Rock Mechanics and Tunneling
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Lecture 07
Rock coring

Hello everyone. I welcome all of you to the second module of this course of Rock Mechanics and Tunneling. The title of this module is Methods for Rock Exploration. Under this module, today is our first lecture that is on rock coring. So, let us start what we will learn today.

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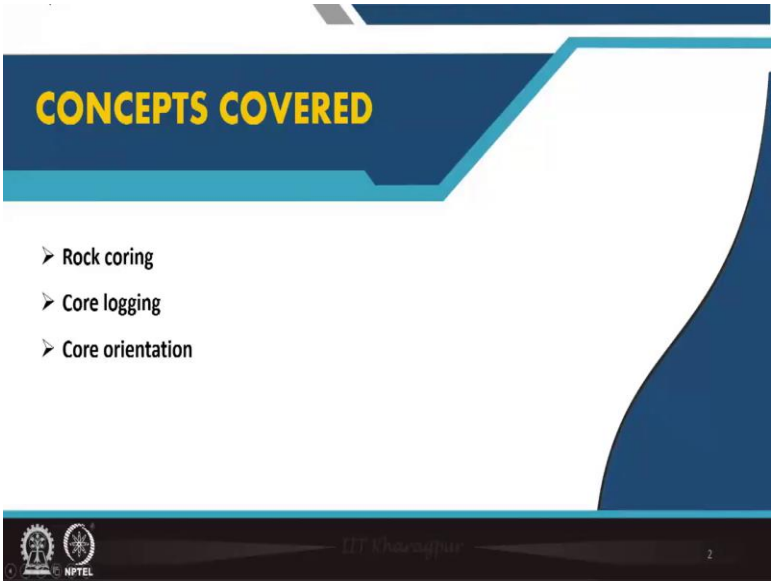

So we will start discussing about rock coring. Then we will discuss about rock core logging and also core orientation. Probably we will not be able to cover entire things in today's class. In the next two lectures will be required to finish entire things. Let us see up to what we can learn today.

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We will start with rock coring. Rock samples are recovered from the ground through the process of coring. So, how it is done? From slide, you can see big machineries are there, and you can see that the coring operation is going on. Cylindrical sampler is there which is inserted here. So rock samples are recovered from the ground through the process of coring.

Now, why this is important? As I told in our previous module, we have to collect samples for conducting laboratory tests and conducting few in situ tests. Therefore, these operations are needed to be done. So, in order to learn those things only, we are learning this module that is rock exploration methods. So, first one as I have stated is coring. From the figures, you can see that the coring operation is going on.

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Now, from this diagram, you can understand, generally due to the high strength of a rock, thick walled core barrels are used to recover the core specimens. So, you can see from figure that it has a quite thick walled. The material with which it is made of, must be having high strength. So, we can say that generally due to the higher strength of rock, thick-walled core barrels are used to recover the rock specimens.

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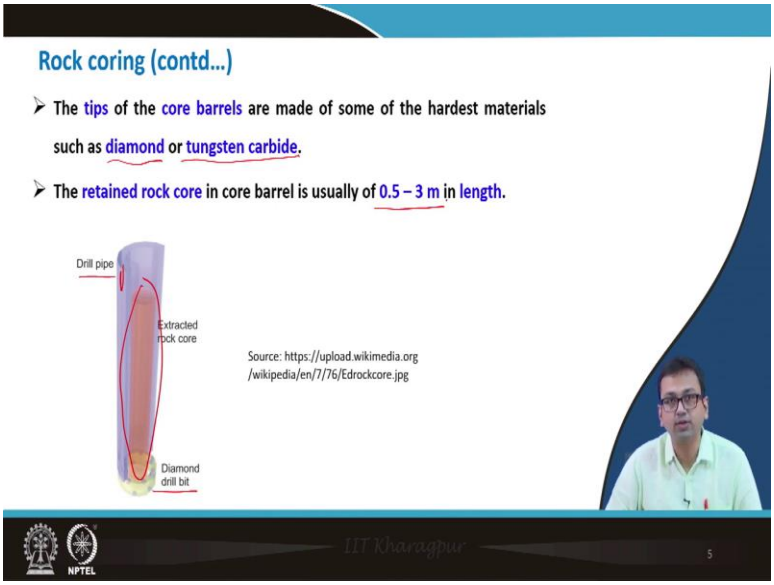

Here, we can see that the tips of the core barrels are made with some of the hardest materials. As it is known that diamond and tungsten carbide are very hard material, the tips of the core barrels

are made of this type of hardest materials. In the slide no 5, there you can see one pictorial representation of diamond drill bit.

In this figure, you can see a drill pipe, where the extracted rock core is present inside. It is important to remember that the retained rock core in core barrel is usually 0.5 meter to 3 meter in length. So, it is obvious that the length of this rock core should be within the range of 0.5 meter to 3 meter.

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In slide no. 6, you can see the pictures of the diamond drill bit and tungsten carbide drill bit. It can be identified that the thickness is quite high for the both the types of drill bit. The front arrangement of tungsten carbide drill bit can be observed from the slide no. 6.

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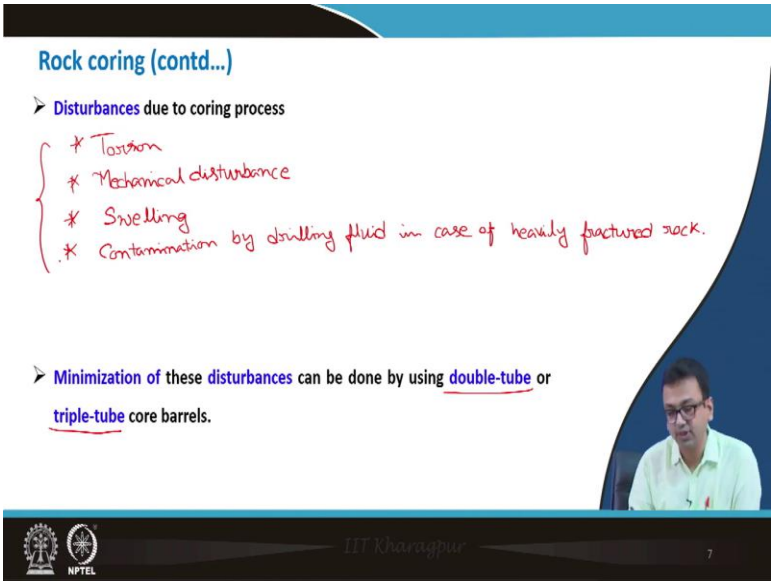

Based on past experience, we know that the disturbance due to coring process is quite common thing. So, the disturbance due to coring process can be due to

- Torsion
- Mechanical disturbance
- Swelling
- Contamination by drilling fluid in case of heavily fractured rock

So, to minimize these disturbances, what can be done? These disturbances can be minimized by using double tube or triple tube core barrels.

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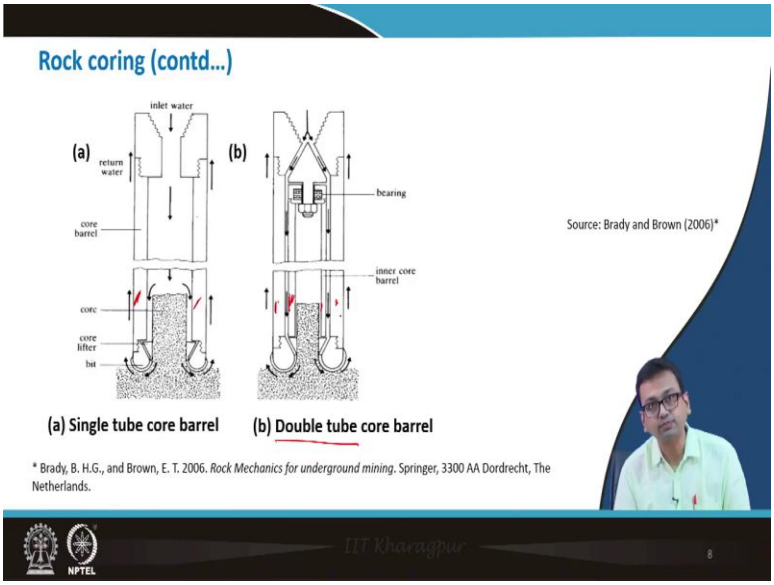

Let us see some pictorial representation of those things in Slide no. 8. The first one is single tube core barrel. So, there is only a single tube. This figure is representing the cross-section of the 3D diagram. The other one is the double tube. Here, two arrows are shown in double tube core barrel.

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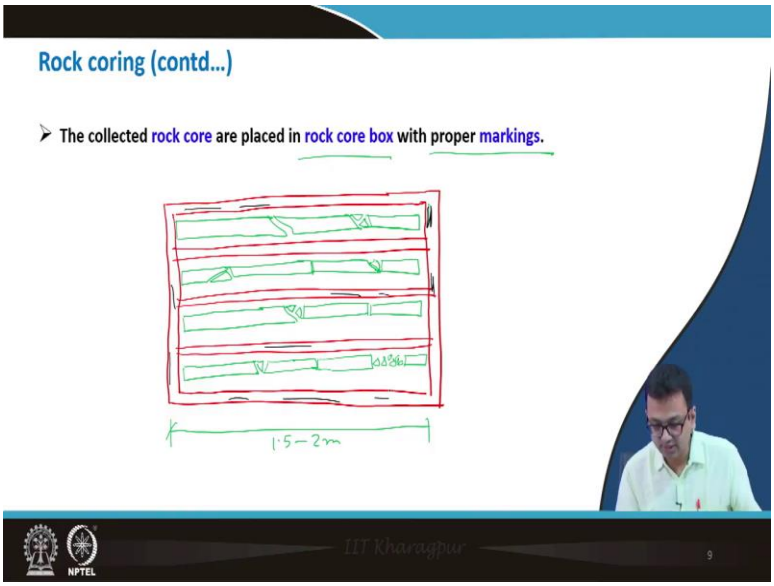

Another important thing is needed to be discussed. The collected rock cores are placed in the rock core box with proper markings. Markings in the rock core box are very important to identify the samples for future usages. The top view of a rock core box is drawn here in slide 9. It should be strong enough to keep the rock cores. In addition, there should be different compartments as

shown figure in slide 9. Here, the rock cores can be intact or fractured one. This figure is drawn not in scale to represent the rock cores.

So generally, the size of rock cores is in the range of 0.5 to 3 m. Most of the time, the dimensions of rock core box are generally 1.5 to 2 meter; but it is not fixed. Most importantly, it depends on the length of rock core. In addition, it also depends on different things like the number of compartments, rock core diameter, clearance, length, and depth.

Considering the above discussed points, this box is prepared. The rock core box generally made of wood. It needs to ensure that the rock core box should be made up of strong material because the rock cores whatever is collected from the field, one should be able to carry them to the laboratory very easily without any damage. That is the main idea.

In the rock core box, different informations are generally written over there. So what are those informations? When one is collected this core and putting them in this rock core box?

The box should be marked with some of the important things as follows:

- Core box number
- Site name
- Date
- Borehole number
- Borehole depth
- Corresponding location of borehole
- Contractor’s name
- Name of the project

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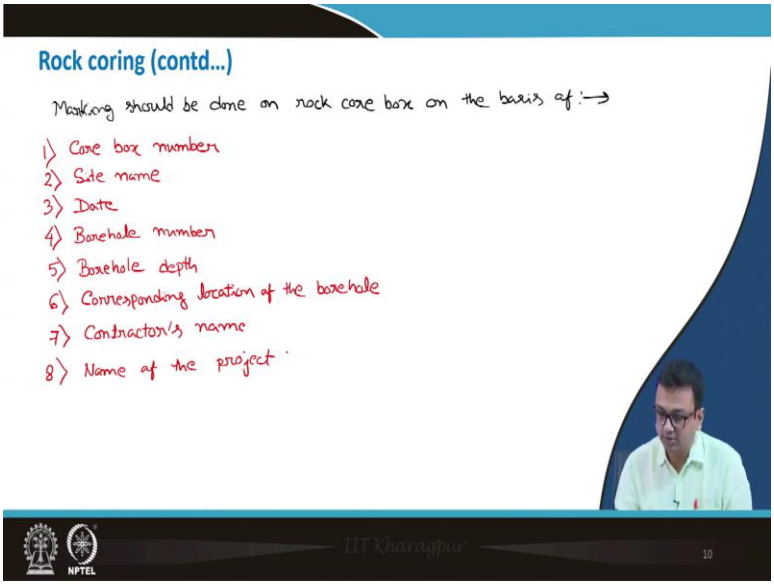

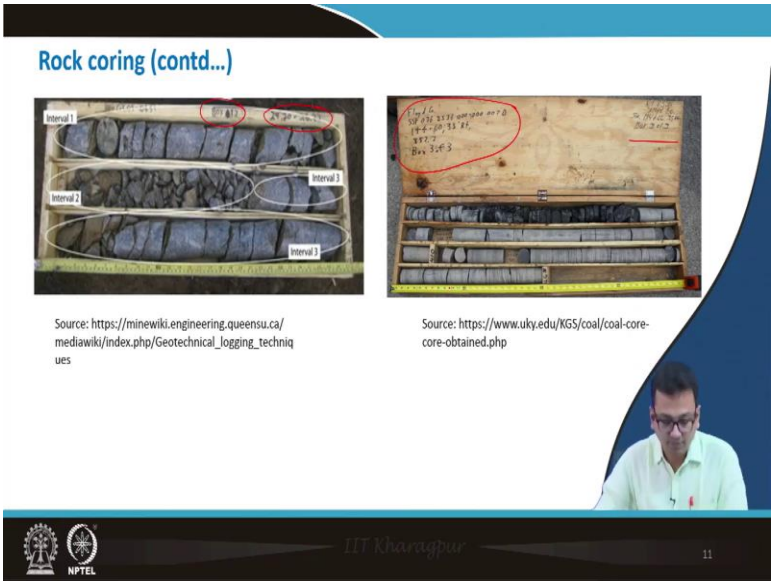

This information is important because at a particular location, you may have to go for a multiple number of boreholes. As it is known to us that rock mass is very much anisotropic and heterogeneous. In addition, there are different orientations of the discontinuities, fractures, joints, and planes. So, within a short vicinity also, rock property changes drastically. So, corresponding location of the bore holes are important. All these things are needed to be marked on this box. So, those informations are present in the lid and sides of the rock core box, as shown in the slide 11.

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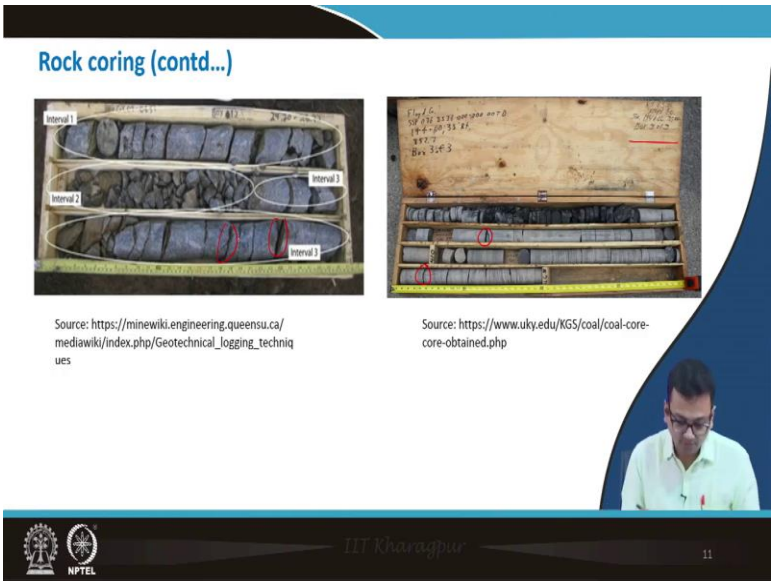

From the slide, we will notice several discontinuities like fractures, joints are quite visible in the rock core. One important points needs to be noted that all these fractures or discontinuities may not be due to the natural cause. In reality, it is possible that there it was a continuous rock mass only. In the other hand, at the time of performing this drilling operation, because of the several manual error and dealing with big machinery, there are some possibilities of error. So, because of that what may happen?

Some Rock mass is may be continuous that may break or fracture may develop during the time of rock coring. So these types of cracks may develop because of the human activities.

So, It is important because in reality no crack at that location. On the other hand, some crack may develop because of this drilling operations. That may obviously affect the results of ultimate strength of rock mass.

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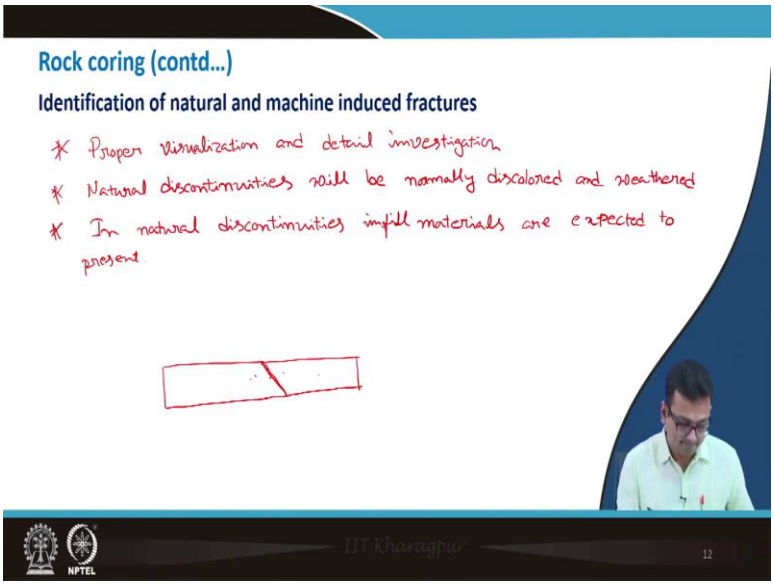

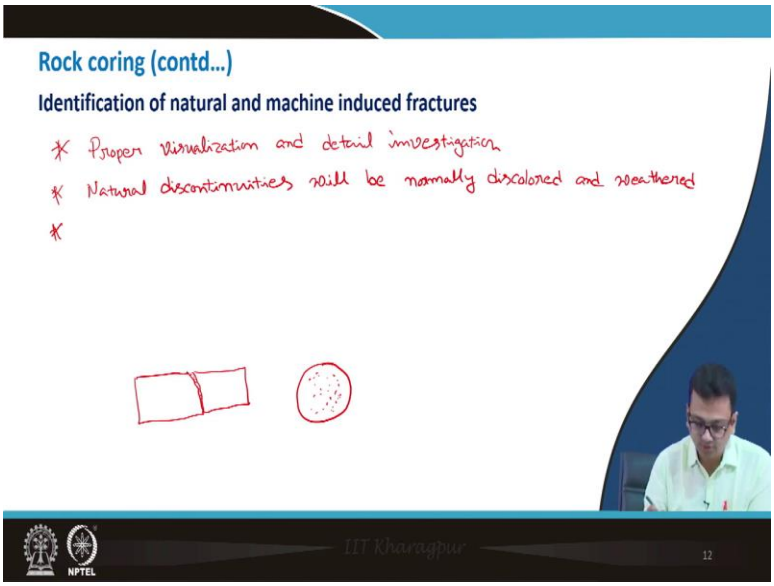

So, there are some ways of identifying the fracture whether it is manmade or natural. The basic idea is by proper inspection. This idea obviously will develop with experience in the field of rock mechanics. But some of the things what we can write regarding these are maybe the proper visualization and detail investigation.

Natural discontinuity will be normally discolored and weathered. So what will happen? If it is a natural discontinuity so it must be present there for the years, and because of that what may happen? Weathering will happen and color may fade for that cause. The sharp edges probably will be not found for weathering.

In addition, over the years some infill materials can accumulate there. So, some trace of infill materials present in the face of the rock core. This way, it can be identified as natural discontinuity.

On the other hand, if it is developing due to the drilling operation, no trace of any infill material will be found between the discontinuities because those have created just at that time only. Thus, the infill material will not accumulate at those locations.

In some situation, it is not possible to identify whether the discontinuity is manmade or it is natural one. Then, the conservative side can be considered. The discontinuity can be identified as a natural discontinuity. With this consideration, the obtained results will be in safer side.

Alternatively, it can be tried to place the two sides of the rock discontinuity over each other and join them. If no gap is developed between them, it is a manmade discontinuity. On the other hand, if it is an old or natural discontinuity, it will not perfectly match the two parts because some part will be eroded due to weathering. Obviously, some gap will be there for natural discontinuity.

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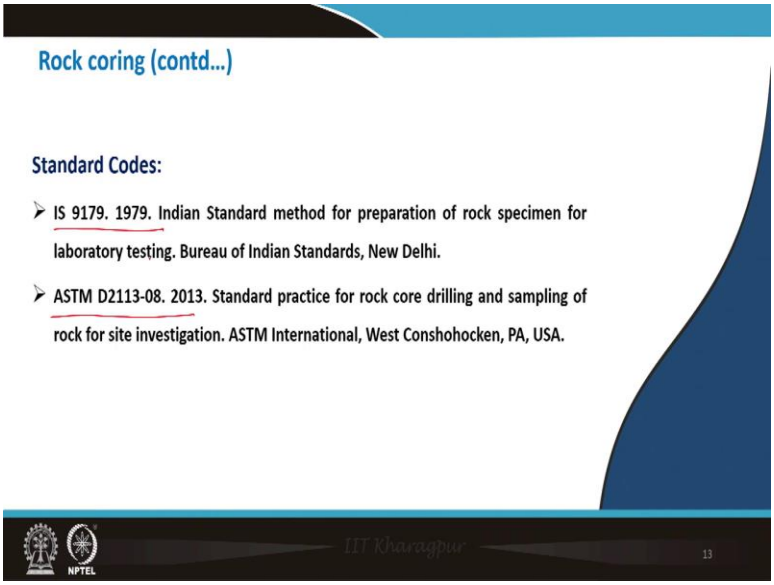

In slide 11, the standard codes, which are used for rock coring, are presented. First one is IS code which we use in India, “Indian Standard method for preparation of rock specimen for laboratory testing”. Apart from that, the ASTM standard is also used “standard practice for rock core drilling and sampling of rock for site investigation”. These two are the standard for rock coring. In today's lecture, we have primarily discuss the rock coring, and in our next lecture we will discuss about rock logging and as well as the briefly about the core orientation. Thank you.