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PLANNING AND DESIGING OF FLOATING STRUCTURE

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ABSTRACT

Floating structures are an option for usage in offshore construction methods. Expensive structures like airports, wind turbines, and oil rigs are often constructed at sea.

We intended to employ this principle when we built a luxury apartment community in another country primarily for housing and recreational purposes. Pile foundations, gravity bases, caissons, and floating types are all viable options for usage in the ocean. Since the floating kind has a less ecological footprint and costs less, we prefer it. The water-elastic characteristics of the material were considered throughout design, as was the possibility of large-scale floating constructions. Tight cables tether this submersible construction chamber to a mass anchor anywhere from 60 to 180 meters deep. Such a tall building could be constructed using today's technology and building techniques. The typical cost of a multistory structure is 2.1557000 crores, and its size is 1620 m2. Floating structures are the sole alternative for limiting land reclamation and cost-effective offshore construction due to the high cost of land and the substantial reduction in accessible land.

INTRODUCTION:

One potential approach to offshore building is the use of floating buildings. Expensive buildings like airports, wind turbines, and oil rigs are often built out at sea.Given this, I'd want to hear your thoughts on the proposal to build a massive residential tower in a foreign city, ostensibly for personal and recreational use. Offshore construction may make use of a wide variety of foundation methods, including piling, gravity, caisson, and floating. The floating variety is our best selection because of its low cost and no impact on the environment. The water-elastic qualities and the need to accommodate very large floating constructions informed the design of the structure. This floating underwater container is secured to mass anchors 60–180 meters below with tight ropes. The current state of construction technology and methods would allow for such a tall skyscraper to be built. Multistory buildings typically cost 2.1557000 crores and have a size of 1620 square meters. Floating buildings are the only viable option for minimizing land reclamation and expanding offshore at a reasonable cost in light of the rising cost of land and the huge decrease in accessible land.

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SPECIFICATIONS:

The specification details of the proposed works to be carried out for the said

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construction are given below

SUPER STRUCTURE:-

First-class chamber-burned brick in a C.M 1:5 mix will be used to build the superstructure of both floors. Over the freshly built brick walls, a 230mm thick lintel beam will be installed. When required, 600mm-wide sunshades will be installed.

ROOFING:-

The roofing of the building will be made of reinforced cement concrete mix of 1:1.5:3 ratios with a thickness of 150mm with necessary steel reinforcements.

Weathering course concrete using broken brick jelly in lime mortar will be laid over the roof and the same will be finished with one course of machine pressed tiles in C.M. 1:5 mix and pointed with 1:3 mix.

WOOD WORK & STEEL WORK:-

The doors, windows and ventilators will be made in the best country wood & steel.

FLOORING:-

Plain cement concrete 1:4:8 using 40mm HBG jelly will be laid as flooring concrete to a thickness of 130mm. Floor finish will be of Marble Slab in C.M. 1:3 mix for all rooms.

FINISHING WORKS:-

All the brick wall surfaces will be plastered with C.M. 1:5, 12mm thick. The exposed surfaces of R.C.C. items will be finished with C.M. 1:3,10mm thick.The

plastered surfaces will be given two coats of synthetic enamel paint over a priming coat.

LUMPSUM PROVISION:-

Necessary lump sum provisions have been given for the following items of

Water and sanitation facilities must be provided. Planned electrical installation.

Staircase planning considerations. Make room for a cricket field.

A contingency fund is a financial reserve set up for the purpose of covering unanticipated expenses.

MATERIALS USED:

Structure components are designed according to standard procedures described in the current IS 456:2000 building codes. Specifications of the principal materials used are summarized below

Material	USE
• Reinforced concrete (cast in place)	buoyance chamber walls 200mm wearing surface mass anchor“box”
• Reinforcing bars	All concrete
• Cable 300mm dia zinc coated Marine cable	Mooring cable

Most of the concrete surface that are exposed to sea water are precast and also Pre-stressed and they are expected to be of a uniformly high density. Service life in excess of at least 25 years can be anticipated, during which period no repairs are necessary, since properly controlled reinforced concrete exhibits high resistance to marine environment.

There is also information on the performance of high strength structural steel in the marine environment in the form of data compiled regarding behavior of steel sheet piling. Corrosion rates are the greatest in the flash zone where the steel surface is

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alternately exposed to air and sea water. This type of exposure will be experienced in the floating structure at the central portion of the tubuler steel columns. If the column is not specially protected in the zone, itsservice life is controlled by the deterioration of this section.

The mooring cable are fully-submerged at all times and deterioration is expected to be negligible during the service life of the structure.FLOATING

STRUCTURE WITH PONTOON-TYPEFOUNDATION:

DESIGN OF SUB STRUCTURE (BUOYANCY TANK)FLOATING

In pontoon type, we planned to construct a multi stored buildingthat building rest on the pontoonplatform.

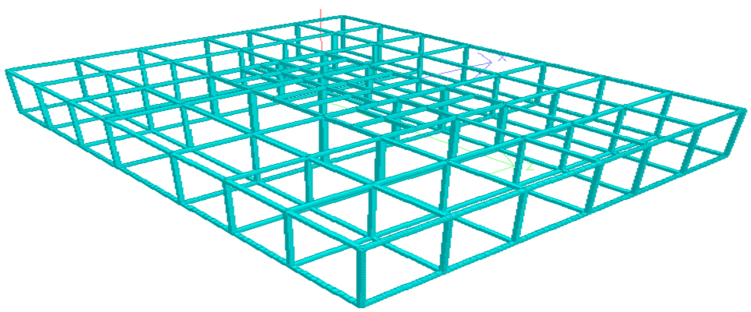

FIG 6.2BUOYANCY TANK (using concrete hollow structure)

The pontoon platform is called buoyancy chamber because of itsshape and structure. It is a hollow structure.We designed a rectanglehollow buoyancy tank. It produced the buoyancy force which is usedfor floating.

DESIGNED OF SUPER STRUCTURE BY USING STAADPRO

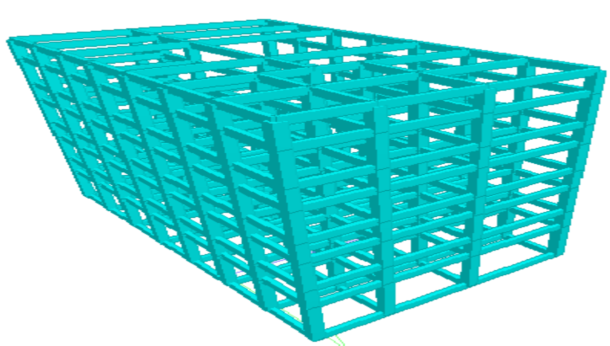

FIG 6.3SUPERSTRUCTURE

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The super structure is designed by usingstaadpro.Dead load, live load, floor load and wind load (chennai offshore wind speed 50 m/hr) are considered.Sub structure is also designed by using staadpro. It is located in calm water surface or inside the break water so wave load value is so minimum. It is neglected for that reason.
Mooring cables are used to hold the structure. Cables are fixed in the sea bed.

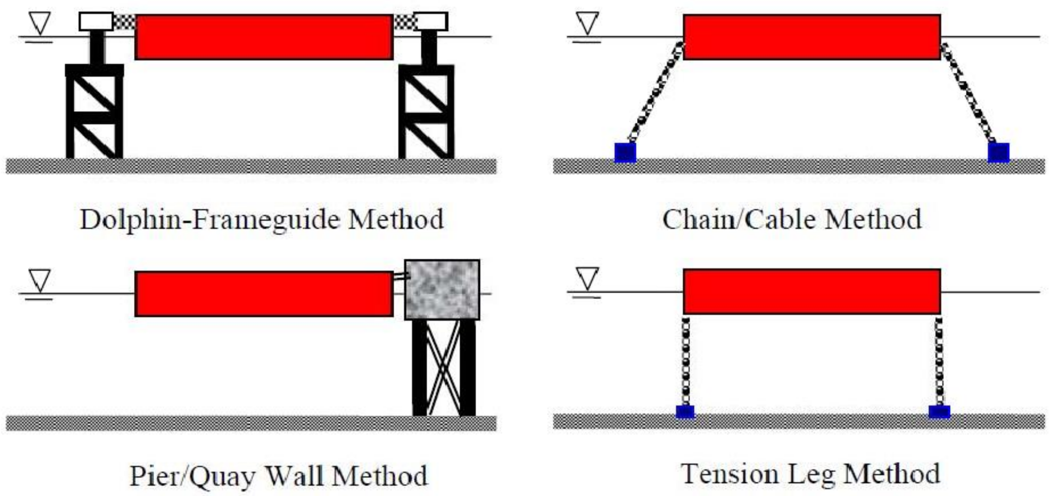

FIG 1 MOORING CABLES

We use the chain/cable approach for the aforementioned techniques. This approach is not only efficient but also economical; when the substructure has been built, the superstructure may be built by extending the central columns.As with any building, the body mass at rest in the vertical plane and payloads are transported bybuoyancy. The horizontal wave forces are countered by inertia forces if a floating structure has a compliant mooring system, such as catenary chain mooring lines. In addition, the wave forces on various areas of the structure will have varied phase (direction and size), reducing the resulting horizontal forces if the horizontal size of the structure is bigger than the wave length.

As a result, the mooring system's forces will be negligible compared to those of the waves. Moorings are installed to keep boats from washing away in the face of constant wind and current, as well as the potential for slow-drifting waves.
more than an order of magnitude less than the first order wave forces.

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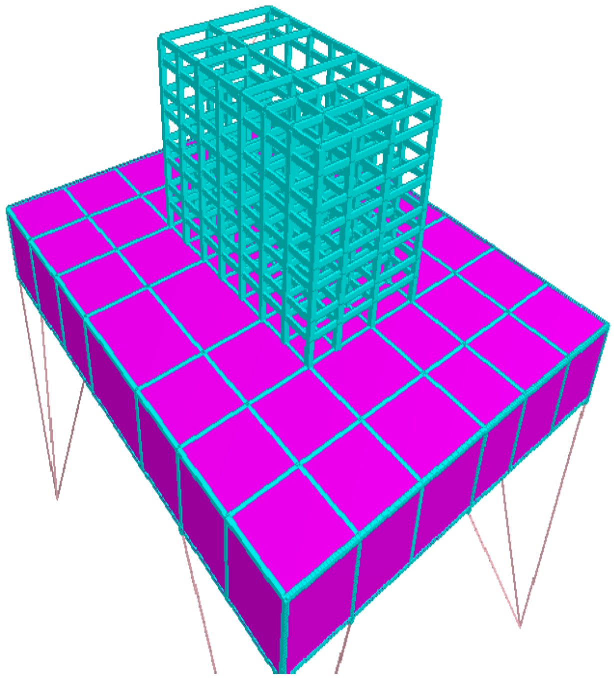

FIG 2 STRUCTURAL MODEL

We are designed the substructure by considering the whole weight of the superstructure. The weight of superstructure is resisted by buoyancy force acting on the substructure. The buoyancy force also resist the self -weight of substructure.

This methodology is collected from ARCHIMEDAS floating principle and ARMSTRONG buoyancy principle.

FLOATING MECHANISM:

A concrete structure will **not** float if the sum of the vertical downward forces (gravitational, **W**) is greater than the vertical upward force (buoyant, **Fb**). When applying this principle to a structure below grade, it can be said that; if the buoyant force (**Fb**) is greater than the mass of the structure and the combined mass of soil surcharges and objects contained within the structure, **the structure will float.**

Example;

Buoyancy is defined as the tendency of a fluid to exert a supporting upward force on a body placed in a fluid (i.e., a liquid or a gas). The fluid can be a liquid, as in the case of a boat floating on a lake, or the fluid can be a gas, as in a helium-filled balloon floating in the atmosphere. An elementary application of buoyancy can be seen when trying to push an empty water bottle downwards in a sink full of water. When

applying a downward force to the water bottle from your hand, the water bottle will stay suspended in place. But, as soon as you remove your hand from the water bottle, the water bottle will float to the surface. The buoyant force on the object determines whether or not a given object will sink or float in a fluid.

Computing the Factor of Safety (**FS**)

A factor of safety can be established from the following calculation:

Factor of Safety (FS) = Down Forces/ Up Force = WT/ Fb

WT >**Fb**Structure will remain stationary

WT <**Fb**Structure will float or shift upwards

When **FS** is less than 1, the up force will be greater than the down forces, which

means that the structure will float. When the **FS** is greater than 1, the up force will be less than the down forces, which means that the structure will not float.

7.2 Computing Downward (Gravity) Forces

All vertical down ard forces are caused by gravitational effects, which need to be calculated in the design of an underground structure in order to determine if the total downward forces (gravitational, WT) are greater than the upward force (buoyant Fb).

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The total downward force (WT) is calculated byvertical forces (W).

WT = W1 + W2+ W3+ W4…

DOWNWARD FORCES (SELF WEIGHT OF SUPERSTRUCTURE) :

Self-weight ofColumns:

W1= volume of column x unit weight of concrete

=0.45 x 0.45 x 14 x 25

= 70.875 KN

No of columns = 33

Total w1= 70.875 x 33

=2338.875 KN

Self -weight of Beams:

W2 = volume of Beams x unit weight of concrete

No of Beams(A)=32

No of Beams(B) =16

Volume of beam(A) = 40.74

Volume of beam(B) = 35.27

W2= (40.74 + 35.27) X 25

= 1900 KN

Self -weight of slabs:

No of slabs= 4

Volume of slab = 12.3 x 21.3 x 0.15 x 4

=157.194

W3= 157.19 x 25

= 3929.85 KN

Self -weight of all brick works:

Volume of brick work from all floors = 1971.04

(include short wall, long wall &

Patrician wall)

W4 = 1971.04x 19

= 37449.80 KN

Self -weight ofsunshed:

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Volume of sunshed = 9.07 + 3.38 + 1.37

= 13.82

W5= 13.82 x 25

=345.5 KN

Total downward forces **= 45964.025 KN**

(self-weight of superstructure)

DOWNWARD FORCES:(SELF WEIGHT OF SUBSTRUCTURE)

self -weight of beams:

Volume of beamsW1 = 36.99 x 25

= 924.75 KN = 36.99

Self -weight of columns:

Volume of columns = 57.47

W2 = 57.47 X 25

= 1436.75 KN

Self -weight of slabs:

Volume of slabs = 839.87

W3 = 839.87 x 25

= 20996.75 KN

Total downward forces in substructure **= 23358.25 KN**

TOTAL DOWNWARD FORCES IN THE FLOATING STRUCTURE:

=50000(including live loads) + 23358.25

= 73358.25 KN

7.3 Computing Upward Buoyant Force:

Buoyant Force (Fb)

As stated in Archimedes' principle, an object is buoyed up by a force equal to the weight of the fluid displaced. Mathematically the principle is defined by the equation:

Fb = γf x vd

Fb= buoyant force KN)

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γf= density of the water (9.81KN/m³)

vd= displaced volume of the fluid (m³)

Volume of buoyancy tank = 45.3 x 36.3 x 6 =9866m^3

Fb = 9.81 X 9866(volume of buoyancy)

= 96785.46 KN

7.4 Factor of Safety (FS)

Factor of Safety (FS) = Down Forces/ Up Force = WT/ Fb

of massive floating objects

structures are on display at this point. A new literature study report by Watanabe et al. (2004) provides a wealth of resources for those interested in the analysis and design specifics of pontoon-type VLFS. This report was written in the hopes that it may spark

structural and civil engineers have a high degree of awareness and interest in the topic.

floating structures, and to make the most of their unique properties in contexts when doing so makes sense.

Due to its unparalleled length, displacement cost, and related hydro elastic response, Very Large Floating constructions (VLFS) are a novel idea in ocean constructions. The development of VLFS is costly and time-consuming.megaproject. The project's technology must be tried and true in order to be successful.minimizing investment danger. The track record of VLFS is scant at best. Researchersand technological advancements have allowed engineers to have a better grasp of hydroelastic response and itsapplication toway of design.Detailedand there was a concerted attemptcarried out by the MOB and Mega-Float initiatives. Growth in significance ofrogramming analyses were place. Formalization of the design process and the design approachas a direct effect of our work. The Preliminary MOB ClassificationGuide mandated and suggested a risk-ased assessment of safety for VLFS as a means to ensure dependability.by theechnicalGuideline Mega-Float On Board (MOB) plus Mega-Floatare significantly

dissimilar in purpose and organization. The research and development for MOB and

Mega- Float were virtually entirely separate, yet their goals were quite similar in many technological respects.

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