Journal of Advances in Science and Technology
Vol. 13, Issue No. 01, (Special Issue) March-2017, ISSN 2230-9659

Splintering Portrayal of Strung Rebar and Coupler

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Abstract – Lap splicing is the conservative technique for linking the steel strengthening bars from several centuries. The main advantages of simplicity and frugality in lap splicing are limited to smaller diameter bars. The mechanical couplers provide the elucidation for splicing when large diameters bars are involved. Spliced rebar performs like continuous reinforcement. Splicing enhances better toughness mechanically, but autonomous of concrete. Consequently contributing ductility in RCC structures independent of the concrete's condition. Proven cyclic performance of spliced rebars offers strength during artificial, seismic or other natural events. The permanency of spliced rebar offers excellent provision for grounding the electric current. The use of couplers as an alternative to lap splices would overcome rebar congestion and improves the flow & consolidation of concrete. It even offers greater flexibility in design options. The ease in detailing of reinforcement, particularly in strengthening bottleneck regions decreases the strengthening fixative inaccuracies, thus detailing and fixing of seismic reinforcement becomes effortless. Moreover the workability with advanced steel-to-concrete proportion permits optimization of size of RCC fundamental associates. The coupler offers quality, cost and time saving. Compared to lapping, simple mechanical ways in adopting mechanical splicing accelerates construction schedules for optimum cost and efficiency.

Keywords—Coupling, Splicing, Strengthening, Ductility, Optimum Sizing.

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INTRODUCTION

Edifice determines development of a country. The aesthetic view of structure leaves an impression of development, use of couplers provides a wide scope as far as building design is concerned. Lapped joints are not continuously suitable means of joining strengthening bars. The use of laps can be time consuming in terms of design and installation and can lead to greater congestion within the concrete because of the increased amount of rebar used[1-2]. Couplers can simplify the design and construction of reinforced concrete and reduce the amount of reinforcement required. Lapped joints are reliant on the concrete aimed at load transmission. For this reason any degradation in the integrity of the concrete could significantly affect the performance of the joint. The vitality of a mechanical splice is autonomous of the concrete in what it is positioned and resolution and retain its strength, despite loss of cover as a result of impact damage or seismic event [3]. The series of reinforcing bar couplers is the greatest existing and contains tapered threaded, parallel threaded, mechanically bolted and grouted couplers. Stainless steel couplers complete the range. Steel is very expensive and construction activities require large amount of steel. Increasing expense of steel is an area of concern. Use of couplers helps to overcome this concern couplers need fewer quantity of steel as associated to lap splicing. About 3%-5% steel is saved per splicing [4-5]. We know that time is also a major parameter in the construction of building. In situation of the high-rise building and highway bridges each day matters. And we know that splicing the bars with the help of wires takes time. In case of couplers this time can be protected. Couplers are the key for numerous difficulties which arise in the building construction.

TRADE OF COUPLER

The split ends of bars to be interconnected are cut square and distended by cold forging to raise their diameter so as to ensure that the joint is tough than the bar. The couplers are usually supplied attached to the reinforcing bar. First we use the upsetting machine to thicken the rebar at its ends as shown in Fig.1.Then use the steel bar threading machine to make thread on the end of rebars. Connect the two rebar ends with the upsetting rebar couplers.

Pluses: This system enhances the strength of rebar at its end. It can be used to link the rebar whose diameter is from 12 mm to 40mm. It has High efficiency, simple structure, and small volume, lightweight and easy operation. It is also suitable for hot working environment.

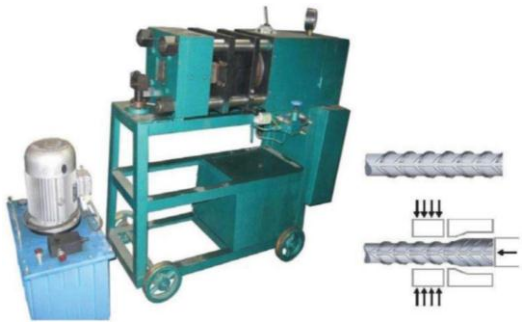


Fig. 1 Upset forging machine

Table I. Details of the upset forging machine

Sr. No	Particulars	Proportions
1.	Rebar diameter range	10mm to 42mm
2.	Oil pump flux	6l/min
3.	Electric motor power	4.5kW
4.	Piston movement distance	100 mm
5.	Out dimensions (mm)	250*550*1200
6.	Weight	600 kg

The cutting threads externally on the outside of element are done on threading machine by chasing technique shown in Fig. 2. HSS tangential chasers are secondhand as cutters. The module leftovers stationery and Die side revolves. Threads which are cutted on this machine it confide in the category of chasers. For given diameter of rebar bar particular pitch is given TABLE III.

Fig. 2 threading machine

Table II. Particulars of rebar threading machine

Sr.No	Particulars	Proportions
1	Rebar diameter range	10mm to 42mm
2.	Mains voltage(v)	3 phase
3.	Weight	1270 Kg

Thread cutting tools (Chaser)

Fig. 3 Threading tool

TABLE III. Rebar diameter vs Thread pitch

REBAR DIAMETER (mm)	THREAD PITCH (mm)
10	2.0
16	2.5
24	3.0
30	3.5
36	4.0
42	4.0

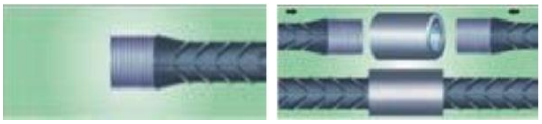
SPLICING PROCESS

Cutting

Fig. 4.1 Reinforced bar

The end of the reinforcing bar is swan cut shown in fig 4.1

B. ***Threading and Splicing***



(a) **(b)**

Fig. 4.2 Enlarged threaded bar and assembly of coupler

Then definitive metric threads are cut above the enlarged end and enclosed by plastic caps to shield the thread of rebar. Finally splice the rebar by using threaded couplers shown in fig 4.2

2. Material Used

Material used for the production of the couplers is DIN 17200Gr. C45

TABLE IV Chemical properties of material

Chemical Properties	
% carbon	0.41-0.50
% Sulphur	0.055 max
% Phosphorus	0.047 max
% Manganese	0.60- 0.80
% Silicon	0.12- 0.38

Mechanical Properties

1. Grade- C45
2. Condition- Rolled, Annealed, water quenched, oil quenched
3. Yield strength (MPa)- Rolled -460 Annealed -330
4. Tensile strength- Rolled -750, Annealed -540, water quenched -2270, oil quenched -1980
5. Elongation A5(%)Rolled -18, Annealed -30
6. Hardness HRC Rolled -58, Annealed- 55
7. Quenching Temperature- Rolled- 820, Annealed- 860
8. Bend ability Min..recommended bending radius (<= 900)

TYPES OF COUPLERS

Established procedure of splicing couplers are restricted keen on four parts

Rotatable rebar splice

(Threaded rebar and coupler)

(Turns the rebars into the couplers to connect)

Used where the joining rebar can be revolved, after that end of bars are threaded upto partial the size of the coupler

Non rotatable Rebar splice

(Threaded rebar and coupler)

(Turn the coupler onto short threaded rebar)

Used where both rebars are not rotatable, then starter bar is threaded for the full coupler length so screw coupler onto the extended threads.

Different diameter splice

(Threaded rebars of different diameters and coupler)

Used to connect rebars of different diameters by using reducing coupler.

Non rotatable rebar splice with lock –Nut

(Turn the coupler and the lock nut onto the small threaded rebar)

Worn wherever together rebars are not rotable, after starter bar are threaded for the full coupler lock nut length screw coupler and lock nut onto the extended threads.

A. Size of Couplers

TABLE V. Estimated dimensions of Threaded couplers

Bar dia. (mm)	Outer dia. (mm)	Length (mm)	Thread size
16	28	44	M20x2.5
24	34	52	M24x3.0
30	42	64	M30x3.5
36	52	76	M36x4.0
42	64	94	M45x4.0

TABLE VI. Estimated dimensions of pressing couplers

Bar dia. (mm)	Outer dia. (mm)	Length (mm)	Inside dia. (mm)
16	33	120	21.0
24	38	132	26.0
30	47	152	31.5
36	58	194	40.8
42	72	242	48.0

TABLE VII. COUPLER UNDER UTS

Gauge Dia. (mm)	Ultimate Load (kN)	UTS (N/mm^2)	Fracture	Dist. From center (mm)
16	129	648	TMT bar	188
24	196	630	TMT bar	130
30	336	690	TMT bar	94
36	550	682	TMT bar	148
42	800	640	No Fracture	No Fracture

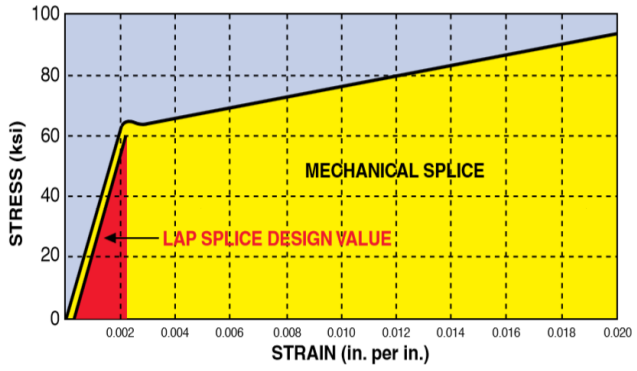


Fig.5 Mechanical Splice Vs Lap Splice

B. Cost estimation

Cost of the coupler is from 5 Rs to 2000 Rs per piece. It depends on the type of the coupler.

If we consider the wastage of the steel in overlapping splicing process after that price of the coupler is insignificant. Mostly 3%-5% steel bar is overlay on further bar so if we use the couplers this much amount of steel will be saved. In same approximate budget only we can use the couplers.

Advantages of Using Couplers

1. Mechanical systems are more reliable than lap systems because they don't depend on the concrete for load transfer.

2. Mechanical connections offer greater structural integrity. Mechanical splices offer strength and toughness during man-made, seismic or other natural events.

3. Codes require that mechanical splices distribute advanced recital than distinctive design sizes aimed at lap splices. This is normally 125% to 150% greater capacity provided by the mechanical splice versus the lap splice.

4. Lap splicing upsurges rebar bottleneck at the lap region and is one of the foremost sources for forming rock pockets and voids in the concrete. Mechanical splices eliminate these bottleneck difficulties and resolve the global job additional price definite over minimalized job site difficulties.

5. Building codes stipulate a steel ratio of under 8% and this makes it nearly impossible to achieve a stable design with lap splicing. Mechanical splices permit the fashionable to achieve an perfect balance of steel and concrete by eliminating the additional rebar in the lap zone.

6. Working with "slight" diameter strengthening bars might necessitate the use of greater column proportions to billet a bigger quantity of bars. Using mechanical splices allows the option of larger diameter rebar in a minor column while minimalizing bottleneck. This condensed column size outcomes are more efficient design and an optimum use of floor space.

7. Mechanical splices eliminate tedious lap calculations

8. Mechanical splices are fast and easy to install and require no specialized skilled labor.

9. Mechanical splices are price effective by falling labor prices and fast-tracking job agendas.

10. Dowel bar substitutes reduce labor on site, form- work costs and increase job site

safety. Bar terminators eliminate congestion and simplify bar placing.

11. Repair splices eliminate the cost of breaking away massive amounts of concrete.

RESULTS

From Table VII we observe that after the application of load and stress on the bar, fracture was observed in the TMT bar spliced with coupler. But even though none of the cases fracture was observed in coupler. So this splices is having greater strength and toughness.

CONCLUSIONS

As we ensure that raised use of the coupler is tranquil and design welcoming. Though it is hard and benign to use. Though manufacturing cost of couplers in budget of construction is going to increase, but even 3% to 5% steel is protected which was lost in overlying. The price of saved steel is more than that of the manufacturing cost of couplers. So we can conclude that those couplers are welcome. They are not only unrestricted but they are money-spinning. Due to its rewards and not even any cost this method is more useful than the earlier one.

REFERENCES

[1] Bertero V, Miranda E, Thompson C, "Cyclic behaviour of shear wall boundary elements incorporating prefabricated welded wire hoops," National institute of Standards & Technology, New York, 1990.

[2] Cheok S, and Stone C, "Performance of a 1/3 scale model precast concrete beam-column collections subjected to cyclic inelastic loads," Report no, vol.4, Nistir 5436, June 1994.

[3] Saatcioglu M, and Grira M, "Concrete columns confined with welded reinforcement grids," Ottawa varelton Earthquake research center, Report OCEERC, pp. 96-05, March 1996.

[4] Englekirk R. E, "Seismic Design of Reinforced and precast concrete buildings," John wiley & sons, New Jersey June 2003.

[5] Ozbakkaloglu T, Saatcioglu M, "Response of reinforced concrete frame buildings to blast loading," Proceedings of the CSCE annual conference, Toronto, Dec 2005.

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