



COCHIN PORT TRUST



LAKSHADWEEP ISLANDS : Report of Expert Committee of Cochin Port Trust

REPORT ON PROPOSED DEVELOPMENT AND UPGRADATION OF EXISTING AND NEW HARBOUR INFRASTRUCTURES AT LAKSHADWEEP ISLANDS.

SEPTEMBER 2021

CONTENTS

Sl. No	Description of Items	Pages
1	The Expert Committee	3
2	Message from Chairperson, Cochin Port Trust	4
3	Message from the convenor of the Committee, Cochin Port Trust	5-6
4	Executive Summary	7-10
5	Chapter – 1- Introduction	11-27
6	Chapter – 2 – Study of Existing Facilities Jetties, Harbour and related facilities and helipad.	28-38
7	Chapter – 3 –General Problems of the Jetty and Harbour Infrastructures.	39-43
8	Chapter – 4 – Proposed Up-Gradation of the Existing Infrastructures and Construction of New Infrastructures.	44-70
9	Chapter – 5- Summary of key Recommendations	71-72
10	Annexure I – IV	73-94
	Annexure I & IA- Harbour Facilities at Lakshadweep Islands	73-74
	Annexure II - Lakshadweep Vessel details	75-81
	Annexure III – Proposed Development works in Islands	82-83
	Annexure IV – Budgetary Cost Estimate of Development works	84-94

EXPERT COMMITTEE

Ministry of Port, Shipping and Waterways vide OM dated 23.06.2021 has constituted an Expert Committee to aid and to advice on port operations and upgrading the shipping infrastructure in Union Territory of Lakshadweep (UTL), particularly on future projects to be taken up and for effective utilization of existing infrastructure in UTL, with the following composition:

1. Chairperson, Cochin Port Trust
2. Chairman, New Mangalore Port Trust
3. Secretary (Shipping Services), UT of Lakshadweep Administration, Kavarathy
4. CMD, Shipping Corporation of India Ltd.
5. Managing Director, Dredging Corporation of India Ltd.

The Expert Committee, during its meeting held on 08.07.2021 constituted a Sub Committee of Cochin Port Trust with following members:

- | | | |
|----|---|---------------------|
| 1) | Dr. Cyril Gorge, Dy. Chairman CoPT | Chairman |
| 2) | Shri Paritosh Bala, Chief Engineer, CoPT | Member and Convenor |
| 3) | Capt. Joseph Alapat, Dy Conservator ,CoPT | Member |
| 4) | Smt Philo C.A, Superintending Engineer | Associate Member |

The Sub Committee, visited Lakshadweep and obtained relevant information from the concerned offices. They further inspected jetties, breakwaters, wharfs and other related sites and gathered first-hand information.

Dr M. Beena, IAS

Chairperson, CoPT

MESSAGE

Lakshadweep is an Island territory where the transportation of both passengers and goods is mainly through vessels/ships, with limited option of air travel mode . The lifeline of water transportation depends on availability of all-weather berthing facility of vessels/ships.

The Report on new Development, Renovation and Upgradation of the existing infrastructure of Lakshadweep Port & Harbour and allied Infrastructures is a result of the initiative of Ministry of Ports, Shipping and Waterways. Senior level officials of Cochin Port Trust, having vast experience in the field, associated in field level studies and preparation of the Report.

The report aims to produce a high quality reference document on upgradation of existing Port & Harbour Infrastructure focussing on future development of all-weather Port & Harbour Infrastructure capable of handling both Cargo vessels and Passenger Vessel including Cruise Vessels throughout the year. The report also includes an outline of possible strategies for making the Island UT a hub of International Tourist and Cruise change destination for International Shipping Liners.

The problems of the existing Port & Harbour Infrastructure of UTL are different from other ports of Mainland and even that of Andaman Island. The report aims at critical analysis of the experiences of the officials of Lakshadweep and provide suggestions for the development of new infrastructures and up-keeping of existing infrastructures, not only for present-day requirement but also to meet the challenge for the years ahead. The Report has been prepared considering concerns of the population of the Island hoping to provide a broader road map of future needs of the Island UT and assist the Island Administration to move to all-round human and economic development.



Dr. M. Beena, IAS
Chairperson, Cochin Port Trust

FOREWORD BY CONVENOR OF THE COMMITTEE

Ministry of Ports, Shipping and Waterways launched the Sagarmala Programme with a vision to reduce logistics costs for EXIM and domestic trade, with minimal infrastructure investment.

This programme inter alia includes:

- Reducing cost of transporting domestic cargo through optimising modal mix
- Lowering logistics cost of bulk commodities by locating future industrial capacities near the coast
- Improving export competitiveness by developing port proximate discrete manufacturing clusters
- Optimizing time/cost of EXIM container movement

Various components of Sagarmala Programme are:

- 1. Port Modernization & New Port Development:** De-bottlenecking and capacity expansion of existing ports and development of new Greenfield ports
- 2. Port Connectivity Enhancement:** Enhancing the connectivity of the ports to the hinterland, optimizing cost and time of cargo movement through multi-modal logistics solutions including domestic waterways (inland water transport and coastal shipping).
- 3. Port-linked Industrialization:** Developing port-proximate industrial clusters and Coastal Economic Zones to reduce logistics costs and time of EXIM and domestic cargo.
- 4. Coastal Community Development:** Promoting sustainable development of coastal communities through skill development & livelihood generation activities, fisheries development, coastal tourism etc.
- 5. Coastal Shipping & Inland Waterways Transport:** Impetus to move cargo through the sustainable and environment-friendly coastal and inland waterways mode.

Though most of the programmes of Sagarmala are relevant for Lakshadweep Island, to date no programme has been implemented under Sagarmala scheme in Lakshadweep. The proposal of this report mostly fulfils the requirements of Sagarmala Programme and may be implemented under the programme.

The report mainly aims at Port & Harbour Infrastructure of UTL, it also includes some outline comprehensive programme of possible future development which may culminate into the future growth of the Island UT in particular, and India in general. It is mentioned here that in future most of the commercial activities will be around the Harbour area, and there will be a concentration of human settlement around the area.

The report has been prepared by an Expert Team of Cochin Port Trust which contains useful suggestions of various aspects of timely relevance as well as future needs of the Port & Harbour Infrastructure of UT, which, if implemented, the people of Lakshadweep may be able to travel safely and comfortably.

I am grateful to Sri A. Anbarasu, IAS, Advisor to Administrator; Sri Shivkumar, IAS, Secretary and Sri Sachin Sharma, MD, (Port, Shipping & Aviation, UTLA); for their cooperation in providing logistic support in visiting various Islands and providing guidance and valuable inputs to facilitate the preparation of the Report. I would like to place on record our sincere appreciation to UTL's Administration and ALHW Departments, with special thanks to Sri. Aneesurrahman. A, Asst Director, UTLA, for the services rendered towards providing inputs and logistic in preparation of the Report.



Paritosh Bala

Chief Engineer, CoPT & Convenor

Executive Summary

Lakshadweep Island has ten inhabited islands, 17 uninhabited islands, a good number of attached islets, four newly formed islets and five submerged reefs.

Lakshadweep islands mainly depend on water transport for movement within the islands and from the mainland and it is the only affordable mode of transportation between islands both for passengers as well as cargo. Apart from the construction materials for development works even the essential commodities like ration, POL, medicine, clothing, stationeries, provisions and other essential items required to meet the daily needs of the local people are brought from the mainland. Moreover, the students have to travel for schooling and for pursuing their higher education. Also patients need to travel regularly to main land particularly, Kochi as there is limited medical facility available in the island. Additionally, huge number of tourists also visits Lakshadweep by ship. Shipping services, therefore, is the lifeline of the people of Lakshadweep islands.

All the Islands, except Andrott Island, have shallow water lagoon on the western side and open deep waters on the Eastern side. The lagoons have shallow waters which is not adequate even for the Pablo boat traffic. On the eastern side of the islands, the sea is very deep immediately from the shore and is exposed to the disturbances in the sea in monsoons.

All inhabited Islands of Lakshadweep are provided with ferry jetties located inside the lagoon on the western side of the islands, whereas two Islands i.e. Andrott and Kalpeni are provided with wharf inside partial breakwater . In order to facilitate berthing of the bigger ships, deep water open type jetties are provided in the eastern side at Kavaratti, Agatti, Amini and Minicoy Islands. These jetties provided at the eastern side are operational only during calm weather and sea conditions and yet to achieve the projected target of safe and all weather operation of bigger ships.

The jetties constructed inside the lagoons can only handle berthing of low draft crafts like boats, tugs, dump barges etc. As there is draft restrictions, passenger operations are carried out at high sea with small Pablo boats from ship to island and vice versa and the cargo transport is facilitated with the help of dump barges towed by wooden tugs. During low tide the movement of crafts become difficult inside the lagoon in most of the islands, leading to delay, unpredictable and lower safety standards in cargo as well as passenger operations.

As the sea is the high way to these islands, shipping services assume major role in the development of the islands. At present the Port facilities in the islands are not well developed to the industry standards. In order to cater the above requirements, these

inhabited islands should have well developed infrastructures for facilitating all-weather 24x7 unhindered shipping operations and effective and safe passenger handling. In view of this, there is immediate need for providing new Port infrastructures with modern facilities and refurbishing the existing infrastructures presently provided for handling the passenger ships and the cargo vessels.

In pursuant to the directions of the Expert Committee, constituted by Ministry of Port, Shipping and Waterways vide OM dated 23.06.2021 to aid and advise on port operations and upgrading the shipping infrastructure in Union Territory of Lakshadweep (UTL), particularly on future projects to be taken up and for effective utilization of existing infrastructure in UTL, Senior Technical Expert Team of Cochin Port had visited the Lakshadweep Islands during the period 20th to 24th July 2021 and inspected the jetty infrastructures, breakwater, dredging facility and existing embarkation / disembarkation facilities at the nine Lakshadweep islands.

In due consideration of peculiar geography of the Islands and prevailing climatic / weather conditions and also based on the condition of the existing Port infrastructures, in order to achieve safe, efficient and effective operation of port and shipping services in all the islands of UT of Lakshadweep, modifications / up gradation to the existing infrastructures and new constructions are proposed.

Upgrading physical and social infrastructure in the islands is an important issue. Some physical infrastructures required in the islands are potable water supply, renewable electrical energy generation, training institute for imparting training to the resident of the islands etc. The cyclone shelters are considered essential to be built in elevated part of the port area. These facilities should be installed in all islands. Untreated sewage disposal has to be avoided and if required ,treated sewage waste may be disposed but the outfalls should be placed below the level of coral growth or to be discharged in deep water.

Solid waste disposal /management pose problem and alternative to sea dumping needs must be explored. Electricity generated through Solar Panels and wind mills can act as alternative clean source of energy, which will reduce use of fossil fuel considerably.

Considering all these factors, the key recommendations are as follows:

- All future developmental works of the entire Lakshadweep islands are proposed to be port led and to be taken place in and around port area.
- It is proposed to develop at least one all-weather Harbour around the existing jetty in west side in all the Islands by providing breakwater including seawall and increasing the draft in the inner Harbour area and approach channels.

- Kadmat Island is proposed to develop as base hub for High Speed Crafts for passenger as well as cargo movements.
- The Andrott Port will act as main hub of Coastal Shipping as well as International Shipping. The port should have all modern facilities and compliance of all international law like MARPOL, ISPS etc. It is also proposed to construct new container handling infrastructures and liquid petroleum product handling facility with storage tank at Andrott. It is proposed to develop infrastructures including floating jetty for sea plane service to facilitate development of the island as a Business Hub.
- Dredging and development of approach/entrance channel in the west side jetties is also proposed to take up; however, the dredging activities shall be done without causing much disturbance to the coral reef. A close environmental monitoring should be done. All programmes should be oriented according to the guidelines suggested by the Reef Monitoring Network and Management Plans.
- Reclamation of land utilising dredged materials.
- Construction of breakwater and sea wall for all west side jetties.
- Nourishment and strengthening of existing partial break waters of Andrott and Kalpeni islands and Construction of new part to complete the breakwater.
- Strengthening of existing jetties and wharfs including extension of jetty head.
- Construction of new jetties on the eastern side.
- Installation of infrastructures at the existing water intake jetties of the desalination plant, for utilising those to handle petroleum products.
- Construction of two storied passenger terminals which will also to be utilised as shelter during emergency/ disaster.
- Construction of shed for storing of General cargo and accommodating workshop.
- Installation of solar panels on the sheds for harvesting solar energy.
- Construction of structures at the approaches of the jetties for installation of solar panels.
- Construction and installation of wind mills for harvesting wind energy.
- Construction of water storage tank for rain water harvesting.
- Construction of sewage treatment plant to cater the requirements of adjacent residential area.

- Construction of dumping ground for disposing the garbage for proper waste management of surrounding area.
- Creation of provision for development of tourism and small scale industries like fish processing, ice plant, coir industry etc.
- Creation of Entertainment facility like park etc.
- Development of landing area for sea plane to boost tourism.

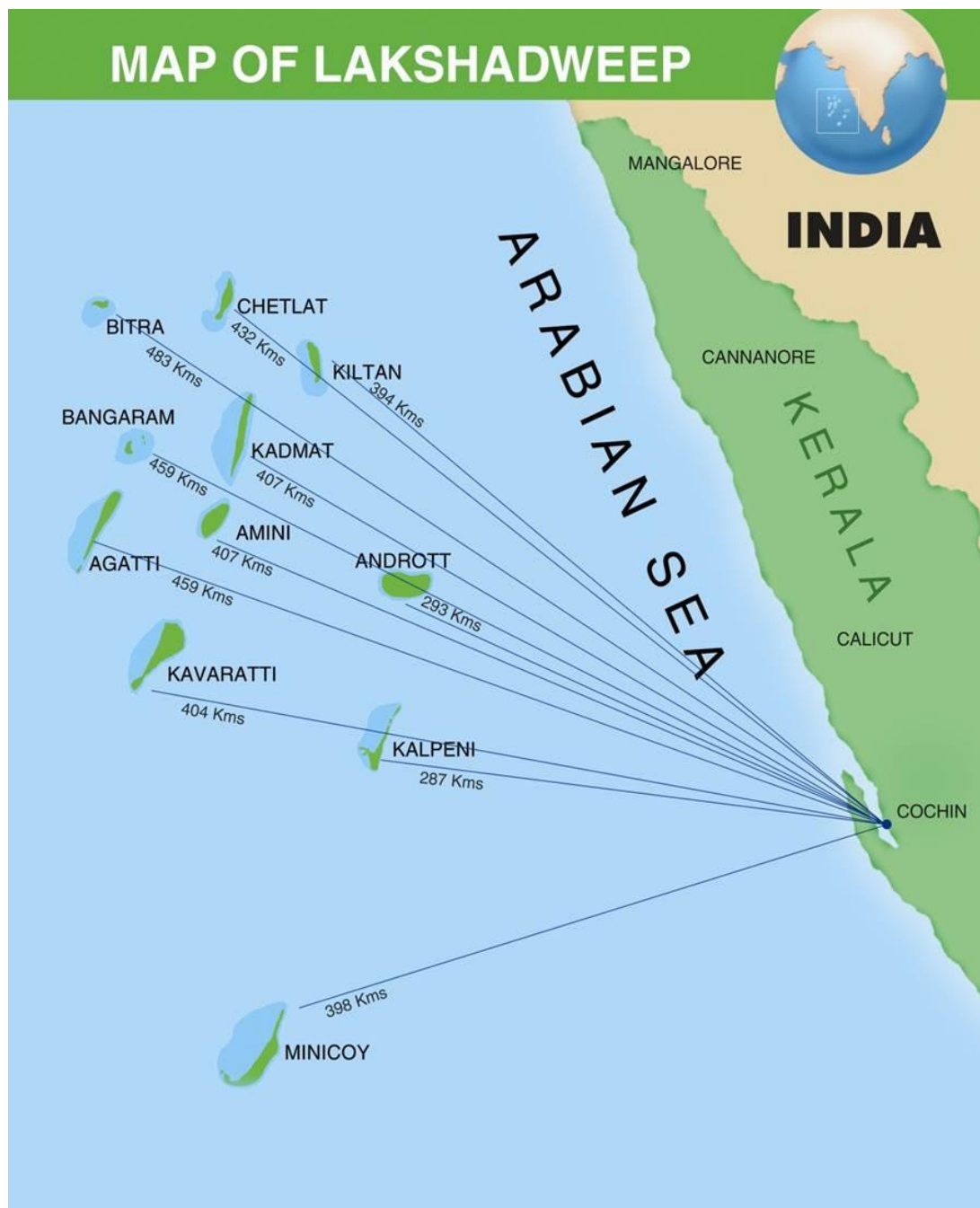
Budgetary Cost Estimate of the above proposed development of infrastructures in the Lakshadweep Islands comes to around Rs. 4047 Crores.

All the proposed development schemes are fulfilling the requirements of Sagarmala Scheme and may be executed under the Sagarmala Scheme. Lakshadweep Administration may approach Ministry of Port, Shipping and Waterways for availing financial assistance for taking up the scheme, on priority basis.

CHAPTER 1: INTRODUCTION

1.1. BRIEF DETAILS OF LAND AREA, LAGOON AREA AND LOCATION OF ALL THE ISLANDS

The Lakshadweep group of islands lie on the northern edge of the 2500kms long North-South aligned submarine Lakshadweep Chagos ridge. The ridge rises from a depth of 2000m to 2700m in the Lakshadweep Sea and about 4000 m in the Arabian Sea. The eastern side of this ridge is steeper than the western. The ridge has several gaps, the main being the Nine Degree (9⁰) Channel which separates the atoll of Minicoy from the northern group of islands.



It is an archipelago of twelve atolls, three reefs and five submerged banks, with a total of about thirty-nine islands and islets. Out of the thirty-nine islands and islets, ten islands are inhabited islands. The reefs are also atolls, although mostly submerged, with only small sand cays above the high-water mark, which is also un-vegetated.

The submerged banks are sunken atolls. Almost all the atolls have a northeast-southwest orientation with the islands lying on the eastern rim and a mostly submerged reef on the western rim, enclosing a lagoon. It has ten inhabited islands, 17 uninhabited islands, attached islets, four newly formed islets and five submerged reefs.

All the islands are covered with white sand. At a few metres under the sand on all the islands; excepting Minicoy and Kalpeni, lies a horizontal bed of coral lime-stone. The limestone layer contains a reserve of potable water and freshwater, which can be tapped by drilling bore well through the limestone subtraction at an average depth of two to three metres.

The main islands are Kavaratti, Agatti, Minicoy and Amini. The total land area of the islands is 32 sq. km and total population of the territory is 64,429, according to the 2011 census. Agatti has an airport with direct flights from Kochi.

The islands of the Lakshadweep are spread in north-south direction; except Andrott, which is spread in east-west direction. Lakshadweep's surface formation consists of coral conglomerate overlying broken pieces of coral and coral sand. All the islands are part of atolls and have lagoons on the west side. There is also a narrow coral reef in the east side of the islands except Andrott which has a very narrow coral reef on the south and west side. The coral reef width of the outer rings of all the atolls except Andrott is around 50 m to 100 m. All the lagoons are saucer shaped and have greater depth in the middle area and shallow depth at both outer reef ring and shore side. The formation of the lagoon on the west side of the islands is due to the direction of wind, which flow from north-west direction to south-east direction particularly in monsoon. While the lagoons are situated in the wind side, the east side of the islands being at the lee side, the width of the coral reef at this side is very narrow (50m to 100 m only).

Inhabited islands of Lakshadweep are Bitra, Chetlat, Kiltan, Kadmat, Amini, Agatti Andrott, Kavaratti, Kalpeni and Minicoy and uninhabited islands/islets/land mass are Cherbaniani (Beleapani) Reef, Byramgore (Chereapani) Reef, Perumal Par, Viringili, Cheriya, Kodithala, Tilakkam, Pitti, Thinnakara, Parali, Kalpatti, Suheli Valiya Kara, Suheli Cheriya Kara, Bangaram

Lakshadweep is connected to Cochin by sea route. Seven passenger ships operate between various islands & Cochin and it takes 14-20 hours for the passage. Agatti of Lakshadweep is also connected to Cochin by regular commercial flights and it takes around 1 hour 20 minutes.

1.2. BRIEF FEATURES OF VARIOUS ATOLLS/REEF :-

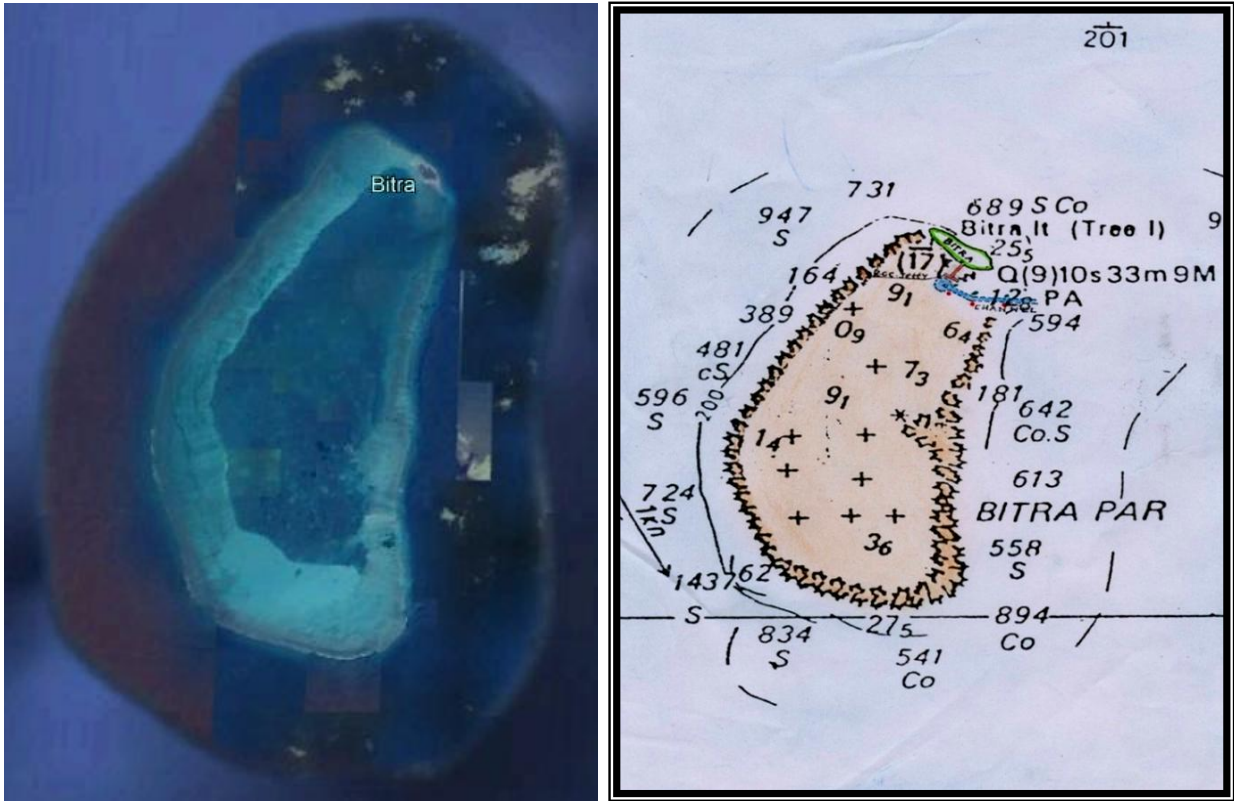
1. Cherbaniani Reef is a coral atoll belonging to the Amindivi Subgroup of islands and located 33 km north of Byramgore Reef. It is the north-western most feature of Lakshadweep. The atoll has roughly an oval shape and its total lagoon area is 57.46 sq. km. The 14 km long coral reef that encloses the lagoon has three small uninhabited islands on it.



2. Byramgore Reef, is a coral atoll located 33 km south of Cherbaniani Reef and 41 km to the northwest of Bitra Par. The whole northern part of the atoll is submerged. The total length of the atoll, including the submerged part, is 21.5 km, with a maximum width of 6.3 km. The atoll has a vast lagoon of area 172.59Sq km. There are a few sandbanks on the reefs, but little land is above the water surface during high tides.



3. Bitra Par is a coral atoll of the Amindivi subgroup of islands . The atoll has one island (Bitra) and one very small land mass (South cay). The atoll is situated at a distance of 33 km north of Perumal Par ,41 km southeast of Byramgore Reef and 483 Km away from Kochi. The lagoon area of the atoll is 45.61 sq. km.



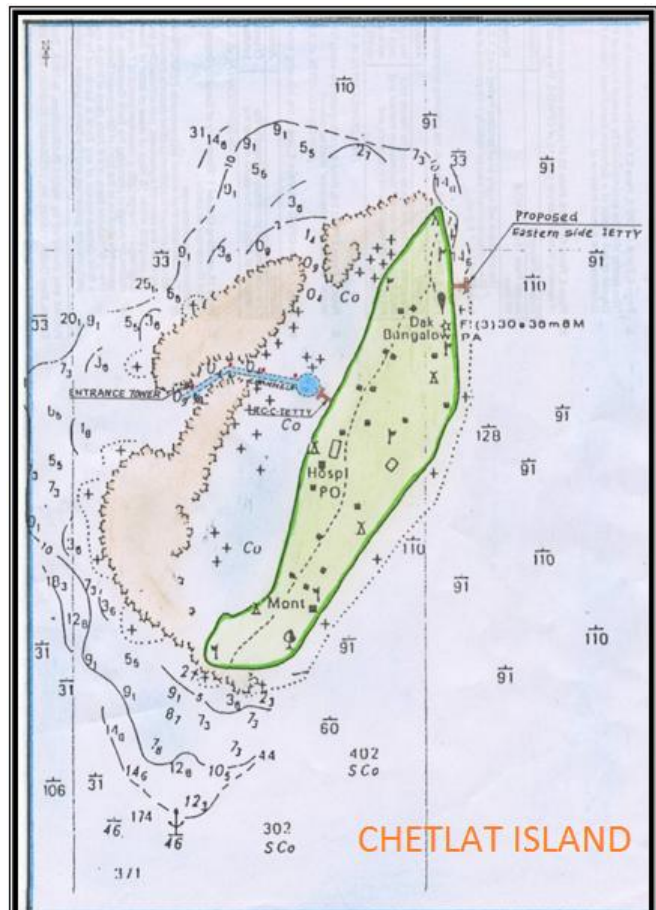
Bitra Island is the main island of the atoll and has an area of 0.148 Sqkm. It is located at the northern end of the Bitra Par coral Reef. The length and width of Bitra island are 0.57 Km and 0.28 Km at the widest point. Bitra is the smallest inhabited island with population 271 (2011 census). Another small land mass, named as south cay is located on the southern part of the coral reef. The area of the islet is only 0.009 sq. km.



4. The Chetlat Island is the northern most inhabited island of Lakshadweep archipelago. The length of island is 2.74 Km and width of 0.59 Km at the broadest point. The area and perimeter of the island are 1.174 sq. km and 5.9 Km. This Island is part of a Coral Atoll and it is situated at the eastern side of the Atoll. There is a small land mass of area 0.001 sq. km, located on the northern most part of the coral reef. The two land mass is joined with a narrow sandy strip.

The atoll has a lagoon in the west side of an area of around 3.79 Sq. km. The outer Coral reef is mainly situated in the west of the island and is broken. There are two big inlets in the outer coral ring. Along the eastern side of the island, there is a wide belt of a coral delta that broadens at the north and covers the whole southern end of the island. The atoll lagoon area has very small living coral except the outer reef ring area, where the presence of coral is more. There is a narrow coral reef in the east of the island.

The Chetlat Island is 37 km to the northwest of Kiltan Island , 56 km on the north of the Amini Island and 432 km away from Kochi.



5. The Kiltan Island is an inhabited island of Lakshadweep, having a land area of 1.7 Sq. km. It has a length of 3.4 Km and a width of 0.6 Km at the broadest point, the perimeter of the island is around 7.7 Km. This island is part of a Coral Atoll of Amindivi subgroup

and situated at the eastern side of the Atoll. The atoll has a small lagoon of area around 1.76 Sq. km and perimeter 7.1 Km. The outer Coral reef is almost continuous with two small broken inlets. Most of the lagoon area has living coral except the north-western area, is situated between the shoreline and outer coral ring. On the northern and southern ends of the island, there are high storm beaches. There is a narrow coral reef on the eastern side of the island. Kiltan island is situated 38 Km south-east of Chetlat, 33Km north-east of Kadmat and 394 Km away from Cochin.

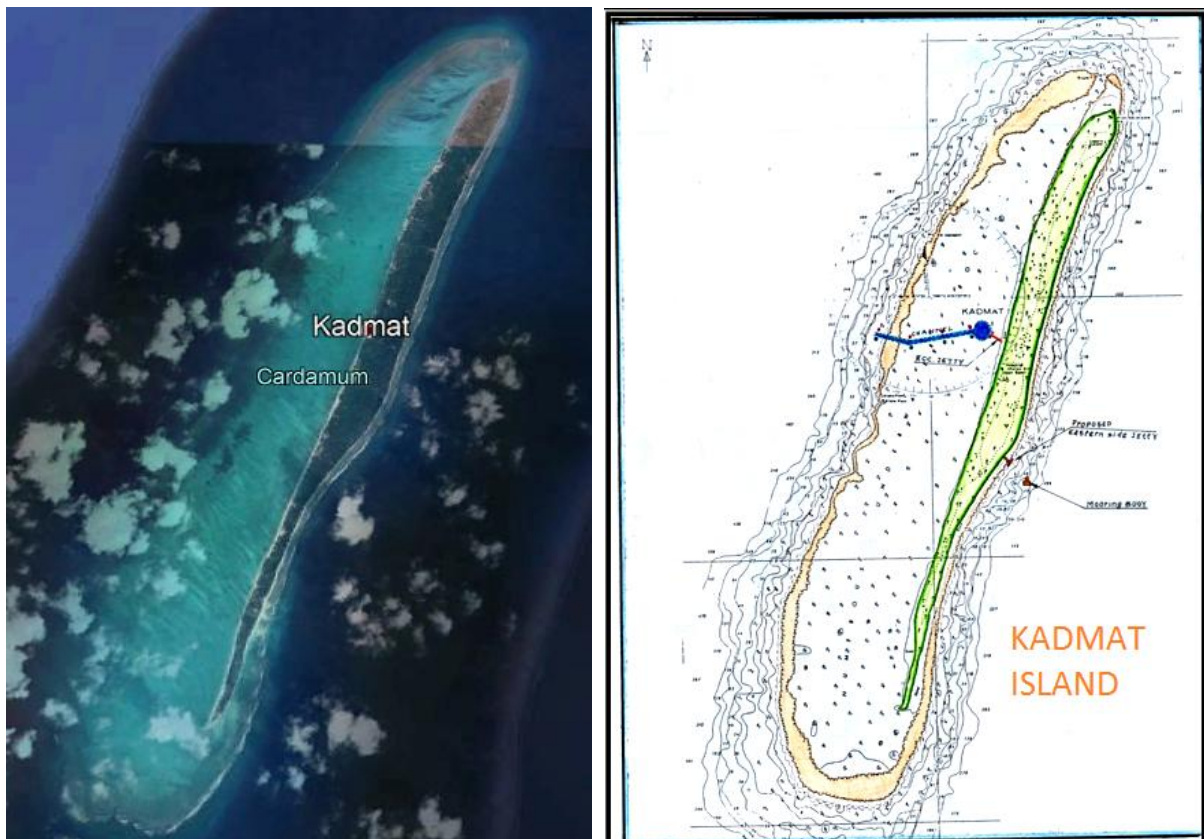


6. Perumal Par, is an uninhabited coral atoll. It is located 33 km south of Bitra Par and 25 km to the northwest of Bangaram Atoll . It has a large lagoon and three small sandy islets encircling the reef, located in the eastern area. The lagoons area is 73.6 Sqkm and perimeter 38.9 Km. The area of the small islets is i) North Islet 0.1 hectares, ii) Middle Islet 0.64 hectares and iii) South Islet 0.98 hectares.



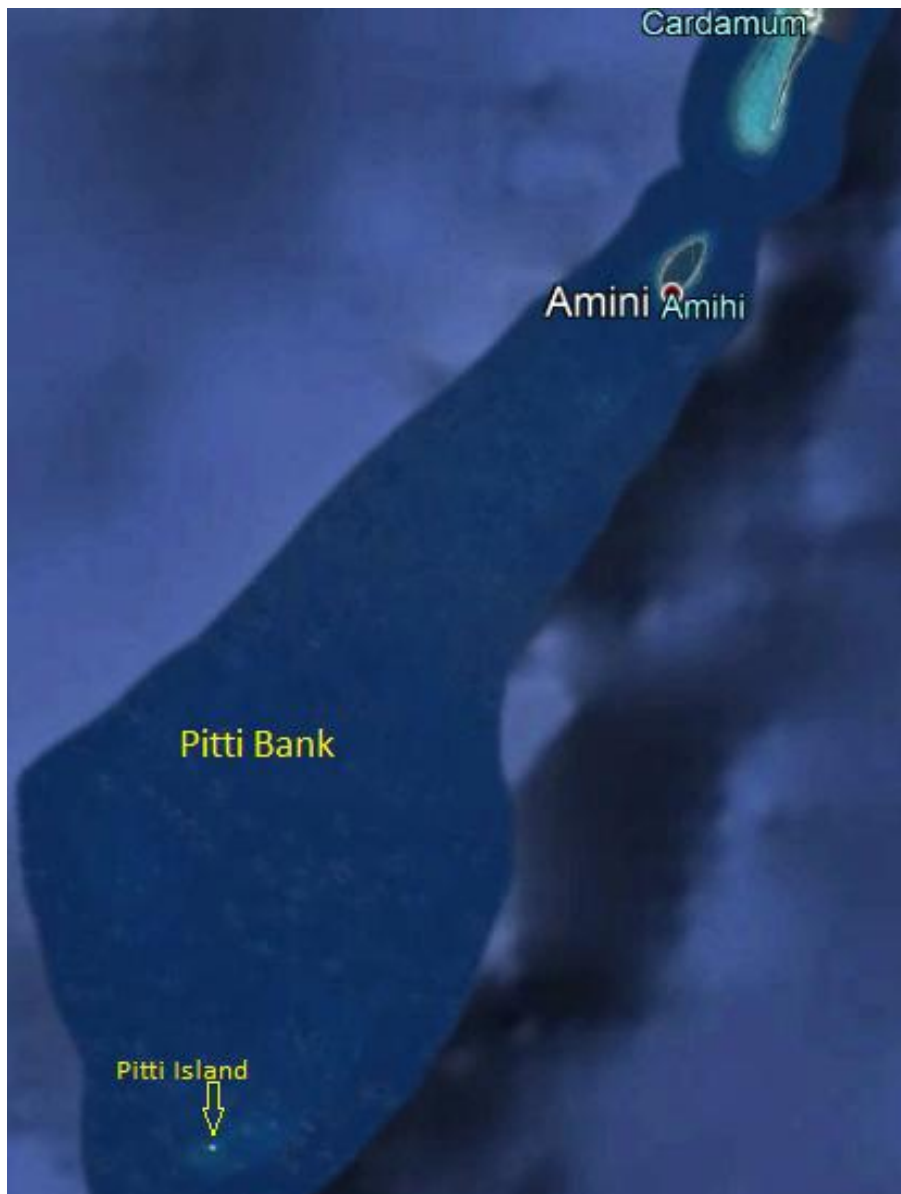
7. The Kadmat Island is a long (9.3 Km) and narrow (width 0.57 Km at the broadest point) island of an area of 3.34 Sq. km and belongs to Amindivi subgroup. This Island is the longest island of Amindivi group. Though the southern end of Kadmat island is only 6 Km away from the northern end of Amini island, the two islands are situated on different atolls. This island is 407 Km away from Kochi and located between Amini Island in the south and Chetlat Island in the north. It is the central most Island of Lakshadweep Union Territory.

The lagoon is situated on the west side of the island and is about 2 Km wide at the broadest point with a covering area of 37.0 Sqkm. There is a narrow lagoon on the east side. There is a sand accumulation at the southern part of the island, giving rise to undulations. The northern side is however flat. The lagoon is mostly devoid of living coral except in the outer ring. The outer coral reef ring area has living corals and the same is mostly unbroken except at north corner and at the mouth of approach channel. North corner of the outer coral reef has an inlet. The lagoon has sea grass.



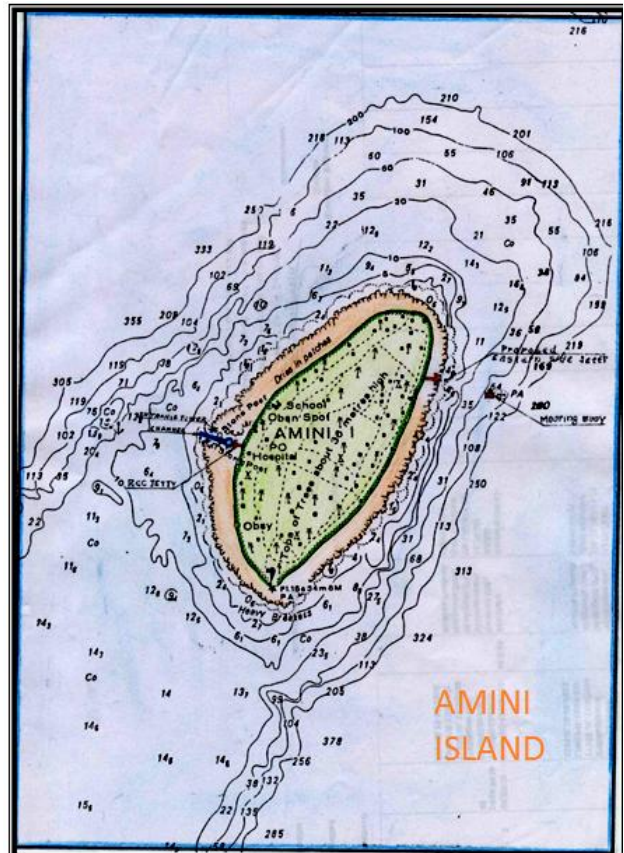
8. Pitti Bank is a largely submerged and sunken atoll, with an estimated lagoon area of 415 Sq km, with just the two islands Amini and Pitti situated at its opposite ends. Amini is situated in the north-east and Pitti islet is on the south of the bank. It is oriented in a

northeast-southwest direction, is 49 km long, in the northern part from 2 to 7 km wide and in the southern part up to 18 km wide.



The **Amini** is an oval shape inhabited island and is part of Pritti Bank. The island is 2.8 Km long and up to 1.3 Km wide with an area of 2.67 Sq. km and perimeter 6.7 Km. The island is only 6 Km away from the southern end of Kadmat but situated on a different atoll. The Amini Island is at a distance of 407 km from Kochi and is located between Kavaratti Island (60 Km away) in the south and Kadmat Island (6 Km away) in the north. The island is surrounded by a narrow strip of coral reefs of varying width of 100m to 300 m. The width is more in west and southern end. The area of the lagoon is only 1.41 Sqkm. The coral reef has an outer ring of width 50 m to 100 m. On the east side of the

Island ,there is rapid change in water depth . The west side has one approach channel towards the Jetty.



Pitti is a very small uninhabited islet, located at the south-western extremity of Pitti Bank. The area of the island is 2.87 Hectares and the perimeter is 690 m only. There is no vegetation and anchoring point on the island.



9. Bangaram is roughly a rectangle shape atoll of 8.1 km in length with a maximum width of 4.2 km. The atoll has a lagoon of 36 Sqkm. The atoll has seven islands/islets. It

is located about 7 km northeast of the island of Agatti. Bangaram atoll is connected to the reef of Agatti through a shallow submarine ridge and part of the same bank.



Bangaram Island, the largest island in the atoll, with a land surface of 0.57 Sq km and perimeter 3.7 Km. It is located on the south west side. Bangaram Island has no permanent residents but has a small migrating population of 10 numbers. It is surrounded by a shallow lagoon enclosed by a coral reef ring.



Thinnakara, is another large island in the atoll, has a land surface of area 0.522 Sq km. It is located 2.4 km East-Northeast of Bangaram island, at the edge of the lagoon basin.



Parali 1, Parali 2 and Parali 3 are three small islets at the eastern fringe of the reef. The Islets have a total land surface of 0.089 Sq km. Parali-1 no longer exist ,it washed away in 2017. There is another small land mass, named South Bangaram Cay, in the atoll of area 0.001 Sq km. The islet is located in south-east of Bangaram island.

10. Agatti Atoll's total land area is 3.925 Sqkm out of it the main island area is 3.84 Sqkm and the small Kalpatti Island has an area of 0.085 Sqkm. Kalpatti is located at the southern end of the same reef. The lagoon area of the atoll is 24.84 Sqkm. The largest island of Agatti atoll is Agatti, which is a 7.8 km long coral island of Lakshadweep. It is located 7 km to the southwest of Bangaram, the nearest island. Kavaratti is the closest inhabited island, lies 54 km to the south east.

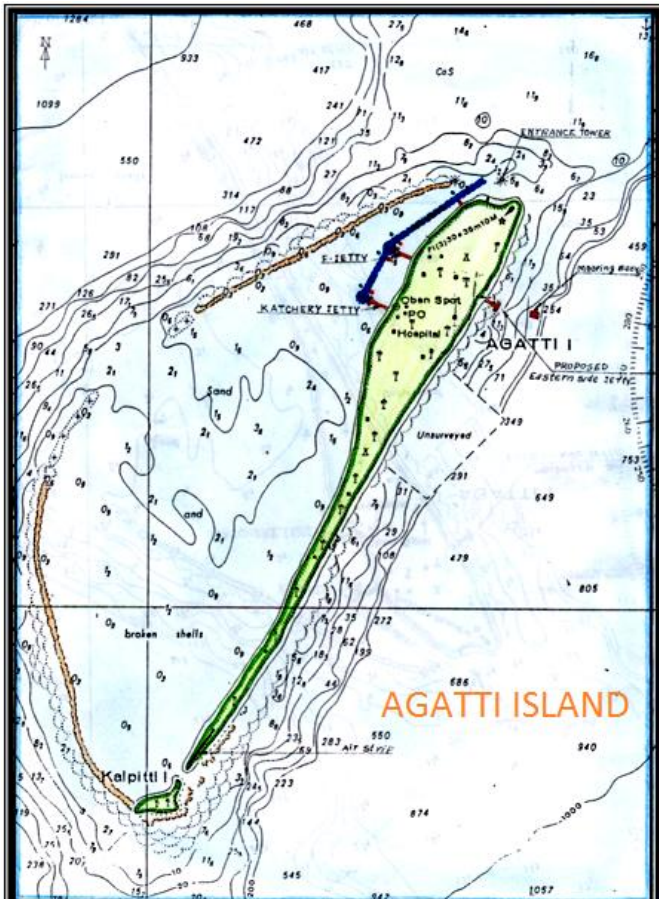


The Agatti atoll has a big lagoon on the western side, with a width of

about 3.3 Km at the broadest point and area of 24.84 Sqkm. There is also a narrow coral reef in the east. There is a sand accumulation at the north-eastern corner of the island.

The outer coral ring of the lagoon is broken and there are few inlets in the ring. The lagoon area particularly the outer coral reef ring has living coral.

The Agatti Island is a long (7.8 Km) and narrow (only 0.91 km wide at the broadest point) island of an area of 3.84 Sq. km and perimeter 16.2 Km. The island is located 7 Km south-west of Bangaram Island and 54 Km north-west of the nearest inhabited Island Kavaratti. It is 459 Km away from Kochi.



Kalpatti is a small Island mass of area 0.085 Sqkm. It is located at the southern end of the Agatti reef atoll.



11. Suheli Par is a coral atoll. The atoll is an oval-shaped 17 km long atoll surrounded by a zone of rich coral reef. The atoll is 52 km south west of Kavaratti and 76 km south of Agatti .The Lagoon area of the atoll is 87.76 Sqkm . There are three islands on the reef encircling the lagoon.



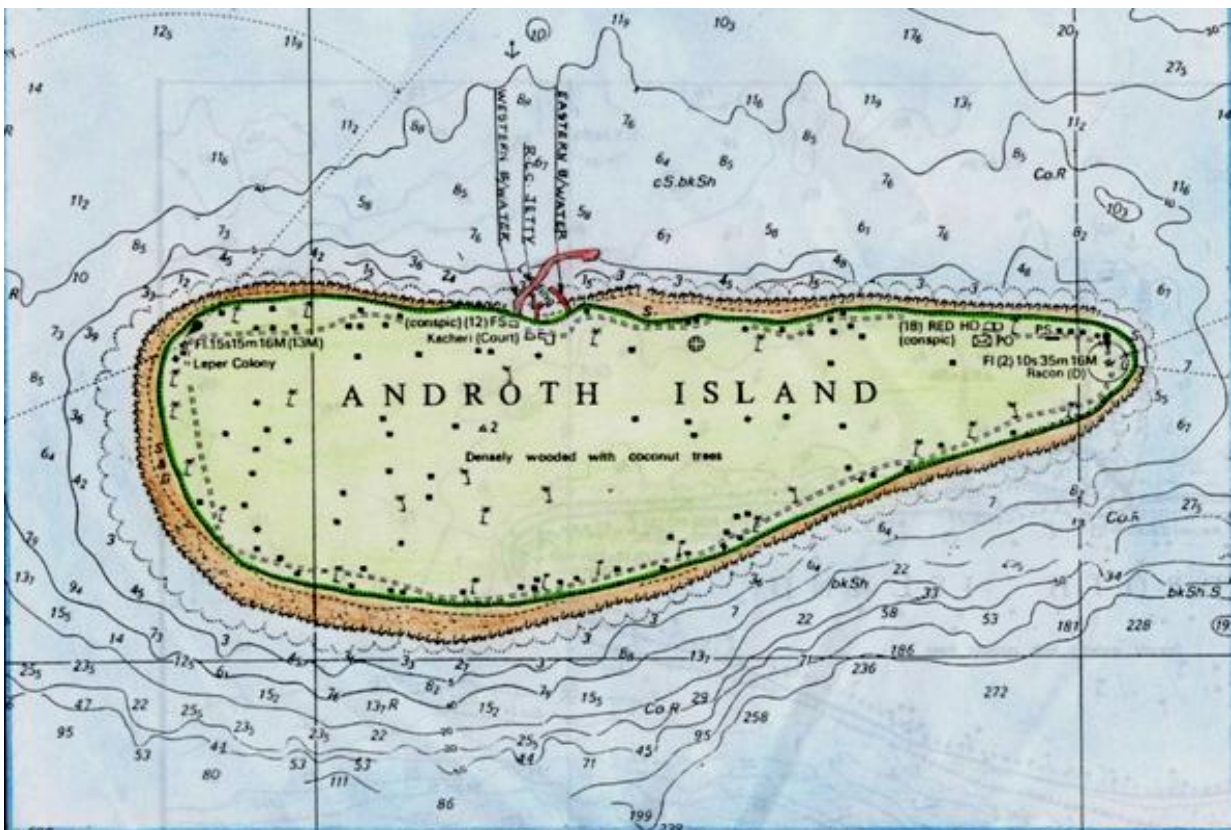
Valiyakara is an Island of area 0.395 square kilometres, located at the northern end of the atoll. There is a lighthouse on this island.

Cheriya-kara is an Island of the atoll having an area 0.383 Sq.km, located on the south-eastern side of the lagoon and slightly smaller than Valiyakara.



Indira-Shastri Dweep is a long narrow sandbank of area 0.11 square kilometres located between the two islands.

12. The **Andrott** Island is the largest island of Lakshadweep with a land area of 4.90 sq. km, the length of the island is 4.66 km and the maximum width is 1.43 km. This island is the nearest island of the main land and only 293 Km away from Kochi. The island has the highest population of the Lakshadweep Union territory with a population 11,191 (as per 2011 census). It is the only island of Lakshadweep that lies in the east-west direction while all other islands lie in north-south direction. Andrott is 119 km away from Kavaratti. The island has a small coral reef surrounding it and the area of the coral reef is only 6.6 Sqkm. There is an accumulation of sand at the north-east end of the island.



13. The **Kavaratti** island is the capital of the Union Territory of Lakshadweep and is located in the centre of Lakshadweep archipelago. The island is at a distance of 404 km from Kochi and is located between Agatti Island on the West and Andrott Island on the East. The closest islet is the uninhabited Pitti islet situated 24 km north of Kavaratti. The maximum length of the island is 5.8 km and width is 1.6 km with an area of 4.22 Sq. km.



It has a shallow lagoon on the western side having a length of about 6 km and an area of 4.96 sq. km. The lagoon has a mostly unbroken coral reef outer ring except for the two outlets in the North and in the East. The lagoon area has living coral patches. The east side of the island has a narrow strip of coral reef.

14. Kalpeni atoll is 22.4 Km long and 7 Km wide, at the broadest part coral atoll .Kalpeni atoll is 287 Km away from Kochi and lies 71 Km south of Andrott and 201 Km North-Northeast of Minicoy. The atoll rests on a single ridge of Bank. The atoll has a large lagoon on the west side measuring about 3.5 km at the point of maximum width and area is 25.6 Sqkm.

The atoll consists of inhabited Kalpeni island, Cheriya island and three small land masses, Tilakkam, Kodithala and Pitti. The Kalpeni Island is situated on South-Eastern end of the atoll while Cheriya Island is situated on the North-East end. The rest of the three islets are situated West of Kalpeni Island. The northern tip of Kalpeni Island is only 3 Km away from southern tip of Cheriya Island.



Kalpeni is the largest inhabited island of Kalpeni atoll, located in the South-East end of the atoll. The island is 5.3 Km long and maximum width 1.4 Km at the widest part with area of 2.79 Sqkm and perimeter 12.1 Km.

The island is located South-East of Kavaratti Island and midway between Andrott and Minicoy (75 Km and 200 Km away respectively) and it is 287 km away from Kochi. There is a large lagoon (area 25.6 Sqkm) on the North-West side of the island area .The lagoon outer ring is almost unbroken and inside the lagoon ,living coral is present over large area.

Kodithala islet is situated immediately North of Kalpeni Island and has an area of 0.0027 Sqkm

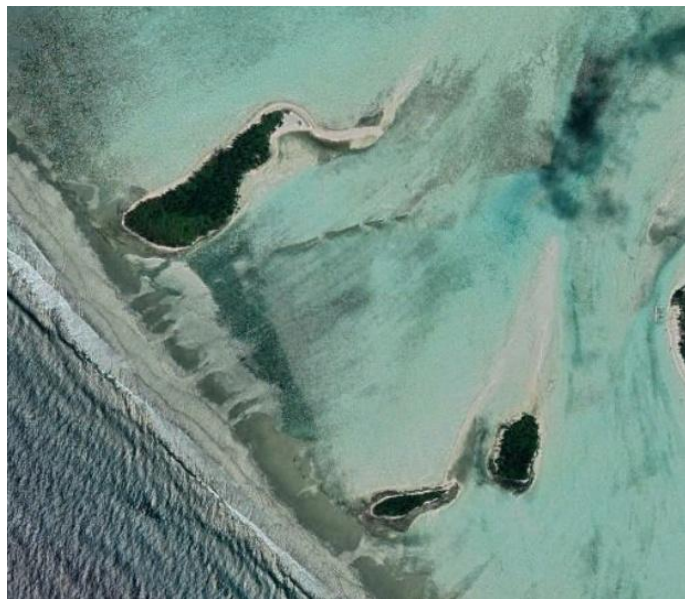


Cheriyam is the northern most island of the atoll and second largest island of the atoll in terms of area (0.537 Sqkm) .The island has a migrating population of 10. The island has a lighthouse at the North point. Tilakkam group are a group of islands off the West of Kalpeni. The land area of these islands is 0.055 Sqkm belong to two different families of Kalpeni.



Koomel is a small islet off the West tip of Kalpeni with an area of 2000 Sqm.

Tilakkam east has an area of 8800 Sqm. Tilakkam west has an area of 8200 Sqm. Pitti islet has an area of 3.6 hectares



There is another atoll in the south end of Lakshadweep Archaeologies. Name of the atoll is Maliku and the atoll has two islands, Minicoy and Vitingili.

CHAPTER 2: STUDY OF EXISTING FACILITIES JETTIES, HARBOUR AND RELATED FACILITIES AND HELIPAD

2.1. INTRODUCTION:

Lakshadweep is a group of Islands and as such water transport is the only affordable mode of transportation between islands for both passenger as well as general cargo. Helicopter service is available between islands, the service also available to and from Kochi. But the Heli-service is mainly available for medical evacuation. However, the Heli-service between Agati Airport and Kavaratti Helipad is almost regular.

In addition to the movement of residents, Lakshadweep also depends on a water transportation system, plying between inter islands as well as between main land and islands for movement of all essential commodities like building materials, POL, medicine, clothing, stationeries, provisions and other essential items required to meet the daily needs of the local people, including produces of the island. The students and their parents of Lakshadweep also need ship service to travel for schooling and pursuing higher education. As there is limited medical facility available on the island patients along with accompanied travel regularly to main land particularly, Kochi. Additionally, huge numbers of tourists also visit Lakshadweep by ship.

Shipping services, therefore, is the lifeline of the people of Lakshadweep islands.

The port infrastructures at the Mainland at Cochin Port and New Mangalore Port are well developed with all the necessary infrastructures like all-weather Berths, cargo and passenger handling equipment etc. However, the infrastructures available at old Mangalore Port and Beypore Port are inadequate. As this is not part of the scope of study no detail is furnished.

The existing Port facilities in the islands are as follows :-

1. Berthing Facilities at Bitra Island

Bitra Island has a small permanent jetty at the western side. There is a Helipad at the Northern corner of the island. The details of the jetty are as follows:

- Jetty head 15.3 m long x 6 m wide,
- Approach 169 m long x 4.5 m wide
- Top level of Jetty +3.5 m and Depth (-) 1.5 m
- Year of construction 1986.

There is an approach channel to the Jetty of length 2126 m and width 16 m. There is no permanent rubber fender in the Jetty.



2. Berthing Facilities at Chetlat Island



Chetlat Island has a small permanent jetty at the western side of the island and has a helipad at the southern end of the island. The Jetty head is around 90 m away from the shore line.

There is an embarkation/ disembarkation area without the basic facility, at the eastern side.



The details of jetty of Cetlat island are as follows: -

- Jetty head 24.5 m long x 10.m wide,
- Approach 78 m long x 6 m wide
- Top level of Jetty +3.5 m and Depth (-) 1.0 m
- Year of construction 1981.

There is an approach channel to the Jetty having length 880 m and a width 16 m. There is no permanent rubber fender at the Jetty. As foreshore infrastructures at Chetlat Jetty, there are 40 Sqm Passenger shed, 40 Sqm general Cargo shed and 94 Sqm Workshop facility.

3. Berthing Facilities at Kiltan Island

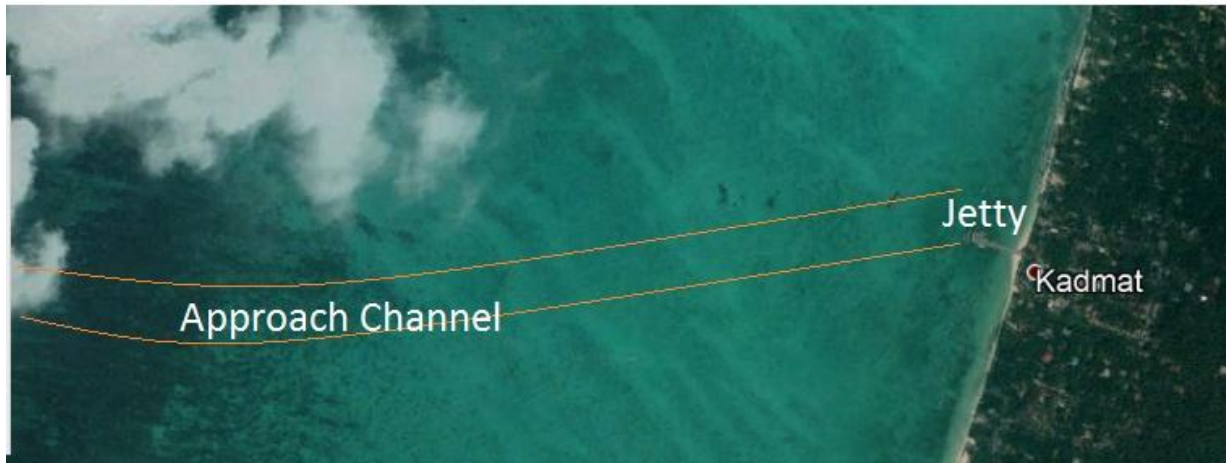


Kiltan Island has two small Jetties one at the Eastern and another at the Western side of the island .There is a helipad at the north-western corner of the island . The Island has a landmark 41-metre high lighthouse .The details of the west side jetty: -

- Jetty head 20 m long x 15.8 m wide
- Approach 72.8 m long x 6 m wide
- Top level of Jetty +3.3 m and Depth (-) 1.2 m
- Year of construction 1978.

There is a well-defined approach channel to the west side Jetty having a length 780 m and a width 16 m. The east side jetty is very small in size. There is no permanent rubber fender at the Jetty. As foreshore infrastructures at Kiltan's west side Jetty there is 40 Sqm Passenger shed and 40 Sqm general cargo shed facility.

4. Berthing facility at Kadmat Island



Kadmat Island has two small jetties on the west side of the Island .Out of the two jetties , the southern jetty is very small. There is one small jetty and one water intake jetty on the east side. There is a Helipad in the middle part of the island towards west. The west side main Jetty is located in the middle of the island and the Jetty head is 85 m away from shore line. East side water intake Jetty is located in the middle of the island and the jetty is 100 m away from shore line.

The details of west side jetty: -

- Jetty head 18 m long x 14.7 m wide
- Approach 69 m long x 6 m wide
- Top level of Jetty +3.5 m and Depth (-) 1.5 m,
- Year of construction 1979.

There is a well-defined approach channel to the west side Jetty of length 1870 m and width 16 m. The east side jetty has high draft close to shore line. There is no permanent rubber fender at the Jetty. As foreshore infrastructures at Kadmat's west side Jetty, there is 40 Sqm Passenger shed and 40 Sqm general cargo shed facility.

5. Berthing facilities at Amini Island:

Amini Island has a Helipad on the north end, one small jetty at the west side and one standard size Jetty on the east side.



Additionally there is a very small jetty and one water intake jetty at the east side.



The details of the west side jetty ,known as Kachery jetty: -

- Jetty head 20 m long x 14.1 m wide
- Approach 74 m long x 6.65 m wide
- Top level of Jetty +3.9 m and Depth (-) 1.8 m
- Year of construction 1979.

There is a well-defined approach channel of length 295 m and width 16 m to the west side Jetty. There is no permanent rubber fender at the Jetty. As foreshore infrastructures at Amini's west side Jetty, there are 60 Sqm Passenger shed, 60 Sqm general cargo shed and 150 Sqm workshop facility.

The details of the east side jetty, known as EHFC jetty : -

- Jetty head 127 m long x 12.0 m wide
- Approach 355 m long x 6.0 m wide
- Top level of Jetty +5.05 m and Depth (-) 8.0 m
- Year of construction 2013.

No proper fender system exists in the Jetty.

4. Berthing Facility at Agatti Island

Agatti Island has the only Airport in the entire Lakshadweep and the Airport is situated at the southern tip of the island. Indian Air Lines operate regular flights between Kochi and Agatti. There is a Helipad inside the Airport area. The island has two small jetties on the west side and one standard Jetty on the east side. The two west side jetties are only 830 m apart. There is a water intake jetty in the east, very close to the east side jetty of the island. The west side two jetties have a common approach channel of total length 2160 m and width 16 m.



The details of the west side jetty ,known as Kachery jetty: -

- Jetty head 30.0 m long x 16.0 m wide
- Approach 100 m long x 6.0 m wide
- Top level of Jetty +3.2 m and Depth (-) 1.8 m
- Year of construction 1978.

The details of the west side Fisheries jetty : -

- Jetty head 24.0 m long x 10.0 m wide
- Approach 70 m long x 3.0 m wide
- Top level of Jetty +2.7 m and Depth (-) 1.8 m
- Year of construction 1988.

There is a well-defined common approach channel of length 2160 m and width 16 m. to the west side Jetties .There is no permanent rubber fender at the Jetties . As foreshore

infrastructures at Agatti's west side Jetty, there are 60 Sqm Passenger shed, 60 Sqm general cargo shed and 150 Sqm workshop facility.

The details of the east side jetty, known as EHFC jetty : -

- Jetty head 127 m long x 12.0 m wide
- Approach 332 m long x 6.0 m wide
- Top level of Jetty +5.05 m and Depth (-) 8.0 m
- Year of construction 2012.

No proper fender system exists in the Jetty.

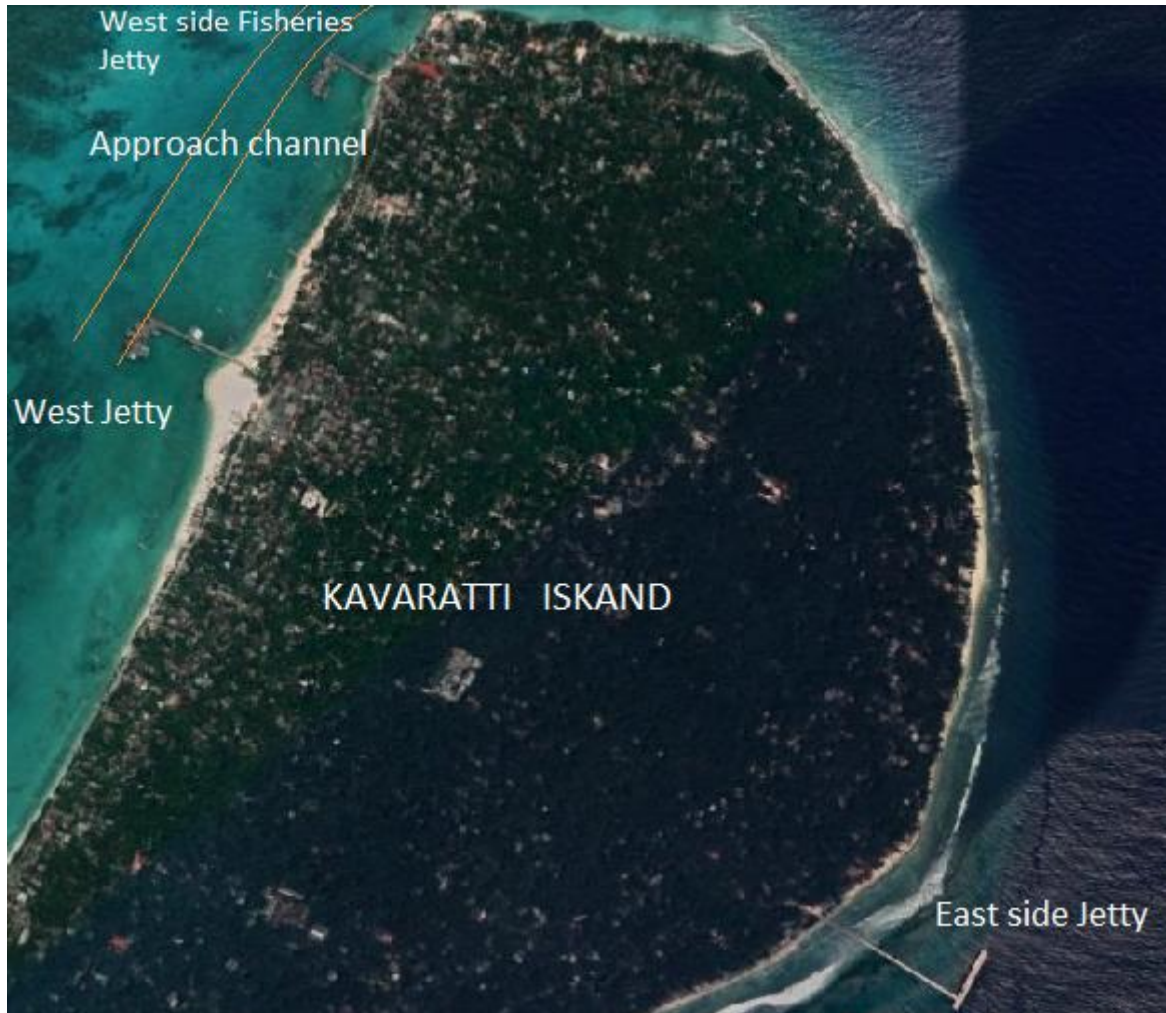
5. Berthing Facility at Andrott Island

Andrott Island has a helipad at south east end of the island. The island has a breakwater of length 470 m at the north. The breakwater was built in three stages and completed in 2002. There is an inner harbour to shelter small fishing boats. The outer part has three wharves of length 60 m, 15.2 m and 40 m. The slope of the sea bed is gentle and needs dredging mainly inside berth area only. As Foreshore infrastructures at Andrott's only Jetty, there are 60 Sqm Passenger shed, 60 Sqm general cargo shed and 94 Sqm workshop facility exist.



6. Berthing facilities at Kavaratti Island:

Kavaratti island has a Helipad at the southern corner of the island. The island has one Jetty at the east and two small jetties at the west. The two west side jetties are 600 m apart.



The details of the west side jetty ,known as Kachery jetty: -

- Jetty head 77.3 m long x 17.0 m wide
- Approach 254 m long x 7.0 m wide
- Top level of Jetty +3.2 m and Depth (-) 2.5 m
- Year of construction 1989.

The details of the west side Fisheries jetty : -

- Jetty head 80.2 m long x 10.0 m wide
- Approach 107m long x 6.0 m wide
- Top level of Jetty +2.7 m and Depth (-) 2.0 m
- Year of construction 1972.

There is a well-defined common approach channel to the west side Jetties of length 1140 m and width 40 m and 2.6 m depth . There is no permanent rubber fender at the Jetties . As foreshore infrastructures at Kavaratti's west side Jetty, there are 90 Sqm Passenger shed, 70 Sqm general cargo shed and 150 Sqm workshop facility.



The details of the east side jetty, known as EHFC jetty : -

- Jetty head 127 m long x 12.0 m wide
- Approach 318 m long x 6.0 m wide
- Top level of Jetty +5.05 m and Depth (-) 8.0 m
- Year of construction 2013.

Four numbers Pneumatic fenders have been provided at the Jetty. No proper permanent fender system exists in the Jetty.



7. Berthing Facilities at Kalpeni Island:

There are two jetties (North Jetty and South Jetty) on the west side of Kalpeni Island. There is a Helipad towards the north narrow part of the island. The Jetty is south of Helipad. In the east of the island, there is break water and a wharf. The break water is under reconstruction. The approach channel is towards north-west with some part passing through the coral reef area The channel is 3300 m long and 16 m wide.



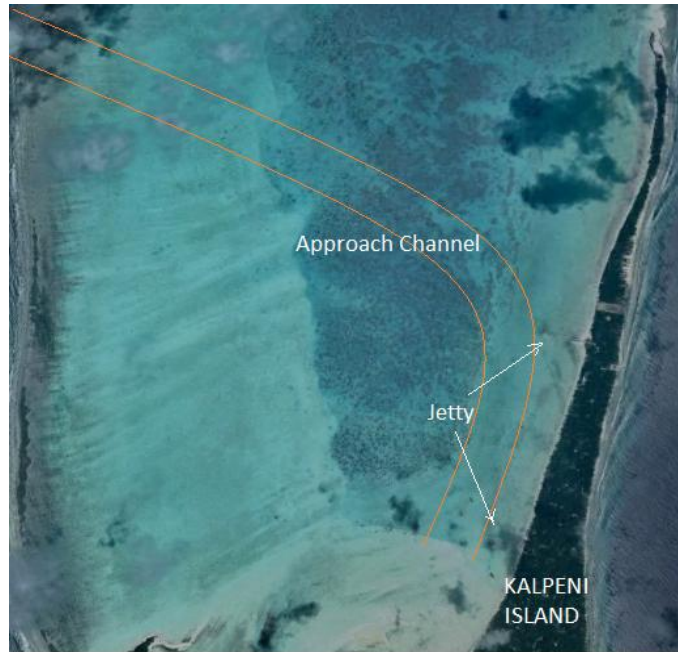
The details of the west side - south jetty :-

- Jetty head 11.6 m long x 16.0 m wide
- Approach 183 m long x 6.0 m wide
- Top level of Jetty +3.2 m and Depth (-) 1.8 m
- Year of construction 1979.



The details of the west side - north jetty :-

- Jetty head 11.0 m long x 15.0 m wide
- Approach 120 m long x 6.0 m wide
- Top level of Jetty +3.2 m and Depth (-) 1.8 m
- Year of construction 2010.



There is a well-defined common approach channel to the west side Jetties of length 3300 m and width 16 m and 1.8 m depth

As foreshore facility of west jetty , it has a passenger hall of area 74 Sqm and a workshop area 184 Sqm. The east side jetty has a passenger hall of 88 Sqm and a workshop of 94 Sqm. All the jetties have no permanent rubber fenders.

The east side breakwater of Kalpeni island is 165 m long .There is an wharf of length 40 m. and 9.4 m width. Top level of the wharf is +3.5 m and depth is 1.8m .The partial break water and wharf was competed in 2002 and restoration work is being executed



Details of existing jetties, breakwaters and related facilities in the Lakshadweep Islands are given at Annexure I.

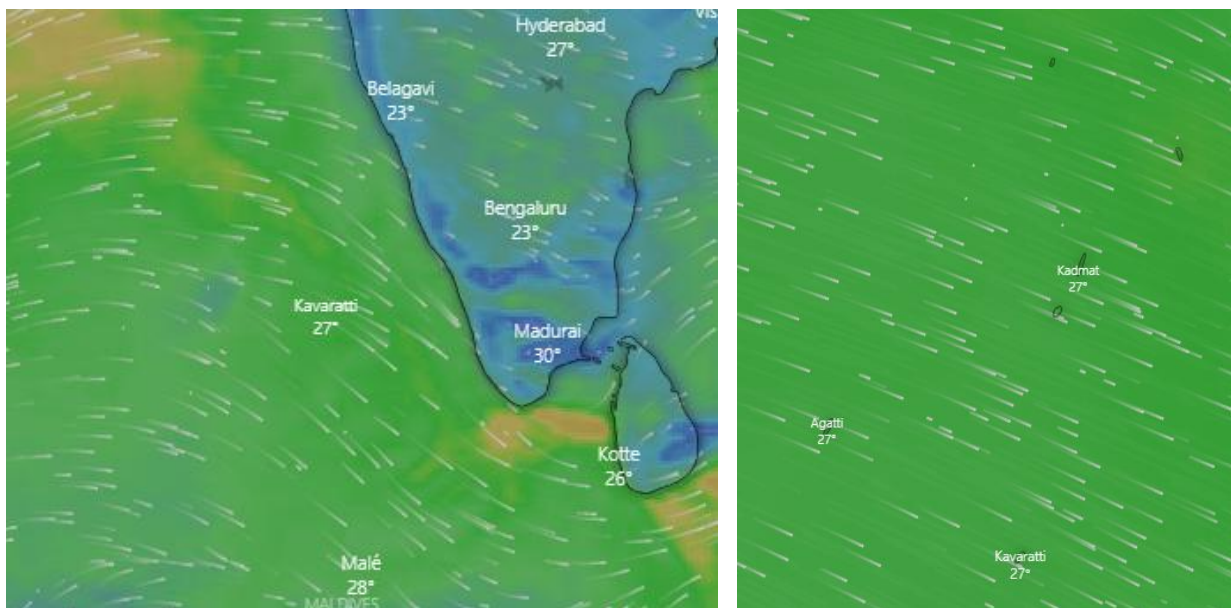
Details of vessels and equipment owned by Lakshadweep administration is also given at **Annexure II.**

CHAPTER 3: GENERAL PROBLEMS OF THE JETTY AND HARBOUR INFRASTRUCTURES

3.1. PHYSICAL AND NATURAL SETTING

The islands of Lakshadweep archipelagos are oriented primarily in North-South direction except Andrott Island, which is oriented in East-West direction. The reason for such orientation is mainly due to the orientation of underneath banks on which the atolls and islands are situated and subsequent growth due to coral action in the creation of the lagoon sands. The coral also plays the role in building up the reef.

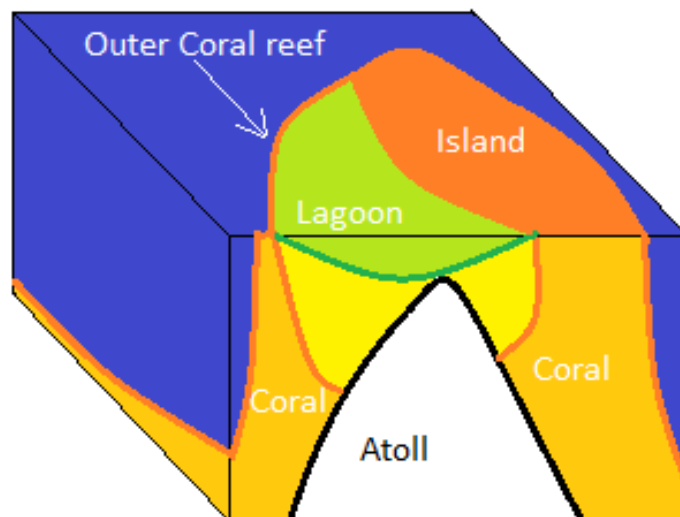
All the atolls of Lakshadweep have lagoon on the west side, except Andrott atoll, which has no lagoon. Moreover, the Amini Island has also a small coral reef cover. Reefs usually vary in width from 200-400m among the different islands. However, the wave cut platform extends from the reef margin to a distance of 50-100m only towards the sea and the depth falls steeply within a short distance. The reason for the development of the lagoon on the west side of the atolls is due to the presence of ambient conditions for living and growth of corals. The outer coral reef area is in fact the most productive area where reef-building corals grow culminating generation of calcium carbonate. The direction of the wind in the area is mainly from West and North-West during monsoon months, the direction of the wind in July is shown below: -



In addition to the wind, ocean/ sea currents play a very important role in the development of atolls; it brings nutrients for the coral and also transports the materials.

The sediments are generated and transported on the atoll by waves, currents and importantly by cyclones. The currents in turn may be generated by waves or due to winds and tides. The continuous pounding of the reefs by waves breaks the corals and dislodges other organic communities from the substratum. The dominant direction of the waves in the area during the summer and monsoon (April- September) is from the W, WNW and WSW, though waves from the N, NNE and ENE are common during the winter (October- March). However, because of the greater height, the waves from the west are more effective agents for the generation of sediments and its eastward transport across the atoll. The eastern reef of the atolls is narrower which also limits the capacity for carbonate production and sediment generation while the western reef and reef flat is much wider. The sediments generated are deposited on the reef front and subsequently in the lagoon. The westerly waves also generate a circulation pattern favouring transport in the lagoon.

Cyclones have played a significant role in the generation and transport of sediments. The high waves generated during the cyclones break and transport not only the corals but also large sized colonies and blocks to some distance. The corals broken and deposited by cyclones on the eastern reefs perhaps effectively plugged the gaps in the reef and formed an effective barrier for trapping the sediments generated and transported from the western reef front. A very dominant role has been played by waves and currents to transport the sediments.



General the topography of the atoll, island, lagoon and coral reef outer ring is shown above.

The typical general features towards the island margin are normally uniform but some area may be uneven mainly due to damage of corals at the reef margin. A number of broken coral reef outer ring is present in Lakshadweep archipelagos, some of the surge channels oriented in NW-SE to NE-SW direction are also present in the outer reef.

The lagoons particularly the smaller lagoons are filled with sediments and have a shallow depth. The larger lagoons however are comparatively deep. At low tide, the reef is exposed and during high tide, it is submerged. The eastern seaside part of the atolls has a steep storm beach with deposits of shingles and boulders .and the lagoon side beach is sandy. The inner reef flat has thicker sediment cover, parts of which are transported to the lagoon.

The reef areas are the living places of various communities of corals and they are responsible for the creation of the lagoon sands and play the role in building up the reef.

The geomorphic situation of the coral islands is delicate and it is not advisable to remove sands and /or dead Coral stone or living coral reef without precaution except for dredging purpose. All dredged materials have to be dumped on the shore side for reclamation purposes.

The sands occur in a loose form on the lagoon floor and are easy to remove through dredging by using Cutter Suction Dredgers. There is a possibility that the area may recoup without disturbing the delicate balance as long as the depth of dredging is limited. Slight changes will be automatically adjusted. However, the most important sediment-forming area is the outer ring area of the reef and it should not be disturbed as far as possible. The lagoon is the most important accumulation site of coral sand and the lagoon will have the tendency to fill up automatically if the sands are taken out in dredging. However, close environmental monitoring should be done. All programmes should be oriented according to the guidelines suggested by the Reef Monitoring Network and Management Plans.

It appears that little sediment is generated within the lagoon. The sands mostly originate at the outer reef area and are then transported, irrespective of their final resting place. The removal of limited quantities of sediment from the lagoon without disturbing the reef will have minimal effect on the rates of production or derivation as long as the generation of sediment is not disturbed.

Large scale dredging operations may affect the floral and faunal systems within and peripheral to the lagoon. Any significant lowering of lagoon floors may increase wave amplitude on downwind shores, i.e. west side of the islands. This may activate erosion. Dredging activity will draw much larger volumes of sediment into suspension than that is present in a normal situation. The channel area will have a concentration of water flow particularly during ebb tides. A new channel may result in active erosion in its head ward area at the lowest stage of the falling tide. Sediment is mainly generated from reef areas and so there may be no significant impact on limited area dredging. If there is a continuous south-easterly movement of sand/sediments, the dredged channel may be filled up. Human induced damage to corals reefs must be avoided by careful control.

3.2. EXISTING SYSTEM AND SHORT COMING OF PASSENGER AND CARGO HANDLING ARRANGEMENT AND RECOMMENDATION

The jetties on the eastern side of Lakshadweep islands (Amini, Agatti, Kavaratti and Minicoy) have a high draft and all all-weather ships travelling between Cochin and islands can be berthed easily but the problem is that the jetties are in the open sea and safe berthing of ships is difficult, particularly during monsoon period due to high wind velocity and rough weather.

The jetties at the western side of Lakshadweep islands are situated at a very shallow depth and all-weather ships travelling between Cochin and islands cannot be berthed there, though the jetties are otherwise safe for berthing of small ships/vessels. However, there will be some difficulty during the monsoon period due to high wind velocity and rough weather.

Due to the above reasons, all-weather Ships remain anchored in the open sea and passengers embark and disembark into small boats brought to the existing jetties constructed inside lagoons on the western side. This embarkation and disembarkation system becomes extremely tough & risky and sometimes leads to capsize of small boats and human casualties also. Loading and unloading of general cargo to and from ships are also equally risky and dangerous. During monsoon, even this facility does not remain viable because of the extreme sea conditions on the western side. The passengers have to disembark and embark from the eastern side, and then ride in small country boats across the turbulent zones & jump from the water to reach to the shore. The children, ladies particularly patients suffer enormously due to this. The movement of general cargo is also challenging due to the above reason.

All inhabited Islands of Lakshadweep are provided with ferry jetties located inside the western lagoons, whereas two Islands i.e. Andrott and Kalpeni are provided with breakwater and wharves for catering to the ships having draft up to 1.8 meters except Andrott where available draft at berth face is 8 m. In Agatti, Amini and Kavaratti Islands open jetties have been provided on the eastern side of these Islands for berthing of ships plying between the mainland and Islands.

All the jetties of the islands have no proper fenders and only tyre fenders are provided. It is considered essential to provide permanent rubber fenders with adequate capacity and high quality rubber capable of taking the load, energy and deflection. Presently at the east side jetty of Kavaratti island, four numbers pneumatic fenders have been provided, which act as additional berthing aids. It is also proposed to procure and place pneumatic fenders for additional berthing aids. Most of the jetties need to provide new bollards and/or strengthening existing bollards.

3.3. PHYSICAL AND SOCIAL INFRASTRUCTURE

Untreated sewage disposal is to be avoided and if required treated sewage waste may be disposed but the outfalls should be placed below the level of coral growth or to be discharged in deep water.

Upgrading physical and social infrastructure on the island is an important issue. Some physical infrastructures required in the islands are potable water supply, renewable electrical energy generation, training institute for imparting training to the resident of the islands etc. The cyclone shelters may be built in an elevated port area. These facilities should be installed on all islands.

Solid waste disposal /management pose a problem and an alternative to sea dumping must be explored.

Electricity generated through Solar Panels and wind mills can act as alternative clean source of energy, which will reduce the use of fossil fuels considerably.

The reefs are very fragile and vulnerable to human activity. The resources of the Lakshadweep atolls are enormous and it may be relevant to decide to what extent this fragile ecosystem can be used without causing any /minimum damage to the delicate balance.

In Lakshadweep the lagoon is the most important sediment accumulating site. A large volume of sediment is being generated from the reef and deposited in the lagoon. So, if a limited amount of sand is taken out there will be no or minimal long-term damaging effect. However, close environmental monitoring needs to be done. Once the system of safe dredging is established in such an environment it can be widely used in other areas also.

There are still plenty of scopes to work on a number of different aspects of the Lakshadweep group of atolls. In the backdrop of the above stated discussion, proposal for various future developments has been made.

CHAPTER 4:

PROPOSED UP-GRADATION OF THE EXISTING INFRASTRUCTURES AND CONSTRUCTION OF NEW INFRASTRUCTURES

4.1. INTRODUCTION:

In due consideration of peculiar geography of the Islands and prevailing climatic / weather conditions and also based on the existing Port infrastructures, in order to achieve safe, efficient and effective operation of port and shipping services in all the islands of UT of Lakshadweep and modifications / upgradation to the existing infrastructures and new constructions are proposed in the Islands.

All future developmental work of the entire Lakshadweep Island is proposed to be port led development and to take place in and around the port area. The basic infrastructure shall inter-alia include, reclamation of land utilising dredged materials, Construction of breakwater for all west side jetties including a sea wall, Nourishment and strengthening of existing partial break waters of Andrott and Kalpeni islands and Construction of new part to complete the breakwater, strengthening of existing jetties and wharves including the extension of jetty head, Construction of new jetties on the east side, installation of infrastructures to utilise the water intake jetties at the desalination plant for handling petroleum products. The new development work shall also include construction of two storied passenger sheds to be utilised as shelter during emergency/ disaster, construction of sheds for storing of general cargo and accommodating workshops, the sheds to be fitted with a solar panel for harvesting solar energy, construction of structures at the approaches of the jetties for installing of solar panels. Construction and installation of wind mills for harvesting wind energy, construction of water storage tank for rain water harvesting, construction of Sewage Treatment Plant to cater adjacent residential area, construction of dumping ground for garbage for proper waste management of the surrounding area, creation of provision for the development of tourism and small scale industries like fish processing, ice plant, coir industry etc, creation of Entertainment facility like park etc. The infrastructure shall also include the development of landing area for sea plane to boost tourism. It is also proposed to construct new container handling infrastructures and liquid petroleum product handling facility with a storage tank at Andrott.

It is considered essential to provide permanent rubber fenders with adequate capacity and high quality rubber capable of taking the load, energy and deflection. It is also proposed to procure and place pneumatic fenders for additional berthing aids. Most of the jetties need to provide new bollards and/or strengthening the existing bollards.

4.2. ISLAND WISE DETAIL RECOMMENDATIONS WITH BOUDGETARY COST

1. Bitra Island: -

Bitra is a very small and the least populated island of Lakshadweep. The demand for Bitra is least both for the passenger as well as cargo. Bitra has also not developed as a tourist spot. The existing jetty has no permanent fenders, navigational aids like channel making buoys and cargo/passenger handling equipment. The existing jetty



head is very small in size; the available draft is also limited. It can handle only very small passenger vessels and cargo barge at the jetty. The existing jetty is very close to the Helipad of Bitra.

a) Recommendation:

It is proposed to develop an all-weather Harbour around the existing west jetty in the Bitra Island. Following development works are proposed to be taken up:

- Construction of 400 m long seawall to the west side of the island. The sea wall will be constructed at a distance of 15 m from shore line and the area between existing shore line and sea wall to be filled with dredged materials and to be reclaimed. Construction of 325 m Long and 300 m wide breakwater and extension of existing Jetty head to total 50m. Dredging the breakwater inside area up to a depth of (-) 2.5 m with Cutter Suction Dredger. Dredging and development of approach/entrance channel towards south-east of width 20 m.
- Construction of two storied passenger shed in the reclaimed area. The shed will have capacity of 100 heads and to be utilised for sheltering local residents in emergency/ disaster. Construction of a water reservoir for storing water during rainy season and utilise in the port area including supplying to the local residents of the area. Construction of Sewage Treatment plant for treating the sewage of the entire island. Construction of a dumping yard for solid waste management. Construction of storing shed.
- Construction of four number of wind mill for harvesting wind energy. Providing light posts at the approach of the jetty and one high mast tower at jetty head for

lighting purpose. Providing solar panel over the sheds, at approach and on the shore area of suitable capacity for harvesting solar energy.

- Installation of new permanent rubber fenders and bollards in the jetty. Providing passenger cum cargo handling equipment like mechanised ladder and small crane (3ton capacity).

b) Cost: The block cost estimate of various development works are as follows :-

Construction cost of Sea wall and breakwater is Rs 135 Crores (1350 m long) and other infrastructure like sheds, passenger and cargo handling amenities, dumping ground etc is Rs 24 Crores. Cost of extension of jetty head is Rs.15 Crores. Cost of solar panel and wind mill including allied infrastructures is Rs 12 Crores. Cost of providing light post at the approach of the jetty and one high mast tower is Rs.2 Crores. Construction cost of sewage treatment plant and water reservoir is Rs 2 Crores. Cost of Rubber fender and bollard with fixing arrangement is Rs.2 Crores.

Cost of capital dredging of approach/entrance channel and inner harbour area is Rs. 4 Crores.

Total cost of the recommended work is Rs 196 Crores.

2. Chetlat Island: -



Chetlat is a small island of Lakshadweep. The island has a small permanent Jetty on the west side of the island. There is an embarkation / dis-embarkation area without basic facilities on the island, which is on the eastern side. The existing harbour infrastructures of Chetlat island is inadequate for both passenger as well as cargo. Chetlat island has also not developed as a tourist spot. The existing jetty on the west side has no permanent fenders, the jetty has inadequate navigational aids like channel marking buoy, cargo/passenger handling equipment. The existing jetty head of the west side jetty is very small in size; the available draft is also limited. It can handle only very small passenger vessels and cargo Berge at the jetty. The east side embarkation/disembarkation area is void of the basic facility.



a) Recommendation:

1. It is proposed to develop an all-weather Harbour around the existing west jetty in the Chetlat Island. Following development works are proposed to be taken up:
 - Construction of 400 m long seawall on west side of the island. The sea wall will be constructed at a distance of 15 m from shore line and the area between existing shore line and sea wall to be filled with dredged materials and to be reclaimed. Construction of 300 m Long and 250 m wide breakwater and extension of existing Jetty head on both sides to total 50m. Dredging the breakwater inside area up to a depth of (-) 2.5 m with Cutter Suction Dredger. Dredging and development of approach/entrance channel of width 20 m towards west.
 - Construction of two storied passenger shed in the reclaimed area. The shed will have capacity of 200 heads and to be utilised for sheltering local residents in emergency/ disaster. Construction of a water reservoir for storing water during rainy season and utilise in the port area including supplying to the local residents of the area. Construction of Sewage Treatment plant for treating the sewage of the harbour area including the proposed jetty of the east side. Construction of a dumping yard for solid waste management. Construction of storing shed.
 - Construction of four number of wind mills for harvesting wind energy. Providing light post at the approach of the jetty and one high mast tower at jetty head for lighting purpose. Providing solar panel of suitable capacity over the sheds, at approach and on the shore area for harvesting solar energy.
 - Installation of new permanent rubber fenders and bollards in the jetty. Providing passenger cum cargo handling equipment like mechanised ladder and small crane (3ton capacity).
2. It is proposed to construct a new jetty of 120m long jetty head and 150 m long approach trestle on the east side at the existing location of the embarkation/disembarkation area in the Chetlat Island. Following works are proposed to be taken up.

- Construction of new jetty of 120m long jetty head and 150 m long approach trestle. The proposed jetty will have a draft of 9 m .Construction of 400m long sea wall The sea wall will be constructed at a distance of 10 m from shore line and the area between existing shore line and sea wall to be filled with dredged materials and to be reclaimed. The dredging to be carried out with Cutter Suction Dredger. Dredging and development of approach/entrance channel of width 100 m towards east.
- The east side of the proposed jetty has stiff sea bed slop and construction of breakwater to provide tranquil environment is not possible .As such it is proposed to provide two numbers mooring buoys for safe berthing of bigger ships .
- Construction of single storied passenger, cargo and workshop sheds . Construction of a water reservoir for storing water during rainy season and utilise in the port area including supplying to the local residents of the area.
- The other infrastructures like providing light post at the approach of the jetty and two high mast towers at jetty head for lighting purpose. Construction of four number of wind mill for harvesting wind energy. Providing solar panel of suitable capacity over the sheds, at approach and on the shore area for harvesting solar energy.
- Providing passenger cum cargo handling equipment like mechanised ladder and one crane (15 ton capacity). Providing Permanent rubber fenders and bollards in the new jetty of required capacity.

b) Cost: The block cost estimate of various development works are as follows :-

1. Construction cost of Sea wall and breakwater of west jetty is Rs 120 Crores (1200 m long) and other infrastructure like sheds, passenger amenities, dumping yard. etc is Rs 25 Crores. Cost of extension of jetty head is Rs. 15 Crores .Cost of solar panel and wind mill including allied infrastructures is Rs 13 Crores. Cost of providing light post at the approach of the jetty and one high mast tower is Rs 3 Crores. Construction cost of sewage treatment plant and water reservoir is Rs 2 Crores. Cost Rubber fender and bollard with fixing arrangement is Rs 3 Crores.

Cost of capital dredging of approach/entrance channel(650m long) and inner harbour area is Rs. 4 Crores.

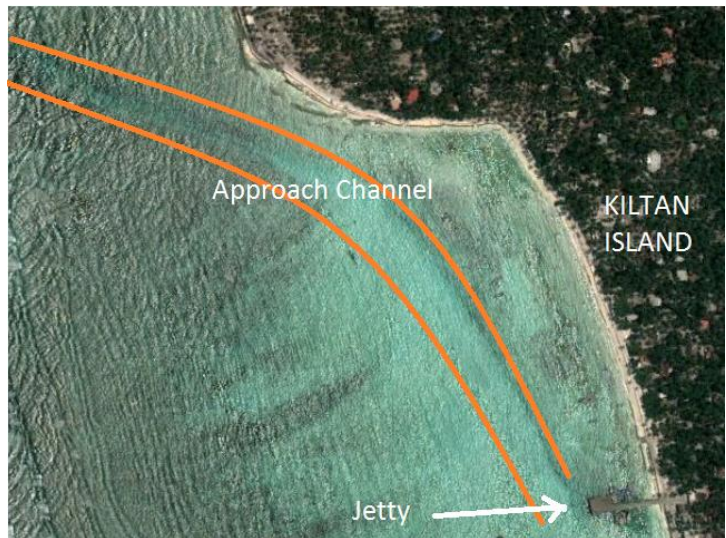
2. Construction cost of sea wall of east side new jetty is Rs 30 Crores (400m long) , and other infrastructure like sheds, passenger and cargo handling amenities etc is Rs 20 Crores. Cost of construction of new jetty with fenders and bollards is Rs 100 Crores .Cost of solar panel including allied infrastructures is Rs 8 Crores. Cost of providing light post at the approach of the jetty and two high mast tower is Rs 4 Crores Construction cost of water reservoir is Rs. 1 Crore. Cost of providing two mooring Buoy is Rs 3 Crores.

Cost of capital dredging harbour area is Rs. 4 Crores.

Total cost of the recommended work is Rs 355 Crores.

3. Kiltan Island: -

Kiltan has a helipad on the north-western corner of the island and two small Jetties on both sides of the island i.e. east and west. The approach channel of the west side jetty is well defined and has a length of 800 m towards North West direction. The east side jetty has high draft close to shore line. The Island has a landmark 41-metre high lighthouse.



The approach channel appears to be dredged recently. The east side jetty is very small and devoid of basic infrastructures. The existing harbour infrastructures available at Kiltan island is inadequate for both passenger as well as cargo. Kiltan has also not developed as a tourist spot. The existing jetty on the west side has no permanent fenders, the jetty has no navigational aids like channel marking buoy, cargo/passenger handling equipment. The existing jetty head of the west side jetty is very small in size, the available draft is also limited It can handle only very small passenger vessels and cargo vessels at the jetty. The east side jetty is very small and has no basic facility



a) Recommendation:

1. It is proposed to develop an all-weather Harbour around the existing west jetty in the Kiltan Island. Following development works are proposed to be taken up:

- Construction of 400 m long seawall to the west side of the island. The sea wall will be constructed at a distance of 20 m from shore line and the area between existing shore line and sea wall to be filled with dredged materials and to be reclaimed. Construction of 300 m Long and 250 m wide breakwater and extension of existing Jetty head to total 50m. Dredging the breakwater inside area up to a depth of (-) 4.5 m with Cutter Suction Dredger. Dredging and development of approach/entrance channel of width 20 m towards west.
 - Construction of two storied passenger shed in the reclaimed area. The shed will have capacity of 200 heads and to be utilised for sheltering local residents in emergency/ disaster. Construction of a water reservoir for storing water during rainy season and utilise in the port area including supplying to the local residents of the area. Construction of Sewage Treatment plant for treating the sewage of the harbour area . Construction of a dumping yard for solid waste management. Construction of storing shed.
 - Construction of four number of wind mills for harvesting wind energy. Providing light post at the approach of the jetty and one high mast tower at jetty head for lighting purpose. Providing solar panel of suitable capacity over the sheds, at approach and on the shore area for harvesting solar energy.
 - Providing passenger cum cargo handling equipment like mechanised ladder and one crane (15 ton capacity). Providing Permanent rubber fenders and bollards in the new jetty of required capacity.
2. It is proposed to carry out up gradation work of east side existing jetty including extension of the jetty head and development works proposed are detailed below.
- Upgradation work of east side existing jetty including extension of the jetty head to 50 m. Providing two mooring buoys to facilitate safe berthing of small ships.
 - Construction of single storied passenger shed , cargo shed and workshop shed . Construction of a water reservoir to be utilised for storing water during rainy season and utilise in the port area including supplying to the local residents of the area. Construction of Sewage Treatment plant for treating the sewage of the harbour area. Construction of a dumping yard for solid waste management. Construction of storing shed.
 - Providing rubber fenders, bollards etc. Providing solar panel and allied infrastructures. Providing light post at the approach of the jetty and one high mast tower at jetty head for lighting purpose

b) Cost: The block cost estimate of various development works are as follows :-

1. Construction cost of Sea wall and breakwater of west jetty is Rs 180 Crores (1200 m long) and other infrastructure like sheds, passenger amenities, dumping yard etc is Rs 25 Crores. Cost of extension of jetty head is Rs 15 Crores. Cost of solar panel and wind mill including allied infrastructures is Rs 12 Crores. Cost of

providing light post at the approach of the jetty and one high mast tower is Rs 3 Crores. Construction cost of Sewage Treatment Plant and water reservoir is Rs 2 Crores. Cost Rubber fender and bollard with fixing arrangement is Rs.3 Crores.

Cost of capital dredging of approach/entrance channel(500m long) and inner harbour area is Rs. 10 Crores.

2. Cost of east side existing jetty upgration and extension of jetty head is Rs 6 Crores .Cost of providing rubber fender ,bollard and mooring buoy is Rs 4 Crores . Cost of solar panel and wind mill including allied infrastructures is Rs 12 Crores. Cost of providing light post at the approach of the jetty and two high mast towers is Rs 2 Crores. Construction cost of water reservoir and sewage treatment plant is Rs. 2 Crores.

Cost of capital dredging harbour area is Rs. 1 Crore.

Total cost of the recommended work is Rs 277 Crores.

4. Kadmat Island: -



Kadmat island has a Helipad in the middle part of the west side and two jetties on west side of the Island out of the two jetties the southern jetty is very small. There is one very small jetty on the east side of the island. There is another jetty on the east side for water intake purposes. The approach channel of the west side jetty is well defined and has a length of 1750 m. The two southern jetty one on the east side jetty and the other is on the west side can handle only small fishing boats /boats used for tourist

entertainment and there is adequate draft for that purpose. The two jetties are devoid of most of the basic infrastructures. The existing harbour infrastructures available at the west side jetty is inadequate for both passenger as well as cargo. Kadmat island is however very developed as a tourist spot. The existing jetty



on the west side has no permanent fenders, the jetty has inadequate navigational aids like channel making buoy, cargo/passenger handling equipment. The existing jetty head of the west side jetty is very small in size; the available draft is also limited. It can handle only small passenger vessels and cargo Berge at the jetty. The east side jetty is very small and has no basic facility.



a) Recommendation:

1. It is proposed to develop an all-weather Harbour of high draft around the existing west jetty in the Kadmat Island. Following development works are proposed to be taken up:
 - Construction of 500 m long seawall to the west side of the island. The sea wall will be constructed at a distance of 20 m from shore line and the area between existing shore line and sea wall to be filled with dredged materials and to be reclaimed.

Construction of 400 m Long and 250 m wide breakwater. Extension of existing Jetty head to total 50m long on south side.

- Capital dredging in the Harbour area and reclamation. The dredge depth of the harbour is proposed to be (-)4.5 m. The breakwater inside area is proposed to be dredged with Cutter Suction Dredger to a depth of (-) 4.5 m and the dredge materials to be utilized for the reclamation of the area between existing shore line and proposed sea wall. Dredging and development of approach/entrance channel of width 20m towards west
- Construction of two storied passenger shed. The shed will have capacity of 200 heads and to be utilised for sheltering local residents in emergency/ disaster. Construction of water reservoir for storing water during rainy season and utilise in the port area including supplying to the local residents of the area. Construction of sewage treatment plant for treating sewage of the harbour area . Construction of a dumping yard for solid waste management. Construction of storing shed.
- Construction of four numbers of wind mills for harvesting wind energy. Providing passenger cum cargo handling equipment like mechanized ladder and crane(15 ton capacity) . Providing light post at the approach of the jetty and one high mast tower at jetty head for lightening purpose. Providing solar panel over the sheds, at approach and on the shore area of suitable capacity for harvesting solar energy. Providing new permanent rubber fenders and bollards to the jetty.
- Construction of a Hover Craft landing area of width of 40 m and with a shed of size 33m x 33 m to be utilized for maintenance of the shed of the Hovercraft.

2. It is proposed to construct a new jetty of 120m long jetty head and 150 m long approach trestle on the east side at the existing location of the embarkation/disembarkation area in the Kadmat Island. The works as detailed below are proposed to be taken up. It is also proposed deepened west jetties to be utilized for the purpose of developing Kadmat as a base port of HSC.

- Construction of new jetty of 120m long jetty head and 150 m long approach trestle. The proposed jetty will have a draft of 9 m .Construction of 400m long sea wall The sea wall will be constructed at a distance of 10 m from



shore line and the area between existing shore line and sea wall to be filled with

dredged materials and to be reclaimed. The dredging to be carried out with Cutter Suction Dredger.

- The east side of the proposed jetty has stiff sea bed slop and construction of breakwater to provide tranquil environment is not possible ,as such it is proposed to provide two numbers mooring buoys for safe berthing of bigger ships .
- Construction of double storied passenger shed, cargo shed and workshop sheds . Construction of a water reservoir for storing water during rainy season and utilise in the port area including supplying to the local residents of the area. Construction of sewage treatment plant for treating sewage of the harbour area . Construction of a dumping yard for solid waste management. Construction of storing shed.
- The other infrastructures like providing light post at the approach of the jetty and two high mast towers at jetty head for lighting purpose. Providing solar panel of suitable capacity over the sheds, at approach and on the shore area for harvesting solar energy.
- Providing passenger cum cargo handling equipment like mechanised ladder and one crane (15 ton capacity). Providing Permanent rubber fenders and bollards in the new jetty of required capacity.

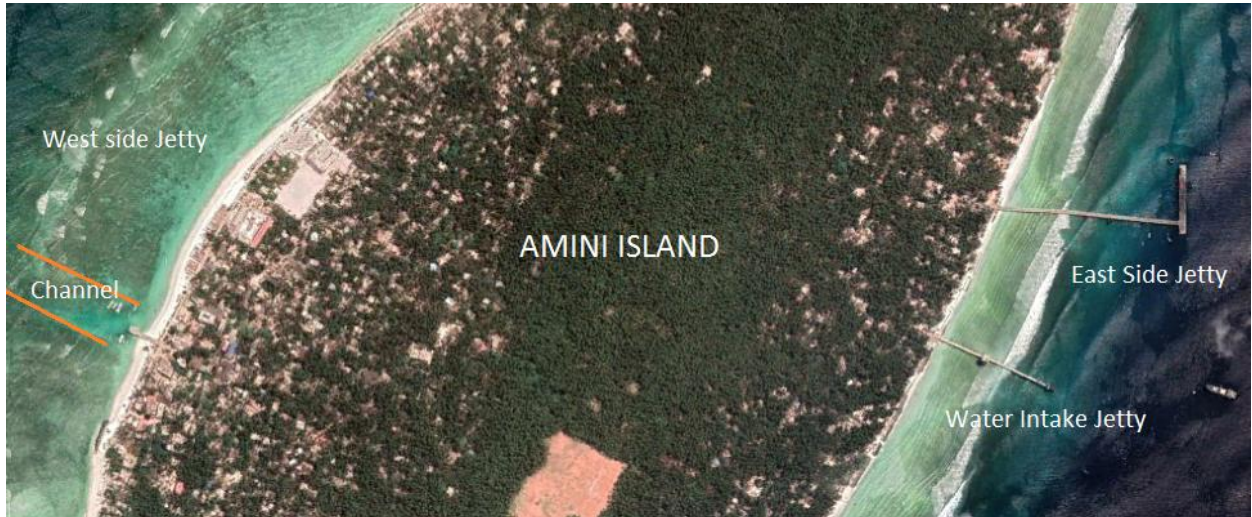
b) Cost: The block cost estimate of various development works are as follows :-

1. Construction cost of Sea wall and breakwater of west jetty is Rs 180 Crores (1450 m long) and other infrastructure like sheds, passenger and cargo handling amenities, dumping yard etc is Rs 30 Crores. Cost of extension of jetty head is Rs 15 Crores. Cost of solar panel and wind mills including allied infrastructures is Rs 12 Crores. Cost of providing light post at the approach of the jetty and one high mast tower is Rs 2 Crores. Construction cost of sewage treatment plant and water reservoir is Rs. 2 Crores. Cost Rubber fender and bollard with fixing arrangement is Rs. 3 Crores. Cost of capital dredging of approach/entrance channel(1500m long) and inner harbour area is Rs. 30 Crores.
2. Construction cost of sea wall of east side new jetty is Rs 30 Crores (400m long) , and other infrastructure like sheds, passenger and cargo handling amenities, dumping yard etc is Rs 20 Crores. Cost of construction of new jetty with fenders and bollards is Rs 100 Crores . Cost of solar panel including allied infrastructures is Rs 8 Crores. Cost of providing light post at the approach of the jetty and two high mast tower is Rs 3 Crores. Construction cost of water reservoir and sewage treatment plant is Rs 2 Crores. Cost of capital dredging harbour area is Rs. 4 Crores. Cost of Permanent rubber fender and bollard to be is Rs.3 Crores. Cost of two mooring Buoys is Rs 3 Crores.

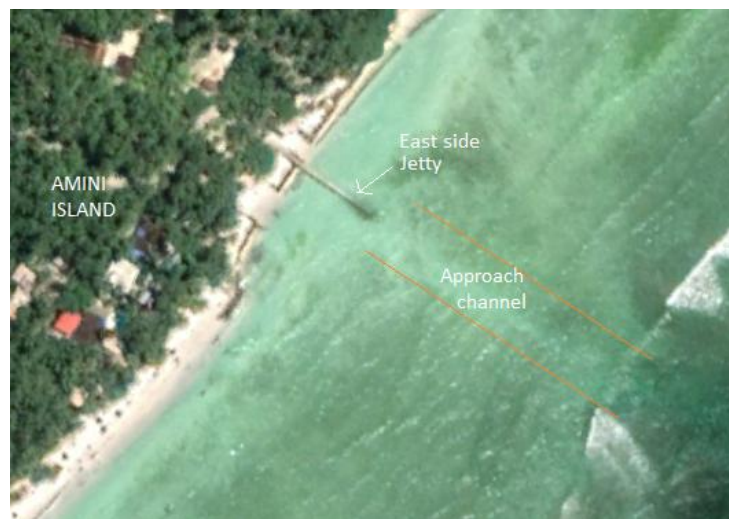
Total cost of the recommended work is Rs 447Crores.

5. Amini Island: -

The Amini island has a Helipad on the north and one small jetty on the west side of the Island and one standard size Jetty on the east side. Additionally, there is a water intake jetty on the east side.



The approach channel of the west side jetty is only 250 m long. The existing harbour infrastructures available at the west side jetty is inadequate for both passenger as well as cargo. Amini island is not developed as a tourist spot. The existing jetties of Amini island have no permanent fenders, the jetties have inadequate navigational



aids like channel making buoy, cargo/passenger handling equipment. The existing jetty head of west side jetty is very small in size; the available draft is also limited. It can handle comparatively smaller passenger vessels and cargo vessels at the jetty. The east side main jetty is however capable in handling big ships and has high draft. But during the monsoon period berthing ships alongside the jetty is very challenging due to the presence of strong wind and sea current. The other jetty of east side is very small and has no basic facility and can handle only small fishing boats only.

a) Recommendation:

1. It is proposed to develop an all-weather Harbour of high draft around the existing west jetty in the Amini Island. Following development works are proposed to be taken up:

- Construction of 400 m long seawall to the west side of the island. The sea wall will be constructed at a distance of 10 m from shore line and the area between existing shore line sea wall to be filled with dredged materials and to be reclaimed.



Construction of 300 m Long and 250 m wide breakwater. Extension of existing Jetty head to total 50m long towards north.

- Capital dredging inside the breakwater area. The dredged depth of the harbour is proposed to be (-)4.5 m. The area inside the breakwater is proposed to be dredged with Cutter Suction Dredger to a dredge depth of 4.5 m and the dredge materials to be utilised for the reclamation. Dredging and development of approach/entrance channel of width 20 m and length 30 m towards west.
- Construction of two storied passenger shed. The shed will have capacity of 200 heads which can be utilised for sheltering local residents in emergency/ disaster. Construction of water reservoir for storing water during rainy season and utilise in the port area including supplying to the local residents of the area. Construction of sewage treatment plant for treating sewage of the harbour area including the proposed jetty of east side.—Construction of a dumping yard for solid waste management. Construction of storing shed.
- Construction of four numbers of wind mills for harvesting wind energy. Providing passenger cum cargo handling equipment like mechanised ladder and crane (15-ton capacity), light post at the approach of the jetty and one high mast tower at jetty head for lightning purpose and solar panel of suitable capacity over the sheds, at approach and on the shore area for harvesting solar energy. Providing new permanent rubber fender and bollard to the jetty.
- Construction of a Hover Craft landing area of width of 40 m and with a shed of size 33m x 33 m to be utilized as maintenance shed of the Hovercraft

2. It is proposed to upgrade the existing infrastructures on the **East side jetty**. The development works are as below:

- Construction of a 400m long sea wall at east side jetty and reclaim land up to a width of 10m.



The jetty of east side has a draft of 9m and need no/limited dredging in future.

- The east side of the east side jetty has stiff sea bed slope as such construction of breakwater to provide tranquil environment for ship berthing is not possible. Provide two numbers mooring buoys for safe berthing of bigger ships as it is also not possible to construct breasting dolphins .
- Providing passenger cum cargo handling equipment like mechanised ladder and crane (15 ton capacity). The other infrastructures will include providing light posts at the approach of the jetty and two high mast towers at jetty head for lighting purpose.
- Construction of other infrastructures same as proposed for west side jetties like sheds for passenger, cargo and workshop on the reclaimed and available land, sewage treatment plant, water reservoir etc. The passenger shed will be utilised for sheltering purpose also in emergency/disaster. The proposed infrastructures will include providing four numbers wind mills and providing new solar panel of suitable capacity over the sheds, at approach and on the shore area.

b) Cost: The block cost estimate of various development works are as follows :-

1. Construction cost of Sea wall and breakwater for west jetty is Rs 160 Crores (1200 m long) and other infrastructure like sheds, passenger and cargo handling amenities dumping yard etc is Rs 30 Crores. Cost of extension of jetty head is Rs. 15 Crores .Cost of solar panel and wind mills including allied infrastructures is Rs 12 Crores. Cost of providing light post at the approach of the jetty and one high mast tower is Rs 2 Crores. Construction cost of sewage treatment plant and water reservoir is Rs 2 Crores. Cost Rubber fender and bollard with fixing arrangement is Rs 3 Crores. Cost of capital dredging of approach/entrance channel(30m long) and inner harbour area

is Rs. 3 Crores. Construction cost of Hover craft landing area and shed is Rs 10 Crores.

2. Construction cost of sea wall of east side new jetty Rs 30 Crores (400m long) and other infrastructure like sheds, passenger and cargo handling amenities, dumping yard etc. is Rs 25 Crores. Cost of solar panel and wind mills including allied infrastructures Rs 12 Crores. Cost of providing light post at the approach of the jetty and two high mast towers is Rs 3 Crores. Construction cost of water reservoir and sewage treatment plant Rs 2 Crores. Cost of capital dredging harbour area is Rs. 4 Crores . Cost of Permanent rubber fender and bollard to be Rs.3 Crores. Cost of two mooring Buoys is Rs 3 Crores.

Total cost of the recommended work is Rs 319 Crores

6. **Agatti Island:** Agatti Island has the only airport in the entire Lakshadweep Union territory. The airport is situated in the south-west tip of the island, there is a Helipad inside the Airport area. The island has two small jetties on the west side at a distance of 850 m and one standard Jetty on the east side of the island. There is a water intake jetty in the east, very close to the east side jetty of the island.

The approach channel of west side jetties is combined and towards the north of length 2050 m long. The existing harbour infrastructures available at the west side jetty is inadequate for both passenger as well as cargo. Agatti island is



well developed as a tourist spot and has good infrastructures..The existing jetties of Agatti island have no permanent fenders, the jetties have inadequate navigational aids like channel marking buoys, cargo/passenger handling equipment. The existing jetty head of the west side jetties are very small in size; the available draft is also

limited. It can handle comparatively smaller passenger vessels and cargo vessels at the jetty. The east side jetty however can handle big ships and has a high draft. But during the monsoon period berthing ships alongside the jetty is very challenging due to the presence of strong wind and sea current.

a) Recommendation:

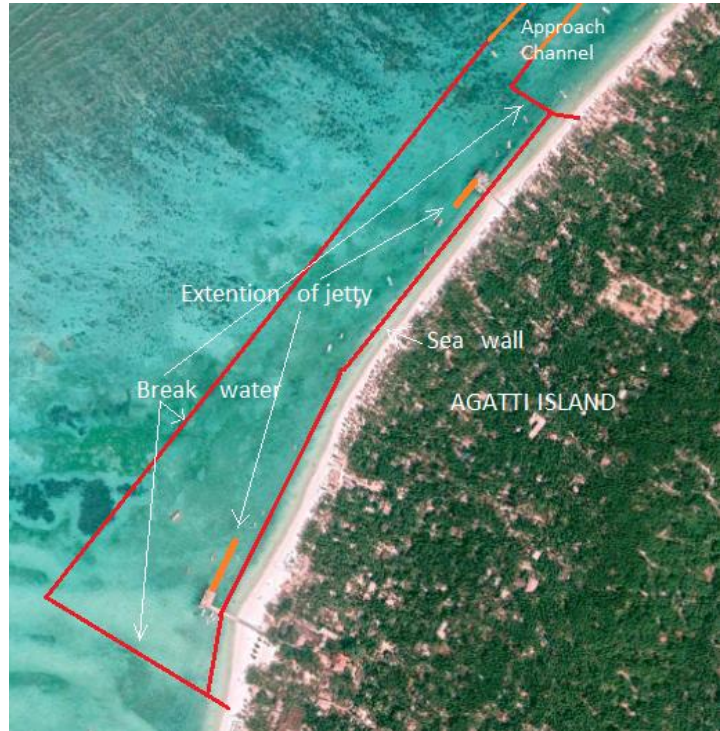
1. It is proposed to develop an all-weather Harbour of comparatively high draft around the existing west jetty in the Agatti Island. Following development works are proposed to be taken up:

- Construction of 1150 m long seawall. The sea wall will be constructed at a distance of 15 m from shore line and the area between existing shore line and sea wall to be filled with dredged materials and to be reclaimed. Construction of

850 m Long and 250 m wide (in the south side) breakwater.

The total length of breakwater will be 1200m.

Extension of existing south Jetty head to total 40m long towards



north and north jetty head to 25 m long. Capital Dredging for development of approach/entrance channel and in the break water inside area. The dredge depth of

the harbour proposed is 3.5 m. The area inside breakwater is proposed to be dredged with Cutter Suction Dredger.

- Construction of two storied passenger shed. The reclaimed area is proposed to be utilized for shed construction. The shed will have capacity of 200 heads which can be utilised for sheltering local residents in emergency/ disaster. Construction of water reservoir for storing water during rainy season and utilize in the port area including supplying to the local residents of the area. Construction of sewage treatment plant for treating sewage of the harbour area including the surrounding area. Construction of a dumping yard for solid waste management. Construction of storing shed.
 - Construction of twelve numbers of wind mills for harvesting wind energy. Providing passenger cum cargo handling equipment like mechanized ladder and crane (15-ton capacity).
 - Construction of new foreshore road.
 - Providing light post at the approach of the jetty and one high mast tower at jetty head for lighting purpose. Providing solar panel of suitable capacity over the sheds, at approach and on the shore area. Providing new permanent rubber fender and bollard to the jetty.
 - Construction of a Hover Craft landing area of width of 40 m and with a shed of size 33m x 33 m to be utilized as maintenance shed of the Hovercraft.
2. It is proposed to upgrade the existing infrastructures of the **East side jetty** .The development works are as below:
- Construction of a 400m long sea wall at east side jetty and reclaim land up to a width of 10m. Providing two numbers mooring buoys.
 - Construction of sheds for passenger, cargo and workshop on the reclaimed and available land. The passenger shed will be utilized for sheltering purpose also in emergency/disaster. Construction of sewage treatment plant, water reservoir etc.
 - Providing passenger cum cargo handling equipment like mechanized ladder, crane (15-ton capacity), forklift etc.
 - Providing light posts at the approach of the jetty and four high mast towers at jetty head for lighting purpose. Providing solar panel over the sheds, at approach and on the shore area of suitable capacity and twelve numbers wind mills.

b) Cost: The block cost estimate of various development works are as follows :-

1. Construction cost of Sea wall and breakwater of west jetty is Rs 235 Crores (2350 m long) and other infrastructure like sheds, passenger amenities, dumping yard etc. is Rs 30 Crores. Cost of extension of jetty heads is Rs 20 Crores .Cost of solar panel and wind mills including allied infrastructures is Rs 20 Crores. Cost of providing lighting infrastructures including light posts and one high mast tower is Rs 3 Crores. Construction cost of sewage treatment plant and water reservoir is Rs. 2 Crores.

Cost of Rubber fender and bollard with fixing arrangement is Rs 3 Crores. Construction cost of Hover craft landing area and shed is Rs 10 Crores. Cost of capital dredging of approach/entrance channel and inner harbour area is Rs. 12 Crores.

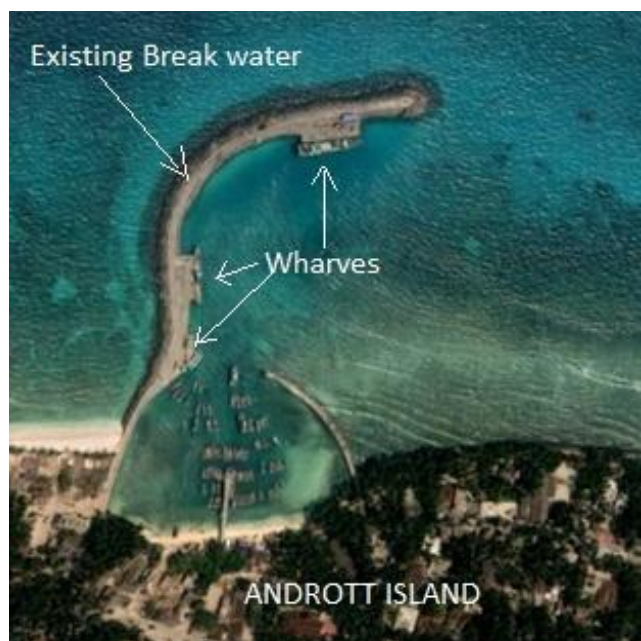
2. Construction cost of sea wall of east side new jetty is Rs 30 Crores (400m long) , and other infrastructure like sheds, passenger and cargo handling amenities, dumping yard is Rs 25 Crores. Cost of solar panel and wind mills including allied infrastructures is Rs 12Crores. Cost of providing lighting infrastructures including light posts and four numbers high mast towers is Rs 4 Crores. Construction cost of water reservoir and sewage treatment plant is Rs 2 Crores. Cost of capital dredging harbour area is Rs. 4 Crores. Cost of Permanent rubber fender and bollard to be Rs.3 Crores. Cost of two mooring Buoys is Rs 3 Crores.

Total cost of the recommended work is Rs 418 Crores

7. Andrott Island

Andrott island is a unique island in many sense, it is the nearest island to the mainland, the island is oriented in east-west direction, it's area is largest (4.90 Sqm) and population is highest (11,191 numbers) among all islands of Lakshadweep. Andrott Island has a helipad in south-east end of the island. The island has an incomplete breakwater in the north side of the island of length 470 m with three berths of lengths 60m, 15.2m and 60 m. There is an inner harbour to shelter small fishing boats.

The slope of the sea bed in the breakwater area is gentle and suitable for construction of all-weather harbour. The island has the potential to be nerve centre of transportation hub for the entire Lakshadweep. Presently the bigger passenger cum cargo ships are anchored at outer deep sea and embarkation/ disembarkation of passengers and transportation of cargo are done in small boats, which becomes unsafe during rough sea, especially during south-west monsoon, when wave height at outer sea is very high



The existing breakwater is incomplete and does not provide safe tranquil water for loading /unloading of cargo and/or embarkation/dis-embarkation of passengers.



a) Recommendation:

It is proposed to develop an all-weather Harbour of very high draft around the existing harbour of the Andrott Island. Following development works are proposed to be taken up:

- Construction of a new part of Break water 550m long and 50m extension of the existing west side breakwater including strengthening. Construction of sea wall of 400 m length. The sea wall is to be constructed 15 m away from the shore line and the area between shoreline and sea wall to be reclaimed.
- Capital dredging for increasing the depth inside harbour area. Dredge depth 10 m in the east side and 8 m in the west side is proposed to be provided. The dredging is to be carried out using Cutter Suction Dredger and the dredged materials is proposed to be used for reclaiming the area between sea wall and shore line. Reclamation of land of area 6000sq.m using dredged materials.
- Construction of two new Berths one at the east side of the inner harbour area of size, 200 m long & 20 m wide and the other berth 150m long & 15 m wide with 10 m wide approach road on the breakwater, for handling passenger ships, cargo ships including liquid petroleum products and container ships.
- Construction of shed on the shore for container stuffing and de-stuffing.

Construction of Sheds for passenger and for storing of fish and other essential commodities

- Construction of storage tank for liquid petroleum product. New infrastructures like passenger, break bulk cargo, container as well as liquid product handling equipment. Construction of floating jetty for sea plane service to facilitate development of the island as a business hub.
- Providing light posts at the approach of the jetty and four high mast towers at wharfs for lighting purpose. Providing solar panel over the sheds, at approach and on the shore area of suitable capacity and twelve numbers wind mills.

The Andrott port will act as main hub of coastal shipping as well as international shipping. The port should have all modern facilities and compliance of all international law like MARPOL, ISPS etc. The following additional facilities is also proposed to be developed at Andrott island :

- It is proposed to acquire another 6000 Sqm area in the shore side to develop various infrastructures as proposed above. The existing land available with the port authority can also be used for the new development purpose.
- It is proposed to develop infrastructures including floating jetty for sea plane service to facilitate development of the island as a future business hub.

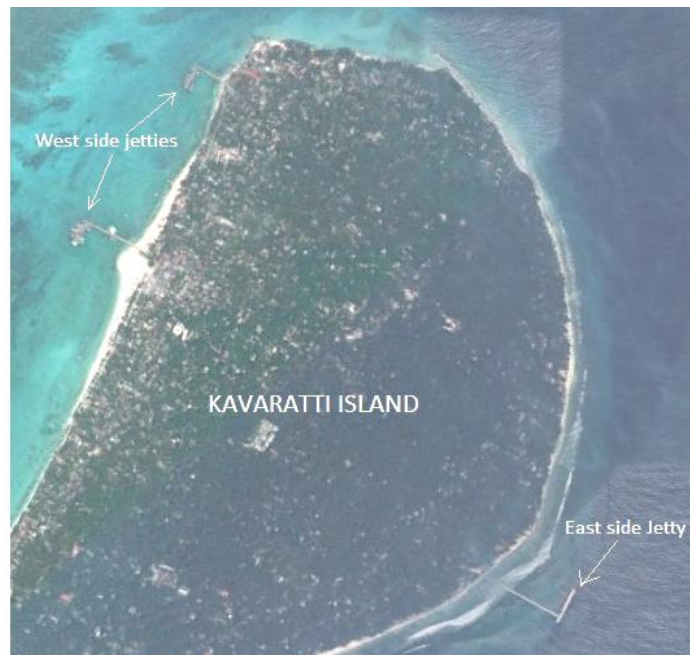
b) Cost: The block cost estimate of various development works are as follows :-

Construction cost of new part of breakwater including extension and strengthening of existing breakwater of the harbour of length 600 m (New & extension) is Rs 240 Crores and Sea wall (400 m long) is Rs. 40 Crores and other infrastructure like sheds, passenger amenities, dumping yard is Rs 40 Crores. Cost of construction of new berth (two nos.) and approach road on the breakwater is Rs 75 Crores . Cost of solar panel and wind mill including allied infrastructures is Rs 14 Crores. Cost of providing light post at the approach of the jetty and four high mast towers is Rs 5 Crores The construction cost of sewage treatment plant and water reservoir is Rs.3 Crores. Cost of capital dredging of approach/entrance channel(350m long) and inner harbour area is Rs. 100 Crores. Cost of providing permanent rubber fenders and bollards is Rs 8 Crores. Construction cost of Hover Craft landing area and shed is Rs 10 Crores. Cost of Foreshore road (500 m) is Rs 5 Crores.

Total cost of the recommended work is Rs 540 Crores

8. Kavaratti Island: The Kavaratti is the capital of the Union Territory Lakshadweep and is located in the centre of Lakshadweep archipelago.

The island has a helipad in the southern end and is connected with Agatti airport with regular services. The island has one Jetty on the east side and two jetties



on the west side towards north of the island. The two west side jetties are 600 m apart..Bathymetry of the sea bed in and around the east Jetty particularly towards the outer side is very steep and it is technically not advisable to construct a breakwater to make the Jetty an all-weather harbour. However, two mooring Buoys may be provided for safe berthing of ships and embarkation/disembarkation of passengers and transportation of cargo from a ship, by anchoring at the jetty in place of the existing practice of anchoring at the outer sea and deploying small boats for last leg transportation.

As the two west side jetties are 600 m apart, it is considered prudent to construct a combined breakwater to make the jetties useable throughout the year. The jetties of the west side have a well defined common approach channel of length less than 500 m towards the north side.

There are no permanent fenders in the jetties. Rubber tyres are being used as fenders. There are four pneumatic fenders provided as a temporary measure. Another type of fenders are also seen provided in the rear side of the jetty, for berthing of the smaller type vessels.



a) Recommendation:

1. It is proposed to develop an all-weather Harbour of 3 m draft around the existing two jetties of the west side of the Kavaratti Island. Following development works are proposed to be taken up:
 - Construction of 1570 m long break water and 1050 m long seawall. The sea wall will be constructed at a distance of 15 m from shore line and the area between existing shore line and sea wall to be filled with dredged materials and to be reclaimed.
 - Capital dredging in the approach channel and break water inner harbour area. The dredged depth of the harbour is proposed to be 3.5 m. The breakwater inside area is proposed to be dredged with a Cutter Suction Dredger and the dredged materials to be utilised for the reclamation. Dredging and development of approach/entrance channel of width 40 m and length 400 m towards north.
 - Construction of two storied passengers shed. The reclaimed area to be utilised for construction of two storied passengers shed. The shed will have capacity of 300 heads which can utilised for sheltering local residents in emergency / disaster. Construction of water reservoir to be utilised for storing water during rainy season and utilise in the port area including supplying to the local residents of the area. Construction of sewage treatment plant for treating sewage of the harbour area including the surrounding area. Construction of a dumping yard for solid waste management. Construction of storing shed.
 - Construction of new foreshore road.
 - Providing passenger cum cargo handling equipment like a mechanised ladder and crane (15-ton capacity).
 - Providing light post at the approach of the jetty and two high mast tower at jetty heads for lighting purposes. Providing solar panels of suitable capacity over the sheds, at approach and on the shore area. Installing twelve wind mills at the shore area for harvesting wind energy. Providing new permanent rubber fenders and

bollards to the jetty.

- Construction of a Hover Craft landing area of width 40 m and with a shed of size 33m x 33 m to be utilised as maintenance shed of the Hovercraft.
 - Construction of a low cost jetty for handling liquid petroleum products to the south of existing south jetty. The jetty head will consist of breasting Dolphins and the approach trestle will rest on single line pile.
2. It is proposed to upgrade the existing infrastructures of the **East side jetty** .The development works are as below:
- Construction of a 400m long sea wall at east side jetty and reclaim land up to a width of 10m. Providing two mooring buoys for safe berthing of bigger ships.
 - Providing passenger cum cargo handling equipment like a mechanised ladder, crane (15-ton capacity), forklift etc. at the jetty.
 - Providing light posts at the approach of the jetty and two high mast towers at jetty head for lightning purposes. Providing new solar panel of suitable capacity over the sheds at approach and on the shore area and four number wind mills.
 - Construction of other infrastructures as proposed for west side jetties like sheds for passenger, cargo and workshop on the reclaimed and available land, sewage treatment plant, water reservoir etc.

b) Cost: The block cost estimate of various development works are as follows :-

1. The construction cost of Sea wall and breakwater of west jetty is Rs 260 Crores (2620 m long) and other infrastructure like sheds, passenger and cargo handling amenities is Rs 30 Crores. Cost of solar panel and wind mill including allied infrastructures is Rs 12 Crores. Cost of providing light posts at the approach of the jetty and one high mast tower is Rs 4 Crores. Construction cost of sewage treatment plant and water reservoir is Rs 3 Crores. Cost of capital dredging of approach/entrance channel(400m long) and inner harbour area is Rs. 30 Crores. Cost of providing permanent rubber fenders and bollards is Rs 5 Crores. Construction cost of Hover Craft landing area and shed is 10 Crores. Construction cost of liquid handling jetty is Rs 20 Crores.
2. The construction cost of Sea wall(400 m) on the east site jetty is Rs 40 Crores. Cost of other infrastructure like sheds, passenger and cargo handling amenities is Rs 25 Crores. Cost of solar panel and wind mill including allied infrastructures is Rs 12 Crores. Cost of providing light post at the approach of the jetty and two high mast tower is Rs 4 Crores. Construction cost of sewage treatment plant and water

reservoir is Rs 2 Crores. Cost of Permanent rubber fenders and bollards is Rs.4 Crores. Cost of two mooring Buoys is Rs 3 Crores.

Total cost of the recommended work is Rs 464 Crores.

9. Kalpeni Island

The Kalpeni Island is the largest inhabited island of Kalpeni atoll. The Kalpeni has a helipad in the north-central area and two jetties in the west side. There is one 165 m long breakwater and 30 m long Wharf at the east. The breakwater is incomplete. The existing north-west Jetty head is around 200 m away from the shore line. The Jetty is very close to Helipad and south of Helipad. The approach channel is 3300 m long and spanning towards the south-west side and some part of the channel is passing through coral reef area. The island has a 37 metre high lighthouse .



Large size vessels are being berthed in the open sea near to the eastern side breakwater and the passengers are transferred in the small boats at the breakwater. This breakwater was damaged and presently restoration works are being executed.

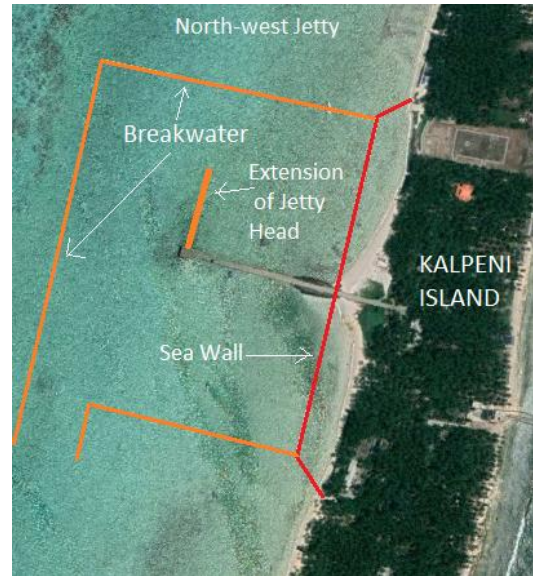
In the south-west jetty, smaller passenger vessels and cargo vessels are being handled. There are no permanent fenders in the jetties. Rubber tyres are being used as fenders.



a) Recommendation:

1. It is proposed to develop an all-weather Harbour of 3 m draft at the north end of west side jetties of Kalpeni island. Following development works are proposed to be taken up:
 - Extension of jetty head to 50 m. Construction of 400 m long seawall and 1000 m long breakwater.
 - Capital dredging inside the breakwater area. Reclamation of the area between the sea wall and shore using dredged materials. Dredging and development of approach/entrance channel of width 30m and length 3000m towards south -west.

- Construction of a two storied passengers shed in the reclaimed area. Construction of water reservoir for storing water during the rainy season and utilise in the port area including supplying to the local residents of the area. Construction of sewage treatment plant for treating sewage of the for the harbour area including the surrounding area. Construction of a dumping yard for solid waste management. Construction of storing shed.



- Construction of four wind mills for harvesting wind energy . Providing light posts at the approach of the jetty and one high mast tower at jetty head for lightning purposes. Providing solar panels of suitable capacity over the sheds, at approach and on the shore area.
- Providing new permanent rubber fenders and bollards to the jetty. Providing passenger cum cargo handling equipment like mechanised ladder and crane (15-ton capacity)
- Construction of a Hover Craft landing area of width of 40 m and with a shed of size 33m x 33 m to be utilised as maintenance shed of Hovercraft.
- Laying pipe line and allied infrastructures at the south jetty for handling liquid petroleum product



2. It is proposed to upgrade the existing infrastructures of the **East side jetty** .The development works are as below::

- Construction of a 400m long sea wall at east side jetty and reclaim land a width of 15 m. Construction of new part of break water of length 600 m long. Construction of two new wharves.
- Providing passenger cum cargo handling equipment like a mechanised ladder, crane (15-ton capacity), forklift etc. at the wharfs.

- Providing light posts at the approach of the jetty and three high mast towers for lightning purpose. Providing new solar panel over the sheds, at approach and on the shore area of suitable capacity and four number wind mills
 - Construction of other infrastructures as proposed for west side jetties like sheds for passenger, cargo and workshop on the reclaimed and available land, sewage treatment plant, water reservoir etc.
3. It is also proposed to join Kalpeni and Cheriya islands with road and Tourist huts may be constructed on both side of the road. The road may be constructed just west of the coral ring.

b) Cost: The block cost estimate of various development works are as follows :-

1. Construction cost of Sea wall and breakwater of west jetty is Rs 140 Crores (1400 m long), cost of extension of jetty is Rs 15 Crores and cost of other infrastructure like sheds, passenger and cargo handling amenities, dumping yard etc is Rs 30 Crores. Cost of solar panel and wind mills including allied infrastructures is Rs 12 Crores. Cost of providing light post at the approach of the jetty and one high mast tower is Rs 3 Crores. Construction cost of sewage treatment plant and water reservoir is Rs. 3 Crores. Cost of capital dredging of approach/ entrance channel (3000m long) and inner harbour area is Rs. 70 Crores. Cost of providing permanent rubber fender and bollard cost is Rs 4 Crores. Construction cost of Hover Craft landing area and shed is Rs 10 Crores. Construction cost of liquid handling infrastructures is Rs 10 Crores.
2. The construction cost of new part of east side breakwater and strengthening of existing breakwater is Rs 180 Crores. Construction cost of sea wall is Rs 40 Crores (400 m) and other infrastructure like sheds, passenger and cargo handling amenities is Rs 30 Crores. Cost of construction of new wharves (two nos.) and approach road on the breakwater is Rs 75 Crores. Cost of solar panel and wind mills including allied infrastructures is Rs 15 Crores. Cost of providing light post at the approach of the jetty and three high mast towers is Rs 5 Crores. Construction cost of sewage treatment plant and water reservoir is Rs.3 Crores. Cost of capital dredging of approach/entrance channel (350m long) and inner harbour area is Rs. 80 Crores. Cost of providing permanent rubber fender and bollard is Rs 6 Crores.
3. Construction cost of concrete bridge link road between Kalpeni and Cherlyam islands is Rs 300 Crores (3000 m long)

Total cost of the recommended work is Rs 1031 Crores.

Details of recommendations of new construction and up gradation of existing jetties , breakwaters and related facilities in the Lakshadweep Islands are given at **Annexure III**.

Details of cost estimates of proposed works is also given at **Annexure IV**.

The abstract of block cost estimate of various recommended development works is tabulated below:

Ser	Development works proposed	Cost (Rs. in Cr)
1	Bitra island	196 Crores
2	Chetlet Island	355 Crores
3	Kiltan Island	277 Crores
4	Kadmat Island	447 Crores
5	Amini Island	319 Crores
6	Agatti island	418 Crores
7	Andrott Island	540 Crores
8	Kavaratti Island	464 Crores
9	Kalpeni Island	1031 Crores
	Total cost	Rs. 4047Crores

CHAPTER 5: SUMMARY OF KEY RECOMMENDATIONS

In order to achieve safe, efficient and effective operation of port and shipping services in all the islands of UT of Lakshadweep various recommendation have been made in this report with cost (budgetary) for the future infrastructure development and modifications / upgradation to the existing infrastructures.

The basic theme of the recommendation is that all future developmental works of the entire Lakshadweep islands have to be port led and to be taken place in and around port area. Port will reclaim good land mass and this will give an opportunity to develop various infrastructures in port area.

In the recommendation it is proposed to develop at least one all-weather Harbour around the existing jetty on the western side of all the Islands by providing breakwater and seawall and increasing the draft in the inner Harbour area and approach channels.

Kadmat Island is also proposed to develop as base hub for High Speed Crafts for passenger as well as cargo movements.

The Andrott port will act as main hub of coastal shipping as well as international shipping in future. The port should have all modern facilities and compliance of all international law like MARPOL, ISPS etc. New container handling infrastructures including CFS facility is recommended to develop at Andrott island. It is also recommended to develop liquid petroleum product handling facility with storage tank at Andrott port. Floating jetty for sea plane service to facilitate development of the island as a business hub is recommended to develop as new infrastructures.

Dredging and development of approach/entrance channel in the west side jetties is also proposed to take up without damaging coral reef.

The proposed basic infrastructure shall inter-alia include the followings:-,

- Reclamation of land utilising dredged materials
- Construction of breakwater to the all west side jetties including sea wall.
- Nourishment and strengthening of existing partial break waters of Andrott and Kalpeni islands and Construction of new part to complete the breakwater,
- Strengthening of existing jetties and wharfs including extension of jetty head.
- Construction of new jetties on the east side in selected islands
- Installation of infrastructures to utilise the water intake jetties constructed for desalination plant for handling petroleum products.

- Upgrading physical and social infrastructure like potable water supply, renewable electrical energy generation, training institute for imparting training to the resident of the islands etc. The cyclone shelters to use in natural disaster . Electricity generated through Solar Panels and wind mills can act as alternative clean source of energy, which will reduce use of fossil fuel considerably.
- Untreated sewage disposal to be stopped and treated sewage waste to be disposed below the level of coral growth or to be discharged in deep water.
- Solid waste disposal /management to be done to avoid environmental damages and alternative to sea dumping/inclination needs to be explored.

In order to achieve the present and future requirements as elaborated in the report , the recommended new development work includes the followings:-

- Construction of two storied passenger terminals to be utilised as shelter during emergency/ disaster.
- Construction of shed for storing of general cargo and accommodating workshops
- Installation of solar panels on the sheds for harvesting solar energy.
- Construction of structures at the approaches of the jetties for providing and installation of solar panels.
- Construction and installation of wind mills for harvesting wind energy.
- Construction of water storage tank for rain water harvesting.
- Construction of sewage treatment plant to be catered for adjacent resident area.
- Construction of dumping ground for garbage for proper waste management of surrounding area.
- Creation of provision for development of tourism and small scale industries like fish processing, ice plant, coir industry etc.,
- Creation of Entertainment facility like amusement park etc.
- Development of landing area for sea plane to boost tourism

Budgetary Cost Estimate of the above proposed development of infrastructures in the Lakshadweep Islands come around Rs. 4047 Crores.

All the proposed development schemes are coming under the Sagarmala scheme. Lakshadweep Administration may approach Ministry of Port, Shipping and Waterways for availing financial assistance for taking up the scheme, on priority basis.

6	Chetlat	1.14	2553	110.00	6.00	10.00	(+) 3.50	1.00	1981			880	16.00	1.00	60.00	40.00	40.00	94.00	2	4	2	-	1	-	1	1					1			
7	Kadmat	3.12	5319	75.00	6.00	10.00	(+) 3.50	1.50	13/11/79			1870	16.00	1.80	60.00	40.00	40.00	-	2	-	8	2 Set	1	-	2	1	Floating crane 1 No				1			
				41 x 2 m						2006																								
8	Kalpeni	2.79	4319									3300	16.00	1.80	60.00	E/s- 88m2 W/s- 74m2	-	94.00	1	16	27	2 Set	1	-	1	1								
				Katchety jetty	183.00	6.00	24.20	(+) 3.20	1.80	14/11/79																								
				Northern jetty	135.30	6.90	11.90	(+) 3.20	1.70	2/2012																							Floating crane 1 No	
				Breakwater						5/2002	165M	40 x 9.40																				Hind crane 12T Cap-1 No		
9	Kavaratti	4.22	10113									1140	40.00	2.60	100.00	90.00	70.00	150.00	2	2	14	3 set	1	2	2	2	1				1			
				(i) Katcheri Jetty	270.00	7.00	77.35x17	(+) 3.20	2.50	3/1989																								
				(ii) Fisheries Jetty	107.00	6.00	85.15x9.85	(+) 2.70	2.00	1972																								
				(iii) Eastern side jetty	A- 318 m B- 126.8 m	6	12 m	(+)5.05m (-)8.00		31/5/2013																							Tyre mounded crane 12T Cap. - 1 No	
10	Kiltan	1.63	3664	77.00	6.00	17.00	(+)3.30	1.20	1978			780	16.00	1.50	60.00	40.00	40.00	-	2	-	12	-	1	-	1	1					1			
11	Minicoy	4.39	9495									3275	50.00	4.00	100.00	130.00	130.00	150.00	6	18	6	2set	1	2	2	2					1			
				(i) Katcheri jetty	190.00	6.00	17x30	(+) 3.00	1.70	8/1/1982																								
				(ii) Fisheries Jetty	160.00	3.00	5.30	(+) 3.50	1.80	31/12/87																								
				(iii) Eastern side jetty	A- 230 m B- 126.8 m	6	12 m	(+)5.05m (-)8.00		14/8/08																							10T cap. Mobile Hydraulic crane -	
12	Cheriyapani Reef																																	
13	Valiyapani Reef																															1		
14	Perumul Par																															1		
15	Suheli																															12		

DETAILS OF INFRASTRUCTURES PROVIDED AT LAKSHADWEEP ISLANDS

Table 1: Details of Infrastructure provided in Bitra Island

SL No	Island	Area in Sq. Km	Permanent jetty					Completion date
			Length in meter	Width in meter		Top level in Mtrs	Depth in meter	
				Approach	Berthing			
1	Permanent Jetty.	0.1	172.00	4.5	15.3	(+) 3.50	1.50	15.4.86

Entrance channel & Turning circle				Foreshore Facilities				Navigational Aids					
Length in metre	Width in metre	Depth in metre	Dia of Turning Circle in metre	Passenger hall M ²	Cargo shed	Workshop	Entrance Tower	Rubber Buoy (Nos)	G.R.P lighted Buoy	Twin point mooring buoy	Port Control Tower	Ospery / Skrit keel	M.S Mooring buoy at eastern side for 5000 GWT vessels
2126.00	16.00	1.00	60.00	0.00	0.00	0.00	0.00	2.00	2.00	0.00	1.00	0.00	0.00

Table 2 :Details of Infrastructure provided in Chetlat Island

SL No.	Island	Area in Sq. Km	Permanent jetty					Completion date
			Length in metre	Width in metre		Top level in Mtr.	Depth in metre	
				Approach	Berthing			
1	Permanent Jetty.	1.04	110.00	6.00	10.00	(+) 3.5	1.00	1981

Entrance channel & Turning circle				Foreshore Facilities				Navigational Aids					
Length in metre	Width in metre	Depth in metre	Dia of Turning Circle in metre	Passenger hall M ²	Cargo shed Sqm.	Workshop Sqm	Entrance Tower	Rubber Buoy (Nos)	G.R.P lighted Buoy	Twin point mooring buoy	Port Control	Ospery / Skrit keel	M.S Mooring buoy at eastern side for 5000 GWT vessels
880.00	16.00	1.00	60.00	40.00	40.00	94.00	2.00	4.00	2.00	0.00	1.00	0.00	1.00

Table 3 : Details of Infrastructure provided in Kiltan Island

SL No.	Island	Area in Sq. Km	Permanent jetty					Completion date
			Length in metre	Width in metre		Top level in Mtr.	Depth in metre	
				Approach	Berthing			
1	Permanent Jetty.	1.63	77.00	6.00	17.00	(+) 3.30	1.2	1978

Entrance channel & Turning circle				Foreshore Facilities				Navigational Aids					
Length in metre	Width in metre	Depth in metre	Dia of Turning Circle in metre	Passenger hall M ²	Cargo shed Sqm.	Workshop Sqm	Entrance Tower	Rubber Buoy (Nos)	G.R.P lighted Buoy	Twin point mooring buoy	Port Control Tower	Ospery / Skrit keel	M.S Mooring buoy at eastern side for 5000 GWT vessels
780.0	16.00	1.80	60.00	40.00	40.00	0.00	2.00	0.00	6.00	0.00	10.00	0.00	10.00

Table 4: Details of Infrastructure provided in Kadmat Island

SL No	Island	Area in Sq. Km	Permanent jetty					Completion date
			Length in metre	Width in metre		Top level in Mtr.	Depth in metre	
				Approach	Berthing			
1	Permanent Jetty.	3.20	75.00	6.00	10.00	(+) 3.50	1.50	13.11.79

Entrance channel & Turning circle				Foreshore Facilities				Navigational Aids					
Length in metre	Width in metre	Depth in metre	Dia of Turning Circle in metre	Passenger hall M ²	Cargo shed Sqm.	Workshop Sqm	Entrance Tower	Rubber Buoy (Nos)	G.R.P lighted Buoy	Twin point mooring buoy	Port Control Tower	Ospery / Skrit keel	M.S Mooring buoy at eastern side for 5000 GWT vessels
1870	16.00	1.80	60.00	40.00	40.00	-	2.00	-	6.00	2 Set	1.00	-	1.00

Table 5: Details of Infrastructure provided in Amini Island

S. No	Island	Area in Sq. Km	Permanent jetty					Completion date
			Length in metre	Width in metre		Top level in Mtrs.	Depth in metre	
				Approach	Berthing			
1	Kachery Jetty	2.59	74	6.65	14.1	(+)3.9	1.8	13.11.79
2.	EHFC Jetty		A-355 M B-126.8 M	6.00	12.00	(+) 5.05 M	(-) 8.00 M	31.5.2013

Entrance channel & Turning circle				Foreshore Facilities				Navigational Aids					
Length in metre	Width in metre	Depth in metre	Dia of Turning Circle in metre	Passenger hall M ²	Cargo shed Sqm.	Workshop Sqm	Entrance Tower	Rubber Buoy (Nos)	G.R.P lighted	Twin point	Port Control	Ospery / Skrit keel	M.S Mooring buoy at eastern side for 5000 GWT
295.00	16.00	1.80	60.00	60.00	60.00	150.00	2.00	0.00	0.00	0.00	1.00	0.00	1.00

Table 6 :Details of Infrastructure provided in Agatti Island

Island	Area in Sq. Km	PERMANENT JETTY					Completion date						
		Length in metre	Width in metre		Top level in Mtrs.	Depth in metre							
			Approach	Berthing									
AGATTI	3.84												
Katchery jetty		155.00	6.00	30.00	(+) 3.20	1.80	9.5.78						
Fisheries jetty		135.00	3.00	24.00	(+) 2.70	1.80	3/88						
EHFC - jetty		A- 332 m B- 126.8 m	6.00	12 m	(+)5.05 m	(-) 8.00	12/2012						
Entrance channel & Turning circle				Foreshore Facilities				Navigational Aids					
Length in metre	Width in metre	Depth in metre	Dia of Turning Circle in metre	Passenger hall M ²	Cargo shed Sqm.	Workshop Sqm	Entrance Tower	Rubber Buoy	G.R.P lighted Buoy (Nos.)	Twin point	Port Control Tower	Ospery / Skrit keel	M.S Mooring buoy at eastern side for 5000 GWT vessels
2160.00	16.00	1.50	60.00	60.00	60.00	150.00	3.00	10.00	12.00	1.00	1.00	0.00-	1.00

Table 7: Details of Infrastructure provided in Andrott Island.

SL No	Island	Area in Sq. Km	Permanent Jetty					Completion date					
			Length in metre	Width in metre		Top level in Mtr.	Depth in metre						
				Approach	Berthing								
a.	B/Water 1 st stage	4.84	77.00	3.00	10.5	(+) 4.00	1.80	14.11.79					
b.	Western arm	155.00 meter (5/2002)											
c.	Eastern Arm	120.00 meter (5/2002)											
d.	Break water 2 nd stage	Length – 375.00 m Top width – 6.00 m Extension to Western arm (+) 5.50 Meter											
e.	Main wharf	--	60.00	--	15.00	(+) 3.50	--	2/2010					
f.	Wharf for IIF vessel	--	15.20	--	1.50	(+) 3.50	--	2/2008					
g.	Additional Wharf	--	40.00	--	10.6	(+) 3.50	--	2/2010					
Entrance channel & Turning circle			Foreshore Facilities				Navigational Aids						
Length in metre	Width in metre	Depth in metre	Dia of Turning Circle in metre	Passenger hall M ²	Cargo shed Sqm.	Workshop Sqm	Entrance Tower	Rubber Buoy (Nos)	G.R.P lighted Buoy	Twin point mooring buoy	Port Control Tower	Ospery / Skrit keel	M.S Mooring buoy at eastern side for 5000 GWT vessels
-	-	2.00	-	60.00 167.00(N)	60.00	94.00	-	4.00	-	-	1.00	-	-

Table 8: Details of infrastructure provided in Kavarathi Island.

Island	Area in Sq. Km	PERMANENT JETTY					Completion date						
		Length in metre	Width in metre		Top level in Mtrs.	Depth in metre							
			Approach	Berthing									
Katcheri Jetty	4.22	270.00	7.00	77.35	(+) 3.20	2.50	3/1989						
Fisheries Jetty		107.00	6.00	80.15	(+) 2.70	2.00	1972						
EHFC - jetty		A- 318 m B- 126.8 m	6.00	12 m	(+) 5.05m	(-) 8.00	31.5.2013						
Entrance channel & Turning circle		Foreshore Facilities				Navigational Aids							
Length in metre	Width in metre	Depth in metre	Dia of Turning Circle in metre	Passenger hall M ²	Cargo shed Sqm.	Workshop Sqm	Entrance Tower	Rubber Buoy (Nos)	G.R.P lighted Buoy (Nos.)	Twin point mooring buoy	Port Control Tower	Ospery / Skrit keel	M.S Mooring buoy at eastern side for 5000 GWT vessels
1140	40.0	2.60	100.0	90.00	70.00	150.00	2.00	3.00	11.00	3.0	1.00	2.0	2.00

Table 9 :Details of Infrastructure provided In Kalpeni Island

SL No.	Island	Length in Metre	Width in Metre		Top level in Metre	Depth in Metre	Date of Completion		
			Approach	Berthing					
1	South Jetty	183.00	6.00	24.00	(+) 3.20	1.80	11 / 1979		
2	Northern Jetty near Helipad	120.00	6.00	11.00 X 15.00	(+) 3.20	1.80	10 / 2010		
3	Rubble Mound Break-water	165.00	--	Wharf	(+) 3.50	1.80	05 / 2002		
				40.00 X 9.40					
Entrance channel & Turning circle				Foreshore Facilities					
Length in Metre	Width in Metre	Depth in Metre	Diameter of Turning Circle in Metre	Passenger hall Sq. M		Cargo shed Sq. M.	Workshop Sq. M		Entrance Tower
				Eastern side	Western side		Eastern side	Western side	
3300	16.00	1.80	60.00	88.00	74.00	0.00	94.00	184.00	1.00

Navigational Aids					
Rubber Buoy (Nos.)	G.R.P lighted Buoy (Nos.)	Twin point mooring buoy	Port Control Tower	Osprey / Skirt keel	M.S Mooring buoy at eastern side for 5000 GWT vessels
0.00	10.00	2.00	1.00	0.00	1.00

Table 10 :Details of Infrastructure provided in Minicoy Island

S L N o.	Island	Area in Sq. Km	Permanent jetty					Completion date					
			Length in metre	Width in metre		Top level in Mtr.	Depth in metre						
				Appr- oach	Berth - ing								
1	Katchery Jetty	2.59	190.00	6.00	17.00	(+) 3.00	1.70	8/1/1982					
2.	EHFC Jetty		A- 230 m B- 126.8	6.00	12 m	(+)5.05 m	(-)8.00	14 / 8 /08					
3.	Fisheries Jetty		160.00	3.00	5.30	(+) 3.50	1.80	31/12/87					
Entrance channel & Turning circle		Foreshore Facilities			Navigational Aids								
Length in	Width in metre	Depth in metre	Dia of Turning Circle in metre	Passenger hall M ²	Cargo shed Sqm.	Workshop Sqm	Entrance Tower	Rubber Buoy (Nos)	G.R.P lighted	Twin point mooring buoy	Port Control	Osprey / Skrit	M.S Mooring buoy at eastern side for 5000 GWT vessels
3275	50.00	4.00	100.00	130.00	130.00	150.00	6.00	19.00	0.00	2set	1.00	2.00	2.00

VESSEL DETAILS OF UTLA

Technical Specifications of UTL Ships

	SHIPS									
	M.V. Kavaratti	M.V. Arabian Sea	Lakshadweep Sea	Bharat Seema	Tipu Sultan	Dweep Setu	Aminidivi	Minicoy	MV Corals	MV Lagoons
Year of built	2007	2009	2010	1973	1982	1984	2000	2000	2014	2015
Date of deliver	27.6.2008	02.01.2010/25 Jan	15.10.2010/3 Nov	27.7.82	23.9.88	12.11.87	25.8.2001	19.10.2001	10.01.2015	
LOA (mtrs)	117.67	89	89	86.54	93	48	51.57	51.57	98.62	98.62
Beam (M)	18.99	15.5	15.5	15.5			10.5	10.5	17.00	17.00
Depth (M)	11.09	6.3	6.3	5.35		3	3.8	3.8	9.20	
Draft (M)	5.3	3.5	3.5	4.92	4.25	1.7	2.2	2.2	4.26	4.50
Gross tonnage	8763	3261	3261	3670	3725 T	492 T	931	931	5939.00	5938
Speed (knots)	17	15	15	12 Knots	12 Knots	8	13	13	13.00	13.2
DWT	2387	725	725	1040 / 1101	887/1118	98/148	183.9	183.9	1179.00	1179
Net Tonnage		978	978							
Main Engine	2*2950 KW	2*1920 KW	2*1920 KW	B&W Alpha 1360 KW at 710 RPM	stork Wer STMAIORL	Kirloskar VGV BSLM				
Engine Power				2*2775 KW	2*4330	2*368	2*1175 BHP	2*1175 BHP		
Bollard Pull										
Cargo Capacity	160 MT	100 MT	100 MT	160 MT			25 MT	25 MT		
Pax capacity	700	250	250	386	658	150	150	150		

	Speed vessels							Bollard Tug		Barge					
	Viringili	Parali	Valiyapani	Cheriyapani	Skip Jack	Blue Marlin	Black Marlin	Kiltan	Kalpitti	Suheli	IIF Vessels	Ubaidulla	Hinnakara	Laccadives	Cheriyam
Year of built	2006.00	2007	2007	2007	2007	2007	2007	2006	2007	1987	1991	1993	1993	1995	1997
Date of delivery	1.5.2007	19.6.2007	19.6.2007	19.6.2007	29.11.2007	29.11.2007	5.12.2007	9.5.2006	9.6.2007	16.8.1987	21.1.92	13.5.93	6.11.93	10.3.1995	24.5.97
LOA (mtrs)	18.95	35	35	35	32.13	32.12	32.13	24.8	24.8	30.2	30.21	57.5	57.5	57.5	57.5
Beam (M)	4.99	9.6	9.6	9.6	9	9	9	8	8			11	11	11	11
Depth (M)	2.25	4.45	4.45	4.45	3	3	3	4	4	2.6	3.3	3.5	3.5	3.5	3.5
Draft (M)	1.19	1.35	1.5	1.5	1.2	1.2	1.2	2.7	2.7	1.8	1.35	2.7	2.7	2.7	2.7
Gross tonnage	48.00	396	396	396	164 T	164 T	164 T	179	179	164 T	254 T	738 T	738 T	738 T	738
Speed (knots)	25.00	25	25	25	20	20	20	10	10	8	25	7	7	7	7
DWT	5.50	43	43	43	24.3	24.3	24.3	Nil	Nil	110/49	40.75/76	945.51	945.51	945.51	945.51
Net Tonnage								54	54						
Main Engine	Caterpillar Modle 3406E Marine Diesel Engine. 2x600 BHP @2100 RPM	2XCI,,OMS LTA 50 M2 Marine Diesel Engine, MCR Power 2*1800 bhp (1342 KW) @1900rpm			2x100 bhp @2100 RPM Caterpillar 3412 E			Caterpillar modle 3406 2*335 KW		Kirloskar cummins N734M 1800RPM	Deutz MWM TBD 604 BV 12 1242 KW	Kirloskar cummins Vt 1710 M2	Kirloskar cummins Vt 1710 M2 Pro. Power 2x415 tip 1500 rpm	Kirloskar Cummins Vt 1710 M2	Kirloskar Cummins Vt 1710 M2
Engine Power								2*335kW	2*335kW	2*235	2*1690	2*520 BHP	2*520 BHP	2*520 BHP	2*520 bhp
Bollard Pull								10 T							
Cargo Capacity										60 T Oil		600 MT	600 MT	600 MT	600 MT
Pax capacity	15.00	150 Economy Class +4 Business Class			50 Economy Class & 4 VIP Class						100				

Budgetary Cost Estimate

PROPOSED DEVELOPMENT WORKS AT LAKSHADWEEP ISLANDS

1. Bitra Island

Sl. No	Description of item	Amount (Rs. In crores)
West side jetty		
1	Construction of Sea wall (400m long) and breakwater (325 m Long and 300 m wide) at the existing jetty	135.00
2	Other infrastructures like sheds, passenger amenities etc.	24.00
3	Extension of existing jetty head (Total 50m long)	15.00
4	Installation of solar panel and wind mill including allied infrastructures	12.00
5	Construction of sewage treatment plant and water reservoir	2.00
6	Providing Rubber fenders and bollard with fixing arrangement	2.00
7	Providing lighting post at the approach of the jetty and one high mast tower at jetty head for lightning purpose	2.00
8	Capital dredging of approach/entrance channel and inner harbour area	4.00
	Total I	196.00

2. Chetlet Island

Sl. No	Description of item	Amount (Rs. In crores)
West side jetty		
1	Construction of Sea wall and breakwater (1200m long) of West jetty	120.00
2	Other infrastructure like sheds, passenger amenities at West jetty	25.00
3	Extension of jetty head 50m long on either side	15.00
4	Providing Solar panel and wind mill including allied infrastructures	13.00
5	Construction of sewage treatment plant and water reservoir	2.00
6	Providing Rubber fender and bollard with fixing arrangement	3.00
7	Capital dredging of approach/entrance channel (650m) and inner harbour area	4.00
8	Providing lighting post at the approach of the jetty and one high mast tower at jetty head for lightning purpose	3.00
East side jetty		
9	Construction of seawall of east side new jetty (400m long)	30.00
10	Construction of sheds for cargo, passenger with amenities, workshops etc.	20.00
11	Construction of a new jetty [120m long jetty head and 150 m long approach trestle] including providing all service facilities	100.00
12	Providing Solar panel and wind mill including allied infrastructures	8.00
13	Construction of water reservoir	1.00

14	Providing lighting posts at the approach of the jetty and two high mast tower at jetty head for lightening purpose	4.00
15	Capital dredging in harbor area	4.00
16	Providing Mooring buoys	3.00
	Total II	355.00

3. Kilten Island

Sl. No	Description of item	Amount (Rs. In crores)
West side jetty		
1	Construction of Sea wall and breakwater (1200m long) of West jetty	180.00
2	Construction of shed, passenger amenities etc. at West jetty	25.00
3	Extension of west jetty head	15.00
4	Providing Solar panel and wind mill including allied infrastructures	12.00
5	Construction cost of sewage treatment plant and water reservoir	2.00
6	Providing Rubber fenders and bollards with fixing arrangement	3.00
7	Capital dredging of approach/entrance channel (500m) and inner harbour area	10.00
8	Providing lighting post at the approach of the jetty and one high mast tower at jetty head for lightning purpose	3.00
East side jetty		
9	Upgradation and extension of jetty head of east side jetty including construction of a small shed	6.00

10	Providing rubber fenders, bollards etc and two mooring buoys	4.00
11	Providing solar panel and wind mill including allied infrastructures	12.00
12	Construction of water reservoir and sewage treatment plant	2.00
13	Providing lighting post at the approach of the jetty and two high mast tower at jetty head for lightning purpose	2.00
14	Capital dredging in harbor area	1.00
	Total III	277.00

4. Kadmat Island

Sl. No	Description of item	Amount (Rs. In crores)
West side jetty		
1	Construction of Sea wall and breakwater (1450m long) of West jetty	180.00
2	Other infrastructure like sheds, passenger amenities at West jetty	30.00
3	Extension of west jetty head	15.00
4	Solar panel and wind mill including allied infrastructures	12.00
5	Construction of sewage treatment plant and water reservoir	2.00
6	Rubber fender and bollard with fixing arrangement	3.00
7	Capital dredging of approach/entrance channel (1500m) and inner harbour area	30.00
8	Providing lighting post at the approach of the jetty and one high mast tower at jetty head for lightning purpose	2.00
East side jetty		
9	Construction of Sea wall (400m long)	30.00

10	Other infrastructure like sheds, passenger amenities.	20.00
11	Construction of a new jetty [120m long jetty head and 150 m long approach trestle] including providing all service facilities	100.00
12	Solar panel and wind mill including allied infrastructures	8.00
13	Construction of sewage treatment plant, dumping yard and water reservoir	2.00
14	Capital dredging in harbor area	4.00
15	Providing permanent rubber fenders and bollards	3.00
16	Providing lighting post at the approach of the jetty and two high mast towers at jetty head for lightning purpose	3.00
	Providing Mooring buoys	3.00
	Total IV	447.00

5. Amini Island

Sl. No	Description of item	Amount (Rs. In crores)
West side jetty		
1	Construction of 400m long Sea wall and breakwater (300 m Long and 250 m wide) of West jetty	160.00
2	Construction a two storied passenger sheds along with all passenger amenities at West jetty	30.00
3	Extension of existing jetty head	15.00
4	Solar panel and wind mill including allied infrastructures	12.00

5	Construction of sewage treatment plant and water reservoir	2.00
6	Providing Rubber fenders and bollards with fixing arrangement	3.00
7	Capital dredging of approach channel and inner harbour area	3.00
8	Providing lighting post at the approach of the jetty and one high mast tower at jetty head for lightning purpose	2.00
9	Construction cost of Hover craft landing area and shed	10.00
East side jetty		
10	Construction of Sea wall (400m long) and reclamation	30.00
11	Providing rubber fenders and bollards	3.00
12	Construction a two storied passenger sheds along with all passenger amenities at East jetty and a storage shed	25.00
13	Providing solar panel and wind mill including allied infrastructures	12.00
14	Construction of sewage Treatment Plant and water reservoir	2.00
15	Capital dredging in harbor area	4.00
16	Providing lighting post at the approach of the jetty and two high mast tower at jetty head for lightning purpose	3.00
	Providing 2 nos. mooring buoys	3.00
	Total V	319.00

6. Agatti Island

Sl. No	Description of item	Amount (Rs. In crores)
West side jetty		
1	Construction of Sea wall and breakwater (2350 m Long) of West jetty	235.00
2	Construction of a two storied passenger sheds along with all passenger amenities at West jetty	30.00
3	Extension of existing jetty head total 40m long towards north and north jetty head to 25 m long.	20.00
4	Providing Solar panel and twelve wind mills including allied infrastructures	20.00
5	Construction cost of sewage treatment plant and water reservoir	2.00
6	Providing Rubber fenders and bollards with fixing arrangement	3.00
7	Capital dredging of approach channel and inner harbour area	12.00
8	Providing lighting infrastructure including light post and one high mast tower at jetty head	3.00
9	Construction of Hover Craft landing area of width of 40 m and with a shed of size 33m x 33 m	10.00
East side jetty		
10	Construction of Sea wall (400m long) and reclamation	30.00
11	Providing permanent rubber fenders and bollards	3.00
12	Construction of a two storied passenger sheds along with all passenger amenities at East jetty and a storage shed	25.00

13	Providing solar panel and 4 nos. wind mill including allied infrastructures	12.00
14	Construction of sewage Treatment Plant and water reservoir	2.00
15	Providing lighting infrastructures including light post and four high mast towers	4.00
16	Capital dredging harbor area	4.00
17	Providing two mooring buoys	3.00
	Total VI	418.00

7. Andrott Island

Sl. No	Description of item	Amount (Rs. In crores)
1	Construction of a new part of Break water 550m long and 50m extension of the existing west side breakwater including strengthening	240.00
2	Construction of sea wall 400m long and reclamation	40.00
3	Capital dredging for increasing the depth in the breakwater inside harbor area and approach channel (350m long)	100.00
4	Construction of two new Berths in the inner harbour area including approach road on break water	75.00
6	Construction of Sheds for passenger and for storing of fish and other essential commodities	40.00
9	Providing Solar panel and 12nos. wind mills including allied infrastructures	14.00
10	Construction cost of sewage treatment plant and water reservoir	3.00
11	Providing permanent Rubber fenders and bollards with fixing arrangement	8.00

12	Construction of new foreshore road 500m long	5.00
13	Providing light post at the approach of the jetty and one high mast tower at jetty head for lightning purpose	5.00
14	Construction of Hover Craft landing area of width of 40 m and with a shed of size 33m x 33 m	10.00
	Total VII	540.00

8. Kavarathy Island

Sl. No	Description of item	Amount (Rs. In crores)
West side jetty		
1	Construction of 1570m long breakwater and 1050 m Long sea wall	260.00
2	Construction a two storied passenger sheds along with all passenger amenities at West jetty	30.00
3	Providing Solar panel and wind mill including allied infrastructures	12.00
4	Construction of sewage treatment plant and water reservoir	3.00
5	Providing Rubber fenders and bollards with fixing arrangement	5.00
6	Capital dredging of approach channel (400m long) and inner harbour area	30.00
7	Providing lighting post at the approach of the jetty and one high mast tower at jetty head for lightning purpose	4.00
8	Construction of Hover Craft landing area of width of 40 m and with a shed of size 33m x 33 m	10.00
9	Construction of liquid handling jetty	20.00

East side jetty		
10	Construction of Sea wall (400m long) and reclamation	40.00
11	Providing permanent rubber fenders, bollards etc	4.00
12	Construction of a two storied passenger sheds along with all passenger amenities at East jetty and a storage shed	25.00
13	Providing solar panel and 12 nos. wind mill including allied infrastructures	12.00
14	Construction of sewage Treatment Plant and water reservoir	2.00
15	Providing lighting infrastructures including post at the approach of the jetty and two high mast towers at jetty head for lighting purpose	4.00
16	Providing two mooring buoys	3.00
Total VIII		464.00

9. Kalpeni Island

Sl. No	Description of item	Amount (Rs. In crores)
West side jetty		
1	Construction of 400m long Sea wall and 1000m long breakwater	140.00
2	Construction a two storied passenger sheds along with all passenger amenities at West jetty	30.00
3	Extension of existing jetty head to 50m	15.00
4	Providing Solar panel and wind mill including allied infrastructures	12.00
5	Construction of sewage treatment plant and water reservoir	3.00
6	Providing Rubber fenders and bollards with fixing arrangement	4.00

7	Capital dredging of approach channel (3000m long and 30m wide) and inner harbour area	70.00
8	Providing lighting post at the approach of the jetty and one high mast tower at jetty head for lightning purpose	3.00
9	Construction of Hover Craft landing area of width of 40 m and with a shed of size 33m x 33 m	10.00
10	Construction of liquid handling jetty	10.00
East side jetty		
12	Construction of new part of Break water and strengthening of existing break water	180.00
13	Construction of Sea wall (400m long) and reclamation	40.00
14	Construction of two new wharves and approach road on breakwater	75.00
15	Capital dredging of approach / entrance channel (350m long) and inner harbour area	80.00
16	Providing permanent rubber fenders, bollards etc	6.00
17	Construction of a two storied passenger sheds along with all passenger amenities at East jetty and a storage shed, work shop etc	30.00
18	Providing solar panel and 4 nos. wind mill including allied infrastructures	15.00
19	Construction of sewage Treatment Plant and water reservoir	3.00
20	Providing lighting infrastructures including light post and three high mast towers	5.00
21	Construction of concrete bridge connecting Kalpeni and Cheriyam Islands and tourist huts	300.00
	Total IX	1031.00

GRAND TOTAL (TOTAL I + II + III + IV + V + VI + VII + VIII + IX) = Rs. 4047.00 Crores