Port and Harbour Structures
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Module No 08
Lecture 40: Proposed Mega Terminal Chennai

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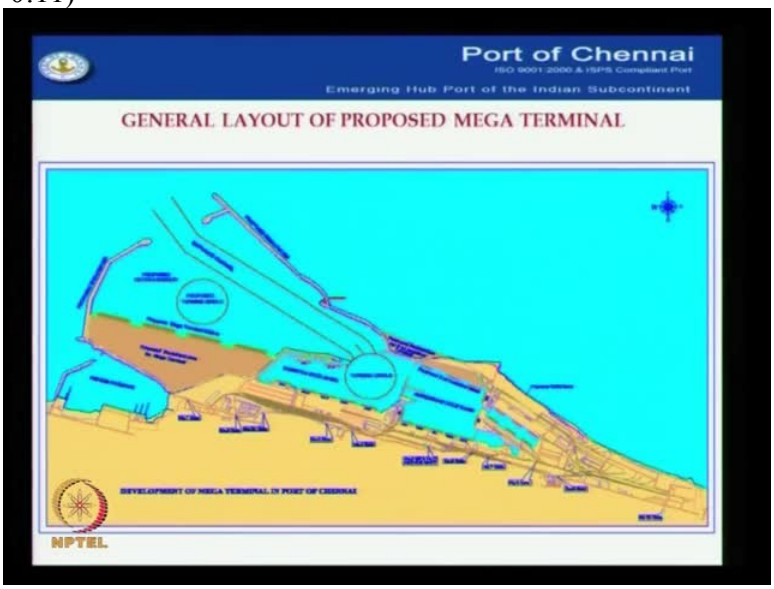

In this class we will discuss about the proposed mega terminal at Chennai, some of the environmental issues.

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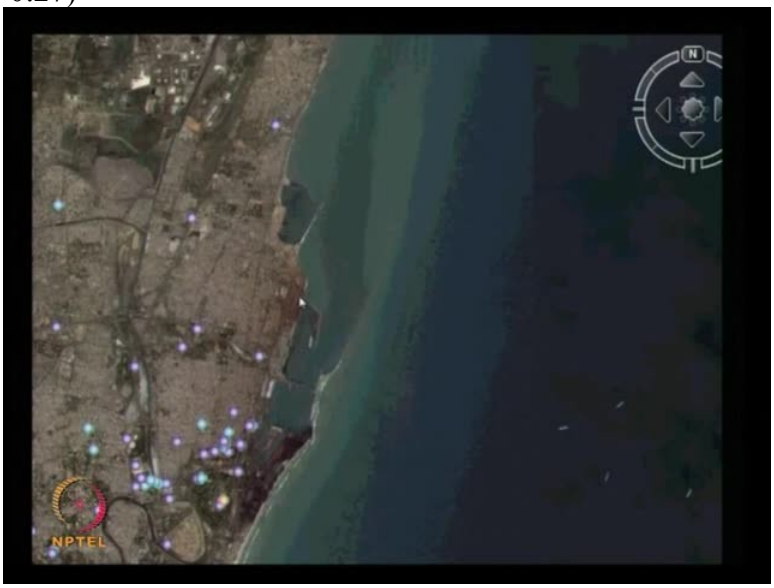

This mega terminal is built, this is the existing port of Chennai and we will be building 2 breakwaters. Proposed breakwaters are shown here. This is a fishing harbour. So you can see that this terminal what we are going to build is much bigger than what is existing here. In India, the 2nd biggest container terminal is Chennai.

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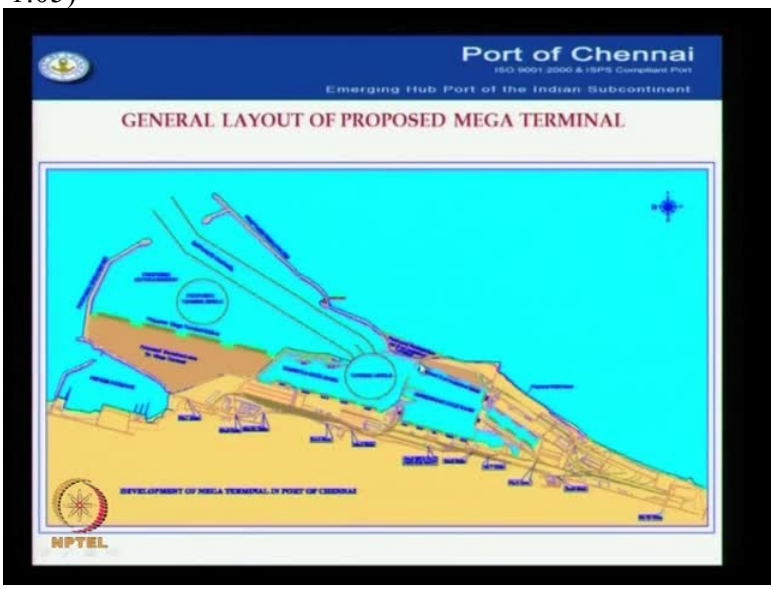

So what we are having in Chennai is two container terminals, container terminal 1 here, container terminal 2 here. What we are proposing is the mega terminalhere. This will be for a length of about 2 kilometre, existing is 1 kilometre here and about 900 metres here. So it will be such a big terminal here. To construct this terminal, what we need is one breakwater on this side and another breakwater on this side, a small one here.

And whatever material that is going to be dredged in these areas, will be used for reclamation so that we can use this area for transshipment facilities.

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These 2 breakwaters along with dredging what is being carried out at reclamation forms part of the mega terminal. The reclamation zone is shown here.

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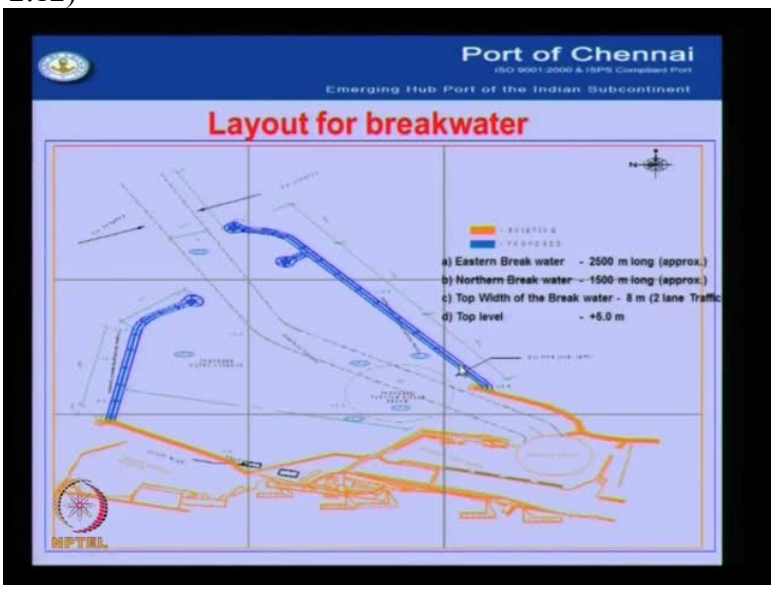

The breakwater we have 2 breakwaters, one is the northern breakwater. This breakwater length is about 1500 metres. Then we have the Eastern breakwater. Its length is about 2500 metres. We normally provide the top width of the breakwater is about 8 metres to take care of the two-lane traffic. The top-level is kept as plus 5 meter. We have studied various locations of turning circle. In the previous slide, turning circle was some other location but this is the final chosen

breakwaterentrance channel and turning circle location. The existing turning circle is somewhere inside.

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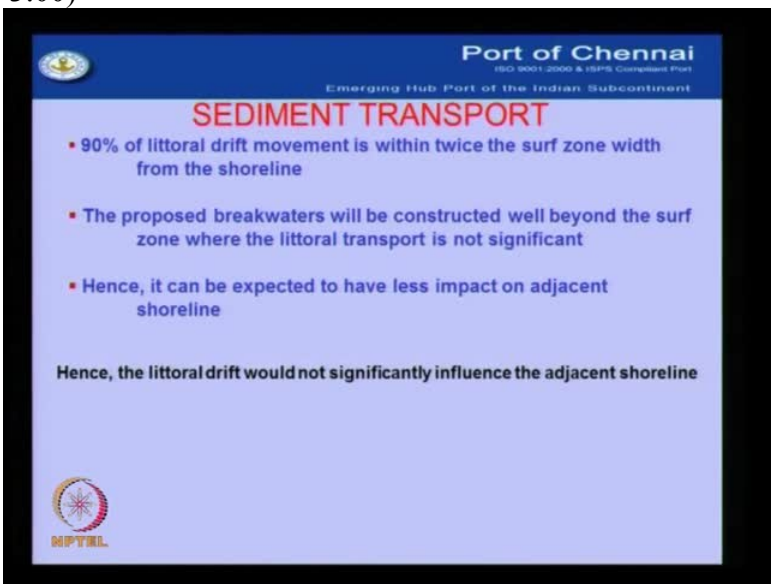

One of the studies that we have to consider is sediment transport. The sediment transport, last class I said that 90 percent of the littoral drift moment is within twice the surf zone width from the shoreline. Surf zone is the zone where the waves break, whatever is the width, you calculate the twice the width and there we will have the 90 percent littoral movement. And we are planning to build the breakwaters well beyond the surf zone where the littoral transport is not significant.

So there cannot be any effect of the construction of the new breakwaters on the littoral movement. So it will not have any impact on the adjacent shoreline. Hence littoral drift would not significantly influence the adjacent shoreline. This is one of the main benefit of this particular development.

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So as you see here, this is the zone of littoral zone and we are building it beyond that. Here we have this where we are seeing the wave breaking, this wet patch, that is the place where normally the waves will break. Twice the width if we take, it will be somewhere here. And we will be starting the breakwater here at this location maybe about 10 meter contour and here it is 5 meter contour. So we will not have any effect on the shoreline.

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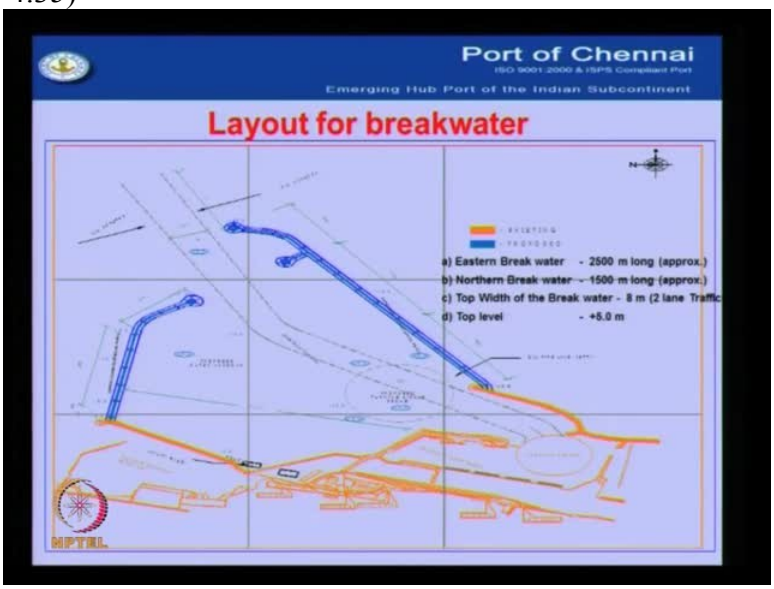

One of the major advantage of this container terminal is as I told before, it is a transshipment terminal.

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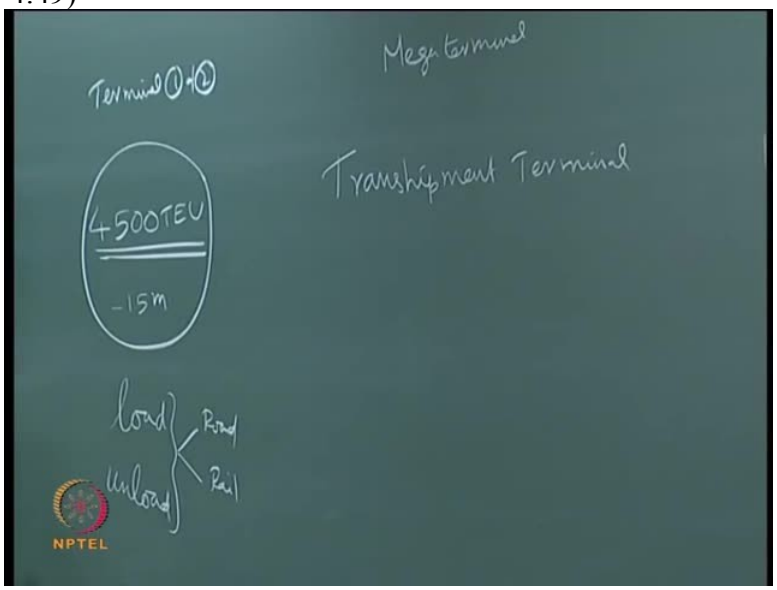

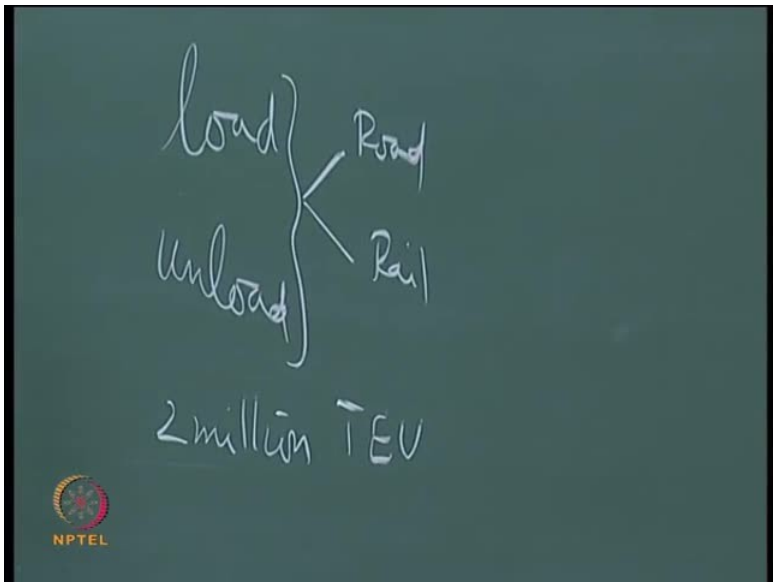

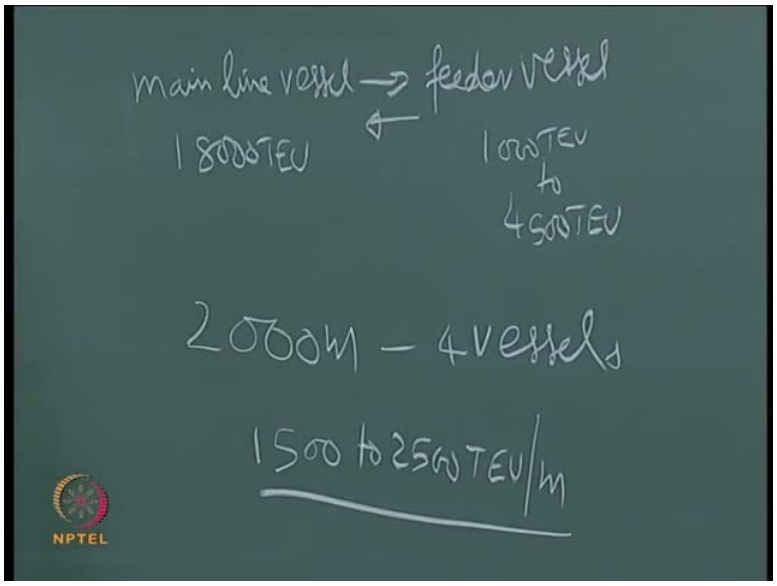

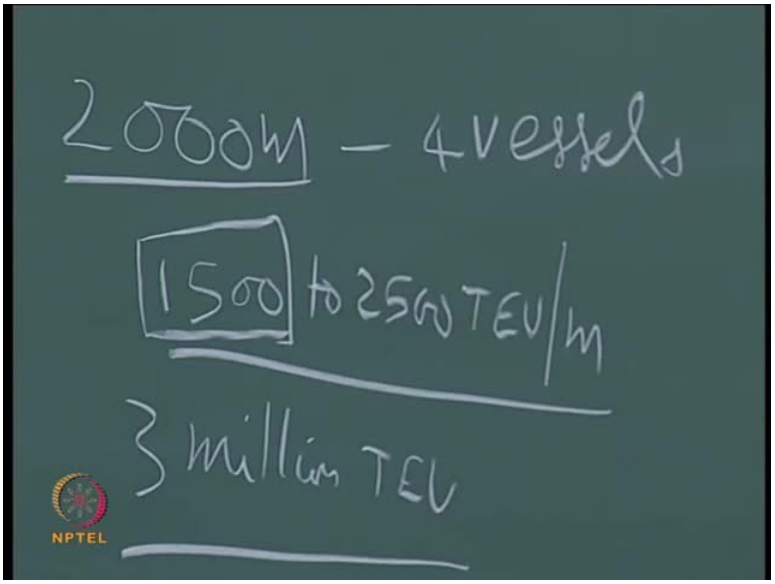

At present we are handling about 4500 TEU vessels, this is what we are handling. And about we are providing a draft of around minus 15 meter. This is what we are providing to handle this vessel. This transshipment terminal once it is commissioned, this will be handling about 18,000 TEU vessel and we will have a depth of about 21 metres. So this is the existing terminal 1 and 2 and the proposed mega terminal is given here. The advantage is it is a transshipment terminal whereas here the cargo comes and container comes, either you are loading or unloading. And this is going either by road or rail.

What at present, it is planned is about 2 million TEU approximately. This is what is being handled here and the length is around 1900 metres. But here for the transshipment terminal, you will have a bigger 9 line vessel. From this, it will go to a feeder vessel for unloading. For loading, from feeder vessel it will come to 9 line vessel. This is the advantage. Thistraffic is not for Chennai hinterland, this traffic can be for the entire East Coast or other countries. So you will get a very big vessel, maybe 18,000 TEU vessel.

And the feeder vessel can be 1000 TEU to 4500 TEU. This is the advantage of the transshipment terminal. And we do not have any transshipment terminal in India. Our cargo for India goes to Singapore or Colombo where the bigger vessels come and then from there it gets transferred. So we want to attract that, for that we need a very deep draft vessel and the length of the berth is around 2000 metres.

Typically we can keep 4 vessels of smaller size or 2 vessels of bigger size, 2 or 3 vessels. Typically per annum, in 1 metre you can handle about 1500 to 2500 TEU per metre. This is what we can handle. In India JNPT, they are handling around 2000 TEU per metre length of the key. So here, the length is around 2500 metres. If we take 1500 TEU per metre, we will be handling about 3 million TEUs. That is what we want to handle.

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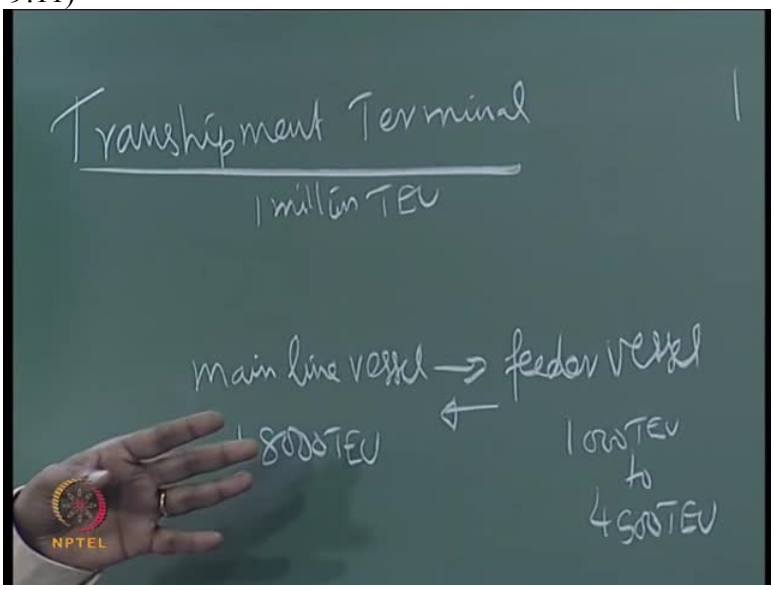

So if you get 1 million TEU cargo for transshipment terminal, you will be loading into feeder vessel, 1 million TEU. That means you will unload from here, 1 million TEU and then load it into the feeder vessel, 1 million TEU. So you will get the throughput as 2 million TEU because the mainline vessel will come and will unload the cargo into the terminal, backup space what we are creating.

Then the feeder vessels will come in different times and from this the feeder vessel also can come with some cargo, then it can unload the cargo, then from the transshipment terminal, it will take the cargo and take it out. That means when you create adequate storage and deep draft, the mainline vessel will come and unload the cargo and go and the feeder vessel can come and take it back. In the other way, the feeder vessel come and unload the cargo and we can load from the terminal to the mainline vessel. So the both of the things are possible.

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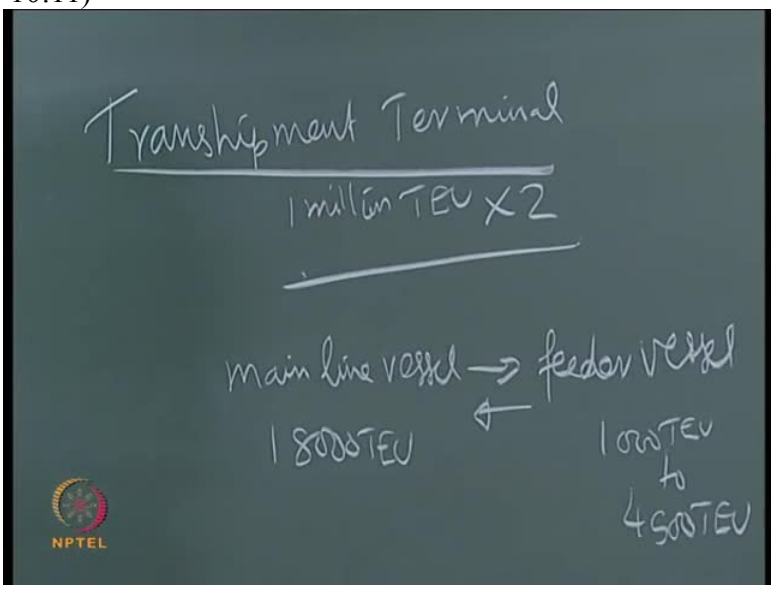

And only 1 million TEU into 2, this is the catch here. And another 1 million TEU is planned for Chennai hinterland, that is what is in plan. So that is the disadvantage in a transshipment terminal because using the same infrastructure, you will be able to maximise the throughput because samecontainer box you take it from one bigger vessel, keep it on the berth and then put it back on a smaller feeder vessel. So this way, this is very advantageous.

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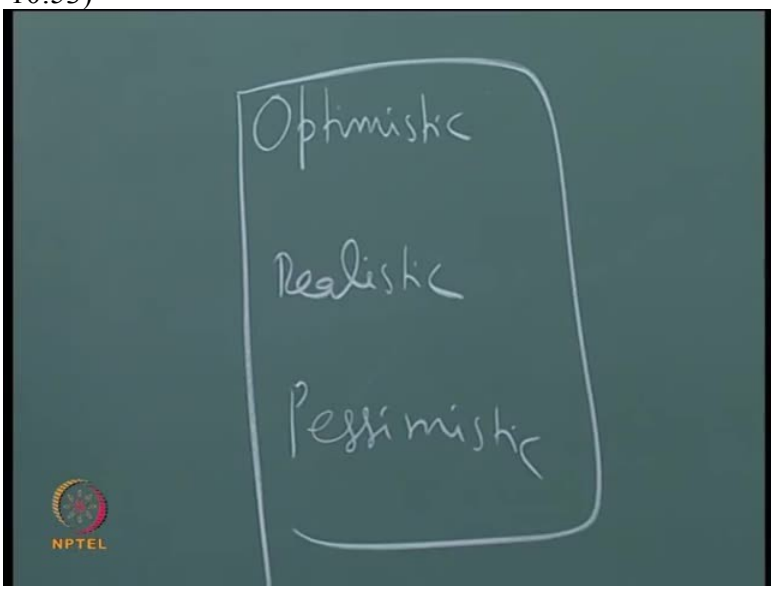

And this is the whenever we give the projection of traffic survey, we give optimistic, realistic and pessimistic, these are the 3 scenarios we can see. The pessimistic is 1500, realistic maybe 2000, optimistic can be 2500. That means, it can vary from 3 million TEU to 5 million TEU. That is what. If there is a traffic potential, then you will be able to handle this much amount of cargo.

Another advantage of transshipment terminal is you do not need so much ofroad and rail linkages. So if there is a road and rail linkage required, then there is traffic problem, then pollution due to so many containers being transported, that problem also is not there.

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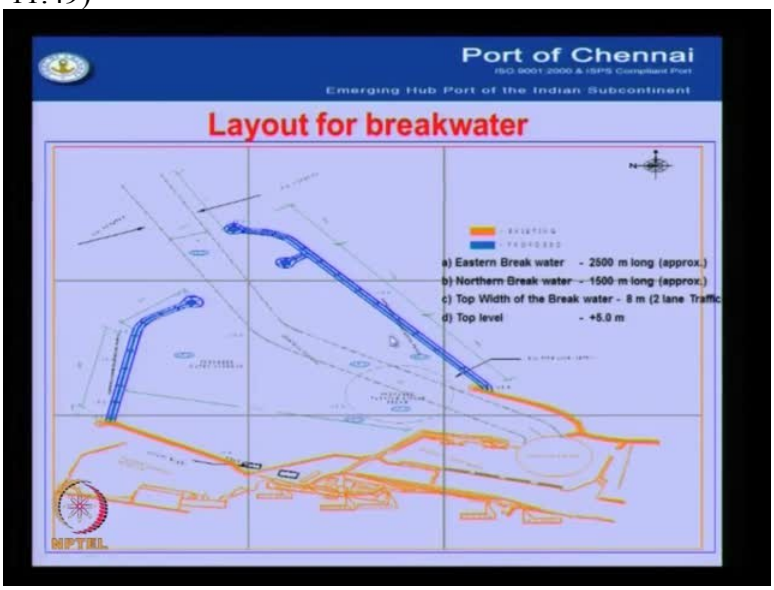

In addition to that, we are planning some more facilities here, some liquid terminal and berth terminal, that is in the proposal stage only.

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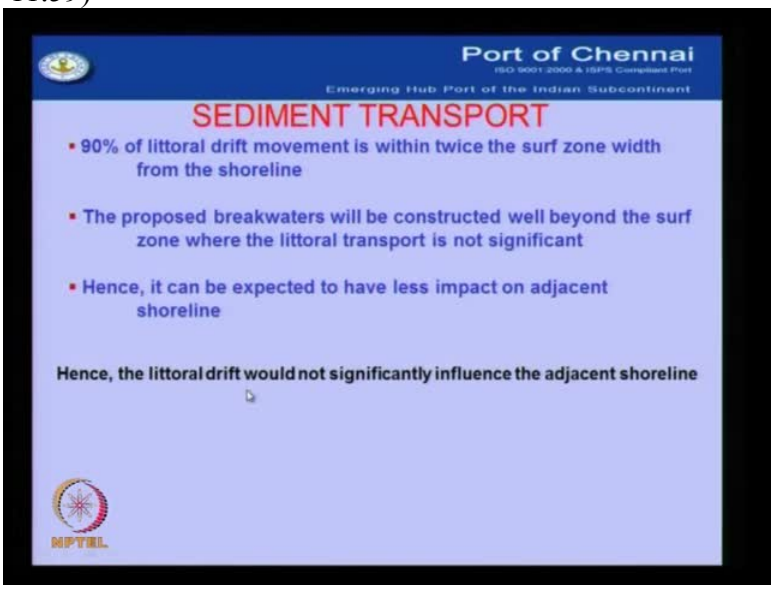

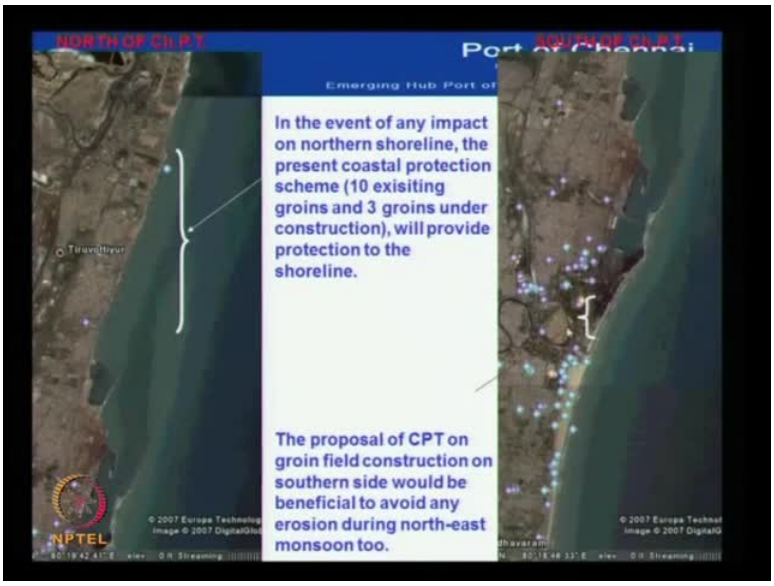

So this particular slide we are giving what are the environmental concerns that are to be addressed. Suppose even after considering that the sediment transport may influence some portion of the coastline, we have built a lot of groynes here all along the coast. Present coastal protection scheme, there are 10 groynes already built here and 3 are under progress. This will protect the shoreline.

And the proposal of CPT, this is on the southern side, this is on the northern side. This is the port, this is on the northern side. This is the port and this is on the southern side. There also, Chennai port is planning some groyne field so that during north-east monsoon, there will be erosion here that can be avoided. So during Southwest monsoon when the waves are coming from this side, the erosion will be here. During north-east monsoon, when the waves are coming from here, the erosion will be here.

So the Southwest monsoon waves when they are travelling like this, if there is a erosion here, these groynes will help. During north-east monsoon when the waves are coming here, these groynes which are planned here south of this will prevent the erosion.

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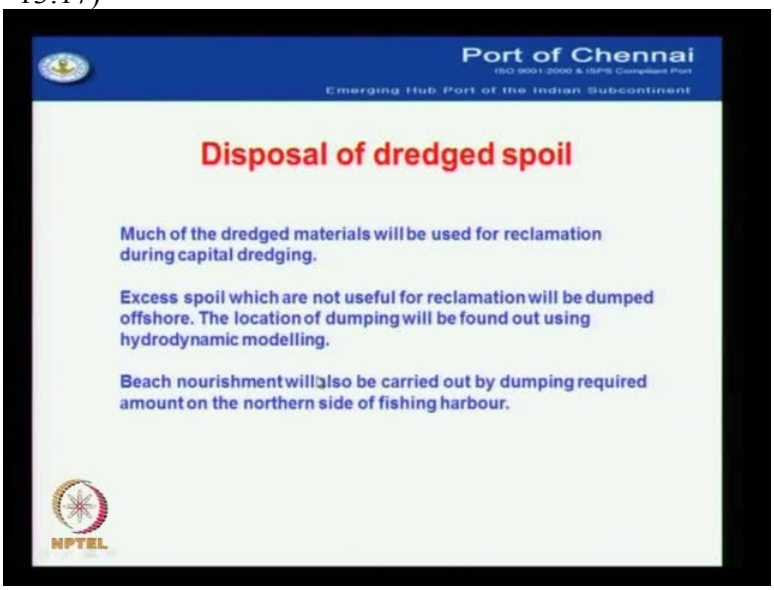

Then we have this dredged material. Whenever you remove the soil by dredging, what are you going to use it for? Now we have planned that we will using it for reclamation during capital dredging. This is an advantage. Suppose Rs. 200 per cubic metre is the cost of dredging. If you want to reclaim the land, getting the sand from other place, it is another Rs. 200, so total Rs. 400 are required for dredging separately and reclamation separately. Suppose you use the same material for reclamation, the Rs. 200 dredging cost, the same cost you can reclaim also.

Sometimes, the cost will be less also because if you want to dredge and dispose it off into the sea, the cost of transportation of the barges which are transporting is to be added. Soif you can dredged and reclaim very close by, the cost of dredging also will come down. All the soil will not be useful for reclamation because if it is a clay soil, it will not be useful. So we dump theexcess pile that is into the deep sea.

And we have carried out in a hydrodynamic modelling where we can dump the soil. Therequirement is wherever you are dumping, from there it should not come back to where you have dredged. So because of the coastal movement and sediment movement onshore-off-road, that is one of the thing we have to see. And it should not create any environmental problem also. In addition, the beach nourishment is also proposed on the northern side of fishing harbour where there is some, in spite of groynes, certain problems associated with erosion.

So we will do the beach nourishment. So the dredged material it will be disposed in 3 categories. One is for reclamation inside the mega terminal, other one is dumping the soil which cannot be used for reclamation in the deep sea, then artificial nourishment on the northern side as a stockpile.

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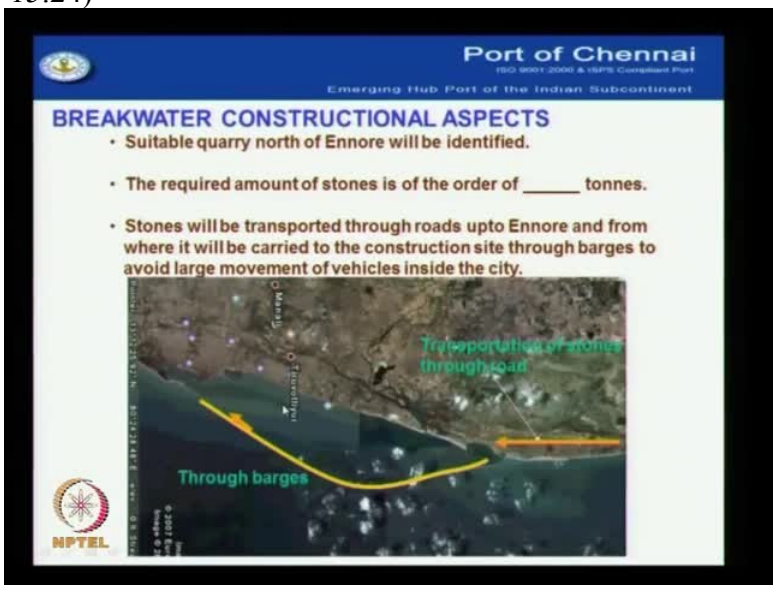

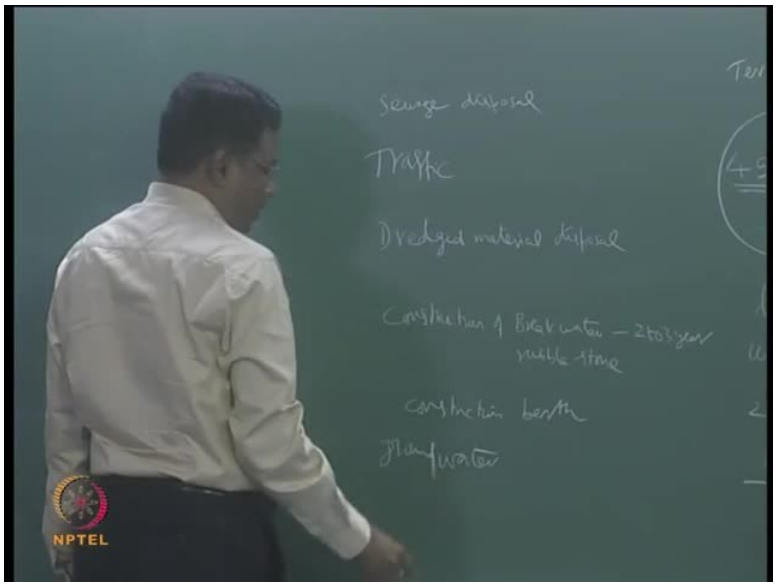

So the environmental aspects connected with any development can be summarised like this. One is the traffic. You have to build roads, rails and other thing. The 2nd one is disposal of dredged material. And during construction of a breakwater which is very, we will be using either artificial

armour or stone. So there will be a lot of transportation required for breakwater, that is rubble stone transportation. This also has to be studied.

Normally, the breakwater construction will take about 2 to 3 years because it is a very long breakwater and deeper water also. Then construction of berth will also create some pollution. Thenthis water what you are using for construction and other purpose, you should not take it from ground. So groundwater tapping is to be avoided. Then we need to have this sewage disposal, some water disposal and other associated issues also you have to see, these are the various studies which you have to carry out to see that this particular structure what you are building will not create any problem.

So what is planned for this breakwater construction is we want to the quarry will be identified, this is on the north of Ennore around 60 kilometre, then we have to take the required amount of stone, this is of the order of about 20 to 30 million tonnes based on the type of breakwater what you are going to plan. I will explain about that later and the stones will be transported through roads up to Ennore.

This is the Ennore port, so the quarry will be somewhere here. You will transport by road. Here it is not a congested area, you can transport it through road and from here, you will be transporting by barges to the Chennai port because we want to transport the stone all the way to Chennai port by road, this is a heavily congested area, so there will bevarious issues related to bottleneck of traffic and other things. So we will be transporting it by barges.

Another advantage is barge dumping is required for construction of breakwater because it is easier to dump from the barge rather than from the road.

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And we can have bargeswhen you talk about the barges, so the barge one one set of barges can start construction of this, another set of barges can start construction of this, so you can do 2 breakwaters parallely for the construction. Once you fill up this area and reclaim this and develop the port, from here if you want to transport it either by road or rail, there are certain proposal which are already there.

There is already a direct connectivity to the port which is being planned, elevated corridor. So that will solve the problem. Once this is commissioned, parallely that road also will be commissioned.

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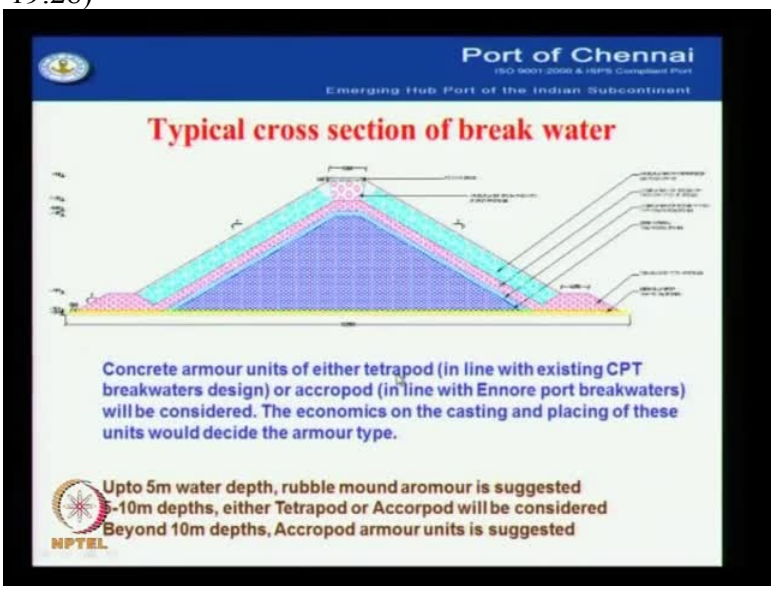

This shows a typical cross-section of the breakwater. This has a filter, core, primary armour, secondary armour and these armour layers. These armour layers can be either tetrapod. This is what isbeing used in existing Chennai port trust breakwater or a new type of design that is using accropod which is successfully used in Ennore port. Both of the things will be considered. The economics of casting and placing of these units would decide the armour unit but this breakwater construction will be for the private developer.

This will not be done by Chennai port. So they will decide which type of breakwater they have to use. As I told, the Eastern breakwater starts from 5 metre, so from 5 meter to 10 meter, we will use a rubble mound armour. That is, this armour will be rubble mound and beyond 10 meter water depth we will use either written tetrapod or accropod for the breakwater.

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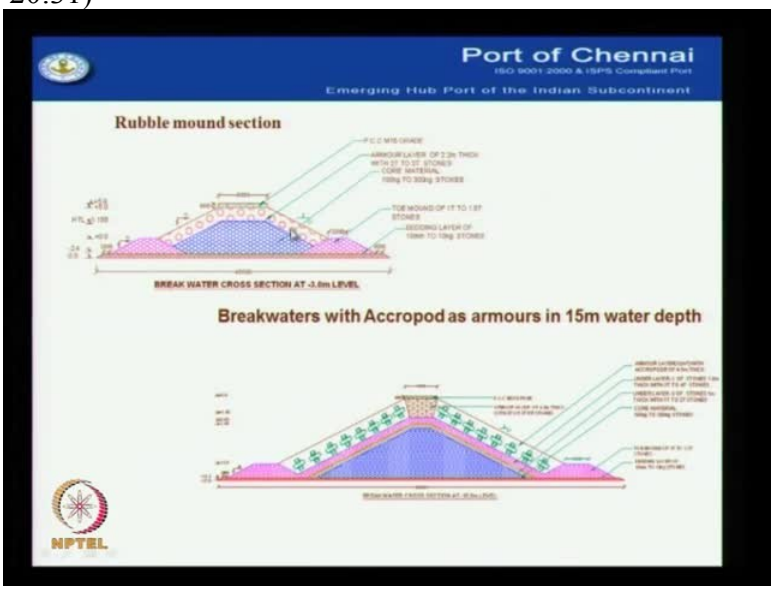

So this shows the rubble mound section. So here the armour units what we are placing, we have a 2.2 metre thick with 2 to 3 ton stone. We provide 8 meter width of the breakwater and it starts at about minus 3 metre contour. The top-level will be kept as plus 5 meter. Any breakwater cross-section will have a filter, a core, an armour and a toe mound. This is the toe mound which will be placed. In 15 meter water depth, we will be going for a armour unit using accropods.

When you use a very big size armours, between core and armour we will have a core cover and a secondary armour unit that will be placed. But other things also will remain, that is a filter, core, toe mound, armour will be there. In addition, we will have 2 more layers.

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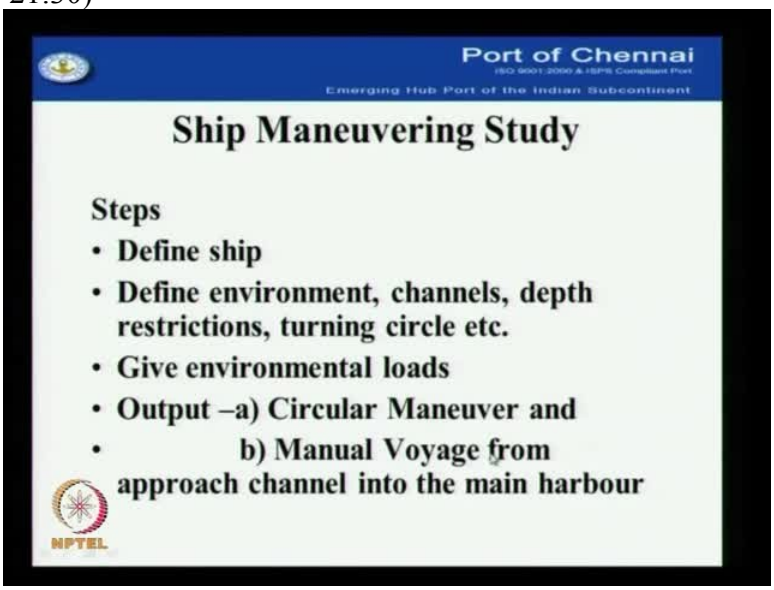

Another important study to be carried out is the ship manoeuvring study. That is when you are bringing a bigger size vessel, you have to define the ship that is if it is 18,000 TEU vessel, what is the length, beam and draft of the vessel? Then you to define the environment channels, depth restrictions, turning circle, et cetera. You have to give the environmental load and we should find the output what is the circular maneuver and manual voyage from approach channel into the main harbour. These are the studies which you have to carry out.

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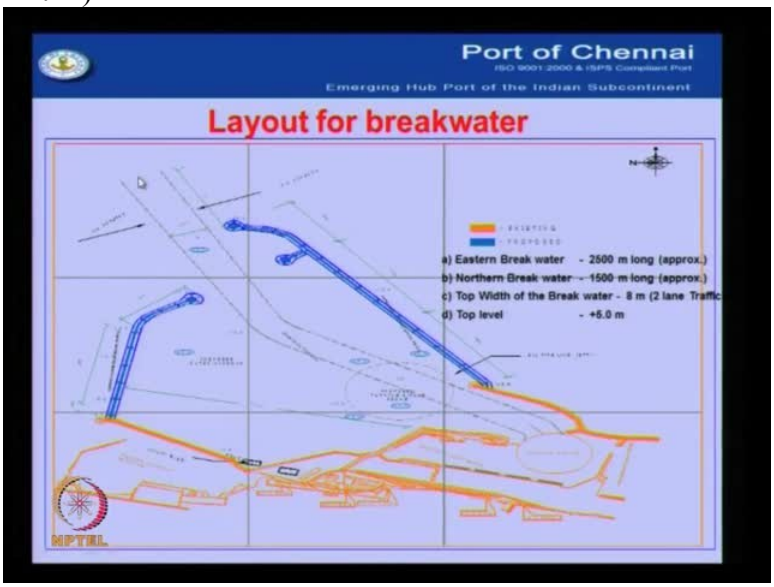

For example if for this particular structure which we are planning to do, somewhere here the tip of the breakwater is there, at this level the water depth is around minus 20 meter, somewhere here it is minus 10 meter. We have to dredge the Channel for a width of about 21 metres inside, then we have to make a harbour basin turning circle also. So whenever the vessel comes here, they stop the engine here, it does not move.

Normally vessels move between 15 knots to 20 knots. 1 knot is 1.8 kilometre per hour. Generally 15 to 25 knots it will be going outside. But when it comes to the port, it will slowly reduce the speed and it will come about 2 to 3 knots. Then they stop the engine, then tug boats will go from here, then bring the vessel inside. So when you stop the engine, the vessel does not stop immediately because it is coming with an inertia.

It does not have a break. So the bigger size vessel, 18,000 TEU vessel means the weight will be around 1, 80,000 tonnes. So when it is coming with the speed, it will not stop on its own. You have to, there is no break. You stop the engine, then it travels. The distance it travels before it comes to complete halt is 7 times the length of the vessel. Suppose 300 metre is the length of the vessel, it needs 2.1 kilometre for bringing the vessel for bringing the vessel to a stop.

So this distance is approximately 2.1 kilometre, Eastern breakwater length is 2500 metres, so the vessel will come, this is the manual voyage, they are using tug assistance. The vessel will come and stop. Then they will turn the vessel and along this berth, they will berth the vessel. After unloading or loading, the vessel will start the engine and go out like this. So this study has to be carried out. We need a very big harbour basin for carrying out this maneuver and all. So the study has also been carried out.

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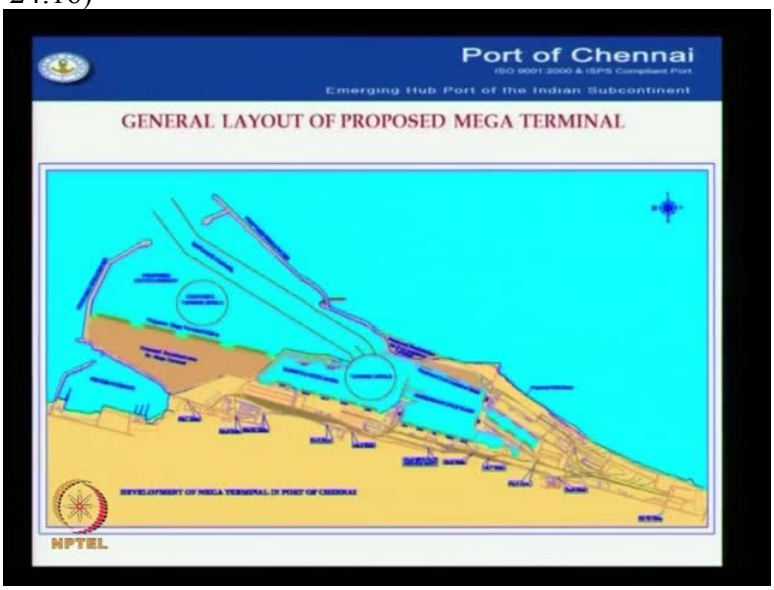

So this shows again the layout of the mega terminal.

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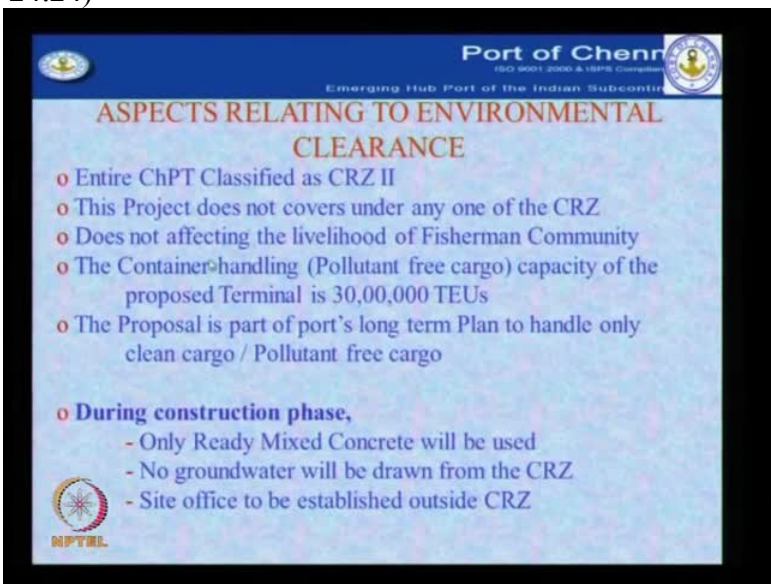

What are the aspects relating to environmental clearance? There is a CRZ I, II, II and IV it is classified. I will explain about the CRZ zonesseparately. This does not come under CRZ I you have to write in that. It does not affect the livelihood of fishermen community because we are not disturbing the fishermen. The fishing harbour will have a protection from these breakwaters. The wave attack will be less.

The container handling because this is a pollutant free cargo, so there will not be any pollutants. At present, what is happening is we are handling coal, iron ore and other cargoes in Chennai port. So this creates lot of dust and other problems. Slowly we will be shifting all this dusty cargo to Ennore port and Chennai port will handle only the container cargo.

Andthis long-term plan for Chennai port is to make it has a clean cargo terminal. So we have clean cargo ports and dirty cargo ports. If we use iron ore, coal and all, it becomes very dirty whereas the container is a clean cargo port. And I have listed out various schemes to be done for environmental clearance and another important thing during construction phase is, we have to use ready mixed concrete.

That means you do not make the concrete in the Harbor basin, you get the supply from outside. No groundwater will be drawn from the CRZ area and the site office also will be located outside the CRZ area.

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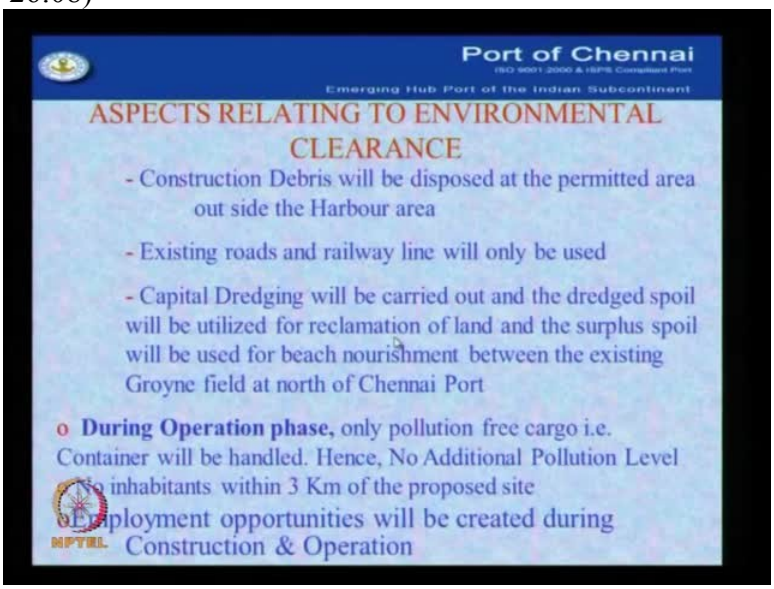

Then construction debris that will be disposed at permitted area outside the harbour and we will they will be using only the existing roads and railway line during construction period. And as we have told earlier, the capital dredging will be used for reclamation and surplus oil will be used for beach nourishment. This is during the construction phase. During the operation phase, there will be only pollution free cargo.

So there will not be any additional pollution. There is no inhabitants within 3 kilometre of the proposed site. And this will create a lot of employment opportunities during construction as well as in the operation. This is direct benefit to the local community.

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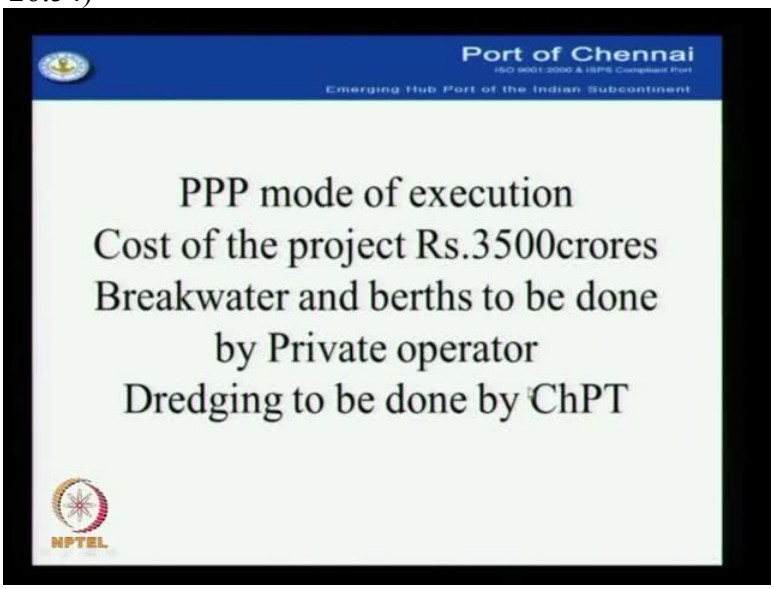

This project will be handled in public-private partnership mode, this is called as a PPP mode of execution. The cost of the project is about 3500 crores and the breakwater and berths will be done by the private operator and the dredging is to be done by Chennai port. So dredging is about 600 or 700 crores, the balance will be invested by the private operator. Now comes the viability of the project. Generally in India, this viability of the project, there is a ballpark figure.

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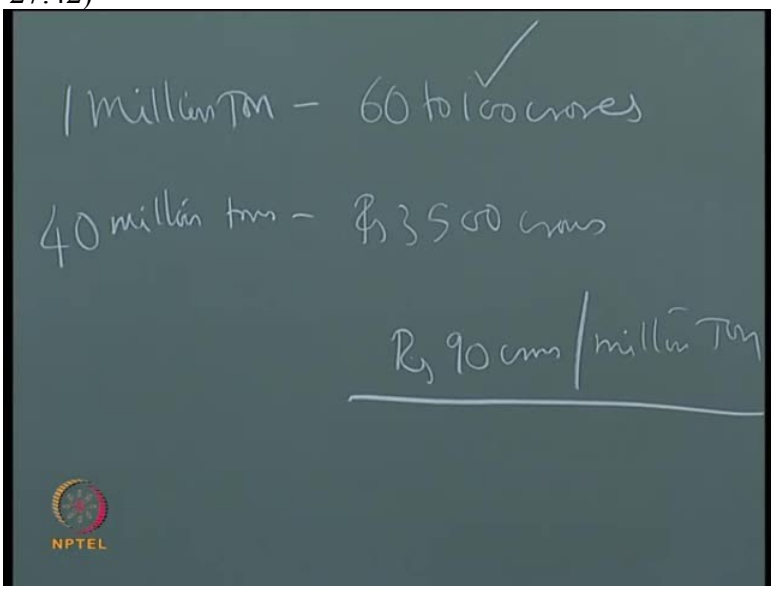

Suppose you want to develop a port for handing 1 million tonne, if the capital investment is between 60 to 100 crores, then it is viable depending on the type of cargo and the location and the hinterland development and competition, this will be there but generally the upper limit 100 crores if it is there, it is okay. When you talk about 3 million TEU, that is equal to approximately about 40 million tonnes you can take and the cost is about 3500 crores.

So approximately the cost come to about Rs. 90 crores per million tonne. So this show the viability of the project. So when you spend about 90 crores per million tonne, when you handle it then the project will become viable based on the charges what you are doing and all, this is the ballpark figure which can be used to see whether this project is viable or otherwise. So in the next lecture, I will be discussing aboutthis development of DPR for many projects. There also we will be discussing about all these things.

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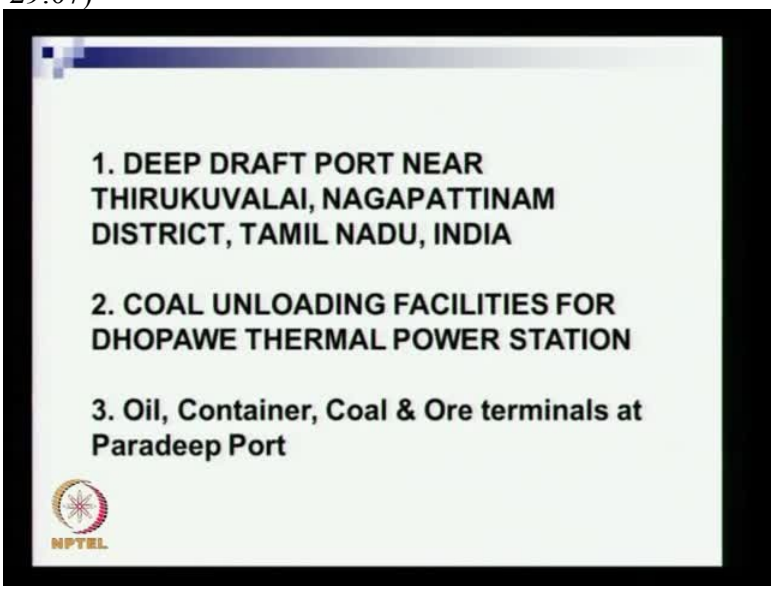

So this lecture will be on detailed project report. We will be discussing about 3 projects. The 1st project is a deepwater, deep draft port near Thirukuvalai, Nagapattinam, district Tamil Nadu. The 2nd project is coal unloading facilities for Dhopawe thermal power station, the 3rd project is oil, container, coal and ore terminals at Paradip port. These 2 projects are considered as a greenfield project.

Greenfield means there is nothing existing. You have to start afresh and start doing this. The 3rd project is only a terminals which you are developing. In the existing port you are constructing separate terminals for these 4 different types of cargoes. This coal unloading facilities for Dhopawe thermal Power Station, this can be considered as a captive port. So when you talk about the port, we can talk about different classifications.

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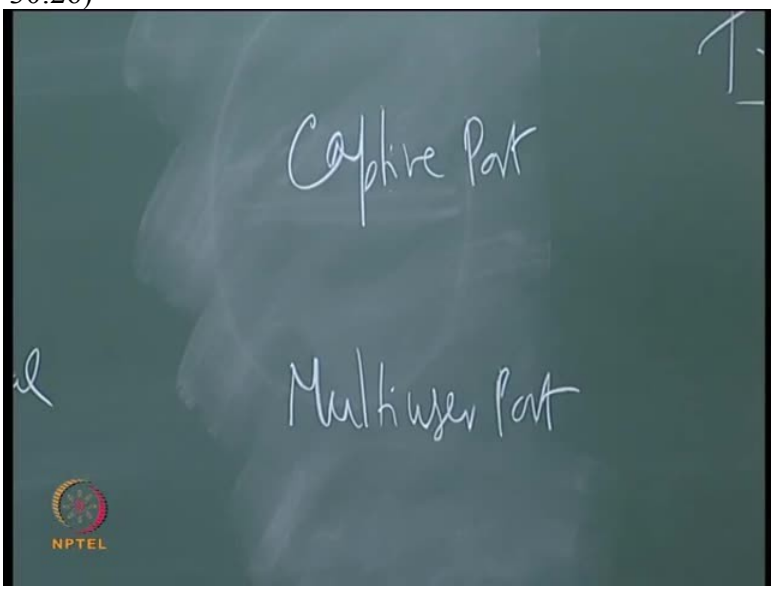

One of the classification what we will be discussing is whether it is a captive port or multi-user port. Chennai port is a multi-user port where different people, we have car terminal, we have container cargo,, we have liquid cargo for different uses. That is called as a multi-user port. Captive port means if you are developing a power plant, you will be getting the cargo only for the power plant. That is called as acaptive port. Sothis Dhopawe thermal Power Station what we are developing a coal unloading facility is a captive port. This we are planning as a multi-user port.

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1st see the Tirukuvali port. This is the India map. Our Tirukuvali is somewhere here, the location shown here. So adjacent, we have this Nagapattinam, Karaikal, (())(31:22) and here we have (()) (31:26). And this is a wetland, somewhere here we have the Vailankanni. So this Tirukuvali is when you develop a port, from any historical site, it should be 10 kilometre away. Actually, this is about 12 kilometre. And natural heritage and other areas also it should be away.

So you cannot build any port facility here because it is a wetland. So this is far away from this wetland area. So this location is decided. One of the reason this port is being developed here isthough it is a multi-user port, there was a proposal, there is a proposal to build a power plant

here. For this powerplant, this will act like a captive port but as a captive port, this project is not viable. So they want to convert as a multi-user port so that they will use for the captive as well as for other cargoes.

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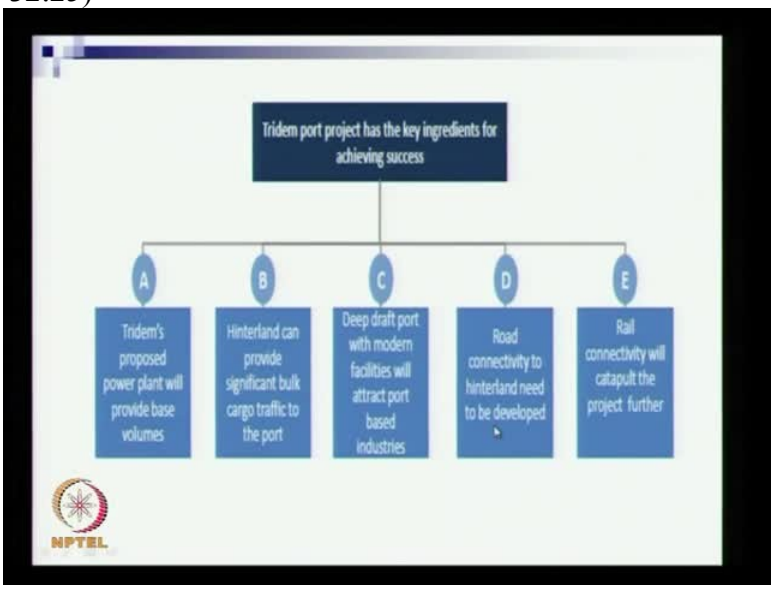

For that to do, we have to do a traffic study. Thistraffic study will tell you whether the project will be viable or otherwise. There are 5 segments of the traffic study. One is the base volume, that is the minimum guarantee traffic that will be for the captive power plant of the Tridem port. The hinterland, this can provide bulk cargo traffic to the port. This is for the multi-user port. And if we make it as a deep draft port, then it can attract port based industries, you have to provide modern facilities for that.

In order to achieve this, we need a good road connectivity to hinterland and we also need rail connectivity. These are the 5 significant components that are required to make the project successful.

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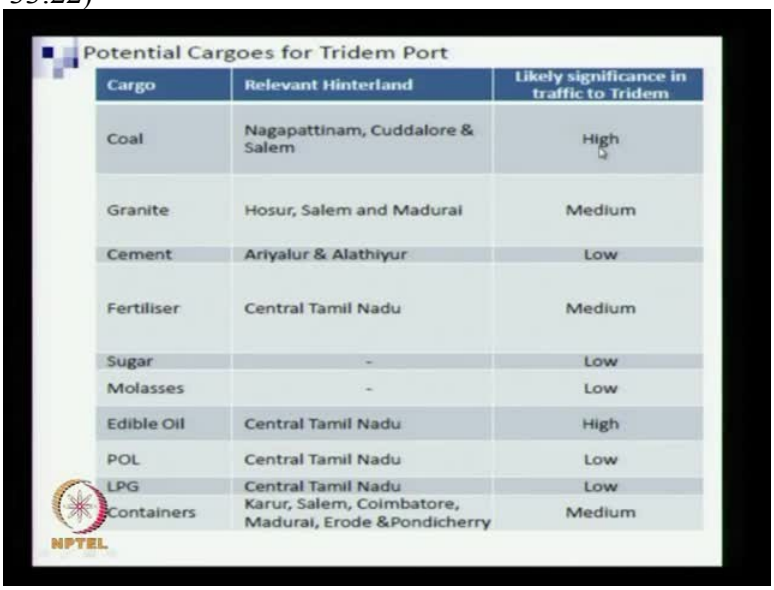

What are the cargo for this port? They can be classified into coal, granite, cement, fertiliser, sugar, molasses, edible oil, POL, LPG and containers. Here likely significance in traffic to Tridem is very high. That means, it is definite that you will get this. And some of them are in medium category, some of them in low category, container is in the medium category. So we are targeting this medium category containers and high category coal as the major source of cargo for this port.

And this shows the hinterland, Nagapattinam, Cuddalore and Salem district and Central Tamil Nadu for fertiliser. And for containers, it is from Karur, Salem, Coimbatore, Madurai, Erode and Pondicherry. These are all industrially developed areas. At present, this cargo goes either to Chennai or to Tuticorin. So once you develop a good facility, then this can attract this cargo.

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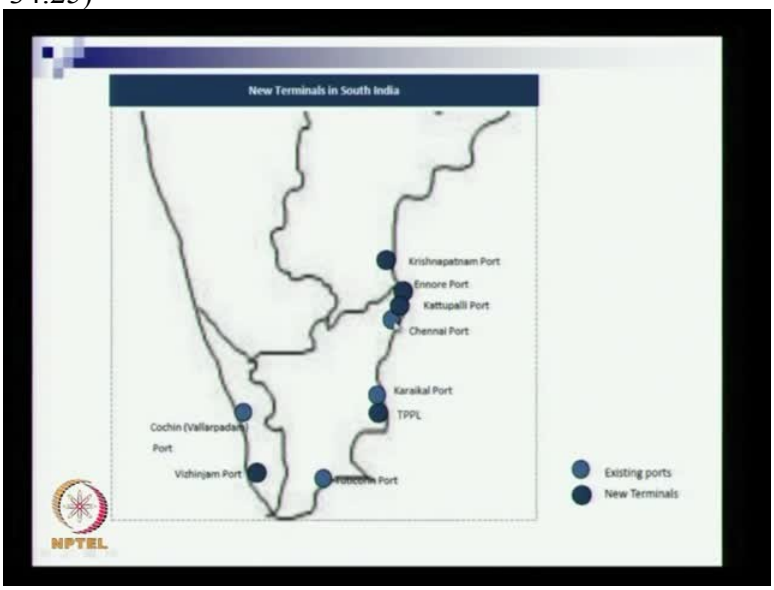

But whenever you develop any port, that this is Tirukuvali port what we are developing, we have to see the competition adjacent, already there is a port called Karaikal port and Tamil Nadu we have already developed Chennai port and Tuticorin Port and the major ports and the Ennore port and the Kattupali port also are already developed. Then we have a Krishnapatnam port here. There is a small mistake here. Ennore port is this and Kattupali port is this. This is Kattupali port and this is Ennore port. In Cochin port, container hub has been developed that is Vallarpadam port. This is in the planning stage, that is the Vizhinjam port is in the planning stage.

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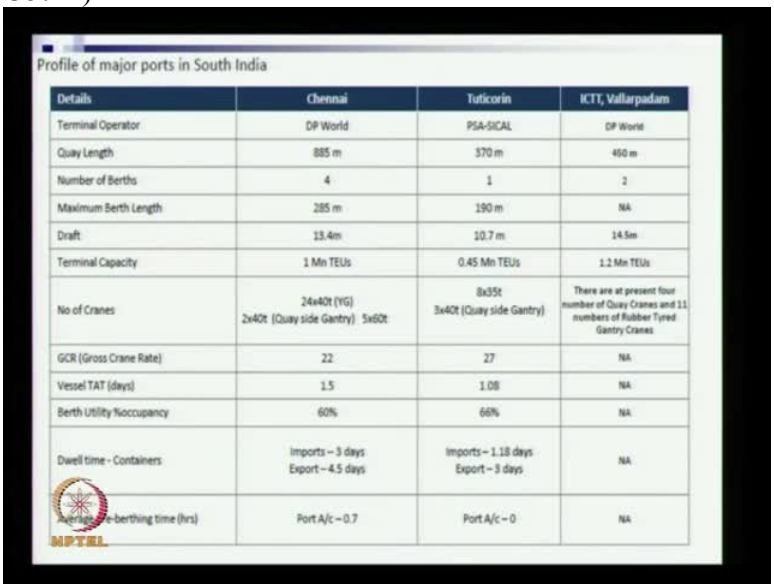

Details	Chennai	Tuticorin	ICTT, Vallarpadam
Terminal Operator	DP World	PSA-SICAL	DP World
Quay Length	885 m	370 m	460 m
Number of Berths	4	1	2
Maximum Berth Length	285 m	190 m	NA
Draft	13.4m	10.7 m	14.5m
Terminal Capacity	1 Mn TEUs	0.45 Mn TEUs	1.2 Mn TEUs
No of Cranes	24x40t (YG) 2x40t (Quay side Gantry) 5x60t	8x35t 3x40t (Quay side Gantry)	There are at present four number of Quay Cranes and 11 numbers of Rubber Tyred Gantry Cranes
GCR (Gross Crane Rate)	22	27	NA
Vessel TAT (days)	1.5	1.08	NA
Berth Utility %occupancy	60%	68%	NA
Dwell time - Containers	Imports – 3 days Export – 4.5 days	Imports – 1.18 days Export – 3 days	NA
Average pre-berthing time (hrs)	Port A/c – 0.7	Port A/c – 0	NA

We will compare the 3 ports which will become competitive to Tridem port. One is Chennai, another is Tuticorin, the 3rd one is Vallarpadam. The operators are DP-world, PSA-SICAL and this is also DP-world. The length is 885 metres, subsequently they added some more length that is being operated by PSA-SICAL. 370 metre is Tuticorin and 450 metre is Vallarpadam. Number of berths are 4,1 and 2. What is the maximum berth length, that is also given here.

Draft is 13.4 metre in Chennai, Tuticorin is 10.7 and Vallarpadam is 14.5. So if we go more than Chennai and very close to Vallarpadam then we can attract cargo. The number of cranes, these are most modern facilities we are talking about. So number of cranes also decide how you quickly you are able to load and unload. And then other occupancy factors and what is the time taken for dwell time for containers, average pre-berthing time, how much time it has to wait, these are the factors that governs.

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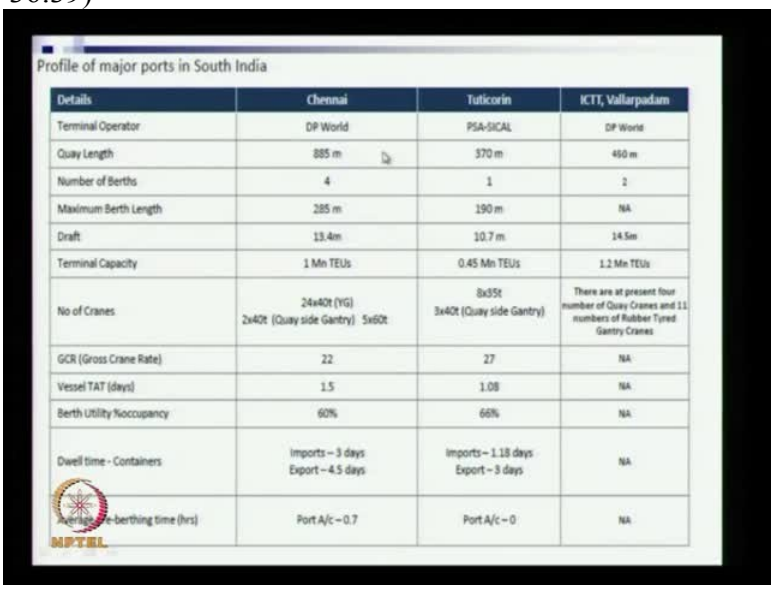

To give a rough idea how much container is being handled, Chennai is 2 million tonnes, Cochin is 1.2 million tonnes, Tuticorin is 0.45 million tonnes. These are all the capacities. They may not be handling this much, they may be handling. I think Chennai port and Tuticorin Port are very close. Vallarpadam has to achieve this target. They have not reached this 1.2 million.

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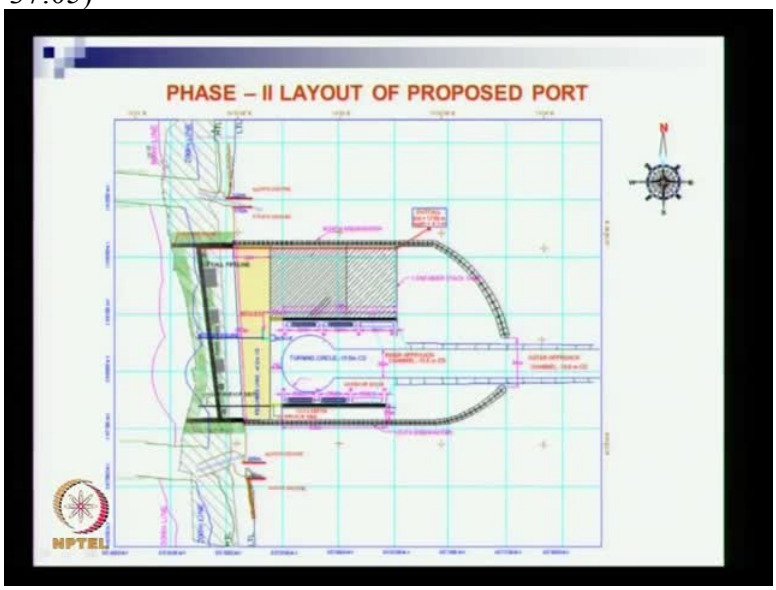

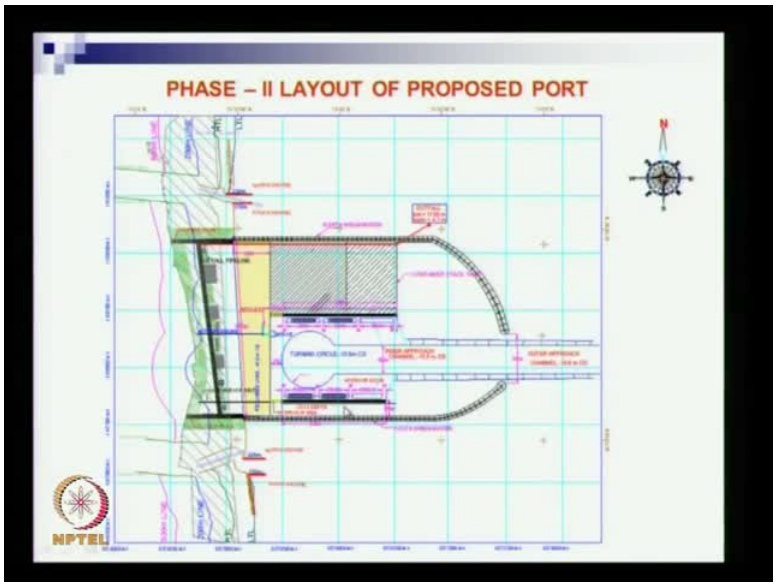

So having seen the traffic potential, we have to make a layout. So this shows the layout of the full terminal. We have an entrance channel, eastern entrance. There is a turning circle, some reclamation area is here, some reclamation area is here. This side, we are developing the container terminal, this side coal terminal will be developed. Coal will be unloaded, 3 vessels will be there and from here they will be transporting through a conveyor to the powerplant directly.

Containers will be loaded here. From here, it will be going to other places. There are 2 rivers which are draining in. So you construct some draining walls on both the rivers so that the mouth

will not get clogged because of the construction of the breakwater. And this whole facility cannot be developed immediately. Initially they will not develop all the facilities together. This will be done in a phased manner that you can see here.

They want to developphase 1 with 2 berths here and 2 berths here, not all the berths together. If you see here, there are 3 berths and 3 berths whereas here they want to do 2 berths and 2 berths only and they will restrict the dredging area. Dredging is a very major issue here. So the 5 meter contour is somewhere here but this bed slope is very flat. So to reach this 5 meter contour it will take more than 2000 metres.

So bed slope is 1 is to 400. So it is a very flat slope, the dozen of the disadvantage for this. That is why, the cost is higher but the advantage is, the environment is very calm. There is not see from this 5 kilometre bed 5 metre depth to 14 metre depth, it has to travel for another 10 kilometres. It is a very large distance to reach port. So you need a entrance channel which is more than 10 kilometre long outside the harbour basin. That is also a disadvantage. But this maintenance dredging will be less because there is not much of littoral moment.

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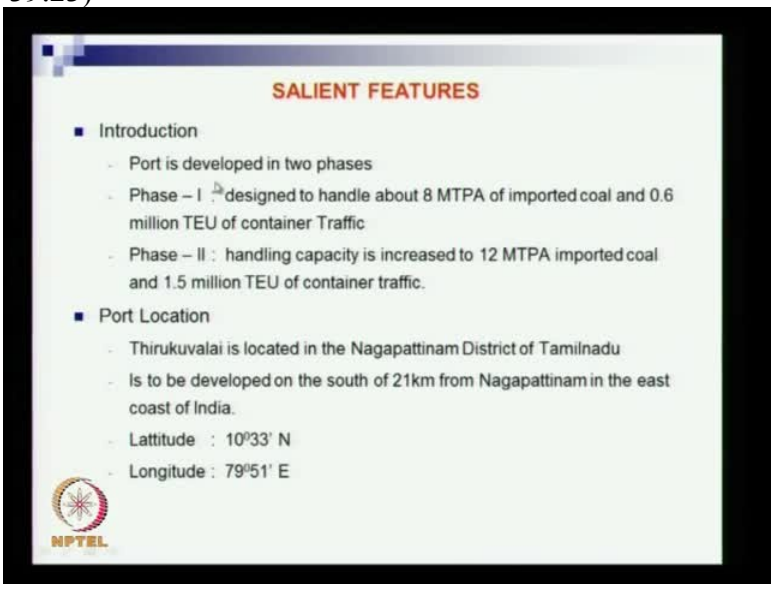

So we are dividing the port into 2 phases, 1st phase we will be handling 8 million tonnes of imported coal and 0.6 million TEU of container. In the phase 2, we will handle 12 million tonnes per annum of imported coal and 1.5 million TEU of container traffic. But after this project has

been prepared, there is a recession. This has been prepared since 2009 onwards, there is a recession. Now this much of cargo throughput is not there.

So we have to revise the estimate. So in phase 1 is reduced down to one berth only coal berth since they are looking how to make this port economical and viable.

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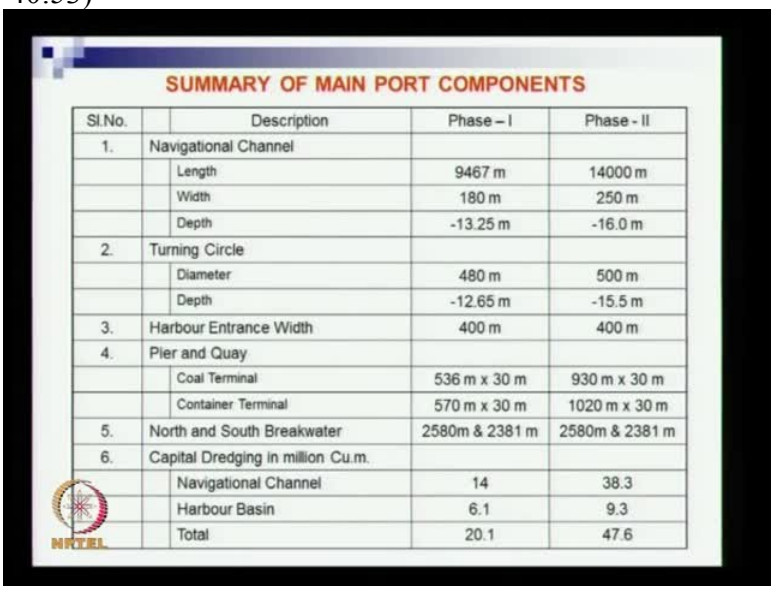

These are the 2 phases that we have to do. That is the phase 1 we will be dredging up to 13.25 meter. There are various components for this port, one is the navigation channel and 2nd one is the turning circle, next we need the harbour entrance width, what are the dimension of the quay, what is the length of North and South breakwater, what is the dredging quantity, navigational channel, harbour basin and total.

So we have to do it in 2 phases. Navigational channel initially will be done up to water depth of minus 13.25, so we will have 9467 metre of navigational channel, width is 180 meter. Afterwards we will increase the width to 250 metres and we go up to 16 meter contour and then make the all the length of about 14 kilometres to keep this navigational channel. Turning circle will be 480 metres and depth will be about 12.65 and in phase 2, 500 meters and 15.5 meters.

The entrance width for the harbour will be the same in both the cases. The water depth is more in the navigational channel because due to wave (())(42:06), the under kill clearance is more, required is more. That is why in navigational channel, the water depth is more and then the

turning circle, the water depth is less. So here we will have 2 berths, 536 meter is the length and 30 meter is the width and container terminal, 570 metre into 30 metre.

In phase 2, we will build 930 by 30 and 1020 by 30. The breakwater lengths will remain the same. All the breakwater will be completed in the 1st phase itself, 2nd phase, there will not be any additional construction. So you have to subtract here when you take 1020 by 30, what we are meaning is 570 is already built, the balance 550 will be built in the 2nd phase. This is the final what is going to be achieved.

The navigational channel is 14 million cubic metre, here it will be 38.3 million cubic metre, harbour basin is 6.1, here 9.3, this is 20.1 and this is 47.6. So Gopalpur port, we discussed the dredging requirement is only about 8 million cubic metre whereas here it is 47 million cubic metre. It is 5 times more because there the contour is very steep and so this project is not picking up whereas Gopalpur, already they have started construction. Dredging cost is very high for this project.

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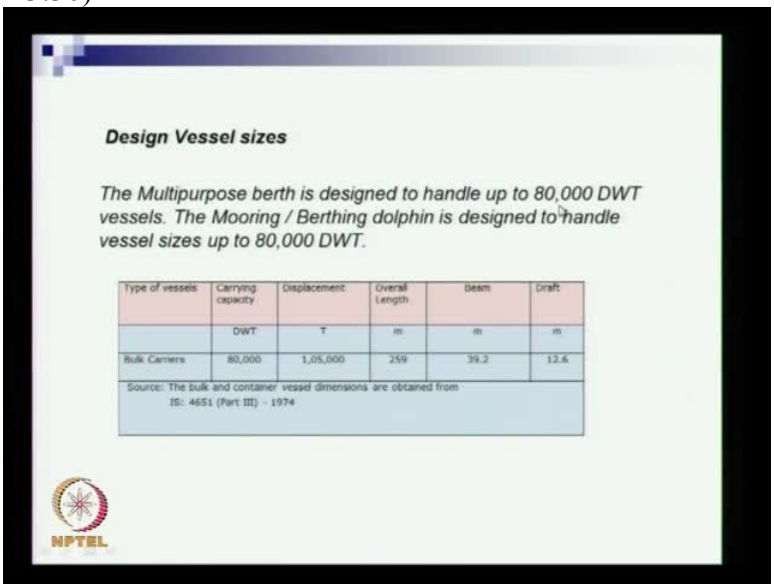

Then we have to talk about the design vessel. The design vessel is 80,000 DWT vessel and displacement is 1,05000, length is 259 metres, beam is 39.2 metres and the draft is 12.6 metres. Thatmeans you want to bring in 80,000 DWT vessels.

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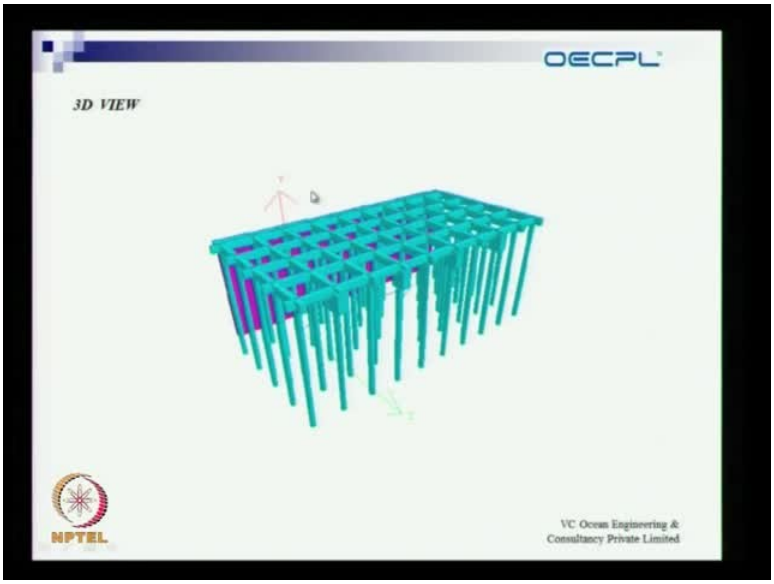

So whenever we construct a structure, we do an analysis. This structure what we are building on the container berth, will have a diaphragm wall on the backside so that you can reclaim the soil and load the container. This will be done with some expansion gaps, the total length is divided into 4 blocks, this shows one of the blocks. What you are seeing here is the fender panels where we will be putting defenders.

There will be 4 fenders which will be put in each block. So you will have the piles, 1, 2, 3, 4, 5 rows of piles and a diaphragm wall on the back with crossbeams and longitudinal beams.

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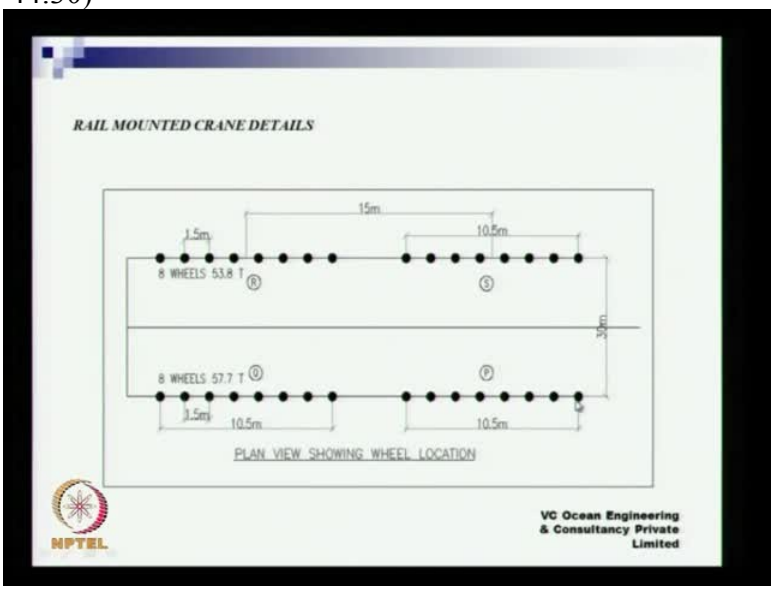

And this has to be decided for about a container crane which is about 30 metres span and this container crane will have 4 legs, P, Q, R and S. Each leg will have about 8 wheels, 1, 2, 3, 4, 5, 6, 7, 8 wheels. The centre to centre distance between the extreme wheels are 10.5 meters, centre to centre distance between one leg and another leg is 15 metres, the spacing between the wheels are1.5 meters, the spacing between the rails is 30 metres and the seaside crane rail, this is the seaside and this is the landside, the wheel load, each wheel load is 57.7 tonnes whereas the landside, the wheel load will be 53.10 tonnes because when it is picking the cargo, the load will be more on the seaside.

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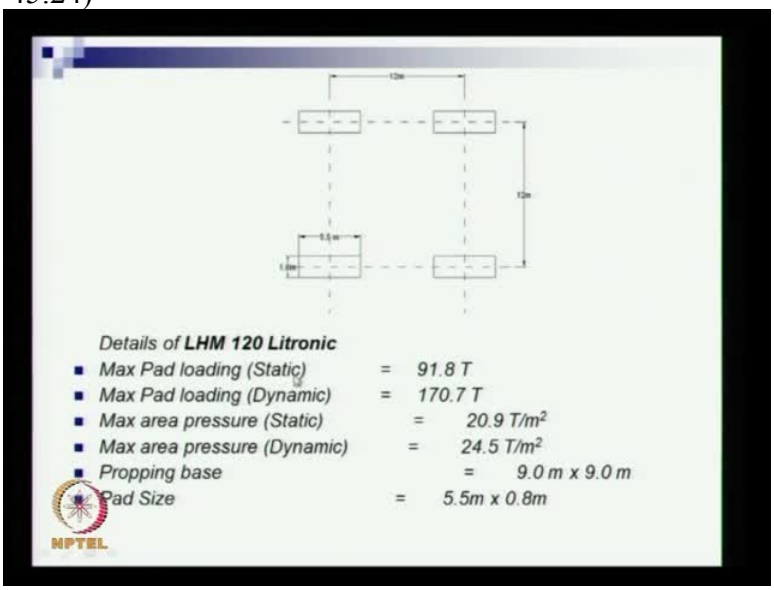

Then this is another mobile harbour crane. This also will have 4 pads like 4 legs of that but each pad is a rectangle pad, 5.5 by 1.8 meter. The centre to centre distance between the pads are 12 meter, this can move anywhere. The loading is about 20.9 tons per meter square in static condition and dynamic addition, it is 24.5 tons per meter square, the pads size is given 5.5 by 0.8 metres.

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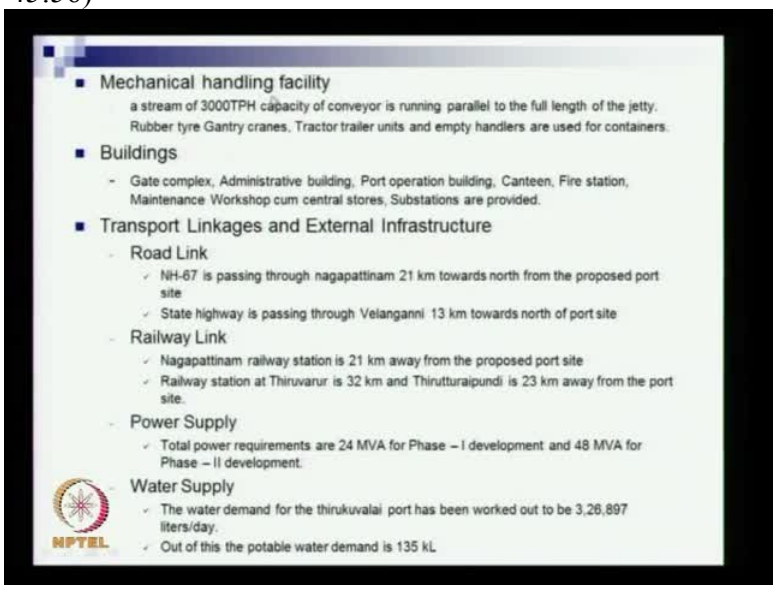

We need good mechanical handling facility. A 3000 ton per hour capacity conveyor will be running parallel to the jetty. We need certain buildings like gate complex, administrative

building, port operational buildings, canteen, fire station, maintenance workshop cum Central stores, substations. Then this is important, the transport linkages. We need the road link, rail link, power supply and water supply.

There is one NH-67 which is passing through Nagapattinam which is about 21 kilometre away. There is a state highway which is passing through Velanganni which is about 13 kilometre. The Nagapattinam railway station is 21 kilometre, there is another railway stations at Thiruvarur which is 32 kilometre and Thiruturraipundi which is 23 kilometres. Power requirement is 24 MVA for 1st phase and 48 MVA for 2nd phase. The water demand is given so many litres per day, 3 lakh litres per day.

And potable water demand is 125 kilolitres. They are planning to have a desalination plant taking the seawater for this purpose.

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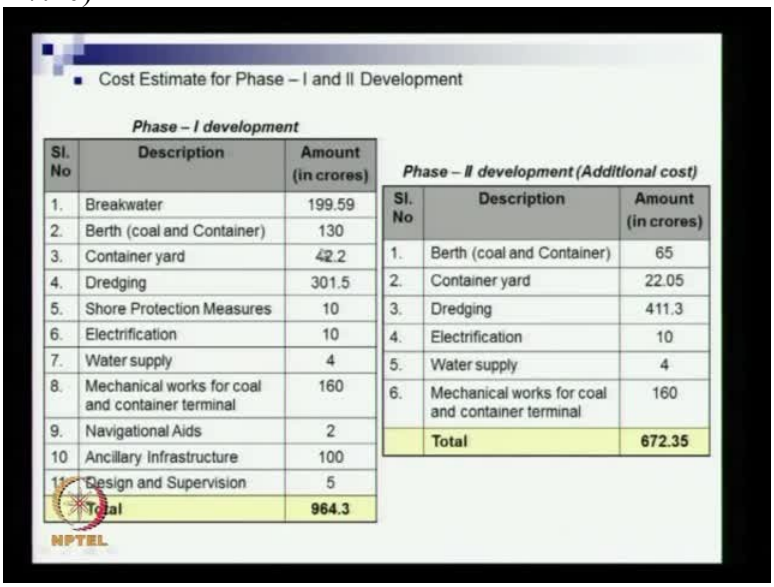

This is the cost estimate for phase 1 and phase 2 development, this is the incremental cost. So in the phase 1, we have the breakwater which is about 200 crores, phase 2, we do not have any breakwater. In phase 1, we have 130 crores of berth, in phase 2, we have 65 crores of berth, container yard will be developed here, 42.2 crores, here it is 22.05, dredging is 300 crores in the 1st phase and 400 crores in the 2nd phase. This cost is very high, this dredging cost.

Then we need shore protection measures, that is the draining walls, electrification, here also electrification is required. Water supply cost, mechanical works 160 crores, here also 160 crores. If we have to put the navigational aids, ancillary infrastructure, design and supervision, this is about 964 crores and this is 672 crores.

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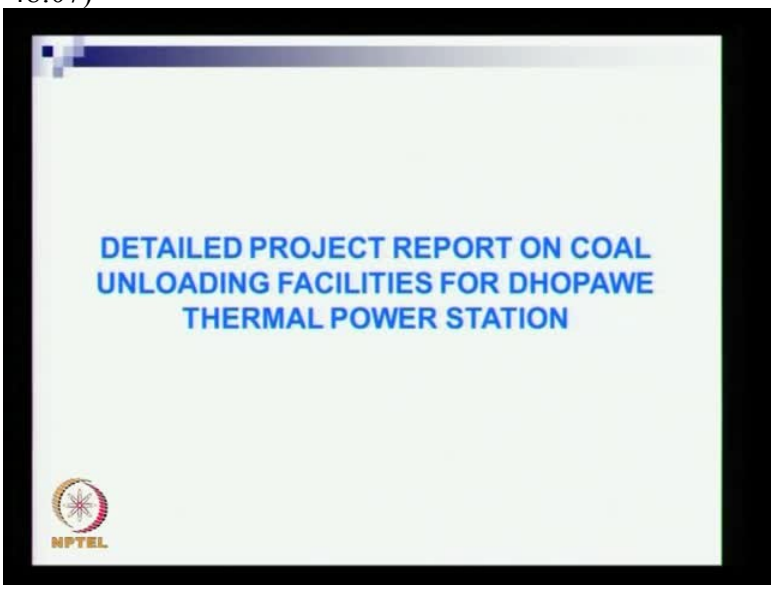

So with this we complete the DPR for Thirukuvali port. All along I was telling about breakwater and dredging and so many requirements.

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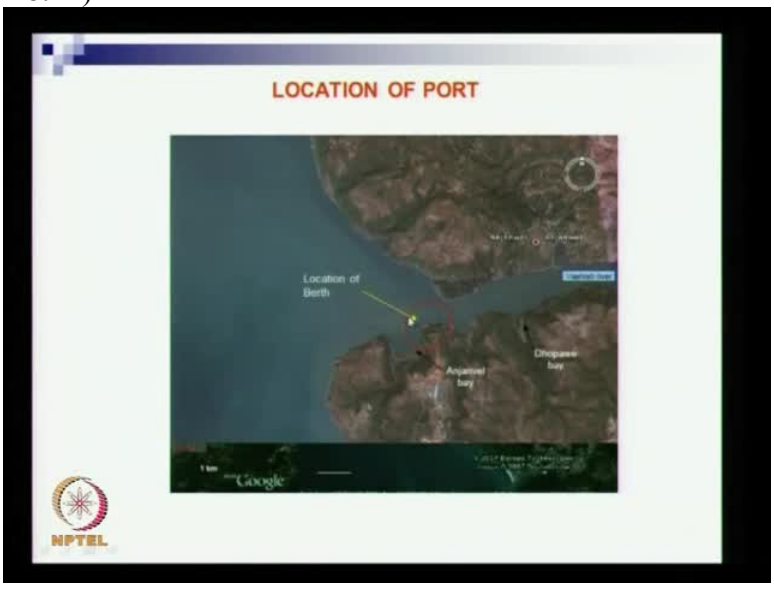

These are all required on the East Coast whereas if we see one facility on the west coast, this shows the Google map. So natural protection is there. No breakwater, nothing is required. Only some dredging is required and the berth will be built here. This is on the estuary of a river.The complete protection is given for this. This is a capital cargo berth for Dhopawe powerstation.

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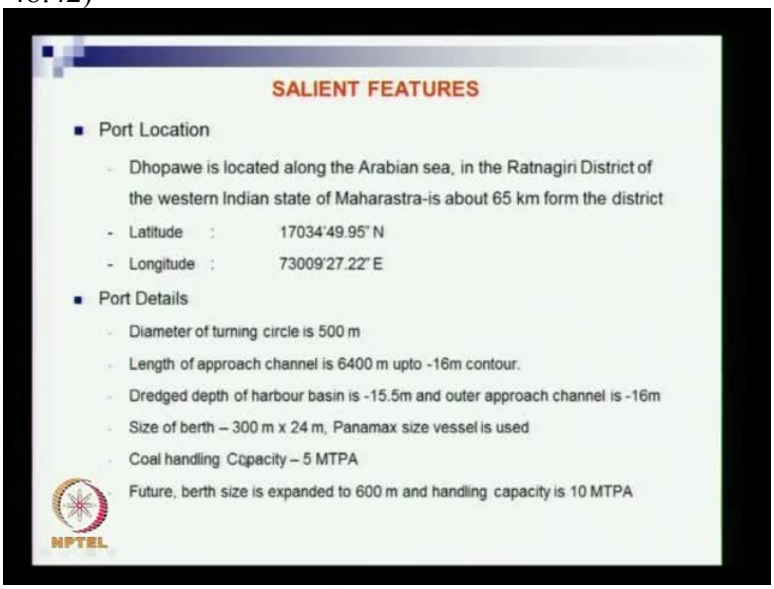

The latttudes and longitudes are given. Location is in Ratnagiri district and we have to provide a turning circle, approach channel and dredging is required. The berthing size is 300 by 24 metre, vessel size is Panamax, the handling capacity is 5 million tonnes per annum, future we will increase the number of berths to 2, length from 300 to 600 meter, the capacity will be increased from 5 milliontonnes per annum to 10 million tonnes per annum.

Strictly speaking, any berth, any port facility what we are creating, minimum capacity to be developed will be of the order of 5 million tonnes per annum. Anything less than that will not be viable. 5 million tonnes per annum means approximately 500 crores you have to spend to develop the facility. Here there is no breakwater for this port. Only dredging is required for the diameter of turning circle and the approach channel.

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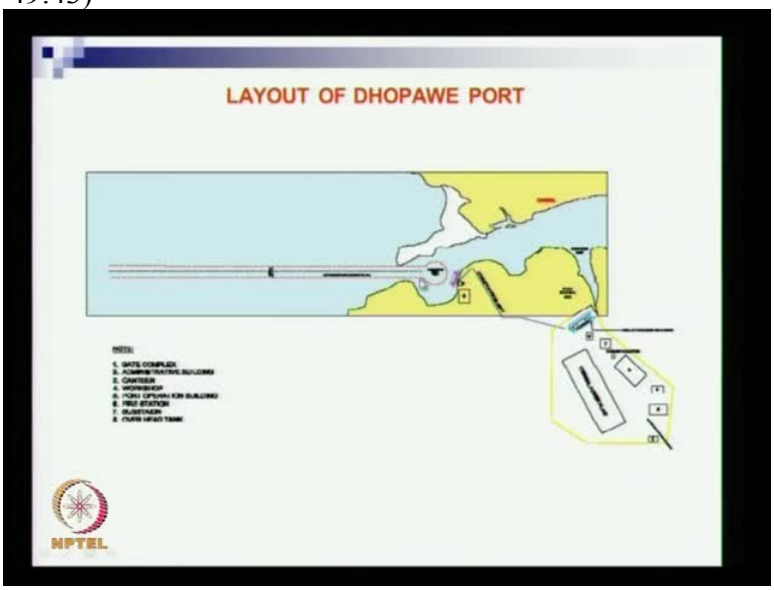

So from 16 metre contour, we create a approach channel, that is shown in this slide. This is a 60 metre long approach channel. Sorry, 6.4 kilometre long approach channel. This is your 16 metre contour. So here we have a turning circle and the berth is shown here. This is well shielded, there is a small bay here inside this, no current will come and disturb the vessel, waves also will not come and disturb the vessel here.

This is the powerplant. So from the powerplant, you need an access for this port, there is a conveyor which will transport the coal from here to this location. It is a very simple configuration and this can be built very easily also.

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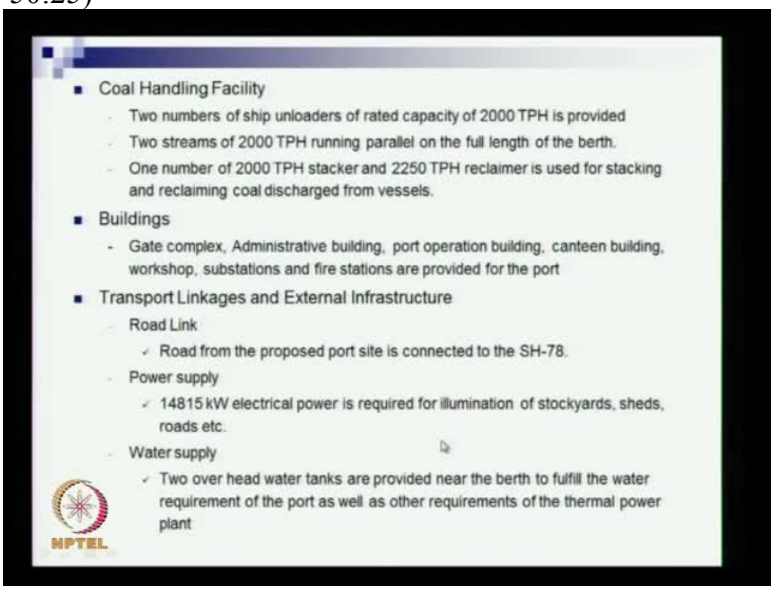

The coal handling capacity is we provide two ship loaders. That means whenever we load and unload, we need 2 cranes. If you start loading or unloading from one side alonethe vessel will trim and it will get submerged. So we need two cranes. So this is ship unloaders. Capacity is 2000 tons per hour. So if you are working about 20 hours, then it will become 40,000 tons per day. So with 2 unloaders, it will become 80,000 tonnes per day.

So one vessel can be cleared in 24 hours. So we have two streams of 2000 tons per hour of conveyor which is running parallel to the full length of the berth. Then we need some stacker and reclaimer, this is whenever the whenever it goes to the plank somewhere here, we have to stack it and we have to reclaim it, then use it. For that purpose, we need a stacker and reclaimer here. Then we need some buildings like as discussed previously, all these buildings are to be provided.

Similarly, we need the road link, which is connected to state highway 78. Power supply requirement, water supply. These are the requirements that are required for the berthing facility.

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Then we will talk about this deep draught berth, Southern dock and bulk terminals at Paradip port.

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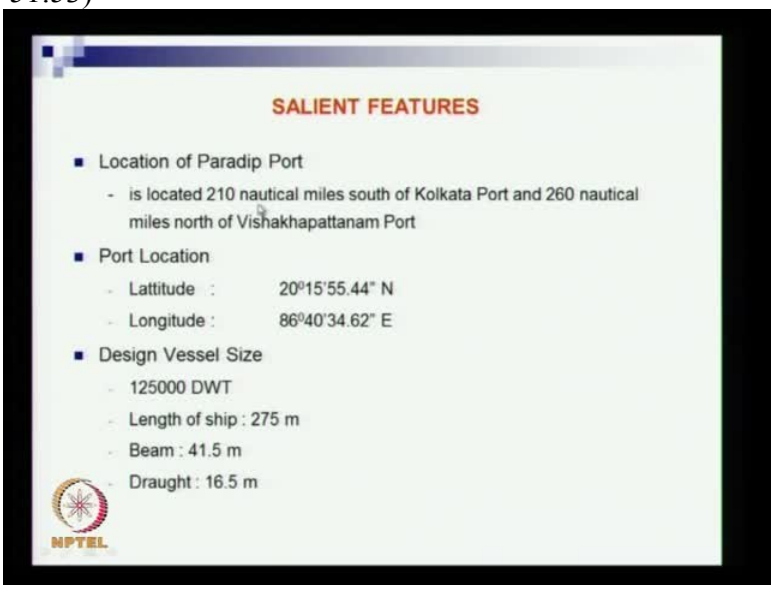

The location is Paradip port which is to 210 nautical miles south of Calcutta port and to 60 from Vizag. It is in between the Vizag port and Calcutta port. The vessel size is 1,25,000 DWT, the draught requirement is 16.5. That means the depth requirement will be about 18 metres, length of the vessel is 275 and beam is 41.5 metres.

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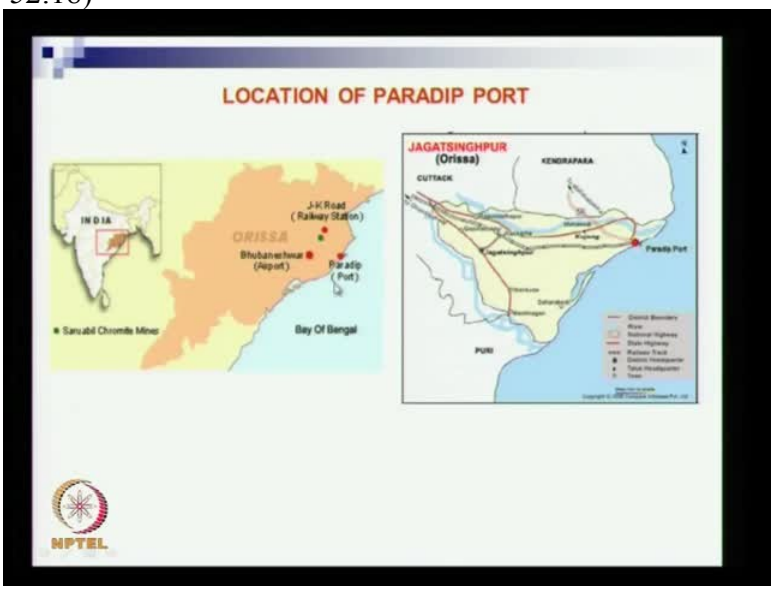

We are seeing the Paradip port here. This red colour shows the state of Orissa. These are the nearby airport and here we have the Mahanai River which is draining into the sea. This is the district map.

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Now the satellite imagery of the total facility. We have a Southbreakwater, a North breakwater. The existing facilities are the South breakwater for a length of 1200 metres, North breakwater for a length of 540 metres, we have a oil jetty here 300 metre long. At present we have some facilities here. There is a east quay, then there is a Central quay, this is a fertiliser berth, two

fertiliser berth 1, then we have a taller berth here. This is called as the East quay, this is called as the South quay and this is the East quay 3 where we have some coal berth, 1 and 2.

This is the place where we handle the iron ore and we have a dry dock here. These are the existing facilities. It is proposed to create 2 complexes. One is the southern dock complex, another is a BOT complex. In the BOT complex, it is planned to develop a coal terminal and Iron ore terminal dirty cargo inside. So this side is a clean cargo area. Here it is proposed to develop a oil terminal here and a container terminal on this side.

As you see here, this is a lagoon harbour, everything is land. They started dredging it and then creating this facility. Now this is the land area which they will be dredging and creating the new facility. Whenever the vessel will come here, just like earlier I explained for mega terminal, it will stop here, then it will go for a distance of about 2 kilometre here, then it will get stopped and we are going to create a turning circle here.

Once the vessel turns here, it comes back and it will come inside this basin or this basin or oil terminal and then get berthed. This is the requirement. Because of the construction of the breakwater, you can see lot of deposition on this side and erosion on this site. So when you plan for dredging, we will use as a stockpile on the northern side.

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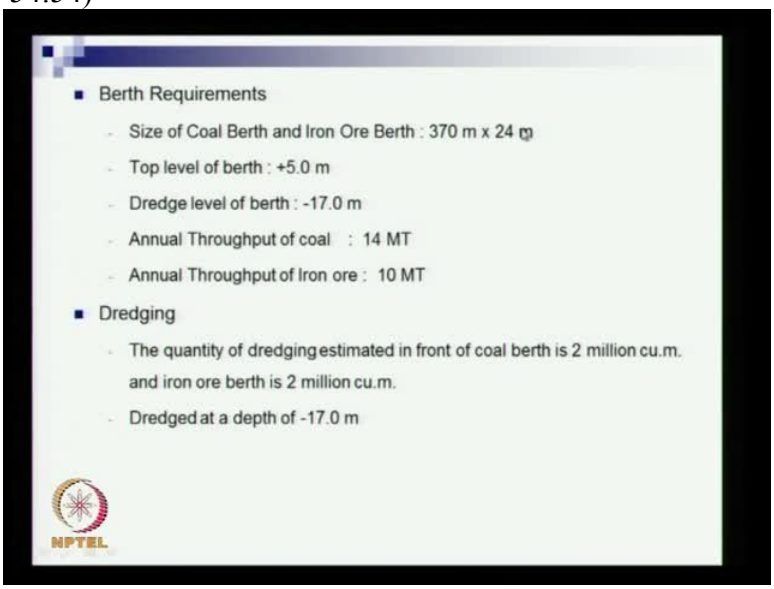

Each berth, coal berth and iron ore berth, the length is 370 metre because the vessel size is longer, width is 24 meter, top-level is kept as 5 meter, dredge level is 17 metre, annual throughput of coal will be 14 million tonnes and iron core will be 10 million tonnes. The dredging for coal berth is 2 million cubic metre, iron ore berth is 2 million cubic metre. So this much has to be dredged. This is for the requirement of coal berth and iron ore berth.

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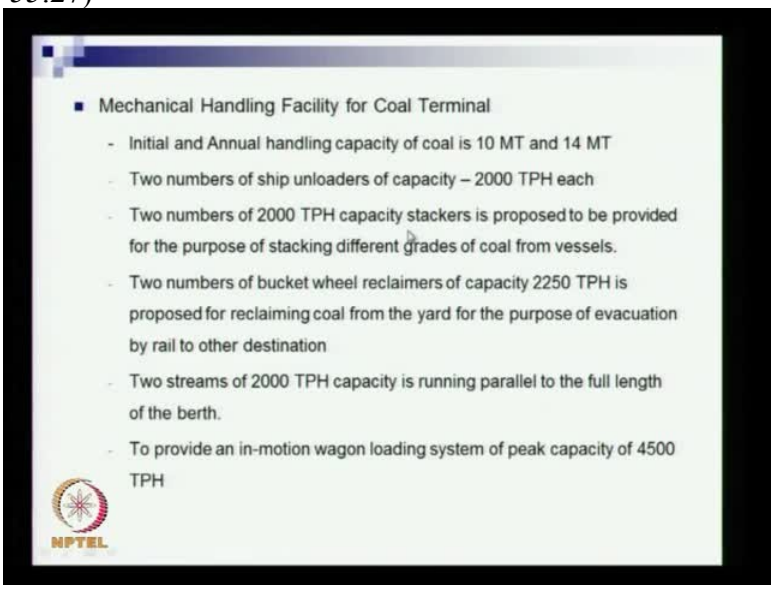

So we have to provide two unloaders. This is stackers, reclaimers,conveyors and then we also need a wagon loading systemto unloadthe coal which is coming from the hinterland.

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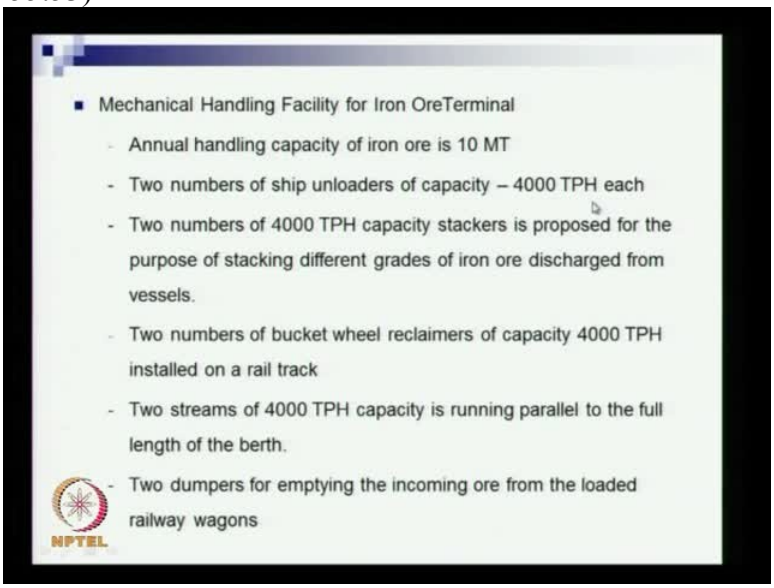

This is for theover terminal the capacity is 10 million tonnes, here the capacity of the unloader is 4000 tons per hour because the density of iron core is more than the coal. So for the same volume, the weight will be more. That is why, we have a bigger capacity here. Then stackers should be there, reclaimers also should be there, the container also, the conveyor system also should be here, then we need a dumper also for emptying the iron core from the railway wagons.

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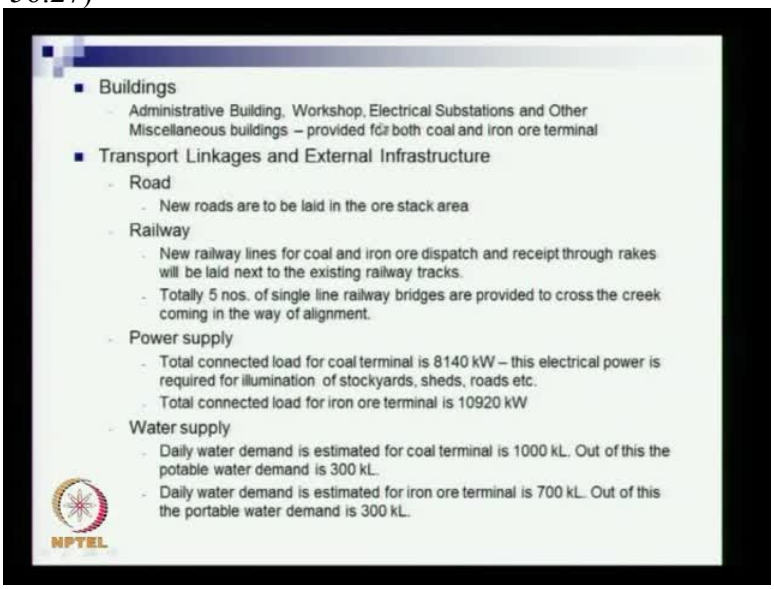

In all these buildings that are required. The linkages, road, rail, power supply and water supply requirements are listed here. These are the most common things that are required while preparing a detailed project report.

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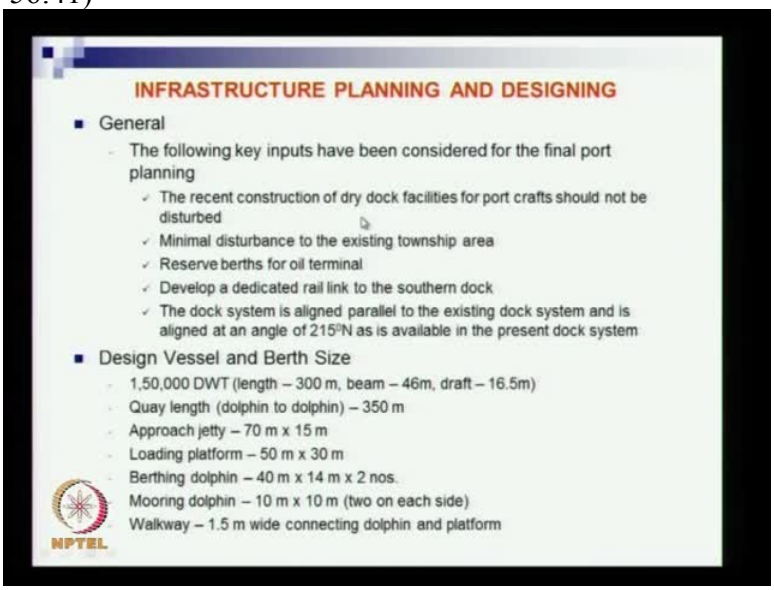

We have to plan and design the infrastructure. When you plan it, you should see that you are not disturbing the existing dry dock and minimum disturbance to the existing township area, we need some reserve berths for oil terminal, develop a dedicated rail link to the southern dock and you have to align the dock system parallel to the existing dock. This is for the clean cargo facility which are being developed on the southern side.

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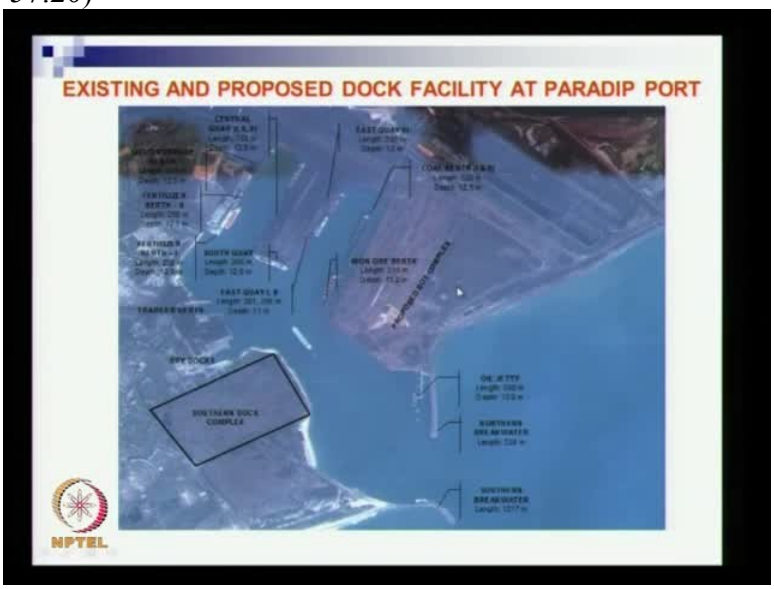

So earlier, we have seen the BOT complex where we are handling the coal and iron ore. Now we are discussing the southern dock complex which is a clean cargo complex. The township were

very nearby. This side, there is no township, this side there is a township. There is a dry dock which is already built, I was listing that these things should not be disturbed.

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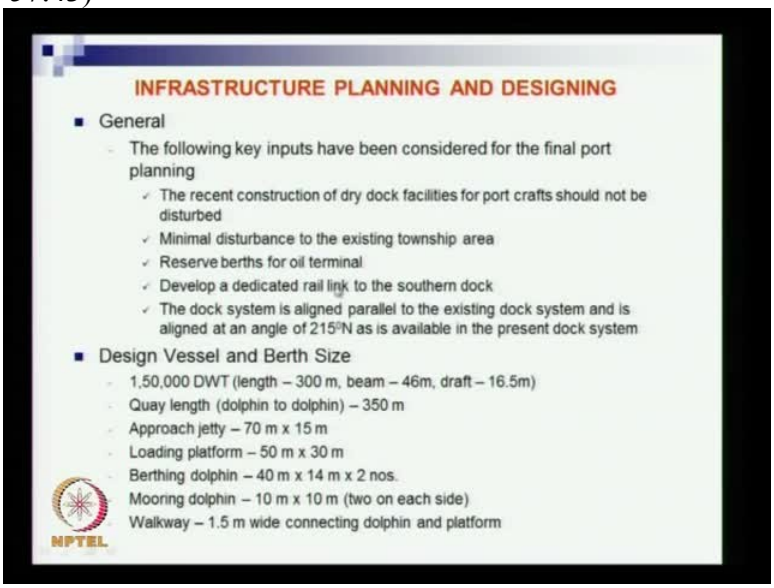

That is what is listed in this infrastructure planning and designing for the clean cargo terminal.

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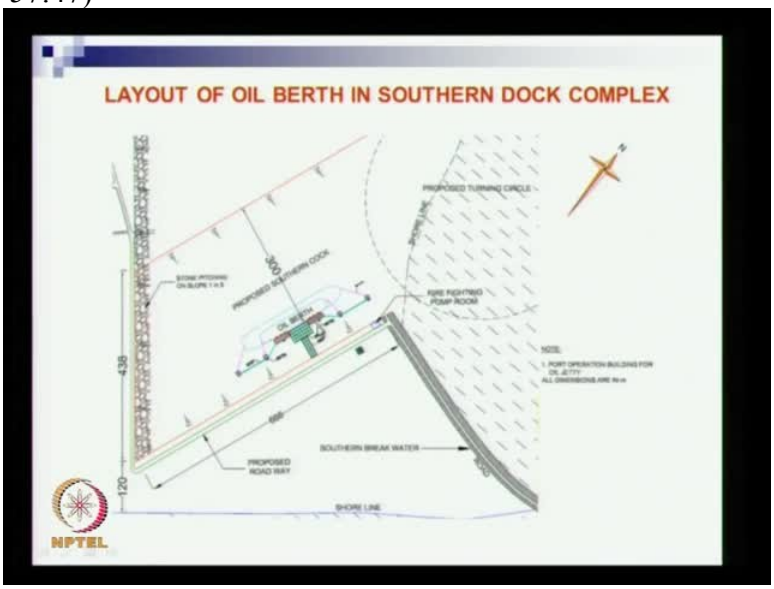

Now we will see the oil berth. This also is planned in 2 stages. 1st, oil berth will be developed, then the container terminal will be developed. There will be one turning circle here. Oil berth typically consists of an approach jetty, a jetty head, berthing dolphins and mooring Dolphins.This

oil berth may handle a smaller vessel like this or a bigger vessel like this. Smaller vessel, these 2 Dolphins are sufficient. For a bigger vessel, we need extreme Dolphins here and the width required for the dock basin is about 300 metres..

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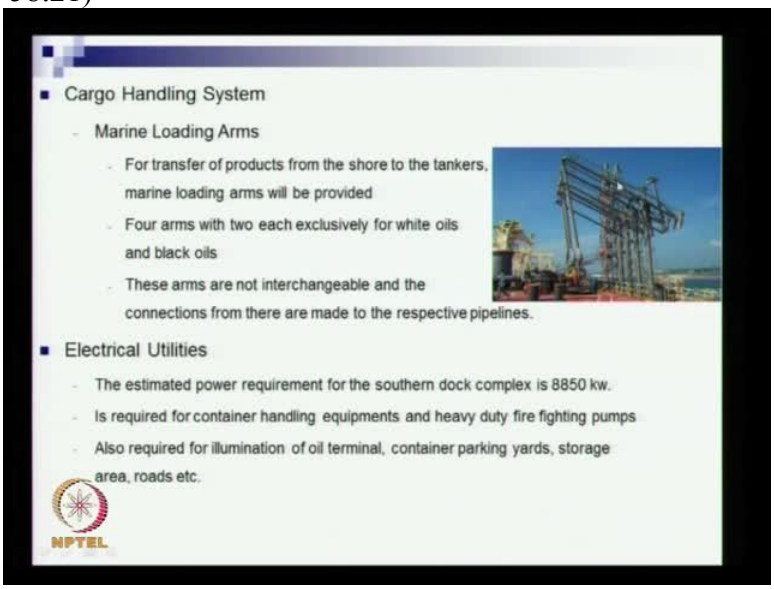

For cargo handling system, we need marine unloading arms. This is for transfer of products from the shore to the tankers. Four arms with 2 each exclusively for white oils and black oils will be provided. These are interchangeable, we need also electrical units.

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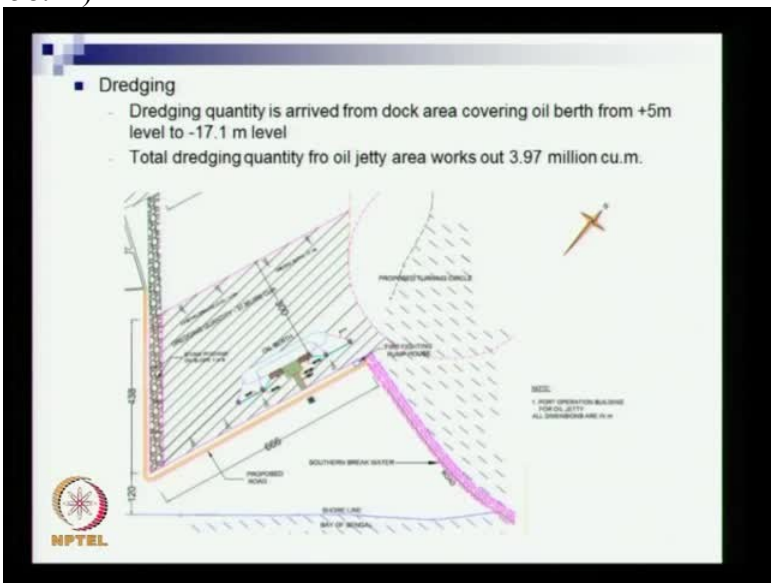

The dredging required is about 3.97 million cubic metres, this area as well as near the berth.

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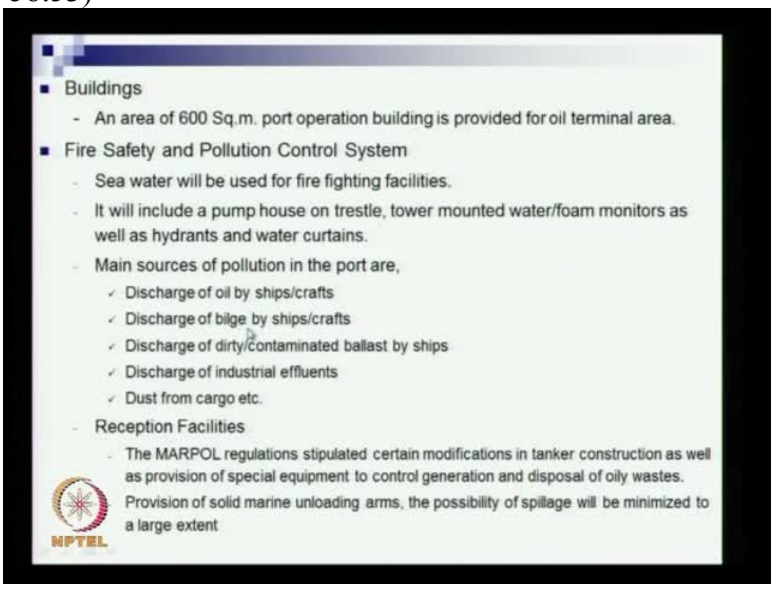

The buildings what are required and fire safety and pollution control is very important for this also. Main sources of pollution are discharge of oil by ships, discharge of bilge. Bilge means the water which they carry for keeping the draught the same, whether it is loaded or unloaded condition. I am sorry, not bilge, this is the ballast I was talking. Industrial effluents, dust from cargo, et cetera. There is a regulation called MARPOL regulation. That also should be followed.

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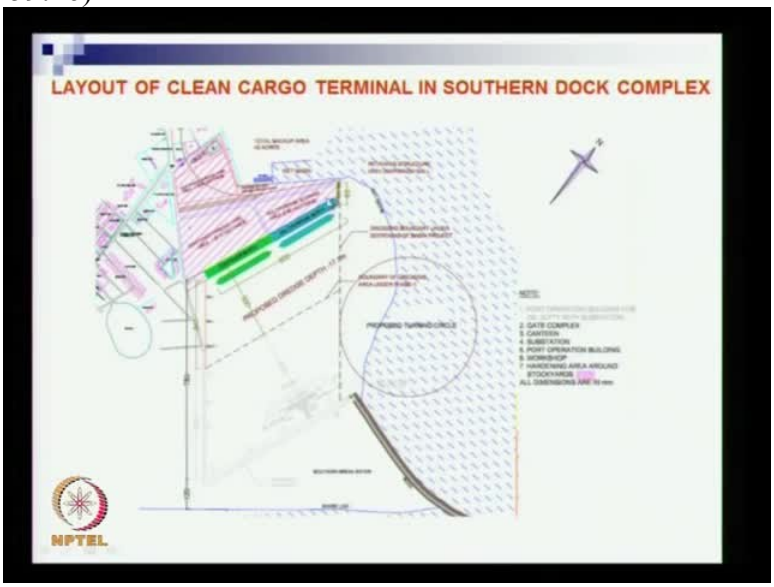

The next is clean cargo terminal on the other side. You have the oil cargo this side and the clean cargo, container cargo is on the other side. Originally you develop this 300 metres, dredge and operate. Then you develop another 300 metres and then operate.

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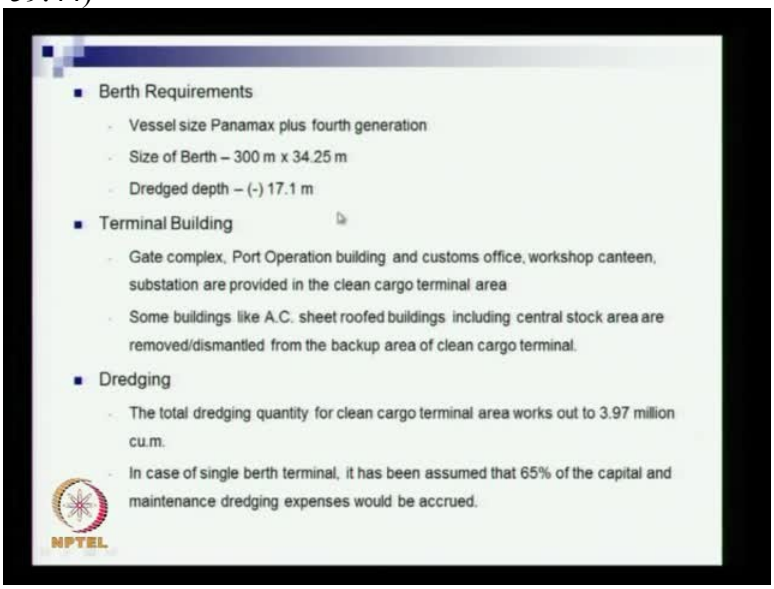

The berth requirement is 300 metre by 34.25 metres, dredge depth is 17.1. These are the terminal buildings that are required, the dredging that is required.

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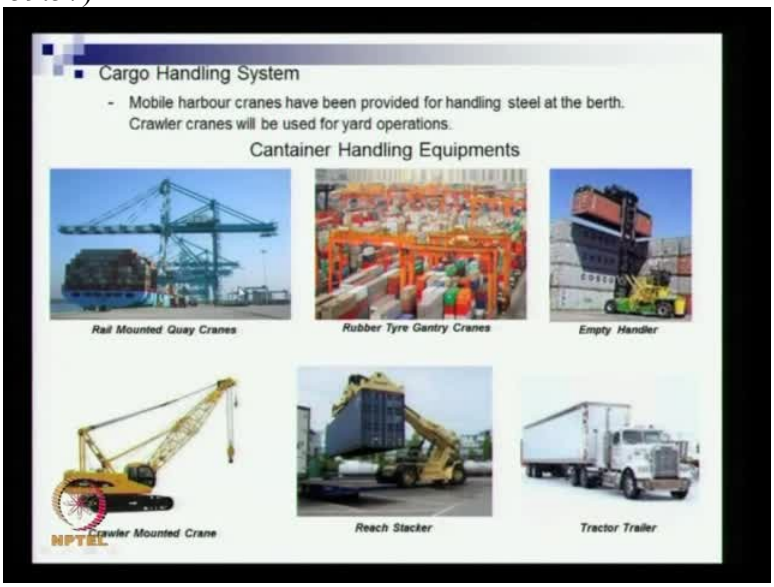

These are the cargo handling system. One is called the rail mounted quay crane which is used to lift the container and then keep it here. Then we have a rubber tyre gantry crane which will be used to move the containers to the stacking yard. Then empty handler, this is a forklift truck, then we may have a crawler mounted crane, then restacker and tractor trailer, this is to transport the container. These are the various cargo handling systems. Thank you.