

Compressive Behaviour of Concrete Filled Steel Tube Cylinders under Axial Load

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ABSTRACT: In modern construction the composite construction plays a vital role in strengthening of structures .concrete filled steel tube is an emerging technique in strengthening of structures . The compressive behavior of CFST is analysed and studied in this project. GI sheet is used for confinement . The interaction between the concrete and the GS sheet are studied .The joints are riveted and the confinement is done at various thickness and it is tested and analyzed .The galvanized sheet of thickness 0.3 mm and 0.35 mm and .5mm are used The strength increases with the increase in thickness.

KEYWORDS: CFST concrete filled steel tube; GI galvanized sheets;

I. INTRODUCTION

Composite construction are of two types one is steel encased into the concrete and the another is the concrete filled steel tubes .The composite construction are mostly used in bridge decks ,piers, high rise buildings , long span bridges and in repair works of buildings especially in columns .They are widely used because of their more advantages .Cfst cylinders gives high strength than nominal cylinders so the size of the member can be reduced and it is more economical .Cfst are more ductile and have high tensile strength. Cfst are good fire resistance .

The main disadvantages of CFST cylinders are the binding nature of the cfst and the concrete .when a binding is not in a proper form it affects the crushing strength of the CFST cylinders .When a load applied it starts delaminate and a whole process is affected . The shrinking of concrete also cause variation in the height of the casing sheet and the concrete .when a load applied the sheet alone will carry the load transfer and it affect crushing strength .

II. MECHANISM OF CFST CYLINDERS

The mechanism of CFST cylinders are when an axial compressive load applied on CFST cylinders first the load is absorbed by the GS sheet and at a point it equally transfers its load to the concrete. The GI sheet gives confinement to the concrete . when the concrete reaches its maximum yield it again transfers the load to the GI sheet .when the GI sheet reaches its ultimate strength it strat yielding . CFST cylinders are good in axial loading. The lateral confinement gives more strength than the normal concrete .hence the CFST cylinders need less cross section compare to the nominal cylinders .The poissons ratio for CFST is higher due to this lateral confinement so the failure is delayed .

Stage 1 – load absorbed by the GI sheet

Stage 2 – transfer of load from GI sheet to the concrete

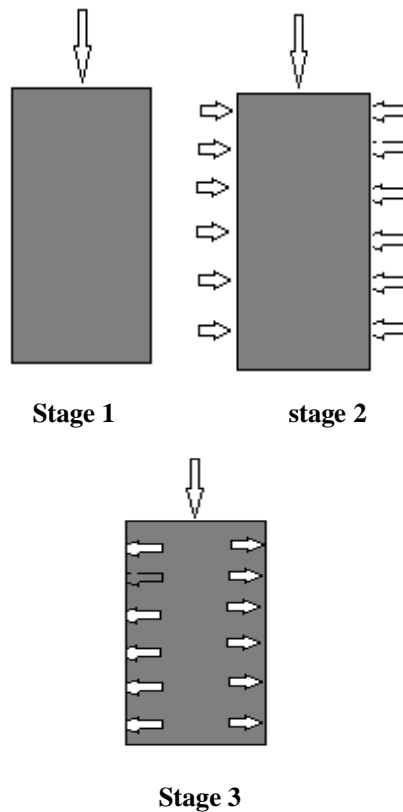
Stage 3 –transfer of load from concrete to the GI Sheet

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III. MATERIALS PROPERTIES

CFST cylinders

A galvanized iron sheet of various thickness is joined using a revited joint. The 150mm diameter and 300 mm height cylinders specimens are made with thickness 0.3mm, .35mm, .5mm



Hollow revited sheets

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Mix proportion

The designed mix proportion of 1:1.6:3.1 was used to attain a strength of 20N/mm², with the water cement ratio of 0.55. The average compressive strength of was found to be 27.5N/mm² at the end of 28days curing.

IV EXPERIMENTAL WORK

General

A circular hollow GI sheet of cross section 300mm height and 150mm diameter are revited .The thickness of the GI sheet used are 0.3 mm , 0.35mm , 0.5mm . The12 specimens are casted and tested under axial load . The12 specimens are casted and tested under axial load .

Table 1- Specimens

SNO	D mm	H mm	t mm	No of specimens
1	150	300	0	3
2	150	300	.3	3
3	150	300	.35	3
4	150	300	.5	3

D –diameter ; H-height ; t – thickness

Casting and curing

The sheets of various thickness are moulded as an hollow circular cylinders of diameter 150mm and height of 300 mm . The bottom portion of the hollow cylinder is covered with plate .The M20 Concrete mix is filled into the hollow cylinder .Proper compaction is done to avoid air voids .The specimens are kept under curing for 28 days .



Fig 1 - Normal and CFST Casted Cylinders

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Experimental setup

The specimens are tested under UTM machine of capacity 4000 KN . The specimen is centrally placed and so that the axially load can be achieved .The load is applied and the failures are recorded .The ultimate load for nominal and various thickened cylinders are investigated .



Fig 2 - CFST Cylinder under UTM Machine

V. EXPERIMENTAL RESULTS

The load carrying capacity for various thickened sheets are absorbed .when a load is applied the GI sheet absorb and it transfer the load to the concrete. When a concrete starts yeiding at that time the GI sheet give confinement to the concrete .on increasing the load the sheet starts buckle and at an ultimate load the busting of GI sheet occur at loud noise .Strength of 0.3 mm thickness cylinders are all most same as that of nominal cylinders.When the thickness increases the strength also increasing .0.3mm gives 22N/mm ; 0.35 mm gives 24.5N/mm ; 0.5mm gives 27N/mm .



Fig 3 - Failure Mode Of CFST

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Fig 4 - At Ultimate Load

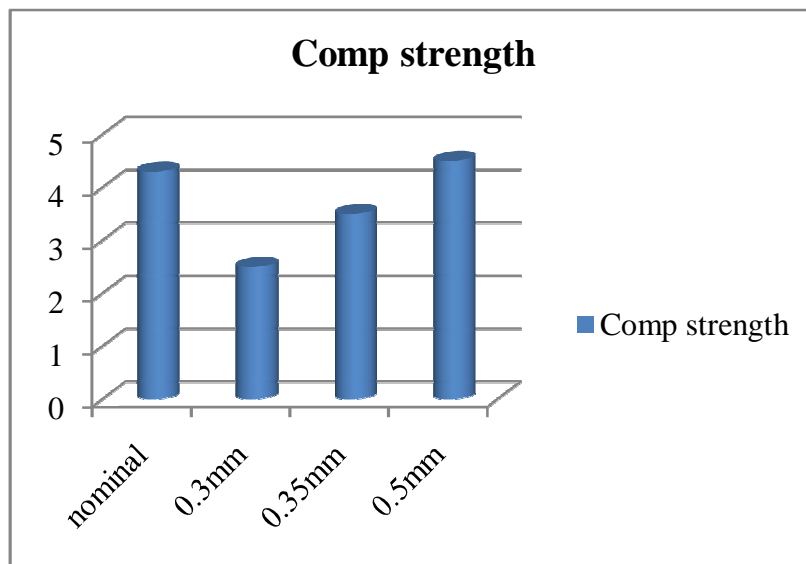


Fig 5 - Thickness VS Compressive stress

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Table 2 - Thickness VS compressive load

S.No	THICKNESS (mm)	ULTIMATE LOAD (kN/mm ²)
1	Nominal cylinders	22.08
2	0.5mm	27.29
3	0.35mm	24.39
4	0.3mm	21.5

V. CONCLUSION

- Compare to nominal cylinders the CFST cylinders give high strength when a compressive load is applied axially.
- The mechanism of CFST cylinders are well absorbed and the transfer of load from inward and outward delayed the crushing strength of the cylinders .
- When the CFST attains its maximum load then the failure starts at the revited joint.
- The crushing strength of the CFST is more when the thickness of the sheet is high .
- The binding between the sheet and the concrete is very poor .

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