REINFORCEMENT BAR COUPLER AS A COST EFFECTIVE ALTERNATIVE FOR LAP SPLICES IN COMPRESSION MEMBERS

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ABSTRACT

Construction practices in the building of concrete structures have focused on the use of steel reinforcement to transfer tension and shear forces. Lap splicing has become the traditional method of connecting the steel reinforcing bars. Splicing the reinforcement bars by laps or welding have various imperfections such low quality welds, inadequate length of lap, failure in joints, increase in labour cost etc. present study was focused on the use and applicability of reinforcement couplers, especially threaded one as an under construction site was taken where couplers was done. Alternatively, the cost of steel was also determined for providing lap splices in the columns. A comparison was done to show difference of cost in lapping and use of couplers significantly reduces he consumption of both construction time and reinforcing steel. It also increases the overall reliability of reinforcement splices. This case study included calculations for 14 columns and showed that how couplers have effectively saved huge amount of money in a single building. The reinforcement couplers not only provide strength to the joints but they are also an economic means of connections of two bars.

INTRODUCTION

There are three basic ways splice the bar. Lap splices, Mechanical connections and Welded splices. Lapped joints are not always an appropriate means of connecting reinforcing bars. The use of laps can be times consuming in terms of design, detailing and installations and can lead to greater congestion within the concrete because of the increased amount of reinforcement bar used. It also increases the overall reliability of reinforcement splices. Of the three, lap splicing is the most common and usually the least expensive. Couplers especially threaded one can simplify he design and construction of reinforced concrete and reduce the amount of reinforcement required. The coupler system is designed to connect two pieces of reinforcement bar together in the field quickly and easily. The applications include standard bar-to-bar connection, reinforcement bar termination and anchorages, transition splicer's, segmental construction and connections to structural steel They've found that mechanical connections afford a reliability and consistency that can't be found with lap splices. Bars in lap splices are usually in contact, but in flexural members the bar can be separated by as much as 6 inches. Bond between steel and concrete transfer the load in one bar to the concrete and then from the concrete to the other reinforcement bar. Reinforcement bar couples have proven to be very cost effective and time saving compared to welding bars, the reinforcement bar couples is economical only with use of bars of diameter 20mm and above.

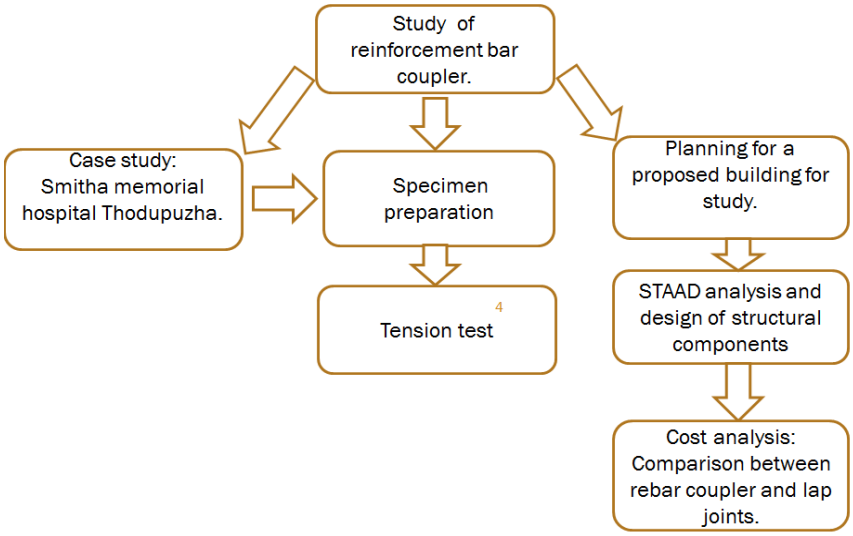
LITERATURE REVIEW

Singh R, Himanshu S. K and**Bhalla N (2013)** conducted a case study to check the cost effectiveness of using reinforcement bar couplers in comparison with lap splices. They carried out case study at Jaypee Greens new undergoing project 'Wish Town Klassic' extended over 40 acres in sector- 129 of Noida, India.The couplers were installed in the columns and the corresponding cost was worked out. Also the lap length was analysed by performing calculations.It also increases the overall reliability of reinforcement splices. The study proved that couplers are an effective and an economic replacement for lap splice.

Gary Connah(2013) conducted a study on requirements for the prequalification of mechanical splices for reinforcing bars in Seismic Conditions. He concluded that the test specifications for mechanical splices vary, depending upon the specifying authority and country and application. Where mechanical splices are considered for use, the designer should ascertain the required coupler performance criteria and consult with manufacturers who can provide expertise in the selection of an appropriate and economical system.

VidmantasJokubaitis and **LinasJuknevicius (2010)** conducted a study to analyze the influence of reinforcement couplers on the appearance of normal cracks in reinforced concrete beams. The method for calculation of cracking moment when tensile reinforcement is spliced by couplers was presented. The analysis of experimental and numerical results obtained by calculation method mentioned above has shown that the first normal cracks usually appear at the end of the coupler

METHODOLOGY



SCOPE AND OBJECTIVE

1. To study the effect of 'Reinforcement bar coupler' as an alternative to 'lap splice' in compression members
2. Analyze he cost efficiency of 'Reinforcement bar couplers.

ANALYSIS OF TEST RESULTS AND DISCUSSIONS

Testing procedure

- In order to replace the conventional lap splices, the reinforcement bar couplers should satisfy adequate strength requirements as well it should be beneficial in the point of view of economy.
- To check the strength characteristics, reinforcement bar couplers were checked against the strength of ordinary reinforcement bars by conducting pull test in UTM.
- To check the cost efficiency of reinforcement bar couplers, a building was modeled in STAAD, designed and the cost analysis was conducted.

INSTALLATION OF COUPLER

- Reinforcement bars are cut to required length at the steel fabrication yard before transferring onto the threading workbench.
- Poorly sheared ends must be cut off using disc cutter prior any threading work.
- Reinforcement bar ends to be cold forged before commencing threading.
- A coupler gauge with 'cut window' will be use to inspect insertion and thread quality of reinforcement bar at 50 threads interval.
- Coupler will be hand tightened onto threaded bar. All exposed threaded bar shall have protective plastic cap

SPECIMEN PREPARATION

- Reinforcement Bar
- Reinforcement bar Coupler
- Cold Forging
- Threading
- Coupling

CALCULATIONS

- According to IS 456 : 2000
- Development lenth of bars, L_d = 48×diameter of bar .
- For 25 mm bars, L_d = 1.2m.
- For 32 mm bars, L_d = 1.54m.

- Unit wieght of 25 mm bar = 3.854 kg/m.
- Unit weight of 32 mm bar = 6.313 kg/m
- Unit price of reinforcement bar = Rs. 64/kg

TENTION TEST IN UTM

Fig1.1 - Universal testing machine

Fig 1.2 -Reinforcement Bar coupler

Sl. No.	Brand Name/ Identification Marks	Ultimate Load (kN)	Ultimate stress (N/mm^2)	Breaking Load (kN)	Nominal breaking stress (N/mm^2)	Remarks
1.	JSW TMT PLUS 500 D	303	616.129	248	504.29	Breaking at 280 mm away from the centre of the bar
2.	JSW TMT PLUS 500 D (Coupler) Quarter span Short span at top	303	616.129	248	504.29	Breaking at 102 mm away from the centre of the coupler at short end
3.	JSW TMT PLUS 500 D (Coupler) Quarter span Short span at bottom	303	616.129	257	522.591	Breaking at 112 mm away from the coupler at longer end
4.	JSW TMT PLUS 500 D (Coupler) Equal span (Yellow)	306	622.23	264	536.825	Breaking at 152 mm away from centre of the coupler .
5.	JSW TMT PLUS 500 D (Coupler) Equal span (Green)	305	620.196	266	540.892	Breaking at 300 mm away from centre of the coupler
6	JSW TMT PLUS 500 D (Coupler) Equal span (Red)	307	624.262	266	540.892	Breaking at 225 mm away from centre of the coupler

Table 1.1 Tension Test On Utm

DETAILING

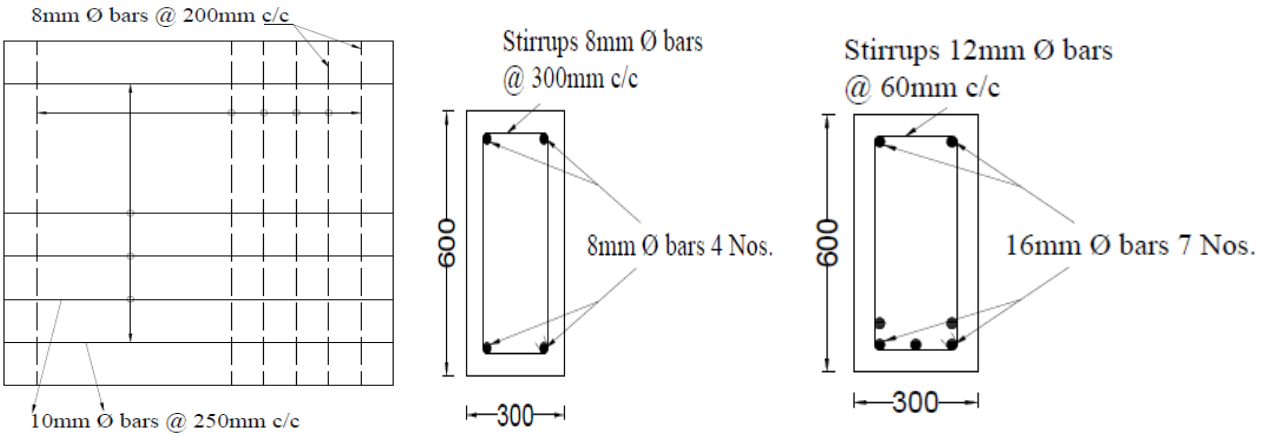


Fig 1.3 Detailing of slab,beam,column

CONCLUSION

The report concludes that the added structural and economic advantages of mechanical splices over laps make the benefit-to-cost ratio extremely attractive because mechanical splices give the structure added toughness and load path continuity that laps cannot offer. The reinforcement couplers not only provide strength to the joints but they are also an economical solution to connect two bars. The taper-threaded splice is a widely used mechanical splicing system worldwide.

Splices are designed for use on worldwide standard grades of reinforcement bar and many international standards. No special high strength, enlarged thread section or increased reinforcement bar size is necessary, thus allowing the supply of reinforced bar from multiple sources for maximum cost savings. These splices are the slimmest couplers available today and their innovative taper threaded design makes them one of the most reliable systems on the market.

REFERENCES

1. Singh R., Himanshu S. K., Bhalla N., "*Reinforcement Couplers As An Alternative To Lap Splices: A Case Study*",International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 2 Issue 2, February- 2013
2. 2.Gary Connah, "*Prequalification Of Mechanical Splices For Reinforcing Bars In Seismic Conditions*",Journal of the Structural Engineering Society of New Zealand Inc ,Vol. 26 Issue 2, 2013
3. VidmantasJokūbaitis, LinasJuknevičius, "*Influence Of Reinforcement Couplers On The Cracking Of Reinforced Concrete Members*", The 10th international conference, May 19-21, 2010, Vilnius, Lithuania
4. M K Hurd, "*Mechanical vs.lapsplicing",*Concrete construction magazine, Jan 2008
5. A. Ruangrassamee , P. Mounnarath , "*Monotonic And Cyclic Behaviors Of Energy-Dissipating Threaded Mechanical Splices",*The 14th World Conference on Earthquake Engineering October 12-17, 2008, Beijing, China