International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

NUMERICAL INVESTIGATION OF GFRG (Glass Fiber- Reinforced Gypsum) COLUMN BEAM END PLATE USING SLEEVED AND BOLTED CONNECTION SUBJECTED TO INFILL AND HOLLOW CONDITION

Ajith Vijayan[1], Varsha Susan Thomas[2]

[1]PG Student MGM College of Engineering and Technology, Pampakuda, kerala
[2]Assistant Professor Student MGM College of Engineering and Technology, Pampakuda, kerala

---

Abstract – Abstract In the world have more population generating, demand for contraction of deferent purpose building area. In the demand of conventional type building category like concrete and brick approach to leads to cost, wastage, quality and delays as like traditional type of contraction. Approach results in –ve action on economic and social parameter, apart from being just unable to deliver maximum required supply level of conventional type building area. In this position of building concept, GFRG has advantage of light weight and lower overall cost of the multi-story building construction bringing economy.

Key Words: static Analysis, Nonlinear Analysis, Different Types of GFRP connection.

1. INTRODUCTION

The conventional type of buildings are more costly, when compare to panel system. The panel has good lifer as same as concrete structure. Now a days the use of panel for construction increases gradually. But most of the people are not aware about this type of construction for residential and commensal types of buildings.

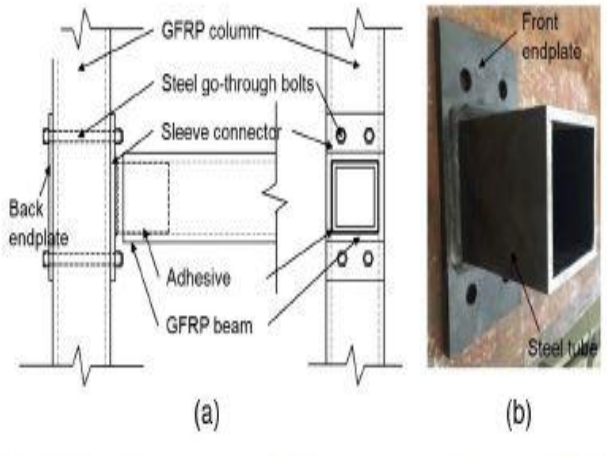

Fig - sleeve connection of GFRG beam column joint

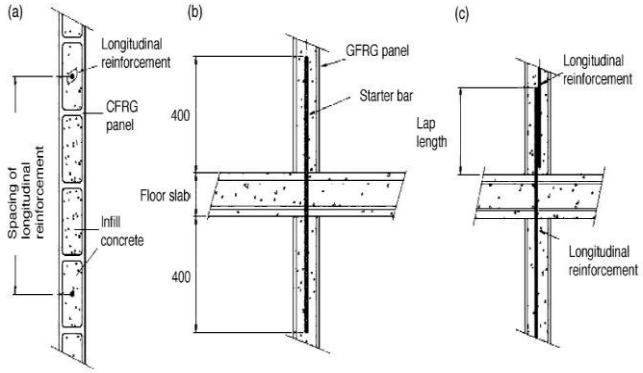

Fig 2: **wall connection**

1.1 Objectives

- To understand the behaviour of GFRG beam column joint under non - linear analysis
- To introducing alternative joint such as weld and bolt connection on GFRG column and beam.
- To compare GFRG and steel beam column joint.
- To introduce suitable connection method

1.2 Methodology

- Selection of topic
- Literature review
- Fixing the objectives
- Numerical validation
- Development of an analytical model of structure in ANSYS workbench 16.0
- Analysis of the model
- Comparison of results and interpretation

2. SEISMIC ANALYSIS –RESULTS AND DISCUSSIONS

2.1 Different models with different types of bracings

MATERIAL PROPERTY	
Grade	GFRG
Grade	SAND
Grade	STEEL
MEMBER PROPERTIES	
Beam span	1750mm
Height of column	2050mm
Length of end plate	300mm
Diameter of bolt	20mm
LOAD DETAILS	
Non linear	Monotonic
Column connection	Displacement

Table -1: Details of beam column frame

The model of a section with welded connection in vertical and inclined direction are shown in Fig 5.2 and Fig 5.3, the model of I sectioned beam column joint with welded connection are shown in Fig 5.5 The proposed connection systems are connected to each other with a friction coefficient of 0.2. There are different connections in the structure considered. One is at the interface of beam and column and another is at the interface of nut and bolt as shown in Fig 5.7 and Fig 5.8.Similarlyy we have made connections for end plate and the bolt.

The fixed supports are provided at the bottom of the structures. The rotation are provided as incremental loads at the tip of the section and the same boundary conditions and loadings are applied for the vertical direction. The displacements are provided as cyclic loads at the tip of the beam and the same boundary conditions and loadings are applied for the other models also. Fig 5.5 shows the boundary conditions and loadings of beam column joint.

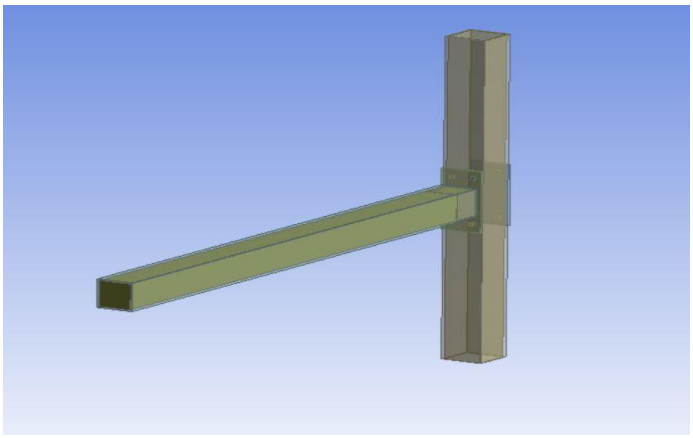

Fig -3: the model of beam column joint with welded connection

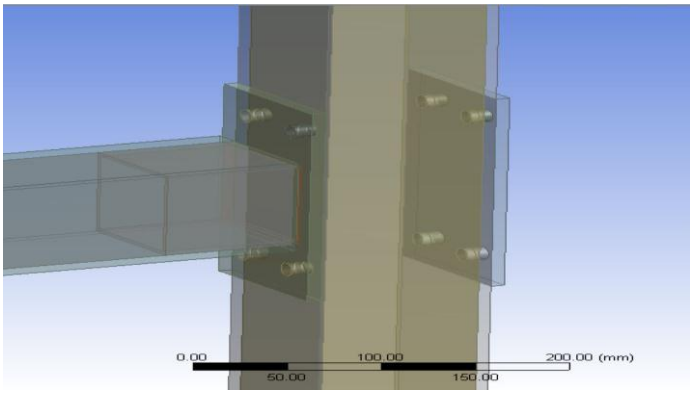

Fig -4: a section of 4 bolted

Static structural analysis is carried out to determine the deformations, stress, strains and force in structures caused by loads that will not induce damping effect. In GFRG beam- column joint static structural analysis was carried out in order to determine the stresses and strains.

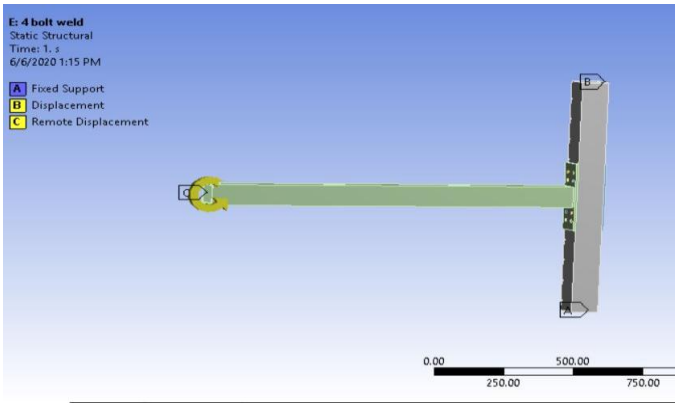

Fig -4 : Boundary condition and loading

Types	Stress(Mpa)	Displacement
4 Bolted	1006.7	57.86
8 Bolted	1069.1	57.055
Welded & 4 Bolted	1066.3	55.331
Welded & 8 Bolted	1119.9	55.069
steel beam and column	312.22	37.0454
4 bolted with weld and infill	1037	55.331
8 bolted with weld and infill	1704.9	55.527

Chart -1: stress and displacement

The base shear value for rectangle, pentagon, hexagon and L shaped models with shear wall at corner position are 4431.1624kN, 4180.56kN, 6154.5915kN, 5400.09kN in the second case the base shear value reduced for all the four shapes.

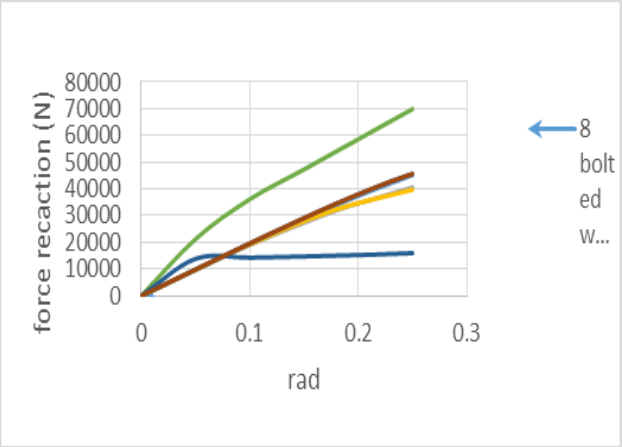

Chart -2: Maximum storey displacement

The displacement- force reaction response for different GFRG beam and column with weld and bolted joint models and their comparison made from analysis are given below.

3. CONCLUSIONS

Various research papers in the past years were studied and understood that further more studies are required in this field. The GFRG with fillet weld end plate connections is an innovative end-plate moment connections. They are a very common connection type used in today's metal building industry. The modeling and analysis of the circular hollow section to rigid end plate connections was done in ANSYS. The result obtained in validation was approximately nearer to the result obtained in the reference and therefore the model is valid and can be extended for further studies. By the objective implementation the GFRG with welded connection are modeled in vertical direction 4 bolted , 8 bolted ,fillet weld and infill sand, From the values obtained in sectioned beam and column joint in welded connection maximum stress value is obtained for weld connection (1069.1Mpa), bolted connection the maximum stress value is 1119.9MPa and infill (1704.9Mpa)

REFERENCES

[1] Bin Cheng, Xinger Cao ,Fatigue tests of welded connections between longitudinal stringer and deck plate in railway bridge orthotropic steel decks,Eng. Structures (2017)173,28-53.

[2] Yiting Yang, Yan Wang, Fan Yang ,Influence of weld details on fracture behavior of connections using high-strength steel(2019),Eng. Struct.173,800-812.

[3] **Adrian Fredrick C.Dya,C Andres Winston. Oreta** (2015) Seismic vulnerability assessment of soft story irregular buildings using pushover analysis, Engineering Structures Journal, Elsevier, Vol.125, Pg. No: 923-932.

[4] **Danish Khan, ArunaRawat** (2016) Nonlinear seismic analysis of masonry infill RC buildings with eccentric bracings at soft storey level, World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium, Vol.161, Pg. No: 9-17.

[5] **5]Arshad K. Hashmi, Alok Madan** (2008)Damage forecast for masonry infilled reinforced concrete framed buildings subjected to earthquakes in India,CurrentScience,Vol.94,Pg. No:61-73

[6] **Danish Khan, ArunaRawat** (2016) Nonlinear seismic analysis of masonry infill RC buildings with eccentric bracings at soft storey level, World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium, Vol.161, Pg. No: 9-17.