(Video Starts: 00:22:07) Your RMC transit mixer, it is also an example of free fall non-tilting reversible mixer. So, here also, you can see, there is only one opening. You have spiral blade arrangement inside. So, you have spiral blade arrangement inside. So, when you feed in the material, you have to rotate in one direction. So, when you want to discharge the concrete out, you have to rotate in the opposite direction.

So, these are reversible drum rotating in one direction for mixing and the direction of rotation is reversed while discharging. So, you can see the picture. When the rotation is reversed, the concrete gets discharged out. So, it is mainly because of the spiral blade arrangement inside the drum **(Video Ends: 00:22:54)**.

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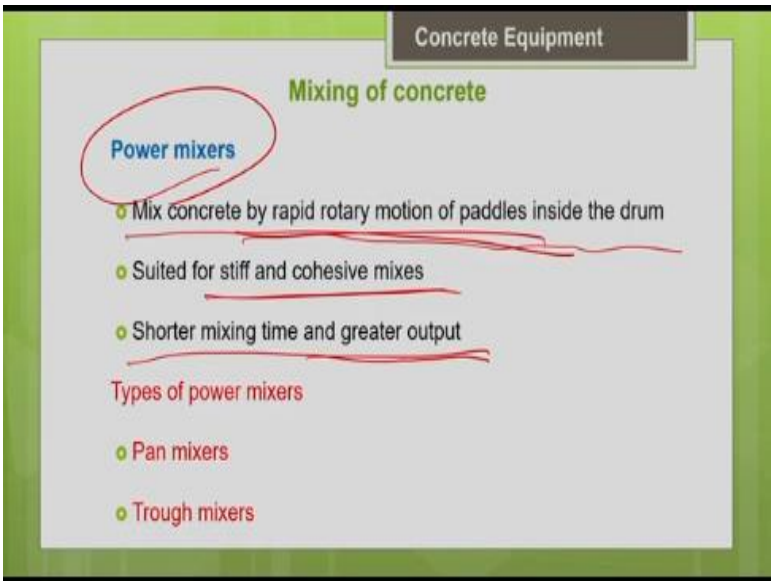

So, so far, we discussed about the free fall mixers. So, they have different categories as we discussed tilting type, non-tilting, non-tilting reversible type. So, different configurations are there. Now, let us move to the next category that is power mixer. So, here, the mechanism is different. Here, you are not dependent upon the free fall of the material. Here, we are dependent upon the rapid rotation.

So, these mixer machines will be rotated at a very high speed. So, there will be some paddles fixed to the shaft inside pan or the drum. So, these paddles will be rotating at a very high speed that enables the rapid mixing and homogeneous mixing of the concrete. So, here, you are going to mixer concrete by rapid rotary motion of the paddles inside the drum. So, this is suitable for stiff and cohesive mixes.

So, basically, you are free fall mixers as I told you, they need a slump of at least 50mm below that, it was very difficult for mixer machine to handle the stiff mix, but your power mixes can easily handle stiff and cohesive mixes, very low slump also because of the rapid rotary motion of the paddles, you can easily mix it. So, the mixing time will be very shorter here. I have a greater productivity with the power mixes when compared to the free fall mixers.

When you compare the power mixer with the free fall mixers, the same size. You can see that the productivity of the power mixer is very high because of the rapid rotary motion of the paddles inside. So, different configurations are possible with this power mixer; can go for pan or trough.

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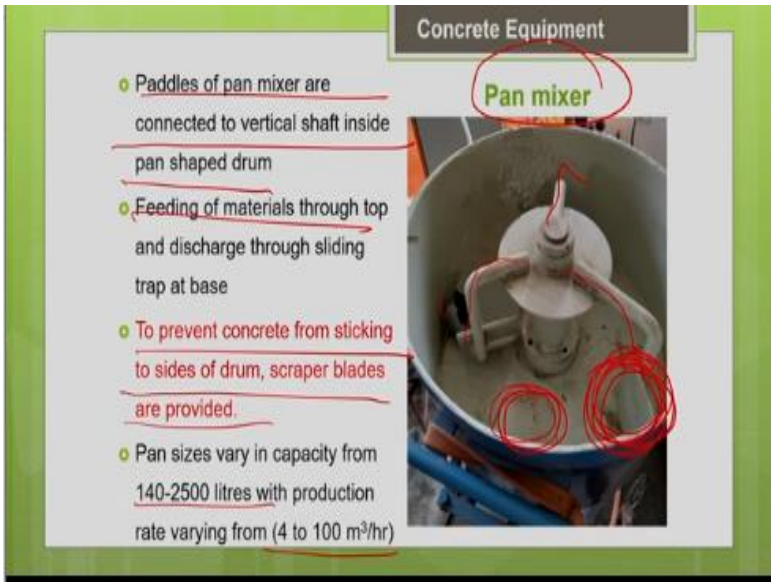

We are going to see that. First, we are going to discuss about the pan mixer. It resembles the shape of a pan. You can see, there is a vertical shaft here and the paddles are connected to the vertical shaft. So, because of the rapid rotary motion of these paddles, you can have a thorough homogeneous mixing of the concrete. Another important thing to be noted with respect to the pan mixer is, you have a blade kind of arrangement, blade or scraper attached to the inside of the drum. This is the one.

So, this prevents the material from sticking to the inside of the drum. This kind of arrangement, we do not have it in the conventional drum mixer conventional free fall mixer. Whatever we discussed earlier, they do not have this kind of arrangement. So, because of, what is the major problem is, when we make the initial trial mixes, the free fall drum mixer, what happens is the most of the paste will stick to the sides of the drum.

So, the first mix will have less amount of paste, more amount of aggregate. So, either you have to throw away that batch. So, this drawback is there. Or what you can do is, you can go for this called as buttering operation. Buttering is nothing but you should go for some trail mixes. You can just,

initially before making your actual concrete batch, you just run a trial batch with a water mix. So, let us just run a trial batch, so, that water mix will stick to the sides of the drum.

So, when you do your actual batch, then later you can see that the amount of material which is sticking to the sides of the drum will get reduced. So, this kind of buttering mechanism is needed, because we do not have any blade or any arrangement in the conventional the drum free fall mixers to prevent the material from sticking to the side of the drum. But, in your pan mixer, you have this kind of arrangement.

So, you have this blade, which prevents the sticking up material to the sides of the drum. So, basically, the paddles of the pan mixer are connected to the vertical shaft inside the pan shaped drum. You can see, the paddles are connected to the vertical shaft. The feeding of the material will be through the top and the discharge, you have sliding trap at the base. You can discharge it to this the sliding trap at the base.

To prevent the concrete from sticking to the sides of the drum, scraper blades are provided. You can see the blade arrangement which prevents the material from sticking to the sides of the drum. So, pan also have different sizes varying from 140 to 2500 liters. Accordingly, a concrete production rate will also vary from 4 to 100-meter cube per hour. It is a very big. Pan mixers are also available which are using a batching plant and precast industries. If you go for a bigger size, you can have a higher productivity.

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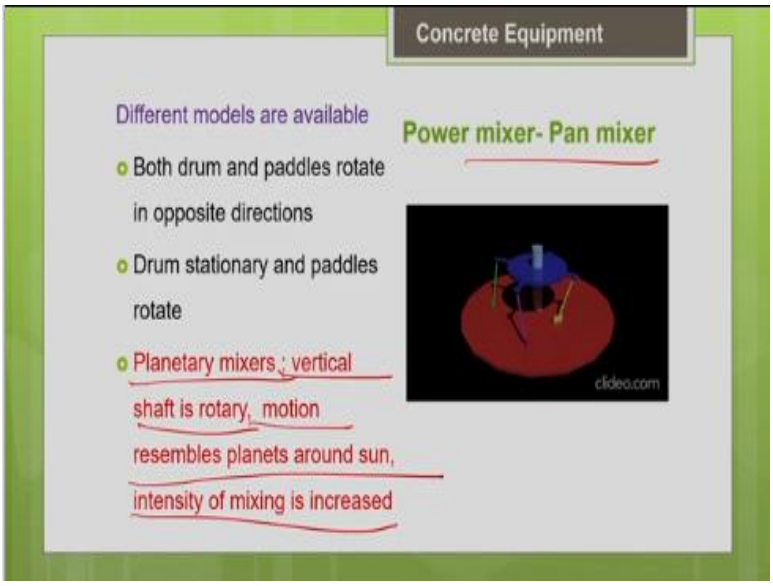

So, there are different configurations of the models available with respect to pan mixer. So, either the drum will be fixed, the paddles will be rotating or both the drums and the paddles will be rotating but in opposite direction. So, another popular model is planetary mixer. Why it is called as planetary mixer is, it resembles in motion planets around the sun, your paddles will be rotating about its axis.

You can see, the paddles are rotating about its axis around the axis of the pan. Just like the planets which revolve around the sun, the planets rotate about its axis and then around the axis of the sun. The same way, these paddles are also rotating about its axis and around the axis of the pan that is why it is called as the++ planetary mixer. So, by this kind of arrangement, you can have a better intensity of mixing.

So, the vertical shaft is rotary the motion resembles the planets around the sun. That is why the intensity of mixing is very high in the planetary mixer. So, there are different configurations of pan mixer. As I told you, you can have the drum and paddles rotating in opposite direction or drum can be stationary and paddles can be rotating. So different models are available.

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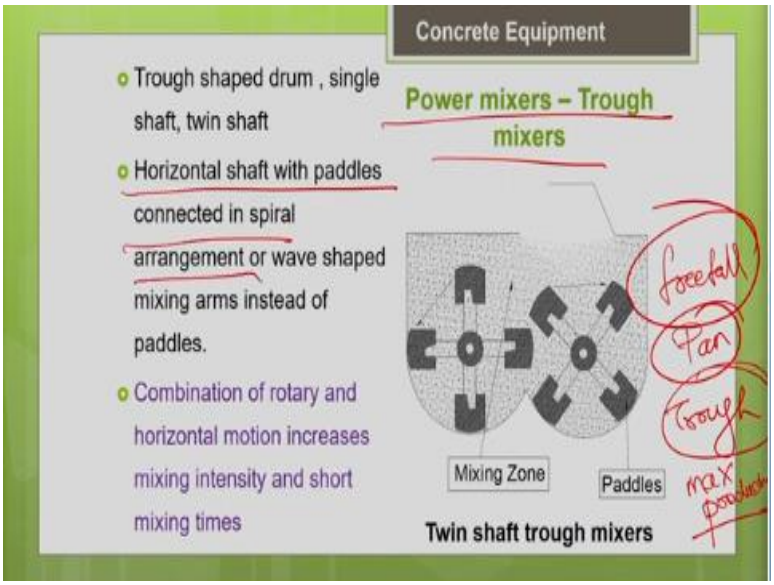

Now, we will discuss about the next type of power mixer which is tough mixer. So, it resembles a trough shaped drum. So, you can see the schematic picture of the trough mixer. You can have a single shaft or double shaft trough mixer. Early, pan mixer, the shaft was vertical but here you can see, the shaft is horizontal. You have horizontal arrangement of shaft. So, on the shaft, you can see, the paddles will be arranged spirally along the shaft.

The paddles are arranged spirally along the shaft. Either you can have paddle arrangement or you can even have a wave shaped arms arrangement. So, that will also give you better mixing. So, whenever you go for twin shaft mixer, you can see, the intensity of mixing will be very good because in the intersections zone, you will have more amount of turbulence that results in good intensity of mixing.

So, the other advantage of your trough mixer is; you can have different types of motions possible, not only the rotary motion as well as the resultant motion. Rotary and horizontal motion result in better intensity of homogeneous mix and the speed is very high. If you compare your free fall mixer, pan and trough, you can see that that trough will have the maximum productivity. Trough has the maximum productivity or the mixing time is very much shorter for the trough when compared to pan and the free fall mixers. So, mostly the RMC batching plan, you can see this trough mixer.

So, that we can have a very high productivity. So, you have a horizontal shaft with paddles connected in spiral arrangement. The paddles will be arranged in a spiral manner. I will show you a video. There, you will understand better. So, instead of paddles, you can also have wave shaped mixing arms. So, as I told you, there is a combination of rotary as well as a horizontal motion which increases the mixing intensity and it results in shorter mixing time when compared to other types of mixer machines.

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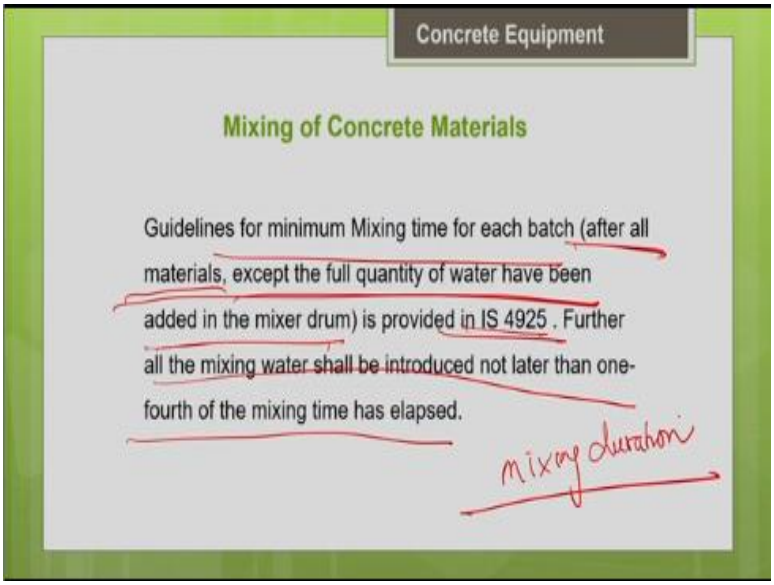

So, another important thing, we have to note here is the mixing duration. The mixing duration is very critical. We have to make sure we meet at least a minimum mixing duration as stipulated by the guidelines of the manufacturer. This is because the mixing duration needed will vary for different types of mixer machines. Your power mixer, the mixing duration needed is lesser when compared to the free fall mixer and also, the duration needed will vary with respect to the capacity of the mixer machine.

So, what is the minimum mixing time needed is given in the codal guidelines in IS 4925 for different types of mixers machines and for different capacities of mixers machines. We should follow the guidelines. So, generally, if you go for a lesser duration, then what is needed? What will happen? You will not get a homogenous mix that is a main problem and if you go for a very high duration, mixing duration also is not good because as you know that as you add water to the concrete, your cement starts setting.

So, it will result in loss of water from the concrete due to evaporation that will affect your workability of the concrete. So, extended mixing duration is also not good with respect to this setting and the workability of the concrete. So, that is why there is an optimum mixing duration for every mixer machine. So, we should go with a manufacturer recommendation. Guidelines for minimum mixing time for each batch is given in the IS 4925.

So, it will apply the mixing time actually starts after all the materials are added into the concrete mixer machine except the full quantity of water is added in the mixer drum that means your mixing time starts counting after all the materials are added into the mixer machine other than the full quantity of water because commonly you can see that the water, you add it in parts. This is because we may add some amount of water with superplasticizer, we break it into the parts because we add the water in stages to avoid the loss of workability due to different reasons.

So, that is why it is mentioned like this. So, after all the materials are added except the full quantity of water is added, your mixing time is taken into account. Another important thing, you have note here is; all the mixing water should be introduced not later than one-fourth of the mixing time has elapsed that means though, you add the water in stages but entire mixing water should be added not later than one-fourth of the mixing time has elapsed. This is a guideline available IS 4925. We are supposed to follow the guidelines.

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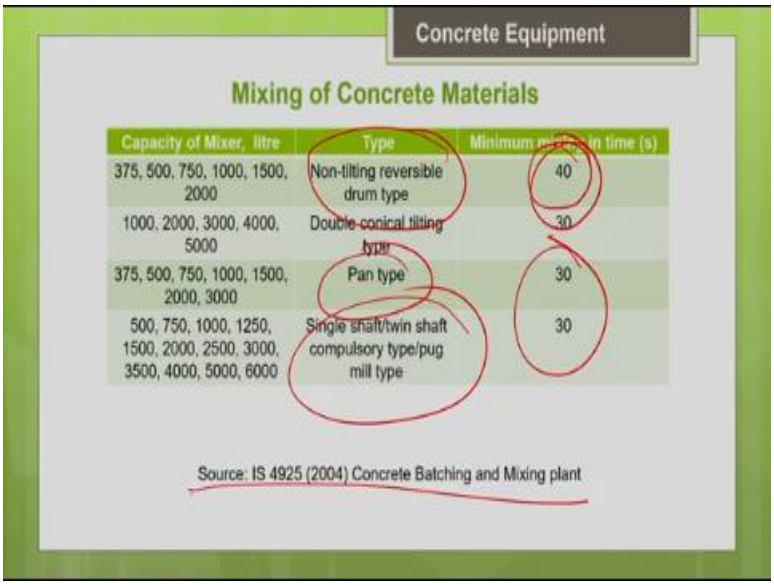

So, this is what I told you. This table is available. It is taken from IS 4925 which gives you a guideline for concrete batching and mixing. So, you can see that the mixing duration is given in seconds. It varies for different types of mixer machines. Say, for instance, if you go for non-tilting reversible drum type mixer, the mixing duration is more. So, generally, for non-titling mixer, it is more.

When compared to the pan type mixer and the shaft mixer, you can see that the mixing duration is more for the non-tilting reversible drum type mixer. So, similarly, for different capacities of mixer machines, you can note the minimum mixing time. This is a minimum mixing time given. We should never go below this.

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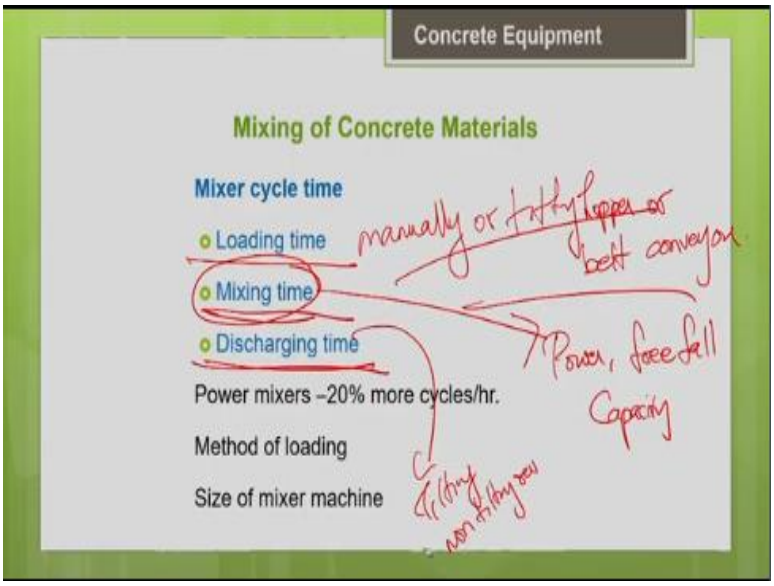

So, how to find the cycle time of the concrete mixer machines? In the earlier lectures, we have determined the cycle time of different equipment. Now, similarly, we have to find the cycle time of the concrete mixer machine also. So, what are the components of the cycle time of a concrete mixer machine? So, it is nothing but your loading time, mixing time and discharging time.

So, loading time depends whether you are going to manually feed in the material or you are going to use the tilting hopper for feeding the material or you are going to use a belt conveyor for feeding the material. So, it depends upon what arrangement you have for loading the mixer machine. Accordingly, your loading time will vary. Similarly, mixing time, it depends upon the type of your mixer machine whether you are going for power mixer or you are going for free fall mixer or what is the capacity of a mixer machine.

All these things will govern your mixing time. Then the discharging time; so, that also depends upon the type of mixer machine whether it is going to be tilting type or it is going to be a non-tilting reversible type. So, all these things will affect your discharging time. So, you have to make the calculations according to your actual equipment. So, the power mixer, you can see that the productivity as I told you, it is more than compared to free fall mixers. 20% more cycles per hour when compared to similar sized free fall mixers.

So, as I told you, the mixer cycle time will depend upon your method of your loading and your type of mixer machine and this size of mixer machine.

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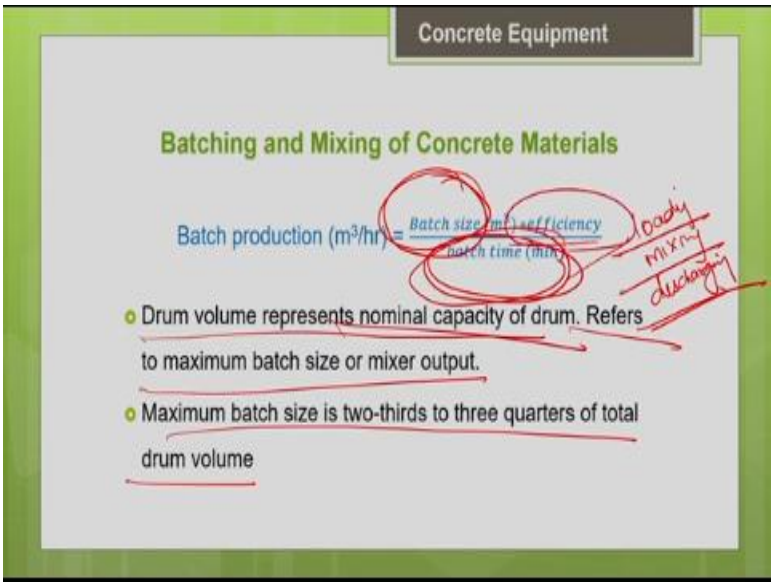

Now, how to calculate the productivity of your batch? Generally, we know that concrete is producing batches. Batch by batch, we produce it. So, how do you know the batch production in meter cube per hour? So, it depends upon your batch size and it depends upon your batch cycle time. So, batch size depends upon your drum size. So, we can never load the concrete to its full capacity.

We cannot take the total volume of drum into account to determine the batch size. We generally take only the nominal capacity of the drum, that means we generally load the drum only to its two-thirds or three-fourths of the capacity only. There should be some space for mixing. So, we never load the drum to its fullest capacity. So, we are not interested in the total volume. So, we are interested only in the nominal capacity of the drum that gives your batch size.

So, the drum volume means, we normally represent the nominal capacity of the drum which is different from the total volume of the drum. So, it refers to the maximum batch size, so that mixer output. So, the maximum batch size is two-thirds to three quarters of the total drum volume. So, you can take it as approximately two-thirds to three quarters of the total drum volume. So, you know batch size says, you know batch cycle time. How will you find the cycle time?

It is nothing but your loading time, mixing time, plus discharging time. So, for your particular concrete mixer, what is the loading time, mixing time, discharging time? You need to find it to know the batch time; then the job efficiency. So, here, the job efficiency, it depends upon your entire the equipment condition or the equipment operation. Say for example, for batching plant, you are going to find the batch productivity.

And your job efficiency will depend upon the ability of your conveyor to feed into the material into the mixer machine that is also important that is an important factor affecting efficiency. It also depends after the concrete is made. There should be a RMC transit mixer, it should come readily and collect the concrete which is going to be discharged. So, there should be RMC transit mixer which is readily available.

Availability of RMC transit mixer that also affects efficiency. So, all these factors are taken into account when you estimate the efficiency of the batch production. So normally, it will vary from 60 to 80% depending upon your batching plant or depending upon your equipment condition of the operation method.

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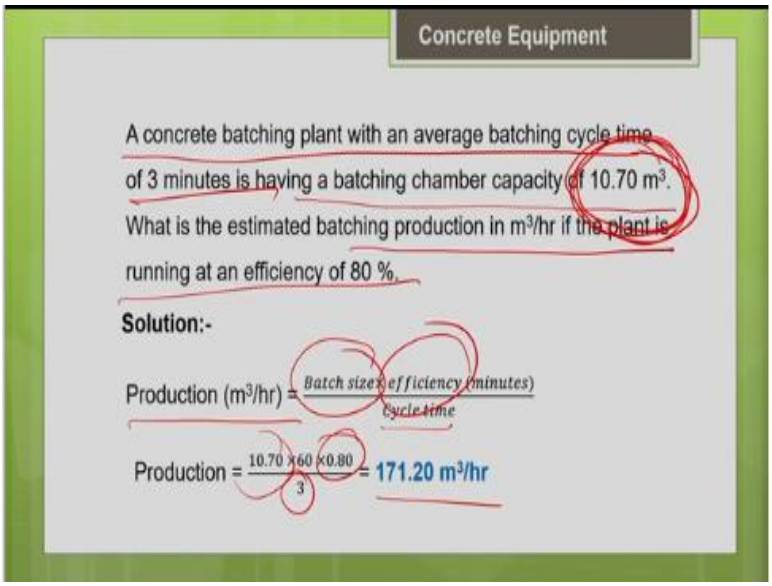

So, let us work out a simple example on estimation of the productivity of the concrete batching plant. So, a concrete batching plant with an average batching cycle time of 3 minutes. So, the cycle

time is given to you directly 3 minutes. It includes the loading time, mixing time as well as the discharging time. So, it is having a batching chamber capacity of 10.7-meter cube. So, the capacity is given. The batch size is given.

So, we normally refer to nominal capacity of the batch size only. It refers to the mixed quantity of concrete only. So, 10.7-meter cube is the capacity. So, what is the estimated batching production in meter cube per hour if the plant is running at an efficiency of 80%? So, the plant efficiency is also given as 80%. Now, you find batch production. So, you know the batch size. So, the chamber capacity, you can take it as batch size obviously as you know.

Generally, the manufacturers never give you the total volume of the drum. They give you only the nominal capacity of the drum that will represent the batch size. So, that is actually 10.7 meter cube of concrete and you should know that here, we are taking the concrete in a mixed condition, not in unmixed because the volume will be different in mixed or unmixed condition. So, that is why the mixed condition volume, we normally present, 10.7 meter cube.

$$\text{Production } \left(\frac{m^3}{hr}\right) = \frac{batch\ size \times efficiency(minutes)}{cycle\ time} = \frac{10.7 \times 60 \times 0.80}{3} = 171.20\ \text{m}^3/\text{hr}$$

So, this is how you have to estimate your productivity of the concrete batching process.

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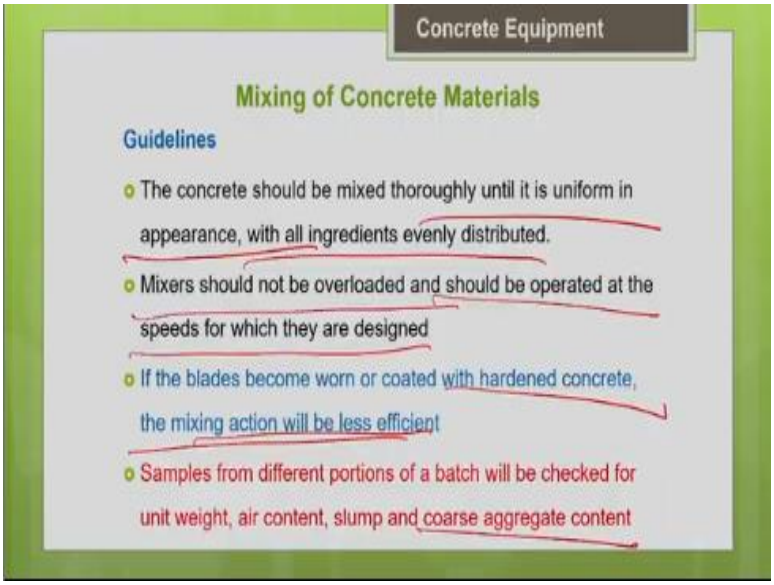

So, now, let us look into some general guidelines with respect to mixing of concrete. So, you should mix the concrete thoroughly as I told you until it is uniform in appearance. So, based on

experience by looking at the color, it says, you can make a judgment whether the concrete quality is good or not with all the ingredients evenly distributed. That the homogenous mixes are very important. That is why I told you, we should go for at least a minimum duration as prescribed by the manufacturer.

You should never go below the minimum duration. Mixers should be never overloaded. If you overload it, the mixing will not be homogeneous and it should be operated at the speed for which they are designed. As I told you, free fall mixers are designed for a particular speed. Power mixers are designed for a particular speed. You should go as prescribed by the manufacturer.

And you should clean the concrete mixes immediately. Because if your blades are going to get coated with the hardened concrete, it is going to affect your mixing action. In many job sites, you can see that blades with hardened concrete because the concrete mix is not properly maintained; not properly cleaned after every mixing process. So, you can see that the concrete is hardened. So, that will also affect mixing efficiency.

So, once the concrete is made, you have to take the samples from different portions of the batch and you should check for the uniformity. For that also, the codes are giving you the guidelines. You take the samples and check for the fresh density; check for the air content, slump, coarse aggregate content, you do the sieve analysis and check the coarse aggregate content. This, the difference between the samples should not be more.

So, what is the permissible difference that limitation is given in the coral guidelines? You have to check for that to ensure the homogeneous mix.

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