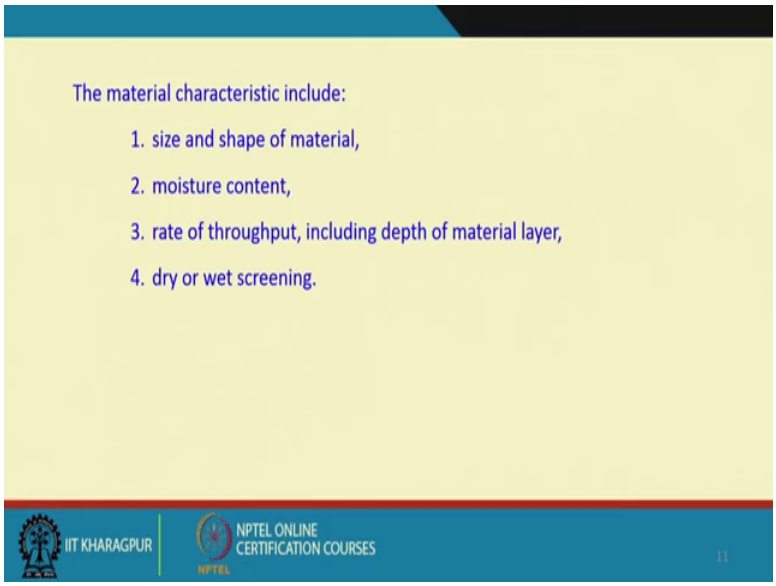

What are the material characteristics that influences the capacity? That is size and shape of the material we have discussed a depth. So, there is no point inhibiting that. Moisture content, if it is sticky then the particle may start getting agglomerated and then your particle may be 50 micron, but when they gate agglomerated they may start behaving like 500 micron micrometre and they have a reduce flow ability. So, your capacity will be reduced your effectiveness also will be reduced.

Rate of throughput including depth of material layer that is what we have discussed already that is if you increase the rate of throughput your efficiency will decrease and if you include increase, the when you increase the rate of throughput naturally your material depth that is a bed depth will increase your capacity will increase, but at the cost of your reduced efficiency.

Then whether it is dry or wet screen, because when you have a wet screening it is the not only the gravitational force it is also the water which helps in particle transport over the your screen bed and then the water helps the particle to be dispersed.

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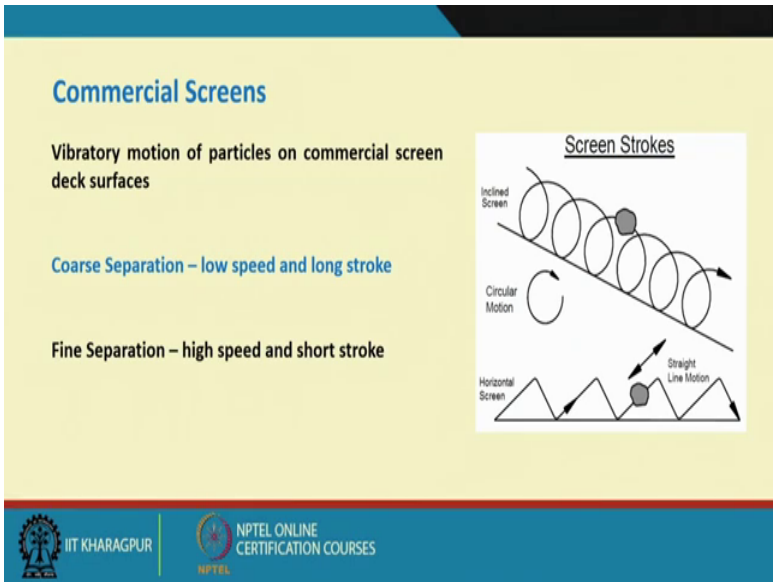

These are some of the commercial screens that is how the material what is the particle or say flow characteristic.

So, if you have a vibrating motion of particles on commercial screen deck surfaces it is the like particle can have a motion like this elliptical one that is a circular motion we can have and then you can have a or that is your straight line motion also. So, these are the basically there are different engineering features of the modern screens that what type of vibration, how you will vibrate that, and then how the particles will move like you are vibrating like an inclined screen you are vibrating and the particle whether it can travel like this or it goes like this and then goes like this. So, it will have effect on your effectiveness because how it is approaching your aperture. So, that will depend on how the material is basically say feed to the aperture side that is your screen surface. And that is also being controlled that your residence time there is how fast the particles are moving over the bed of the screen.

So, it is normally seen that for coarse separations that is a very coarse sizes you need low speed and long stroke that is you need have low speed and a long stroke because your. Why do you need long stroke? Because the bigger mass, you need to lift the particle to a much higher height so that it changes the orientation, because otherwise because of mass it will fall into the settling velocity through air is much faster than your smaller particle. So, for fine separation high speed that is you to do it repeatedly and short stroke you do

not need that much of throw because its settling velocity is less. So, in that it has got your different many probability of changing its orientation.

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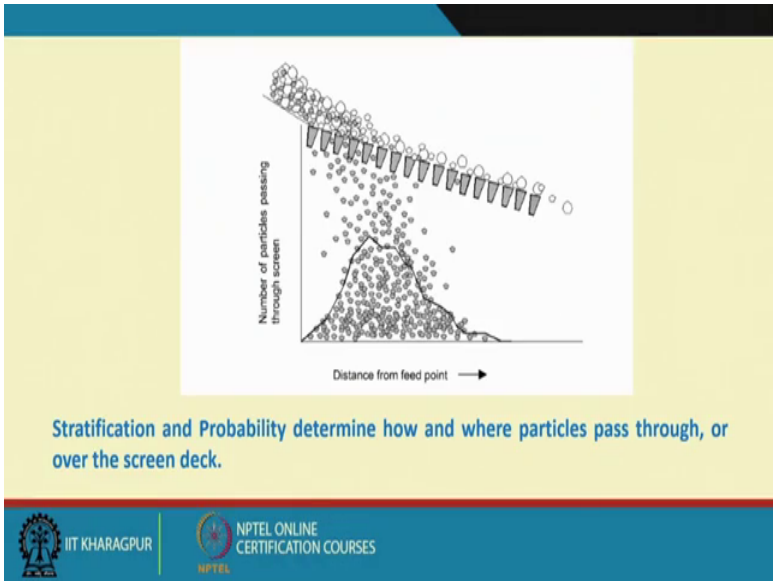

There is the stratification and probability, determine how and where particles pass through or over the screen deck. So, that is again this, this presentation I have already shown you on the straight screen, but this is the distance from the feed point that is here in this section you see that minimal separation is there and your maximum separation is through these zone and you have your very minimum separation here.

So, when you look at your maintenance people that is you have to look at your examine this portion much more closely that whether there is any broken aperture and what is the wear rate of wear here. And this is the guideline based on which you can do your says screen modification based on your says screen design modification based on your research based on the material flow characteristic and their separation characteristic. This is a challenging area definitely for them in processing people even for the mechanical engineers and the material scientist I would say.

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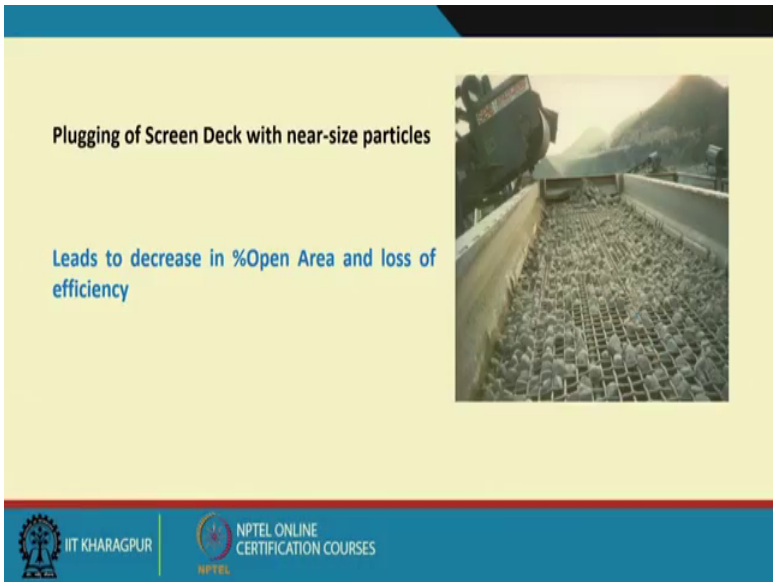

These are the examples of plugging of screen deck with near sized particles. You see that these are from the actual plant size. Of course, I have not taken the photograph it is got from the open sources, I forgot the source that is why I could not keep your credit to that that is I could not give the reference. So, you see that these are the near size material which is plugging your surfaces of the screen. So, you are available aperture area gets lost and eventually what will happen a time will come when your entire screen surfaces will be clocked by these particles. So, you will be having only material going in and material going out through the oversize no undersized particles.

So, these are the things that is which leads to decrease in percentage open area. And this is the reason why you have to calculate the screen effectiveness based on the representative samples on a time bound representative samples you must take, from the oversize an undersized and calculate back the effectiveness of your screen whether it require size by size then you plot the prom car we do the entire size analysis. If you are interested on oversize material you can do the oversize material based effectiveness formula. If you are interested in undersized you can do that and if that screening efficiency is dropping over time you may check it that whether the screen is plucked or not or choked or not. So, that is the first thing you should do and then you look at other things; that is how we could rectify your screening operation into an industrial scale screening operation.

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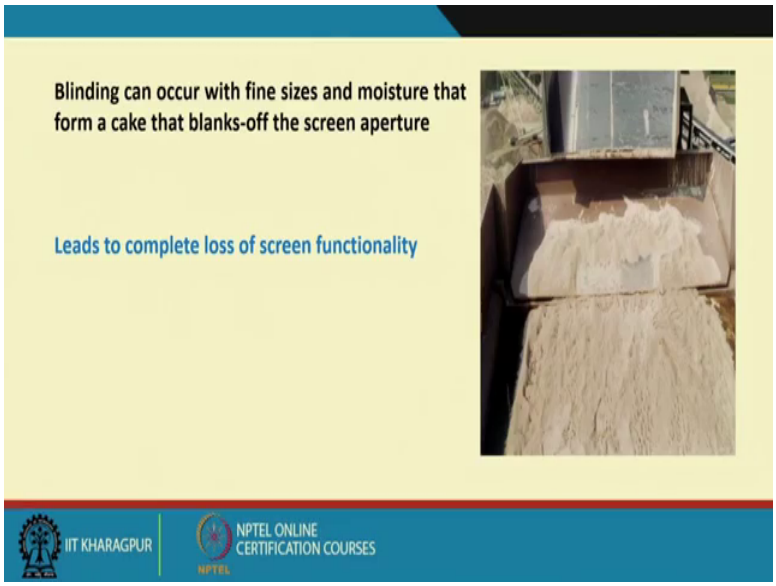

This is what happens with the fine particles that is it may completely choke the passage of your screen surfaces. So, there will be hardly any screen after that. So, this is called the blinding. So, blinding can occur with fine sizes and moisture that form a cake that blanks of the screen aperture that is along with the moisture, if you have very fine particles it will form like a cake and the entire thing will basically create a surface which is impervious. So, there will be no screening, so material going in material going out through the overflow.

So, leads to complete loss of screen functionality this is not wanted and how do I know it that is the modern days you can have some cameras installed on that, you can do the image processing based to your size analysis of the oversized and undersized, but for very fine particles you can get the information that whether my material surface is clogged and how much percentage is allowable and then you can do the screen efficiency calculations also. So, this is how we can monitor the screen performances into an industrial scale.

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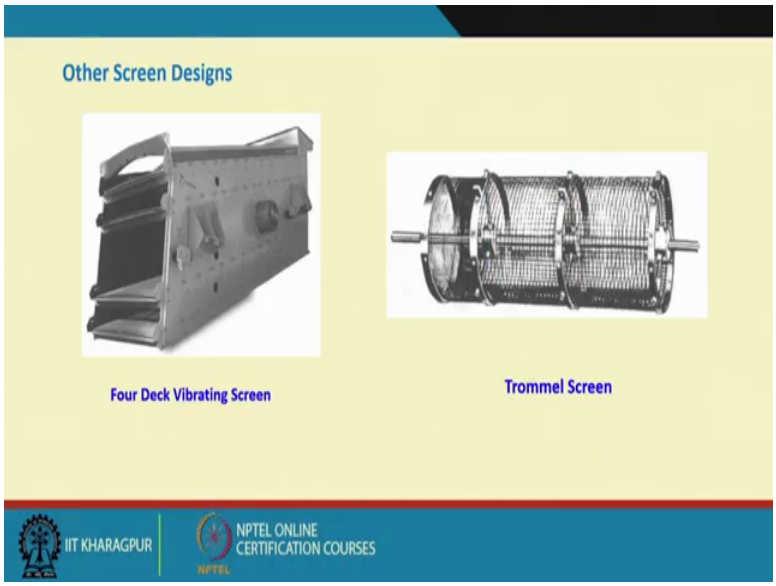

This is what I was talking about that is this is an example of a 4 deck vibrating screen. Why you have given so much of gap in between these two? Because maybe your material what you are having in the feed they are more relatively more percentage available in this size range. So, you have to give more passage for the particle to get accommodated.

This is another one the screen it is called the Trommel which is a cylindrical and rotating type of screen. So, what happens here your material being feed from this end and you have got the finest sizes here and the coarse size is here. So, you can have even the different graded product from this trommel or you may have one size aperture here and the rotation at an angle it helps in particle movement and even when it is rotated. So, the particle is lifted back and lifted up and then you have seen it in the calculations when we discussed about the tumbling mills so the particles were in the fall. So, basically you are trying to give the chances of the particles to change its orientation also so that it can decide whether I will pass or not.

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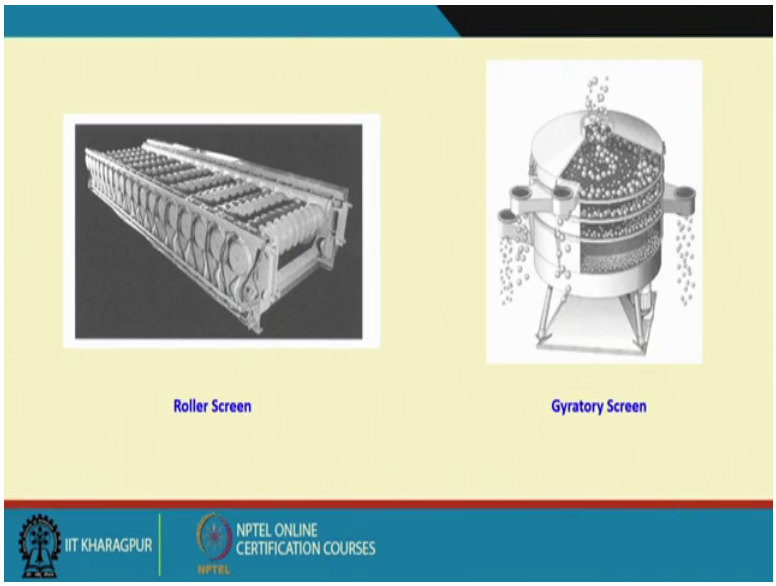

These are the some of the modern screens, these are the roller screens, this is nothing but your particle movement, it helps in particle movement and the apertures have this. So, the challenge is how to create the approaches and how you help in accelerating the particle movement over the bed of the particle so that you can increase the capacity without compromising with the quality of your product. These are some of the gyratory screens these are the screens and then you have got some particles which are basically trying to roll on the surface of that and it has to break the agglomerate that is for very fine screens and then it has got a gyration type to gyratory movement. So, all these are basically used to minimize the material specific problems.

Thank you very much, so that is the end of my say lecture series on screening. So, next lecture we will pick up a new topic.

Till then, thank you very much.