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Floating Dock Island a Modern Alternative for Regulator Cum Bridge Upstream Recreation

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ABSTRACT:-Tourism enhances nearly all aspects of our society. Apart from that it is important to economic changes, Human socio cultural activities and environmental development. The study was undertaken to improve the tourism possibilities of upstream portion of regulator cum bridges by applying implementable eco-friendly and low cost alternatives at the upstream portion. This paper deals with the design and construction of floating dock island at upstream to improve the tourism possibilities. The design was prepared based on Chamravattom regulator cum bridge upstream portion.

Keywords:- Regulator cum bridge, Prestressed wood lumber, Polyurethane adhesives, Stainless steel wire rope, Anchoring block, Live load, Dead load

I. INTRODUCTION

The regulator cum bridges have numerous positive impacts including prevention of saline water intrusion, Increase in ground water table, Increase in agricultural production and improved transportation and communication facilities. Floating dock island implementation at upstream region will positively contribute the development of the region. Static floating dock islands are simple and economic gears to attract tourists which have proportional impact in the social and economic developments. Prestressed wooden lumber sections, Gallon drums, Polyurethane adhesives and steel ropes are used for the construction of a single structural unit of the floating dock island. Similar units are incorporated together to obtain the whole structure and it is anchored to the river bed using stainless steel wire ropes on stable concrete foundation. Adequate factor of safety is considered to maintain the stability of the structure and to cope up with drastic conditions. Required considerations are adopted from Indian design codes and practices.

II. MATERIALS AND METHODS

Fig 1. Chamravattom Regulator Cum Bridge

The initial step of the design and construction of floating dock island is to construct the single structural dock unit.It is done using barrels, Prestressed wood lumber and stainless steel wire ropes.The lumbar and following materials are used :

4 - 2x8" pressure treated lumber. 8 feet long.
7 - 2x4" pressure treated lumber. 8 feet long.
17 - 1x6" pressure treated lumber. 8 feet long.
4 - 4x4" pressure treated posts. 8 inches long.
4 - 55gallon plastic Barrels
100ft of Wire Rope
16 - Screw in Eye Hooks
10 to 20 - L shape braces
Galvanized screws and Nails
Drill/Screw Driver
Hammer
Silicone Caulking

Structural unit creation is done with the aid of the above illustrated materials as follows:

Laying 2x8 boards out in a square and screw them together. Make sure and keep two sides of the square on the inside of the square effectively making an 8'x8'4" square use the pieces of 4x4" posts in the corners as a right angle. At this point we also ready the barrels. Make sure the plugs are tightened and then apply a layer of silicone caulking over the plug to ensure a good seal and prevent leaking. Now we have the basic shape we need to add supports.Measure out the middle of the square and place a 2x4" support there. The remaining bottom layer pieces are playing two roles. They are supporting the frame as well as holding the barrels against the dock and preventing them from pushing up against the decking. Place two of the boards and lay a barrel on top. Shift the boards around until you get the barrel sitting nicely in between the boards without touching the ground but also fitting nicely around the curve in the barrel. Mark that point, screw them in and do the same to the other side. Now the top layerof supports that run perpendicular to the rest also have two jobs. Then provide the cross support and keep the barrels from moving back and forth while in the water. So once again place barrels on the bottom supports and measure where the barrels end. Place top layer supports here and screw them in.After screwing in the 4x4" post pieces in the corner to solidify the structure we can make things a little more stable with L Braces places at each of the support intersections. This will make sure that everything stays where it is and really tightens up the frame. Now place eye hooks in the bottom layer of supports where your barrels lay. Two on each side the barrel. Lay barrels in their slots and tie them up. Start on one eye hook with a knot and ran rope across the barrel, then diagonally, then across again and tied it off on the last eye hook. After all 4 barrels you are ready to flip.Lay out the 1x4" boards and make sure everything fits nicely. Leave a little spacing between each board. Hammer in the boards along each support. Once we get a few in we can jump on top and finish from there. Hence the single structural unit creation is done.

After creation of this single structural unit the similar units are created as per the design according to the requirements and the single similar units are gathered together using Polyurethane adhesivesto form the entire island structure according to the drawings. Finally the structure is anchored to the river bed using stainless steel wire rope on to the anchoring block designed and constructed on the river bed.

Fig 2.Creation of Single Structural Unit

III. DESIGN RESULT AND DISCUSSION

The design procedure is divided in to five parts and tabulated in the tables below.

Table I .Design of Single Structural Unit

SI.NO	SPECIFICATION	QUANTITY	UNIT	QUANTITY	UNIT
1	weight a single barrel can carry	208	kg	2040.48	N
2	weight four barrels can carry	832	kg	8161.92	N
3	DEDUCTIONS OF DEAD LOADS				
4	weight of single 2x8 Pressure treated wood pannel of 8 feet	15.8757	kg	155.740617	N
5	weight of four 2x8 Pressure treated wood pannel of 8 feet to form framework	63.5028	kg	622.962468	N
6	weight of 2x4 pressure treated wood pannel of 8 feet long	7.71107	kg	75.6455967	N
7	weight of seven 2x4 pressure treated wood pannel of 8 feet long to form structural support	53.97749	kg	529.5191769	N
8	weight of 4x4 block wood at corner	2.26796	kg	22.2486876	N
9	total weight of four 4x4 block wood at corner	9.07184	kg	88.9947504	N
10	weight of single 1x6 pressure treated wood pannel of 8 feet to form base floor	5.8967	kg	57.846627	N
11	total length to be floored	8.4	feet	100.8	inch
12	number of plates required for flooring	16.8	17	plates	
13	total weight of plates for flooring	99.06456	kg	971.8233336	N
14	missalanious weight	10	kg		
15	total weight of structural unit	235.61669	kg	2311.399729	N
16	percentage of submergence	28.3193137	%		
17	maximum weight after deductions the structural unit can carry	596.38331	kg	5850.520271	N
18	safe weight carried can be taken as weight for partial submergance	416	kg		
19	weight can be included as extra for partial submergence	180.38331	kg	1769.560271	N
20	TOTAL WEIGHT CARRYING CAPACITY OF SINGLE STRUCTURAL UNIT	180.3833	kg	1769.560173	N

Table 2. Design of Number of Structural Units

SI.NO	SPECIFICATION	QUANTITY	UNIT
1	length of approach walkway	25.6	m
2	length of main walkway	97.52	m
3	number of main walkway	2	
4	number of approach walkway	4	
5	total walkway required	297.44	m
6	bredth of one unit	2.56	m
7	length of one unit	2.438	m
8	number of units needed for walkway main line	80	
9	number of units needed for walkway approach line	40	
10	area required for recreation island	224.68608	m2
11	number of islands	2	
12	number of units needed for single recreation island	36	
13	number of units needed for total recreation island	72	
14	area required for food court island	187.2384	m2
15	number of units needed for food court island	30	
16	TOTAL NUMBER OF STRUCTURAL UNITS REQUIRED FOR THE CONSTRUCTION	222	Units

Table 3.Estimation of Items

SI.NO	SPECIFICATION	QUANTITY	UNIT
1	number of barrels of 55 gallon	888	
2	number of 2x8 Pressure treated wood pannel of 8 feet	888	
3	number of 2x4 pressure treated wood pannel of 8 feet	1554	

4	number of 4x4 block wood at corner	888	
5	number of single 1x6 pressure treated wood pannel of 8 feet to form base floor	3774	
6	total rope required for one unit	4.576	M
7	total rope required	1015.872	M

Table 4. Deduction of Live Loads and Determination of Occupancy of Structure

SI.NO	SPECIFICATION	QUANTITY	UNIT	QUANTITY	UNIT
1	weight of artifitial flower pot and rubber plant	1.2	kg	11.772	N
2	number of flower pots and rubber plant units	63			
3	total weight of artifitial flower pot and rubber plant	75.6	kg	741.636	N
4	weight of sofa round back two piece	65	kg	637.65	N
5	weight of sofa round back three piece	90	kg	882.9	N
6	number of sofa round back two piece	10			
7	number of sofa round back three piece	4			
8	total weight of sofa round back two piece	650	kg	6376.5	N
9	total weight of sofa round back three piece	360	kg	3531.6	N
10	weight of rocking chair	45	kg	441.45	N
11	number of rocking chair	3			
12	total weight of rocking chair	135	kg	1324.35	N
13	weight of dining table	30	kg	294.3	N
14	number of dining table	8			
15	weight of dining chairs	6	kg	58.86	N
16	number of dining chairs	48			
17	total weight of dining units	528	kg	5179.68	N
18	weight of ceramic sink	20	kg	196.2	N
19	number of ceramic sink	6			
20	total weight of ceramic sink	120	kg	1177.2	N
21	weight of piano	140	kg	1373.4	N
22	weight of sump and pump	150	kg	1471.5	N
23	weight of lamp table and lamp	5	kg	49.05	N
24	number of lamp table and lamp	80			
25	total weight of lamp table and lamp	400	kg	3924	N
26	TOTAL IMPOSED LIVE LOAD	2558.6	kg	25099.866	N
27	TOTAL LOAD CARRYING CAPACITY OF STRUCTURE FORMED BY INTERLINKING 222 UNITS	40045.0926	kg	392842.3584	N
28	LOAD CARRYING CAPACITY OF STRUCTURE AFTER DEDUCTION OF IMPOSED LIVE LOADS	37486.4926	kg	367742.4924	N
29	average weight of a single men in kerala is assumed as	80	kg	784.8	N
30	TOTAL OCCUPANCY OF STRUCTURE	468.5811575			

The occupancy result obtained is 468 people at a time for safety consideration and to meet drastic conditions, Half the occupancy of obtained value is considered, Hence the design occupancy is 234 people at a time.

Load concentration on single structural unit should be avoided for that unidirectional movement is only permitted in the walkway. Thus one walkway can be considered as entry walkway and the other one as exit walkway.

Table 5. Design of Anchoring Block and Anchoring Stainless Steel Wire Rope

SI.NO	SPECIFICATION	QUANTITY	UNIT	QUANTITY	UNIT
1	Weight of occupants	18800	kg	184428	N
2	weight of single structural unit	235.6167	kg	2311.399827	N
3	weight of 222 structural units	52306.9074	kg	513130.7616	N
4	imposed weight of items	2558.6	kg	25099.866	N
5	total weight acting on buoyant barrels(structure)	73665.5074	kg	722658.6276	N
6	weight of anchoring block should be double the total weight acting on boyant barrels (structure)	147331.0148	kg	1445317.255	N
7	unit weight of concrete	2406.53	kg/m3		
8	total volume of single block required	61.22134974	m3	64	m3
9	length	4	m		
10	bredth	4	m		
11	height	4	m		
12	total weight of buoyant structure	73665.51	kg	722658.6531	N
13	grade 316 stainless steel wire rope 1x19 of 26 mm diameter is used				
14	maximum safe load	398000	N		
15	maximum carrying capacity	40585	kg/m		
16	minimum length of steel cable required	1.815092029			

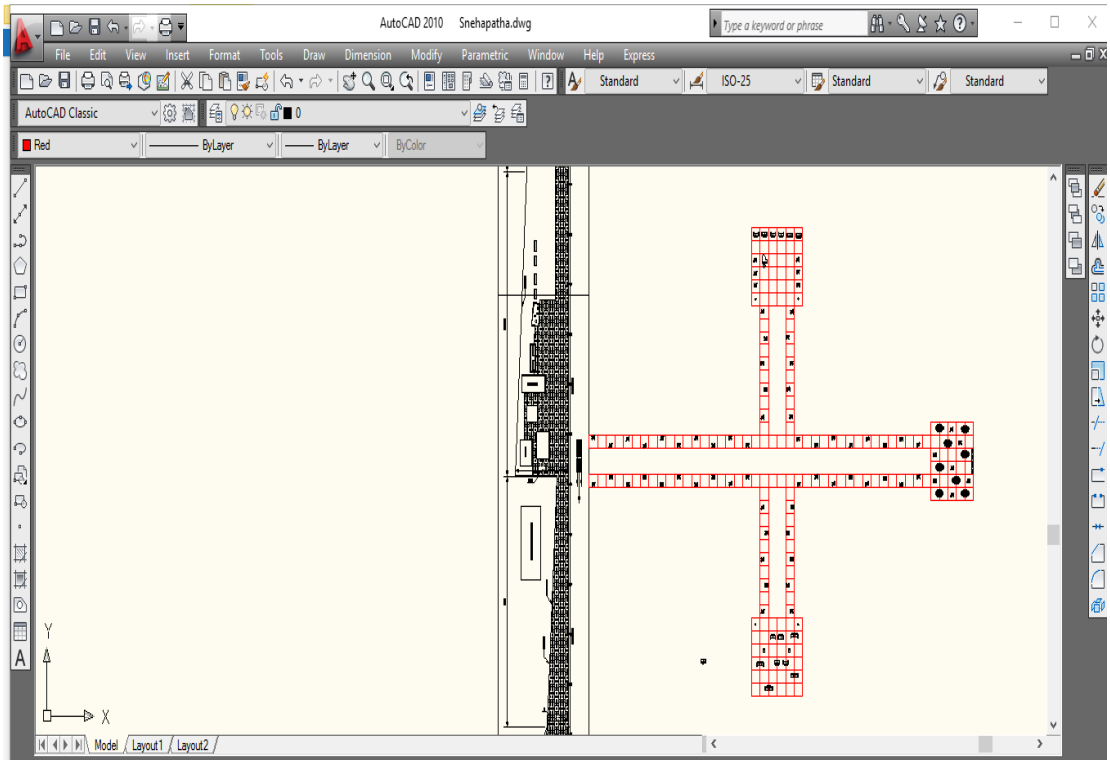

Fig 3. Auto Cad Drawing of the floating dock island

IV. CONCLUSIONS

The study leads to find innovative ideas to creatively utilize the upstream region of regulator cum bridges. The effective utilization of the static water body conveniently promote the tourism possibilities and in turn the economy of the locality.Adoption of floating dock islands enhance the effective utilization of static water. The design of the island is accomplished in an ecofriendly way and the floating structure provide the sunlight passage to the water body effectively due to the type of design.Hence the structure will not hamper the aquatic ecosystem. Required amount of factor of safety is adopted time to time through each steps thus the structure have sufficient serviceability to withstand in the drastic conditions and eccentric loadings too.

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