

Numerical Behaviour of Splice Connection for Tubular GFRP-Section Members under Different Parameters

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Abstract - The use of fiber reinforced polymer (FRP) composites in the reconstruction and strengthening of existing structures has been subjected to research in recent years. Glass fiber reinforced polymer (GFRP) has become an important component in the manufacturing industry. GRP has the advantage of light weight, high strength, durability, resistance to marine and hazardous conditions, which results in low maintains cost. An interlaced connection for tabular GFRP section members combines two bonded sleeve joints (BSJ) and bolted flange joint (BFJ). The steel tube is attached to the GFRP profile and glued together. Developed an analytical model of interlace connection using ANSYS software. GFRP performs nonlinear analysis from column to column, and column to beam connection. The resultant aspect ratio of the structural performance is also evaluated to determine the optimal model. The interlace connection also performs seismic.

Key Words: Nonlinear Analysis, GFRP, ANSYS, Interlaced connection ...

1.INTRODUCTION

Historically, construction industry was dominated by traditional building materials such as steel, concrete wood, and masonry. The, most commonly used building materials are wood, steel, and concrete. These materials have a number of disadvantages, such as the potential for damage, decay, and other aging problems. Hence the growing demands for alternative to traditional construction materials are high.

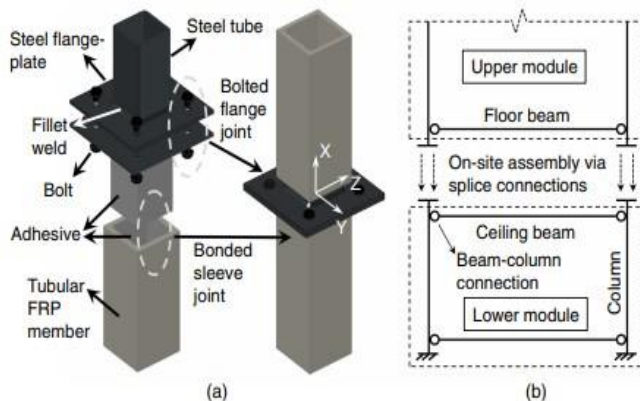


Fig -1.1 Glass Fiber Reinforced Polymer (GFRP) bars Over the past 30 years, fiber reinforced polymer(FRP) composite materials such as steel, concrete, wood, and

carving have dominated the construction industry. The combined properties of two or more materials make up composite materials, which cannot be achieved by fiber or matrix when working alone. Fiber reinforced compound have been used successfully for many decades in all engineering application. Glass fiber-reinforced polymeric (GFRP) composites were most commonly used in the manufacture of composite materials. The optimal composition and orientation of the fibers and the required properties and performance characteristics of GFRP composites are similar to those of steel, which had higher hardness than aluminum and quarter of the specific gravity of steel.

Various GF reinforcement such as elongated longitudinal, woven mat, chopped fiber(different) and chopped mat have been fabricated to enhance the mechanical and tribological properties of the composites. Integrated objects have width laminated GF reinforced composite materials are used in industrial application in the marine and piping industries due to their good environmental resistance, excellent damage to impact loading and high specific gravity

The various advantage of GRP includes:

- High power
- Low weight
- Seamless construction
- Low weight
- Seamless construction
- Low maintenance
- Sustainability
- Virtually any shape and form can be molded
- Resistance to marine environment
- Interlace connection combines two bonded sleeve joints and bolted flange joint to provide excellent mechanical performance

1.1 Critical Review

- Splice connection integrates two bonded sleeve joint and a bolted flange joint improving the overall capacity
- Stress concentration in the FRP members is reduced by the bonded joints

- Convenient on- site assembly and ductile failure is realized by bolted flange joint
- As the number of bolts increases rotational stiffness and yield moment also increases
- Increase in bond length showed improvement in rotational stiffness and yield moment
- Transverse stiffness increases linearly as bolt torque increases
- Bolted flange-plate connections in FRP structures shows good yielding capacity for the connections
- The connection provides adequate ductility and energy dissipation capacity

1.2 Objective

- To evaluate bending performance of splice connection under varying aspect ratio
- To evaluate axial performance of splice connection under varying aspect ratio
- To analyse the non-linear behaviour of splice connection in 2D frame model

2. Result and review

Geometrical modeling and analysis are done using ANSYS software. Mechanical properties are given below in the table. Dimension is given in the figure 1.2

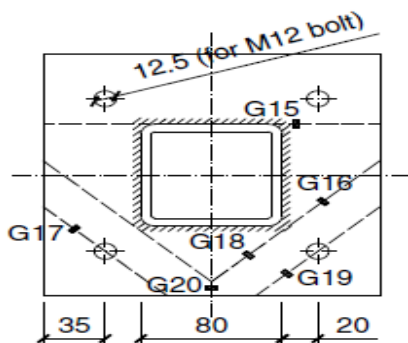


Fig -1.2 Geometrical Details

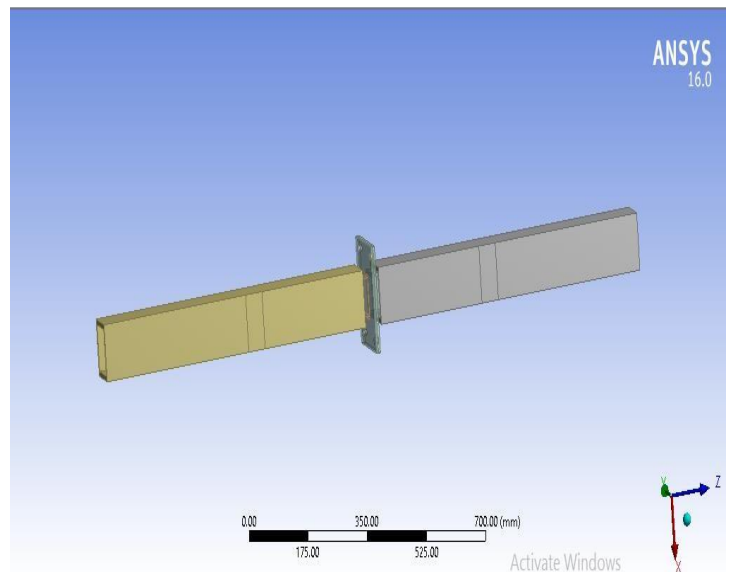


Fig -1.3 Ansys geometry

Table -1: Material Properties

Material properties			
	Yield Strength (MPa)	Yield Strength (GPa)	Poisson, ratio
Steel square tube	420.1	209.5	.28
Steel flange plate	311.8	201.2	.28
GFRP square tube	330.6	25.2	.3
Bolt	1043	235	.28
Epoxy	32.2	4.25	.28

Three type of materials are taken for analysis ,which are 790.102, 790.88,and 790.79. boundary condition and geometry are same for each materials. And the same load has been applied

2.1. Meshed model

The selected three dimensional model of GFRP tubular member was developed by finite element software to demonstrate the behaviour properly.

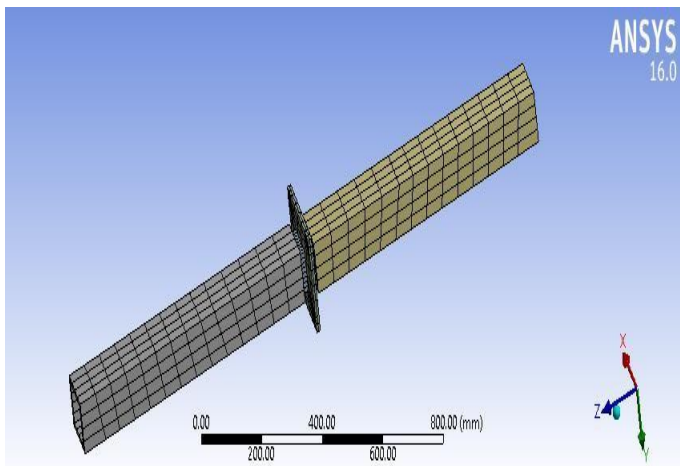


Fig -1.4 Meshed Model

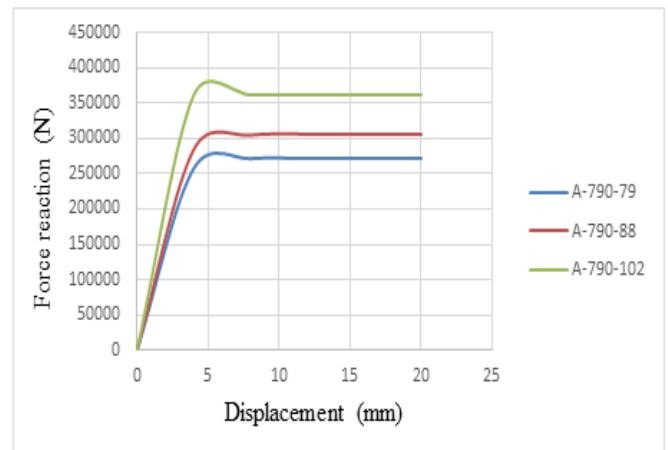


Fig -1.6 Deformation

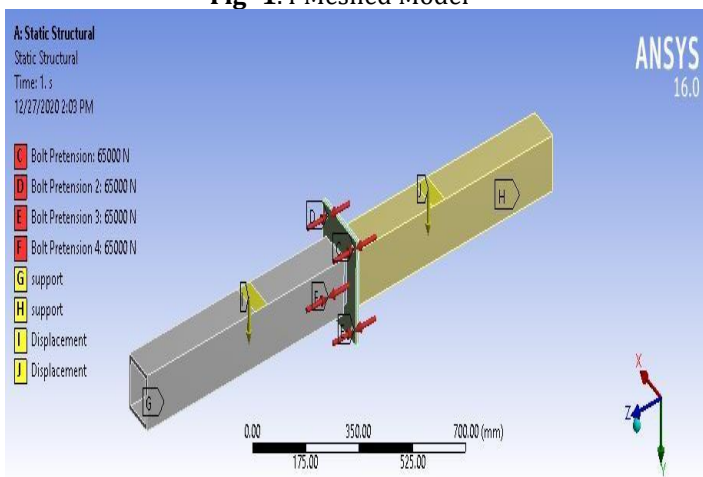


Fig -1.5 boundary conditions

Deformation of various beams with respect to the force has given in the diagram. Beam 790.102 has the ability to withstand more force with lesser deformation compare to beam 790.79 and beam 790.88.

3. CONCLUSIONS

- The GFRP beam-sleeve connection method provides better results in B90/102 design. Its approximately equal to 8000000 Nmm
- From evaluation of column connection, it provides B1020-102 gives above 30% variation from previous objects.
- Hence, GFRP column connection is more suitable for structural constructions.

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2.2 Results

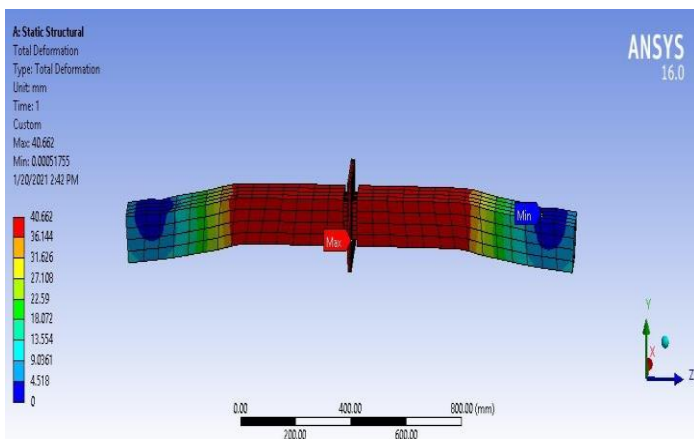


Fig -1.6 Deformation

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