

DETAILED DESIGN REPORT

VOL-3

RECONSTRUCTION OF HARBOURS PHASE 2



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RECONSTRUCTION OF HARBOURS-PHASE 2

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1. INTRODUCTION

The detailed design report of following harbours for the project “Reconstruction of harbours-Phase 2” has been submitted by the consultants on 17 July 2014 and 04 Aug 2014.

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- N. Maalhendhoo
- R. Innamaadhoo
- HDH. Nolvivaramfaru
- HDh. Nolvivaram
- M. Kolhufushi
- K. Thulusdhoo
- L. Gan; and
- N. Velidhoo

The design of Gn. Fuvahmulah was on hold at that time with difficulty in conducting the bathymetry of the harbour due to rough weather conditions and also due to non confirmation of scope of works. The detailed design of Gn. Fuvahmulah harbour is presented in this report.

1.1 Objectives

The objectives of **Design of Fishery Harbours** may be stated as follows:

1. Review prevailing situation with respect to fishery infrastructure development, including previous plans for infrastructure development.
2. Develop alternative layouts of fishery harbours with breakwater protection in consultation with stakeholders and the executing agency at the specified location.
3. Based on Coastal Engineering Studies, optimize the technically most feasible harbour layout.
4. Conduct detailed design of marine/coastal structures (breakwaters, revetments, quay walls, etc.) of the finalized harbour layout.
5. Prepare Tender Documents comprising detailed drawings, technical specifications and Bill of Quantities etc.

1.2 Study Approach

The consultants adopted a three pronged approach for these studies.

1. Initially all existing information relating to available facilities, engineering design, socio-economic status, fishery industry and the environment was gathered.
2. This was followed by detailed site visit in which attention was focused on obtaining first hand information of the existing status, potential demand, ground truth measurements and meeting with the stakeholders. The latter was arranged through the client in consultation with the relevant government agencies. The said forums harness the full local knowledge of the fisherman and their views on the development plans. Another important aspect would be the discussion on potential facilities for improved efficiency of operation. Discussions were made with the island community and Client at different levels to finalize the harbour layout. At this discussion attention was focused on development scenarios and associated facilities and the consultants have taken the views of the users on board within an engineering design framework.
3. The master plans were developed including two layout options for each harbour and presented in the conceptual design stage. The options were in the form of different elements to be included in

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the final designs. After obtaining comments from the Client, the most suitable layout for each harbour is confirmed and detailed design of Gn. Fuvahmulah harbour is presented as Vol 3 in this report.

Consultants believe that no numerical modelling is required in the design of Gn. Fuvahmulah Fishery Harbour. Experience and the expertise of the consultants and the analytical methods were used to estimate design wave conditions for the detail designs.

1.3 Review of Available Data

All forms of available data were acquired at the outset of the study. These include the bathymetry, shore profiles and shoreline survey data, tides, currents and waves.

2 PLANNING AND DESIGN OF GN. FUVAHMULAH HARBOUR

The scope of Gn. Fuvahmulah harbour proposed by the Client was renovation to the existing breakwater structure. But, due to priority set forth in stakeholder meeting and Client's interest to limit the cost within the available budget, the final scope of the harbour is limited to repair of steel sheet pile quay wall structure which has been damaged as of now along with maintenance dredging of harbour basin.

Detailed Designs have been carried out for Gn. Fuvahmulah harbour incorporating the above scope and is presented below.

Details of Harbour Structures

(1) Quay wall repairs

The existing harbour at Gn. Fuvahmulah is built with steel sheet piles which were installed without giving any protective coatings. During the site investigation, it was found that the steel sheet piles were corroded and timber fenders were damaged. In order to protect the sheet piles, sandblasting of sheet piles is proposed by the consultants to remove the rusting. Concrete coping is proposed for exposed face of sheet piles from MSL+0 till crest level and underwater painting is proposed from MSL+0 till MSL-4.00m.

(2) Boat Anchoring

Anchoring with mooring hooks at 8m c/c has been proposed for the quay walls for mooring of boats. In addition, bollards at 10m c/c has been proposed for mooring bigger draft vessels along the sheet piles.

(3) Dredging

The bathymetry conducted for the harbour basin revealed that some areas need maintenance dredging which has been included in the scope of works for Gn. Fuvahmulah harbour.

Preparation of Tender Documents

In parallel with the detailed designs, the preparation of tender documents was carried out by the Tender Document Specialist of the study team. The tender documents are prepared in line with IDB Standard Bidding documents guidelines.

3 HARBOUR AT GN. FUVAHMULAH

Fuvahmulah is the largest island of Maldives comprising one island in one Atoll at the southern part of Maldives. Its a famous hub for boats travelling from South to Male' and from Male' to Southern part of the country. The island harbour is noted with very rough wave attacks during the whole year irrespective of seasonal changes in wind pattern. The main economy of the island is fishing.



Fig 3.1: Gnaaviyaani Atoll [Fuvahmulah Island]



Fig 3.2: Existing harbour

Existing harbour:

An existing harbour of size 770ft x 2500ft is present at this island. This harbour is catering for many fishing boats travelling from South to Male' and Male' to southern part of Maldives at present and community is facing problems of congested space inside the harbour.

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The quay walls are composed of steel sheet piles which are found damaged with severe rusting along the exposed face as well as under water areas. The timber fenders are also found damaged. The breakwaters are built with heavy rocks but the community experiences wave overtopping above the existing breakwaters which has been a worrying problem soon after the harbour was constructed. Due to this issue, the community is not able to use around 165m of sheet pile area at South East harbour corner.



Fig 3.3: Existing harbour



Fig 3.4: Damaged timber fenders



Fig 3.5: corroded steel sheet piles



Fig 3.6: corroded steel sheet piles

Proposed harbour:

Considering the fact that only renovation of existing harbour structures is required for Fuvahmulah, Consultants have concentrated in repairs of sheet pile structures as well as the scope of maintenance dredging as advised by the Client. Since the breakwater renovation component would be too costly to include within the available budget of the project, it is kept untouched for the present scope of harbour renovation works.

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The entire length of steel sheet piles was found rusted due to poor maintenance and saline conditions. It would be of prime importance to remove the rusted part from the existing structure to prevent further problems. Sandblasting would be an effective weapon for the purpose and consultants have proposed the same for removal of rust from the existing structure. The entire height of sheet piles [above and below water] would be sandblasted completely to remove the rusts.

The underwater part of the sheet piles would be coated with protected painting to limit further rusting. The exposed face of the sheet piles would be covered with concrete coping so that the sheet pile will be embedded inside the concrete mass and chance of further rusting will be prevented.

Mooring hooks of size 25mm dia will be provided along the sheet piles at 8m c/c distance for mooring local fishing vessels. The bigger draft vessels can be moored at the bollards which are provided at 10m c/c along the sheet piles.

The need of maintenance dredging is studied from the bathymetry of the harbour basin and areas shallower than MSL-4.00m from outer harbour and MSL-3.2m from inner harbour are proposed to be dredged in the estimate.

Following drawings are attached in relation to the new design of Gn. Fuvahmulah harbour.

DWG. NOS	DRAWING TITLES
FM-CI-00	LIST OF DRAWINGS
FM-CI-01	QUAY WALL REPAIRING LAYOUT
FM-CI-02	DREDGING LAYOUT
FM-CI-03	QUAY WALL COPING DETAILS

4 BUDGET AT DETAILED DESIGN STAGE

Detailed estimate of 9 harbours were submitted along with the 'Detailed design report- Vol 2" to MHI. The estimate for Gn. Fuvahmulah is included in this section and the summary is updated for all the 10 harbours.

GN. FUVAHMULAH ISLAND

ITEM REF.	ITEM DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				USD	USD
1.1	Site Clearance				
1.1.1	Site clearance for the harbour works, protection of existing plants, services and utilities and making good the surfaces at the end of the work.	Item	LS	150,000.00	150,000.00
1.1.2	Dismantling the timber fenders and depositing the debris to acceptable locations as directed by the Engineer.	Item	LS	30,000.00	30,000.00
1.2	Dredging harbour basin				
1.2.1	Inclusive of dredging the harbour area to a depth of MSL-3.40m and MSL-4.20 at inner and outer harbours respectively and to the required shape as specified and shown on drawings and depositing the dredged material for reuse for the contract scope and carting away the remaining materials to any acceptable locations as directed by the Engineer.	m3	1,657	12.05	19,966.85
1.3	SHEET PILES				
1.3.1	Sandblasting of steel sheet piles conforming to Sa 2 to Sa 2.5 standard for the exposed areas from MSL-0.20 to crest level as specified and shown on drawings.	m ²	1,855	22.00	40,810.00
1.3.2	Sandblasting of steel sheet piles conforming to Sa 2 to Sa 2.5 standard for the underwater areas from MSL-0.20 to bottom of sheet piles as specified and shown on drawings.	m ²	3,855	38.50	148,417.50
1.3.3	Cast in Situ concrete in sheet piles from MSL-0.20 to MSL+1.80m, to grades, levels and areas as indicated in the drawing including RCC topping, reinforcements, welding the bars to sheet piles, reveals for anchor hooks and finishing the works to smooth finish as specified and shown on drawings	m	379	1,440.00	545,760.00
1.3.4	Cast in Situ concrete in sheet piles from MSL-0.20 to MSL+1.50m, to grades, levels and areas as indicated in the drawing including RCC topping, reinforcements, welding the bars to sheet piles, reveals for anchor hooks and finishing the works to smooth finish as specified and shown on drawings	m	318	2,160.00	686,880.00
1.3.5	Applying corrosion protection underwater epoxy painting[Interzone 954 or equivalent with 500 micron thickness] to sandblasted sheet piles, from MSL-0.20 till bottom of sheet piles including the costs of primer coat[Interseal 670HS or equivalent with 100 micron thickness], final coat and all materials, labour etc complete	m	697	176.00	122,672.00
1.3.6	Supply & fix SS mooring hooks 25mm diameter for Quay Wall at 8m c/c as specified and shown on drawings.	No	86	96.00	8,256.00
1.3.7	Supply & fix 50mm diameter bollards near Quay Wall at 10m c/c as specified and shown on drawings.	No	68	126.00	8,568.00
	TOTAL				1,761,330.35
	Add Preliminaries and contingencies(15%)				264,199.55
TOTAL ESTIMATED BUDGET - USD					2,025,530.00
TOTAL ESTIMATED BUDGET - MRF					31,233,672.60

SUMMARIZED BUDGET MATRIX(REV-02)					
PACKAGE	ITEM	ISLAND	ESTIMATED BUDGET (INDIVIDUAL ISLANDS)	TOTAL BUDGET FOR PACKAGES	REMARKS
Lot 1	1.00	N. Maafaru	2,413,644	9,413,663	
	2.00	N. Maalhendhoo	2,076,715		
	3.00	HDh. Nohivaramfaru	2,925,543		
	4.00	HDh. Nohivaramu	1,997,760		
Lot 2	5.00	N. Velidhoo	2,025,530	5,225,162	
	6.00	R. Innamaadhoo	3,199,632		
Lot 3	7.00	M. Kolhufushi	2,894,816	6,043,880	
	8.00	L. Gan Thundi Avah	3,149,064		
Lot 4	9.00	K. Thulusdhoo	2,824,763	2,824,763	
Lot 5	10.00	Gn. Fuvahmulah	2,025,530	2,025,530	
TOTAL OF 10 ISLANDS RECONSTRUCTION - USD				\$25,532,998	
TOTAL OF 10 ISLANDS RECONSTRUCTION - MVR				MVR 393,718,831	