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DYNAMIC STABILITY OF TRANSMISSION TOWER RESTING ON PILE FOUNDATION

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Abstract –

The dynamic analysis of a floating offshore wind turbine is at the frontier of green energy/renewable energy, and this structure has a big potential to provide clean, inexpensive energy quickly. Offshore wind turbines continue to rise in popularity. The growing use of renewable energy and technology in recent decades has widened the scope of energy study.

The major analyses in this study include the dynamic analysis of a tension legged platform built for wave loading. This paper also includes the methods for designing a 10 megawatt (10MW) triple spar with mooring. While the anchoring mechanism holds the platform in place and prevents drifting. It is also based on experimental fatigue damage and the calculation of fatigue damage and structure service life with a comparison of characteristics of various types of floating offshore wind turbine platforms. Based on strip theory, the bently moses integrated software is employed. A specific line of study seeks to go beyond the technical in order to evaluate the practical, practicable, and actual possibilities for dynamic analysis of offshore floating wind turbines.

1. INTRODUCTION

The advancement of infa in wind power technology has resulted in massive wind turbines. So far, it has only been put on land and in shallow or low water levels. The floating offshore wind turbine outperforms the onshore turbine. The floating wind turbine at sea will not disrupt life on land. Furthermore, there is a better wind efficiency in the sea, which aids in the creation of renewable energy in an inexpensive manner. The tension legged platform is a floating platform that is combined with buoyancy forces as well as tensile pressures generated by tube links, to the Hull and anchor into the seabed.

Unlike the only spar type that requires offshore assembly. Also, to reduce the cost of floating offshore wind turbines. High fidelity design and modeling tools are required for wind energy to establish itself as a dependable technology. Despite being miles distant from the coast, floating offshore wind turbines are more efficient and provide better speed and consistency in any direction. They also have a lower environmental effect. The floating offshore wind turbines continue to be located further away from the local population. It also has greater construction area in the seas and oceans. As a result, we can generate more cleanly sustainable energy.

2. FORMULATION AND METHODOLOGY

Equation of motion is used for dynamic analysis of floating offshore wind turbine. This equation of motion based on finite element method.

Methodology of analysis and design for floating offshore wind turbine Bently modeler software is used this software is on advanced suite of hydrostatic software that provide for the accurate calculation and simulation of offshore floating system.

2.1 Model Analysis

General properties of model

1) Structure type – transmission tower building
2) Plan area– 196 sq meter
3) Height of building – 35.00 m
4) Section property – ISA 200 X 200 X 25
5) Steel – Fe500
6) Dead load – 1.00 KN/m
7) Live load – 5.00 Kn/m for wing node

Here we are create transmission tower in SAP200 V.23 structure model are showing below,

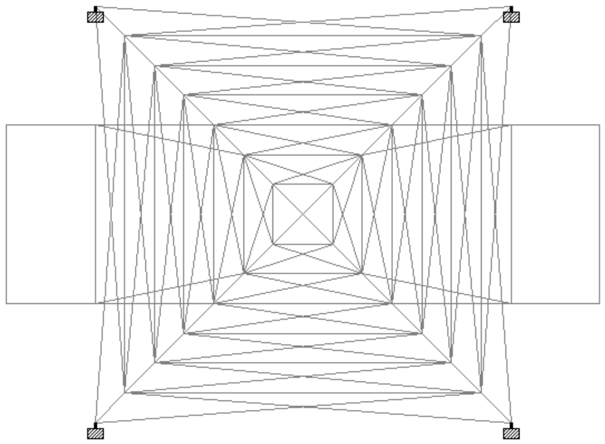

Fig -1: plan view of transmission tower

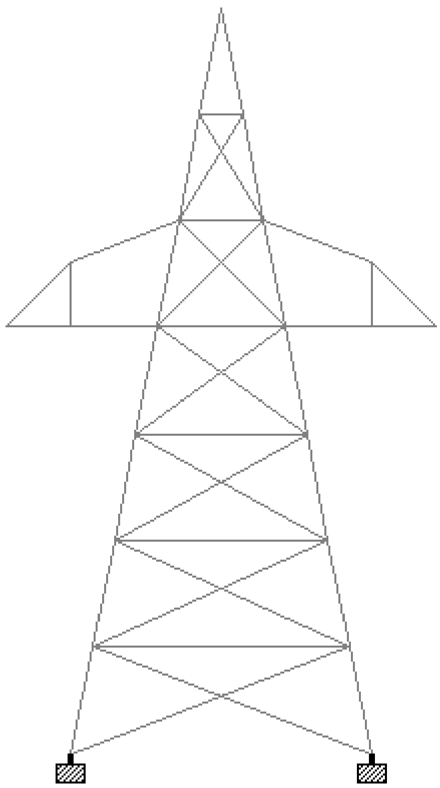

Fig -2: Elevation plan view of transmission tower

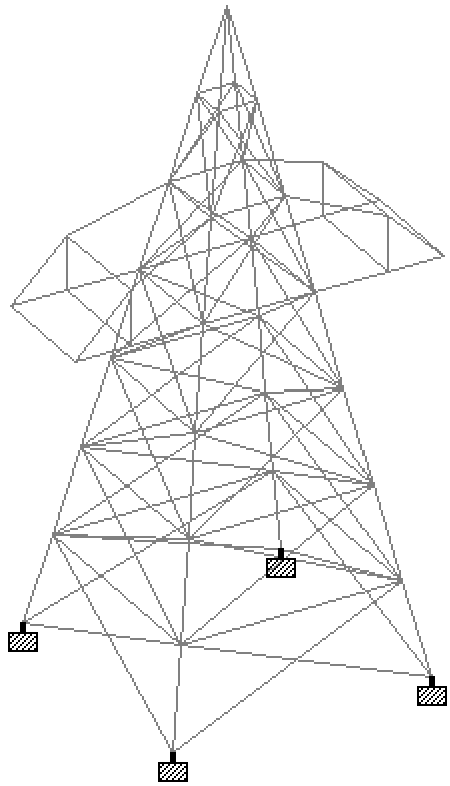

Fig -3: 3D view of with corner shear wall R.C.C. Building

3. RESULTS

This chapter illustrate design, discus and conclude the findings obtained from research. Here we are lattice tower are prepared and analyses then design pile foundation. Various results are obtained to analyze the changes in structural behavior building such as base shear, displacement etc. after analysis we get base reaction or load and we design the pile foundation here.

A. Design of pile foundation of transmission tower

Design data:

Material Data Grade of concrete = 35 MPa

Density of concrete = 25 kN/m3

Modulus of elasticity of concrete = 29580.40 MPa

Grade of steel = 500 MPa

Elastic modulus of steel = 210000 MPa

Pile and Pile Cap Data Diameter of pile = 1 m

Width of pedestal = 1 m

Number of pile per leg = 4

C/c distance between piles = 3 m

Embedment lenght in soil = 6 m

Pile cap top below HFL = 2.2 m

Depth of pile cap = 1.5 m

Overhang of pile cap = 0.75 m

Size of pile cap Width = 4.5 m

Length = 4.5 m

Table. 2. Load Data.

Load point	Vertical Fy	Horizontal Fx	Horizontal Fz	Resultant Horizontal
S1	929.595	155.934	118.212	195.677
S 2	748.057	154.471	116.747	193.626
S 3	855.914	170.475	116.83	206.666
S 4	838.127	146.052	139.309	201.837

Table. 3. Quantity of concrete and reinforcement.

QUANTITIES / TOWER*		
RCC VERTICAL BORED PILE OF SPECIFIED DIA.	=	173.60 R. METER
TOTAL REINFORCEMENT INCLUDING PILES	=	22622.60 KG
CONCRETE – EXCLUDING PILES (M35 GRADE)	=	172.31 M^3
CONCRETE (M10 GRADE)	=	6.49 M^3
PERMANENT MS CASING (10MM THK.)	=	30886.07 KG
MS CASING BOTTOM SHOE (10+6MM THK.)	=	14777.17 KG

3. CONCLUSIONS

The main objective of this study is to learn about transmission tower and design pile foundation for transmission tower and demonstrate the effect of wind pressure on transmission tower. To complete this objective, analysis and design of transmission tower on pile foundation in coastal region were modelled, designed and analysed in STAAD ProV8.

From the results

1. vertical members are more prominent in carrying the load of the tower than the horizontal and transverse members supporting the cables at higher heights is likely to have a major impact on the behavior of the tower the effect of the bending moment of the structure is not significant.

2. The geometry parameters of towers are efficiently considered as design variables and significant weight reductions can often be achieved as a result of geometry changes.

3. Towers with angle sections and X-bracing further reduce weight after optimization.

4. We are providing here pile foundation because of coastal region. In coastal region wind pressure is very high and seismic condition also we are considering and we are analysed model and they are safe in all condition.

6. In chapter 5 we are designed pile, so 4 no. of pile proved each foundation and diameter is 1m and height of the pile is 10.85m. and reinforcement for cap 14 bars 25mm and stirrups 8mm at 150 c/c distance.

7. Pile cap is designed by 4.5 x 4.5 and thickness is 1.5m and reinforcement for cap 16mm at 200 c/c distance.

FUTURE SCOPE

More work can be done in future to improve the understanding of transmission tower and they are listed below.

1. Trying to change the shape of the cross arm can lead to amazing results.

2. Rapid urbanization and increasing demand for electricity, availability of land necessitates the use of tubular pole structures.

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