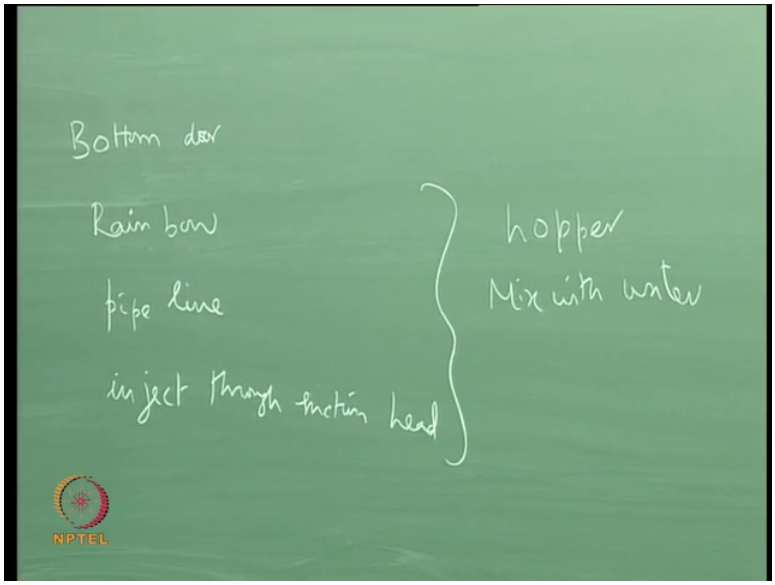
Port and Harbour Structures
Prof. R. Sundaravadivelu
Department of Ocean Engineering,
Indian Institute of Technology Madras
Module 3 Lecture 15
Dredging and Methods of Disposal

So last class we, this is the trailer suction dredge, we are discussing four methods of disposal, what are the four methods of dispersal,

(Refer Slide Time: 00:20)



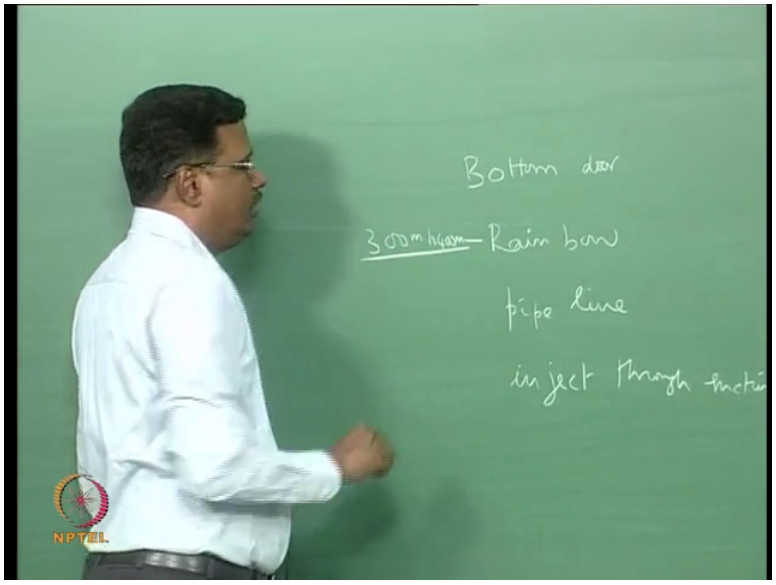
Rainbow, pipeline then, four methods door opening then, detection through the section ok, it is not door opening, I think bottom door we will put or it is called as a split bud, this is one of the method, the second one is by rainbow, then we have pipeline, it inject through the what is it called that is section head.

So these are the four methods of disposal, which will be the fastest, bottom door the other three methods you have to do something before disposal, what is to be done, bottom door you don't have to (any) do anything, just open the bottom door it is gone, you have to mix with water, see for all these three methods you have to mix with water, mixing with water means it is not easy, because you cannot have the full capacity of the that what is it called container.

Or whatever it is, the compartment where we are storing the dredge material it will overflow, water will overflow the sediments will settle, you want to mix it with water then there should be

some space available for mixing, so you cannot carry the full capacity of the hopper ok, you have to mix it in the hopper you have to mix it with water, which is the best method for disposal

(Refer Slide Time: 02:26)



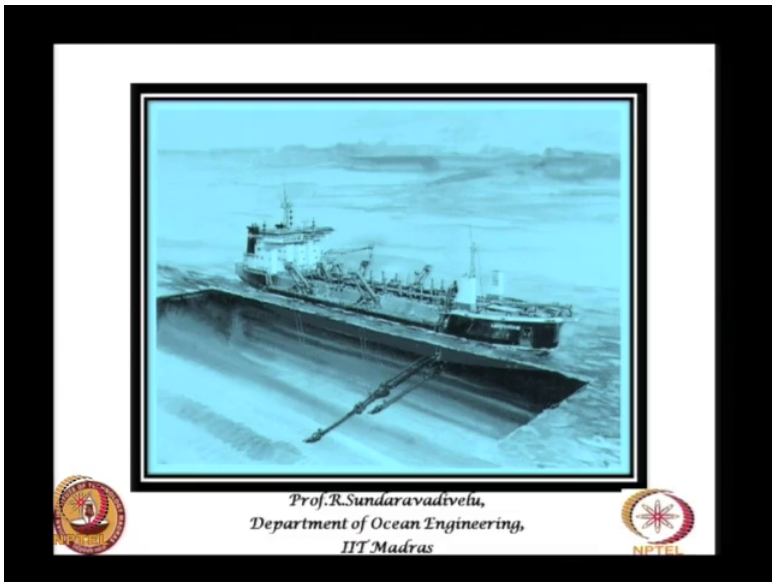
Or which is the worst method for disposal? What are the four methods?

What is it, rainbow is not the worst then which food is good fast food or a normal food, which food is very waste, which is the fastest method here, it is the worst method, because when you are disposing very fast using a bottom barge it will disturb the economy environment in addition the thickness of the sediment will be higher when you do that, that is why you cannot do, rainbow technique and all is good if you are disposing it on the shoreline.

For nourishment this we are doing in Gopalpur also, then this injection through the section head whatever speed you are removing the dredge material the same speed and the same manner you are disposing, pipeline is for creating artificial elements or things like that, in Dubai and all they want to create artificial elements for real estate purpose, there they use it for pipeline and you can use a pipeline instead of rain bowing also, to dispose it on to the land.

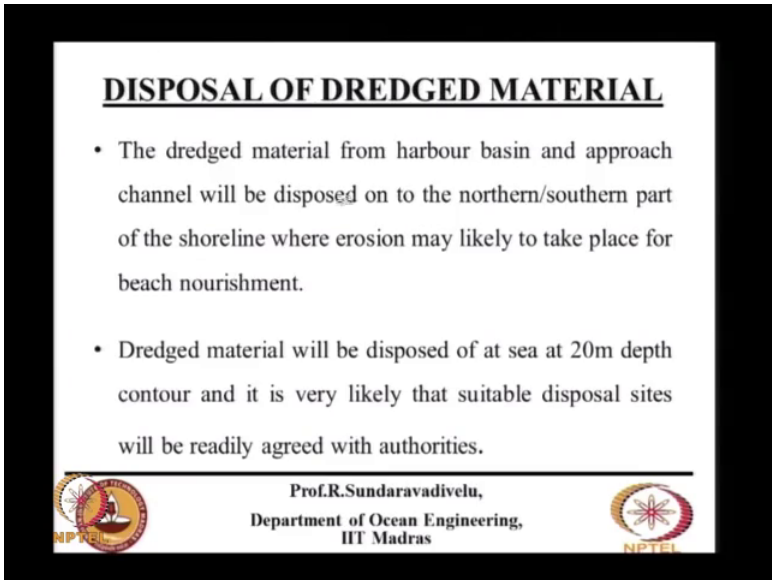
As rainbow you can do only up to 300 to 400 meters distance, so if you don't have the shoreline you need a draft about 6 meter further trailer suction dredge, the 6 meter contour is not very close by, if you do a rainbow it will not go to the shoreline, then you have to use a pipeline,

(Refer Slide Time: 04:10)



In the dredging the environmental clearance if you have to get the main part that discuss about this disposal of dredge material.

(Refer Slide Time: 04:22)



So you can dispose it to the northern or southern path of the shoreline where erosion may likely to take place for beach nourishment, so there is a impact due to construction of breakwater that is either erosion or accretion, accretion is not a very serious hazard whereas erosion is hazard,

erosion where it will take place in the eastern coast, which side? suppose you construct a breakwater which side the erosion will take place northern side or southern side.

Both are correct, (which) which season the erosion will take on the northern side? How many seasons are there monsoon, non-monsoon, monsoon how many monsoons are there, what are the monsoons, not this, non monsoon season (the) this literal drift will be less, it will be there but it will be very less, so north east and south west monsoon, north east monsoon which side will be erosion? Southern side, south west means northern side.

So south west monsoon is for a longer period so the erosion will take place on the northern side, if you go in November, December that is the season for north east monsoon, we go the Marina beach you can see some erosion during cyclone time, you want to see throughout erosion you go to the northern side, the other option is to dispose that 20 meter depth control and this is very likely that that do suitable disposal sites will be readily agreed with authorities.

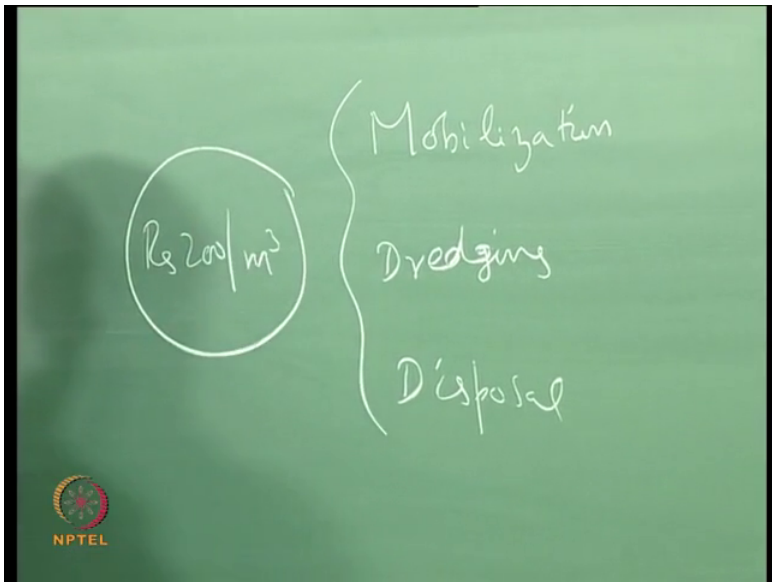
So you can dispose at about a depth of 20 meters or more, this maybe at a distance of about 5 nautical miles from the shoreline so you dredge it and dispose it off at 20 meter depth, there you can use the split barge, bottom door you can open and dispose it off ok, so the depth of when it dispose it off in the open sea at 20 meter depth the permissible increase in sea bed level is about 0.3 meters is it clear? When you dispose it off the contour was minus 20.

It can rise only up to minus 19.7, that's what they permit that means you have take a wider area, see normally the Harbour base and size is around 2km by 2km that is inside the breakwater the accent is about 2km by 2km, typically disposal area will be about 5km by 5km or 10km by 10km area, because even if it is in a Harbour basin and you select only a intern channel, dredging circle and training basin and berth pocket to dredge.

So dispose of about 5km by 5km area if the increase the water level by 0.3 meter it will not create any problem, the another issue here is what type of material you are disposing, is it sand or clay, which will create less turbulence, less suspended sediments? Sand will create less suspended sediments, it will get disposed the northern side if you want to pump you pump only sand not clay, because clay if you pump you cannot get very good foundation.

You cannot do any structure or it may not be the suspended material will be very large also, so clay normally disposes it off in the deeper water depths, sand only you can use it for disposal, this disposal is not only on the northern side even in the Harbour basin to raise the low lying area you can use the disposal method,

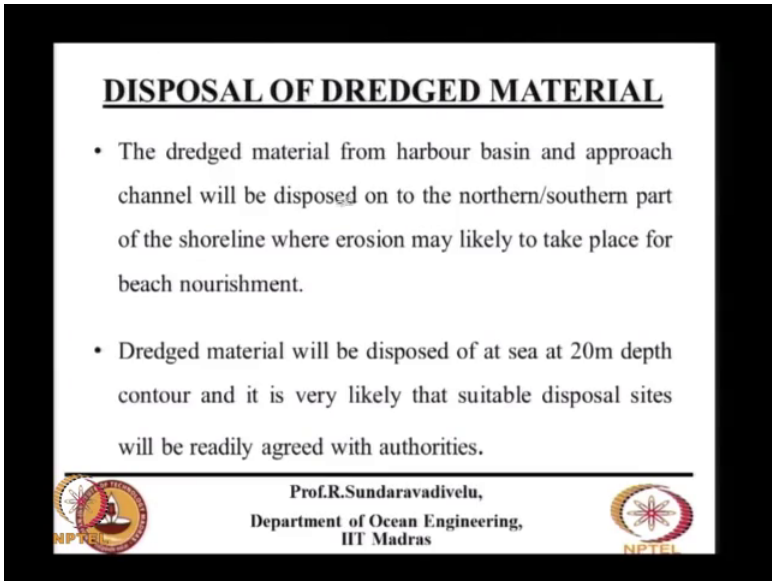
(Refer Slide Time: 08:26)



The cost of dredging is consisting of three components one is mobilization, there are three components of cost one is mobilization.

The second one is dredging, third one is disposal, so an approximate cost is about 200 rupees per cubic meter if it is sand or clay throughout it will be ten times more,

(Refer Slide Time: 08:53)



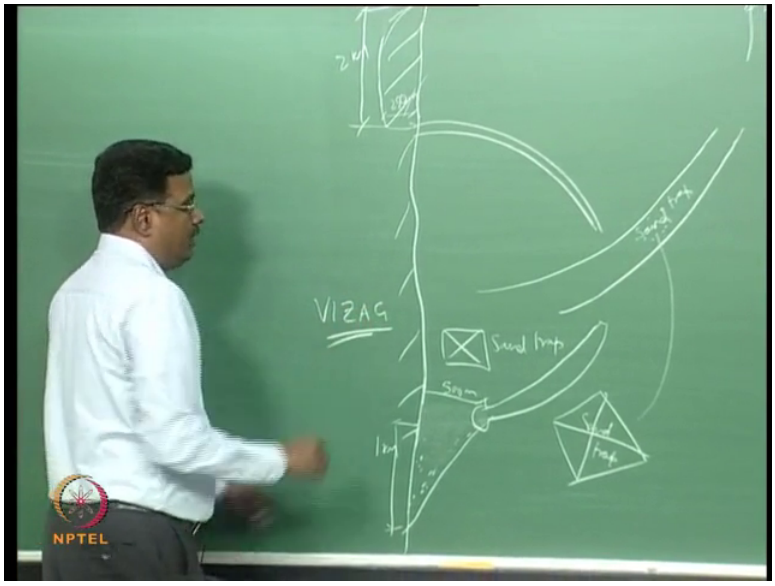
Mobilization is the type of dredger which we mobilize, it may come from a long distance so it will have sufficient quantum of dredging about 5 per million cubic meter, they may mobilize a good dredger, mobilization cost is very high (the), nobody will pay for mobilization.

They will put that mobilization cost in per cubic meter (kart) cost, so if the volume of dredging is more the component of mobilization will become less, similarly disposal if it can be disposed at a shorter distance, the cost will be less, so the east coast which we discussed, we have the literal drift this is from south to north during the south west monsoon and comparatively volumes , less volume session right in the opposite direction during north east monsoon.

(Refer Slide Time: 09:43)

So generally (the can) the net drift will be towards the northern side so erosion will be on northern side of the port, the accretion on the southern side of the port, there are two types of dredging one is called as a capital dredging another is called as a maintenance dredging, so if you put an approach channel that will act like a sand trap and that will create the place for maintenance dredging so if you have a Harbour basin.

(Refer Slide Time: 10:20)



It is very important while doing the layout they have this breakwater on one side and breakwater on the other side, then we have the entrance channel, so you will have an accretion on the southern side, normally when with all the figure the northern side is like this and the shoreline will erode like this, so this much portion will get eroded, we view satellite imagery and we have calculated how much area is accreted and how much area is eroded using satellite imagery for Pondicherry port.

The area is the same, the area of accretion area as erosion is the same but what happens is the distance for accretion is less and the extent of accretion on to the shore is more, so suppose this is about a kilometer, this distance is more than a kilometer this will taper off to some distance, this distance is about 2km, suppose this distance is about 500 meters, this distance is about 200 meters the area will be the same, whereas this erosion distance will be less.

Compare to accretion the zone of influence will be less compare to the northern side of area. So (wa) this some equilibrium will be reach, it will not continuously keep maybe about 4-5 years this equilibrium will reach then afterwards when the sediment is moving here this acts like a sand trap and due to the maintenance dredging on the entrance channel, in sometimes they use a sand trap here on the southern side.

If you don't want the entrance channel dredging to be carried out then they deeper a portion on the southern side and create a sand trap, there is one more method that is adopted you create a detach to breakwater here, now start the breakwater from the shoreline and you create a sand trap here, this is being carried out in VIZAG Vishakhapatnam port trust where they have a sand trap here they dredge this area, so what is the advantage of sand trap here compare to here?

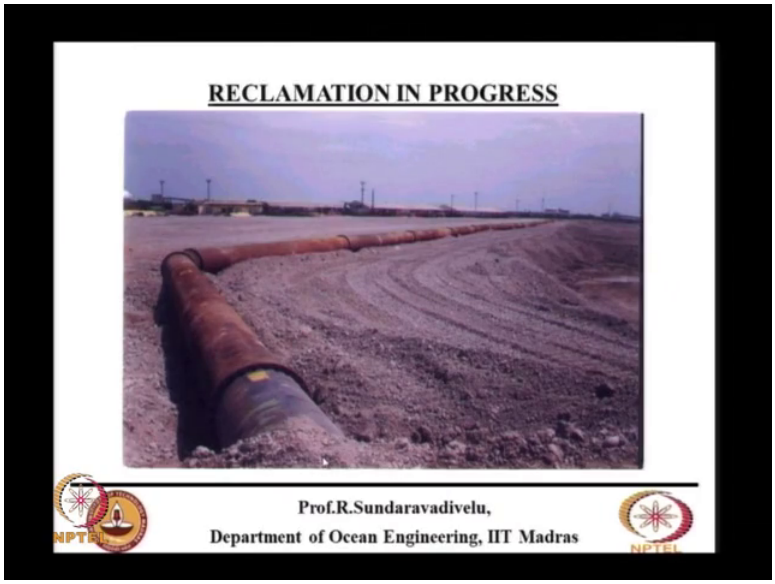
There is an advantage here compare to here, what is the advantage? You are thinking too much very simple, who is answering? Raise your hand then, you are going to the right direction but not exactly, see dredging is easy inside the Harbour basin, dredging is difficult outside the Harbour basin, very simple, most of the solutions are most of the answers are simple, you are going through such for a wrong answer.

See dredging inside it is the easier no compare to dredging outside, dredging outside will be difficult because you cannot do it in all the seasons that is the reason they want to create, this

detached Harbour is done by sir Vishweshwarayya, we celebrate engineers day and he only has said that we will do like this then we are doing like this and still it is being done, Ramakrishna beach is nourished every year by this.

So there is combination of groin field and rain bowing techniques, this is done in Chennai port, our department Professor Sundar has (develop) design this groin field and we do, they don't do any beach nourishment there, but we can still do the beach nourishment using groin field, this is a reclamation in progress where the cutter section, dredger pipeline will go

(Refer Slide Time: 14:51)



And dispose of the sediments; this is a typical figure showing the rainbow technique.

(Refer Slide Time: 14:57)

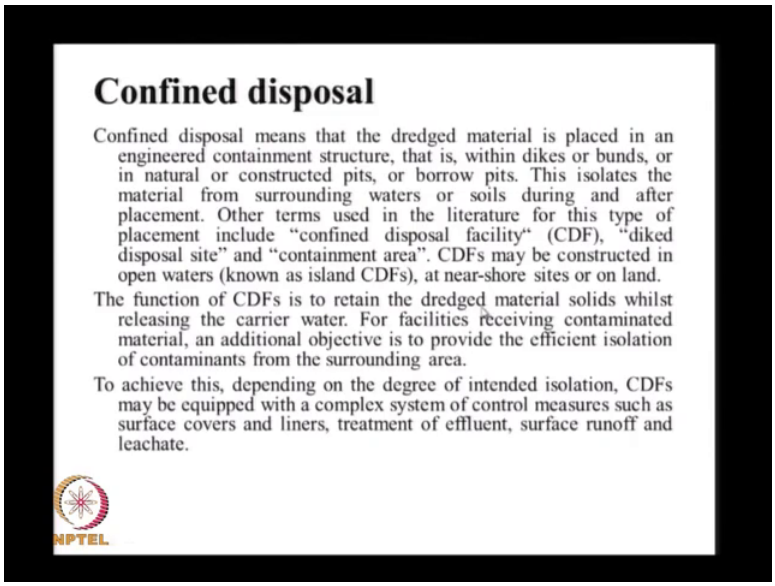
So this distance only I was telling about 300 meters to 500 meters, the draft required for the trailer suction hopper dredger is about 6 meter, so it cannot come closer, so it tends to stand where the ward up to 6 meter then pump the sediments, it should not be pumped in open sea because the because of the pollution being created, so if it is falling directly on to the sea coast it will be better,

(Refer Slide Time: 15:32)

There are some locations where about 6 meter ward depth is available. Very close to the shoreline, you can see here,

You can see how the rainbow goes directly to the coastal line; they have shown on pipeline also, so maybe they have disposed of using a pipeline and brought the shore closer to the ship, a combination this ward we are planning to do in Gopalpur,

(Refer Slide Time: 16:01)



There is another thing called as a confined disposal that means you construct some dikes then dispose of the material.

So the main purpose of this is to retain the dredge material solids, whereas the water will be whilst, if you are receiving some contaminated material, the additional objective is to provide the efficient isolation of contaminants from the surrounding area, there will be some contaminants especially when you have the sewage disposal of municipal wastes and things like that there will be some contamination, some industrial waste and things like that.

So you want to have a dike inside you dispose of so that contaminant is within the dike, so we need to have a control systems such as surface covers, liners, treatment of effluent, surface runoff and leachate, this is a detailed area, which gains lot of importance nowadays, you have to study separately to do this,

(Refer Slide Time: 17:06)

This is one example where they construct dikes all around, then dispose of the sediment, is the area where they have disposed of.

(Refer Slide Time: 17:14)

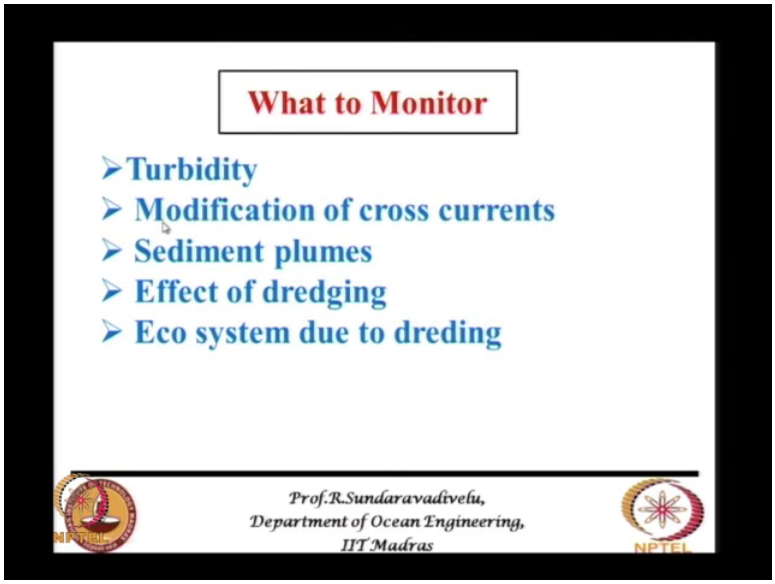
So this environmental impact assessment and environmental management plan that is EIA and EMP, this is very important subject is gaining lot of importance,

The environmental management consists of this five stages one is before dredging, during dredging, along with weather conditions, during stoppage of dredging, and after dredging, so these are the five conditions what we have to study, during dredging we assume a favorable weather condition.

Suppose the weather condition becomes very bad, the still continued dredging but there is a limit up to which we can do because of the permissible motion of the dredger then you have to stop, any stoppage of dredging operation restarting it, it has its own impacts under dredging operation that also you have to do then what happens after dredging, after dredging the Harbour basin and enter channel as well as after dredging in the disposal area.

We have to study the impact and carry out some management plan, so when I talk about this impact, study, and management plan, what are the parameters to be monitored

(Refer Slide Time: 18:28)

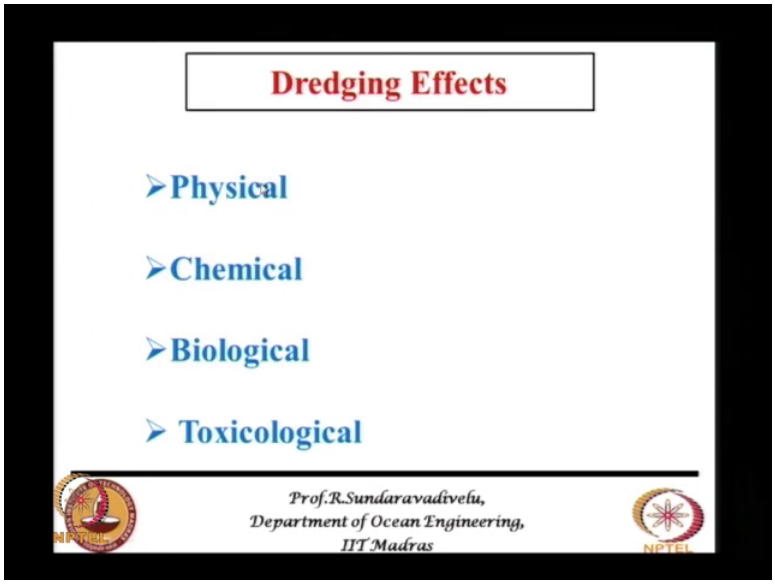


You have to monitor the turbidity, very simple to understand because when you dredge it, you create turbulence so because of that there is turbidity, lot of suspended sediments, what happens to the current (direc), currents direction may change during dredging process as well as disposal.

Then sediments plumes when you are disposing there will be a plume which will come from the sediment then we have to study the effect of dredging, some of these aspects in addition some

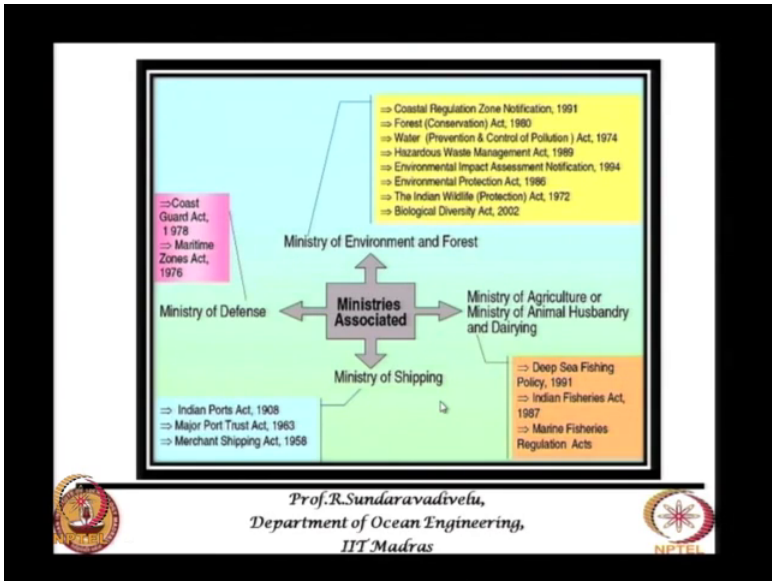
other aspects as well as the eco system during dredging that is eco system means about the generally it consists of temperature, salinity, this zoological parameters, fished and other things,

(Refer Slide Time: 19:14)



So you can classify all these effects into four categories. One is physical, chemical, biological, and toxicological; these are the four parameters that are to be monitored,

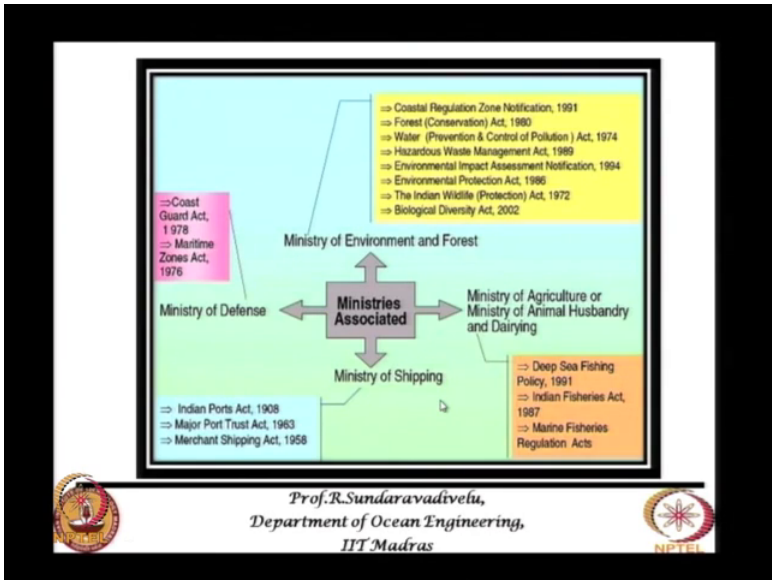
(Refer Slide Time: 19:28)



Now comes the main problem associated with India whereas it is not so difficult in China, China the growth is there mainly because there is no effective monitoring of any environmental impacts, they decide to go ahead with the projects there is minimum interference from environmental lobbies, whereas in India it is very high.

There is no problem in having this monitoring but if you see this various agencies and what they look for then it becomes really difficult,

(Refer Slide Time: 20:13)



First we will start with the ministries, there are four ministries which are involved one is ministry of shipping, another is ministry of defense, another is ministry of environment and forest, next one is ministry of agriculture or ministry of animal husbandry and dairying.

This all the four ministries these are under the control of central government but there are some state governments that also (you have to) that also monitor certain things, there are two permissions given by central government, one is called as consent to establish, another is consent to operate, this is given by the state government, there are various studies required to get that consent to establish means the state government gives the consent.

Either the pollution department or we have the Maritime boards, they give the consent to establish before starting the project, once the project is completed they again come and check

and then give consent to operate this is given by the state governments, but when it comes to the central government will take this ministry of shipping we have the three acts which are to be satisfied so you should know what are these three acts.

Indian ports act, major port trust act, merchant shipping act, these are the four acts which you have to see, for example all of you must be knowing that Pratibha Cauvery , what is the problem of Pratibha Cauvery, you know what is Pratibha Cauvery? If you called what is the problem with that, what was the main problem? All of you know what happened to the ship ok, there are certain certification required for a ship to fly so this certificates they want to withdraw now.

Because certificates have not been done, so whether it comes under one of these acts by compensation (wa) what is the finaltative impose everything is to be done in this and ministry of shipping they have certain controls, we may think that it is not good but it is essential for play, suppose there is a port in which there is a terminal, Chennai port has a terminal they want, they don't want that to be monopolized.

In India container operation there is a company called Dp World, this Dp World is almost containing all the container (ports in Ind) container terminals in India, what they do is if there are three terminals side by side, three berths side by side, so the first berth is given to Dp World, we say the second berth cannot be in Ppp mode public private partnership mode, this Dp World will not be allowed to participate, they cannot bid for that project, the third berth they can do.

The second fellow cannot bid the third berth, this is what they do sometimes what happens is the second berth wore is taken that is sometimes taken by Dp World, second berth is taken by some port of Singapore authorities then Dp world by the whole port of Singapore authorities for example then all the berths belong to them, then what they do is they monopolize and they fix the tariff and they create lot of problem, it is one thing what we want to avoid.

Similarly if it in Chennai port and inner port initially they said Chennai port should not handle all the tea cargos it should go to inner port then inner port should not handle container ports, container berths, container ships, it should be done by Chennai port, it is not being practiced these are the controls for example which you have to do, then this is ministry of defense there is a zone for coast guard then maritime zones act.

So this is also a complex situation that is you have a state police, you have a coast guard, you have a navy, anything inside the landside of high tide line is state police, now high tide line to some distance I don't know how many nautical miles that is for coast guard and beyond that in open sea, in our territorial waters it is navy, all of you know this Mumbai that all the terrorist have come for Taj Mahal and all so they have to split through these three zones navy.

Coast guard and state police they have to go through all these zones and the controls are different navy will not access control on the zone where coast guard is there and coast guard will not access control over state police, so this is what is happening but coming to the port that is for the security angle as far as this ministry of defense is concerned the same example of Pratibha Cauvery or any ship which got damage and there is a (pollution) oil pollution.

Then within the coast guard area, mostly it lies in the coast guard area the pollution control is to be done by coast guard so that is how it comes into (26:19 which), the Myf is a very powerful organization and they have this various notification coastal regulations or notifications 91, forest notification 1980, we see some project that is Posco in Orissa, this forest notification comes into picture because they want to get into the forest land.

So very Paradip port all the lands are under forest area, so they have to get a approval for forest, water prevention and control of pollution act 1974, so water is a main thing you cannot take the water and from the CRZ or adjacent to the shoreline you cannot pump the groundwater then hazardous waste management, the environmental impact notification is further modified in 1994 then there is a environmental protection act, Indian wild life protection act 1972.

Then biological diversity act 2002, you are suppose to know about all these acts and complete this requirements, ministry of agriculture fish comes, I don't know how why in agriculture the fishing comes, they don't want to change agriculture and fishing are same for them, here Deep sea policy, Indian fisheries act, Marine fisheries regulation act all these acts comes into picture, so if you see this slide it is mind boggling.

If a person has to (27:40 start a port) and (the) there is no single window system, I think the ministry of finance and prime minister's office PMO they want a single window system, but this ministry of environmental forest and ministry of defense they have very strong control, coming

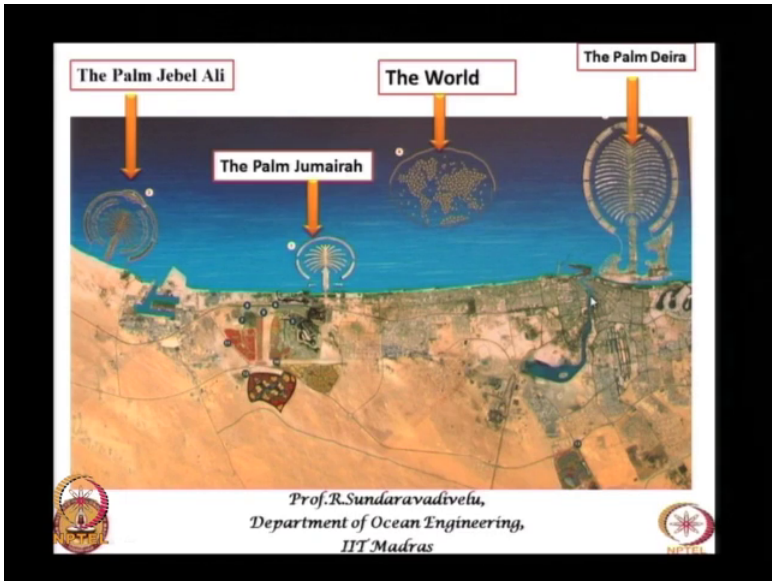
back to ministry of defense in Orissa coast the line is about 400 kilometers, about 150 kilometers comes under some forest act and other acts and biodiversity act and things like that.

Another 150 kilometers coast to defense, only 100 kilometers available for Orissa for development, Orissa share is only 6 percent where Tamil Nadu, Gujarat and Maharashtra put together it may be around 75-80 percent, I have participated in some meeting where Orissa government, ministry of defense and the developer comes and play, Orissa government says why you are penalizing us only, because there is a very good way.

There is a wheeler island and north of wheeler island up to West Bengal coastline there is a some kind of a very protected area where we do all the missile testing and other things, once the area is demark for defense getting it back is very difficult either in the sea or in the land, if you are going to airport there is a area after that Parangimalai Jothi theatre that area is for defense area very difficult to get back.

Even for our airport expansion some area defense it they will give but finally it is very difficult to get come down, similarly near Napier bridge which is near mouth of the Coovum river, there are also there are some defense areas are there, they have their own requirements but we have to go through very big bureaucracy to get all these things solved.

(Refer Slide Time: 29:40)



This shows the what the people who are having a lot of resources do, there is something like a real estate boom. They create (the) I think this is almost completed palm Jumairah, this is palm Jebel Ali, this is the World, and this is palm Diera so this is the shoreline and they want to create separate facilities and all those things that's why, for this also dredging is being used and this is the palm Jumairah where lot of its astonishing to know that about 30 percent of this is owned by Indians you know that.

(Refer Slide Time: 30:30)

Do you know Shahrukh Khan, Salman Khan most of the people investment in this, what is it? Don't forget about dairy milk why are you worried about dairy milk (com) he has so much of money but our Indian Bollywood very interesting here, I forgot the name of the hotel there is some hotel in Dubai, very difficult for a common person to enter, 1977 I went for this Bombay this education trip the Taj hotel in Bombay they didn't allow me inside.

Similarly there is another hotel in Dubai even if you go by Mercedes Benz unless you have some Business inside the hotel whether you have booked a room or you are meeting somebody there they are not allowing you inside, it's not that you are white or black or brown whoever it is. It is a very big hotel and there is a approach into the sea, what is it? What is it? It is a seven star hotel I forgot the name of the hotel.

Not the Inn it's a hotel simply much longer only 15-20 years back, ok we will close it today with this.