

MEHANIČKO NASTAVLJANJE ARMATURE

MECHANICAL REBAR SPLICING

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1 UVOD

Mehaničko nastavlanje armature, kao relativno nova tehnologija u građenju armiranobetonskih i spregnutih konstrukcija, intenzivno se razvija u poslednje dve decenije u svetu. Mnogo proizvođača, i sve širi asortiman proizvoda u vezi sa ovom tehnologijom, dovode do široke primene u građenju savremenih konstrukcija. Mehaničko nastavlanje armature preko spojnice (konektora ili kaplera), predstavlja svojevrsnu dopunu, a ne zamenu, klasičnog načina nastavlanja armature preklapanjem ili zavarivanjem. Odgovarajućom tehnološkom, ekonomskom i konstrukterskom analizom mogu se definisati mesta primene kod kojih je mehaničko nastavlanje armature bolji izbor od klasičnih načina nastavlanja.

2 VRSTE MEHANIČKIH ARMATURNIH SPOJNICA

U poslednoj deceniji razvijeno je i patentirano mnogo različitih tipova mehaničkih spojnica. Po načinu prenošenja sile između dve nastavljene šipke armature, mehaničke spojnice mogu se podeliti u sledeće grupe [1]:

2.1 Mehaničke spojnice sa navojem

Kod ovog tipa spojnice, krajevi armaturnih šipki koje treba nastaviti se narezuju, i zatim nastavljaju uvrtnjem u spojnicu sa urezanim navojem (Slika 1). U zavisnosti od proizvođača, navoji mogu biti konični, ravni ili na proširenom delu šipke. Povoljnost koničnog navoja je mala razlika između prečnika armature i spojnice, jednostavno je pozicioniranje kraja šipke u spojnicu, uz mali ugao obrtanja za postizanje punog spoja. Za narezivanje koničnog navoja, neophodan je originalan, relativno složen

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1 INTRODUCTION

Mechanical rebar splicing, representing relatively new technology in reinforced concrete and composite structures construction is under fast development for several decades. Large number of manufacturers as well as wide assortment of products led to wider use of this technology in contemporary structures construction. Mechanical rebar splicing using couplers could be considered more as a supplement than substitution of classical rebar splicing by overlapping or welding. It is possible to determine locations and situations where mechanical rebar splicing is better solution than classical splicing, using appropriate technological, economic and structural analysis.

2 MECHANICAL COUPLER TYPES

During the last decade, large number of different types of mechanical couplers were developed and patented. It is possible to classify mechanical couplers regarding the means of force transfer between two spliced bars, as follows [1]:

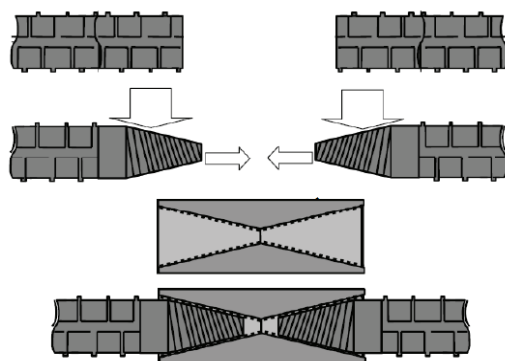
2.1 Threaded mechanical couplers

This type of couplers is qualified by threaded ends of reinforcing bars which are connected by screwing into the coupler with carved in threads (Figure 1). Depending on manufacturer, the threads could be conical, flat or on a thickened part of the bar. Advantage of conical threading is very small difference between coupler and bar outer diameter, as well as simple bar positioning into the coupler, with a minimum screw rotation angle to achieve full connection. Special tool is needed for conical threading

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alat. Treba imati u vidu da svako narezivanje i urezivanje navoja na šipku i spojnicu utiče na konačne mehaničke karakteristike materijala, pogotovu na duktilnost i ponašanje pri cikličnom opterećenju.

ing of bar end. It should be noticed that every treading of a bar or coupler influences final material mechanical characteristics, specially the ductility and cyclic load behaviour.



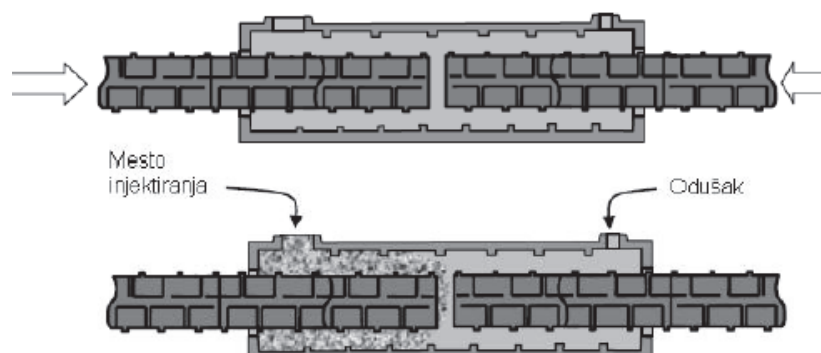
Slika 1. Mehaničke spojnice s navojem
Figure 1. Threaded rebar couplers

2.2 Spojnice sa ispunom cementnom ili epoxy emulzijom

Sistem spojnice sa ispunom podrazumeva da se sila sa šipke prenese na ispunu, a zatim na spoljnu čauru. Spoljna čaura ima dovoljnu dužinu da se omogući prenos sile sa šipke na ispunu prijanjanjem, a ujedno ima i funkciju utezanja ispune, čime se osigurava prenos sile sa rebara armaturne šipke na ispunu. Ispuna može biti na bazi cementa, metala ili epoksi smola, i može se unositi u čauru pre ili posle postavljanja šipki. Spojnice sa ispunom mogu biti dvostrane (Slika 2), ili jednostrane, gde je čaura prethodno povezana s jednom od šipki zavarivanjem ili na drugi način.

2.2 Grouted sleeve coupler

Grouted sleeve coupler system implies that the force transfers from the bar to the grout, than to the coupler sleeve. The sleeve should have sufficient length to ensure the force transfer from bar to grout by mechanical interlock, as well as to provide confinement to the grout. The grouts could be cement based, metallic, or adhesive, and it can be inserted into the sleeve before or after the positioning of the bar. Grouted sleeve couplers can be double-ended (Figure 2) or single-ended, where the sleeve is previously connected to the bar by some other mechanism.



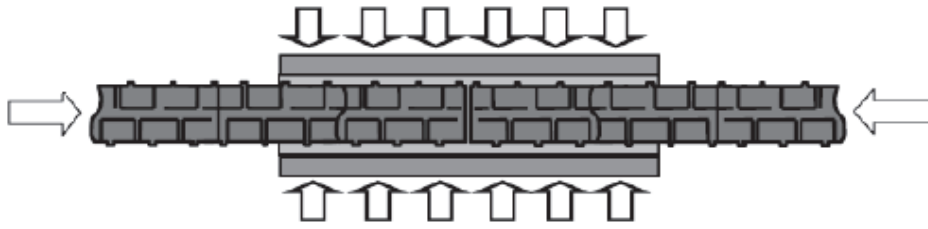
Slika 2. Mehaničke spojnice sa cementnom ispunom
Figure 2. Cementitiously-grouted sleeve rebar-coupler

2.3 Spojnice s deformisanom čaurom

Metalna čaura se posebnim alatom plastično deformiše tako da nalegne na rebrastu armaturu i poprimi njen oblik, čime se omogućava transfer sile sa šipke na deformisanu čauru i obrnuto (Slika 3.).

2.3 Swaged sleeve coupler

A metallic sleeve can be plastically deformed, swaged, onto the outside of a rebar, engaging the rebar's deformations and enabling load transfer from the bar to the sleeve and vice versa (Figure 3).



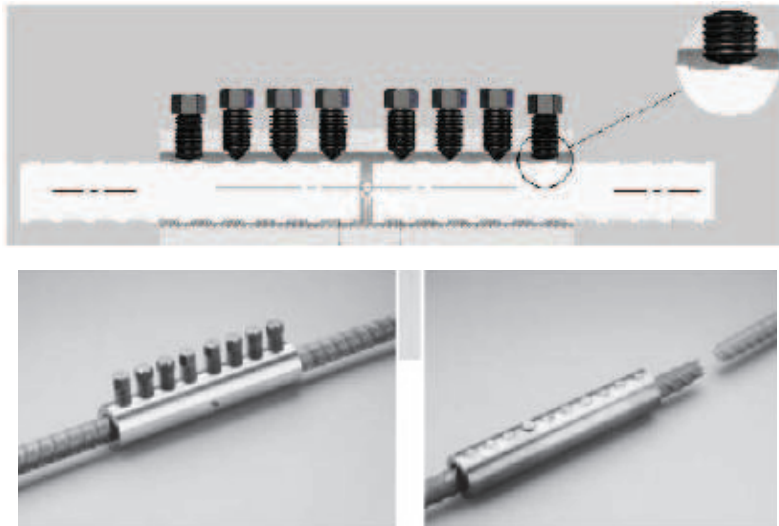
Slika 3. Mehaničke spojnice s deformisanom čurom
Figure 3: Swaged-sleeve rebar-couplers

2.4 Spojnice sa ugrađenim vijcima

Kod mehaničkih spojnica sa ugrađenim vijcima, prenos sile se ostvaruje preko trenja i lokalnog moždaničkog dejstva vijka u kontaktu s površinom orebrene šipke. Po postavljanju šipke u spojnicu, posebnim alatom se pritežu vijci, a zatim se odseca preostali deo vijka van gabarita čaure. Ovakva vrsta spojnice pogodna je za primenu kod sanacija i nastavljanja već građene armature, pogotovu na nedovoljno pristupačnim mestima, jer se ne zahteva obrada kraja šipke, a montaža se obavlja ručnim alatom.

2.4 Bolted couplers

In case of bolted mechanical rebar couplers the forces transfer is conducted by friction and local dowel effect between the bolt and ribbed surface of the bar. After the bar placement into the coupler, special wrench is used to tight the bolts and shear off their heads. This type of coupler is suitable for application in structural repairs and splicing of already built-in bars, especially at hard to reach places, because no previous bars end preparation is needed, and only hand tools are required.



Slika 4. Mehaničke spojnice sa ugrađenim vijcima
Figure 4. Mechanical bolted rebar couplers

3 PRIMENA MEHANIČKIH ARMATURNIH SPOJNICA

Mehaničke armaturne spojnice dizajnirane su prvenstveno za nastavljnje šipki armature u armirano-betonskim elementima. Namenjene su za situacije kada klasični način nastavljanja armature - preklapanje i zavarivanje, nije moguće primeniti, na primer:

- kod nastavljanja armature s visokim procentima armature u preseku, i velikim profilima armature;
- kod nastavljanja maksimalno napregnute zategnute armature u elementima male širine (zidni nosači) ili malih dimenzija (zatege);
- kada, iz tehnoloških razloga, na prekidima betoniranja nije moguće prepustiti armaturu za preklop u potrebnoj dužini;

3 THE APPLICATION OF MECHANICAL REBAR COUPLERS

- The mechanical rebar coupler is designed for splicing reinforcement in concrete structural elements. They are designed for the situations where classical means of rebar splicing - by overlapping or welding are not applicable, such as:

- rebar splicing in elements with high reinforcement percentage and large rebar diameters,
- splicing of the fully loaded reinforcement in narrow structural elements (high beams) or elements with small dimensions (RC ties etc.)
- when, due to concreting technology, it is impossible to extend bars for overlapping at joints,

– kada je potrebno nastaviti više od 50% armature, a to propisima za nastavljnje preklapanjem nije dopušteno;

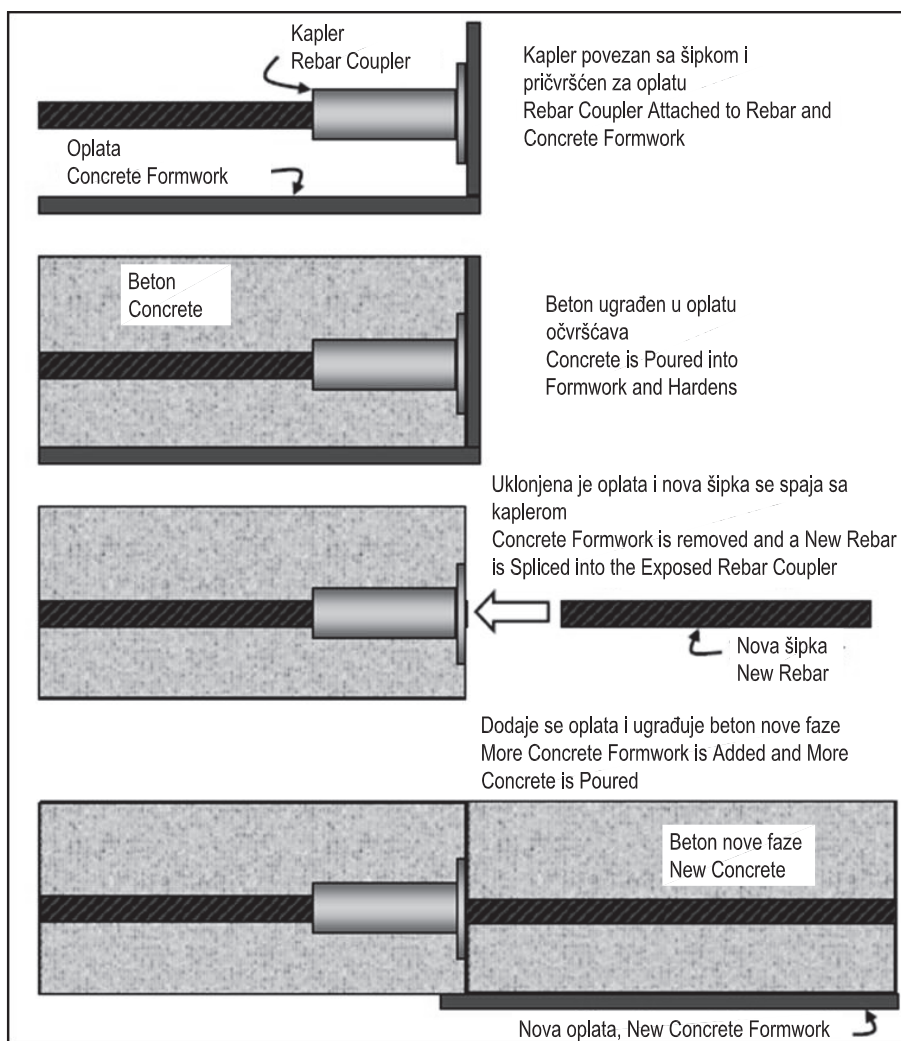
– kod specifičnih metoda građenja (na primer, metod gradnje *top-down*).

Posebna pogodnost primene mehaničkih spojnika jeste mogućnost formiranja nastavaka armiranobetonskih elemenata bez prekidanja oplata u prvoj fazi betoniranja, odnosno bez prepuštanja ankera kroz oplatu. Na taj način se omogućava upotreba velikih inventarskih komada oplata, klizne oplata i sličnog, bez njihovog oštećenja. Princip nastavljanja armature mehaničkim spojnica kroz faze betoniranja prikazan je na Slici 5.

– splicing of more than 50% of reinforcement in cases when such a amount of overlapping is unacceptable by relevant codes,

– in case of using specific building technologies (“top-down” building method, i.e.).

Particular advantage of mechanical rebar couplers use is the possibility to splice the reinforcement through construction joints without formwork interruption in the first phase of concreting, without extending the bars through the formwork. This enables the use of large formwork elements, sliding formwork, etc. without any damaging. The method of mechanical rebar splicing through construction joints is presented at Figure 5.



Slika 5. Nastavljanje armature mehaničkim spojnica na prekidu betoniranja
Figure 5. Rebar-coupler creating continuity of reinforcing across construction joint.

Jedan od malobrojnih, ali veoma značajan primer primene mehaničkih spojnika u srpskom građevinarstvu predstavlja Most preko Ade u Beogradu (Slika 6.). Pri izradi pilona korišćena je složena samopodizuća oplata. Da bi se izbeglo demontiranje oplata na mestu veze pilona sa sandučastom gredom mosta, pylon je betoniran u neprekidnom procesu, a veza sa gredom izvedena

A rare, but rather significant example of mechanical rebar couplers use in Serbian construction represents the Ada Bridge in Belgrade (Figure 6). A sophisticated self-lifting formwork was used for pylon construction. In order to avoid the formwork dismantling at the joint of the pylon and the bridge beam, pylon was continuously concreted, and afterwards connected to the beam.

naknadno. Veza armature grede i pilona izvedena je preko mehaničkih spojnika tipa LENTON, koje su prethodno ugrađene u pilon. Površina betona na pilonu, na mestu spoja s gredom mosta, posebno je projektovana sa odgovarajućim nišama, kako bi se, uz obradu površine betona na samom spoju, osigurao prenos izrazito visokih vrednosti statičkih uticaja na spoju pilona i grede, a naročito sila smicanja.

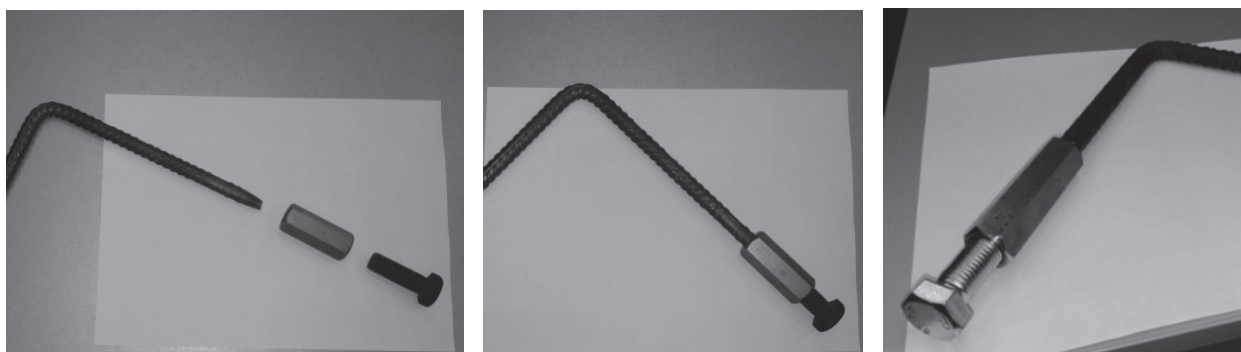
Rebar splicing was conducted using LENTON mechanical rebar couplers, previously embedded in pylon. The concrete surface at join area was specially designed, forming niches, including special surface preparation, in order to ensure the transfer of extremely large shear and other forces.



Slika 6. Primena mehaničkih spojnika – Most preko Ade u Beogradu
Figure 6. Rebar Couplers Application – Ada Bridge in Belgrade

Posebnu grupu mehaničkih spojnika čine spojnice za nastavljavanje armaturne šipke i čeličnog zavrtnja (Slika 7) [6].

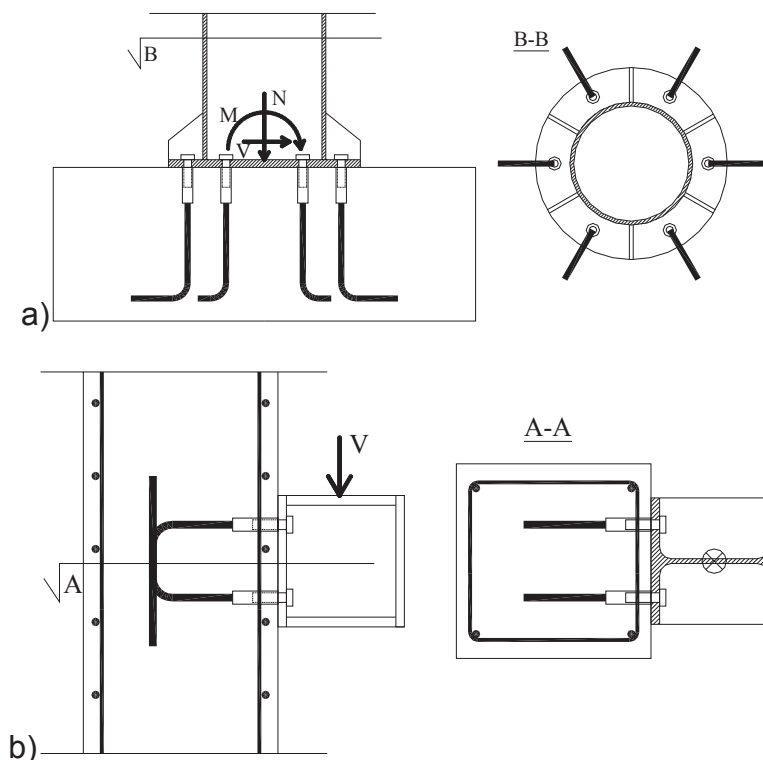
Particular mechanical rebar coupler type is the coupler designed for the connection of reinforcing bars and structural steel bolts (Figure 7) [6].



Slika 7. Mehaničkih spojnice za zavrtnjeve
Figure 7. Rebar Bolt Couplers

Osnovna namena ovakvih anкера jeste za vezu čeličnih stubova i armiranobetonskih temelja, kada se zavrtnji, dominantno aksijalno opterećeni usled uticaja iz stuba, sidre preko spojnice i armaturnog anкера u temelj (Slika 8 a). Ukoliko se ovakav koncept primeni na vezu čelične grede i stuba, zavrtnji i spojnice u vezi pretežno su opterećeni na smicanje (Slika 8 b).

The principal use of this coupler type is connection of steel columns and reinforced concrete foundations, where bolts, mainly axially loaded, due the column forces, are anchored by the coupler and rebar anchor into the foundation (Figure 8a). If such a concept is applied on steel beam concrete column connection, bolts and couplers are mainly loaded in shear (Figure 8 b).



Slika 8. Veza preko zavrtnja i mehaničke spojnice
Figure 8. Bolt-Rebar Coupler Connection

Mogućnost primene mehaničkih spojnica u okviru smičućih konektora sa čeličnim zavrtnjem relativno je slabo istražena, pogotovu za zavrtnjeve većih čvrstoća. Kod veze sa AB stubovima uobičajenih dimenzija, u zgradarstvu se javlja i problem pojave loma betona usled blizine ivice. Primena mehaničkih spojnica kao elemenata smičućih konektora predstavlja predmet istraživanja u okviru šireg programa istraživanja smičućih veza u spregnutim konstrukcijama na Građevinskom fakultetu Univerziteta u Beogradu.

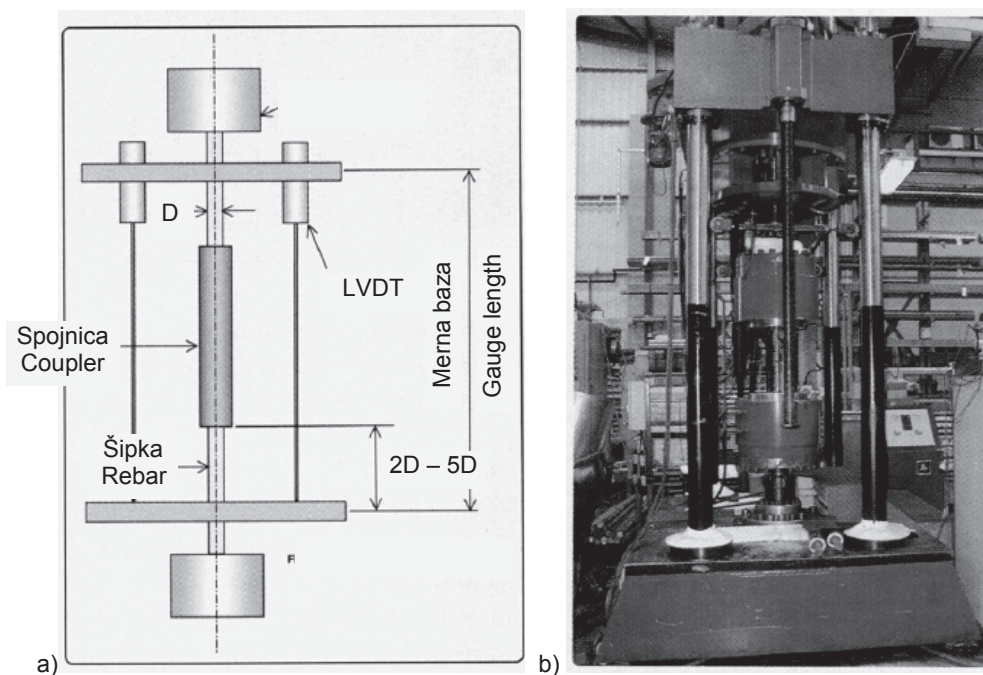
4 TEHNIČKI NORMATIVI ZA MEHANIČKO NASTAVLJANJE ARMATURE

Veoma brz i intenzivan razvoj sistema za mehaničko nastavljanje armature rezultovao je relativno velikim brojem proizvođača i komercijalnih patentiranih proizvoda. Budući da proizvođači potiču iz različitih zemalja, i postavljeni zahtevi u vezi s kvalitetom, mehaničkim karakteristikama i ponašanjem ovih spojnica bili su različiti, kao i načini dokazivanja zahtevanih osobina. Ne tako davno, Fallon je ukazao na potrebu usvajanja jedinstvenog dokumenta koji bi definisao zahteve i način testiranja mehaničkih spojnica. U svom radu [3] iznosi iskustva ispitivanja spojnica koje proizvodi britanska firma ANCON, prikazujući tipičnu dispoziciju za ispitivanje mehaničkih spojnica na statičko i dinamičko aksijalno opterećenje kao i ciklično opterećenje na zamor (Slika 9a), i aktuator koji se koristi za interna ispitivanja (Slika 9b).

The possibility of the use of mechanical couplers, as a part of bolted shear connectors, is rather poorly investigated, especially for high grade bolts. The concrete edge breakout is a problem with these connections at columns with usual cross-section dimension in common buildings. The mechanical couplers use in shear connections is one of the topics of the ongoing experimental, numerical and theoretical research of connections in composite structures at Civil Engineering Faculty of Belgrade University.

4 MECHANICAL REBAR SPLICING TECHNICAL REGULATIONS

Very fast and intensive mechanical rebar splicing system development resulted in large number of manufacturers and commercially patented products. Considering the fact that the manufacturers originate from different countries, the demands on quality, mechanical material characteristics and behaviour of these couplers were different, as well as the procedures for proving the required performance. Recently, Fallon pointed out the necessity of adopting the unified document prescribing requirements and testing procedures for mechanical rebar couplers. In his paper [3], he has presented the experience of mechanical couplers testing at British manufacturer ANCON facilities, presenting testing layout for mechanical couplers statically and dynamically axially loaded, as well as couplers cyclically tested on fatigue (Figure 9a). The actuator used for internal tests is also presented (Figure 9b).



Slika 9. Ispitivanje mehaničkih spojnic ANCON [3]
Figure 9. Mechanical couplers testing ANCON [3]

Evrokod za betonske konstrukcije propisuje, pored nastavljaja armature preklapanjem i zavarivanjem, mehaničko nastavljaja armature [2]. U međuvremenu, 2009. godine su usvojeni međunarodni standardi [4], [5], koji se odnose na nastavljaja armature mehaničkim spojnicama. U prvom delu standarda ISO 15835-1 definisani su zahtevi koje mehaničke spojnice moraju da ispune, a u drugom delu ISO 15835-2 način ispitivanja. Propisani zahtevi za mehaničke spojnice odnose se na sledeće osobine:

Čvrstoća i duktilnost pri statičkom opterećenju: Čvrstoća mehaničkog nastavka mora biti najmanje jednaka proizvodu propisane gornje granice tečenja armature ($R_{eH,spec}$) i odnosa stvarne i propisane vrednosti napona tečenja za armaturu ($(R_m/R_{eH})_{spec}$). Ukupno izduženje pri najvećoj sili A_{gt} ne sme biti manje od 70% propisanog ukupnog izduženja pri maksimalnoj sili za armaturu, ali ne manje od 3% u apsolutnom iznosu.

Proklizavanje (slip) pri statičkom opterećenju: Proklizavanje ne sme biti veće od 0.1mm.

Zamor pri cikličnom opterećenju u zoni elastičnosti: Mehanički nastavak mora da izdrži opterećenje na zamor od najmanje dva megaciklusa, sa obimom opterećenja $2\sigma_a$ od 60 MPa.

Ponašanje pri niskocikličnom opterećenju u elastoplastičnoj oblasti: Propisuje se maksimalno opterećenje i maksimalna zaostala deformacija za dva tipa niskocikličnog opterećenja kojima se modeliraju zemljotresi srednjeg i velikog intenziteta.

Sve navedene osobine mehaničkog spoja armature odnose se na aksijalno opterećenje. Treba napomenuti da ISO 15835-1 u tački 3.4 definiše mehaničke spojnice kao čaure ili narezane spojnice čija je namena da prenesu silu zatezanja ili pritiska s jedne na drugu šipku armature. Dakle, smicanje se u ovom standardu ne razmatra.

Eurocode for concrete structures allows use of mechanical splices, along with overlapping and welding [2]. In the meantime, during 2009, international standards [4] and [5], covering the area of mechanical splices was adopted. The first part of the standard ISO 15835-1 defines requirements for mechanical couplers and the second part, ISO 15835-2 defines the testing methods and procedures. Prescribed requirements for couplers relate to:

Strength and ductility under static forces: The strength of the mechanical coupler should not be less than product of specified characteristic (or nominal) yield strength value of the reinforcing ($R_{eH,spec}$) and the ratio of Specified tensile and characteristic yield strength value of the reinforcing bar ($(R_m/R_{eH})_{spec}$). Total elongation at maximum tensile force A_{gt} shall not be less than 70% of the specified characteristic value at maximum tensile force of the reinforcing bar, with a minimum value of 3%.

Slip under static forces: The total slip value measured shall not exceed 0,10 mm..

Fatigue properties under high cycle elastic loading: Mechanical splices shall sustain a fatigue loading of at least 2 megacycles with a stress range, $2\sigma_a$, of 60 MPa without failure.

Properties under low cycle reverse elastic-plastic loading: There are two prescribed sets of low cycle fatigue requirements, one simulating moderate-scale earthquakes, and one simulating violent earthquakes.

All mechanical splice properties listed above are related to axial loading. It should be pointed out that ISO 15835-1, in paragraph 3.4, defines mechanical couplers as coupling sleeve or threaded coupler for mechanical splices of reinforcement bars for the purpose of providing transfer of axial tension and/or compression from one bar to the other. Shear is not considered.

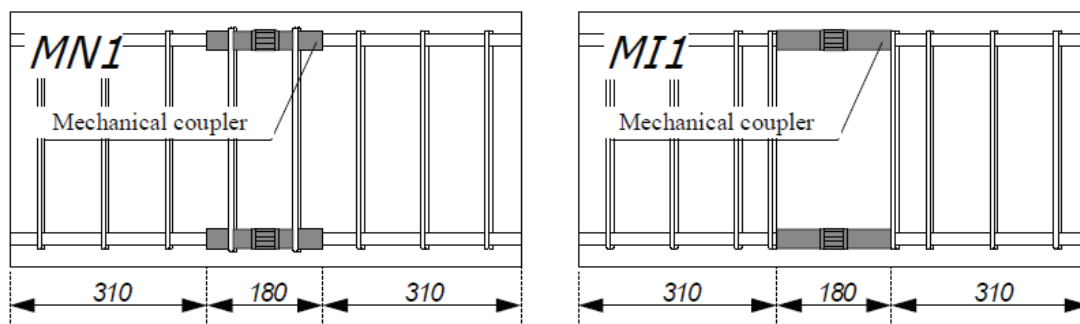
Numerous papers are explaining mechanical rebar

U literaturi postoji relativno veliki broj radova koji objašnjavaju mehaničke nastavke armature, oblast i pogodnosti primene. Urađeno je i mnogo testova na zatezanje, uglavnom s namenom dobijanja tehničkih dopuštenja u pojedinim zemljama.

Pored radova koji se odnose na ispitivanje nosivosti i pomerljivosti armaturnih mehaničkih spojeva na zatezanje pri statičkom opterećenju, posebno treba istaći opsežno istraživanje praktično svih vrsta mehaničkih spojnica na zatezanje s kontrolisanom brzinom deformacije - sporom, srednje i velike brzine, u nameri da se utvrdi ponašanje ovih spojeva pri dinamičkom i incidentnom eksplozivnom opterećenju, gde su se najbolje pokazale spojnice s ravnim navojem (threaded rebar couplers) [7]. U radu Sanade i dr. [8] razmatran je uticaj načina poprečnog armiranja u zoni mehaničkog nastavka armature u armiranobetonskoj gredi pri visokim transversalnim silama (Slika 10). Na slici desno je predloženi način armiranja, da bi se izbeglo pomeranje podužne armature od ivice preseka zbog nešto veće debljine spojnice u odnosu na debljinu šipke.

splicing in professional literature. Large number of splice tests in tensile were conducted, mostly in order to obtain the approval in different countries.

Along the papers related to testing of mechanical couplers capacity and slip under static axial loading, the extensive research of different mechanical splices types under load with controlled speed should be pointed out, conducted in order to determine the behaviour of mechanical splices under dynamic and explosion loads. Threaded rebar couplers showed best results in this research [7]. Sanada et al. [8] researched the influence of the transverse reinforcement arrangement in the zone of the mechanical rebar splice, under high shear loading (Figure 10). The right side of the picture presents the proposed way of stirrups arrangement, to avoid shifting longitudinal bars away from the section edge, due to somewhat larger diameter of the mechanical coupler.



Slika 10. Poprečno armiranje u zoni mehaničkog nastavka
Figure 10. Transverse reinforcement at mechanical rebar splice

Ispitivanja su pokazala da ovakav način lokalnog pregrupisanja poprečne armature u zoni visokih transversalnih sila ne utiče na ponašanje armiranobetonske grede, i preporučuje ga za praktičnu primenu.

5 ZAKLJUČAK

U radu su prikazani različiti sistemi mehaničkog nastavljanja armature i definisane neke od situacija kada mehaničko nastavljanje ima prednost u odnosu na nastavljanje armature preklapanjem i zavarivanjem.

Razmatrani su novi internacionalni standardi za ispitivanje i dokaz kvaliteta sistema za mehaničko nastavljanje armature, nastali kao posledica potrebe za unificiranjem kvaliteta u ovoj oblasti koja se intenzivno razvija u svetu, s mnogim proizvođačima i varijacijama mehaničkih spojnica. Intenzivan razvoj proizvodnje, u određenoj meri, prate i istraživanja u ovoj oblasti. Predmet onih istraživanja čiji su rezultati dostupni javnosti, predstavlja ponašanje i nosivost mehaničkih spojeva pri statičkom, dinamičkom aksijalnom opterećenju, pri opterećenju koje se nanosi različitim brzinom. Istraživan je i lokalni uticaj mehaničkih spojnica na ponašanje armiranobetonskih elemenata opterećenih na smicanje. U radu je prikazan i sistem mehaničkih spojnica za povezivanje zavrtnja i armaturnog ankera, koji se

Research results showed that the local stirrups rearrangement in the shear loaded area does not influence significantly the reinforced beam behaviour, so it is recommended for design use.

5 CONCLUSION

Different mechanical rebar splicing systems are presented, and design situations where mechanical splicing has advantage over reinforcement splicing by overlapping and welding are defined in this paper.

New international standards for testing and proof of systems for mechanical rebar splicing quality are considered. The development and publication of these standards have been initiated by the need for quality unification in this area that is developing rapidly worldwide, with large number of manufacturers and diversity of products. The intensive production development is, to some extent, followed by researching in this area. The scope of this research, available to the public, is behaviour and capacity of mechanical rebar splices under static and dynamic axial loading, and under the loading applied with different speed. The influence of the mechanical splices reinforced beam behaviour under shear load was also researched. Mechanical splicing system for rebar and bolt

može koristiti za vezu čeličnog i armiranobetonskog elementa.

Malobrojni su primeri primene mehaničkog nastavljajanja armature u našoj zemlji. Jedan od značajnijih - veza pilona i grede Mosta na Adi u Beogradu - prikazan je u radu.

Može se zaključiti da intenzivan razvoj proizvodnje i primene mehaničkog nastavljajanja armature u svetu, istraživanja u ovoj oblasti, kao i internacionalni standardi koji propisuju zahteve u pogledu kvaliteta i procedure dokaza kvaliteta, predstavljaju osnovu za razvoj odgovarajuće tehničke regulative u ovoj oblasti i u Srbiji. Usvajanje standarda i propisa u ovoj oblasti ubrzalo bi procedure dokaza kvaliteta i izdavanja atesta i odobrenja za pojedine sisteme mehaničkog nastavljajanja armature, čime bi se proširila primena ovih sistema u svim situacijama kada oni predstavljaju bolje rešenje u odnosu na klasične načine nastavljajanja armature.

connection, usable in steel and reinforced concrete structural elements connections, is presented in this paper. There are only few examples of mechanical rebar splicing in our country. The most significant one – the pylon and beam connection at Ada Bridge in Belgrade is presented in the paper.

It can be concluded that intensive development of production and use of mechanical rebar splicing systems, research in this area, as well as publication of international standards prescribing requirements for quality and procedures for proof of quality, is an excellent base for development of corresponding technical norms in Serbia. The legislation in this area would quicken proof of quality procedures, attest and approval issuing for individual products, leading to wider use of this system in all situations where it is in advantage over the classical reinforcement splicing.

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REZIME

MEHANIČKO NASTAVLJANJE ARMATURE

Branko MILOSAVLJEVIC

U radu su prikazani različiti sistemi mehaničkog nastavljanja armature i definisane neke od situacija kada mehaničko nastavljanje ima prednost u odnosu na nastavljanje armature preklapanjem i zavarivanjem. Razmatrani su novi internacionalni standardi za ispitivanje i dokaz kvaliteta sistema za mehaničko nastavljanje armature. U radu je prikazan i sistem mehaničkih spojnica za povezivanje zavrtnja i armaturnog ankera, koji se može koristiti za vezu čeličnog i armiranobetonskog elementa. Malobrojni su primeri primene mehaničkog nastavljanja armature u našoj zemlji. Jedan od značajnijih - veza pilona i grede Mosta na Adi u Beogradu - prikazan je u radu. Intenzivan razvoj proizvodnje i primene mehaničkog nastavljanja armature u svetu, istraživanja u ovoj oblasti, kao i internacionalni standardi koji propisuju zahteve u vezi s kvalitetom i procedurom dokaza kvaliteta, predstavljaju osnovu za razvoj odgovarajuće tehničke regulative u ovoj oblasti i u Srbiji, čime bi se proširila primena ovih sistema u svim situacijama kada oni predstavljaju bolje rešenje u odnosu na klasične načine nastavljanja armature.

Ključne reči: mehaničko nastavljanje armature, spojnice, testiranje, standard.

SUMMARY

MECHANICAL REBAR SPLICING

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Different mechanical rebar splicing systems are presented, and design situations where mechanical splicing has advantage over reinforcement splicing by overlapping and welding are defined in this paper. New international standards for testing and proof of systems for mechanical rebar splicing quality are considered. Mechanical splicing system for rebar and bolt connection, usable in steel and reinforced concrete structural elements connections, is presented in this paper. There are only few examples of mechanical rebar splicing in our country. The most significant one – the pylon and beam connection at Ada Bridge in Belgrade is presented in the paper. Intensive development of production and use of mechanical rebar splicing systems, research in this area, as well as the publication of international standards prescribing requirements for quality and procedures for proof of quality, represent very good base for development of the corresponding technical norms in Serbia. The legislation in this area would quicken proof of quality procedures, attest and approval issuing for individual products, leading to wider use of this system in all situations where it is in advantage over the classical reinforcement splicing.

Key words: Mechanical Rebar Splicing, Couplers, Testing, Standards