

# AN ECONOMICAL STUDY ON BEHAVIOR OF HIGH REINFORCED CONCRETE FILLED UPVC COLUMNS

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**Abstract:** Composite materials are used in a lot of works. The study finds behavior of concrete filled UPVC tubes. The study included a complete of twenty-four specimens. The strength enhancement depended upon percentage of the stiffness of the UPVC tube in radial direction. Higher grade of concrete makes the CFUT's much brittle, because the verge of collapse of concrete is above the UPVC tubes. And study showed that higher ash content provides better strength in CFUT's than in RCC members.

**Keywords:** CFT, Composite Materials, Columns, UPVC Columns

## 1. INTRODUCTION

Composite materials are engineered or present materials made up of two or more constituent materials with significantly different physical or chemical properties which remain separate and distinct at the macroscopic or microscopic scale within the finished structure. Due to this the load of member reduces, serviceability, over all shape of the member by not compromising the strength of the fabric and by keeping economy on top of things.

In engineering constructions, the merits of a cloth are supported the factors like availability, structural strength, durability and workability. It's hardly surprising that no present material is understood to possess of these properties to the specified level. The engineering problem therefore consists of an optimization involving different materials and methods of constructions, with the target of building a structure at a minimum cost to satisfy the specified requirements of the structure. Methods of improving material utilization are often classified into two categories. the primary is to pick appropriate materials to make a replacement product with desired properties, thus leading to a composite material; for instance, glass fibers, cement and an additive are combined to make a comparatively cheap product used as cladding in buildings. This composite drives its lastingness from the glass fibers and its compressive strength from the cement matrix, while its durability is appreciably improved by the utilization of additives.

Alternatively, different materials are often arranged in an optimum geometric configuration, with the aim that only the desirable property of every material are going to be utilized by virtue of its designated position. The fabric should be chosen in such how that, it'll not compromise with all parameters that an ingenious member possesses, and there shouldn't be any problems within the availability of this material. it'll be another advantage if the materials getting used are the waste products.

## 2. CFT COLUMNS

Concrete filled tubular (CFT) columns are increasingly utilized in many modern structures, such as dwelling houses, tall buildings, and arch bridges. The composite tubular columns have better structural performance than that of bare steel or ferroconcrete structural members. Steel hollow sections act as reinforcement for the concrete. Steel concrete composite members have advantageous qualities such as enhanced strength, ductility and stiffness. Concrete filled steel tubes are a cheap column type, because the majority of the axial load is resisted by the concrete, which is a smaller amount expensive than steel. The steel tubes function the formwork for casting the concrete, which reduces the development cost. No other reinforcement is required since the tube act as longitudinal and lateral reinforcement for the concrete core. The confining effect causes the core concrete to behave during a triaxial stress state while the core concrete prevents the wall of the steel hollow section from buckling inward. Experimental studies on concrete-filled steel tubes are on-going for several decades.

## 3 High Performance Concrete

Concrete is not any longer made from aggregates, hydraulic cement and water only. Often, if not always it's to include a minimum of one among the extra ingredients like admixtures, supplementary cementitious material or fibers to reinforce its strength and sturdiness. The utilization of mineral admixture together with chemical admixture has allowed the concrete technologists to tailor the concrete for several specific requirements. Amongst the mineral admixture, silica fume, because of its finely divided state and very high percentage of amorphous silica, proved to be most useful, if not essential for the event of very high strength concretes and concrete of very high durability i.e. high performance concrete. But the silica fume is extremely expensive and it should be imported.

## 4 Results and Discussion

In this paper the graphs are plotted for load carrying capacity and ductility of the various specimens which are varying with reference to grade of concrete alongside varying amount of ash, and UPVC is of a continuing diameter. Results of the load carrying capacity of CFUT's were obtained from the corresponding load displacement curve of the specimen. The load carrying capacity thanks to

the UPVC confinement effect was analyzed. The specimens were tested for combined loading i.e. concrete loading and UPVC loading, so these two results were compared consistent with their grade of concrete and therefore the amount of varying ash. The results of the compressive strength are given in table below. The load V/s displacement graphs were plotted. The tables represent the height load of all the four categories. The graphs were also plotted for all the four categories with load in KN on Y-axis and displacements in mm on X-axis respectively. These graphs are plotted, by taking the typical values of load and displacement for every category, so a complete number of 4 graphs out of which two graphs are with same grade of concrete with varying amount of ash. Two graphs with same amount of ash with different grade of concrete.

#### 1 Experimental results of specimens 20FM40D190

S.NO.	SPECIMEN	LENGTH (mm)	MAX. LOAD (KN)
1	20FM40D190-1	750	999.00
2	20FM40D190-2	750	990.00
3	20FM40D190-3	750	942.00
4	20FM40D190-4	750	981.00
5	20FM40D190-5	750	985.25
6	20FM40D190-6	750	974.15

#### 2 Experimental results of specimens 30FM40D190

S.NO.	SPECIMEN	LENGTH (mm)	MAX. LOAD (KN)
1	30FM40D190-1	750	779.40
2	30FM40D190-2	750	775.30
3	30FM40D190-3	750	773.70
4	30FM40D190-4	750	750.00
5	30FM40D190-5	750	739.40
6	30FM40D190-6	750	410.00

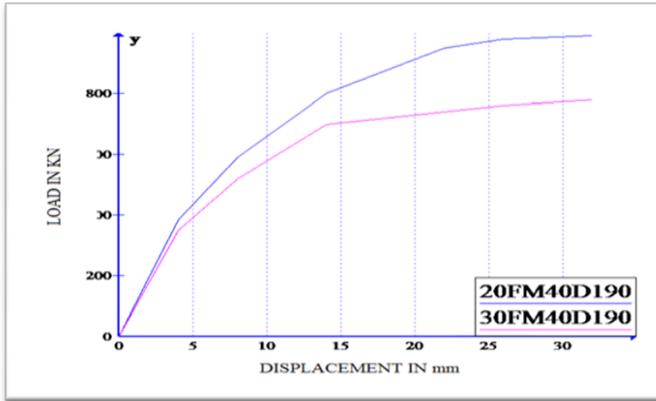
#### 3 Experimental results of specimens 20FM30D190

S.NO.	SPECIMEN	LENGTH (mm)	MAX. LOAD (KN)
1	20FM30D190-1	750	878.30
2	20FM30D190-2	750	877.00
3	20FM30D190-3	750	852.40
4	20FM30D190-4	750	837.10
5	20FM30D190-5	750	825.00
6	20FM30D190-6	750	812.70

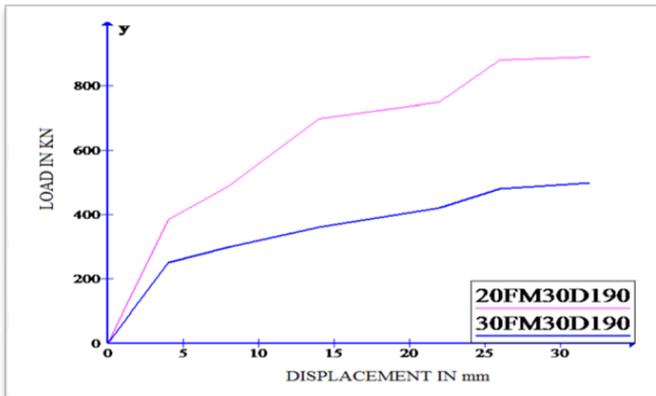
#### 4 Experimental results of specimens 30FM30D190

S.NO.	SPECIMEN	LENGTH (mm)	MAX. load (KN)
1	30FM30D190-1	750	440.00
2	30FM30D190-2	750	459.90
3	30FM30D190-3	750	457.00
4	30FM30D190-4	750	440.40
5	30FM30D190-5	750	432.40
6	30FM30D190-6	750	428.20

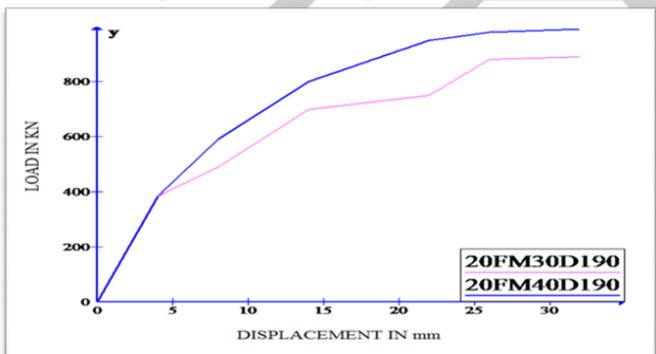
1: Load Vs Displacement of average of 20FM40D190 & 30FM40D190



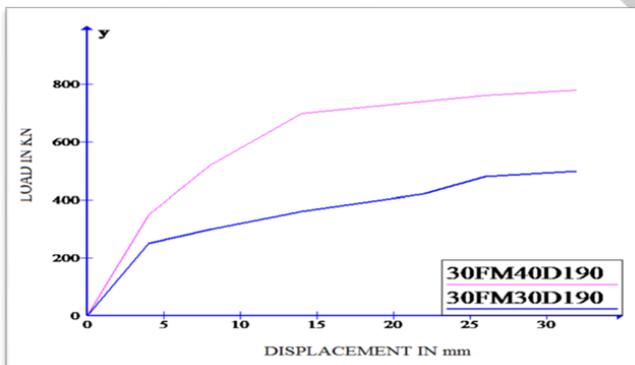
2: Load Vs Displacement of average of 20FM30D190 & 30FM30D190



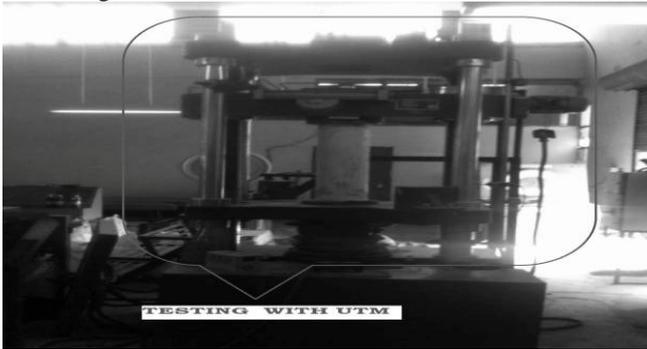
3: Load Vs Displacement of average of 20FM40D190 & 20FM30D190



4: Load Vs Displacement of average of 30FM40D190 & 30FM30D190



### 5: Testing with UTM



### 6: Failure of both Concrete and Steel



## 3. CONCLUSIONS

The current study has investigated the behavior of concrete filled UPVC tubes (CFUT) columns. Within the experimental program, the CFUT columns were reinforced internally with steel bars. UPVC tubes were used as stay-in-place form works for the columns. The experimental program included a complete of twenty four specimens cast alongside standard cubes. The columns were tested using concentric loading condition. During this experimental program to grades of concrete M30 and M40 are used with 20% and 30% of replacement of cement with ash. The UPVC of 190mm diameter was used as a CFUT column and therefore the 28 days strength was investigated. All the procedures conformed to the relevant IS codes. The CFUT columns were tested for concentric loading. Corresponding load carrying capacity displacement graphs are obtained. It had been observed that the majority of the columns failed by local buckling and bulging of material in the radial outer ward direction. The gauge length was taken as entire length of the CFUT column. The plotted graphs obtained were used for locating percentage increment within the load carrying capacity of CFUT.

The following conclusions are often drawn supported the experimental research work presented during this dissertation:

1. The longitudinal steel bars provide significant dowel action, which delays the dilation of concrete core inside CFUT, thereby improving the ductility of CFUT columns.
2. It's found that the majority of the CFUT columns failed by local buckling and bulging of fabric radially within the out ward direction of the column which causes the failure of UPVC tubes.
3. The load-carrying capacity of the CFUT is considerably above the traditional RC columns.
4. The strength enhancement will depend upon percentage of the stiffness of the UPVC tube in radial direction.
5. Local pipes fail by explosion and hence not preferred for low cost housing. The local pipes can't be used for low cost housing; however the CFUT's are often used as piles, because the external pressure of the soil keeps the pipes intact preventing from an explosion.
6. Most of the samples are failing in shear failure with diagonal crack, resulting to an explosion.
7. Higher grade of concrete makes the CFUT's much brittle, because the verge of collapse of concrete is above the UPVC tubes.
8. The mode of failure of the CFUT columns was by local buckling and bulging of fabric radial outer ward direction of the column.
9. Higher ash content provides better strength in CFUT's than in RCC members.

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