*International Journal of Application or Innovation in Engineering & Management (IJAIEM)*
**Web Site: www.ijaiem.org Email: editor@ijaiem.org**
**Volume 6, Issue 5, May 2017** **ISSN 2319 - 4847**

# Experimental study of column wrapped with Textile fabrics

**Asso.Prof. Dharmesh K. Bhagat[1], Parishi H. Dalal[2], Sagar D.Rana[3], Darshil M. Rasania[4], Haresh D. Gayakwad[5]**

[1]Associate Professor(CIVIL), Sarvajanik College of Engineering & Technology, Surat, Gujarat, India.

[2,3,4,5]Student (CIVIL), Sarvajanik College of Engineering & Technology, Surat, Gujarat, India.

## Abstract

***Strengthening has become the best suitable way of improving the load carrying capacity and extending the service lives of these structures .The most practicable solution for repairing and strengthening work to resist higher design loads or to provide additional safety to the constituent when it is not constructed to carry the design load due to the human or other errors is to externally apply technical textile fabrics. This technique is one of the latest and less used developments in the civil engineering industry. There are large number of projects have been done with textile fibers and it has be concluded that wrapping technique is suitable for structural repair and strengthening. In this experimental work, the columns were wrapped by textile fabrics in stripping form and studied the behavior of the column in term the crack patterns development and the ultimate load carrying capacity of column subjected to axial compression load. This work is done to conclude the utility of the textile fabrics, the extent of the Strip wrapped column that would carry the load and the pattern of textile fabrics that would give the effective results.***

**Keywords:** Reinforced concrete, load carrying capacity, textile fabrics, universal testing machine, strip wrapping

## 1. INTRODUCTION

Concrete column or pillar in architecture and structural engineering is a structural constituent that transmits, through compression, the weight of the constitution on top of two other structural elements below. In other words, a column is a compression element. They are vulnerable in situations where there is an increase in structural capacity. Strengthening of column is most challenge work for civil engineering. The most challenging thing is selection of suitable strengthening techniques for that work as economical, faster and easier than other and effective than other methods. Replacement of any component of structure is uneconomical and time consuming so that strengthening of component by Retrofitting. This technique is suitable for structural repair and strengthening. This technique is one of the latest and less used developments in the civil engineering industry. There are large number of projects have been done with textile fibers and it has be concluded that this technique is suitable for structural repair and strengthening.

### 1.1 Aim and objective

The main aim of this project is to study how much useful and effective strips of textile fabrics to strengthening of RCC column and effect on load carrying capacity of column by increasing no of fabrics layer. Objectives of the project are:

- To compare the load carrying capacity of an ordinary RCC column and RCC column wrapped with strips of textile fabrics.
- To compare the strength result by wrapping the fabrics on full surface, L/4 portion of top and bottom portion and middle L/2 portion.
- To compare the load carrying capacity increment by wrapping strips of fabrics with single and double layer.
- Finally to use woven textile fabrics for external reinforcement to check whether the increment in load carrying capacity and it can be use for repairing work instead of retrofitting.

## 2. EXPERIMENTAL WORK

In experimental work casting of column and testing of column can be include. Every column has same dimension and same concrete mix and reinforcement.

### 2.1 Casting of column

For this experiment rectangular shape columns are used with 150×150×750 mm dimensions. For reinforcement as main steel in longitudinal direction 4 numbers of 8mmØ bars and for stirrups in lateral direction 6mmØ bar at 90mm c/c distance, i.e. 2-legged 6mmØ bars with 90mm c/c distance are used. The concrete mix was prepared to targeted strength of M20, i.e. 20 N/mm$^2$. Following properties materials are used for preparing concrete: Cement – 53grade

ordinary Portland cement, Sand – white sand, coarse aggregate. Polypropylene of 120GSM is used as textile fabrics for wrapping of column in strips manner. Sikadur31 is used as adhesive to join concrete and fabrics.

### 2.2 Preparation of column

Columns were prepared by filling of moulds with concrete mix with proper placing of reinforcement and compacted with tamping rod and vibrator machine. Columns were unmolded after 24 hrs and cured for 28 days in water tub. After curing columns were rest in atmosphere for 24 hrs and then wrapping of strips were started. Columns were cured for 7 days after wrapping of strip for proper bonding of concrete and fabrics.

The columns were divided into following groups for testing purpose:

**Table 1** Details of specimen

| Sr. No. | Specimen Indication | Description |
|---|---|---|
| 1 | Normal column | Reference column used without wrapping |
| 2 | FSSL | Full strip single layer |
| 3 | FSDL | Full strip double layer |
| 4 | ¼ SSL | ¼ from top and bottom strip single layer |
| 5 | ¼ SDL | ¼ from top and bottom strip double layer |
| 6 | MSSL | Middle strip single layer |
| 7 | MSDL | Middle strip double layer |

### 2.3 Testing of columns

'Universal Testing Machine-UTM' of 1000kN was used for the testing of columns. Reference column was tested first and then other wrapped columns. Load was applied on the column up to its ultimate capacity and the ultimate load was noted digitally for each specimen.

**Figure 1** Column placed in UTM

## 3. RESULTS

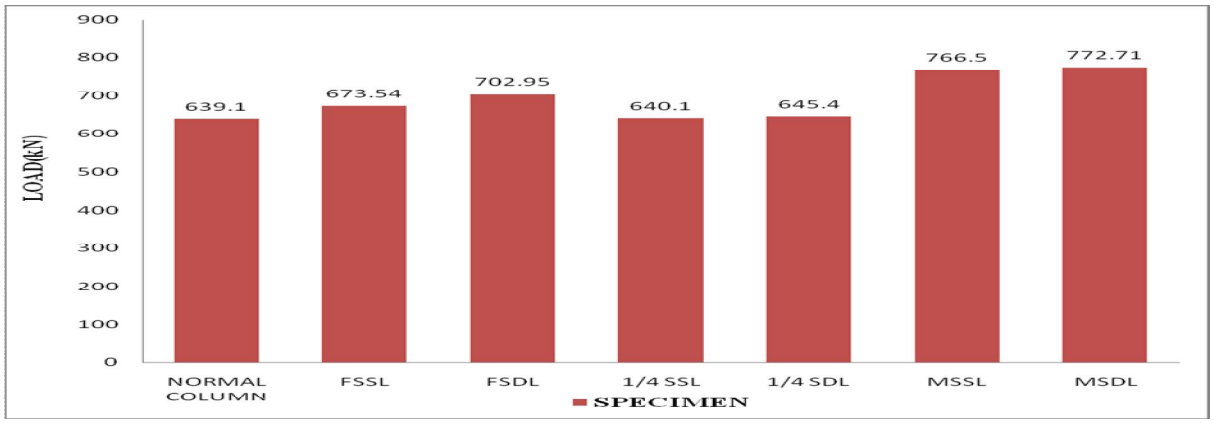


**Figure 2** Bar Chart

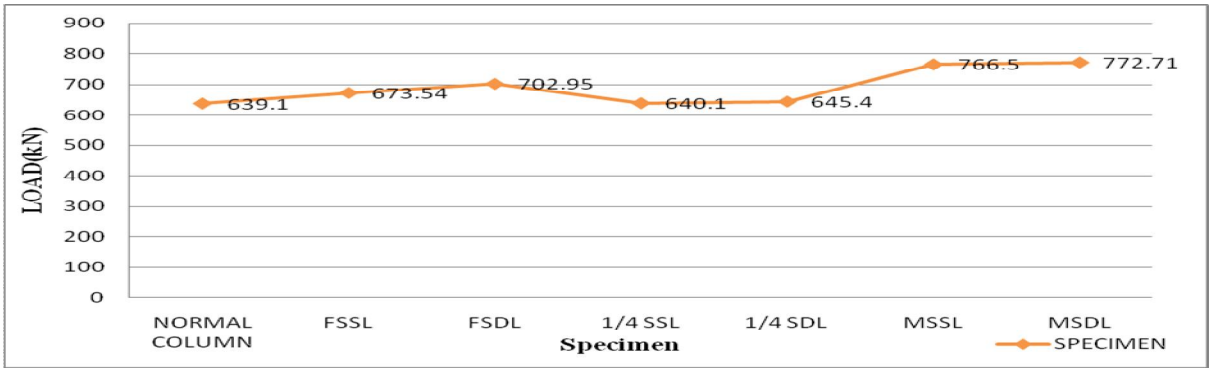


**Figure 3** Line Chart

**Figure 4** Failure of MSDL

**Table 2** Test results of columns

| Sr. No. | Specimen Indication | Description | Ultimate Load (kN) | % increase in load carrying capacity (%) |
|---|---|---|---|---|
| 1 | Normal column | Reference column used without wrapping | 639.1 | ---- |
| 2 | FSSL | Full strip single layer | 673.54 | 5.39 |
| 3 | FSDL | Full strip double layer | 702.95 | 9.99 |
| 4 | ¼ SSL | ¼ from top and bottom strip single layer | 640.10 | 0.1565 |
| 5 | ¼ SDL | ¼ from top and bottom strip double layer | 645.40 | 0.99 |
| 6 | MSSL | Middle strip single layer | 766.50 | 19.93 |
| 7 | MSDL | Middle strip double layer | 772.71 | 20.91 |

Here, we can observe that the ultimate loads of wrapped columns are more than the reference column. So increase in load carrying capacity of full strip single layer wrapped column, full strip double layer wrapped column, ¼ strip single layer wrapped column from top & bottom, ¼ strip double layer wrapped column from top & bottom, middle strip single layer column and middle strip double layer column in percentage respectively 5.39%, 9.99%, 0.1565%, 0.99%, 19.93% and 20.91%.

## 4. CONCLUSION

From the experiment result we can conclude that wrapping at middle one half portions is more effective than the other two methods. As short columns fails by crushing and external support provided at the most affected area of the column this was occure. The crushing of column occurs in that region. Due to failure of column crushing will occur. As the column is wrapped at middle one half portions, it gives the extra external support at the most affected area. So the capacity of withstanding the column against the compressive load is increased.

The load carrying capacity of wrapped column at middle one half portions is more than the fully wrapped column. As we have seen that the increment in load carrying capacity of column wrapped at ¼ top and bottom portion is negligible. So in the fully wrapped column those portions' wrapping are negligible and non effective. As these will act as silent mode and hence the load carrying capacity has not increased much.

## References

[1] Akshay P. Mote, H.S.Jadhav, "Experimental Study of Axially Loaded RC Short Columns Strengthened With Basalt Fiber Reinforced Polymer (BFRP) Sheets," Akshay P. Mote Int. Journal of Engineering Research and Applications, Vol. 4, Issue 7( Version 4), pp.89-92, July 2014.
[2] Azadeh Parvin, David Brighton, "FRP Composites Strengthening of Concrete Columns under Various Loading Conditions," Polymers 2014, 6, 1040-1056; doi: 10.3390/polym6041040, pp: 1040-1056, 2014.
[3] Engr. Azam Amir, Dr. AmjadNaseer, Engr. Orooj Azam, "Strengthening of Existing Building Column Using FRP Wrap & GI Wier Mesh," International Journal of Scientific & Engineering Research Volume 4, Issue 5, pp: 211-216, May-2013.
[4] GRACE YAU, "REPAIR AND STRENGTHENINGTKENING OF COLUMNS WITH FIBRE REINFORCED COMPOSITES", pp: 1-164, 1998
[5] Halil Sezen, Eric A. Miller, "Experimental Evaluation of Axial Behavior of Strengthened Circular Reinforced-Concrete Columns", American Society of Civil Engineers, pp: 238-247, 2011.
[6] K. OLIVOVÁ, J. Bilcik, "Strengthening of concrete columns with CFRP", Slovak journal of civil engineering, pp: 1-9, April 2008.
[7] Kunio Fukuyama, et.al., "Studies on repair and strengthening methods of damaged reinforced concrete columns", Cement and Concrete Composites 22(1), pp:81-88, February 2000.
[8] P L Shrive, et.al., "Strengthening of concrete columns with carbon fibre reinforced polymer wrap", Canadian Journal of Civil Engineering 30(3), pp: 543-554, February 2011.
[9] Y S S Al-Kamaki, R Al-Mahaidi, I D. Bennetts, "Confinement of heat-damaged RC circular columns using CFRP fabrics", vol. I, Byron Bay, NSW, Southern Cross University, Lismore, NSW, pp. 477-482, December 2012

**AUTHOR**

Asso. Prof. Dharmesh Bhagat received the D.C.E., B.E. and M.E. degrees in Civil Engineering from Technical education board(TEB), Ahmedabad; Sardar Vallabhbhai Regional College of Engineering and Technology (SVRCET) currently known as SVNIT and SVNIT in 1986, 1992 and 2000, respectively. He has total 11 years field experience. He has 20 years of teaching experience in Sarvajanik college of Engineering and Technology (SCET), Surat, Gujarat, INDIA. He is currently working as Associate Professor at SCET, since 1997.

Parishi Dalal is studying in last semester of civil engineering at Sarvajanik College of Engineering and Technology (SCET), Surat, Gujarat, INDIA in 2017.

Sagar Rana is studying in last semester of civil engineering at Sarvajanik College of Engineering and Technology (SCET), Surat, Gujarat, INDIA in 2017.

Darshil Rasania is studying in last semester of civil engineering at Sarvajanik College of Engineering and Technology (SCET), Surat, Gujarat, INDIA in 2017.

Haresh Gayakwad is studying in last semester of civil engineering at Sarvajanik College of Engineering and Technology (SCET), Surat, Gujarat, INDIA in 2017.