Ocean Structures and Materials
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Module - 1
Lecture - 2
Fixed Type Offshore Structures

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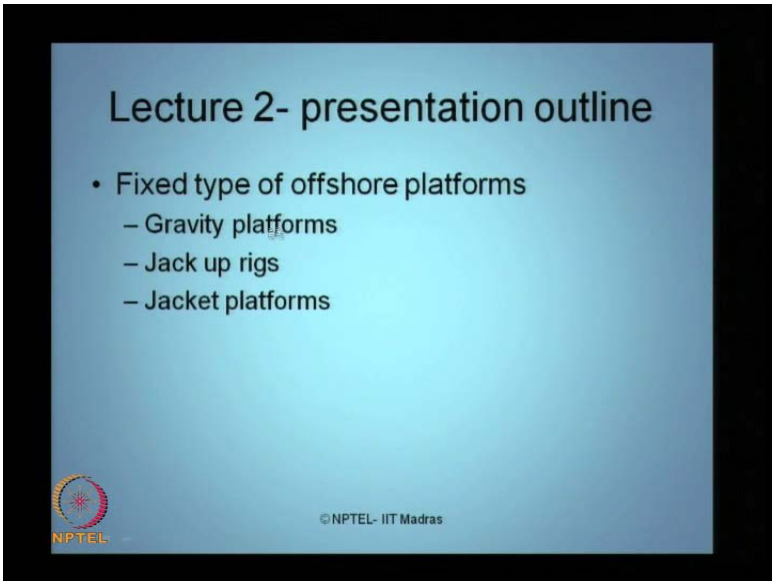

Welcome to the second lecture on module one of ocean structures and materials. In this lecture, we will see the presentation outline for the second lecture on module one. We will talk about fixed type of offshore platforms in this lecture. I will discuss types of gravity platforms, their construction and the structural actions; the jack up rigs; and then jacket type platforms in this presentation.

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When we look at the offshore installations in general, in the previous lecture we have seen a list of different kinds of offshore installations all over the world. In general, there are more than about 6500 offshore installation around the world. They are spread in about 53 countries. These installations are built for varied applications. They are meant for drilling, preparing water or gas for injection into the reservoir which we called as enhanced oil recovery. Some platforms are also constructed for processing the explored oil and gas from the reservoirs. Some of them are constructed for cleaning the produced water before it is disposed back in the sea, because that is one of the important requirements of environmental impact assessment studies carried out on offshore installations. There are platforms constructed for accommodation facilities which will house people or personal on both, will be working on the exploration and drilling works.

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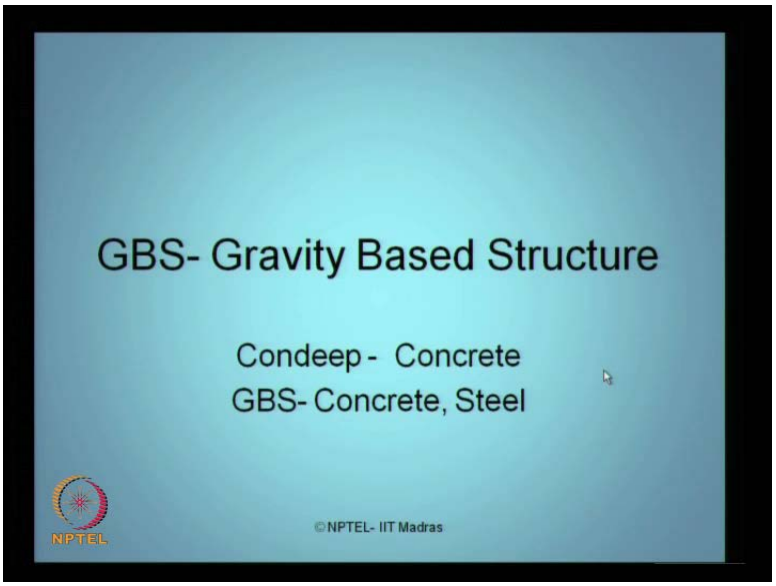

Let us look at the first type of fixed type platform, which we call as gravity based structure, briefly named as GBS. The material essentially used for constructing these kinds of structures can be either concrete or steel. The picture you see here is a very famous gravity platform which is Hibernia.

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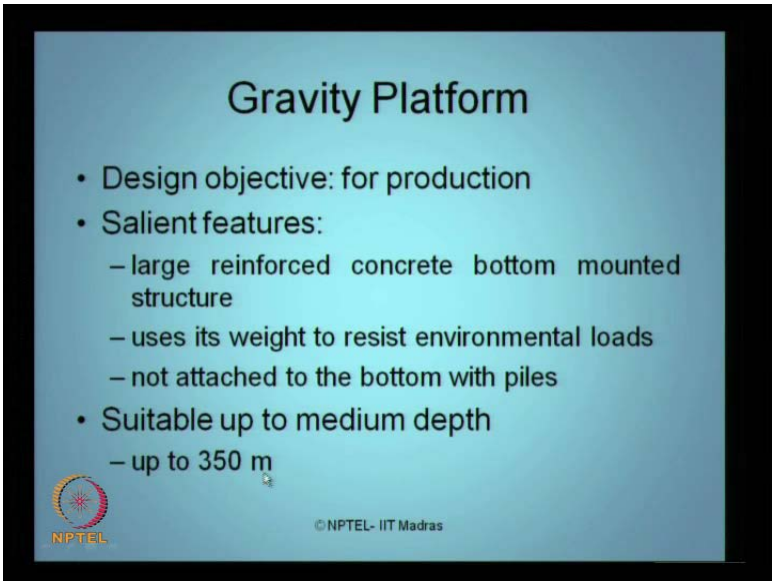

Gravity platforms have a very specific design objective. They are essentially meant for production of oil from the reservoirs. If you look at the salient features of a gravity platform: they essentially consist of large reinforced concrete bottom mounted structures;

essentially these platforms use their self weight to resist the environmental loads that is why the name gravity based platforms is given to them. These platforms are not attached into the bottom through the piles. They are essentially suitable up to a medium water depth of maximum 350 meters.

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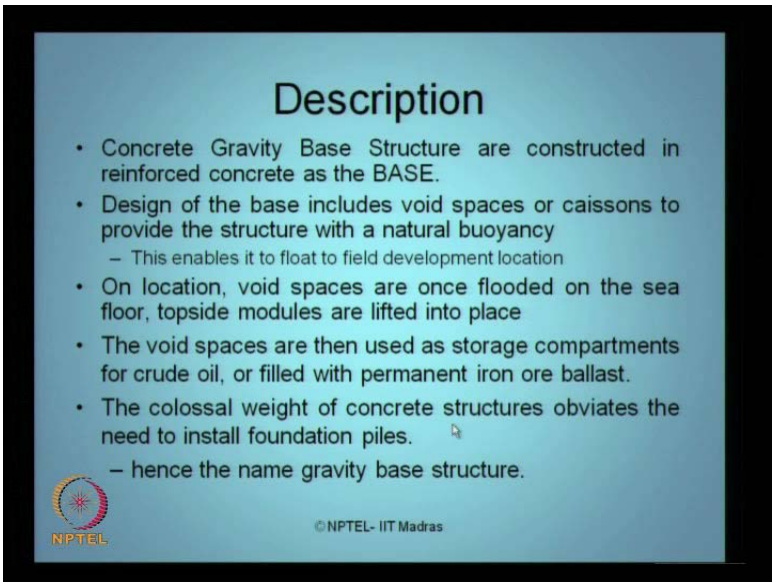

Concrete gravity based structures are constructed with the base as reinforced concrete structure system. The design of the base includes lot of void spaces, what we call them as the caissons. They are provided for the structure to initiate natural buoyancy. This enables the structure to float to the field development location during installations. Once the location is reached, these void spaces are flooded on the sea floor; the topside modules are lifted and placed in position over the top of these spaces. The void spaces are then used as storage compartments for storing the explored crude oil. Sometimes, they are also used to fill permanently iron ore ballast to maintain stability during operation.

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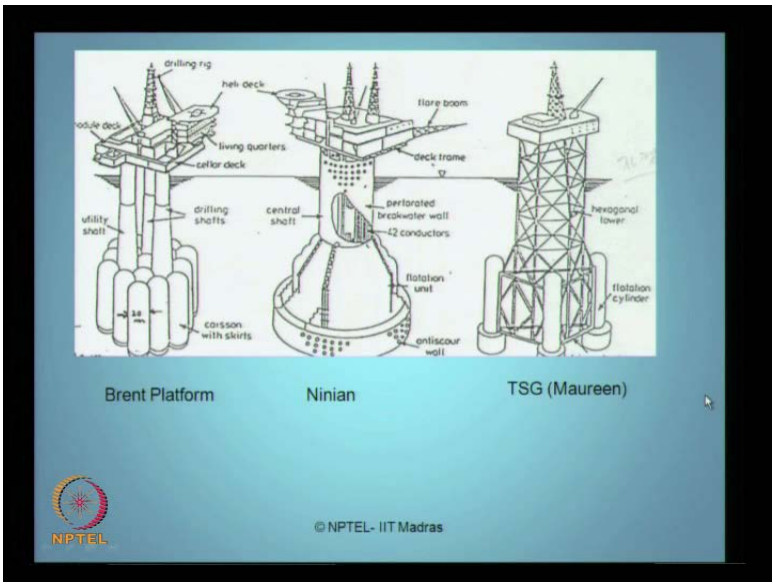

The picture you see here, show three different schematic views of gravity based structures constructed in different parts of the world: Brent platform, Ninian platform, and Maureen GVS. There is commonness between all these three kinds of platform. I want you to observe this commonness. All of them do have a caisson base at the bottom. These caisson bases are very large in diameter in size; they help them to flow; and the void spaces in the caissons will help to store the crude oil on exploration. All of them have very large and comfortable depth, topside activities. These platforms are very stable and lateral loads. Look at the common structural members of these kinds of platforms. They have all common operational systems like heli deck, double deck system, housing quarters, flare booms, drilling rigs, and almost all of them.

And also see, these structures are very massive in size. And because of its weight, we call as the colossal weight of this platform; they are installed in sea without any pile supports. They rest on the sea bed by its own self way that is why the name gravity based structure is given to these kinds of platforms.

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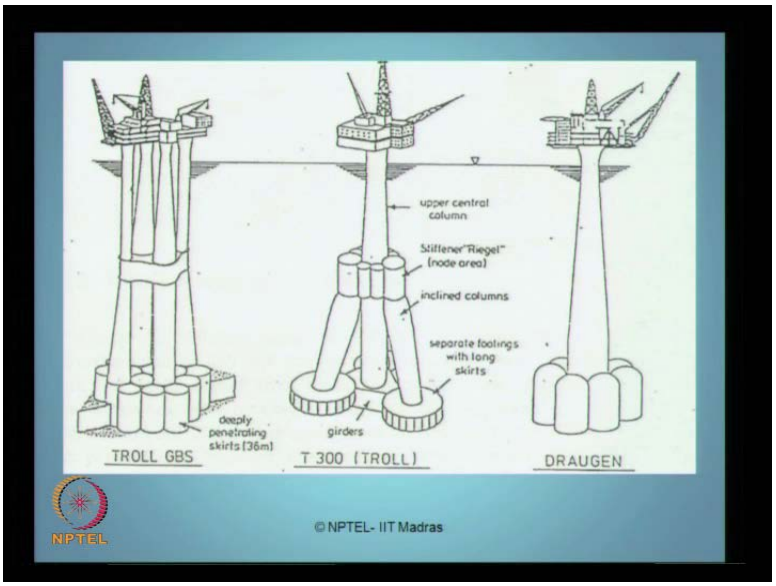

The picture you see here show other three varieties of gravity based platforms constructed in the world. Troll GBS is a famous platform which contains lot of caissons at the bottom; T 300 which is called as the troll platform; and the Draugen, as with a single tower with lot of caissons at the bottom, which have very common and similar topside facility. Of course, the limitation in depth cannot exceed up to 300 meters, for as these kinds of platform are concerned.

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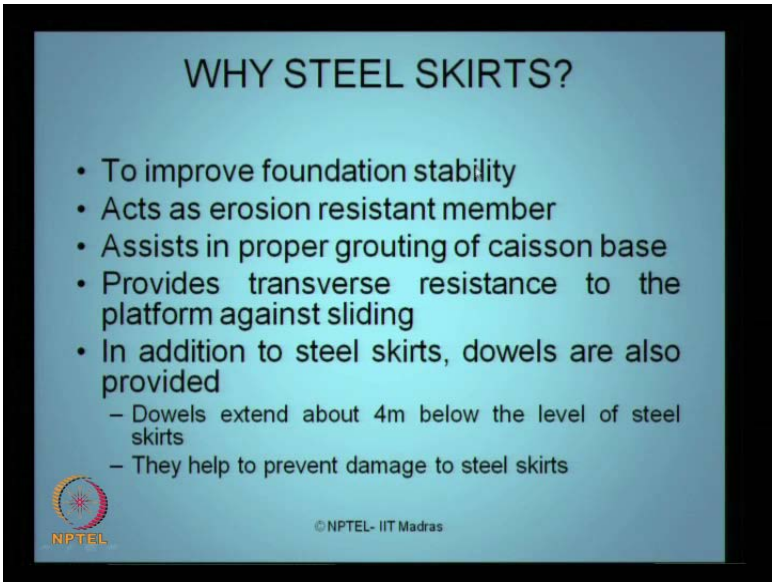

In the previous pictures you see, these platforms have caissons at the bottom which are supported by the steel skirts. Now the fundamental question comes is, why do we need steel skirts when caissons are very large in size and volume, which can enable stability of the platform by its self range. Steel skirts are required to improve the foundation stability; they act as erosion resistant members of gravity based platforms; they assist in proper grouting of the caisson base to the sea floor; they also provide transverse resistance systems to the platform against sliding. In addition to steel skirts some platforms also have steel dowels. The dowels are extended about 4 meter below the level of steel skirts; they help to prevent damage to steel skirts. Essentially steel skirts improve foundation stability against slide.

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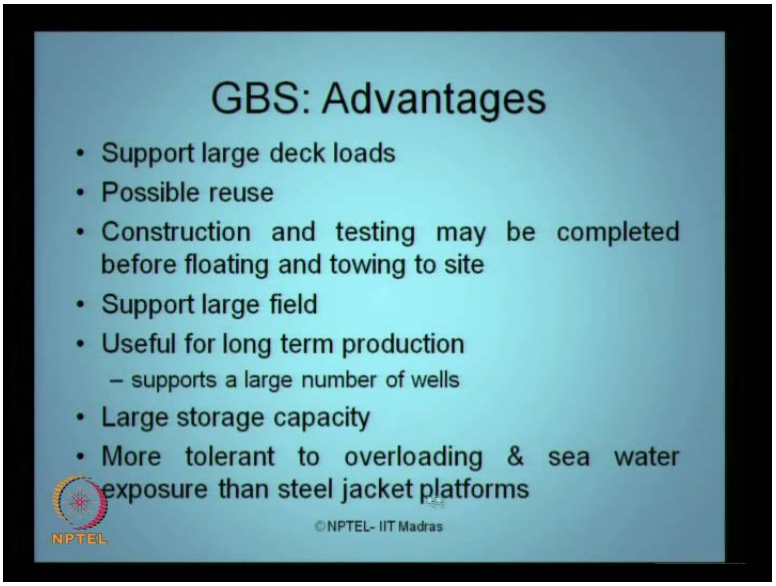

Gravity based platforms have many salient merits in offshoot relay. They support large deck loads; they have a very high possible reuse of the material; the construction and testing of these kinds of platforms are generally completed, even they are floating and towing to the site. So, there is a big amount of quality control in constructional inspection can be done, before the platform circle installed in the site; they support large field of oil exploration; they are essentially useful if you have a long term production; among other hand, if they have a large number of wells which are yielding oil at a very high rate, then gravity based structures are very good choice to support large number of wells. The one of the greatest advantage of this kind of structure is that they have a very large storage capacity; they are more tolerant to overloading and sea water exposure in

comparison to steel jacket platforms, which we will see subsequently at the end of the structure.

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Of course, gravity based structures have some demerits as well. The cost increases exponentially with increase in depth of this platforms; they are also impossible in serious situation, they cause what we call foundation settlement; geo-technical problems are very specifically critical as for as GBS platforms are concerned; they are very subjected to very high seafloor scour; they may require more reinforcing steel than the total steel that is required to construct a jacket structure. It means the costs of the structures are very high, and the volume of steel we used in this, is much larger than the steel structure by itself when we compare it with the jacket platforms.

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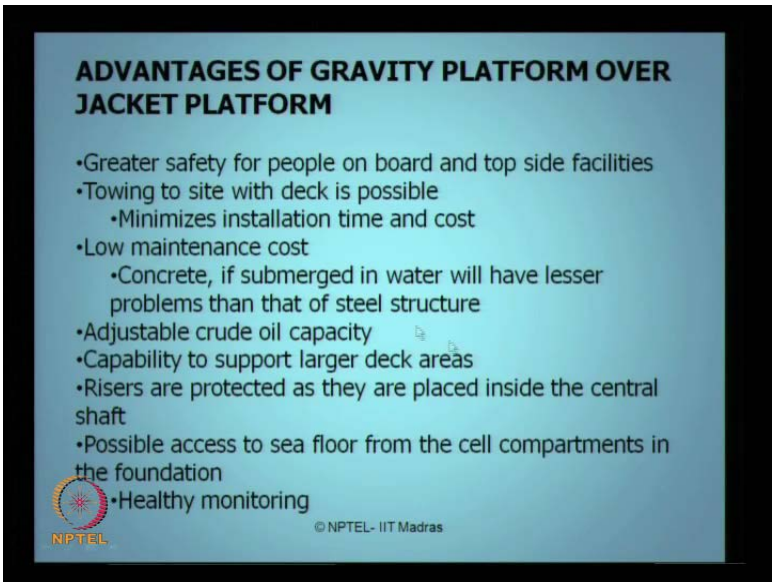

There are some advantages of gravity platforms over jacket platforms. It has a greatest safety for people to work on board, and top side facilities. Towing to site with the deck is possible; it means this minimizes installation time and cost. It is low maintenance costs because concrete, if submerged in water is understood have lesser problems than that of steel. It has got a very high and adjustable crude oil capacity which comes from, essentially the hollow wide spaces it the caissons. It has a capability to support very large deck areas. Risers which are used for oil exploration are generally protected because they are placed inside the central shaft of these kinds of platforms. They also create possible access to the sea floor, from the cell compartments in the foundation which has got very healthy monitoring system of these kinds of platforms. These are considered to be comparative advantages of gravity platform with respect to steel jacket platforms. Of course, both of these platforms are fixed type of platform structures.

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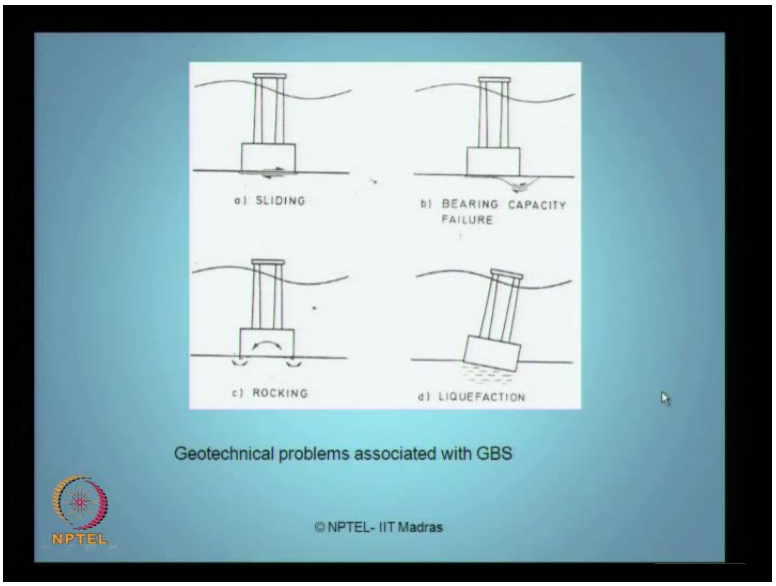

Let us look at some specific problems associated with gravity based structures, in terms of its geotechnical complications. The picture you see here; so four different kinds of problems associated with GBS platforms. Sliding, if do not have proper installation of the skirt piles and dowel rods; though the weight of the structure can be very high, still because of the sea floor's covering, the platform entirely can slide on the clay bottom of the sea floor. So, sliding is one of the important parameters or problem, associated with GBS platforms.

Because of its very high colossal weight, sometimes it can result in what we call a bearing capacity failure. There can be a bearing capacity failure at specific stress concentration created at the foundation level on the sea floor because of its massive colossal weight of the super structure. Sometimes, when there is a differential settlement happening on the sea board because of its weight, can result in an action called rocking. This can damage the foundation system and the caissons of the platform very easily, and the extended damage could be very severe. As we all understand, when there is a water entrapment happening below the larger area of foundation of these platforms, it can result in what we call soil liquefaction. Once liquefaction occurs, it can cause a differential settlement with the caissons of the platform which can be associated as a very serious geotechnical problem of gravity based structures.

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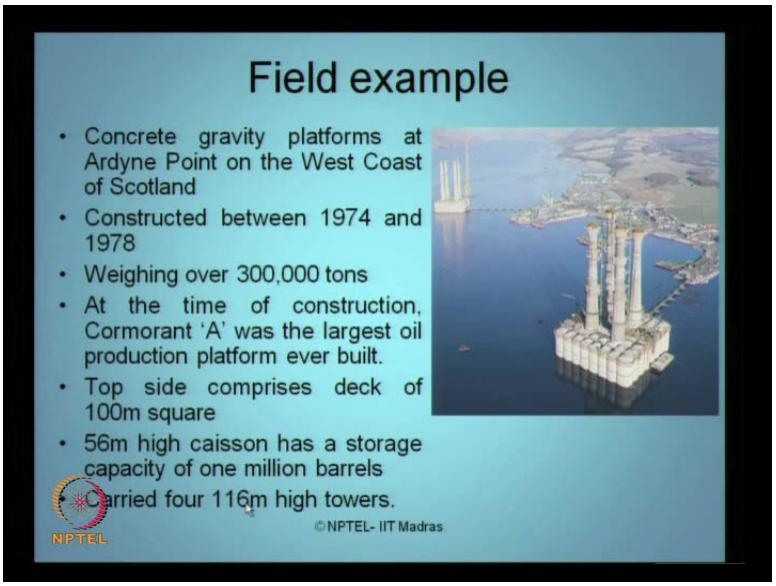

Here is a field example. From this photograph, we can very well see, there are interesting many number of towers constructed, which are supported at the bottom by large number of caissons which are essentially void spaces when they are floated. Then they can be either ballasted to achieve a specific draft or the void spaces of these caissons can be also used for West Coast crude oil which is explored from this platform. We can see one more here which is being floated total from the offshore; one is very close to the shore is getting floated now.

Ladies and gentleman, the example you see here is actually concrete gravity platforms at Ardyne Point on the western coast of Scotland. It is been constructed between 1974 and 1978. The total structure weighs about 300000 tons, so very massive colossal weight of the structure. At the time of construction, the Cormorant 'A' which we see here, was considered to be one of the largest oil production platform ever built there in the time of 1978. It was a record at that time. The top side you see here, which is compressing a depth about 100 square meter area. It is got about 56 caissons at the bottom, which has storage a capacity of 1 million barrels of oil imported. It is carried by 4 116 meters high towers. These towers are of about 116 meter high. Just to give a physical feeling for you, it is as good as about, let us say 75 to 100 storied building.

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This is the closer view of the platform. You can see here, the caissons have been constructed and then they have been tucked off by the board. The construction was undertaken in a dry basin, as you see here, before the platforms are floated out for completion.

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Now you can see the platform in position. Of course, the depth is not yet installed. You can see the four towers; you can see the caissons; you can see the requisite drafts. Now the platform is getting floated, being towed by the tug boats is in the side. You can see

these are tug boats in front side; these are tug boats on the rear side, which is actually towing the platform for the required site for installation.

The second classified platform what we have in fixed type of a structure is what we call a jack up platform. Briefly, they are called as jack up rigs. Yes, you have clearly understood, rigs are nothing but structures used for exploration under sea or under soil. We have used common land based rigs for exploring water, is a same principle at which the jack up platforms also works.

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The photographs you see here are different kinds of jack up rigs which has been shot by me in different locations. There is again commonness between all these jack up rigs, you see here; I will get a closer view of this particular rig in the next line. You can see essentially these rigs essentially consist of legs, it is a steel lattice tower; you can see these legs are all essentially steel lattice towers. All of them are similar. It has got a very large complicated top side deck, which has got all facilities as similar to that of the gravity based structure.

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You can see a closer view of a jack up rig which is masks giant; it is the top side. The red (( )) you see here is actually an index; for us to understand, it is a maximum water level. Now, you can see, the three lattice legs which is coming out from the tower; you can see a helipad which is being used for helicopter landing. You can see a very complicated top side facility is being given, or made available on these jack up rigs.

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Now the question comes, why these structures members or these kinds of platforms are called as jack up rigs? This is the closer view of this rig. We can this three lattice towers

which we call them as of legs jack up, or the jack ups are installed. So, these legs are protruded into the sea bent for better stability. And then the jack, the deck is jack up, above the sea water to have an enough (( )) for operation.

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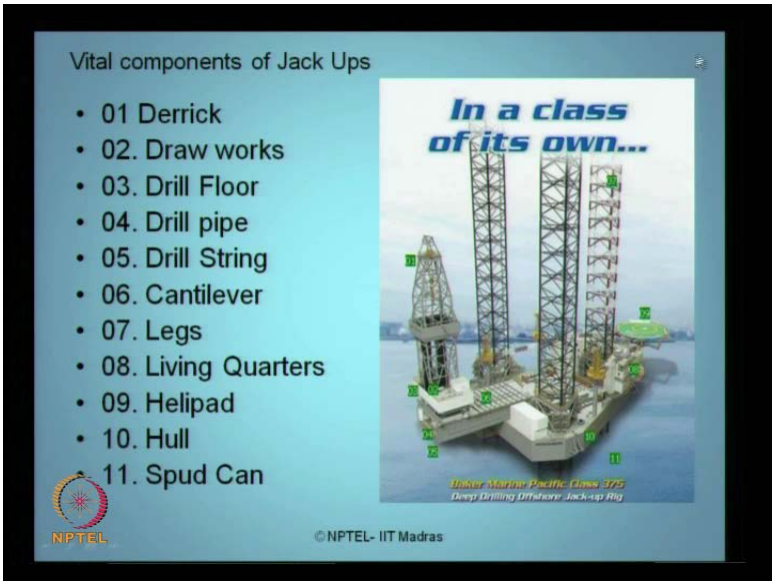

Some of the vital components of jack up rigs are shown in this figure. For example part number 1, what you see here, is a derrick; is what we call as the derrick of a jack up rig. Part number 2 is nothing but the draw out works which have been used for oil exploration. Three, shows you the drill floor where we are going to do the drilling operation for these jack up rigs. Four, is of course, is the drill pipe which is not seen in the photograph very clearly. Five, is a drill string. Six, is a cantilever segment which can be extended out, form top side of the rig. And you can see clear the drilling does not affect the top side mount pool facility of the jack up tower. So, the drilling platform or the drilling area gets extended from the rig and then the release takes place.

The seventh component, what you see here, are the steel lattice towers which are otherwise called as legs of the jack up rigs. Eight, of course, is the living quarters; you see the complicated living units here; where people live here to work on the rigs. Nine, of course, is the helipad facility for helicopter landing. And ten, is what we see here, is the hull of the jack up rig. And spud can is a specific vital component of the jack up rig which is not seen in this photograph; it is hidden in water, but I will show you in the next slide, how a spud can looks like.

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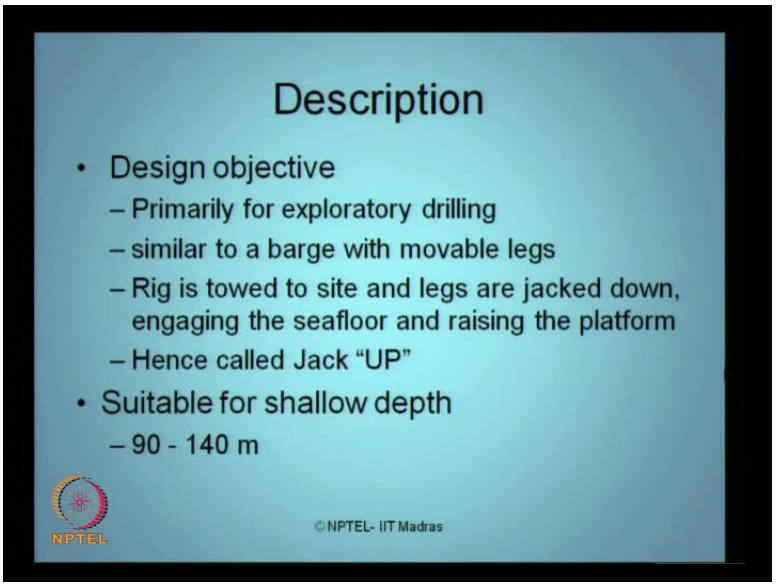

Let us quickly describe a jack up rig, and its vital components. The primary design objective of a jack up rig is for exploratory drilling. Ladies and gentlemen, please catch this word, the jack up rigs are not used for production drilling; they are used for, only explorative drilling. For example, you need to identify a reservoir which has got a good yield trying for explorative drilling, instead of going for a permanent installation like a gravity based platform, people generally go for a semi permanent type what we call as a jack up rigs. That is why the name rig is associated with jack up platforms.

It is similar to a barge with the moving legs. Imagine a ship, or a very large barge which is got a moving leg. So, that is what we say as jack up rigs. The rig is towed to the side, and the legs are jacked down, engaging to the sea floor, and raising the platform. Since, the legs are jacked down, and the platform is raised up, we call these as jack up rigs. They are suitable for shallow water depths up to 140 meters, which are essentially used for exploration drilling only; not for production.

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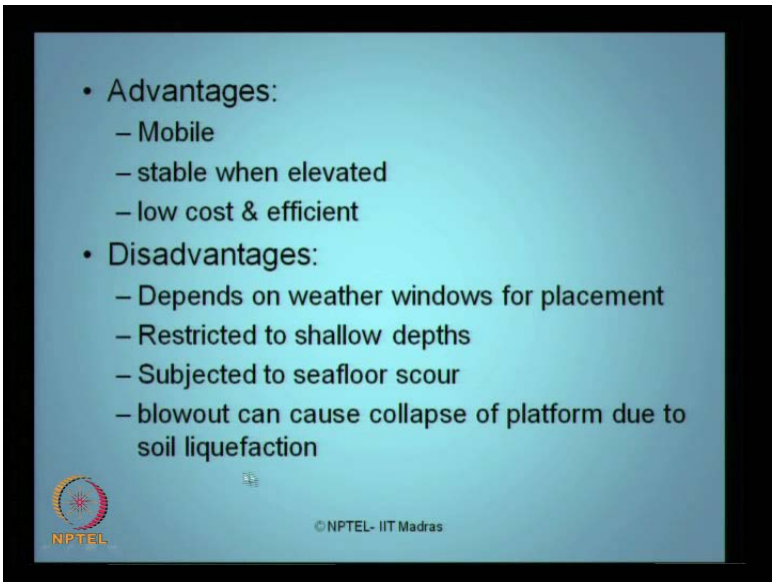

These platforms do not have storage capacity. There are salient advantages of these platforms. They are, highly mobile; they are stable when elevated; they were very low cost of operation; and they are very efficient, if you want to use it for exploration drilling.

Of course, there are lots of demerits. The operational characteristics of this platform, depends on a specific weather windows, where they are located. They are strictly restricted to shallow water depths only; they cannot operate in deeper water. They are subjected to very high seafloor scouring problems. A blowout, if happens, during the explorative drilling, can cause a complete collapse of the platform due to its soil liquefaction.

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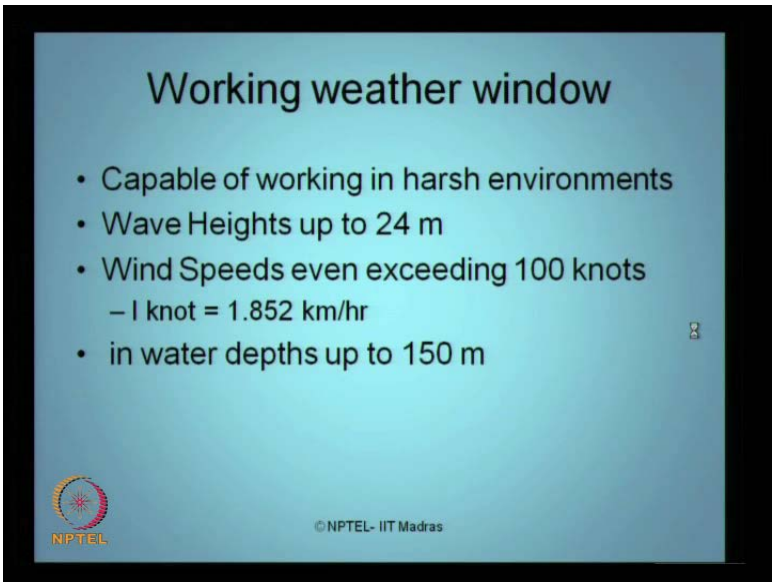

Let us look at the working weather window, at which the jack up rig can successfully operate. Jack up rig, though they are capable of operating in harsh environments, it can work up to, wave heights of up to 24 meters; the wind speeds can even exceed 100 knots. For your information, 1 knot is approximately equal to 1.852 kilometer an hour of speed. So, 100 knot if you can always see, what the wind speed is at which these platforms can remain operational. Of course, limitation is, they cannot exceed depth of our 150 to 170 meters; they are meant for shallow waters only.

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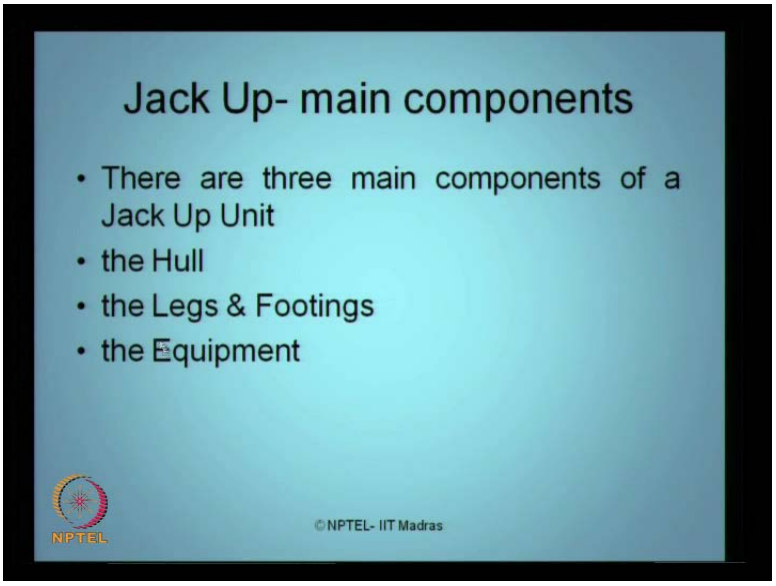

There are three main components of a jack up unit. Namely: the hull, the legs and the footings, and then the equipment. Of course, we have seen a detail photograph and view of a hull and the equipment, and of course the lattics leg towers.

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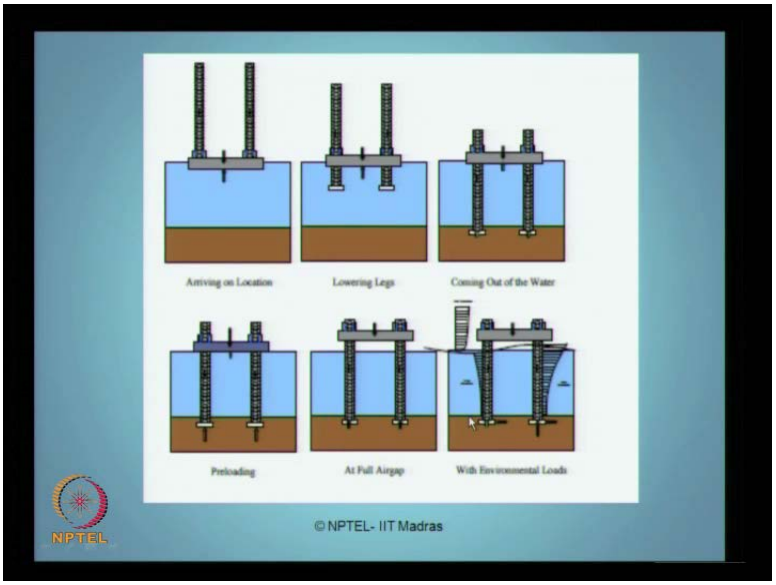

Then we focus on the footing design of a tower. Before that let us see, what are operational characteristics of a jack up rig? When a jack up rig is floated to a side which is equivalent to a moving barge; the depth is located at the bottom which floats, which is actually towed, with the legs are all the kept on the upside position. So, this is what the towing position is; it is a arriving a location, then the legs are lower. On the other hand, the deck is lifted up. As the deck is lifted up, it comes to a position; then it is pre-loaded and tested whether the legs have reached enough location on resistance in the sea floor, so that, the legs can stay in position firmly. So, it is preloaded.

Once the preloaded test is completed, the deck is further lifted to have a very clear air gap during operation. What it means is? In case of operation, because of high tides, the waves should not interact with the plants and equipments present on board. Therefore, the deck is shifted upwards, further to create a sufficient air gap for safe operation. Once it is installed within air gap, now, the jack up rig is ready for encountering different environmental loads caused because of waves, because of current, and because of wind as well. So, this is the schematic view of how a jack up rig is actually towed to the side, install, commission, and then made ready for exploratory drilling operations.

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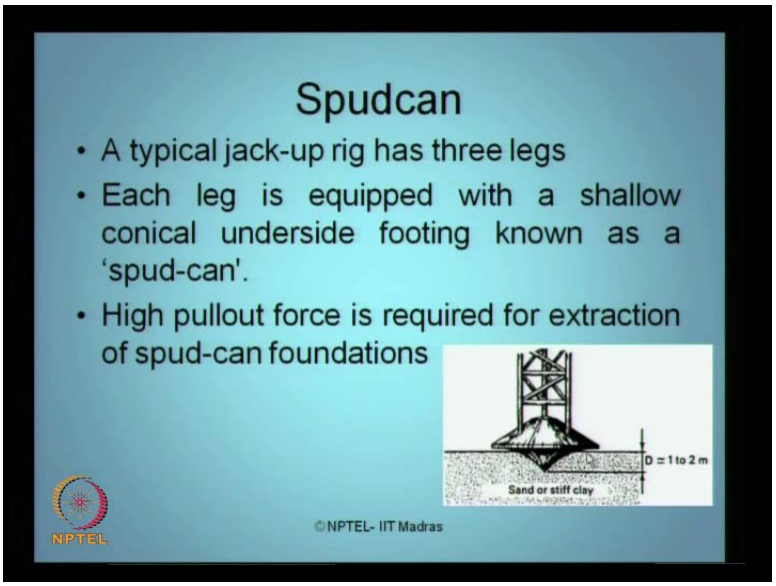

As you see, foundation becomes a very important and vital component, of this kind of platform. Spudcan is a very important component of a jack-up rig. As we saw in the previous photographs, a typical jack up rig has actually three set of lattice towers, what we them call as legs. Each leg is equipped with a shallow conical underside footing, because these as a Spudcan. The photograph what you seen here, is a conical shaped component which is put, or which is located at bottom of every leg. It is typical lattice tower leg.

So the conical shaped Spudcan is located under every leg. This gets founded in soil; may be stiff, clay, or sand. The depth of penetration of this conical portion is approximately varying from 1 to 2 meters. Once you do this kind of foundation arrangement for a leg, it requires a very high pullout force, for extracting this from the foundation.

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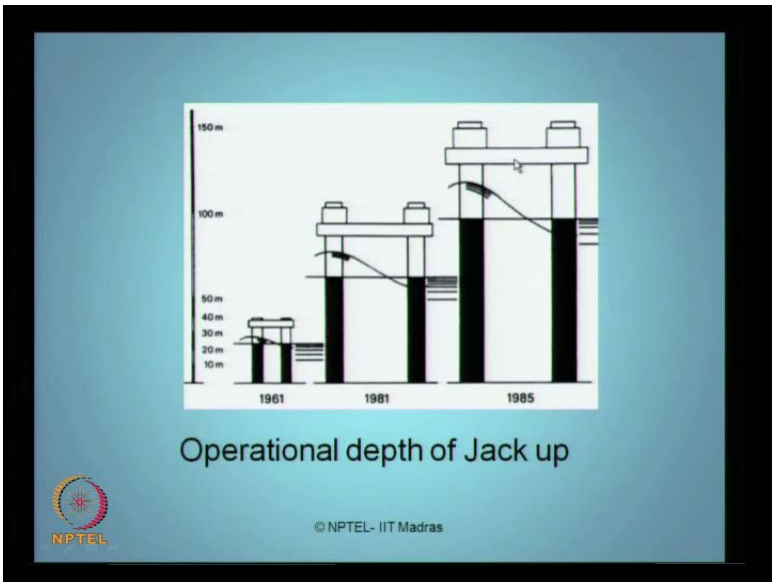

If you look at the operation features in terms of its depth of a jack up rig, initially in 60s jack up rigs were used only up to depth of 30 meters; whereas, in earlier 80s, people have tried jack up rigs, till about 100 meters; whereas in late 80s, and early 90s, people have tested jack up rig successfully for a depth of about 170 meters as well.

So, jack up rigs have been used for maximum depth of about 170 meters. Ladies and gentlemen, I want you to recollect a very important point that these kinds of platforms are never meant for production drilling. They are meant only for exploratory drilling. Therefore, they are very highly economical. And you can see, in many countries people heir jack up rigs for explorative drilling. You do not have to own a rig; can hire then do an exploration; try to find, what are the possible oil deserve present in that site, chosen by geologists. If they are successful, you can plan to go ahead and to build the platform; if you are unsuccessful, you can give away the rig back, to the lease person; can go for exploration of some other site. So, they are actually used in terms of explorative drilling only.

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As I said, disasters can be caused to jack up rigs during storm. Here is a photograph, where the complete jack up rig got capsized because of the storm weather. You can see, a complicated top side; we can see here, the three lattice legs; you can also see here, the three lattice legs completely over topped and fully capsized. So, strong and severe storm weather can cause disasters to the jack up rigs; you may lose the whole facility under such kind of critical situations.

The next type of platform, which is a fixed type platform, is what we see here, is a jacket platforms. Essentially, it is made out of steel. Therefore, people call this, a steel jacket structures.

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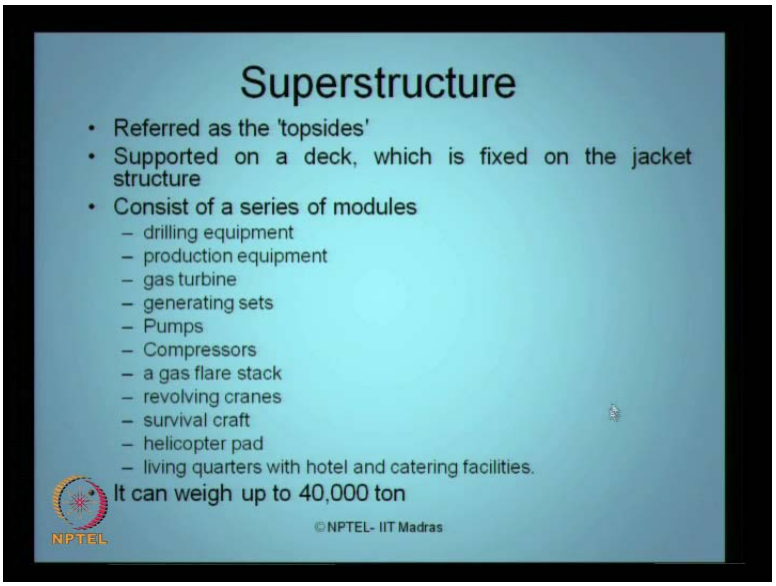

If you look at the component of a steel jacket platform, it has two main components: superstructure and substructure. The superstructure is referred as topsides, in the literature. It supports a deck which is fixed on a jacket structure. The topside consists essentially of different modules, containing- drilling equipment, production equipment, gas turbine facilities, generator units, pump sets, compressors, a flare stack, revolving cranes, survival aircraft, helipads, living quarters with hotel and catering facilities for personal working on board. The total weight of topside alone can be as higher as 40,000 metric ton.

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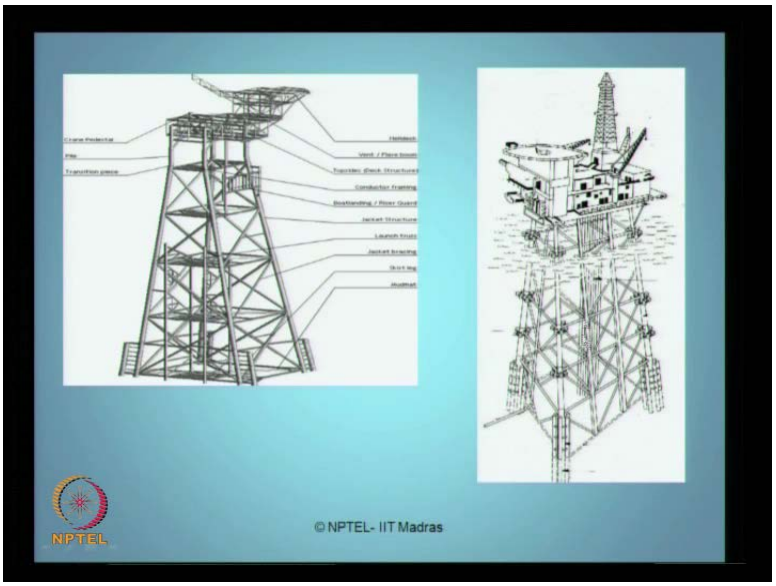

Here is the typical photograph of topside, or of a complete steel jacket structure. This is an animated photograph, which is generated from the computer software. This is a real line diagram of a typical jacket platform. Different components of a jacket structure are marked here; you can see a helipad here; you can see a flare boom which is essentially used for allowing the outlet of a flare gas coming during the drilling operation; you can have the transaction piece which is seen here, which I will explain in the next successive slides, what is the transaction piece, is what we call as a crane pedestal; I will explain the component of crane pedestal in the next slide. These are called riser guards, or boat standing areas. This is what we call as a jacket structure.

So, it looks like an assembly of different kinds of tubules steel members, forming a jacket. So, we call this platform as a jacket platform. You can also see the jacket bracings on every plane of the jacket structure. This is what we call as the mud mat of a jacket platform. I will explain what the mud mat is in the successive slides. This is a schematic diagram generated in the computer software of a jacket platform for analysis. This is the line diagram of a real jacket platform; you can see the flare boom; you can see the cranes; the helipad; the living quarters; the jackets; the bracings; then the skirt piles; then the risers; then derrick, etcetera.

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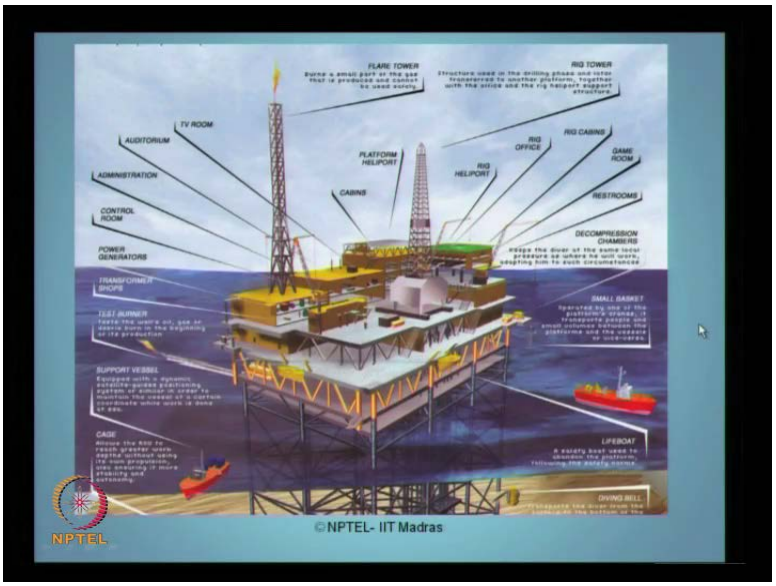

So, closer view of animated model of a jacket platform. You can see the top side can be as complicated as, can have a officers for TV room, auditorium, and a administrative block, control room, power generator units, transformer units, test burners, support vessels, rig helicopters, rig heliports, platform heliports, cabins for working, rig office, games room, rest rooms, decompression chambers, and so on. This, what we call as a flat tower of a flat stack; this is a rig tower which is used for drilling veins, we can see the lines which is going down; these are all risers. The next photograph, you will see them in detail.

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These are all risers; these are umbilical cable; this, what we see, the blue line here, is a jacket structure; these are all the bracings of a jacket structure, and so on.

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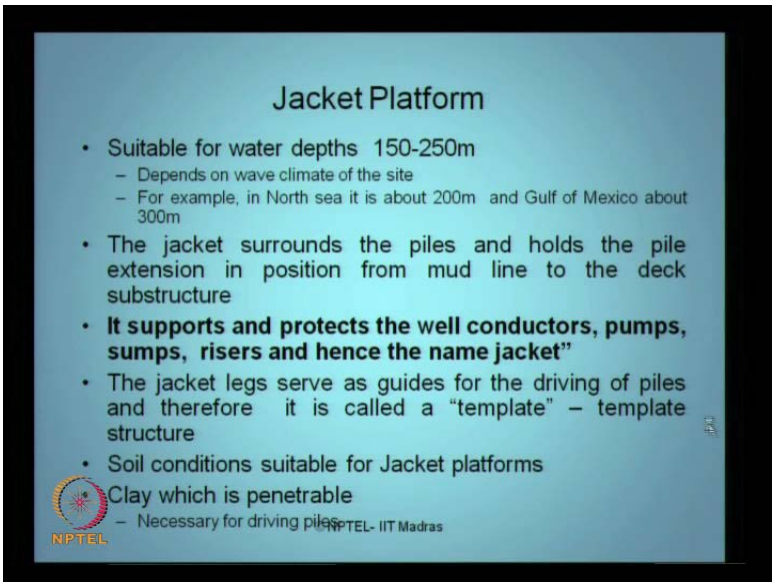

Jacket platforms are suitable to water depths up to 250 meters. Of course, the selection of depth depends on the wave climate of the site. For example, look at the North sea, it is suitable up to 200 meters because of its weather condition. Whereas, in Gulf of Mexico people have successfully installed jacket platforms up to a depth of about 300 meters. We saw in the last slides, in the last lecture, different lists of jacket structures being installed in North America.

The jacket surrounds the pile; holds the pile extension in position from the mud line to the deck substructure. It supports and protects the well conductors, the pumps, the sumps, risers, and hence the name jacket is given to this structure, because it is forming a protection for different upper tenancies, and equipments which are housed in this platform. The jacket legs also serve as a guide for driving the piles. Sometimes, because of this reason, people call jacket platforms as templates structures also. Soil conditions suitable for jacket platforms; essentially it is suitable for clay because it needs penetrable material for driving the necessary piles; it cannot be done in case of hard rocks.

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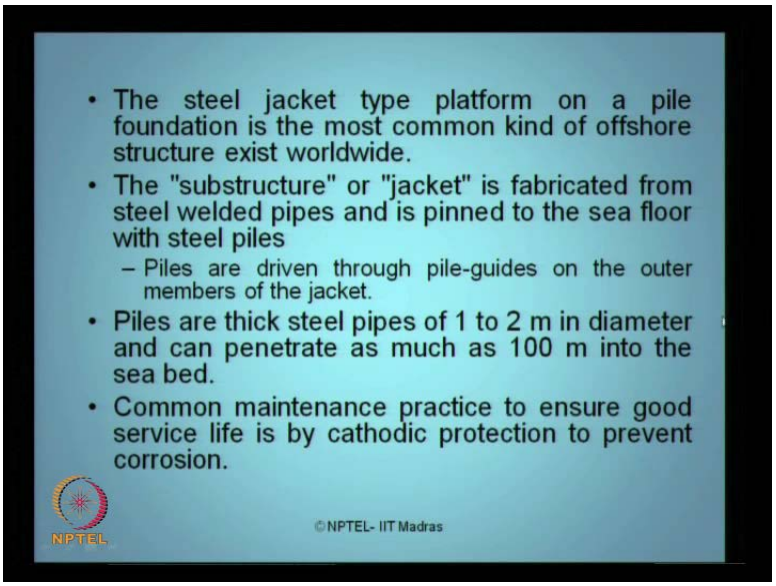

The steel jacket platform is one of the fixed jacket type platforms which are on, resting on the pile foundations. And is one of the very common kinds of fixed structure which is existing and used worldwide. The substructure or jacket, essentially is fabricated from steel welded pipes and then pinned to sea floor with steel piles. Piles are driven through pile guides on the outer members of the jacket. Piles are thick steel pipes of diameter to 1 to 2 meter; can penetrate as much as 100 meters into the sea bed. The common maintenance practice which is done for jacket structures is a cathodic protection, because steel being embedded in water, which is partially immerged in water, always acceptable to severe corrosion. Therefore, people generally use corrosion protection, by what we call as cathodic protection measures, which we will discuss this in later modules.

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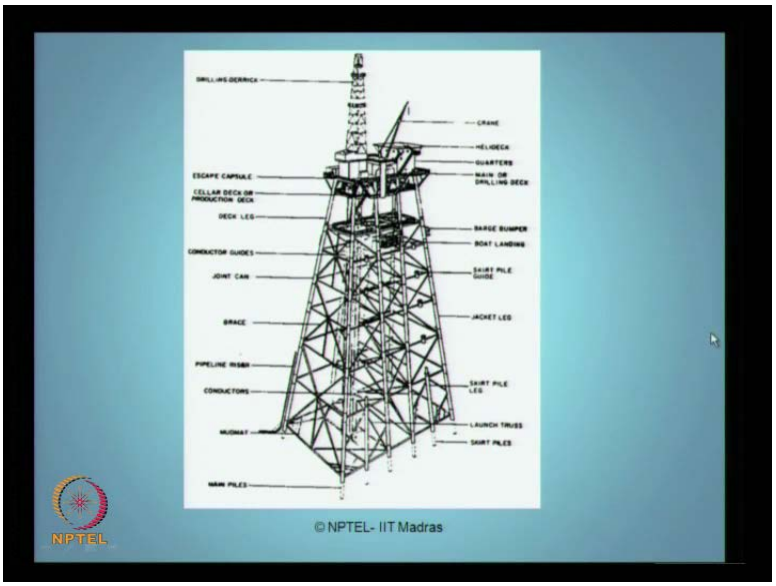

This is a typical view, line diagram, showing all the vital components, steel jacket structure. You can see a crane and the flare boom; you can see a derrick; you can see the topside; you can see the deck legs; you can see the bracings; you can see the pipeline risers; you can see the mud mat; you can see the main piles, which are shown in dotted here. We can also see the skirt piles. You can see, what is called as launch trusses is been used to launch the platform; you can see the skirt piles; the skirt pile guides; the barge bumpers; the boat landing facility, etcetera.

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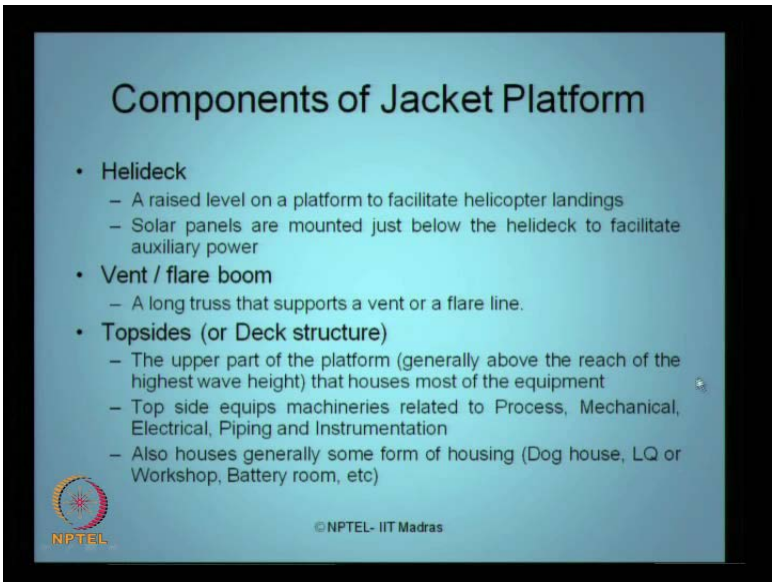

Let us see quickly the components of jacket platform. It contains the Helideck. Helideck is the raised level of a platform which is used for facilitating helicopter landing. Solar panels are also mounted just below the Helideck to facilitate auxiliary power for the platform. Flare boom is a long truss that supports a vent or a flare line.

Topside or deck structure has upper part of the platform, generally above the reach of highest wave height that houses most of the mechanical equipments used for production drilling. Remember, jacket platforms are meant for permanent installations; they are used for production drilling. The topside generally equips machineries related to process, mechanical, electrical, piping and instrumentation. It also houses, in form of housing: dog house, living quarters, workshops, and battery rooms, extra.

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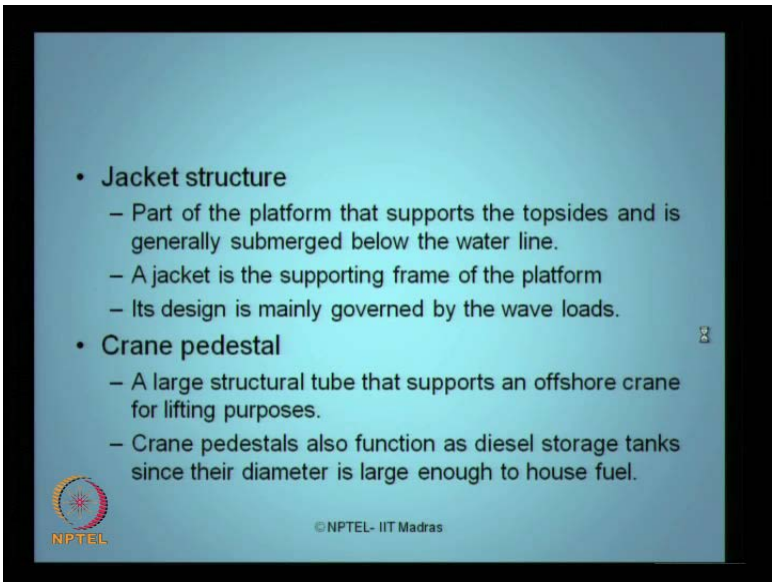

Jacket structure is part of the platform, which supports the platform. It is essential assembly of steel jacket pipes. Jacket is the supporting frame of the platform. It is designed mainly for encountering lateral forces from the waves.

Crane pedestal is a large structural tube that supports an offshore crane for lifting purposes. Crane pedestals also function as diesel storage tanks, since the diameter in pedestals are very large, and they house large of, large amount of fuel.

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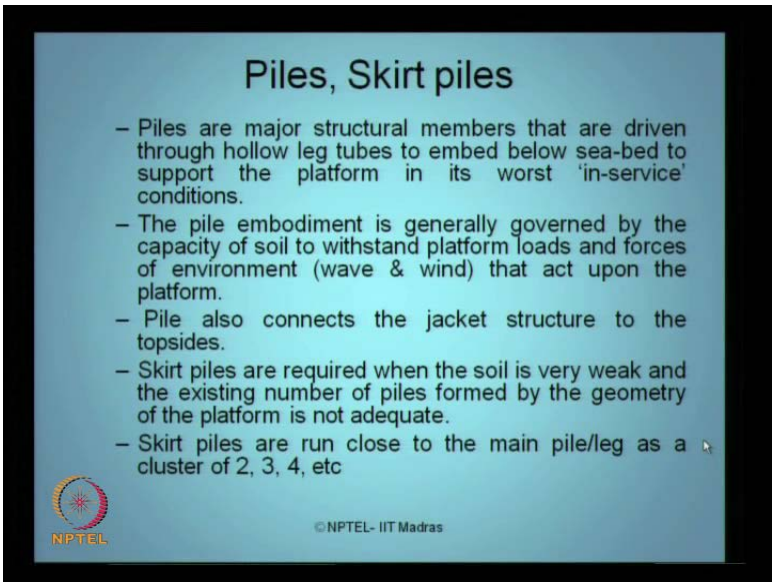

Piles are one of the major structural members that are driven through hollow leg tubes to embed the steel jackets below the sea-bed. The pile embodiment generally is governed by the capacity of soil to withstand platform loads. Pile also connects the jacket structure to the topsides. Skirt piles are required when the soil is very weak and the existing number of piles formed in the geometry is not adequate. Skirt pikes are run closer to the main piles as the cluster of 2, 3, and 4 in numbers. They are actually in groups.

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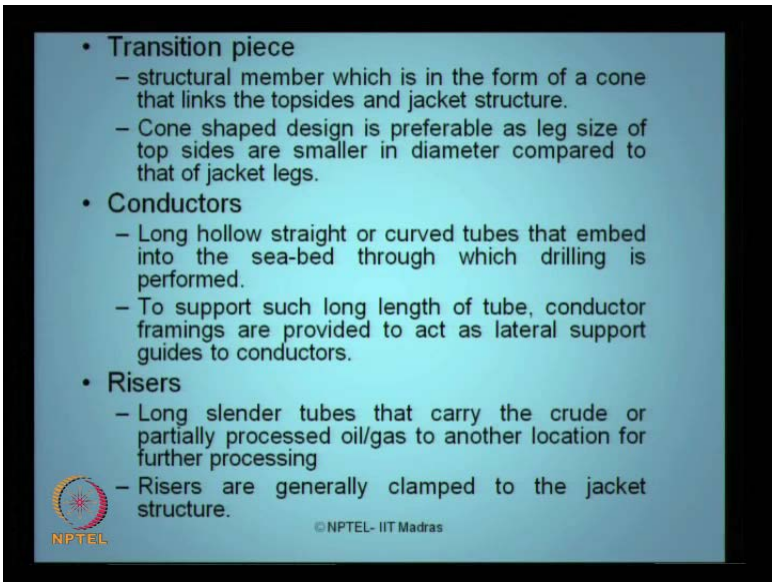

Transition piece is a very important component which is structural member, which is in the form of a cone that links the top sides with that of a jacket. It is a cone shaped design because it is preferred as the leg size of top sides are much smaller in diameter compared to that of the jacket legs. Conductors are long hollow straight or curved tubes that embed into the sea-bed through which drilling is performed. To support such long length of the tube, conductor framings are provided. Risers are long slender tubes that carry crude oil, or partially processed oil to another location for further process. Risers are generally clamped to the jacket legs.

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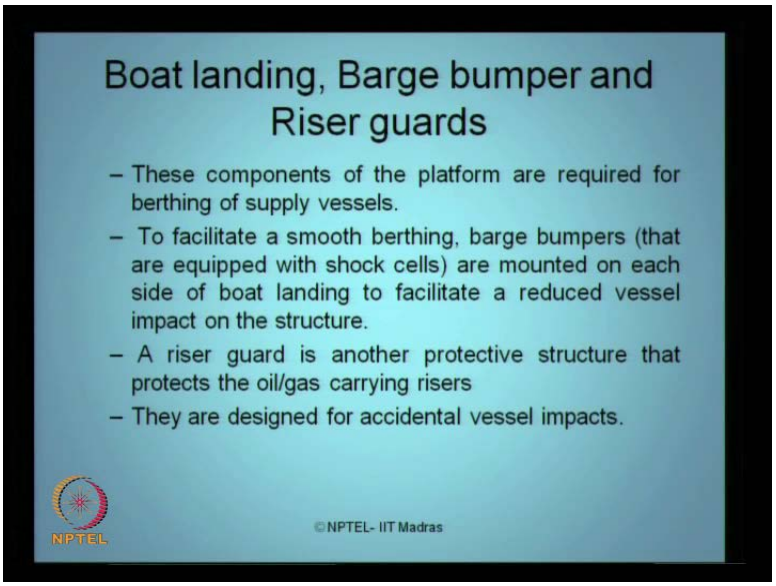

Boat landing, barge bumpers and riser guards are components of the platform which are required for berthing of supplying vessels. They are used to facilitate smooth berthing; barge bumpers are equipped with shock shells which are mounted on each side of boat landing to facilitate a reduced vessel impact on the jacket platform. Riser guard is another protective structure which is used to protect the oil carrying risers from the impact, accidental impacts caused on the jacket platforms.

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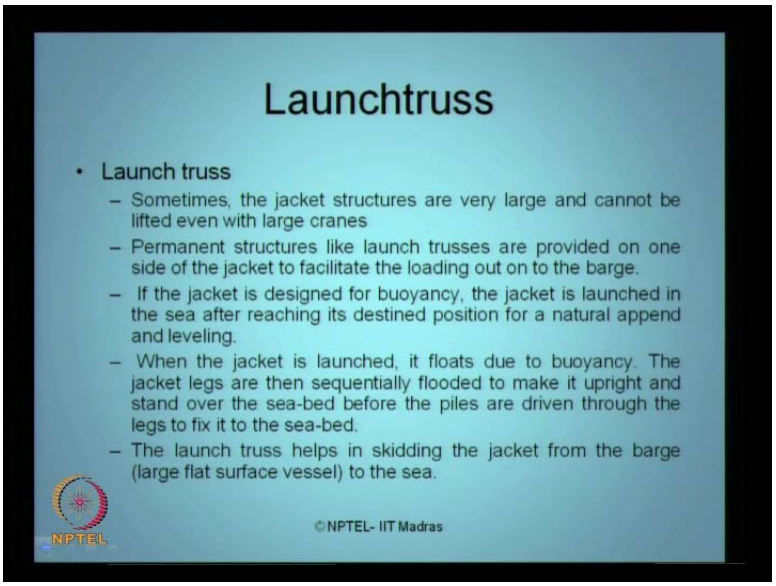

Launch truss is a very important vital component used for installation of jacket structures. Sometimes jacket structures are very large; it cannot be lifted even with large cranes. Permanent structures like launch trusses are provided on one side of the jacket to facilitate the loading out to the barge. If the jacket is designed for buoyancy, the jacket is launched in sea after reaching its destined position, for natural append and leveling. When the jacket is launched, it floats due to its buoyancy. The jacket legs are sequentially flooded to make it upright which we call as appending. In next few lectures, we will see the construction process involved, in case of installation for jacket structure.

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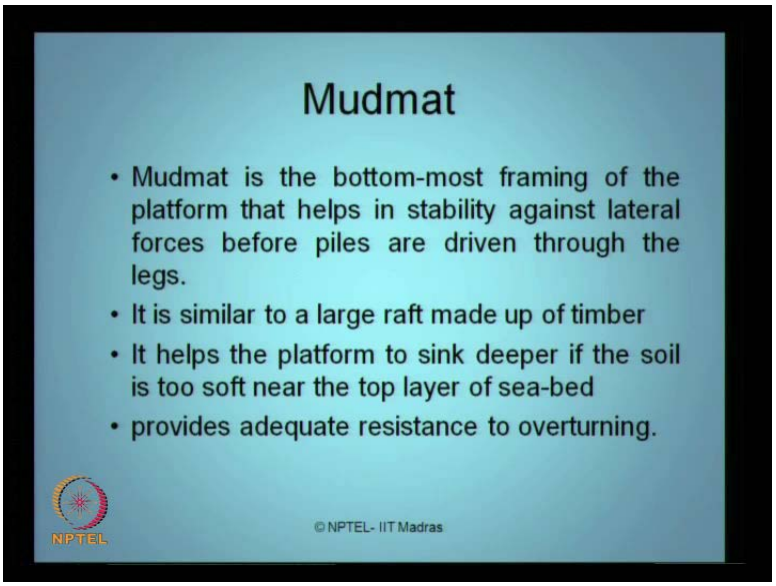

Mud mat is a very important component. The bottom-most framing of the platform that helps in the stability against lateral forces. They are useful to create stability of the platform even before the piles are driven. It is similar to a large raft made out of timber. It helps the platform to sink deeper because the soil is too soft, near the top layer of the sea-bed. Essential purpose of a mud mat is to provide adequate resistance to overturning during installation as well as in operation.

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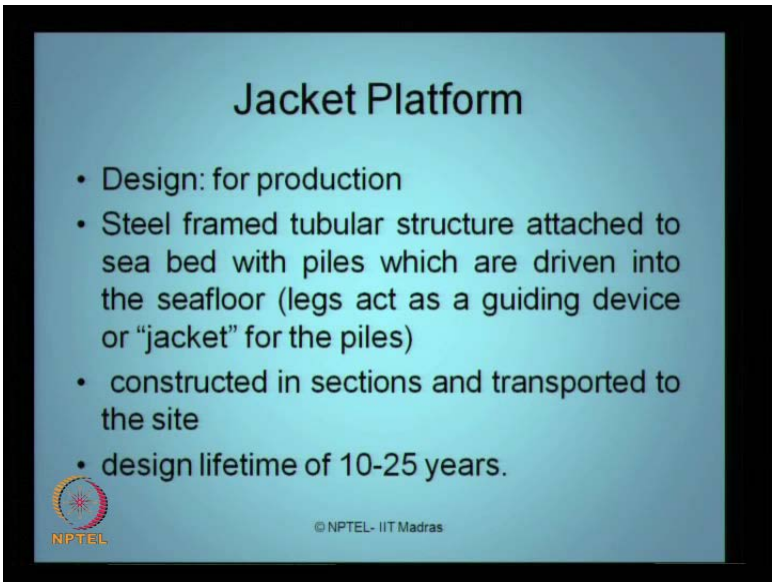

Essentially jacket platforms are meant for production. It is nothing but a steel framed tubular structure attached to the sea-bed with piles which are driven to the sea floor, legs act as a guiding device, or jacket for the plies. Constructed in sections and transported to the site in pieces. The design lifetime for jacket platform varies from 10 to 25 years.

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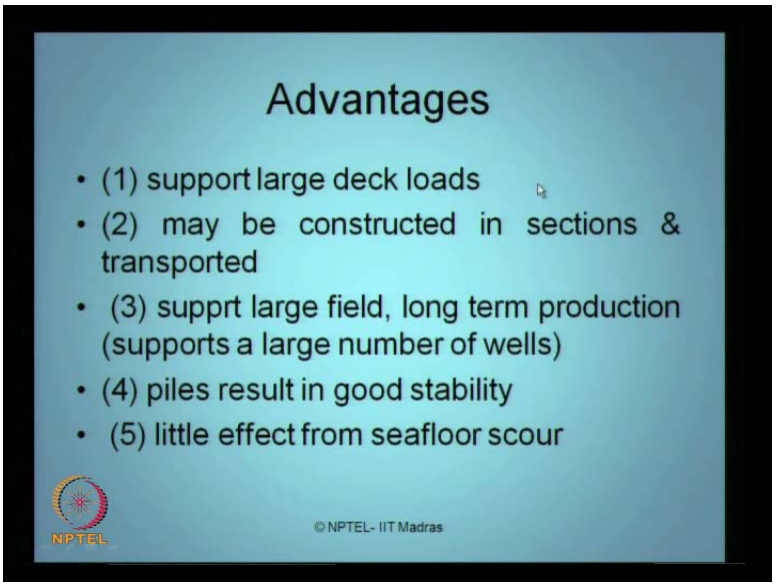

There are couples of advantages of jacket platforms: supports large deck loads; maybe constructed in sections and transported, because installation then becomes easy and simple; supports large field, long term production; it can support large number of wells; piles results in good stability of the platform; it has got a very little effect from the seafloor scouring whereas gravity based platforms are sensitive seafloor scour.

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There are couple of disadvantages for these kinds of platforms because the cost of these platform increases exponentially with depth; they have a very high initial and maintenance costs; they are not totally reusable; steel structural members are extensively subjected to corrosion which is a very serious problem; and therefore, corrosion protection measures are to be adopted in the design stage itself.

Thank you.