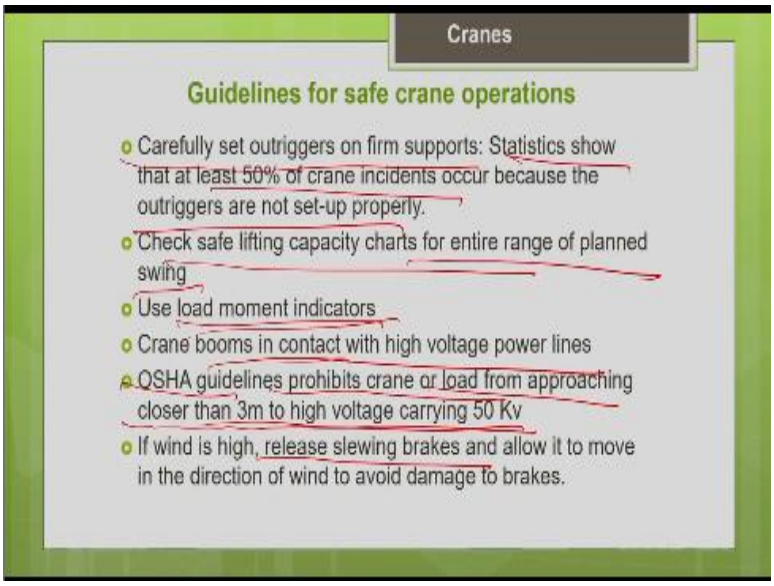


There are also some guidelines given for the safe crane operations because you know that there are so many accidents related to crane reported very commonly. So, that is why we should follow some safe guidelines when you operate the crane. So, carefully set the outriggers on firm supports because statistics shows that at least 50% of crane incidents occur because outriggers are not extended properly that is why we have to carefully set the outriggers and is also check for the soil condition.

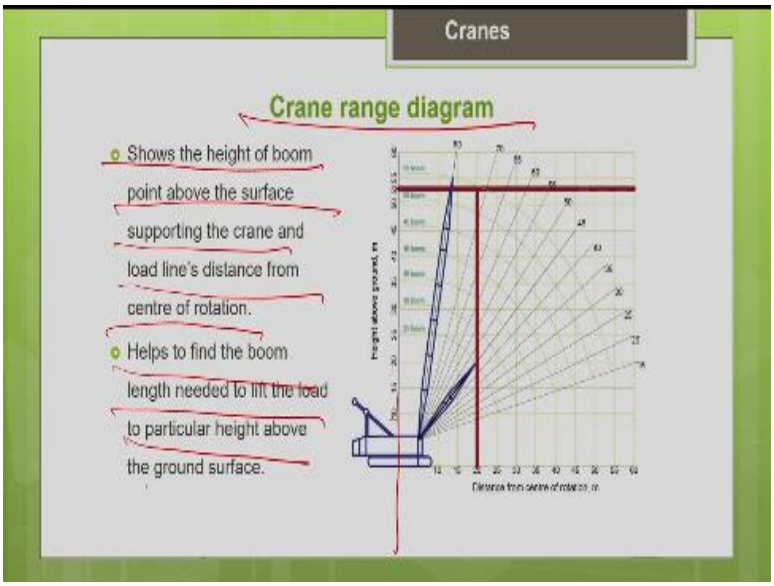
If the soil is going to be weak, provide some timber mats or steel mats and on that, you can place with the outriggers. Check the safe lifting capacity charts for the entire range of planned swing that is very important. You know that lifting capacity will vary with the operating radius and the lifting capacity varies depending upon the position of the boom with respect to the carrier. So, you have to check for the entire range of the planned swing and in modern cranes, you have this load moment indicators also.

So, if the load is getting exceeded at a particular operating radius, it gives you the warning or some alarm or indication is given. So, that we can check for the safety. Such kind of indicators are available nowadays and some of the accidents are reported due to electrocution when the crane booms are in contact with the high voltage power lines. So, that is why according to OSHA, some specific guidelines are given that we should prohibit the crane or the load from the approaching closer than 3 meters to high voltage carrying 50 kilowatts.

So, this guideline, you should keep in mind. OSHA guidelines prohibits crane or the load from approaching closer than 3 meters to high voltage lines carrying 50 kilowatts and another important thing is; wind load should also be considered. If the wind speed is very high say, as I told you as per the highest score, if it is greater than 72 kilometre per hour, you should stop the crane operation and according to the wind speed prevailing that particular area, the lifting capacity should be reduced.

And when the wind is high, you should release the slewing break and allow it to move in the direction of the wind to avoid the damage to the brakes.

(Refer Slide Time: 44:44)



So, let us see what is the significance of this crane range diagram. As a name indicates if you know what is your working range needed, you can find what is the boom length needed to satisfy the working range in my project site. That is the purpose of the crane range diagram or in the reverse way, for a particular boom length, with this particular boom length, what is the maximum working range, horizontal range and the vertical range I can have? That information I can get it from the crane range diagram.

So, what you have in this crane range diagram in the x axis is a distance from the centre of axis of rotation of the crane to the load line, distance from the centre of axis of the rotation of the crane

and what you have in the y axis is the height of the boom tip above the ground. Say, for example, if you know that your operating radius working radius needed, maximum working radius needed is 20 meters and if we want to, say, for example, I need to reach a height of say 53 meters.

The maximum height reach needed is say 53 meters. Then what is the boom length needed for my particular project? I can determine from this range diagram. These curved lines indicate your boom length. You can see the curved lines indicate the boom length. So, you can see for 20-meter operating radius and for the vertical height of say, 53 meters, the boom length what I need is approximately 55-meter boom length I need.

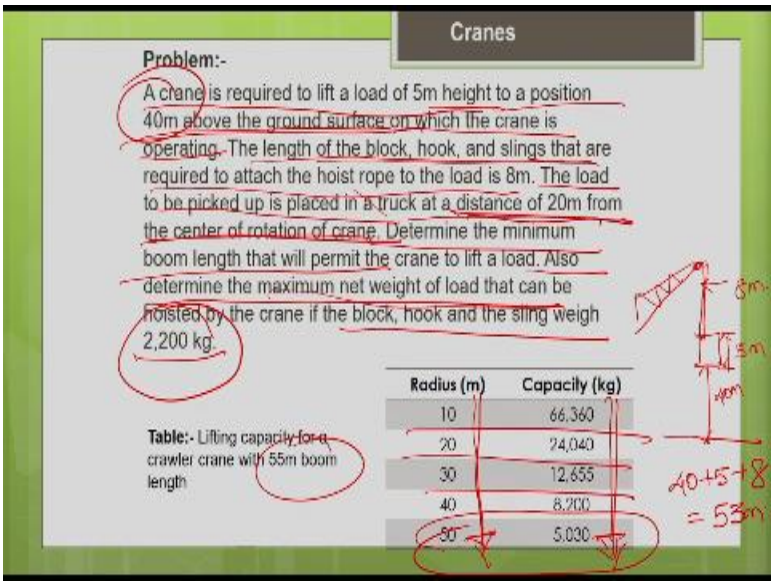
So, what is the minimum boom length needed for this working range requirement? I can find from the range diagram. So, and also, you can see that then as a boom angle varies, what is happening to the operating radius? You can see that. As a boom angle varies so, what is happening to the operating radius? You can check here. So, either way, you can use the range diagram.

So, if you know what is the maximum range needed, what is the boom length needed, I can find it or for a particular boom length, what is the maximum working range possible that also I can find it from this chart. So, this crane range diagram shows the height of the boom point above the surface supporting the crane and also, what you have in x-axis is the load line distance from the centre of axis of rotation.

It helps you to find the boom length needed to lift the load to particular height above the ground surface. If you know, this is my vertical reach requirement, what is the boom length needed? You can find it from this particular chart. So, let us know to work out the problem to find what is the minimum boom length needed for a particular working range. I will see how to use the crane range diagram which will help us to determine the minimum boom length needed for a particular working range in a project.

And also, we need to find what is the maximum net the load possible for a particular crane. So, that also, we can determine in this problem. First let us read the question.

(Refer Slide Time: 47:59)



So, here, a crane is required to lift a load of 5-meter height. The height of the load is 5 meters to a position of 40 meters above the ground surface on which the crane is operating that means the lifting height needed is 40 meter above the ground. The lifting height needed is 40 meter above the ground and the length of the block hook and the slings that are required to attach the hoist rope to load is 8 meters. So, that is also provided to you what is the length of the block, hook, slings?

And the load has to be picked up from a truck, the load is to be picked up is placed in a truck and that is at a distance of 20 meter from the centre of axis of rotation of the crane. So, the horizontal reach, the operating radius needed is 20 meters. So, that means the crane has to pick up the load from a truck which is placed at a distance of 20 meter from the centre of axis of rotation of the crane.

So, the horizontal range needed is 20 meter and the load has to be lifted to a height of 40 meter above the ground surface. This is the range given. For this particular working range, what is the minimum length of boom of the crane needed that is what we are going to determine now. So, determine the minimum boom length that will permit the crane to lift the load. Also, determine the maximum net weight of the load that can be hoisted by the crane.

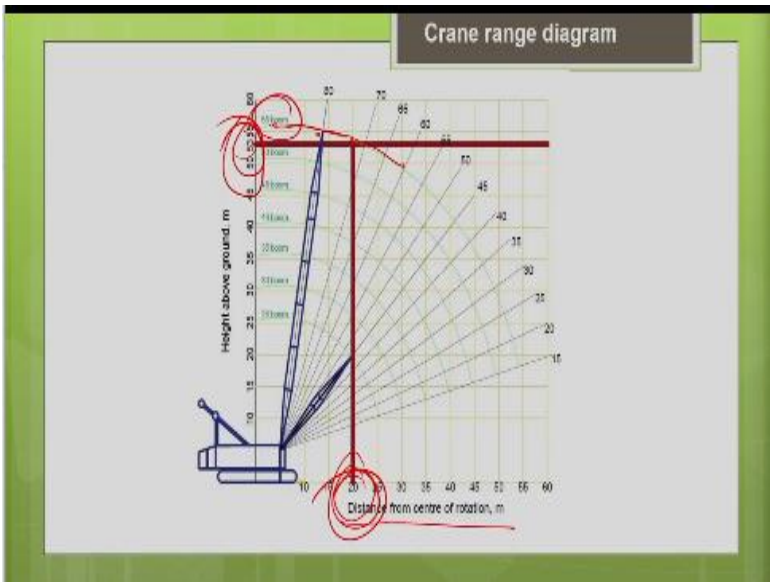
If the block, hook and the sling weight 2200 kg, as I told you when you consider the lifting capacity of your crane, you should include the weight of the hook, block, sling, everything, the rigging

device also. This is because your crane has to lift that also. So, that also has to be included in the lifting capacity of your crane. So, and its weight is given as 2200 kg. So, now, we are going to determine what is the maximum net weight of load that can be hoisted by the crane, safe net weight of load on the crane.

So, you can get the information from the load charts so, which are provided by the manufacturer. So, the load charts are available for different boom length of the crane. So, these values are taken for a particular boom length of say, 55 meters. You can refer any equipment handbook to get the different load charts for the particular crane model. So, you can see as operating radius increases, your lifting capacity is reducing.

You can see that as operating radius increases, your lifting capacity is reducing. Operating radius is nothing but the distance horizontal distance from the centre of axis of rotation of the crane to the load line. As the load line moves away from the centre of the crane, your stability is reduced. So, lifting capacity is reduced. So, at the higher operating radius, your lifting capacity is reduced. So, these values, you can take it from the equipment handbook from the manufacturer for the particular model.

(Refer Slide Time: 50:51)



Now, with the help of the crane range diagram, I can determine what is the boom length needed for this particular project. So, it is given that the crane has to pick up the load from a truck which

is placed at a distance of 20 meter from the centre of rotation of the crane, 20 meters. So, the horizontal reach, the radius, distance from the centre of axis of rotation of the crane to the load line is 20 meters. And what is the vertical height needed?

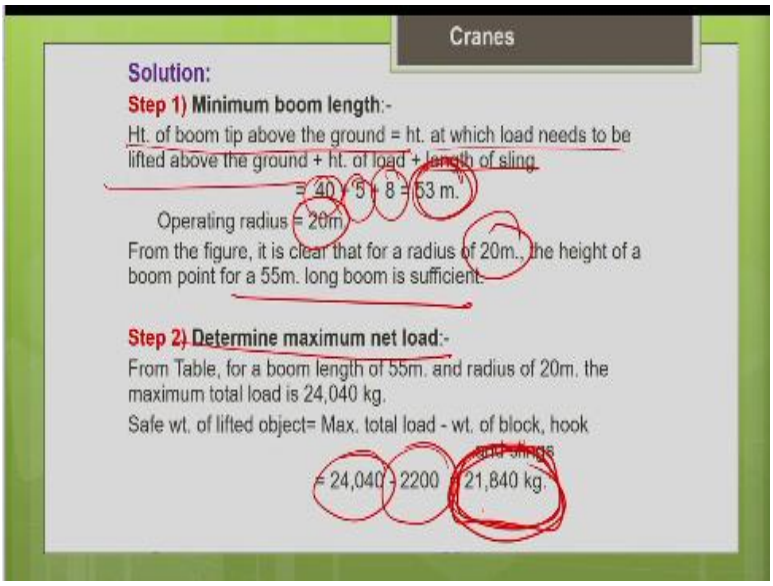
The vertical height needed is, you have to lift the load to a height of 40 meter above the ground surface. So, the load has to be, if this is the ground surface, the load has to be lifted to a height of 40 meter above the ground surface and the height of your load is given as. What is the height of the load? 5 meters and above this, you have the sling and the rigging device.

The length of the block, hook and slings that are required to attach the hoist stroke to the boom, you have the crane boom here to which it is attached. This height is, this is your crane boom assume. So, the height of this is given as 8 meters. So, in the crane range diagram, so, what you have in the y axis is here, height of the boom tip above the ground level. You have the height of boom tip above the ground level.

So, now, you can see what is your required height of boom tip above the ground level is 40 plus 5 plus 8. So, that is nothing but 40+5+8 that is giving you value as 53 meters. This is the height needed, 53 meters for the height of boom tip above the ground level 53 meters and for the horizontal distance of 20 meter. To reach, for this vertical reach and for this horizontal reach or this working range, what is the boom length needed?

The intersection point, you can see, it is closer to boom length of 55 meters. So, the boom length chosen is 55 meters.

(Refer Slide Time: 53:06)



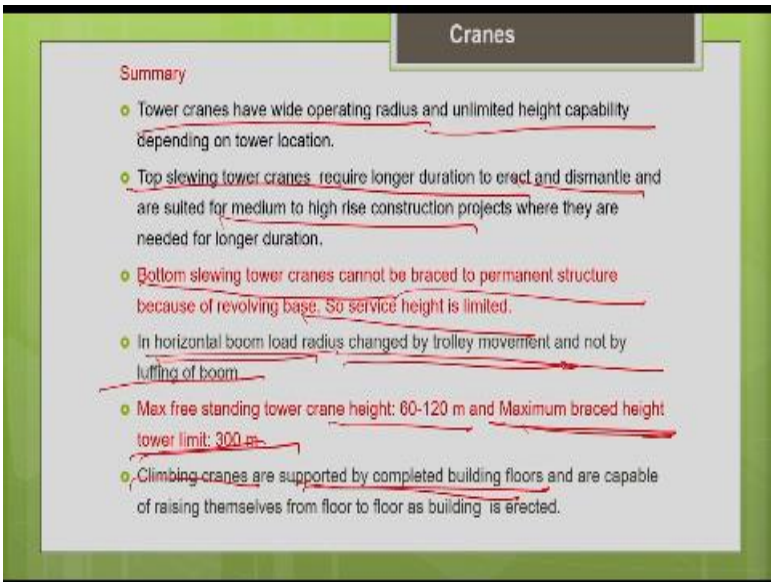
So, that is what is given here. The height of boom tip above the ground equal to height at which the load needs to be lifted above the ground, it is 40 meters. Height of the load is 5 meter plus the length of the sling is 8 meters. You add everything; you get 53 meter that should be the height of boom tip above the ground that is what you need for this particular project. And the operating radius, the horizontal radius is 20 meters.

So, from the crane range diagram, for these 20 meters and 53 meters, we have chosen the boom length of 55 meter. So, what is the minimum boom length needed is 55 meters. Now, you determine what is the maximum net load now using the load chart. For the 55-meter boom length, the load chart is given to you and for the 55-meter boom length you can vary the radius by changing the angle of inclination of the boom. Say, now, the radius I mean the working radius needed is given as 20 meters.

So, for the operating radius of 20 meter, the lifting capacity possible; the maximum lifting capacity possible at this 20-meter radius is 24040 kg that you can take it from the load chart given by the manufacturer. So, maximum total load permissible is 24040 kg. So, from this, you have to detect the weight of your sling and the hook block everything. So, this is the actual weight of the load you can lift excluding the weight of the hook block and the sling, other accessories.

So, what is that the maximum lifting load possible from the safety of the crane for this particular boom length for this operating radius, it is 21840 kg. This is how you have to determine what is the maximum load possible for the particular crane at this particular operating radius.

(Refer Slide Time: 55:02)



So, now, we have come to the end of this lecture. Let me now summarize what we have discussed earlier. So, the tower cranes, you know that it can give you wide operating radius because you can place it very close to the structure and you can place it even inside the structure which is being constructed and it gives you unlimited height capability depending upon the tower location that is the main advantage of the tower crane.

And there are different types of tower crane based on the method of slewing, you can classify into top slowing and bottom slewing. Top slewing tower crane requests longer duration to erect and dismantle and you can use it for a high-raised building. For medium to high res construction projects, you can use it where you need it for a longer duration because its erection, dismantling will take more time.

So, you use it for a project where you need it for a longer duration. So, bottom slewing tower cranes, you have a height restriction. This is because here the tower will also rotate. You cannot brace it to the permanent structure. So, you cannot go for a greater height. So, the service height

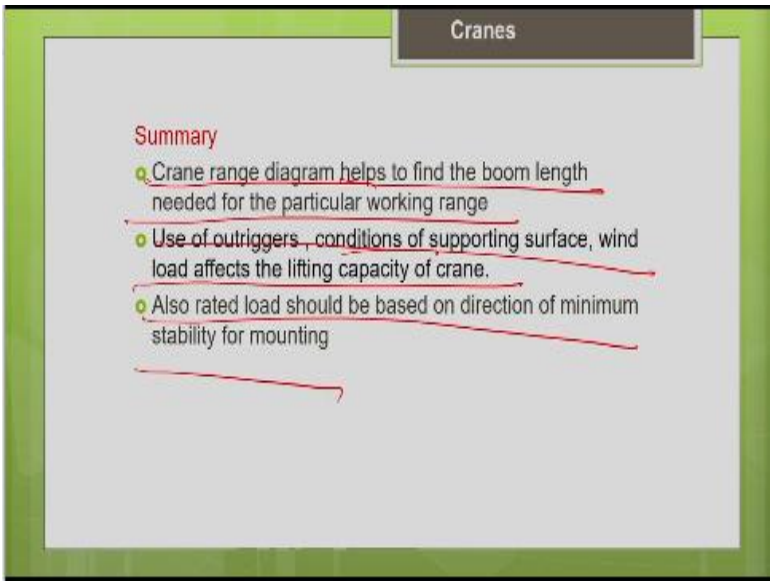
of the bottom slewing tower crane is limited. Based on the type of the boom, you can classify it into horizontal boom, luffing boom and articulated jib.

So, in horizontal boom, you change the load radius by the trolley movement. So, you have a trolley which can move along the jib where you change the trolling moment. By the trolling moment, you can vary the working radius, load radius but you cannot do the luffing of the boom that is not possible with the saddle boom crane and one thing note that the maximum free standing height permissible, there is 60 to 120 meter.

Beyond 120 meters, we have to brace the crane to the nearby structure. So, it has to take the support from the nearby structure to transfer the overturning moment due to wind and the other load. So, even with bracing, I cannot go beyond 300 meters. Maximum brace height tower limit is 300 meter. And we discussed about the climbing tower cranes. So, particularly for structures which are beyond 300 meters, we can go for the option of climbing tower cranes.

They are supported by the completed building floors. As your structure grows, your tower crane will also grow with the structure. They are supported by the completed building floors. That is why when you design the floor of the structure, you have to take into account the weight of the crane and the load, it is going to carry. So, they are capable of raising themselves from floor to floor as the building is erected.

(Refer Slide Time: 57:25)



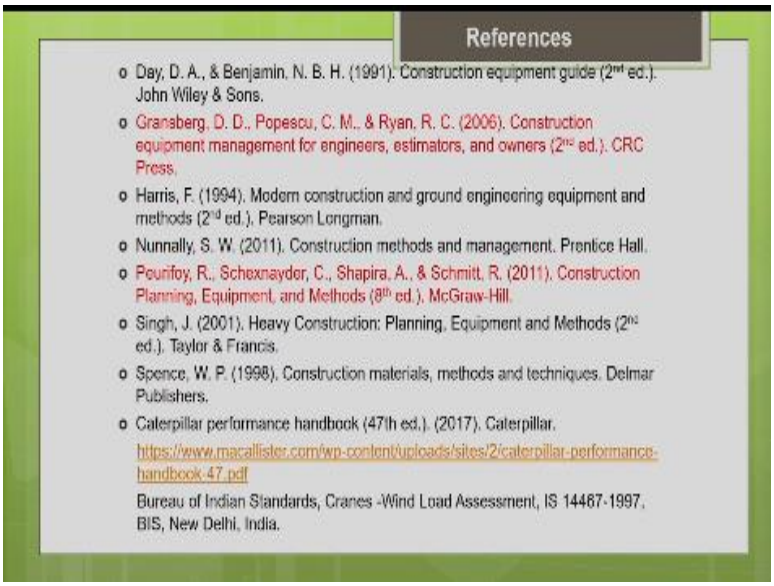
So, we saw the importance of crane range diagram. It will help you to find what is the boom length needed for a particular working range or what a working range boom length can offer. Either way, you can get the data from the crane range diagram. It helps to find the boom length needed for the particular working range. So, you should also always note that the crane rating given by the manufacturer is done.

Assuming that if it is going to be tire mounted crane, it is assumed that you are going to use the outriggers and it is assumed that the crane surface is level. The surface on which the crane is supported is going to be level and it is assumed that the wind speed is not high. So, according to those conditions only, the rating is applicable. If your project conditions are different from the ideal conditions, you have to apply the adjustment and reduce the lifting capacity accordingly.

So, use of outriggers, condition of the supporting surface, then load, everything affects the lifting capacity of the crane. So, and also, the rated load is based on the direction of the minimum stability for mounting that is what we discussed. As a crane boom shift from quadrant to quadrant, you can see that the stability gets affected and the stability is more.

When the crane boom is at the rear end with respect to the carrier, there, the lifting capacity will be more because the stability is more but, the rating of the crane is done based upon the direction of minimum stability for mounting that you have to take it into account.

(Refer Slide Time: 58:48)



So, these are the references which I have used for this lecture preparation. You can go through the books. So, in the next lecture, we will be discussing about the concrete and the concreting equipment. Thank you.