Concrete Technology
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Lecture - 20
RMC & Transporting Concrete

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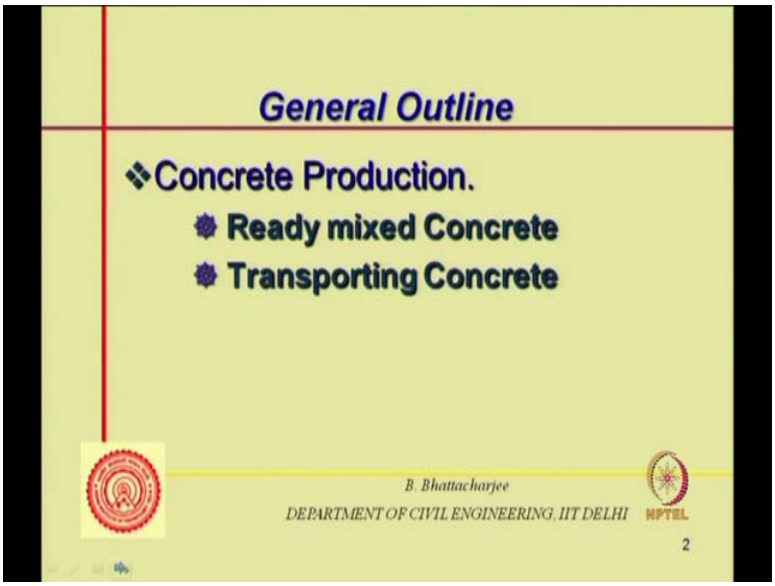

Having looked at mixing. Now, we should look into transporting the concrete. And therefore, in this lecture 2 for the module 5. We should be looking into ready mixed concrete, which combines actually mixing or at least part mixing and transporting together and transporting concrete. So, outline of this talk of this lecture would be Concrete Production in terms of Ready mixed Concrete and Transporting Concrete.

So, What is Ready mixed Concrete? You see ready mixed concrete production is a process whereby mixing and transportation of concrete can be combined together and the product is deliver to the sight at times write into the mould straight away. So therefore, it combines mixing and transporting and it can deliver. So, your plan batching plan which is far away that is what we discuss the batching plan yesterday the mixing and the batching is done at the central plan, and then it can be transported and delivered (( )) to the mould or close to the mould. Or it can be pump directly from the truck output you know from the discharge of the RMC truck it can be simply pump into the mould itself. So, that is what is defined as ready mixed concrete.

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Now, Indian standard IS 4926 it defines ready mixed concrete as concrete delivered at site or into the purchasers vehicle in a plastic condition and requiring no further treatment before being placed in position in which it is to set and harden. So, no process is required it can be delivered in plastic condition and it will not require and further treatment being placed in position in which it is to set. And harden when the compaction where required so that is ready mix concrete definition wise.

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And you know there can be first of all mixing can be done at while transporting some plans which will call central plan. So, you can have a central plan may have mixing in the truck. So, batching is done at the plan and mixing can be done on the truck itself fully and such a vehicle would be called Truck Mixture. Like the one shown here which will have a water tank and off course, the mixing. You know vessel or mixing drum on which mixing will be taking place and we have blades inside vessels which will cause the mixing. So whole mixing will be done here.

So, in between you know what you can be do is batching can be done quit early. It is weather the truck will carry the ingredients right proportions and some are during the transient it can start mixing, Obviously, since mixing requires lot of power than the pay load of the truck like light will be less plus also it has to carry the water separately. So, this is not only cleaning water but, mixing this is mixing water tank. And these are the discharge chutes this is discharge chute. And you know this is actually for inlet hopper through which ingredients are putting. So this could be a truck mixture.

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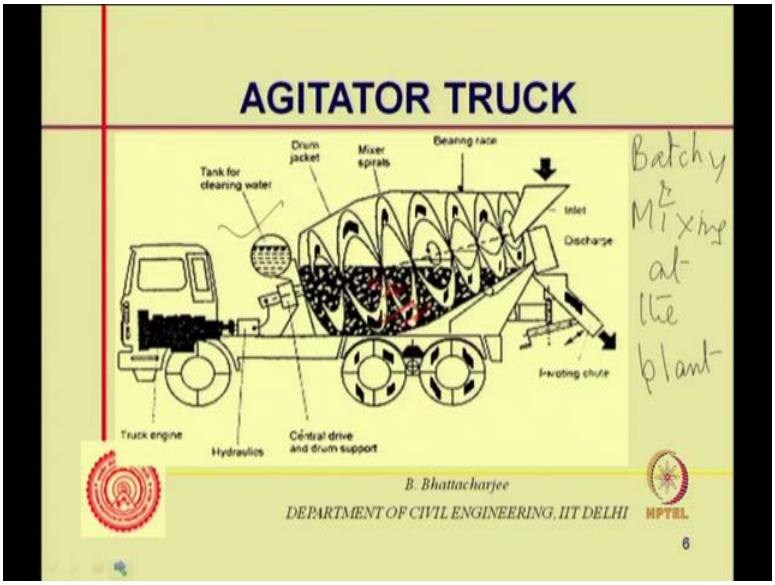

An Agitator Truck might look something like this. So, which does not do mixing so mixing at the plan batching and mixing at the plan and it only simply agitates the concrete to keep it plastic. And then, they leave us to the side so, you can see that the internal construction somewhat there is a speedwells. Through which actually the blades

and then this is of course, outer peripheral and drum periphery and then tank for cleaning essentially since it is a Agitated Truck.

So, this is cleaning water only is just for cleaning in let hopper and discharges through this. So, agitated truck only agitates and its RPM is much less you know around 3 years. So, 3 to 4 virus mixing could be 7 RPM and so on. So, batching and mixing at the plan and one only transporting and during transportation its keeps on agitating the concrete. Here, you know keeps on agitating the concrete here. This concrete is agitated it keeps on agitating concrete that is here you know this concrete is agitated truck.

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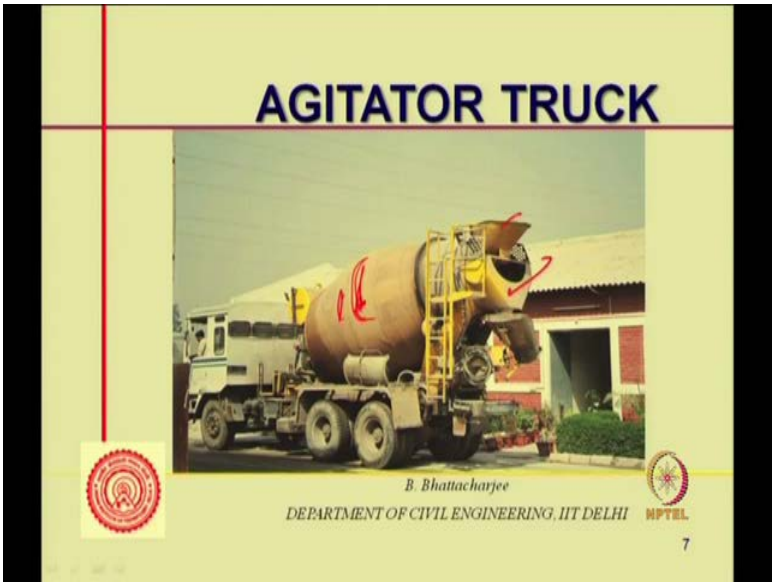

Now, modern ones would be actually combinations of all it came you know that usually some mixing can be done so typical at a truck would be look like this. Now, you can see that there is sorts of kind of you know cloth cover here. As a basically sort of a hessian type of cloth Jute or similar sort of things. You can keep a lot of water absorb this is covered drum, covered with that. The reason being this is in the hot condition tropical condition of Delhi or in northern India.

So, this is kept wet so that inside material gets heated up because of the radiation the temperature outside. So, that is a truck you can see the hopper. You know there is a discharge hopper the in wet hopper and the truck as we have seen earlier inside the there will be bare full mixture. So, this could be agitator come mixing also can mix both

rotation capacity should be there. Typically shrink mix concrete that means is the mostly mixed in the plan.

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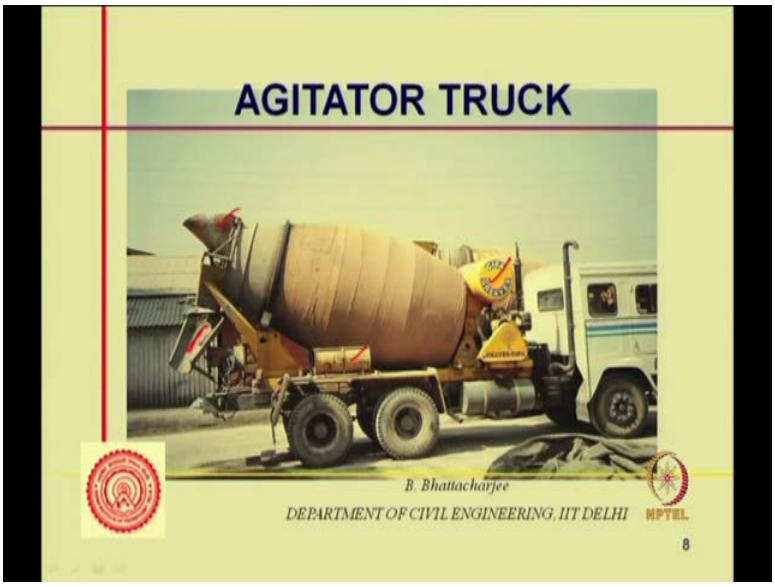

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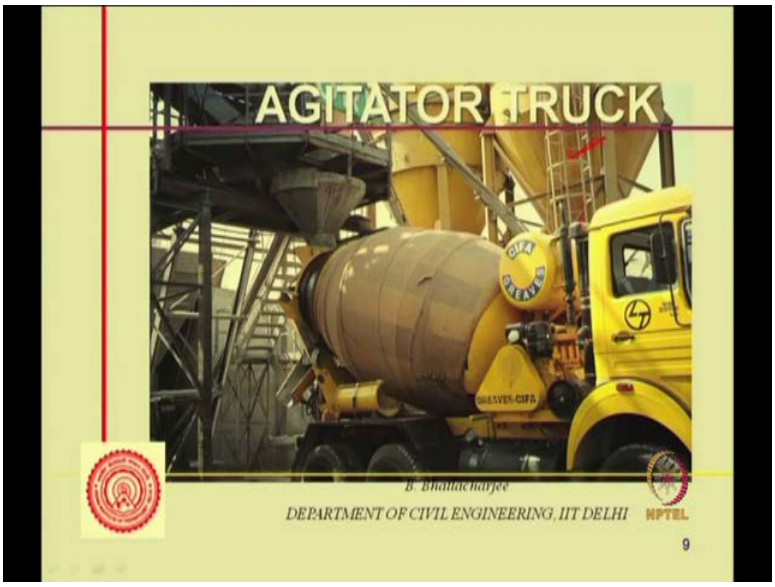

And then if requires some mixing can be done at the site as well. So, this another view of the same one you can see the discharge chute easily, these the discharge chute. And this is where so it getting (( )), it will get loaded. And the cleaning water tank is here, and you know this is what you see in most of the places some of the trucks are like this. So, there

is an extra chute through discharge can be you know you can this chute which can be connected here and discharge can take place.

Generally they call it transit truck mixer or transit mixer, this is what they call it. So, this is getting loaded actually it is getting loaded to the hopper. It is getting loaded through this hopper. Concrete is getting loaded you know this is through the hopper is getting loaded, it is getting loaded there not this is the salon, concrete is getting loaded through this hopper here you know. So, this is actually getting loaded.

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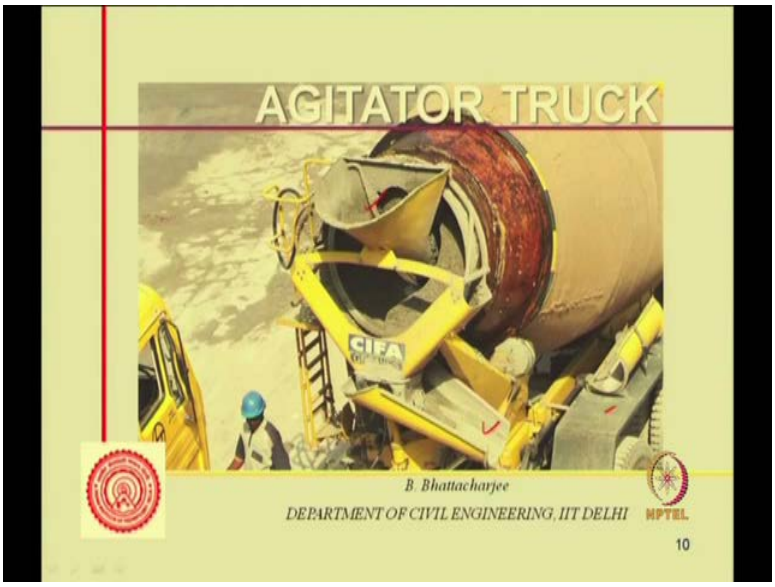

And next diagram would show possibly this is showing the inlet and the outlet chute. So, which is actually discharged into the pump that standing here. As you can see it can discharge into the pump and there is another truck going waiting in the line next to discharge so on.

The major issue is a uniformity of the concrete and loss of slump. Since, your transporting in the agitating in uniformity should be maintained and loss of slumps should not be there. You know the setting characteristics of the concrete while setting characteristics the cement is one issue. Setting characteristics concrete is the other issue which is related to slump loss.

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Because, you know have dead mixture so it is not the cement settings it is related to cement settings but, something more than that. Because, not only the cement setting but then you are adding some kind of mixtures if it is a retarder. You know make the setting time longer concrete will set for a longer period of time set after a longer period of time and if it is an accelerate it will actually make it to set must faster.

So, some classes of measuring issue one of the major issues that is because, make it to you know transport for a long distance know most of the codes. What they do there actually restacks the time of all to 1, 2 hours off course, depends upon the ambient condition in what one condition higher temperature in a time of haul could be lesser. So, setting would be faster that is why there was a cover you might cover the drum white colored in this case it was some sort was hessian type of cloth which was shown here.

And the maximum number of revolutions sometimes it is restricted all most the code actually restricts it is at the mixing speed. You know of the mixing drum it is limited to 300 revolution at agitating speed. And at mixing speed 100. So, 100 revolutions maximum or 300. So, 1 to 2 hours or in a 300 are revolutions at a RPM of 3 to 4 which are agitating RPM and under goes 7 or so which is actually mixing RPM them it restricted to 100, So, otherwise you know there will be sufficient loss of slump.

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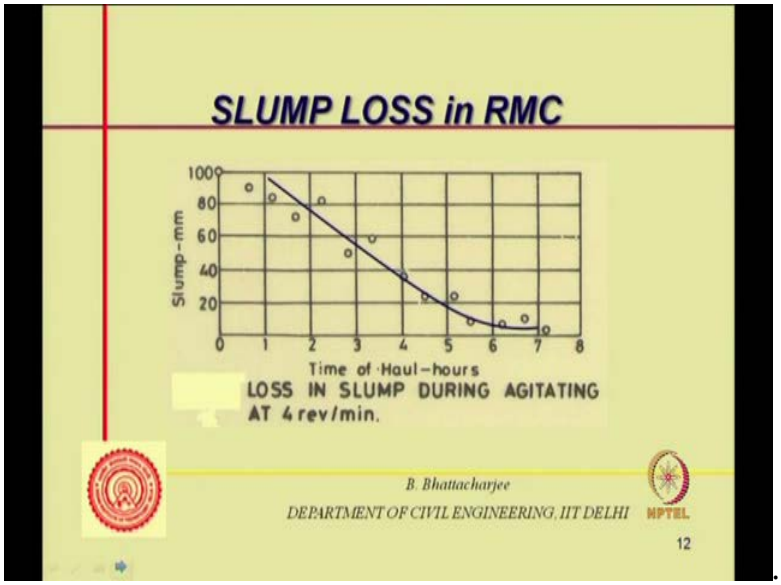

Typically the SLUMP LOSS might look like this. Typically slump loss might look like some results shows this loss of slump during agitating at four revolution parts. But, this is the some work done pre early if you see current once it might be quite different. Because, you can have retenders to which can actually problem it but not the 100 mm sort coming down to the nearly 0 in above 6 to 7 hours.

But, then we slump loss of slump that is possible. Now, if you want take care of this what you can do is you can keep the initial slump high. such that when it reaches to the sight actual slump is desired slump whatever you are suppose to deliver you know or slump at the delivery so initial slump can be kept high.

Other way is to use retarder which will you know prolong it but, keep the initial slump high retarder will prolong it. But, if there is of somewhere there is the traffic jam or something and there the truck is actually stuck. Then, in between adding water just like that you know without any kind of experimentation done early. Or without by you know default if I measure.

So, writing at mixtures this is not producing an in generate concrete. If, it is known that you have to have a longer period of time of travel and you may have to add some kind of a retarded in between and re agitated. Then this must be first checked at the planted level that how much will be the loss of slump otherwise now negative effect of adding admissions of water is loss in strength.

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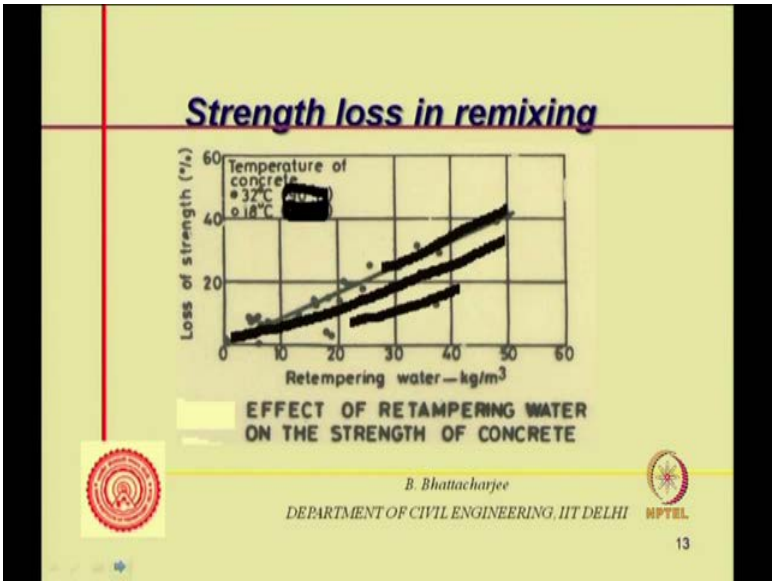

For example, if you look at this you know this will show you kind of loss in Strength. So the data number of data which is there and it will depend upon of course, the temperature. So, if it is low at temperature it is strength loss you know depending upon temperature of concrete is which is this diagram of 32 degree centigrade. So, it will depend upon temperature as well as how much water you have added. So if you add water there will be strength loss and as much as if you added 50 kg meter cube in some cases there is an example I mean typical is not all the time.

So, if you have 10 Kg per meter cube. Or 20 or you know 10 Kg you can see about 5 percent loss 20 Kg may be 20 percent strength loss and 30 Kg some around 30 percent strength loss you know. So, percentage strength loss could be higher so by adding water all retarded again it can off course, retarded can have other kind of effect also it might result in aggregation and similar sort of problems. But, so adding retarded in between by default is not the best thing to do and you should not left to the truck driver or you know somebody who is not very qualified. If, it is to be done because of traffic situation or similar sort of thing this must be actually done earlier in the laboratory simulated.

And do a test and see what happens to your strength if you have an added an admixture in between if you have added water in between obviously the strength will be reduce. So, if you have added admixtures what is effect on strength what is the effect if you add even in some water. It will also affect your strength because, water cement ratio is likely

to change it might increase the slum. So, what you do you actually you know design for an higher strength that even there is some amount of strength loss. Finally, the strength at the delivery point the concrete which will be there at delivery point this must you know this must actually produce. I mean this must actually yield same strength or result in same strength what is desired.

So, this is important to understand by default things should not have done it should be done by doing experimentation. Earlier if there is an extreme case of traffic situation which is quite happens in Indian synario. And but, just like that without any kind of testing, without any kind of free verification admixture should not be added neither one should add water and remix it. Because, there will be strength loss you might get the slum back but, there will be strength loss. So, this point has to be kept in mind. Two issues are very important uniformity of the mix which I have talked earlier yesterday I talked about I mean last class last module we talked about the mix you know uniform mix uniformity of the mix produced from the mixture machine.

So, you have to see that the RMC delivery of the concrete from the RMC truck is as uniform as possible. And I should you should check time to time the uniformity. So, this is one issue loss of slum is the other issue which one must tackle in case of red mix concrete. Now, ready mix concrete gives you a big advantage because it is done at the plant. So, since you are doing at the plant level in a factory sort of situation so actually if it has done in the systematic manner with a batching in the batching plan.

Or you know it is almost like a factory like situation although modern precast industrial of much more sophisticated system. But, ready mix concrete if it is done in an engineered way, it can give you much better quality concrete. But, if it is done again not in an engineered way like mixing admixture any time not checking continuously monitoring the results that you are obtaining. And then you know its again as bad as manual construction but, it gives you a chance to actually a make concrete quality much better and much faster off course done. You know it simply you know you can do a away with the space in the side storing at the side and if, you look at the cost even if it slightly costlier that is no problem.

Because, the cost of aggregates and cost of storing the aggregates cost of getting the aggregates cost of inventory management purchasing etcetera all these are reduced. So,

all this course should be taken together if one is like a you know one would like to compare the RMC cost with the site mixed cost anywhere the quality question is very much there. And therefore, RMC is always a preferred situation than a site mix concrete because space and everything put together.

And small quantity of concrete in large number of places one single RMC plan can deliver but, it has to be engineered concrete must be done in an engineered way in a systematic engineered way and not just manually. Almost like manual treatment same treatment as a manual concrete should not be given. It should be handled with knowledgeable qualified people. Quite often this you know this is the point you cannot ignore. Because, if you want to maintain the good quality of concrete people should be knowledgeable and also systematic procedure should be installed. So, that is about RMC.

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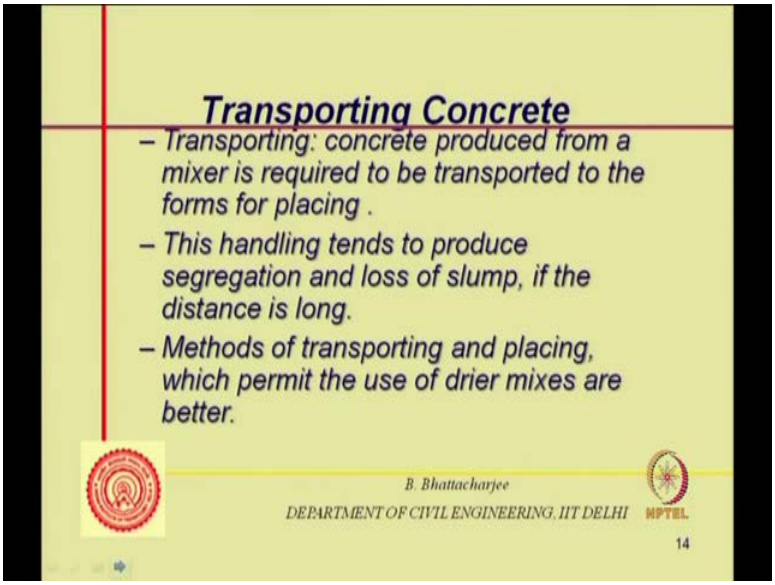

The other kind of now we can look into the other kind of Transporting, you know methods of concrete and obviously main issue of course, we meant that it should during transportation it should not segregate. So, basically handling tends to produce actually segregation and loss of slump. Especially when distance is long and that is to be that is to be seen. You know the RMC of course, combines some transporting together with mixing, but there kinds of other kind of mixing procedure can be adopted in large site especially and even sometime in small sites.

Today in a mechanized process many of those transportation methods which I am talking about may not be may become redundant. Because, if you use a pump together with you know truck transit mixture and so on so fourth most of this can be eliminated out. But, however some cases one may have to go to various kind of methods. one have to adopt various kinds of methods for transporting concrete so while ever which ever method is being selected one must see that there is no segregation. Therefore, methods of transporting in placing concrete which permits the use of most you know the driest mix, dry mix, drier mix that has to be better.

Now, one issue related to off course adoption of pump is that the concrete must be pump able but, if it is not pump able than you cannot pump. So, one of this methods you have to may adopt.

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What are the methods? This methods are discharge directly in to forms through short chutes or for a very small lead manually in containers. Not the best thing not very desirable thing short chute is a better one manually discharges is not the best thing. But, even if you have to do really than sudden precautions are to be taken will go through this. By barrows, wheel burrows and handcarts you know this are the wheel burrows and handcarts. This have been used for quite often earlier and power barrows or power buggies than, dumpers and trucks. Now, non agitating trucks are not the best thing to do it should be agitating trucks but, we look into some of them quickly the process.

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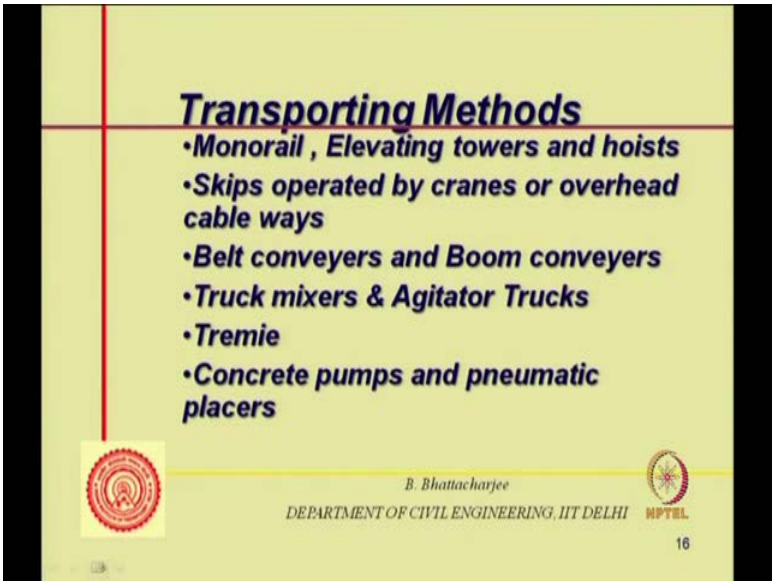

Then you have monorail, elevating towers and hoists, buckets or skips operated by cranes or overhead cable ways. Belt conveyers and boom conveyers, then you have got agitator truck we have already talked about. So, these are the kind of methods we have and concrete is used under water or somewhere in the deep trents. Concrete pumps and pneumatic placers are the other ones which are used. So let us look at some of the issues related to former ones that is our discharge directly into forms you know, discharge directly should be avoided as much as possible. Concrete should not be dropped more than 2 meters because, if you drop the concrete from a height you know and especially if the mix is dry larger particles has a tendency to go a further away.

For example, you know all the large particles will have tendency. Suppose we are dropping concrete full from here you are trying to drop them now large particles will have a tendency to come here smaller page deliver tendency to fall here. So, large particle go there large particles. So, it is desirable that this height should not be should be less than you know height should not be h, should not be less than it should be always less than 2 meters. I mean h should not be greater than 2 meter so it should be always less than 2 meter. So, because if your dropping from a larger height if the tendency is two have tendency is to have larger particle will have a tendency to go further away. So, drier mixer this situation is more prominent and therefore direct discharge.

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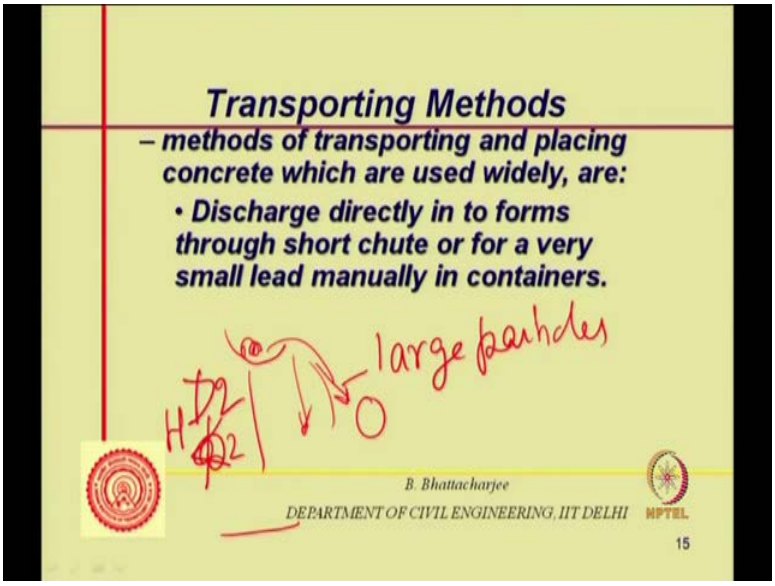

A chute is a better one which is nothing but, we will have a cross section like this a chute will have a cross section like this. As we have seen earlier and it may be something of this kind you know made of mold. So, this something of this kind so through a chute one can discharge from discharge first.

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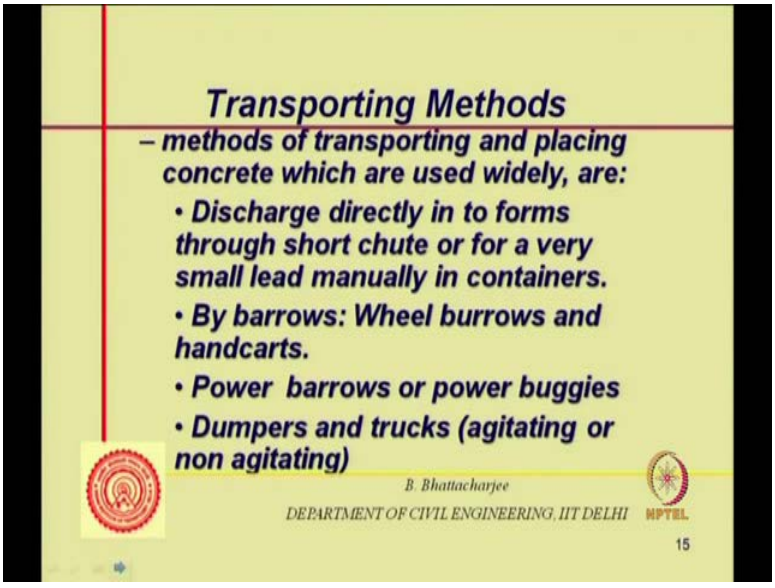

To the chute and which is on a slope you can discharge through that. So, if the height is you know say 2 more than 2 meters or even somewhere around 2 meters. So discharge chute is usually better long chute are not very good. They might cause streaking of the

paste there and larger particle again may go away. So, this is discharge through the chute wheel burrows is a one thing must remember the whole load from the mixture machine should go to the wheel barrow. We will see that one slide later on in does and do not's of concrete. In case of small mixture whole load should go to the single barrow earlier sparrow barrows were used same thing and people have used dumpers earlier. But, today is largely agitated it is better to keep agitated truck what happens in case of dumpers trucks you see if it is going over the rough road there can be jaunting even if it is a pneumatic tire.

So, if there is some amount of jaunting then what will happen these jaunting results in segregation. Larger particle will jump up while paste will stick and than larger particle will tend to separate out from the paste because, the paste should have you know by this kind of jaunting action paste and larger particle tend to separate out. So, as a result dumpers or non agitating trucks are not preferred especially when the road is rough agitating truck off course, manage to agitate and keep them together. So, thus using a truck monorail systems can be used over large slag you know it can discharge over both the sides if it is travelling over the slag or similar sort of system in a precast factory this might be use full. Elevating towers and foist they actually lift the concrete up in building or sometime in breezes. So, you will have to have buckets through which concrete should be lifted up and than if it also a horizontal travel then, the bucket has to be unloaded somewhere may be on to a barrow or something so that horizontally concrete can be moved horizontally.

So, elevating towers and foists moves transport is a concrete only along vertical direction you need something else for horizontal moment. Monorail off course, also you can have little bit of slope usually it is of slab or flat surfaces in cast pre cast situation. This could this is the habit we just found this used skips operated by cranes or overhead cable ways buckets has essentially operated by cranes. So crane has got both horizontal as well as vertical moment overhead particular radius it can deliver concrete both horizontally as well as somewhat vertically. But, there is a limitation depending upon off course, the types of cranes the tower cranes and it can actually transport quite a bit both horizontally as well as vertically. Overhead cable waves are been used in river valley projects you know to transport concrete from one bank to the other bank or over the somewhere over the river itself. So, this are but you need again buckets and temp transport to the using

the buckets can be transported. Belt conveyers or boom conveyers, Boom conveyers are actually used along with the tower crane.

So, concrete can be lifted up through hoist or towers and discharge into a container in a boom or in a boom conveyer through the conveyer concrete can be transported at different places. And the boom conveyer can actually rotate and move and therefore, over the circular area it can spread the concrete. Belt conveyers are also used from point to point actually. But, one thing in both these cases over the rollers of the belt. Belt moves over the roller and it moves over the roller there can be jaunting action. Because, it you know it actually it would actually belt moves like this over roller belt moves over rollers something like this. Then, there is another roller so as the concrete there are concretes here concrete has this is the section has seen from this direction you know this is the real concrete it moves.

So, as it moves over this roller that can be some jaunting. So, this kind in resulting a segregation besides the slope is restricted you can only it can transport the concrete through slopes over 15 degree maximum 20 degree or something that kind not very stiff slop it cannot transport concrete.

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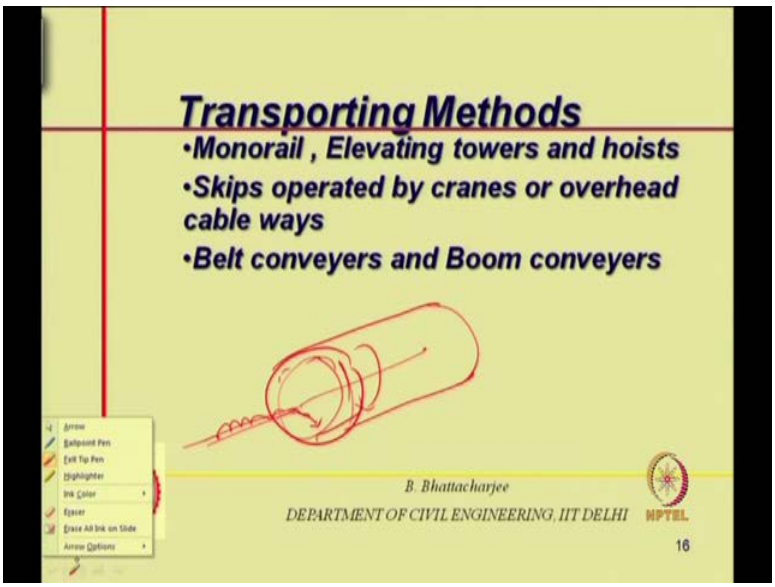

So, this is you know conveyers which have been also used in some cases. It still used actually is we in you know for example, you are making the lining of a steel pipe. Usually, pipes which carry water steel pipes there is a inside motor lining or heat cement

motor lining or heat cement paste lining. Now, what is done is the belt conveyer takes the concrete right inside the pipe you know it is like this is your pipe cross section the belt conveyer this is your pipe steel pipe right belt conveyer will move the concrete here. And discharge from the concrete you will discharge here right away on to this spins this off course, spins rotates. And by this rotation it transports the concrete or puts the concrete right up anywhere and this through this process actually or cement paste or not really concrete cement in motor reach cement motor.

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This could be this would actually be gets spreaded. Now, the conveyer can move inside right inside and then gradually shifted and you know through this belt conveyer concrete gets transported. So, pipe lining one can use these conveyers many other places over a short distance not much slope. But, belt conveyers can be used but they are very specific not very common for doing it but, there are also you know this is also a method agitated trucks and trick mixer. I have already talked about tremie is used in under word concrete you will have diagrams and look at that. Pumps and pneumatic placers are the most commonly used and will deport a complete you know separate lecture on this particular one. And you can use any combination of the above because, if it is to be example for earlier days let us say you have a high level bridge. So, the bridge deck you know something like you have a bridge deck you want to do some casting.

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So, you have something like this is your pier and there is a pier head and you know pier head is here and bridge spends along this direction this spends along this direction. So, that is something like this guider system box guider may be so what we do is over the pier head actually there is a center point you have to leave the concrete and transport. If, I see like this would be my if I see it like this it would be my deck system right on this side and I have a tower here. So, I leave the concrete to the tower transport it along this direction if I have to cast some segment here let us say I am casting some segment here. So, I need two methods combination that is the tower through which, I lift the concrete here and there is a wheel barrow or some sort of transport horizontal transport to take the concrete at this point. So, this in case of a bridge and this is common building too. So, you may have to actually use combination so combinations are used any combinations depending upon the situations. So any combination depending upon the situation one may use.

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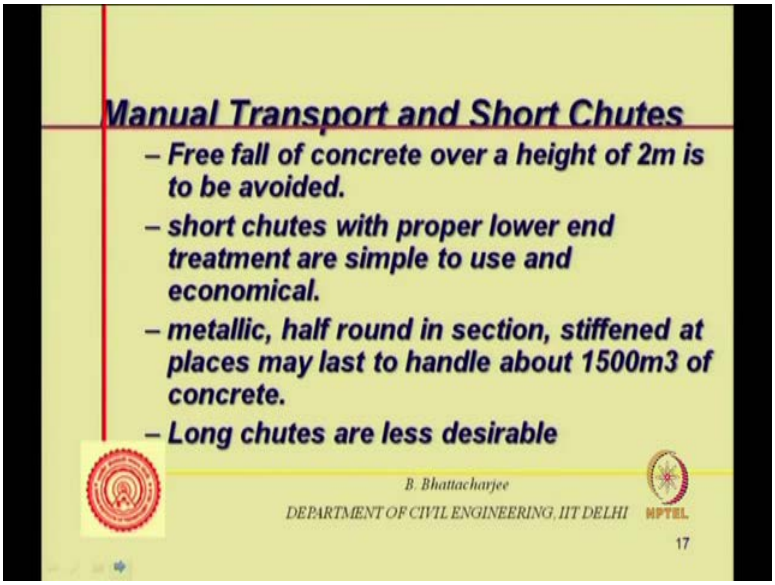

Let, us see some of them in more details something to do the Manual Transport. Free fall of concrete over a height of 2 meter is to be avoided that is what I have said it cannot drop concrete more than 2 meter short chute with proper lower treatment are simple to use and economical. Short chute can be used wherever required and that is you know actually last for large number of reputations steel chutes, metal chutes. You say semicircular, cross section, simple semicircular cross section, apart you know you can half cut pipe if you have a pipe it just cut it half something of that kind. But, it is not usually pipe it is a metal bend so, something of that kind metal, steel, bend chutes can be used.

And there are very useful because, of our short distances. Supposing you have a trend, or you have the foundation you know of which is slightly below the ground footing you want to cast and you want the concrete from the top. Now you should drop it you should not drop then 2 meters. Because relatively dry concrete would have a course aggregate in relatively dry concrete would have a tendency to go further away while paste relatively to remain so it causes a kind of segregation. But, short chute if it is dropped on to the short chute it goes.

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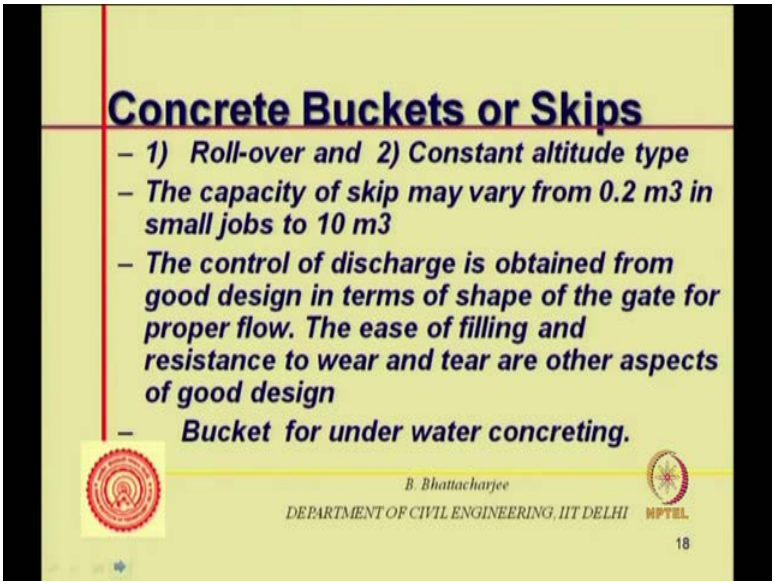

Down to the general slope the actually the larger particle will be still be sticking to the paste and so on and so fourth. So, short chute is fine long chute should there can be a problem because some paste will have a long run. It will tempt to go dry and at the end it may actually cause the paste to remain stick sticking you know very long chute should not be preferred manual concrete. Therefore, you know this 2 meter height 1 should give this for example, this what about the chute it is metallic half round in section stiffened places may last to handle about 1500 meter cubic concrete.

So, chutes are almost they must even if you have all other mechanism of transporting concrete, some chute sometimes you have to use a chute somewhere in the concrete long chutes are lot desirable. So, this is one major issue which you have to look into then buckets are skip this are most important. Well 2 types bucket have been actually used or proposed but, this is not very common one is Rollover other is Constant altitude type. They are actually designed bucket. They are another kind of buckets which have been used they are not be the stone but, instead you know I did not discuss much about monorail not about the cable ways and all that. But, I choose to discuss buckets or skips it was there are used quit often most commonly used and you have to combine them together with your tower or anything else. You know many places you have to combine the bucket and skip even if you are using a crane you have to use a bucket.

So, there are two kinds of bucket to think about one is called a Roll over bucket other is the you know Constant altitude type of bucket. These are actually design buckets for concrete transporting and placing the capacity. Off course, can have point 0.2 meter cube to as large as 10 meter cube. Now, 10 meter cube to handle it accordingly 0.2point meter cube is a small and they would something like this as usually see later on control of discharge is obtained from good design in terms of the shape of the gate for proper flow. The ease of feeling should be there and to resistance to wear and tear are other aspects of good design. So, essentially discharge you know control discharge control is very important gates shape should be very important and it should have proper flow. But, while feeling it should be very easy to feel and it should last for long period of time. Buckets are also used for under water concreting we will come to that some time later.

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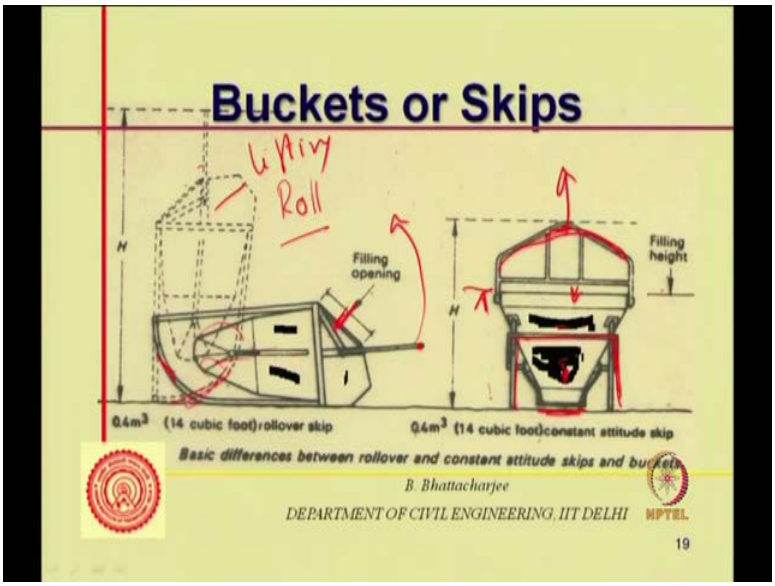

So, the two types of buckets I was talking about this one is Roll over. You know it is actually roll over and what it does is while lifting it is like this. So, this is the position while lifting while is a position while lifting while loading its position is like something like this. So, this is the one it gets lifted so you actually load it through this and concrete gets loaded here. So, it gets loaded there this mechanism is a essentially meant for lifting it up so bucket shape is something like this and then as it is filled in this is lifted like this.

So, discharge is from bottom opening you just make it to open and this is discharge is from bottom only. So, this is roll over type one can use them roll over. This is constant

height so this is height is constant this can go down a little bit but, this is the height of the bucket this is actually the height. And when its lifted you know this can come down this is the lifting mechanism it is simply for lifting right this height and this is the bucket gets supported on this frame. Bucket is supported on this frame this is actually the bucket the concrete will be inside the black portion is a concrete so concrete is inside. So, while lifting you know this is while in position while loading is from the top, the bucket is in this position it is simply supported on this frame and while lifting you can simply lift from this position.

Now, you can see that it is wide open this also has to be wide open here this also has to be wide open. So, buckets main thing is 2 kinds of design actually but, there can be various other kind of design possible. Essential requirement is this should be wide open, as open as possible and should not be very narrow and not in one corner. Because, if it is wide open. And bottom opening type that is much better. So, this can be opened by let us say first you close it, then load it, and when it reaches the concrete reaches, simply the gate here can be opened it might be hooked or some sort of mechanism..

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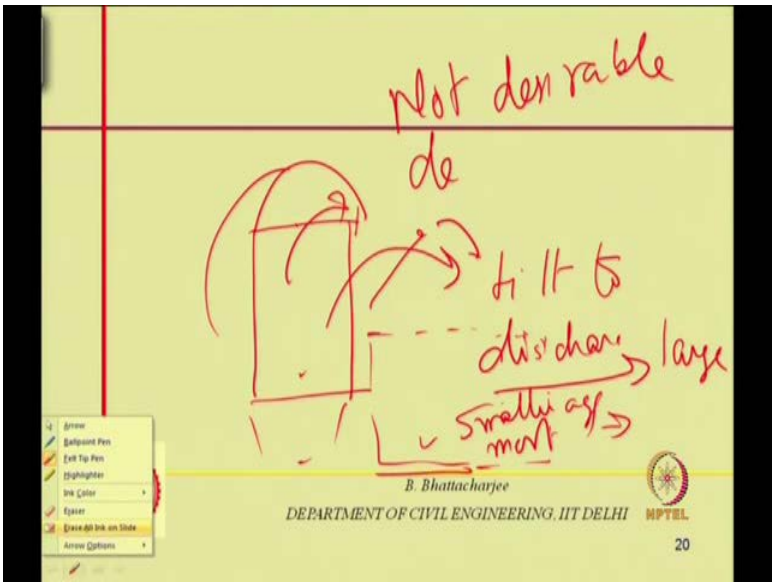

Now, conventional some time we people would use this kind of buckets, large cylindrical buckets with a hook and you know just tilt it to discharge tilt to discharge. That means it will take a shape of it like this while discharging. You know and manually discharge takes a shape like this. So, while it is in some position here because it has been tilted

large size aggregate will get tendency to go out this is not the best way to do so discharging from the top is not desirable, discharging from the top is not desirable tilting this one and actually discharging the concrete is not desirable. It should be bottom it should always be bottom it should discharge should always be from the bottom because, if you try to tilt at this charge large aggregate if the concrete is little bit dry, not comp able or self compacting concrete that concrete off course, does not require all this.

But, slightly drier concrete would if you are trying to tilt it the large size aggregate will have a tendency to go further away. So large size you know large aggregate smaller aggregate and smaller mortar aggregate and mortar would have a tendency to remain close. Because, you are tilting so large particle will go away paste and you will find that the segregation at the point of discharge. So, this is been used quite often sometime these are used but, that is not the best thing to this is not. The best thing to do one should be using bottom opening bucket, one should be using bottom opening bucket and large opening.

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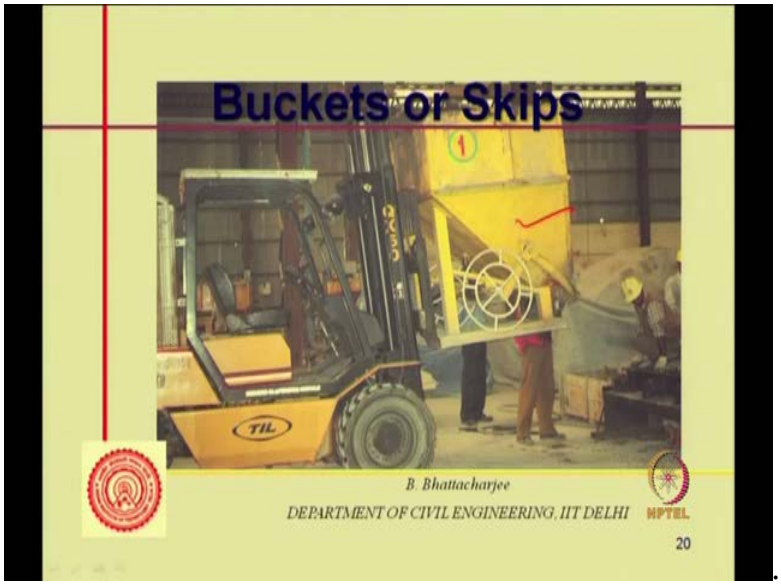

For example, this photograph shows a bucket here. So, this is the bucket but, this is not a very good bucket this is inclined although the opening is here. This is actually a fork lift which has lifted it up and it has been concrete his has been transported using fork lift. It will be discharging somewhere ahead. So, fork lift transfers that is not the best thing to do. So, this bucket actually while on to the ground it is supported like this like simply

supports here but, this inclined discharge is not the best thing to do. And this should be narrow while inclination in the discharge actually faced to have a tendency to you knows block here, clog here. And that is not the best thing that is not the best way to actually discharge concrete it should be bottom open wide open bucket bottom open.

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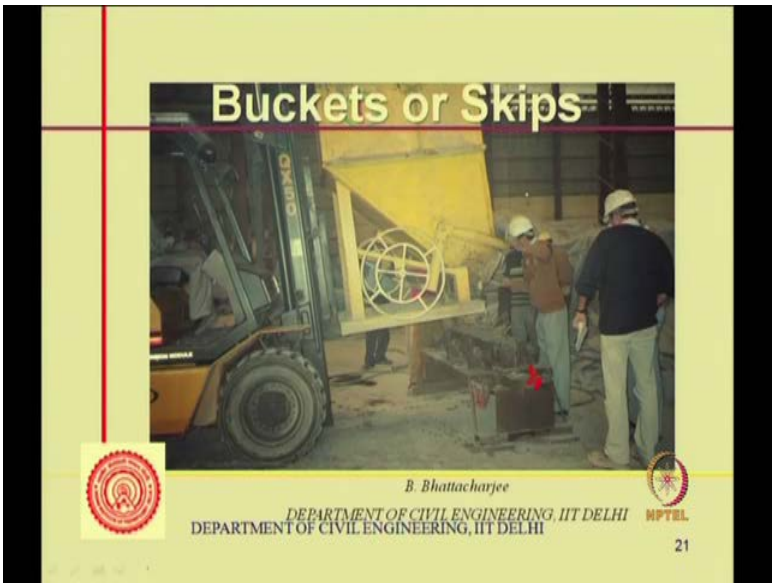

Wide open bucket for example, this is one discharging somewhere there it is you know it is actually discharging concrete into this mould. And this is not the best bucket as possible discharge is through this particular end and this is not you know this position is not the best thing to do. It should be bottom often preferably and with a wide opening you know. So, that the gate can be closed and open easily and smoothly most of the concrete should be discharge.

So, this was related to bucket. So, important point is this one is using bucket and very commonly used you know main porting concrete one should be careful. Because, segregation is the major issue so, while transporting concrete one has to be very careful segregation is the major issue. As I said you know if the bottom is narrow nothing will pass through it possibly only paste will go aggregate will go later. So, narrow opening should not be there large opening and bottom opening large opening and bottom opening should not be tilt because tilting can be done in segregation. So, you know to remix it again etcetera.

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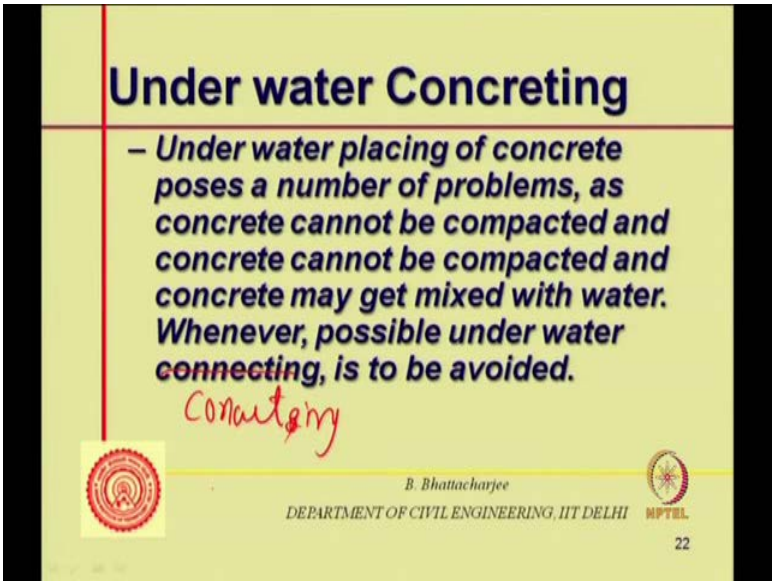

So, this is very important. Now, one important place will be looking through while transporting concrete under water placing concrete causes a number of problems. You cannot compact the concrete and you know concrete may get mixed with the water. So, whenever possible under water concreting in an underwater concreting should be avoided this is not connecting. They should be concreting it should be concreting underwater concreting should be concreting should be you know.

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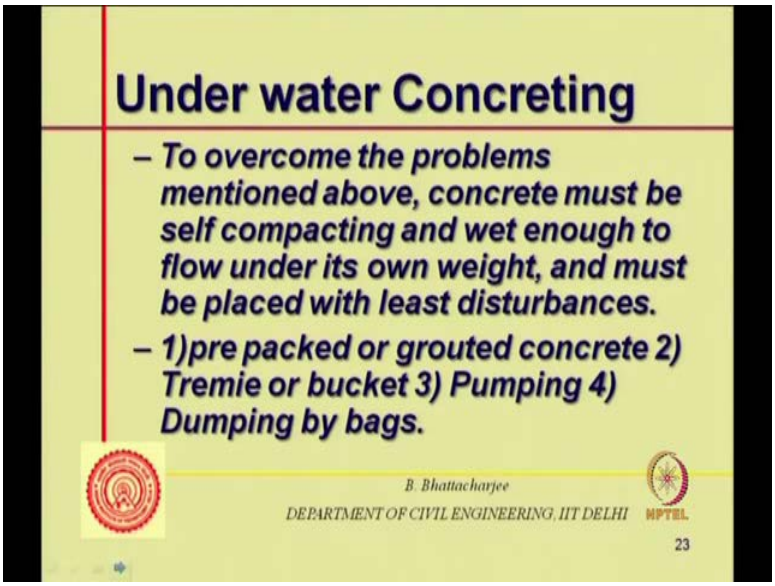

Avoided this should be avoided actually under water concrete should be avoided. You know well today we have self acting concrete so, we can actually go compact may not be any issue you can pump the concrete so that also may not be any issue but, still mixing with a water getting mixed with water that is usually an issue. So, they are many ways of doing it actually underwater concreting, concrete must be self compacting and wet enough to flow under its own way emerged placed with least disturbances. One may use what is called anti wash out at mixtures, one may use what is called anti wash out at mixtures which actually thicken is the concrete. So, or something similar to what is called viscosity modifies. So, that would ensure that it you know it does not lose much of the cement. So, one of the way off course is use pre packed or grouted concrete.

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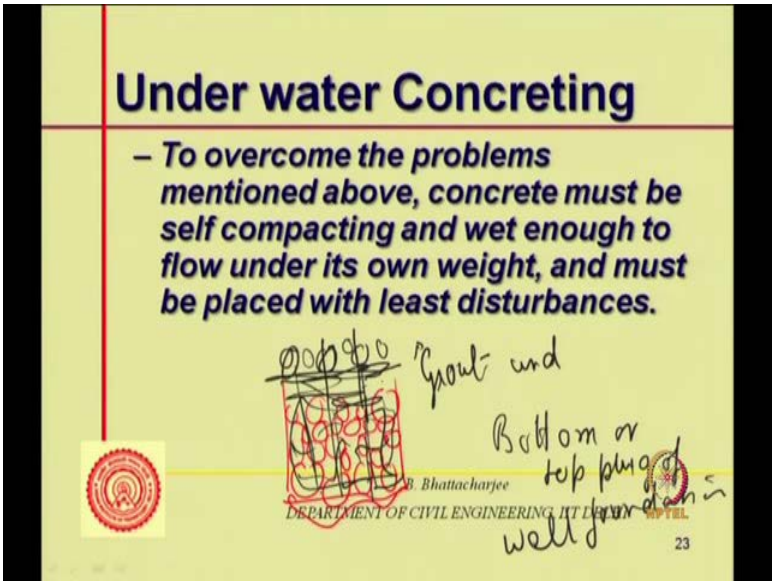

You know tremie or bucket as usual see pumping and dumping by bags. Now, plotted concrete is a pre packed or grouted concrete is you know see this well foundation, we do something called Bottom plugging. Bottom plugging blabbing so well is sun one the well sunk well is being as sunk boulder's are dumped, boulders are dump. So, you dump the boulder, then lower the pipes simply grout pipes and they you know the actually first pipes are lowered and the boulders are dump over it. So, just us see how it looks like something like this you know you have a lets us say you have well you dumb bottom of the well. Let us say and you dump the boulders of different sizes up to certain height which you can found it out by you know find out by what is called sounding.

Then, pipes are already so are already there in the beginning pipes are already inserted there in pipes brought in pipes and they go right up then inject that grow out through this inject the grout inject you no grout under pressure. So, grout under pressure goes in, and in its faded inside and then mix this grout at concrete. This is what is used in bottom plug, bottom or top plug of well foundation.

Because, in a well for a bridge you use a well foundation. There will be water well foundation inside the well there is water. So, what is done is once the sinking of the well is over you do what is called bottom plugging. So, actually make it heavy, stability as well as put you make a kind of concrete there.

So, the first put down the pipes, grout pipes and each cement 1 is 2 3 cement motor we use with you know it is a but, then it has to flow. So, there is a lot of water sometime one can use actually we plaster seizer and any other kind of mixtures like actually. Shrinkage compensative may be that is not usually one. We use a plaster seizer or generally is simply at the grout you know using a call grouting process as it is called. So, basically, grouting you do so it actually plugs of the bottom.

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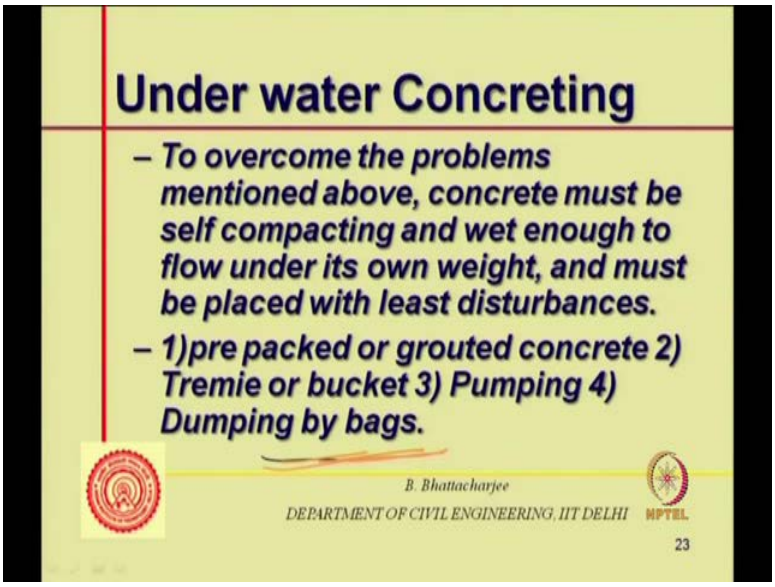

Then, you feeling soil here soil is filled in here and when you do again what is called it a Top plug. So, what you do is again top plug so top plugging is you know top plugging is done here actually, top plugging is done here you know top plug you do here. So, you do

top plugging again boulder dumping and same thing. So, this is the process by which actually you do under water concreting in case of well foundation.

And that is essentially using the kind of grout that I talked about. Now, dumping by bags is also possible to dump by bags is also possible to use bags and dump it by bags. You know it is also possible to use dump it by bags. So, what you do put the concrete inside the bag and the simple dump it. Now then, you are doing it what you are doing you are actually some place were just filling in concrete with the bags. So the bags keep concrete away from the water not you know it can be done. Some were at the shape of the things are not very important you just want to some dump bags and that is. Pumping can be done and the nosal of the discharge nosal must be always below the concrete itself.

Tremie concrete it very common in franchise. And that is what it will look something like this cement concrete is you know it look something like this.

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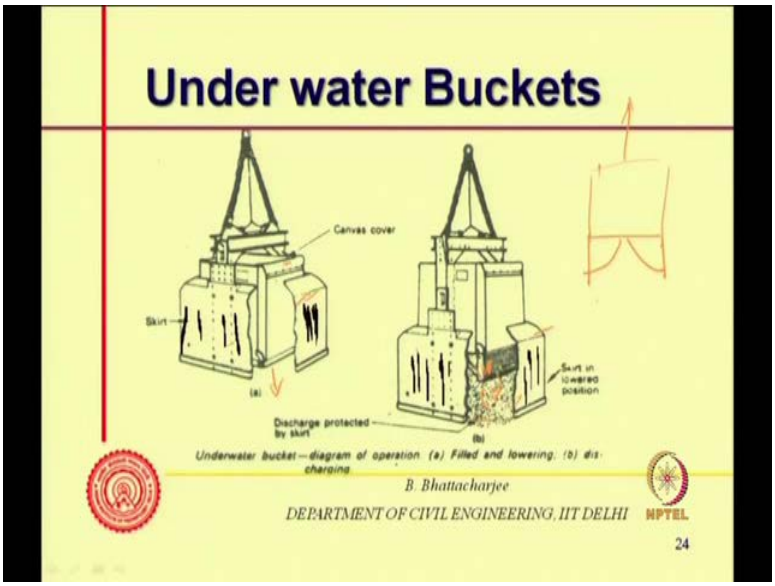

So, let us see the buckets and then, now under water buckets could be something of this kind this is not a Skart. It is called a Skart. Canvas cover under skart. So, you have a bucket which is the bottom discharge open that means it will open like this you no like this is the bucket in close position and while opening simply this will get open like this. This bottom will open like this. If, you see this portion has opened. So bucket is something like this bottom of opening complete.

But there is a skart outside. So, this skart normally as you are transporting the concrete it is up. So once in this portion goes in touch the bottom like this you know bottom. The skart actually will open up and concrete will discharge with in this skart. So, concrete is this skart portion so this is concrete is a concrete and concrete is discharge within the skart. So, that you know it does not get mixed up with water in immediately. So this one way it will depend upon were you using. So, this one first this is the way the spirit and loaning and this is the discharge. So this is the discharge.

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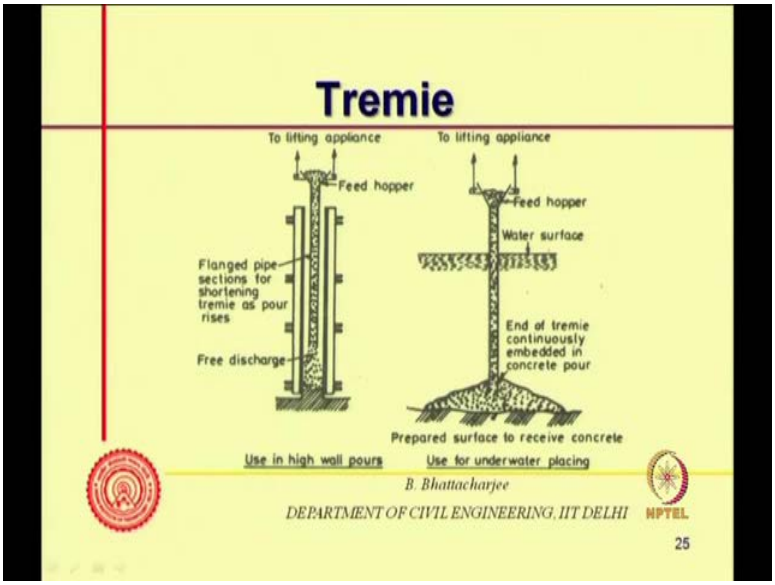

So, bucket but more common is what is called Tremie concrete, at tremie process. Now, in tremie processes actually done into clench. And any way actually any way you know you can do it so in crunches for examples. Or let us say piles casting see to piles, in casting see to piles first you drill the board hole, and then put bentoniles slurry to stabilize the water around. And then, dilute the interknit and put that tremie pipe inside and discharge. Now, one thing the pipe bottom must be inside the concrete, here also it is actually this pipe bottom must always be below the concrete. So, first is prepare surface to receive concrete weather there can be some preparation or water verities, and end of the tremie is continuously below the top surface of the concrete.

So, to start with actually what you do to start with a little bit of concrete you know you put the concrete actually little bit. But, that concrete will be you know it forms a heat but, concrete some other concrete will actually come in contact with water. But, later on you

have always the trieme bottom of the tremie pipe below the concretes so this portion if it is discharging actually concrete will built up from here.

Now, this surface is in contact with water. So is the case here the top surface of the concrete is in contact with water, rest of the inner concrete will never be in contact with water. And this pipe once it is field in let us say once you have filled in the concrete up to this way you lift it up. So, there is a you can lifted up when means flange pipe so there are flanges you make connection there are segments or sections.

So, you make connections and as you make the connections through the flame gradually you lifted up depending upon what is a you know how much of the concrete is in place. So, lifted up and there here there is a off course, a hopper so which concrete is dropped through the concrete is dropping but, dropping to the you know depending upon the height if you dropped from a too much of a height I mean it is you know dropping height should be a chute actually. So, you have a chute through which you drop the concrete and the concrete comes down below the surface of this is the hopper and gradually you can lifted up remove the hopper. Remove one of the segment of the pipe, connect the hopper bag and so on so force concrete in can concrete proceed in the manner.

So, this is the special case of concreting below the water well. Today off course, you can simply put the pump you know the host of the pump and the nozzle just at this position and you are not compacting the concrete. So, concrete should be as flowing as possible in good old days people would make a very high slump and also use very low water cement ratio. Essentially, to see that because water cement ratio is you know might get disturb. Modern days of course water cement ratio still is an issue it can keep it low. But, one can use the pump or self compacting sort of concrete pump able concrete which will go inside and which will actually when flow. So, that is actually related to high you know under water concrete on concreting.

So, we have discussed actually most to the method related to concrete transport, transporting concrete and also before that we looked into transportation by ready mix concrete. You know trucks which actually combines the mixing as well as a mixing as well as a transporting process together. And most commonly used today off course, is a combination of truck and agitator truck and a pump. Now, well discuss about pumping of concrete in our next module I mean next lecture of the same module. And today of

course, we have discussed all the methods of transportation transporting concrete and ready mix concrete. So, main issue while transporting or even transporting through ready mix concrete it is essentially 2 issues one is a segregations concrete shall not segregate in any manner and other issue is related to loss of slump while transporting.

So, you should not segregate because placing of concrete should be within the initial setting time of cement off course, but then the setting time of the concrete. Setting time of concrete can be different then the cement as I said because, I can add a retarder or some kind of plasticizer retarder combination. This would actually delay the setting of the concrete itself. So, I must place with in that period of time the doming period which we discuss in the beginning you know the reaction domain period during which actually cement hydration reaction, plate expressed goes from the plastic state to the solid state.

So, during which I should do it and then it should remain cohesive and should not lose it is a uniformity as per as possible no segregation. So, this is what you summaries today transport of concrete. We looked into all namely you looked into the names of the methods or we discuss in the details and followed from this well be discussing about pumping in the next lecture.