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ANALYSIS AND DESIGN OF PILE JETTY

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Abstract : *Jetties are lifeline structures as they provide a cost effective method for transporting large quantities of goods and raw materials. Pile Jetty structures are generally located in deep sea. Generally structures are subjected to dead load, live load, wind load, earthquake load and temperature load while Jetties are subjected to additional marine loads like current load, wave load, berthing load and mooring load. This additional forces are complex in nature and hence the understanding of the forces is of importance.*
This paper is focused towards the calculation of various forces acting on jetty structure by using Piles and its application.
To overcome the complication of jetty pile design process, artificial neural networks (ANN) are adopted. To generate the training samples for training ANN, finite element (FE) analysis was performed 50 times for 50 different design cases.
Keywords –*Berthing, Fender System, Fixity Calculation, Jetty, Mooring*

I. INTRODUCTION

A jetty is a structure that projected from land into water, the term derived from the French word jetee 'thrown', signifying something thrown out. Jetty is one of the varieties of engineering structures connected with river, harbour and coastal work designed to influence the current or tide or to protect a harbour or beam from waves. It is a narrow man made structure that projects from short line into the water. It is fixed in positions with piles and is commonly made by wood and concrete. Their purpose is to offer docking the boats and ships.

II. OBJECTIVE

1. To learn different loading combinations on the jetty structure.
2. To analyse the deck slab.
3. To design different components of jetty.
4. To design the deck slab.
5. Urban island travel tourism and connectivity for public business.

III. METHODOLOGY

A. LOCATION

ARNALA

The site chosen for the project is Arnala Fort island, Virar.
Co-ordinates: 19.4646875, 72.730405

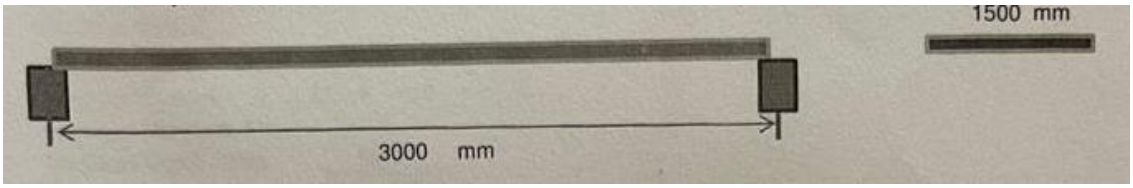
B. COMPONENT DETAILS

1. PILE

- Pile Diameter, D 1.000m
- C/S Area of Pile 0.785m^2
- Cut-off level of pile 2m
- Elastic Modulus of Pile,E (as per IS 456) 31622777 Kn/m^2
- Moment of inertia of pile, I 0.049 m^4
- Grade of Concrete M40

2. SLAB

Simply supported span	3000mm
Width of the precast slab panel	1500mm
Depth of the precast slab panel	150mm
Density of RC Concrete	25 Kn/m^2



C. Load Combinations

- Limit State Design

Limit State Design principles are used for the design of reinforced concrete elements in the jetty structures. The load combinations for such design are based on IS 4651 guidelines.
The methods used are Limit state of serviceability and collapse respectively.
The loads acting on the structure are:

i. Dead Load
ii. Imposed Loads
iii. Live Load
iv. Wave and Current
v. Berthing Load/Mooring load
vi. Wind Load
vii. Seismic Load

IV. DESIGN

The water depth of proposed jetty location is approximately 4.16m. The size of jetty is 120m. The jetty is supposed to be supported on bored cast-in-situ RC piles .The diameter of piles are 1000m. the jetty consists of concrete decks on a piled structure. Precast pile capping beams of 1200mmx700mm are supposed to be placed on top of the pile. The size of the deck slab is supposed to be 150+100mm thickess (precast+cast-in-situ).
The design data are extracted from relevant indian and international code standards as well as engineering practices.

If execution of piles in hard soil takes too long compared to the rest of the tasks, a temporary jetty can be erected alongside the permanent jetty to allow safe and permanent access to the works along the full length.
Some merits include:

- Safer working conditions with limited contact with the sea water.
- No marine equipment required
- Faster execution of works with very reduced weather downtime for rough sea conditions.
- Execution of the concrete works onshore in excellent conditions ensuring the best quality of works.

Dead loads will be calculated using the structural member sizes. The superimposed dead loads such as wearing coat, hand rails etc will be calculated manually and applied at appropriate location. The design live load on the jetty will be assumed to be 1.0 t/m^2 and the approach is designed for 3 lanes of traffic as per IRC.
Seismic load is for the maximum considered earthquake. Wind loads will be calculated on the total blockage area. Wind pressure is determined as per is 875 Part 3, 1987. Mooring force acts on account of current and wind. Current is of very small magnitude. Hence, mooring force will be worked out on the basis of wind force. Wind force as per IS 875.
These loads will be applied to the joints at appropriate locations in longitudinal and transverse directions.

V. RESULT

1. Precast Panel 150mm thk
   Bottom Reinforcements
   Main r/f T 12mm
   Distribution r/f T 10mm

2. Overall Beam
   Bottom Reinforcements

Main r/f	T	12mm
Distribution r/f	T	10mm

3. Shear Reinforcements
   Stirrups of T 8mm , 2 legged @ 300mm c/c (in precast slab)

REFERENCES

[1] "An experimental study of impact loading on deck of shore-connecting jetties exposed to oblique waves and current" by MENG Yan-qui, CHEN Guo-ping,
[2] and YAN shi-chan, Journal of Hydrodynamics 26(2):216-225, Year-2014.
[3] "Performance of harbour structures in Andaman Islands during 2004 Sumatra earthquake" by Goutam Mondal & Durgesh C. Rai, Journal of Engineering
[4] Structures, Vol: 30, (174–182), Year-2008.
[5] "Wave-in-deck loads on exposed Jetties" by Giovanni Cuomo, Matteo Tirindelli & William Allsop, Journal of Coastal Engineering, Vol: 54, (657–679),
[6] Year-2008.
[7] "Numerical investigation of the effect of vertical load on the lateral response of piles" by S. Karthigeyan, V. V. G. S. T. Ramakrishna and K. Rajagopal,
[8] Published in ASCE. 1 May, 2007.
[9] "Load tests on tubular piles in coralline strata" by James M. Gilchrist, Published in ASCE. 5 May, 1985.
[10] "Dynamic response of a near-shore pile to lateral impact load" by Francesca Dezi, Fabrizio Gara and Davide Roia, Journal of Soil Dynamics and
[11] Earthquake Engineering, Vol. 40 (34–47), Year-2014.
[12] M.J. Tomlinson. "Pile Design and Construction Practice., fourth edition", 1994.
[13] [8] ALONZO Def. QUINN. "Design and Construction of Ports and Marine Structure" McGraw Hill Book Company, New York, 1st edition, 1961.
[14] Swami Saran. "Analysis and Design of Substructures" Taylor and Francis Group, London, second edition," 2006.
[15] R. Srinivasan. "Harbour Dock and Tunnel Engineering" Charotar Publishing House, Anand, Gujarat.
[16] R. M. Sorensen. "Basic Coastal Engineering" Third Edition, Springer Science & Business Media, Inc.
[17] PIANC (International navigation association) "Guideline for design of fender system: 2002"
[18] U.S. Army Coastal Engineering Research Center "Shore Protection Manual-volume2"
[19] IS : 4651-1974, "Part-I Site Investigation" Code of Practice for Planning and Design of Ports and Harbours.