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INNOVATIVE STUDY ON DIFFERENT BOLT ARRANGEMENTS ON BUILT UP K-JOINT

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Abstract: This study has been undertaken to investigate the stress concentration capacity of different bolt arrangements in chord member of the built up K-joint. Chord member with three bolt arrangements are analysed using ANSYS 16.0. The behavior of 10 bolts arrangements including zigzag, arch shape, X-shape configurations under incremental loading was analysed using ANSYS 16.0. Here three models of bolt arrangements are introduced. This paper aims to obtain proper ranges for the geometric design parameters such as pitch, spacing for different bolt arrangements. In this order, 3 bolt connection were tested to evaluate the performance connections, and then a parametric study was carried out using the verified numerical models.

Key Words **– Bolt, loading, stress.**

I. INTRODUCTION

Jacket tubular structure (often referred to a superstructure) usually consists of four, six or eight tubular legs which are framed together by a series of tubular braces at different horizontal and vertical planes. To optimize the cost and risks of installation of large offshore platforms, different construction strategies has been developed. One strategy are fully construct the offshore facility at onshore and tow the installation to site floating of its own buoyancy. Offshore jacket structures are composed of Circular Hollow Sections(CHS) called tubulars. Tubular or CHS are used for jacket structures due to the capability for resisting the various forces. Also, they have good buoyancy in weight ratio, good resistance against hydrostatic pressure, uniform property across the section. This paper aims to develop finite element model for different bolt arrangement to evaluate the stress concentration capacity in each of them.

2. OBJECTIVE OF PROJECT

- To evaluate different bolt arrangement

3. MATERIAL PROPERTIES

It can be seen that under incremental loading of linear arrangement of bolt on joint, there is a chance of strength degradation and local buckling. For improving the performance of joint different bolt arrangements are provided. The bolt diameter is 20 mm. The number of bolts are provided on chord member is 10 in which five on each side of the member. The adopted arrangements are:

- Zigzag Arrangement
- Arch Shape Arrangement
- X- Shape Arrangement

From the above three models the stress concentration capacity is minimum on X-shape arrangement. Hence this model is taken for further analysis.

Table 1: Material Properties

Properties	Steel	Bolt
Young's Modulus (K Pa)	$2x10^{11}$	$2x10^{11}$
Yield Strength (M Pa)	792	225
Poisson's ratio	0.3	0.3

4. MODELLING AND ANALYSIS OF DIFFERENT BOLT ARRANGEMENTS

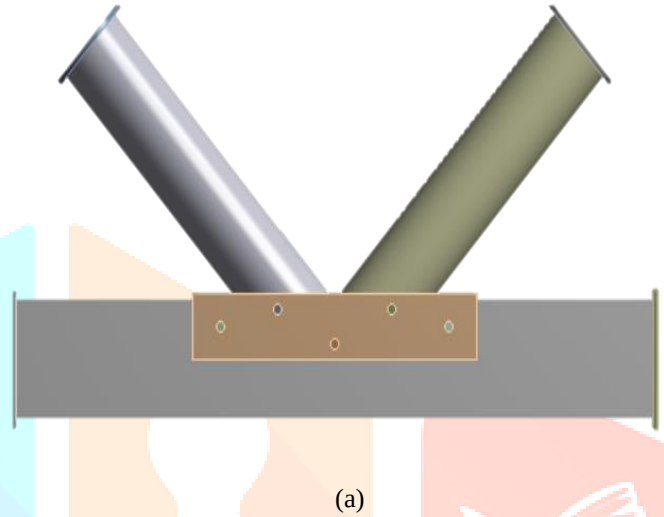
ANSYS 16.0 software was used to model all the specimens for non-linear analysis. SOLID 186 from ANSYS library was used for three dimensional finite element modelling of the brace chord joint model.The endplate with 650x120x10 mm was modelled and connected with M20 bolts. Then different bolt arrangements are Zigzag, arch shape and x-shape were modelled. Bolt are designed as per IS 800: 2007.

For zigzag arrangement with M20 bolt with pitch 2.5 d_o and 1.5d_0 end to bolt distance is placed in Fig 1(a). The total 10 bolts having 5 is provided on each side of the endplate.

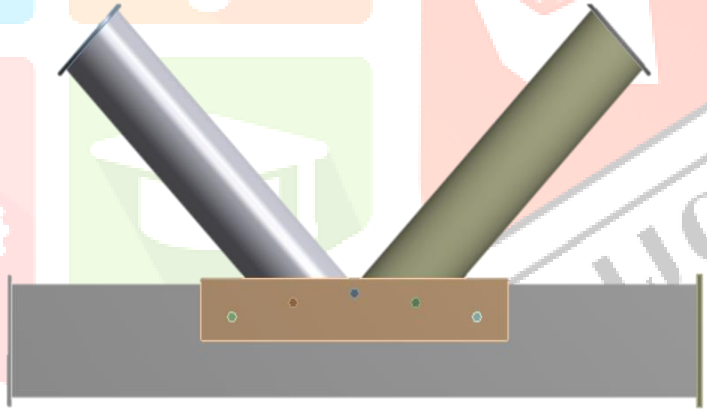
For arch shape arrangement bolts are arranged in semi circle form, having five on each side of the member with 2.5d_o spacing 1.5d_o bolt distance shown in Fig 1(b)

For X-shape arrangement bolts are provided in the shape of 'X' shown in Fig 1(c).Here also 5 bolts are provided on each side of the endplate. The overall arrangement forms in the shape of X.

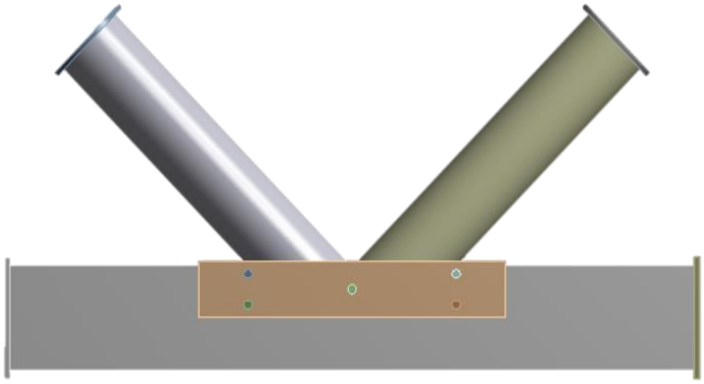
From the above three model the best model was selected. From the analysis it can be concluded that the best model was bolt arrangement with x shape configuration.



(a)



(b)



(c)

Fig1: Bolt Arrangements: (a) Zigzag Shape, (b) Arch Shape (c) X- Shape

5. RESULT

Stress of bolt arrangements are listed in Table 2

Table 2: Result of different bolt arrangement

SHAPE	STRESS (MPa)
Zig zag	612
Arch Shape	608.23
X- shape	603.5

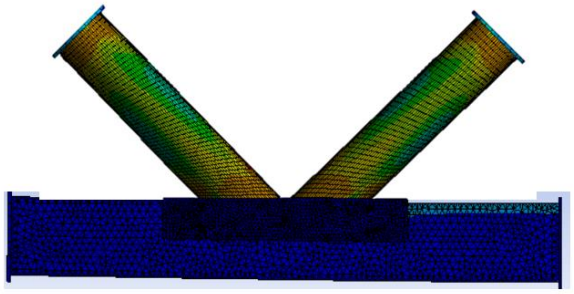


Fig 2(a) Equivalent Stress in X- Shape

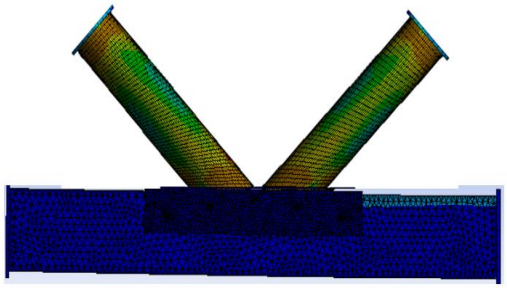


Fig 2(b) Equivalent Stress in Arch Shape

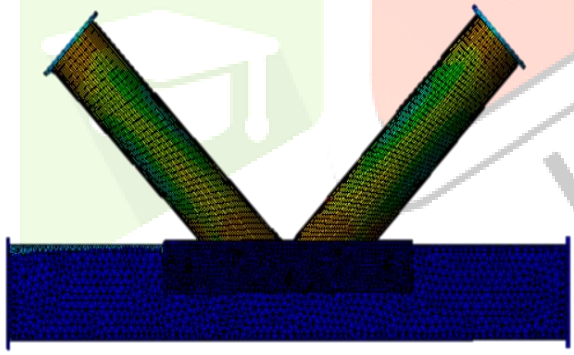
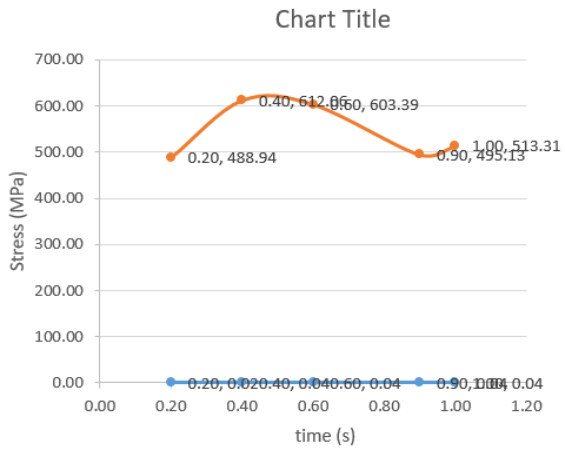


Fig 2(c) Equivalent Stress in Zig zag Shape



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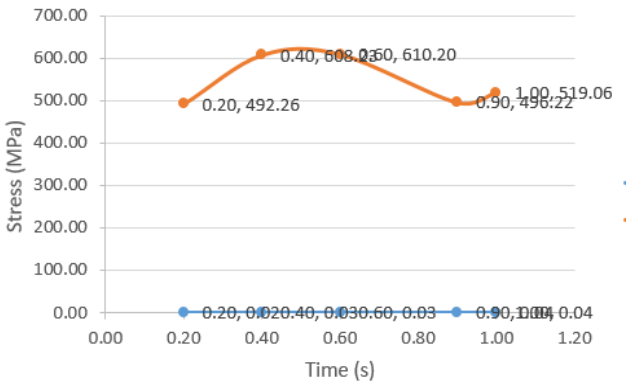

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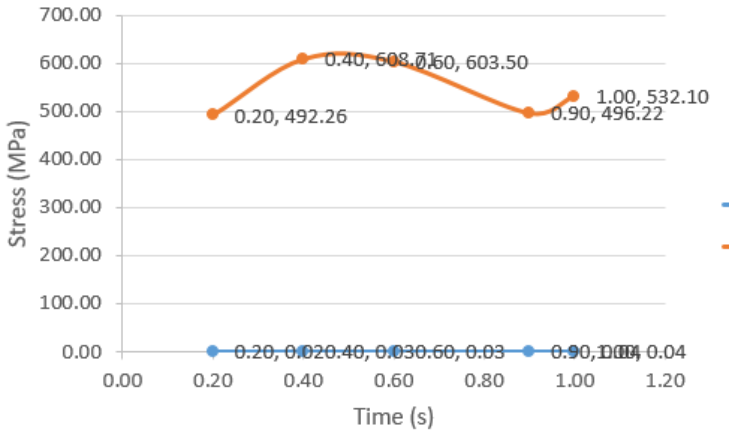

(iii)

Fig 3 Stress time graph (i) Zigzag, (ii) Arch shape (iii) X- shape

6. CONCLUSIONS

From the analysis model 3 shows that minimum stress capacity as compared to others. In 3 bolt arrangements X- shape had better value.

7. REFERENCES

[1] Dengyiding Jin et.al (2020) "Numerical performance of blind-bolted demountable square CFST K-joints" *J. Building Engineering*

[2] Fei Gaoa et.al (2019) "Dynamic behavior of CHS-SHS tubular T-joints subjected to low-velocity impact loading" *Engineering Structures*