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Behavior of Circular CFST Columns with Central Wood Piece under Axial Loading

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***Abstract:** Over the past few years various studies are conducted to identify the behavior of concrete-filled steel tubular (CFST) columns. An investigation was conducted on a CFST column under axial loading. This paper mainly explores the carrying of the ultimate load in wood in filled CFST columns. The utilization of wood as inner core material to reduce the amount of concrete. For this research considering three pairs of specimens in each pair one specimen consist of wood. The dimensions of the three pairs are different and the two specimens in each pair have the same dimensions. Tests were conducted by loading frame. The confinement effect of steel tube and concrete filled in it guides the behavior of CFST columns. By the application of wood in CFST column properties like capacity, ductility, energy absorption will be enhanced. Experimental results are compared with Euro and Australian codes.*

***Index Terms:** Axial Loading, CFST, Composite tubular columns,Wood Piece.*

I. INTRODUCTION

Concrete filled steel tubular columns are broadly used as structural component utilized in structures because of their performance characteristics which incorporate high ductility and strength.

There are two types of composite members are the concrete filled steel tubular column, In which concrete is filled in steel tube and the steel reinforced concrete column, In which consists of steel section encased in strengthened or unreinforced concrete. The CFST columns which decrease development cost. For the concrete core, the tube acts as longitudinal and lateral reinforcement so no need for extra reinforcement. When compared to the conventional procedure CFST column will contain high strength, durability and service life of the structure increases. Its mainly describes the axial load behavior of tubular column with central wood piece filled with concrete.

Over the past few years, various studies are conducted to identify the behavior of concrete-filled steel tubular column (CFST) columns.Analytical studies and tests about CFST columns exposed to join flexure and axial load 1. Tests and analytical model an explanatory model for the strong forcequalities of the flexural behavior of CFT sections is proposed and is found to repeat trial results, for example, the synergistic association between the steel tube and filled concrete with great accuracy 2.The load carrying capacities of bamboo in filled CFST samples have a low load in comparison with CFST samples 3. Confined concrete-filled tubular columns in which extra confinement is accommodated the potential plastic hinge regions to enhance seismic execution 4.A proposed axial force proportion and torsional moment relationship utilizing extreme torsional quality of torsion were additionally explored5.Concrete-encased CFST samples showed magnificent deformability under axial tension. Contrasted and RC samples enhanced break design was watched for the concrete-encased CFST samples 6. Various performance parameters are evaluated and discussed, and the influence of compressive strength of the concrete core applied axial loads, and inserted inner steel tubes on the seismic behavior of the column members7.

II. EXPERIMENTAL PROGRAM

Three pairs of concrete-filled steel tubular columns (CFST) specimens, In each pair one column filled with plain concrete and another column wood infilled CFST specimens, are taken for the investigation. Specimens are circular in shape CFST specimen is taken for the examination. The different cross-sectionalregion of wood is utilized for the examination.

The details of the specimens appear in Table1. The constituent materials were weighed in weighing balance with the greatest limit of 300 kg. concrete mixer was utilized for blending concrete. At first, the coarse aggregate was included in the mixer. Along these lines, fine aggregate and cement were included. At that point, the required amount of water was added gradually into the mixer to frame consistent mixture. The diagrammatic representation of specimens as shown in Fig 1.

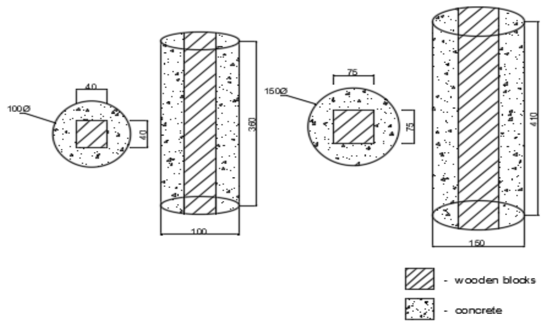

Fig. 1: Geometrical view of the specimen

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Table I: Details of Specimens

Specimen	Diameter D[mm]	Thickness T[mm]	Length L[mm]	D/T	Wood Infill Size[mm]
TC1	100	3	360	33.33	40
TC1A	100	3	360	33.33	40
TC2	150	4	410	37.50	75
TC2A	150	4	410	37.50	75
TC3	200	3	460	66.67	90
TC3A	200	3	460	66.67	90

A. Materials

Materials used are concrete, steel, and circular tubular columns. Before testing the section, the mechanical properties of steel, concrete, and wood has been resolved. Steel has been utilized in the examination. The property of steel has been given in table 2. The normal compressive quality of concrete is given in table 3 and the properties of wood are given in table 4.

Table II: Properties of Steel

The yield stress of steel tube	415 MPa
Modulus of elasticity	200 GPa
Poisson's ratio	0.3

Table III: Properties of Concrete

Concrete Compressive strength	31.6 MPa
Modulus of elasticity	30.06 GPa

Table IV: Properties of Wood

Wood orientation	Parallel to grain
Stress grade of wood	8 MPa
Modulus of elasticity	12.5 GPa

B. Casting of specimens

Circular steel tubular column is put on the smooth plane surfaces. Wood is set halfway on the steel tube. Concrete filled inside the steel tube and inside the wood and compacted utilizing the compaction rod. While pouring concrete into these steel tubes, three pair's specimens were cast and cured them all under same conditions. Curing of CFST columns is finished by applying paint on the uncovered surfaces. After 28 days of restoring specimens are prepared for testing. The column moulds were done in his experiment was shown in Fig 2.

Fig.2: Casting of CFST Columns

C. Material Properties

The cubes were tested according to models and the compressive quality and Young's modulus were observed to be 36.1MPa and 30.06GPa individually. For the properties of steel tube, standard tensile tests were directed, yield quality and modulus of elasticity were determined. Here, wood thought to be a homogeneous material and the quality and modulus of elasticity are taken as 8Mpa and 10GPa after conducting sample tensile and compressive tests.

Fig. 3: Universal Testing Machine

III. EXPERIMENTAL TEST SETUP

Tubular columns are exposed to axial loading and are tested on compression testing machine of limit 2000 KN in the Structural Laboratory of the K L University. The dial gauge is put on the base of the loading plate.The test samples are set halfway and concentric loading is given on the specimen.For each 20kN, the dial measure readings are noted.Similarly, the load-deformation graph is acquired.The test setup appears in Fig 4.

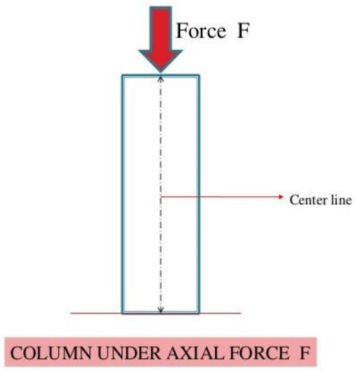

Fig. 4: Schematic view of the test setup

IV. RESULTS AND DISCUSSIONS

There are three pairs of wood in filled CFST specimens were cast. The tests were conducted to determine the axial load carrying capacity of wood in filled CFST column (CFSTW) and furthermore to examine the load-deformation behavior,failure modes, and energy absorption capacity. The test outcomes are given below:

Table 4: Test results of CFST circular specimen with and without a wood piece.

Specimen name	Ultimate load	Ultimate deflection
TC1	1348	6.2
TC1A	1162	4.1

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TC2	1665	7.75
TC2A	1398	4.36
TC3	1863	8.3
TC3A	1650	5.6

A. Ultimate load

The Chart demonstrates the variety of ultimate load of round specimen heights. From below Fig 4a, 4b&4c. We gathered that extreme load conveying limit of control specimen is higher contrasted with the wood infilled specimen. It is on the grounds that the measure of solids present in the wood filled specimen is less contrasted with control specimen. Columns have brought low load conveying limit since it has a most part cross-sectional region of wood.

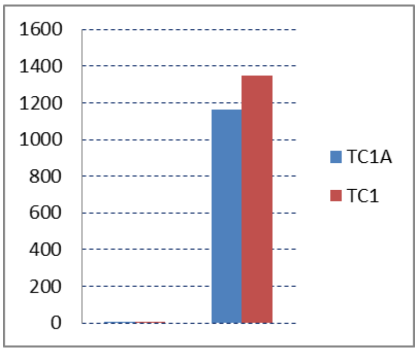

Fig. 4a

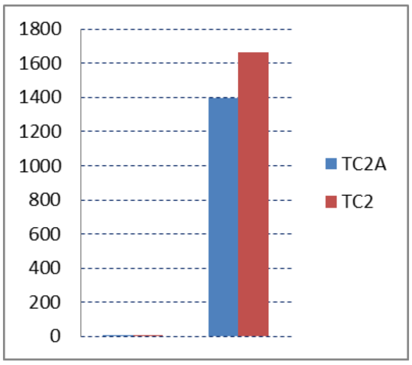

Fig. 4b

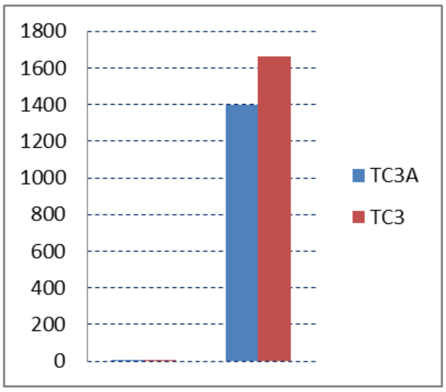

Fig. 4c

Fig. 4: Variations of ultimate load of CFST specimen

B. Load-deformation graph

In view of load-deformation curve Although these specimens were made of various materials, for example, Steel, Concrete and Timber, it went about as a homogeneous material. Fig.5 speaks to the variation of the axial deformation with the load. With the expansion in the eccentricity of the load, the axial deformation of the specimen increments. The example with wood piece had higher distortion when contrasted with the other without a wood piece.

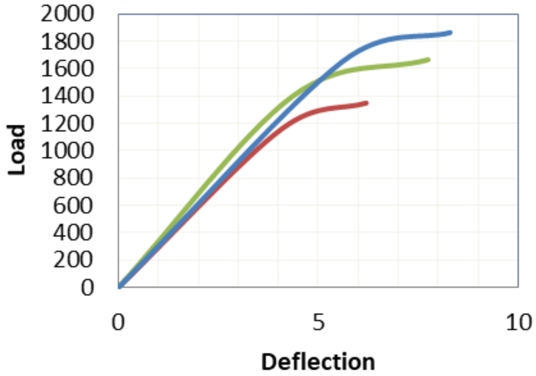

Fig.5: Load-deflection graph for three pairs of specimens

V. CONCLUSION

In this test, tubular columns with the central wood piece and without wood piece were tested under Axial Loading. Relating to the outcomes acquired in the test the following conclusions are gotten:

[1] Circular CFSTW specimens have a higher capacity to weight proportion contrasted with control specimen, around 10 % expansion in capacity to weight proportion happens. Its energy absorption capacity is brought down contrasted with control specimen.

[2] Circular CFST with the central wood piece having the low load carrying capacity when compared to control specimen.

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