DESIGN AND ANALYSIS OF APPROACH TRESTLE

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Abstract

The present research work examines the operational efficiency of select major ports in in india over the period of time 1993 to 2011 through data envelopment analysis. Hypothesis tested in this study is, size does not determine port efficiency. Based on the results it is found that both bigger ports i.e. Mormugao, Jawaharlal Nehru port Trust and smaller ports Ennore, Tuticorin were proved have efficient port operations all through. Through the result of super-efficient analysis, the study found that JNPT port rated as number one super-efficiency port among the selected major ports in india. Trestle works creating a hierarchical categorization tree that can be used to predict missing attribute values and cluster sets of examples into conceptually meaningful groups. New categorization model is competitive with non-incremental approaches and more closely approximate human performance.

Keywords: Major ports in india, Data Envelopment Analysis, Operational efficiency, Super efficiency model.

1.INTRODUCTION

A Trestle bridge is a bridge composed of a number of short spans supported by such frames. Since this type of bridge is sometimes called a "trestle" for short, each supporting frame is generally referred to as a bent. Steel and sometimes concrete trestles are commonly used to bridge in particularly deep valleys. In this regard, we are proposed to construct a 72m of concrete approach trestle.The location of proposed Heliport and Approach trestle are shown in figure 1.1.

Fig 1. Location of Approach Trestle.

1.1 NEED FOR THE STUDY

The project focuses on meeting of traffic controlled and transporting the loading and unloading the materials. The aim of study is to measuring the operational performance of selected major ports in india. This analysis is closely related whether size influencing operational efficiency of selected major port. The study is entirely based on secondary data which are collected from the port authorities. The analysis is closely relates to size and the efficiency of ports with the close input variable from land, labour and equipments.

General understanding of a bridge's reaction to the expected loads rather then any idealized loading Through numerous case studies and observed results, load testing has become an established method to evaluate a bridge's actual performance. such as container terminal firms are becoming footloose, and are therefore no more tied to their "homeport". We can see Asian firms that are taking over port operations in Europe and elsewhere in the world.

The design of approach trestle bridge provides safe and sustainable crossings and provides technical assistance to easily applied and construction of effective water crossings.

2. MATERIALS

- M40 grade Concrete
- Fe500 Steel

2.1 M40 grade Concrete

The main aim of this project is to provide the general mix design for any grade of concrete, so that, this project contains the mix design for M40 grade of concrete, as per IS 10262:2009.

In this project, general mix proportion is providing us the general procedure for nay grade of concrete. In the field of construction, concrete is the main material made up of different type of materials. The concrete is of different grades and each grade of concrete is useful for different properties and place. Generally these are two type of concrete,

1. By designing the concrete mix, concrete is called as Design Mix Concrete.

2. By adopting the concrete mix, concrete is called as Nominal Mix Concrete.

From the above two type of concrete, design mix concrete procedure is applied in this project. The mix design procedure shall be selected to ensure the workability of fresh concrete. As per IS 456:2000, several information should be provided for design mix concrete.

2.2 Fe500 Steel:

TMT bars are backbone of every civil construction deep rooted into foundation they bear the load of building, slabs, beams, columns and of course the live load of the people and their belongings. And as the strength of every structure,the TMT bars have to be ready to withstand the loads including windstorms and earthquake.Poor quality materials such as cheap steel bars usually contain high levels of unknown elements which are harmful for construction. This means that the steel bars do not have required chemical and physical properties. Now customer is alert and due to higher level education and better purchasing power, They need better quality of product and prepare to pay for it. TMT steel bars are steel bars that are manufactured with unique metallurgical process known as “Thermo Mechanical Treatment”. These TMT bars are approved by the Bureau of Indian Standards for building and construction projects. The Fe 500 and Fe 500D are some of the better quality TMT steel bars that are available in the market today.

3. METHODOLOGY

3.1 BASIS OF DESIGN

The design data summarised in this report are extracted from references provided by codes and standards as required.

3.2 Design Life

The permanent works shall be designed and constructed to give a design life of 50 years.

3.3 Seismic Data

The following parameters for seismic design according to IS 1893 (2002) shall be considered. Chennai falls in Zone III as per the earthquake zoning specified in Indian Standard.

Zone Factor	=	0.16
Importance Factor	=	1.50
Response Reduction factor	=	3.00

Based on the above, the calculated seismic coefficient in horizontal direction is 0.04.

3.4 Environmental Data

3.4.1 Water Depth

The water depth consider for the following structures are given in table 3.1.

Table 3.1 Water Depth

Description	Water Depth in (m)
Approach Trestle	10.60

3.4.2 Wind Speed

The basic wind speed to be used in the design is summarized in Table 3.2.

Table 3.2 Wind Speed

Description	Wind Speed (m/sec) for design of structures
Wind Speed	50

3.4.3 Wave data

Offshore wave propagation study has been carried out to determine 100 year wave conditions at the proposed site. The wave simulation study for heliport is attached in appendix A. The wave height and period to be used in the calculation of the wave induced loads for all structures is given in Table 3.3.

Table 3.3 100 year extreme Wave Data

Description	Design Wave Height (m)	Wave Period (Sec)
Approach Trestle	0.6	9

3.4.4 Hydrodynamic coefficients

Hydrodynamic coefficients for wave and current load estimation are given below.

Cd = 0.7 and Cm = 2.0 for clean piles.

3.4.5 Current data

Current speeds during spring tidal conditions and neap tidal conditions are given in Table 3.4.

Table 3.4 Current Data

Condition	Current (m/sec)	Direction (deg)
Spring tide	1.00	90

3.5 Concrete Design Data

3.5.1 Concrete Grade

Concrete grade shall be M40 with minimum 28 day strength as 40 MPa for reinforced concrete piles, precast beams, and precast and in-situ slab.

3.5.2 Reinforcement

The reinforcement shall be corrosion resistant high strength deformed bars with grade Fe500 for Super Structures and Sub Structures conforming to IS 456 – 2000 and IS 13920-2000. The minimum yield strength shall be 500 N/mm^2 for Sub Structures and Super Structure.

3.5.3 Concrete Cover

Following clear cover to all reinforcement is used in the design.

Piles = 75mm.
Beam = 75mm bottom, 75mm top and 75mm sides.
Slab = 50mm bottom, 50mm top.

3.5.4 Crack Control

The maximum crack width limited to 0.30 for piles, beam and slab. Reinforced concrete design calculations will be carried out in accordance with IS 4651guidelines (0.004 times the clear cover to main reinforcement).

3.5.5 Concrete Design

Concrete design has been carried out in accordance with IS 456-2000 and IS 1893-2000 for reinforced concrete.

3.5.6 Development Length

Development length of 42 times diameter of the bar is considered in the design.

3.6 Allowable Deflection

- Maximum lateral displacement of substructure shall be limited to H/300 where H is the length of pile from deck of superstructure to depth of fixity.
- Deflection of slab shall be limited to Span / 200.
- Deflection of Structural member shall be limited to Span / 250.

4. DESIGN

4.1 PILE DESIGN

The Approach trestle pile has been designed by extracting the loads from the structural analysis. The design forces and moments for 1200mm pile is summarised in Table below 4.1

Table 4.1 Pile design Forces (Factored) – 1200 mm Φ

No.	Case	Dia (mm)	Axial force (kN)	Moment, My (kNm)	Moment, Mz (kNm)	Max Shear (kN)
1.	Max Axial	1200	**2846**	416	33	38
2.	Max My	1200	975	**1481**	9.3	83
3.	Max Mz	1200	1580	15.3	**1546**	120

4.2 BEAM DESIGN

4.2.1 LONGITUDINAL BEAM AND PILE CAPPING BEAM:

The extracted moment and shear force values from global analysis for all the beams are summarised in Table 3.9.1 and design forces are tabulated in table 3.9.2

Table 3.9.1 Beam Forces summary

S.No	Members	Dimensions		Result Form Analysis		
		Width (mm)	Depth (mm)	Sagging (kNm)	Hogging (kNm)	Shear Kn
A. Pre Cast Beam						
1	Longitudinal Beam	600	1200	1000	1683	520
B. RC Beam						
2	Pile Capping Beam	1200	1200	1194	1211	786

Table 3.9.2 Beam design summary

S.No	Description	Size (m)	No of bars provided		% of reinforcement provided	Crack width (mm)
			Top	Bottom		
A. Precast Beam						
1	Longitudinal Beam	0.6 x1.2	14 x 25Φ	07 x 25Φ	1.039	0.3
B. RC Cross Beam						
2	Pile Capping Beam	1.2 x1.2	24 x 28Φ	12 x 28Φ	1.119	0.098

5. STAAD PRO ANANYSIS

5.1. STAAD PRO ANANYSIS 2D VIEW

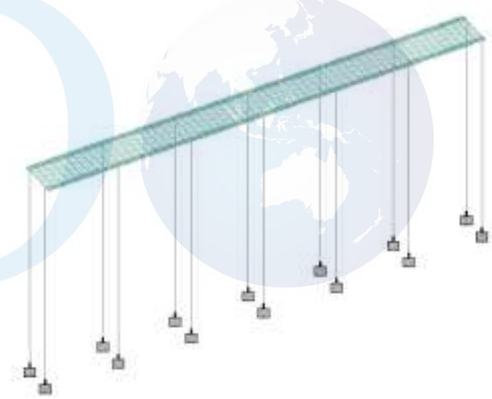

Fig 5.1. 2D view

5.2. 3D VIEW

Fig.5.2. 3D view

5.3. DISPLACEMENT OF THE STRUCTURE

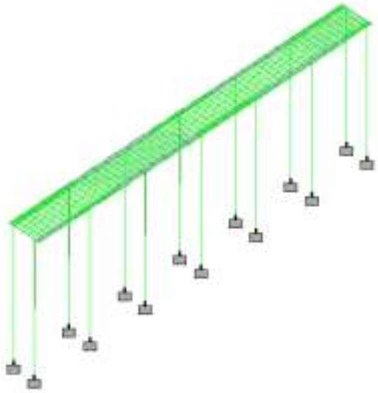

Fig 5.3. Displacement of the structure

5.4. BENDING MOMENT OF THE STRUCTURE X

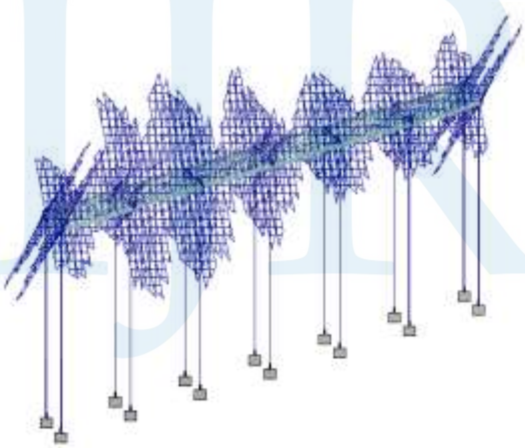

Fig 5.4. Bending moment in x

5.5. BENDING MOMENT OF THE STRUCTURE Y

Fig 5.5. Bending moment in y

5.6. BENDING MOMENT OF THE STRUCTURE Z

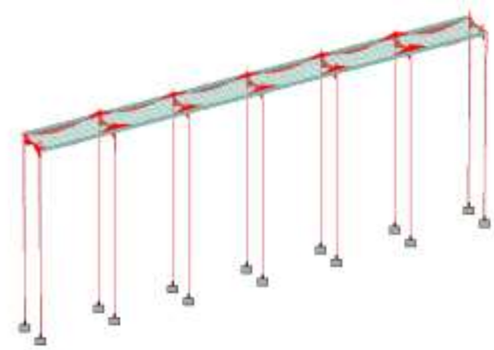

Fig 5.5. Bending moment in z

5.7 SHEAR FORCE OF THE STRUCTURE

Fig 5.7. Shear force

CONCLUSION

Following recommendations are made based on the review of the documents and drawings provided.Approach Trestle.The super structures are found to be safe. The Approach trestle piles are found to be safe.The typical bent having maximum IR Value and Crack width are **0.879** and **0.193** respectively.The bridge has been used for reduce the traffic. It also used for loading and unloading materials from ships. It can also be used for transporting oil through pipe line

REFERENCE

1. Byers et al, " combination of static and dynamic tests",1996.

2. D. Olivier et al, "Port operating firms",2005.

3. D. Olivier et al , " Terminal port of bridge", 2007.

4. Doyle et al, "Timber trestle railroad bridges",2000.

5. Durkee et al, "Railroad box girder bridge", 1972.

6. Gohler et al, "Post-tensioned concrete box girder bridges",2000.

7. Marzouk et al, "Design of precast structure", 2007.

8. McLaughlin et al, "Construction of approach bridge", 2005.

9.Notteboom et al ,"Approach trestle of construction", 2005.

10.Notteboom et al, "Loads of designs" , 2009.

11. Pallis et al ,"Improve the design of port bridge", 2008.

12. Podolny et al," Modern approach bridge",1982.

13.Poulovassilis et al, "Loading system of port", 2013.

14.Shahawy et al, "construction of bridge", 1995.

15.Stopford et al," Design of port", 2009.