Jetty Construction

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Abstract- *jetties are life line structures as they provide a cost effective method for transporting large quantities of goods and raw materials. Generally structures are subjected to dead load , live load , wind load , earthquake 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 and design of jetty.

Keywords- jetty, berthing , mooring ,seismic , current .

I. INTRODUCTION

A jetty is a life line structure as they provide a cost effective method for transporting large quantities of goods and raw materials in and out of a region. These structures also play a significant role in the transportation system in terms of evacuation of people before and after natural disaster . Jetty structure are generally located in deep sea. To achieve this depth and to have a economic structure , it is prefered to have a pile supported structure . In india bored cast in-situ pile are commonly used where berth are located near shore. Jetty to be constructed at **belapur** creek.

METHODOLOGY

A jetty can be desined by referring **is** code:4651-part 3 and **is** 875-1987 part 3,
seismic force from **is** 1893-2002 part 1 and the structure is design by staad-pro.

CALCULATION:

I. WIND FORCE

According to is 875-1987 part 3:
Wind force pressure given by ,

$$PZ = 0.6 \times Vz^2$$

Where vz = vb×k1×k2×k3
Vz = design wind speed at any height in m/s
vb = basic wind speed at any height in m/s
K1 = probability factor (risk coefficient)
K2 = terrain height and structure size factor
K3 = topographic factor

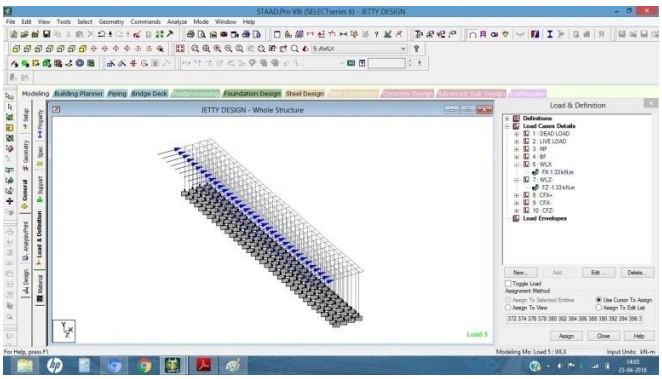

Fig 1.1 application of wind load in x direction.

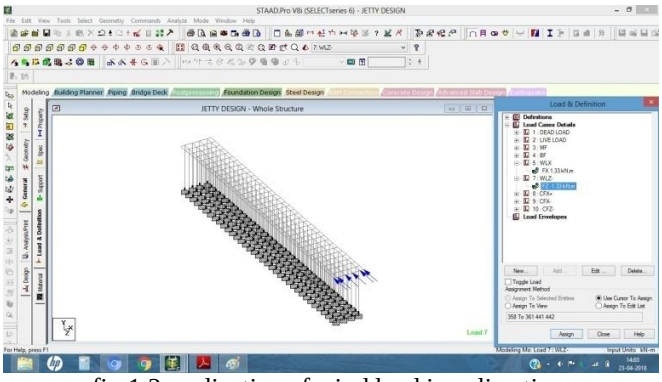

fig 1.2 application of wind load in z direction.

II. SEISMIC FORCE

In areas susceptible to seismic disturbance horizontal force equal to a fraction of the acceleration of gravity times the weight applied as its centre of gravity should be taken. The fraction will be depend upon the likely seismic intensity of the area, and shall be taken in accordance with is: 1893-2002. The weight to be used is the total dead load plus one half of the live load.

The seismic force particularly base shear (vb) is obtained by following expression

Vb= ah×w
Where

$$A_h = \frac{Z}{2} \times \frac{I}{R} \times \frac{S_a}{g}$$

Where,
Z= zone factor = 0.36
I= importance factor = 1.75
R= response reduction factor = 3
Sa/g= spectral acceleration coefficient

Earthquake force acting over jetty structure is calculated from above expression.

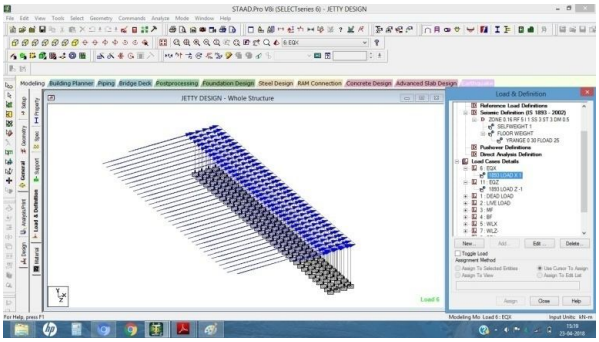

FIG 2.1 APPLICATION OF EARTHQUAKE LOAD IN X DIRECTION.

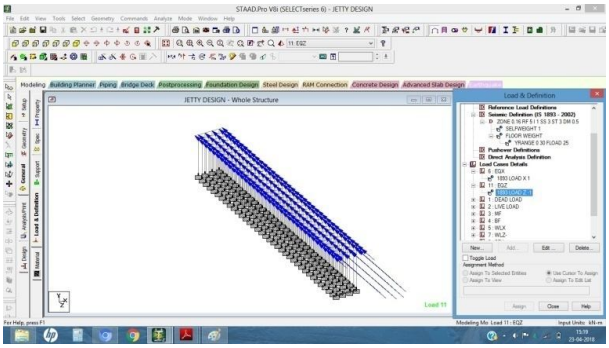

FIG 2.2 APPLICATION OF EARTHQUAKE LOAD IN Z DIRECTION.

III. LIVE LOAD

ACCORDING TO IS 4651 PART 3
TABLE 1

FUNCTION OF BERTH	TRUCK LOADING	UNIFORM VERTICAL LIVE LOAD T/M^2
PASENGER BERTH	B	1
BULK UNLOADING	A	1-1.5
CONTAINER BERTH	A OR AA OR 70R	3—5
CARGO BERTH	A OR AA OR 70R	2.5-3.5
HEAVY CARGO BERTH	A OR AA OR 70R	5 OR MORE
SMALL BOAT BERTH	B	0-5
FISHING BERTH	B	1

Selecting cargo berth = 2.5-3.5 T/M^2
Therefore, vertical live load= $3T/M^2$
Live load =30 kn/M^2

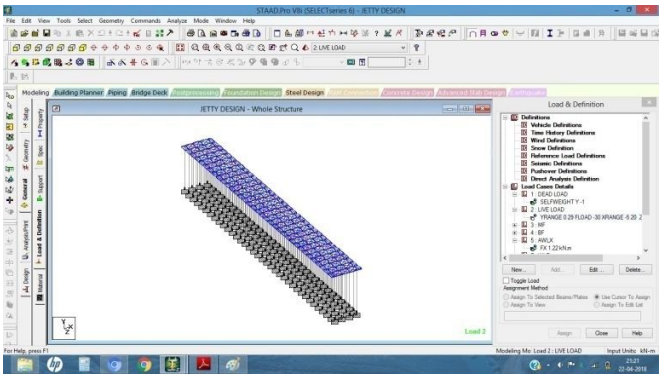

FIG 3 APPLICATION OF LIVE LOAD.

IV. DEAD LOAD

The dead loads shall be assessed considering following unit of materials.

Plain concrete : $24 KN/M^3$
Reinforced concrete : $25 KN/M^3$

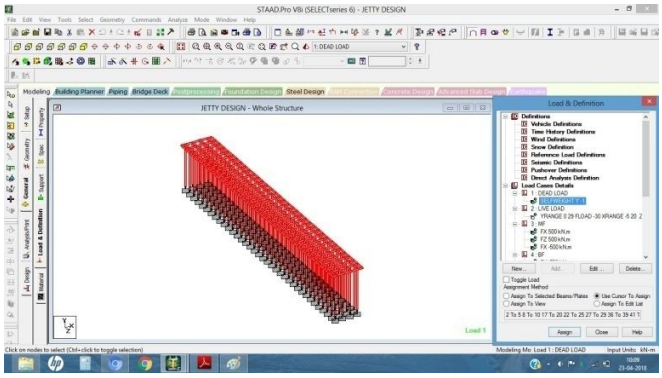

FIG4 APPLICATION OF DEAD LOAD.

The dead load coming on the berthing structure is mainly due to the self weight of the members including slabs,beam,piles,pile cap,fender block etc . This type of load is calculated by assuming initial member sizes and then the total load is calculated and the adequacy of the member size is checked after analysis. In staad.pro modelling,floor load is defined separately,while member load is directly defined as self weight as shown in fig(4)

V. MOORING FORCE

From is code 4651 part 3{ clause 3.2,a-4 }
Selecting mixed cargo freights,

GRT (T)	DWT (T)	DT (T)	OL (M)	LBP (M)	W (M)	DRAUGHT (M)
2000	3000	4000	95	90	13	6

Therefore ,from is 4651,table 4.
Therefore for 4000dt,
Bollard pull or line pull = 15t
Therefore, mooring force = 150kn.

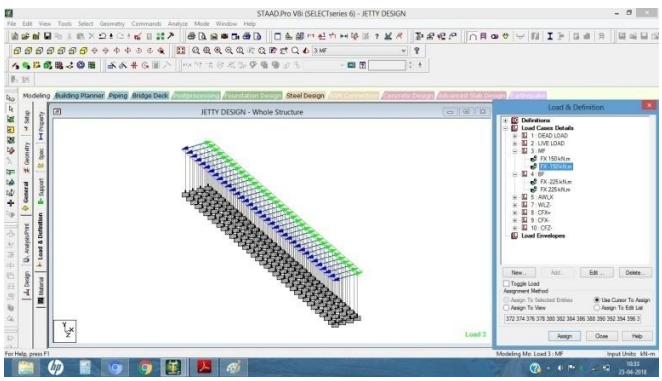

Fig 5.1 application of mooring force from one side.

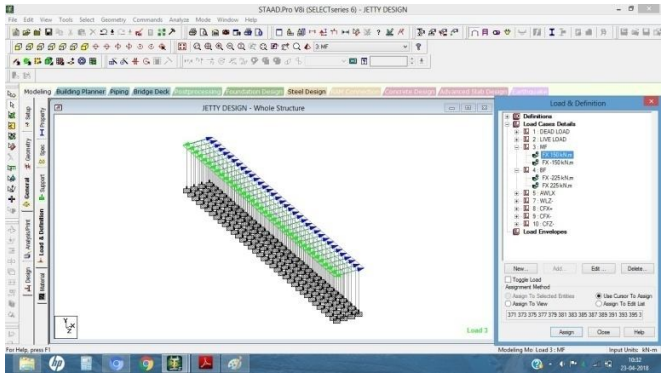

Fig 5.2 appilication of mooring force from other side.

VI. BERTHING FORCE

Berthing fo0rce shall be considered as $\frac{3}{2}\times$ mooring force.

Berthing force $= \frac{3}{2} \times 150$

$= 225$kn.

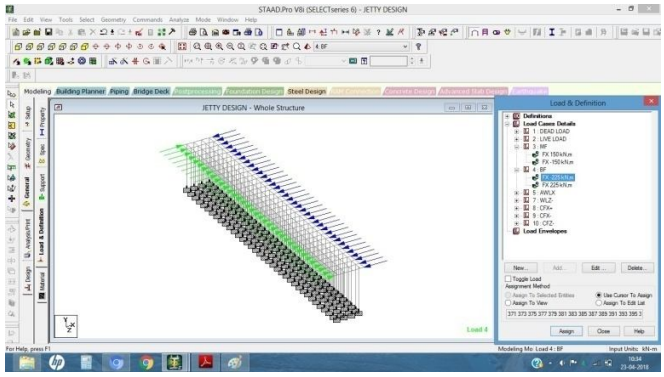

Fig 6.1 application of berthing force on one side

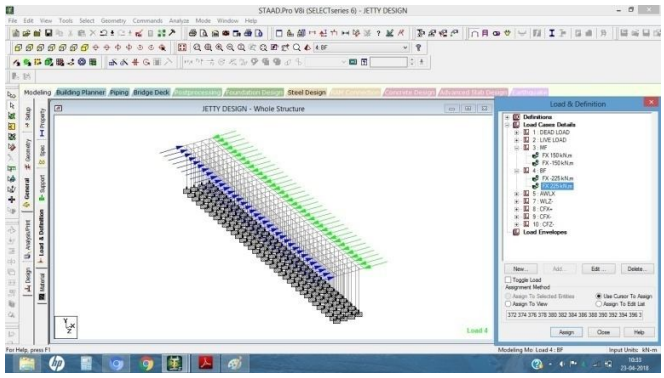

Fig 6.2 application of berthing force on other side.

VII. FORCE DUE TO CURRENT

According to is 4651 part 3.

$F_c = \frac{WV^2}{2g}$ per square metre of area.

Where,

w = unit weight of water in $\frac{TONS}{M^3}$

v = velocity in m/s.

Also w = 1.03 $\frac{T}{M^3}$ for sea water.

Therefore, F_C = 0.21 kn/m.

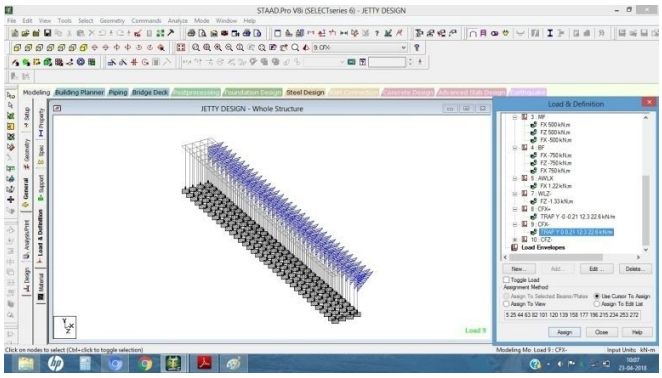

Fig 7.1 application of current load in x direction

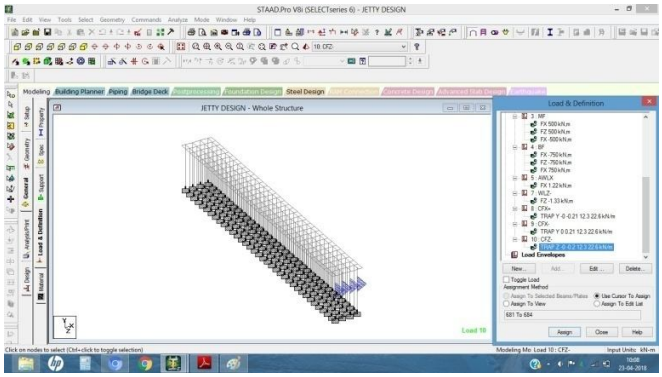

Fig 7.2 application of current load in z direction.

VIII. CONCLUSION

The forces considered had been calculated as per is codes .we have concluded with the design of jetty by using staad-pro . The jetty as to be constructed at belapur creek.

IX. RESULT

Using staad-pro we have succesfully designed jetty.the jetty as been mainly designed for heavy caro loading .various type of forces had considered so that te structure can withstand the severe coniditions.

Size of jetty 175m × 25m.
Fender will be provided at every 5 m.

REFERENCE

[1] Is 1893(part 1):2002 indian standard criteria for eartquake resistant design of structures.
[2] is 875(part 3) :1987 wind load on building and structures.
[3] is 4651 (part 3): 1974 indian standard code of practice for planning and design of ports and harbour s.
[4] is 456:2000 plain and reinforced concrete – code of practice.