

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM**



**A PROJECT REPORT ON**

**“Experimental Investigation on Composite Steel Columns (CSCs) Subjected to Monotonic Loading”**

**Sponsored by**

**KARNATAKA STATE COUNCIL FOR SCIENCE & TECHNOLOGY  
(KSCST)**

**IISc, Campus, Bangalore**

**Proposal ref. no: 34S0181 dt: 21/02/11**

**Corr. Ref. no: 7/01/03/SPP/1388**

**Submitted in partial fulfillment of the requirement for the degree of  
BACHELOR OF CIVIL ENGINEERING**

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RAMANAGARAM-562159  
2010-2011**



## SYNOPSIS

Columns occupy a vital place in the structural system. Weakness or failure of a column destabilizes the entire structure. Strength & ductility of steel columns need to be ensured through adequate strengthening, repair & rehabilitation techniques to maintain adequate structural performance. Recently, composite column are finding a lot of usage for seismic resistance. In order to prevent shear failure of RC column resulting in storey collapse of buildings, it is essential to make **ductility** of column larger. Recently, most of the buildings utilize this CFT concept as primary for lateral load resisting frames. The concrete used for encasing the structural steel section not only enhance its strength and stiffness, but also protects it from **fire damages**.

In this experimental program DOE (Design Of Experiments) as been adopted in order to reduce the material cost and to hence to achieve the economy. As three variable parameter has been considered in this experimental program i.e, Length, Thickness & Cross sectional area which are varied at three levels i.e, for 3 different lengths of columns.hence without adopting DOE approach one should invariably conduct  $3^3=27$  i.e, 27 experiments for one level i.e, for one particular length of specimen. As there are 3 levels i.e, 3 different length of columns have been considered, total experimental to be conducted for all the combinations equal to  $[(3^3) \times 3] \times 3=243$  (all combinations of length, thickness, c/s area, lengths, tripled to get average) samples but as per DOE approach using orthogonal arrays (OAs) only 9 critical combinations are enough i.e, for each level 9 experiments to be conducted hence total number of experiments to conducted as been reduced to  $[9 \times 3] \times 3=81$  (critical combinations of L,T, &C/S area, different lengths, tripled).

Hence using DOE approach as per OAs number of experiment have been reduced from 243 to 81 samples.

Results have been analyzed using most recent soft tool MINITAB V-15.1. analysis have been carried out using Analysis Of Variance (ANOVA) technique. A rigorous statistical analysis and design statistical tool. Linear regression analysis is an attempt as been made in this project work to fit linear regression equation for  $P_u$  (Ultimate Load with/without Epoxy) which is based on which is a function of Length, Thickness, C/S area of the tube.

(detailed explanation in page no. 64-88)

Epoxy Blended Concrete (EBC) is an innovative material for strengthening. Epoxy Blended Concrete columns exhibit higher strength and improved ductility. Seismic performance of EBC was studied by many researchers and they concluded that confinement provided in potential plastic hinge region lead to significant improvement in both strength and displacement ductility.

Here, an attempt is made to study strength and energy absorption capacity (i.e. Modulus of Resilience and Modulus of Toughness) of totally 189 specimens of the following four models. Each model is of three sets, one set for Hollow steel columns, another set for steel columns filled with cement concrete and other set steel columns filled with Epoxy Blended Concrete (EBC) and models are machine cut for different lengths i.e. 150mm, 250 mm and 350 mm.

- 1. Empty steel columns (27)**
- 2. Steel columns filled with cement concrete (81)**
- 3. Steel columns filled with Epoxy Blended Concrete (81)**

Practical importance of this study is in the application of this system to seismic resistant structures prone to earthquakes.