EXPERIMENTAL RESEARCH ON STEEL COLUMN TO INCREASE STRENGTH BY RESTRAIN BARS

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ABSTRACT

The main aim of the research work is to increase the strength of the steel column (Tube-Section) for new and existing structure by adding restrain bars. By increasing the strength of the column by restrain bars for the new structure, the outcome of the section will be more efficient and the performance of the column in buckling will also increase. And for the existing structure, strengthening the column can be done by adding restrain bars in it, thus the column tend to buckle can be restrained so that the load carrying capacity of the column can be increased. The increased strength of column can be identified by testing the conventional and contemporary column for buckling. Technically, In other words, by increasing the moment of inertia of the column, the column can resist more crippling load.

Keyword: - *Steel Column, Restrain Bar, Moment of Inertia, Rehabilitation of Steel Column, Strengthening of Steel Column.*

1. INTRODUCTION

Day by day lots of structures are sprouting everywhere in and around both rural and urban areas. This tremendous development shows strong growth in infrastructure. Always while there is strong growth in infrastructure, more structure will be constructed in conventional types. Most of the conventional type structure will not be efficient as much. When the structure is not much effective it usually leads to failure of structure at certain disaster level or may be inefficient to take design load or some time will cause much bigger section to resist the design load. As a Structural Engineer it is need to design a structure as an efficient one. And when providing higher section it will have much weight, thus the dead load of the structure will be increased. So as a Structural Engineer it is necessary to design contemporary structures that are much efficient.

1.1 Need of the Project Work

The need of the project work is to overcome the problems like

- To bring an easy method of rehabilitation
- To ensure section design is much efficient
- Reducing the material weight
- Global warming

1.2 Objective

The main aim of the research project is to find a new method of strengthening the steel column by using restrain bars.

The objective of the project is to bring out the efficient column section design. When efficient section is designed we can ensure the maximum load carrying capacity. In contemporary column design it will take more load than the conventional column, at the same time material will be used less for the contemporary design column of same load carrying capacity. Here is the two main objective of the research work.

- A new rehabilitation method, for existing building
- An effective section design, for new building

2. METHODOLOGY

Project work will be carried out through the "Experimental Research" work. Models will be designed with available general criteria. All models will be tested with the Loading Frame. With the testing results various graphs will be plotted for comparisons.

3. WORK PLAN

"Tube Section" was selected for this project work. The entire column models will be in the height of 1.0m. And the restrain bars will be place in the center of the column and it be welded rigidly to arrest the movement of the restrain bars. The height of the restrain bars will be varied from 1/3 Height of the column to 2/3 height of the column (0.4m to 0.8m). Height will in the increment measure of 0.1m. In every size 3 numbers of models are tested and mean value of the result is taken as final value.

Tube Section – Height of Model 1.0m

3.1 Conventional Model Details

- 3 Number of model will be tested (without restrain bar)

3.2 Contemporary Model Details

- Model with restrain bar height 0.4m, 3 numbers of models will be tested
- Model with restrain bar height 0.5m, 3 numbers of models will be tested
- Model with restrain bar height 0.6m, 3 numbers of models will be tested
- Model with restrain bar height 0.7m, 3 numbers of models will be tested
- Model with restrain bar height 0.8m, 3 numbers of models will be tested

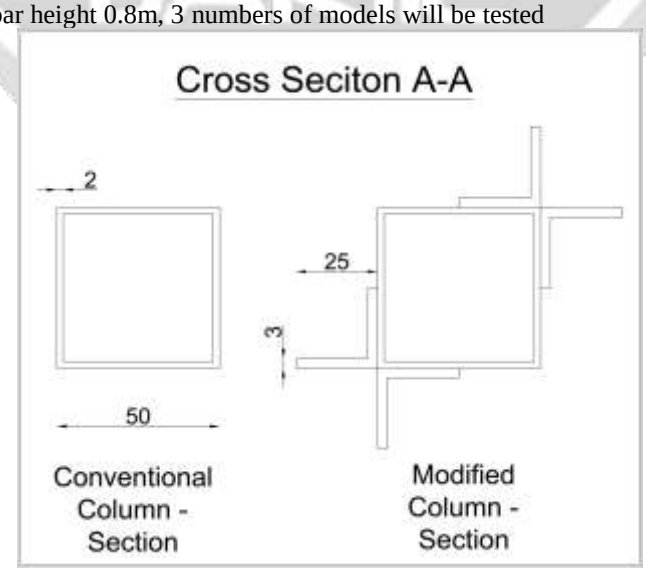


Fig-10: Cross Sectional View

In fig 5, the conventional column is shown with the base plate welded on top and bottom.

Fig – 5: Conventional Column with Base Plate

Fig – 6: Contemporary Column

In the fig 6, the contemporary column in shown, this is welded with the restrain bars and base plates. Base plate is welded on both ends.

4. TESTING SETUP

For testing of the column 500 kN loading frame with proving ring is used. All columns are test in loading frame and readings are taken for ultimate load. The weight of the proving ring is10.5 Kg, this weight will be added to the load, in calculation.

Fig-7: Testing Setup

5. RESULT AND DISCUSSIONS

Testing is carried by using of the loading frame. Total numbers of 18 specimens are tested in loading frame. All the results are tabulated as follows.

Table-1: Result for the Conventional Column

Result for the conventional column		
S.No	**Specimen No**	**Load, In kN**
1	Specimen 1	8.79
2	Specimen 2	8.37
3	Specimen 3	9.20
Mean Value		**8.79**

Table-2: Result for the Column with Restrain Bar (0.4m)

Result for the Column with Restrain Bar (0.4m)		
S.No	**Specimen No**	**Load, In kN**
1	Specimen 1	11.52
2	Specimen 2	11.94
3	Specimen 3	12.35
Mean Value		**11.94**

Table-3: Result for the Column with Restrain Bar (0.5m)

Result for the Column with Restrain Bar (0.5m)		
S.No	**Specimen No**	**Load, In kN**
1	Specimen 1	1302
2	Specimen 2	13.43
3	Specimen 3	13.85
Mean Value		**13.43**

Table-4: Result for the Column with Restrain Bar (0.6m)

Result for the Column with Restrain Bar (0.6m)		
S.No	**Specimen No**	**Load, In kN**
1	Specimen 1	13.60
2	Specimen 2	14.23
3	Specimen 3	15.26
Mean Value		**14.37**

Table-5: Result for the Column with Restrain Bar (0.7m)

Result for the Column with Restrain Bar (0.7m)		
S.No	**Specimen No**	**Load, In kN**
1	Specimen 1	16.83
2	Specimen 2	17.25
3	Specimen 3	17.66
Mean Value		**17.25**

Table-6: Result for the Column with Restrain Bar (0.8m)

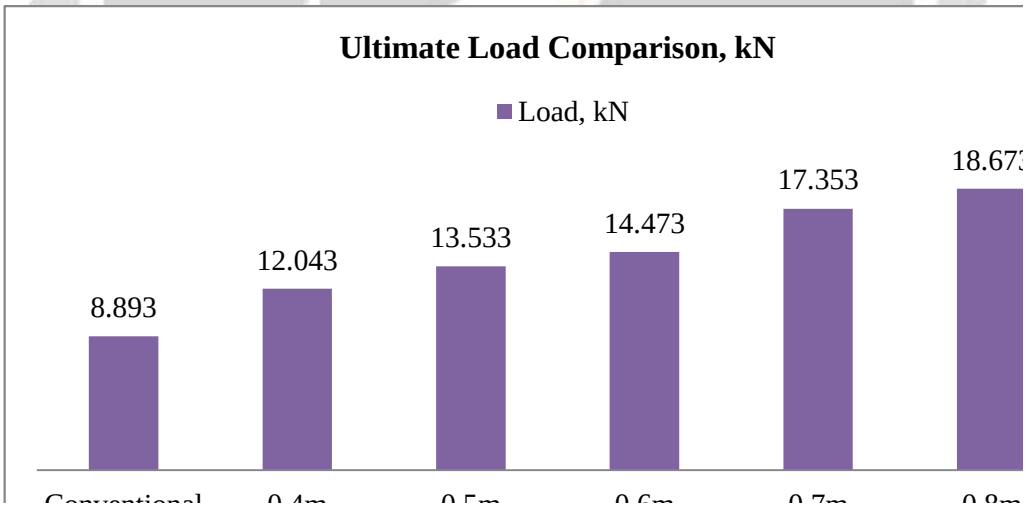
Result for the Column with Restrain Bar (0.8m)		
S.No	**Specimen No**	**Load, In kN**
1	Specimen 1	18.57
2	Specimen 2	18.16
3	Specimen 3	18.99
Mean Value		**18.57**

The weight of the proving ring is 10.5kg, which is converted to kilo newton and the values are added to the load. Exact load are calculated and tabulated in table 7.

Table-7: Exact Ultimate Load, In kN

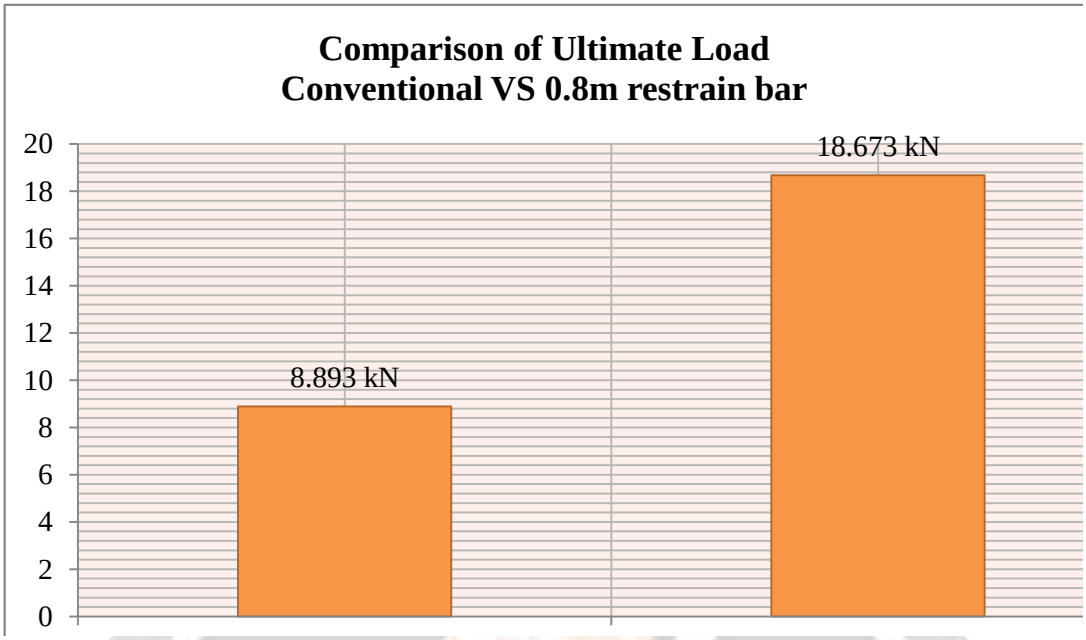
S.No	Specimen Type	Mean Value	Ultimate Load, In kN
1	Conventional	8.79	8.893
2	With Restrain Bar 0.4m	11.94	12.043
3	With Restrain Bar 0.5m	13.43	13.533
4	With Restrain Bar 0.6m	14.37	14.473
5	With Restrain Bar 0.7m	17.25	17.353
6	With Restrain Bar 0.8m	18.57	18.673

From the result, it's clear that the load carrying capacity of the column will be increased when the restrain bar is attached with column. The increments of load carrying capacity with the length of the restrain bar are plotted in
graph-1.



Graph-1: Ultimate Load Comparison

In graph 2, the ultimate load is compared with the conventional column to 0.8m restrain bar attached column. When restrain bar is attached with the column to height of 0.8m in the column the load carrying capacity is increased to 2.1 (18.673 kN) times when compared with the conventional column (8.893).



Graph-2: Comparison of Ultimate Load Conventional VS 0.8m restrain bar

6. CONCLUSION

As expected the load carrying capacity of the column is increased when restrain bar is attached with the column. This method can be extensively used for the rehabilitation purpose. The strength can be increased to the column as required by the altering the height of the restrain bar. The load carrying capacity of the column increases as the restrain bars attached. When comparing the conventional column with modified column (0.8m), the load carrying capacity of the column is increased to 9.76kN. Modified column carried load of 18.673kN, but conventional column carried only 8.993kN.

7. REFERENCE

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