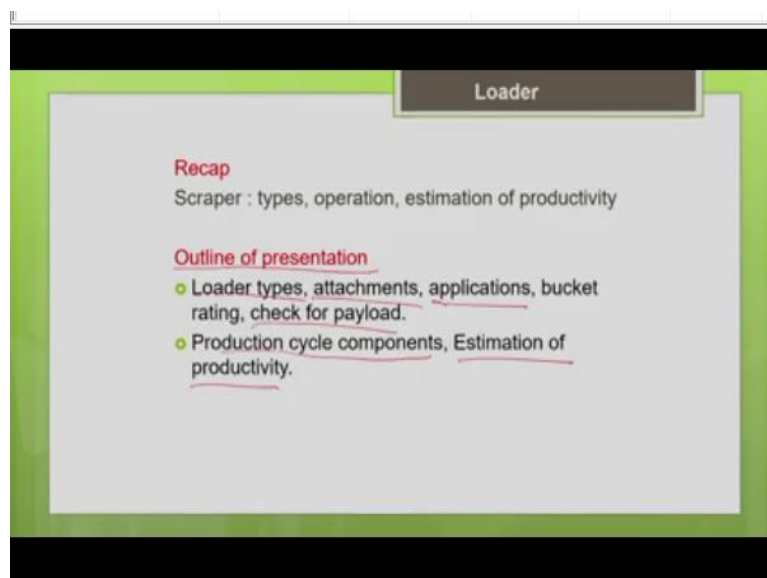


Construction Methods and Equipment Management
Prof. Dr. Indu Siva Ranjani
Department of Civil Engineering
Indian Institute of Technology-Guwahati

Lecture-13
Earth Moving and Excavating Equipment-Front End Loaders

Hello everyone, I welcome you all to the lecture 13 of this course construction methods and equipment management. So, in this series of lectures on earth moving equipment, today we are going to discuss about the front end loaders. So, in the last lecture, we have discussed about the scraper.

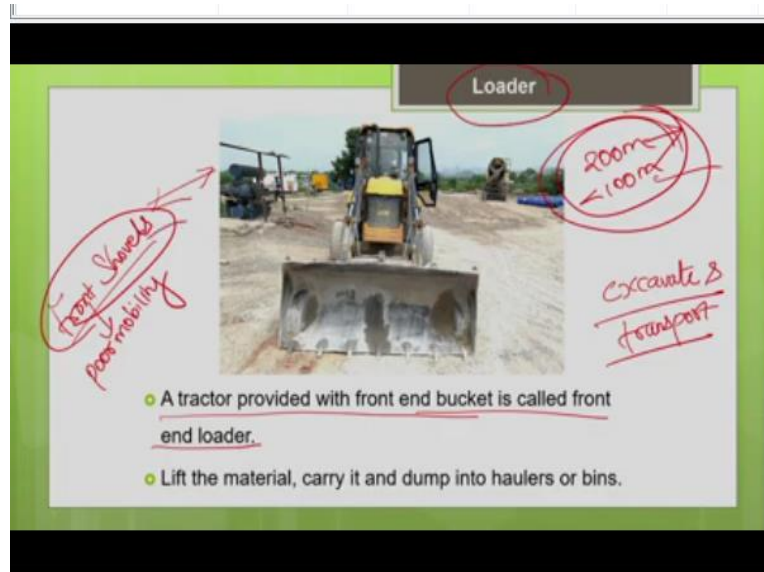
(Refer Slide Time: 00:44)



Like the types of scraper, application, operation scraper and how to estimate the productivity of scraper we have discussed. So, let us see what is the outline of today's presentation? In today's presentation we are going to discuss about the types of front end loaders, what are all the different possible attachments for the front end loaders and what are the applications?

And how to do the bucket rating for the front end loader and the significance of bucket fill factor and how to check the payload from stability perspective and how to define the production cycle of the loader and what are the components of production cycle and illustrations of how to estimate the productivity of the front end loader. So, these are the components which are going to discuss today.

(Refer Slide Time: 01:28)



So, as the name indicates, the front end loader means it is basically a tractor with a bucket at the front end a tractor provided with the front end bucket is called the front end loader. So, you might have seen this front end loader very commonly in many project sites. So, the basic difference between this machine and the; earlier machines which have discussed like bulldozer and scrapers is that.

This machine has a mechanism which facilitates it to lift the material and load it into the truck. So, you have a boom kind of thing which allows you to lift the material, you can lift the bucket and load it into the truck. So, this is not possible with the bulldozer and scraper where you cannot lift the material and load it into the truck. So, that is one advantage of this machine over the earlier machines what we discussed.

So, this is basically a kind of excavator, which is good and excavating at or above the ground level. So, in addition to that, it can also transport the material to certain distance that is one advantage of this loader. So, it can excavate as well as transport the material. So, that is the advantage of the loader. But when you compare this machine with the other excavators like fixed position excavators which we are going to discuss in the upcoming lecture.

Like front shovel the shovel so, we can compare this machine with this front shovel, you can see that this fixed position the front shovel is a fixed portion excavator, which is very good in excavation, but it cannot transport the material to a particular distance, it has very poor mobility. So, it has very poor mobility when compared to loaded front end loader. So, your

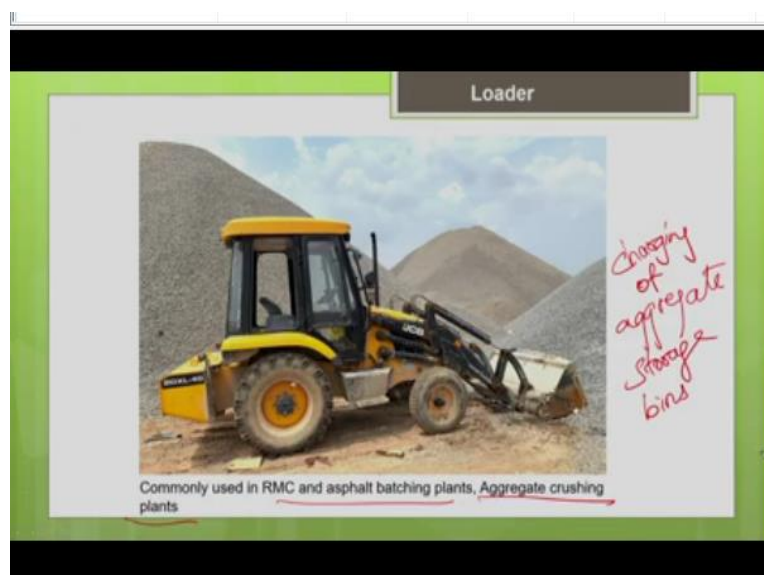
front end loader can give you an economic haul distance of say it is going to wheel loader it can even go up to 200 meter.

So, if it is going to be crawler loader it will be less than 100 meter, but if you look into this front shovels the haul distance will be maybe less than 20 meters. So, this is not designed for transporting the material, this front shovel. Front shovel are fixed position excavators which can just stay at one place. And you can just swing the boom from the loading to a dumping position.

So, but the advantage of the loader is it can excavate the material as well as it can move it to certain haul distances, say depending upon the mounting you can go up to 200 meter for wheel loader or less than 100 meter for crawler loader. So, that advantage you can have with the front end loaders, when compared to other excavators like front shovels. So, we have just compared the front shovel and the front end loader.

But basically discuss from the cost perspective, you can see that the loaders are cheaper when compared to front shovels, there is another advantage.

(Refer Slide Time: 04:17)



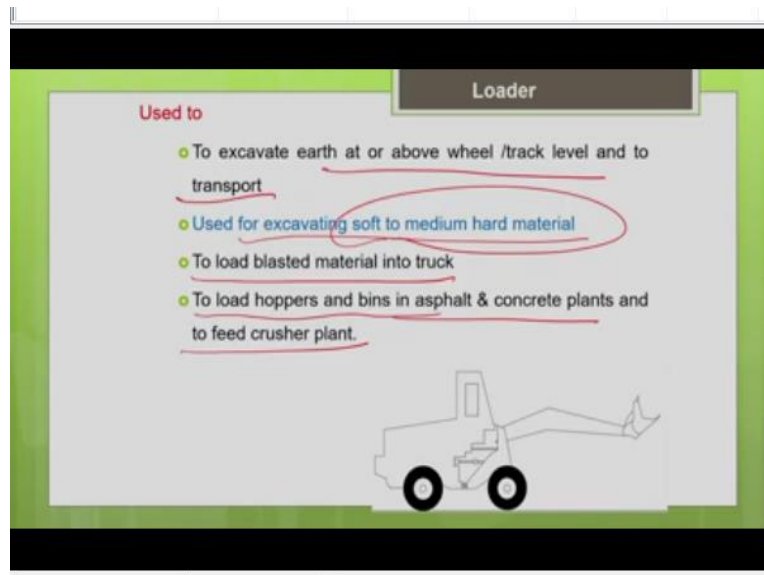
So, very commonly, you can see this front end loader in the batching plants your ready mix concrete factories or asphalt batching plants, you can see this machine very commonly. So, like in the batching plants, you can see that the aggregates will be brought with a truck from the aggregate production plant and the truck will dump the aggregate at the batching plant.

So, from the dumping stockpile, this material the aggregates will be carried by the loader and loader will feed the material into the storage bins. So into the aggregate storage bins, there will be some storage bins for aggregates at the RMC batching plant that charging up aggregate storage bins will be done with the help of loader.

So, the loader will carry the material and then load it into the storage bins. So, that is another application and another thing is it is also used in aggregate crushing plants. In crushing plants, you can see that the loader can dig the quarried rock the blasted rock or a short rock. So, this loader can dig it, load it and then it can transport it to a certain distance and then take it to the aggregate crusher.

And feed it into the hopper of the aggregate crusher, so that way they can help. See in certain cases where the haul distance, the transporting distance is not favourable for this shovels your front shovel, in that case, you can go for a loader which is both good in excavation as well as you can transport it to the required distance. So, in that case a loader will become advantageous when compared to the shovel. So, these are the applications of the loader.

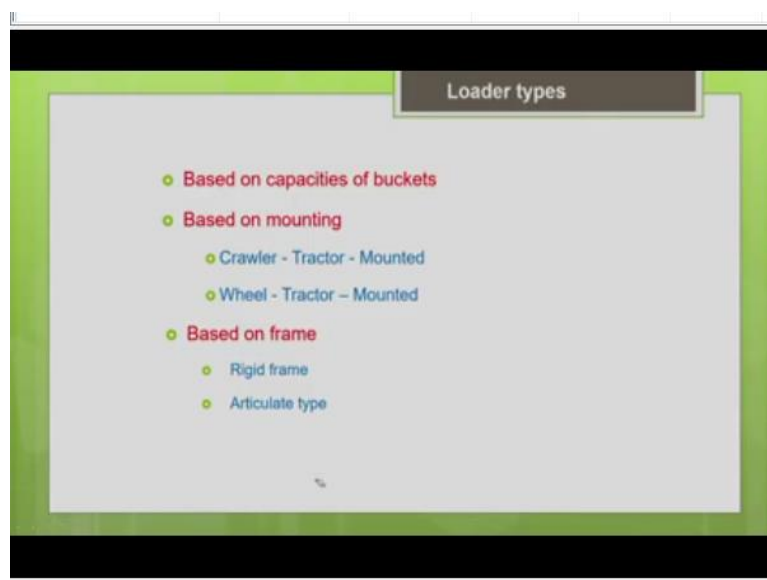
(Refer Slide Time: 06:08)



So, let me just summarize. So, basically the loader is good in excavating at or above the wheel or track level and also it is used to transport the material to certain economic haul distance. We have discussed the haul distance, it varies depending upon the mounting of the machine and it is designed for excavating soft medium hard material, with softer medium hard material, you can get a good productivity.

But for a very hard material you can do it but the productivity will be slightly lesser and very commonly you can see in the quarries, should load the plastic material into the truck that is one application. And as I mentioned just now, it can load the hoppers and bins in the asphalt and the concrete plants to load the aggregate bins in the asphalt and the concrete plants and also to feed the aggregate crusher use a loader. So, these are the different applications of the loader.

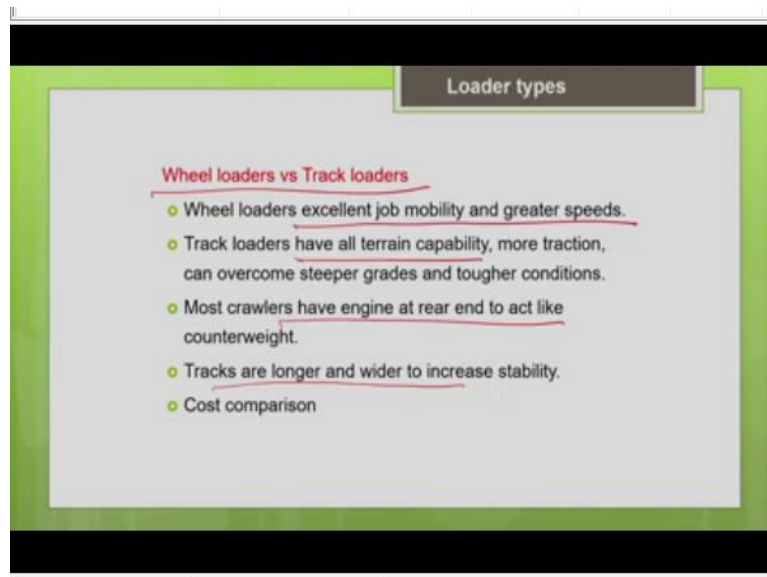
(Refer Slide Time: 07:05)



Now let us see what are all the types of loaders you can classify the loader based upon the capacity of the bucket or based upon the mounting or based upon the frame. So, based upon the capacity of bucket, you have a huge range of the capacity say starting from less than 1 meter cube say 0.2 meter cube to as big as say 15 meter cube bucket is also available. So, depending upon your requirement you can go for the corresponding bucket the size accordingly.

And based upon the mounting as we discussed earlier machines also it can be either a crawler mounted or track mounted or it can be wheel mounted and based on the frame, it can be rigid frame or articulate type frame, we are going to discuss all these things one by one in the upcoming slides.

(Refer Slide Time: 07:50)



So, first let us compare the wheel loader versus the track loader. Obviously, as you know, wheel loader will give you high mobility. So, wherever you need higher speed and greater haul distance, you can go for the wheel loader, with wheel loader I can go for economical haul distance of up to 200 meter. So, excellent job mobility and greater speed, but the main advantage of track loader is it has all terrain capability.

That means it is suitable for very poor underfoot conditions, it can climb steeper grades for a very rocky terrain or clay terrain very poor underfoot conditions also it can give you better productivity with the track loader. So, another important thing you should know that so, obviously the track loader will give you a better traction. So, because of the tractive effort generator and the breakout force generated will be more in the case of track loader.

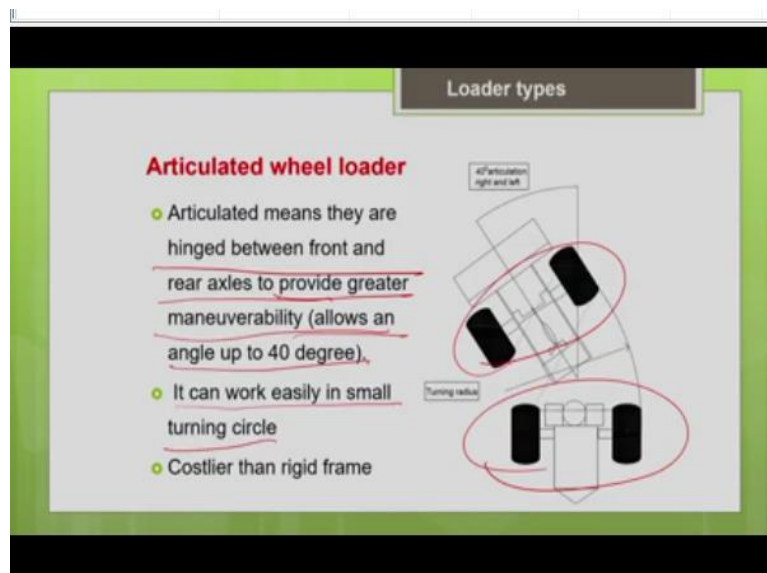
So, that is why for very tough job conditions, particularly for the quarries for handling the rock, it is preferable to go for the track loader, which can generate more amount of tractive effort and you can see that these loaders are particularly since it is carrying the material and travelling for a particular haul distance we are very much concerned about the stability of loader, we should take care that the machine should not tip, it should not tip forward.

So, for that case we have to see that machine stability should be taken care. So, basically even in the track loaders, you can see that the tracks will be generally longer and wider. So, that you can increase the stability; particularly for the loaders that tracks will be longer and wider. So, from the safety perspective and also most of the crawler loaders you can see that the engine will be at the rear end.

Because weight of the; engine will also act like a counterweight to the load in the bucket. So for the purpose they might have engine at the rear end. So, if you compare the cost obviously your track loaders are going to be costlier. The ownership cost is going to be costlier for your track loader. But you estimate the cost, work out the economics through the life of the equipment you can see that the replacement cost of the tyres the wear and tear of the tyres will be more for the wheel loaders.

So, that will make the wheel loaders expensive when you consider the tyre cost in the operating life of the machine.

(Refer Slide Time: 10:14)



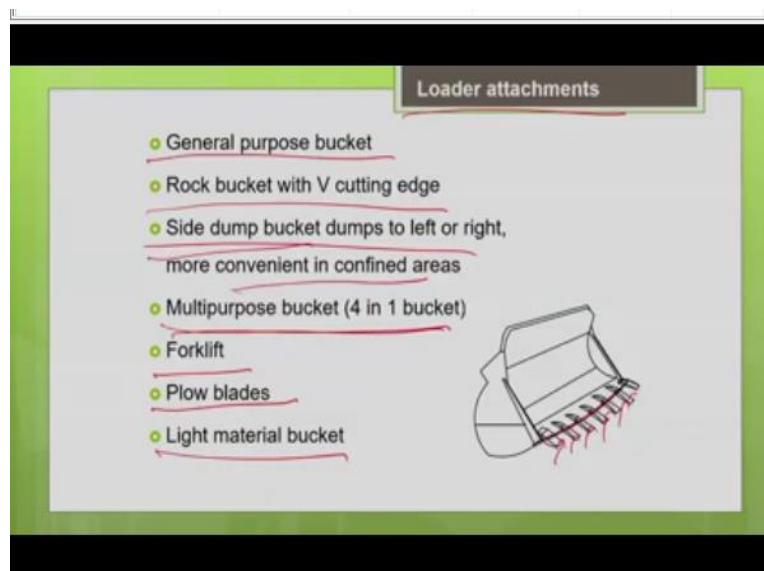
So, we have to work out the economics and select accordingly. Then based upon the type of frame, you can either go for a rigid frame or you can go for a articulated frame. So, what is this articulated frame, basically there is a pivot joint between the front axle and the rear axle, there will be a pivot joint the machine is hinged between the front and the rear axle. So, this joint will facilitate better turning or manure it.

So, like you will have a better turning ability for this machine. So, even in a very confined area, it is possible to work with this machine. Say for example, you are working on the side of the road some trenching work is being done on one side of the road. In that case turning will be very easier to work in narrow spaces with the help of articulated wheel loader when compared to rigid frame loader.

Because this machine will have a better turning ability due to the joint, the pivot joint between the front and the rear part. So, you can have an articulation of say 40 degree in the horizontal plane either to the left or to the right. So, we can see this in the picture. So they are basically hinged between the front and the rear axle to provide greater maneuverability, it allows an angle of up to 40 degree in the horizontal plane either to the left or to the right.

So, this machine can easily work in small turning circle. Of course, it is going to be costlier than the rigid frame, but the cost can be justified whenever you want the machine to work in a very confined area or spaces with space restriction. Now, let us see what are all the possible loader attachments?

(Refer Slide Time: 11:53)



There are different types of attachments possible depending upon the attachment where application of the loader will vary. So, the first one is a general purpose bucket, which we commonly used for handling the earth. So, as we discussed earlier for the bulldozer, even for this bucket or the bucket proper, you will have the cutting edge. So, generally the cutting edge gets worn out fast due to the wear and tear.

So, this cutting edge will be just bolted on it will be just bolted on to the bucket proper. So, you need not replace the bucket frequently. So, only the cutting edge we need to replace it frequently depending upon your usage. So, the cutting edge is just bolted on. So, in general purpose bucket there will be just one plain cutting edge you may not even have this teeth, these are called as a teeth, they are the V shaped cutting edge with a bucket teeth.

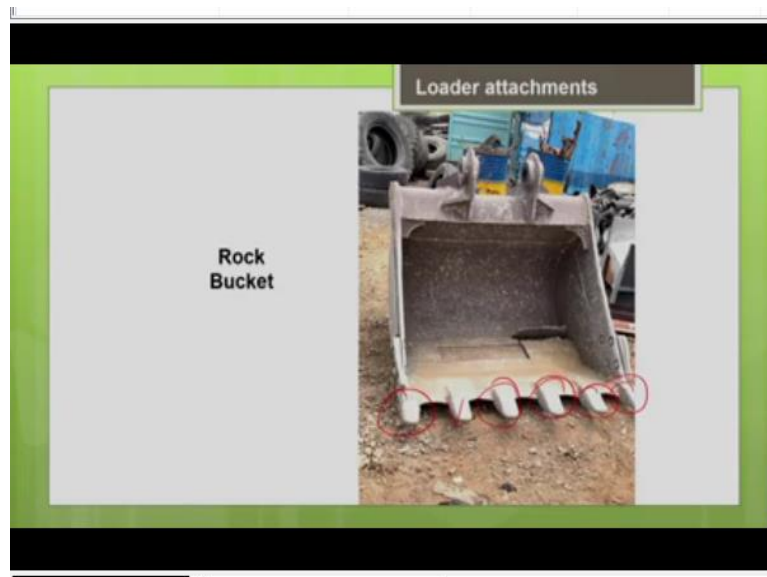
So, basically, in the general purpose bucket, you can see the cutting edge of the plain. You do not have the V shaped cutting edge of the teeth for handling the rock. But if you are going to handle the rock, you have to go for a special bucket like this rock bucket with this kind of teeth with V shaped the cutting edge. The teeth have the shaped cutting edge with which it can easily loosen the rock and it can easily fill the bucket with the rock.

So, this type of cutting edge will help you to loosen the rock. So, this is usually used for the rock bucket. And there is something called a side dump bucket. So, generally, instead of dumping in the front end, if I wanted to dump in the side end, either to the left side or to the right side, then I can go for this side dump bucket attachment. So, this will be more convenient if you are going to work in the confined areas.

Like say for example; as I told you, when I am doing some trenching work on the side of a road. In the case, if you want to dump into side end with the side dump attachment, it will be very easier to dump instead of turning the entire machine, then multipurpose bucket. This is something called 4 in 1 bucket, that the same bucket can be used for different applications. You can either use it as a bulldozer blade, or you can use it as a scraper, or you can use it as a loader or you can use it as a clamshell.

We will see what is it an upcoming slide and another attachment called forklift for lifting the objects, for lifting the precast elements. I can use this forklift. Then plow blades attachment, particularly in the snowy areas for clearing the snow. Then light material bucket. Basically when you are going to handle a material with the lower density, you can go for bigger bucket, but if you are handling denser material then you have to go for a smaller size bucket. This is mainly from the safety perspective of the stability of the machine perspective.

(Refer Slide Time: 14:45)



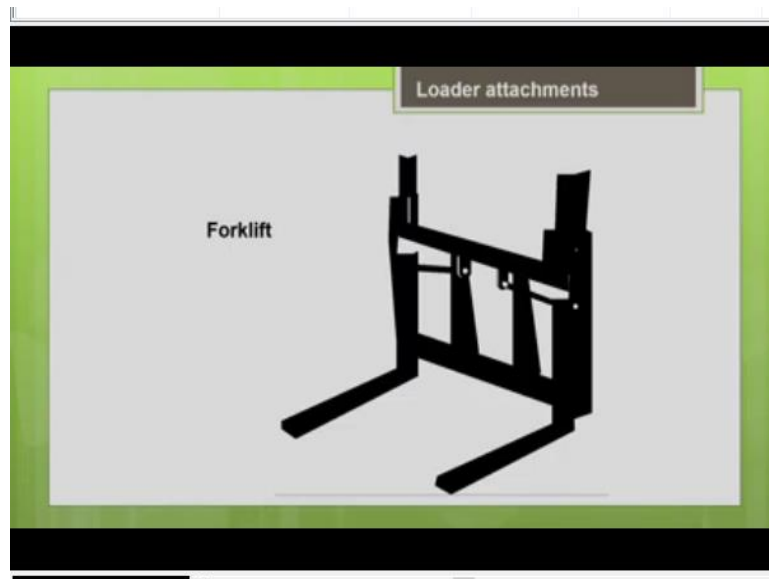
This is a picture of the rock bucket which shows the V shape cutting edge, you can see the V shaped cutting edge with this, even these bucket teeth is bolted on you can easily replace the bucket teeth when it gets worn out. So, this is particularly use for handling the rocks. When you are working with the loader in the quarries to handle the blasted rock or a short rock, then you have to go for this rock bucket, which can easily loosen the rock and load bucket.

(Refer Slide Time: 15:16)



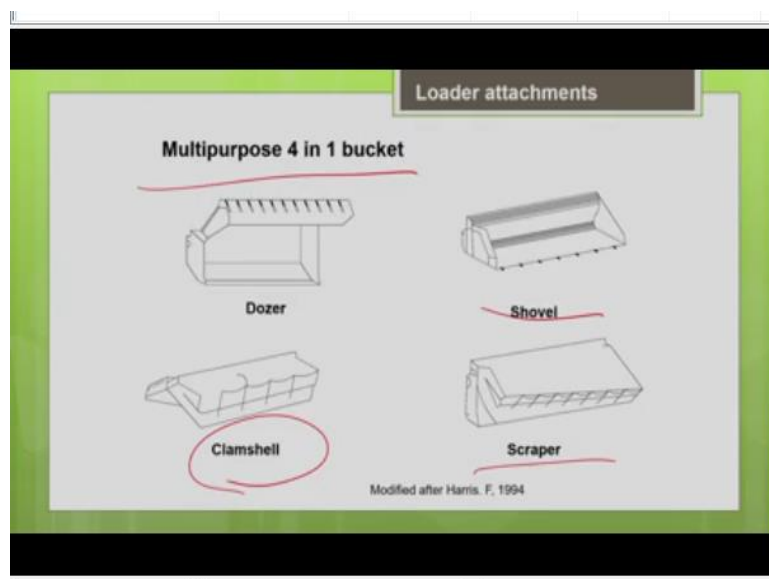
This is the side dump attachment. This is a schematic picture of the side dump attachment, which you can use it in confined areas where you want to do the dumping on one side, I do not want to do the dumping in the front end, but I wanted to do the dumping either to the left side or to the right side, then I can go for this kind of side dump attachment.

(Refer Slide Time: 15:39)



Forklift: So, you can remove the bucket and attach the forklift to the tractor. So, that you can use the loader for carrying the elements say for example, you want to carry some objects precast elements, you can use the forklift attachment.

(Refer Slide Time: 15:55)



Then the one is multipurpose 4 in 1 bucket. As I told you, all these 4 functions are possible with the same attachment, you can either use that bucket as a dozing blade or you can use it as a normal loader or you can use it as a scraper or you can use it as a clamshell. So, clamshell is something which is used for digging vertically. So, for deeper digging, we can go for this clamshell. So, the same bucket, I can use for any of these functions that is what is called a multipurpose bucket.

(Refer Slide Time: 16:30)