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A Study on Construction of Artificial Island using Eco-friendly material and UHMWPE.

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Abstract— **The Artificial island project will be one of the biggest projects in India that will be solely responsible for the advancement in the tourism sector for our country. Many successful attempts have been made in construction of artificial island using Rocks, stones, dumping materials, concrete etc. however the study is aimed at utilisation of "ULTRA-HIGH-MOLECULAR-WEIGHT-POLYTHENE" which is a high-density polymer with least number of harmful effects. This polymer when used as wrapping for wastage or scrap material having high density will form a material with least effects on Environmental. This project will have maximum renewable resources, and this will lead to deterioration in exploitation of Environment. This project will achieve all the necessities and requirements their itself and the utilisation of land and resources will be done precisely.**

Keywords— **Artificial Island, Renewable resources, Construction waste, Tourism, Polymer UHMWPE.**

I. INTRODUCTION

India is a developing country with a population of 125 crore and still increasing. Land acquisition in our country is increasing day by day and since India is a developing country we also need to raise our economy for national development at an International level. This kind of problems can be only handled by constructing a mega project which will increase the economy. Construction of an "ARTIFICIAL ISLAND" is a good idea as the land will also be shaped for this project making it a multinational project with lots of amenities for people. This project will create a huge prospect in various fields and will provide employment in almost all the sectors. This study will also be the boundless source of foreign currency and will be one of the greatest business hubs in upcoming year. The project of an "ARTIFICIAL ISLAND" will create a new marvel for world. It will be an inordinate tourist spot for people all over the world which will give them farfetched experience which was never experienced by anyone till date. It will be a wonder for the world with all the facilities and services at the same place. Considering the Indian point of view, it will be one of the greatest project for India with a source of large economy and employment. This will also be a great source of enjoyment, pleasure, fun, gratification and fulfilment. In short this will be a great holiday destination for people all over the world. This project will not occupy the land since a distinct land will be created for the same.

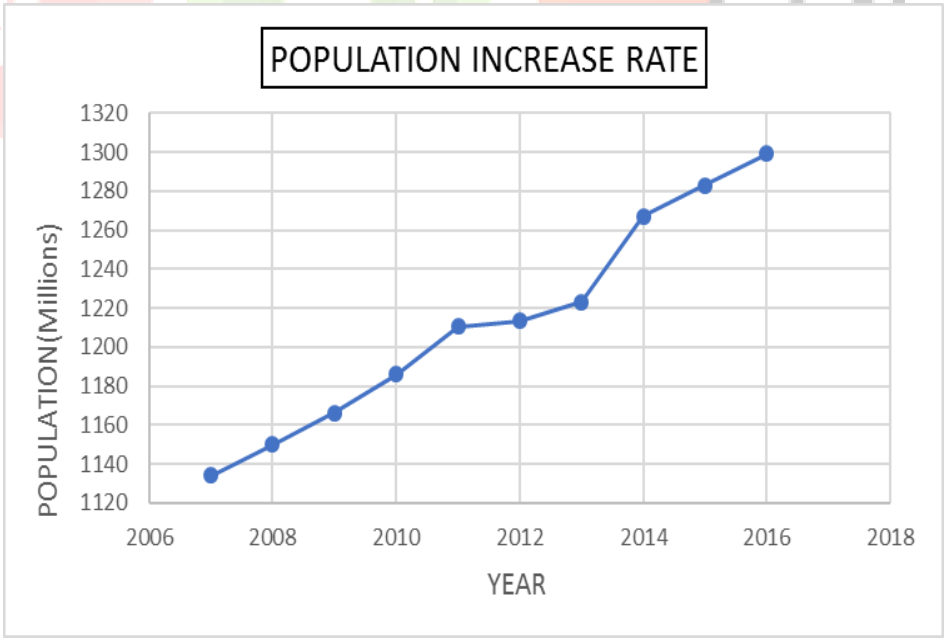

Fig. 1 Figure showing Population increase rate

II. LITERATURE REVIEW

Some of the few examples of Artificial Island are given below-

A. Page Our Lady of the Rocks, Montenegro

Located off the coast of Perast in Bay of Kotor, Montenegro, Our Lady of the Rocks is a small artificial island created by bulwark of rocks and by sinking old and seized ships loaded with rocks. Our Lady of the Rocks is the Adriatic Sea's only artificial island and it is home to a Catholic church, the Church of Our Lady of the Rocks, which has an attached museum. The church houses 68 oil canvases by Baroque masters and over 2,500 gold and silver tablets, according to Montenegro.com. To get to the island, visitors can take boats that travel to and from Perast for around three euros.

B. Palm Jumeirah, Dubai, UAE

Part of the planned Palm Islands, a cluster of "manufactured" islands in the United Arab Emirates, Palm Jumeirah is an artificial archipelago designed in the shape of a palm tree. It consists of a trunk, a crown with 16 fronds, and a surrounding crescent island that forms a 6.8-mile-long breakwater and is now the home of the luxury resort Palm Atlantis Hotel. Once complete, the island will have hotel rooms and homes for 65,000 people, according to Guardian. The Palm was created using 7 million tons of rock, according to its developer Nakheel. The island also includes a curved breakwater using natural rock, intended to encourage the creation of a natural reef and provide habitats for sea life.

C. The World Islands, Dubai, UAE

Also in Dubai, located 2.5 miles off the coast, another mega-project involving artificial islands will be the location of luxury hotels and homes. The World is an artificial archipelago of 300 small islands, composed mainly of sand dredged from the shallow coastal waters, to be constructed in the shape of a world map. However, it seems all is not well with The World. Images taken from space and posted on NASA's Earth Observatory website suggest that the islands of The World are merging and sinking, according to the Daily Mail.

D. Peberholm, Denmark

The construction of the Oresund Bridge connecting Denmark with Sweden included the construction of Peberholm, an artificial island in the Danish side of the Oresund. The island was built to serve as a a crossover point between the tunnel and the bridge. The tunnel had to be built since a bridge spanning the entire link between Malmö, Sweden and Copenhagen, Denmark would have interfered with obstacle-free zones around Kastrup Airport. A tunnel would also allow large ships to pass the Oresund without worrying about the height of the bridge. Officials built Peberholm with ecology preservation in mind. The location, for example, was chosen since it would ensure the freest flow of water through the sound. The island is also home to 8-10 breeding species of birds and rare spiders, according to Birds-of-Denmark's, and two important railway lines are at risk.

E. Burj Al Arab, Dubai, UAE

A towering 1,053 feet, the Burj Al Arab dominates the Dubai skyline as the fourth tallest hotel in the world. It stands on artificial island 920 feet from Jumeirah beach, connected to the mainland with a private curving bridge. To secure a foundation on the island, the builders drove 130-ft long concrete piles into the sand, according to EgyptEng.com. Engineers created a surface layer of large rocks, circled with a concrete honeycomb pattern, which serves to protect the foundation from erosion. Unveiled in 1999, it took three years to reclaim the land from the sea, while it took fewer than three years to construct the building itself, which was designed to resemble the sail of a ship. The Burj Al Arab houses some of the most expensive hotel suites in the world -- all suites are arranged over two floors and have whirlpool baths, living and dining areas and dedicated butlers.

F. Thilafushi, Maldives

The Maldives are known for their stunning natural environments and white beaches, the reason millions of tourist's flocks to their luxury resorts every year. Of its 200 inhabited islands, 99 are dedicated resorts, according to the Daily Mail. One of its islands is Thilafushi, an artificial island built on reclaimed coral reefs in 1992. It doesn't house a five-star hotel, however. Thilafushi was built to serve as a municipal landfill, and was thus nicknamed "Garbage Island." Located to the west of Male, between Kaafu Atoll's Giraavaru and Gulhifalhu, Thilafushi is dumping ground for more than 300 tons of rubbish. In 2005 it was estimated that 31,000 truckloads of garbage are transported to Thilafushi annually, where it is dumped in large piles and eventually used to reclaim land and increase the size of the island, according to the International Red Cross and Red Crescent Societies.

G. Willingdon Island, Kochi

Sea ports always have a unique charm that is inviting for the photographers. Big ships, small boats lined up on the shore, ship building, and the horizons of water make a perfect picture. You might have seen 'underworld' concept of movies; there is often a port or a fight sequence with the boats around. Such is the rustic charm of the sea ports. Willingdon Island is yet another creation of the British to improve their trade relations. A patch of sandy land was gorged out of Vembanad Lake to create a new sea port.

Today, it is the largest artificial island in India. Willingdon Island is a seaport in the city of Kochi. It was so constructed that the isle is connected through road and rail. After the British had left, it came under the Indian Navy and Cochin Port Trust. Whatever it is, British made sure that this port was well connected with the sea ports across the world. Even to this day, Willingdon Island Seaport has sea links with many other sea ports.

H. Shiv Smarak, Mumbai

The Chatrapati Shivaji Memorial or The Shiv Smarak is a huge statue or a monument which is under construction in honour of a seventeen-century Indian hero and the Maratha Empire Chatrapati Shivaji Maharaja. The statue will be in the Arabian Sea, near the coast of Mumbai, Maharashtra, India. The statue is facing Mumbai, 1.5 km away from an island. It will be 210 m high (690 feet) including the foundation and will be the highest statue of the world after the construction. The project area is intended to extend to 130,000 square meters, and the monument will be surrounded by a theatre, a food court and a library. It is expected to be completed in 2019.

III. RESEARCH GAP

A. Advances in Artificial Island Construction Technology in Beach-shallow Sea of China [3]

Shiming Feng, Changmin Zhang and Xian Lin resolved that the results of offshore construction indicate that they tend to be as the structure having multiple use and people can work and live at the same place as on land, even when they are on sea. Artificial island has been chiefly used as means of oil and gas development in beach-shallow sea areas because of the following benefits:

a) Changing the drilling and oil extraction operation from on the sea to on land, avoiding the serious attach or even disaster by sea environment.
b) Reducing the operation risk, easy to establish safety surroundings and logistics sustaining qualification.
c) Convenient for linking up between every working procedure, especially for those anaphase busywork procedure.
d) The gathering pipeline on artificial islands can be easily combined with main pipeline on land.
e) In favour of environment protection, because waste oil, sewage and castoffs can be treated with conveniently.

B. Artificial islands and structures as a means of safeguarding state sovereignty against sea level rise [1]

Grigoris Tsaltas, Tilemachos Bourtzis and Gerasimos Rodotheatos concluded that it is beyond scientific doubt that climate change-caused sea level rise is a problem to be faced in the immediate future. According to reliable scientific data (IPCC Reports 1990, 1995, 2001 and most important IPCC Report 2007) the rise can vary between 0.18 and 0.58 meters, depending on areas and the rise of temperature in the next years. Such a level of rising, despite looking small can seriously affect low lying areas, such as a toll islands and river deltas, worldwide. The areas bound to be more heavily affected are islands and coastal zones. Consequences of this rise to local populations are both multifaceted and of major importance. Economic instability of coastal zones, natural disasters and population displacement are few of the most obvious ones. There are also ensuing problems on state level. The higher cost of civil protection, the inevitable loss of land areas to the sea and possible conflicts with other states are again the more obvious of problems. An example of possible upcoming state conflicts is the ITLOS Case of Bangladesh vs. Myanmar, relating to the delimitation of maritime boundary in the Bay of Bengal, an area among the most heavily affected by sea level rise and flooding. In this paper the major discussion issue will be the problem of land loss from the perspective of States and the deployment of Artificial Islands and Structures as a possible climate change adaptation solution. Presently the answer to the land loss of coastal zones is the use of land preservation and land reclamation techniques. Despite their high cost (Japan's cost of preserving the Okinotorishima islets is estimated at 29.3 billion yen so far and the cost of major preservation works in small states like the Maldives would be far beyond their capacity) and their ambiguous effectiveness, as well as their temporary status, these techniques seem to be the way that States respond to land loss. Land loss is important, especially to island States and low lying coastal States, because it can lead to serious sovereignty loss, due to the movement of maritime boundary baselines. In extreme cases (or not so extreme since a great deal of island States are threatened) this land loss can lead to the complete disappearance of a State, as it was presented by Tuvalu's Representative last December in COP 15 negotiations in Copenhagen. To respond to this challenge, States are keen to spend major amounts of money, to ensure that they minimize the potential economic and sovereignty loss. These type of rises and calamities can be set aside by constructing an artificial island.

C. The pollution of the marine environment by plastic debris [2]

GB Derraik said plastics are sensitive to affected organic polymer though they have existed over a century. There are hundreds more time, but million tons of plastic alone created every year. The flexibility of this material has increased considerably over the last three decades and is rapidly advancing in all aspects of daily life. The plastics are light, durable, durable and inexpensive, making them very friendly to the products. Why is the same function a serious threat to plastic? Because they also floated, plastic and spread further over long distances and could stay at the end of the series when time came. The risk of ecological marine fertilizers has long been neglected and its severity has recently been accepted.

Threats of plastic pollution to biological life in the sea-

There is not yet much information about the impact of plastic pollution on the marine ecosystem. However, the realization of its harmful effects in the biological zone increases. The threat to life at sea is mainly due to edges and scratches made of plastic, cables and synthetic ropes, or caught in nets. As the use of plastic increases, the number of plastic contaminants increases in the marine environment. Two separate studies, in which thousands of birds were examined and the intestinal content of 10-15 years of interval between the studies and after that the plastic was examined and the results shows that they were increased significantly. In a survey in the North Pacific, 11 seabirds were found, 8 of the stomach in plastic particles. The target list shows that the number of seabirds is affected by a significant number of species. At least 267 species affect the world, with 86% seawater species including banding, including 44% of all marine species and 43% of seabirds and mammals. This problem can be very rare because most casualties do not appear in the ocean area because they are consumed by drunkards or predators. The marine coast is a potential threat to marine ecology. It was 80 percent and 85 percent of the plastic waste of the coastal waters in the bay of Tokyo for a floating valley of plethora. Such deposited debris precipitates water and pore water and hypoxia or organ or adipose and animals that fall on the bottom of the sea and insufficient oxidants can inhibit the exchange of gases between the resulting plant ecosystem, interrupting smooth operation and changing lives in the sea.

IV. METHODOLOGY

A. Artificial island Theory

An artificial island is the manmade island which is not naturally made. Artificial island varies in sizes from small islands to the whole city like structure. Artificial structures in early period were floating structures which was used as Dock or Harbour and as wooden structure or megalithic structure erected in shallow waters. Very large floating structure can be classified into-

1)Semi-submersible:

These semi-submersible structures which are made on high seas or large waves.

2)Pontoon:

These are the structures which are constructed on calm water.

Artificial island made here will be totally for tourist and housing will be provided for the employees who will be there for work purpose and tourist will be provided with hotels with lodging purpose. The island will have a Resort, Amusement Park, Adventures park, water sports, underwater sea ride, scuba Diving and a Museum which will show us the way and series of construction of this Island. This will be an amazing holiday destination. This island will also have all sources of energy their itself i.e. there won't be any need to transfer any sort of energy from land and not only energy but also water the only thing that will be needed to be transported will be food since the food cannot be grown or cultivated on such land which has soil as its base material.

B. Steps of project

1) Conducting of Hydrological survey at the site which will be selected for the construction of island. Selecting the site for Breakwater will be the first process and later after site selection for breakwater the site selection for actual land will be conducted. Since breakwater will be the most important part of the project that will help it saving from high tides.
2) After Hydrological Survey we will move towards the collection of material that is required for the construction of Artificial Island.
3) Collecting of scrap material, the recyclable material or any other material like stones and other materials with high density and forming fixed sizes of blocks from it into workshop.
4) The material named as "ULTRA-HIGH-MOLECULAR-WEIGHT-POLYTHENE" (UHMWPE) is world's best water tight material which will be used as the wrapping material for the scrap material. Not only the scrap material but also the waste material or any other material with high density like construction waste, tin or any metal waste etc. This material will fill up the maximum part of the water which will save our most of the filling material and it will also reduce the efficient cost of the project. This material has a boiling point of 130°C to 136°C and it becomes brittle below -150°C which is another reason that makes this material perfect for foundation work. It has got a yield strength of 2.4Gpa or (2.4Kg/mm2) and a specific gravity of 0.97 g/cm3. Which will make it submerge in water easily.
5) This material is odourless, tasteless, non-toxic, it has low moisture absorption, resistive to corrosion chemicals and to that of acid, organic solvents and alkalis which make this material the perfect material to suit in sea water and will harm the aquatic life least.
6) Since this foundation block is ready it will be aligned according to the plan of project and since the Polymer block is stabled, the sand is poured on the polymer blocks as the base of the building foundation. The sand will later be compacted and vibrated to form hard strata. The land on which the foundation is to be made should be hard enough to sustain the load of the buildings so the sand should be better compacted. The piers of the main building will be placed first as that building will be the main building of the project. That building will be the centre of the project and that will also be the security centre of the project. It will have all the coast guard security centre and all the infrared and X-ray scanning centre of the city. It will also have all the offices on the mid floor of the building so that all the work will be done at same place.
7) The planning for the project will be done so that it will be sustainable after 100 years also all the facilities will be there for the people and the energy resources like Electricity, Gas, Water will be developed there itself but only thing that will be needed to be transported will be Food items i.e. Vegetables, spices, Non-veg food etc. The water plant will be set up there which will be a Distillation water plant which will purify sea water into potable water and another plant for sewage treatment that will be used for gardening and supply and other nominal uses.

8) Coming towards Electricity, we will be using Solar Energy as our chief source of energy with addition to Wind Energy above the surface of the water and under the sea. The wave power plant will also be there on the surface of the water which will be producing Electrical energy. All the electricity supply lines, water supply lines will be below the sand that will help us utilising the maximum area above the sand.

C. Layout Description

1) Considering all the requirements and all the suitable data, it is expected that daily 10,000 people will need to be handled on that island including the Employees which will be having their temporary residency. So, the approximate land required for handling the population and required for planning a perfect Township will be 5.25 sqkm which will be 3.5km*1.5 km.
2) Moving towards the breakwater, the breakwater will be constructed with pure igneous rocks since it will be the most important part of our project. The orientation of rock will be responsible for the safety of the island and hence it is required to make it with pure material and in most precise manner. The breakwater will be constructed 100m away from the island.
3) The island will relate to the land with the help if bridge which will be of 4 lanes with security checking's that will inspect the vehicles and the vehicles running on fuels will be parked at the parking section and the other Island public transportation system will be available which will be electrically operated and eco-friendly. This transportation will give door to door service.
4) There will be roads which will be in grid formation which will have width of 6m and which will have many link roads further. These roads will come and end to a main building forming a main square of the island and the main building will constitute of all the offices required to run the island including security, management, finance etc.
5) There will be some of the houses at the beaches side which will be for ease of tourist and tourist will also will be accommodated with small villas with all the facilities.
6) The electricity will be provided and supplied with 3 main sources i.e. solar energy plant that will be set up over every structure there as much as possible and then another main source will be the wind power turbine. There will be some power stations or so-called charging station for the vehicles since all the vehicles there will be electrically operated.
7) Another major requirement will be water and so to complete its need, a Sea water treatment/ Distillation plant will be set up there of 1.35MLD that will convert the sea water into potable and drinking water. In addition to this we will also set up a sewage treatment plant of 1 MLD which will convert all the waste water into usable water and that water will be transported for the use and maintenance of gardens and to fulfil other water requirements except drinking.

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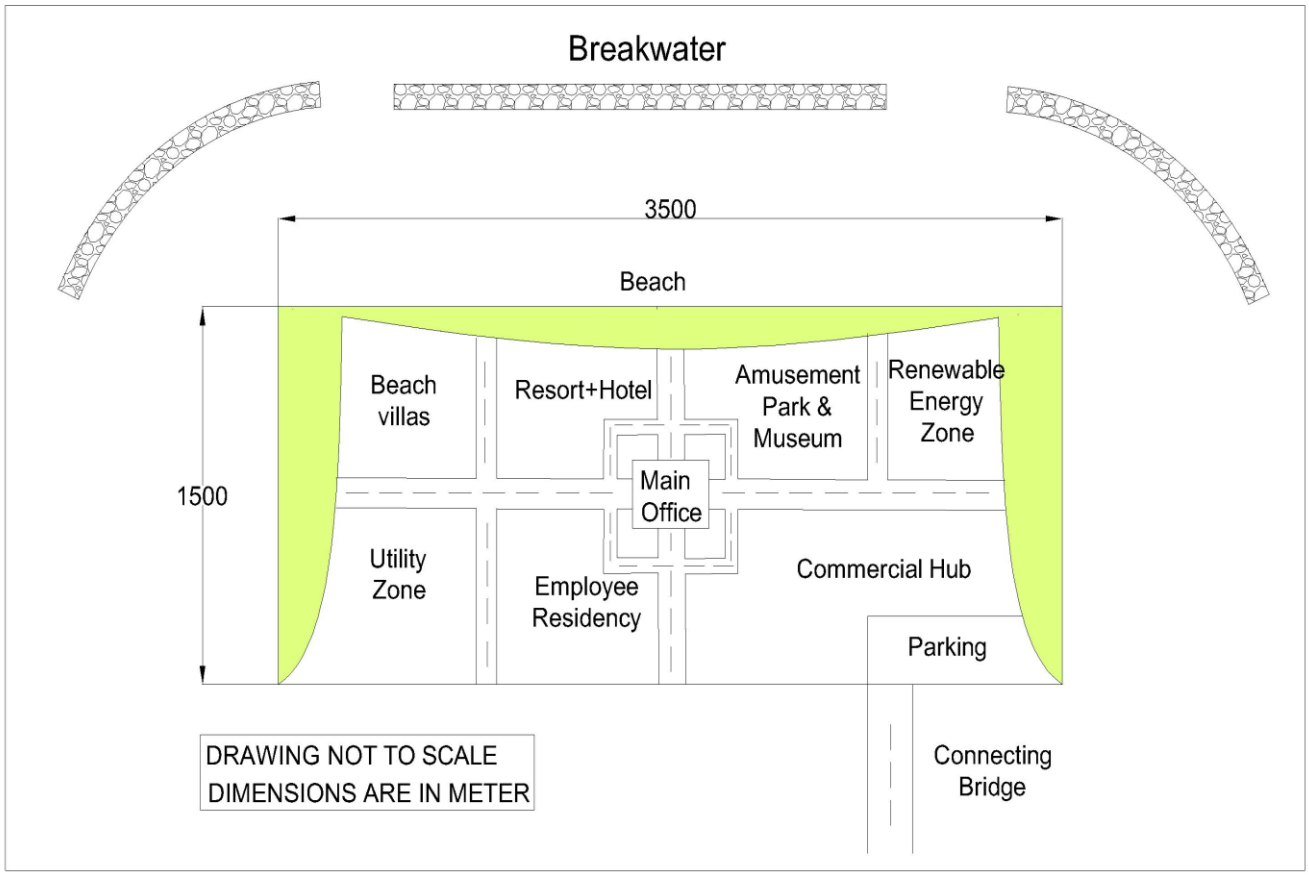

Fig.2 Sample layout of Artificial island

V. CONCLUSIONS

1) Artificial islands have been used successfully and can be utilized more with taking the help of resources more and more.
2) Artificial island here will be used for tourism purpose and many productive work will also be done.
3) Artificial island many be constructed at depth ranging from 6m to 12m.
4) An artificial island will positively contribute to the safety, effective sources and Environmental management.
5) There could be significant operating cost savings in resources and operating of artificial islands.
6) Artificial island can become a focus for sea life and enhancing the marine environment. appearance.

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