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Universitas Muhammadiyah Jember
Jl. Karimata 49 Jember. Telp/Fax : (0331) 336728/337957
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Plagiarism Policy

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Publication Frequency

Contact

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9 772528 05702

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9 772459 99207

JOURNAL INDEXING



PKP|INDEX

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44,918	25
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216	19
95	13
73	12
66	12
43	11
39	10
35	10
33	9

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S2

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S4

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9 772459 992007

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Analisis Eksperimental Pengaruh Jarak Klem Selang Pada Perilaku Lentur Lentur Balok Beton Bertulang Bambu

Muhtar Muhtar

Abstract

Mayoritas kegagalan balok beton bertulang bambu adalah kegagalan slip. Slip terjadi pada tulangan bambu disebabkan oleh kuat lekat antara tulangan bambu dengan beton tidak sempurna. Kuat lekat tidak sempurna akibat adanya perbedaan modulus elastisitas beton dan bambu. Tujuan penelitian ini adalah menganalisa pengaruh jarak klem selang terhadap kuat lekat pada balok beton bertulang bambu. Balok yang digunakan adalah balok beton bertulang tunggal dengan ukuran 75 mm x 150 mm dengan panjang 1100 mm. Jenis bambu yang digunakan adalah bambu petung (*Dendrocalamus asper*). Variasi luas tulangan bambu adalah 150 mm², 300 mm², dan 450 mm² dengan jarak klem selang 0 cm, 15 cm, 20 cm, dan 25 cm. Metode pengujian balok adalah metode empat titik. Analisis data pengaruh jarak klem selang terhadap kuat lekat dianalisis dengan ANOVA dua arah. Hasil pengujian menunjukkan bahwa variasi jarak klem-selang (s) tidak mempunyai pengaruh yang signifikan terhadap kuat lekat (u), sedangkan untuk variasi luas tulangan (A_b) mempunyai pengaruh yang signifikan terhadap tegangan lekat (u). Namun jika diuji secara parsial, pengaruh jarak klem-selang (s) terhadap kuat lekat (u) mempunyai pengaruh signifikan.

Keywords

Beton bertulang bambu; Kegagalan slip; Slip

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References

- Agarwal, A., Nanda, B., & Maiti, D. (2014). Experimental investigation on chemically treated bambu reinforced concrete beams and columns. *Construction and Building Materials*, 71, 610–617. <https://doi.org/10.1016/j.conbuildmat.2014.09.011>
- ASTM C 09. (2002). Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading). In ASTM International. ASTM International.
- Budi, A. S., Rahmadi, A. P., & Rismunarsi, E. (2016). Experimental Study of Flexural Capacity on Bambu Ori Strip Notched V Reinforced Concrete Beams. *AIP Conf. Proc.* 1788 - International Conference on Engineering, Science and Nanotechnology 2016 (ICESNANO 2016), 1788, 030052-1-030052-030057.
- Dey, A., & Chetia, N. (2016). Experimental study of Bambu Reinforced Concrete beams having various frictional properties. *Materials Today: Proceedings*, 5(1), 436–444. <https://doi.org/10.1016/j.mtproc.2017.11.103>.
- Ghavami, K. (2005). Bambu as reinforcement in structural concrete elements. *Cement and Concrete Composites*, 27(6), 637–649. <https://doi.org/10.1016/j.cemconcomp.2004.06.002>.
- Islam, S., Afify, H. M., Sennah, K., & Azimi, H. (2015). Bond characteristics of straight- and headed-end, ribbed-surface, GFRP bars embedded in high-strength concrete. *Construction and Building Materials*, 83, 283–298. <https://doi.org/10.1016/j.conbuildmat.2015.03.025>.
- Lestari, A. D., Dewi, S. M., & Wisnumurti, (2015). Pengaruh penambahan kait pada tulangan bambu terhadap respon lentur balok beton bertulang bambu. 9(2), 81–87.
- Maiti, Agarwal, A., & Damodar. (2011). Experimental Investigation On Behaviour Of Bambu Reinforced Concrete Members. 16th International Conference on Composite Structures, 1–2.
- Mall, P. R., & Datta, D. (2020). Experimental evaluation of bambu reinforced concrete beams. *Journal of Building Engineering*, 28, 101071. <https://doi.org/10.1016/j.jobe.2019.101071>.
- Muhtar. (2020). Precast bridge of bambu reinforced concrete in disadvantaged village areas in Indonesia. *Applied Sciences (Switzerland)*, 10(20). <https://doi.org/10.3390/app10207158>.
- Muhtar, Dewi, S. M., Wisnumurti, & Munawir, A. (2019). Enhancing bambu reinforcement using a hose-clamp to increase bond-stress and slip resistance. *Journal of Building Engineering*, 26. <https://doi.org/10.1016/j.jobe.2019.100896>.

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39	10
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Muhtar*

Fakultas Teknik Universitas Muhammadiyah Jember
e-mail: [*muhtar@unmuhjember.ac.id](mailto:muhtar@unmuhjember.ac.id)

ABSTRAK

Mayoritas kegagalan balok beton bertulang bambu adalah kegagalan slip. Slip terjadi pada tulangan bambu disebabkan oleh kuat lekat antara tulangan bambu dengan beton tidak sempurna. Kuat lekat tidak sempurna akibat adanya perbedaan modulus elastisitas beton dan bambu. Tujuan penelitian ini adalah menganalisa pengaruh jarak klem selang terhadap kuat lekat pada balok beton bertulang bambu. Balok yang digunakan adalah balok beton bertulang tunggal dengan ukuran 75 mm x 150 mm dengan panjang 1100 mm. Jenis bambu yang digunakan adalah bambu petung (*Dendrocalamus asper*). Variasi luas tulangan bambu adalah 150 mm², 300 mm², dan 450 mm² dengan jarak klem selang 0 cm, 15 cm, 20 cm, dan 25 cm. Metode pengujian balok adalah metode empat titik. Analisis data pengaruh jarak klem selang terhadap kuat lekat dianalisis dengan ANOVA dua arah. Hasil pengujian menunjukkan bahwa variasi jarak klem-selang (s) tidak mempunyai pengaruh yang signifikan terhadap kuat lekat (u), sedangkan untuk variasi luas tulangan (Ab) mempunyai pengaruh yang signifikan terhadap tegangan lekat (u). Namun jika diuji secara parsial, pengaruh jarak klem-selang (s) terhadap kuat lekat (u) mempunyai pengaruh signifikan.

Kata kunci: Beton bertulang bambu; Kegagalan slip; Slip

ABSTRACT

*The majority of failures of bamboo reinforced concrete beams are slip failures. The slip that occurs in bamboo reinforcement is caused by the bond strength between bamboo reinforcement and concrete is imperfect. The bond strength is not perfect due to the difference in the modulus of elasticity of concrete and bamboo. This study aimed to analyze the effect of hose-clamp distance on the bond strength of bamboo reinforced concrete beams. The beam used is a single reinforced concrete beam with a 75 mm x 150 mm size with a length of 1100 mm. The type of bamboo used is bamboo petung (*Dendrocalamus asper*). Variations in the area of bamboo reinforcement are 150 mm², 300 mm², and 450 mm² with a hose-clamp distance of 0 cm, 15 cm, 20 cm, and 25 cm. The beam testing method is the four-point method. Data analysis of the effect of hose-clamp distance on adhesive strength was analyzed by two-way ANOVA. The test results show that the variation of the hose-clamp distance (s) does not have a significant effect on the bond strength (u), while the variation in the area of reinforcement (Ab) has a significant effect on the bond stress (u). However, if tested partially, the hose-clamp distance (s) effect on the adhesive strength (u) has a significant effect.*

Keywords: Bamboo reinforced concrete; slip failure; Slip

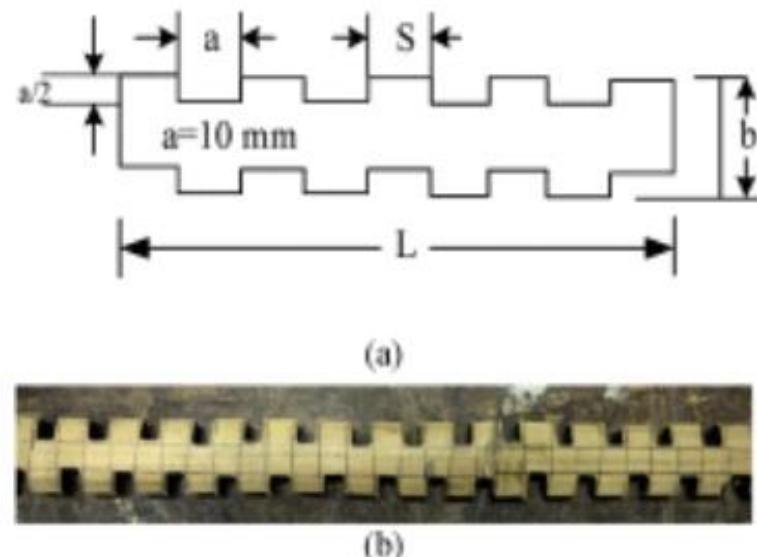
PENDAHULUAN

Beberapa fakta penelitian menunjukkan bahwa penggunaan bambu sebagai tulangan balok beton masih menunjukkan kegagalan slip akibat rendahnya tegangan lekat (*bond-stress*) antara tulangan bambu dengan beton. Pemakaian tulangan bambu pada balok beton memerlukan perawatan atau treatment. Menghilangkan kandungan pati, pengeringan, pemberian lapisan kedap air, dan pelaburan pasir merupakan keharusan (Muhtar et al., 2019). Namun demikian, keruntuhan elemen balok beton bertulang bambu masih terjadi keruntuhan akibat slip pada tulangan bambu. Untuk meningkatkan kapasitas geser tulangan bambu, diperlukan modifikasi kekasaran permukaan tulangan bambu.

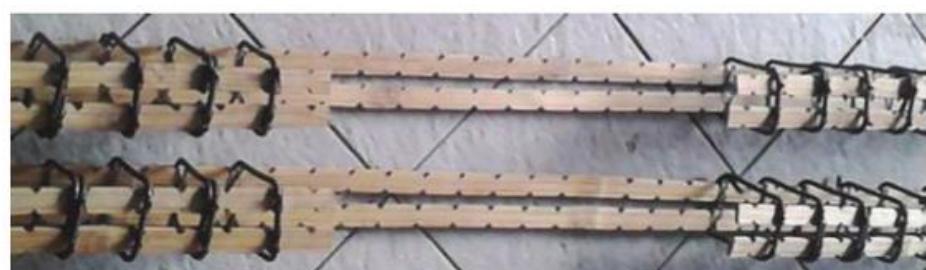
Beberapa penelitian tentang modifikasi kekasaran tulangan bambu dalam rangka meningkatkan kuat lekat diantaranya memberi takiikan (Mali & Datta, 2020) dan (Budi et al., 2016), memberi lilitan kawat dan sabut (Dey & Chetia, 2016), dan penambahan kait (Lestari et al., 2015) seperti yang diperlihatkan pada Gambar 1 sampai Gambar 3. Metode ini dapat meningkatkan daya dukung

balok, namun masih banyak kelemahan, seperti pelaksanaannya relatif sulit dan proses takikan dapat memperlemah tulangan bambu. Oleh karena itu, guna meningkatkan kuat lekat tulangan bambu dengan beton, dilakukan dengan cara memasang klem-selang pada tulangan bambu. Pemasangan klem-selang pada tulangan bambu juga berfungsi sebagai *shear connector*.

Pemakaian klem-selang pada tulangan bambu mempunyai kesamaan dengan konsep tulangan ulir pada beton, dimana pada konsep ini terjadi interaksi gaya tumpu dan gaya gesek antara beton dan tulangan bambu seperti yang ditunjukkan pada Gambar 4 ([Islam et al., 2015](#)).



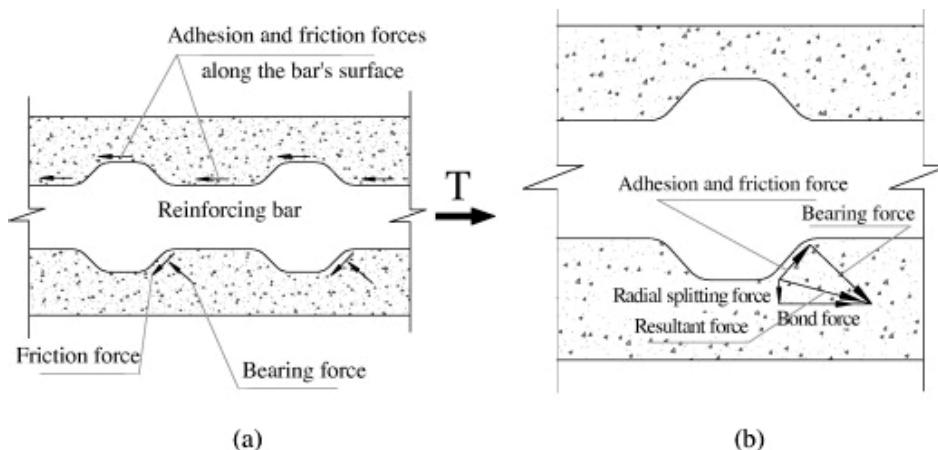
Gambar 1. Modifikasi kekasaran tulangan bambu versi [Mali & Datta](#) (2020)



Gambar 2. Modifikasi kekasaran tulangan bambu dengan takikan versi [Budi et al.](#) (2016)



Gambar 3. Modifikasi kekasaran tulangan bambu dengan lilitan kawat/sabut versi [Dey & Chetia](#) (2016)

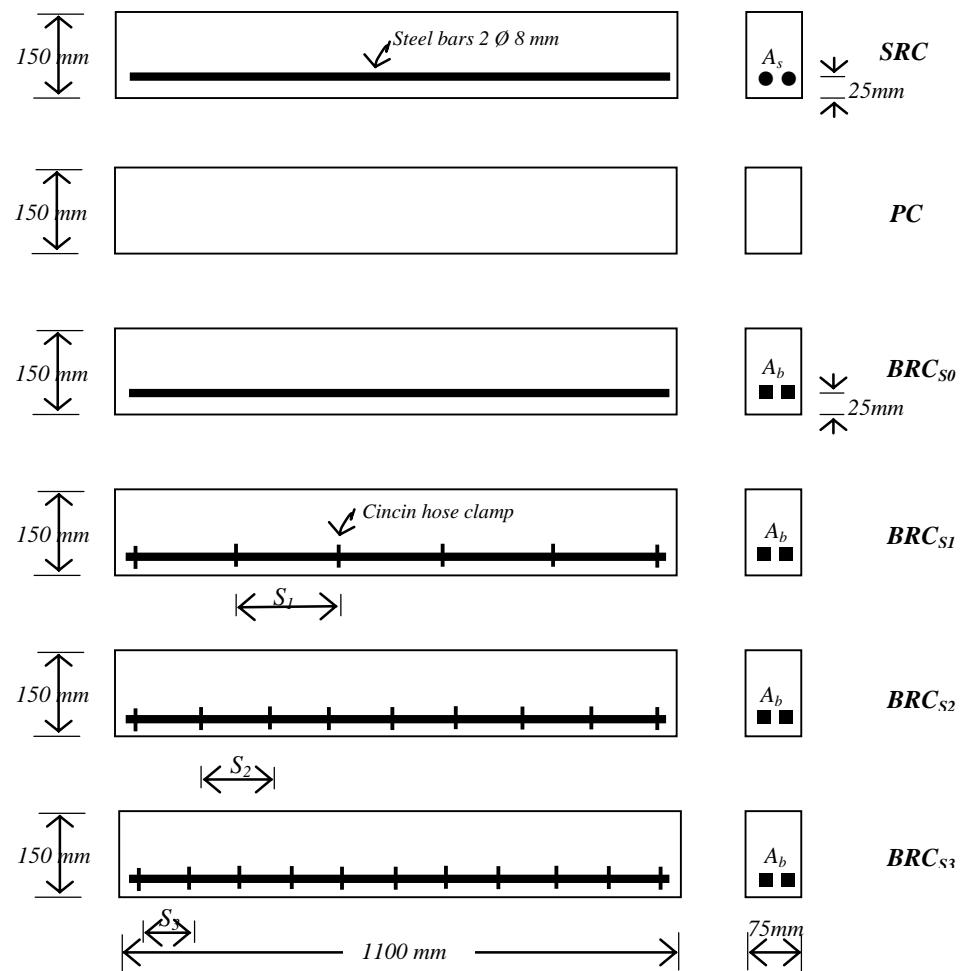


Gambar 4. Gaya gesek dan gaya tumpu pada tulangan baja ulir. [Islam et al. \(2015\)](#)

Dari hasil penelitian para peneliti menunjukkan bahwa modifikasi kekasaran dapat meningkatkan kuat lekat, namun mayoritas kegagalan balok masih menunjukkan adanya kegagalan slip. Metode dan konsep pemakaian klem-selang pada tulangan bambu mempunyai kesamaan dengan konsep tulangan ulir pada beton, dimana pada konsep ini terjadi interaksi gaya tumpu dan gaya gesek antara beton dan tulangan bambu atau dengan klem selang seperti yang ditunjukkan pada [Gambar 4](#). Kelemahan klem-selang mempunyai bentuk bulat yang semaksimal mungkin disesuaikan dengan dimensi tulangan bambu yang cenderung berbentuk kotak. Jika dipasang, perbedaan bentuk ini menimbulkan celah dan memerlukan pengisi yang sekaligus sebagai perekat dan lapis kedap air. Dan perekat yang dipakai pada penelitian ini adalah perekat Sikadur ([Ghavami \(2005\)](#), [Agarwal et al. \(2014\)](#), [Maity et al. \(2011\)](#), dan [Muhtar et al. \(2019\)](#)). Hipotesis penelitian ini adalah pemasangan klem selang pada tulangan bambu dapat meningkatkan kuat lekat. Pemasangan klem-selang pada tulangan bambu akan menambah tahanan gelincir (*slip*) di sepanjang tulangan.

METODE PENELITIAN

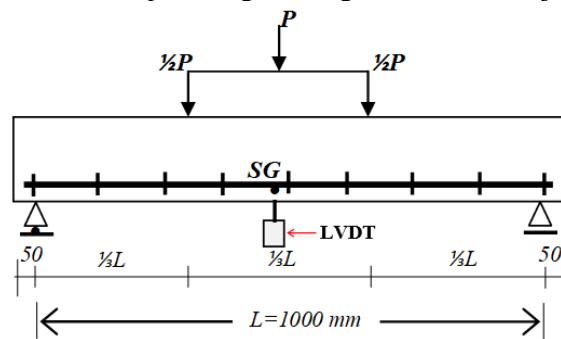
Uji lentur balok beton bertulang bambu dilakukan dengan dua titik beban berdasarkan [ASTM C 09-2002](#). Benda uji balok dibuat sebanyak 25 buah dengan ukuran 75 mm x 150 mm x 1100 mm, termasuk 1 buah benda uji balok beton bertulang baja polos berdiameter Ø 8 mm dengan luas tulangan $A_s = 100.48 \text{ mm}^2$. Detail penulangan dan bentuk benda uji balok ditunjukkan pada Gambar 5. Jenis bambu yang digunakan sebagai tulangan adalah bambu petung (*Dendrocalamus asper*) ([Muhtar, 2020](#)). Variasi luas tulangan bambu adalah 150 mm^2 , 300 mm^2 , dan 450 mm^2 dengan jarak klem selang 0 cm, 15 cm, 20 cm, dan 25 cm. Bahan campuran beton normal yang digunakan adalah semen *portland pozzoland*, pasir, agregat kasar, dan air dengan proporsi 1 PPC : 1.80 Ps : 2.80 Kr : 0.50 Air. Metode pengujian balok adalah metode empat titik.



Keterangan:

- SRC = Balok beton bertulang baja
- PC = Plain concrete
- BRCS₀ = Balok beton bertulang bambu (BRC) – jarak klem-selang 0 cm (s_0)
- BRCS₁ = Balok beton bertulang bambu (BRC) – jarak klem-selang 15 cm (s_1)
- BRCS₂ = Balok beton bertulang bambu (BRC) – jarak klem-selang 20 cm (s_2)
- BRCS₃ = Balok beton bertulang bambu (BRC) – jarak klem-selang 25 cm (s_3)
- A_s = Luas tulangan baja ($A_s = 100,48 \text{ mm}^2$)
- A_b = Luas tulangan bambu (variasi nilai A_b adalah 150 mm², 300 mm², dan 450 mm²)

Gambar 5. Detail penulangan dan geometri benda uji balok



Keterangan:
 SG = Strain gauge

Gambar 6. Pengaturan uji lentur balok

Uji lentur balok dilakukan dengan dua tumpuan yaitu tumpuan sendi dan rol. Beban yang diberikan adalah beban terpusat 2 titik dengan jarak $\frac{1}{3}L$ dari tumpuan. *Strain gauge* dipasang pada tulangan bambu pada jarak $\frac{1}{3}L$ dari tumpuan untuk mengetahui regangan yang terjadi. *Strain gauge* dihubungkan dengan digital *strain meter* berkapsitas 6 digit melalui kabel susun. Untuk mendekripsi

lendutan yang terjadi pada balok uji dipasang LVDT pada jarak $\frac{1}{2}L$ dari tumpuan. Untuk memperoleh tahapan pembebanan dari nol sampai balok runtuh digunakan alat *hydraulic jack* dan *load cell* yang dihubungkan dengan alat *load indicator*. Pembacaan beban pada *load indicator* dijadikan pengendali pompa *hydraulic jack*, pembacaan lendutan, dan pembacaan regangan sesuai tahap pembebanan yang direncanakan. Namun pada saat benda uji mencapai beban ultimate-nya pembacaan lendutan menjadi pengendali pembacaan regangan maupun beban, sedangkan pemompaan *hydraulic jack* terus dilakukan secara berlanjut-lahan sesuai komando pembacaan lendutan. Pengaturan uji lentur balok ditunjukkan pada [Gambar 6](#).

Tabel 1. Rancangan eksperimen pengaruh jarak klem-selang dan rasio tulangan

Rasio Tulangan Bambu (Faktor A)	$A_b = 150 \text{ mm}^2$ (A ₁)				$A_b = 300 \text{ mm}^2$ (A ₂)				$A_b = 450 \text{ mm}^2$ (A ₃)			
Jarak Klem-selang (Faktor B)	0 cm (B ₁)	15 cm (B ₂)	20 cm (B ₃)	25 cm (B ₄)	0 cm (B ₁)	15 cm (B ₂)	20 cm (B ₃)	25 cm (B ₄)	0 cm (B ₁)	15 cm (B ₂)	20 cm (B ₃)	25 cm (B ₄)
	A ₁ B ₁	A ₁ B ₂	A ₁ B ₃	A ₁ B ₄	A ₂ B ₁	A ₂ B ₂	A ₂ B ₃	A ₂ B ₄	A ₃ B ₁	A ₃ B ₂	A ₃ B ₃	A ₃ B ₄

Keterangan: Jumlah pengulangan, n = 2

Tabel 2. Model ANOVA pengaruh jarak klem-selang dan rasio tulangan

Sumber Variasi	Jumlah Kuadrat	Derajat Bebas	Jumlah Kuadrat Tengah	F-ratio
Rasio Tulangan (A)	SS _A	2	$MS_A = \frac{SS_A}{2}$	$F_0 = \frac{MS_A}{MS_E}$
Jarak Klem-selang (B)	SS _B	3	$MS_B = \frac{SS_B}{3}$	$F_0 = \frac{MS_B}{MS_E}$
Interaksi (AB)	SS _{AB}	6	$MS_{AB} = \frac{SS_{AB}}{6}$	$F_0 = \frac{MS_{AB}}{MS_E}$
Galat	SS _E	12	$MS_E = \frac{SS_E}{12}$	
Total	SS _T	23		

Rancangan pengujian balok berdasarkan variabel rasio tulangan dan variasi jarak klem-selang dengan rancangan eksperimen disajikan pada [Tabel 1](#). Uji hipotesis pengaruh faktor dan interaksi faktor dilakukan dengan analisis varian dengan model ANOVA disajikan pada [Tabel 2](#). Analisa pengaruh rasio luas tulangan dan jarak klem-selang terhadap perilaku lentur balok beton bertulang bambu dilakukan dengan ANOVA dua arah. Sedangkan analisis data respon hasil uji lainnya dianalisis secara deskriptif yang diperjelas dengan grafik-grafik hubungan antara parameter-parameter respon. Respon benda uji yaitu kapasitas beban, displacement, regangan, bond-stress, dan lain-lain.

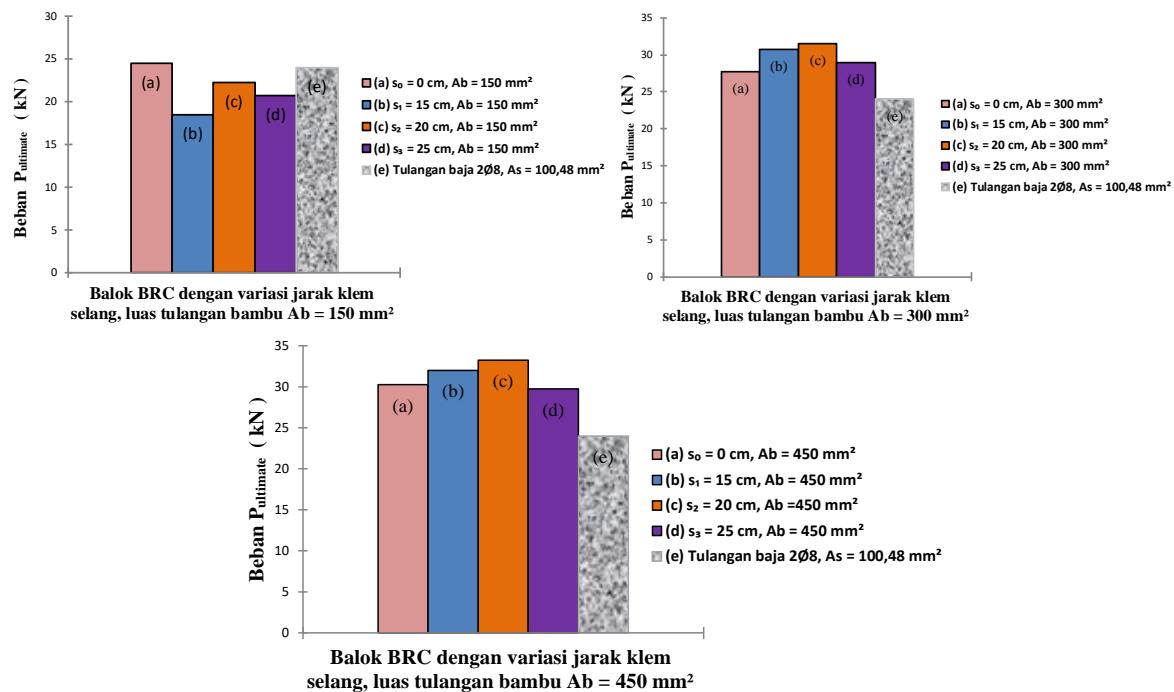
Untuk mendapatkan model hubungan antar respon, maka dilakukan analisis regresi. Model yang dipilih disesuaikan dengan puncaran data hasil pengujian sehingga dapat ditetapkan sebagai regresi linier atau non linier. Sedangkan untuk mengetahui tingkat keandalan model yang digunakan, dicari koefisien determinasinya (R^2) dengan besarnya nilai berkisar 0 sampai 1, dimana jika nilai R^2 semakin mendekati 1 maka keandalan model semakin tinggi. Sedangkan untuk mengetahui kekerasan hubungan antar variabel, maka dicari koefisien korelasinya (R) dengan besarnya nilai berkisar -1 sampai 1, dimana jika nilai koefisien korelasinya mendekati 1, maka keandalannya semakin tinggi.

HASIL DAN PEMBAHASAN

[Gambar 7](#) menunjukkan besar kontribusi jarak pemasangan klem-selang terhadap beban ultimit. Beban ultimit terbesar terjadi pada semua balok dengan jarak klem-selang 20 cm dengan beban ultimit 22.5 kN, 32 kN, dan 33.5 kN berturut-turut terjadi pada balok A₁B₃, A₂B₃, dan A₃B₃. Beban ultimit balok SRC dengan $A_s = 100.48 \text{ mm}^2$ terlampaui oleh balok BRC dengan jarak klem-selang 20 cm sampai sebesar 39.58%. Namun, pada balok BRC dengan luas tulangan $A_b = 150$

mm^2 dengan klem-selang mempunyai beban ultimit yang lebih rendah 15% dari pada balok SRC dengan luas tulangan $A_s = 100.48 \text{ mm}^2$. Sedangkan, balok BRC dengan tulangan bambu tanpa klem-selang mempunyai beban ultimit lebih tinggi 4.17% dari pada balok SRC dengan luas tulangan $A_s = 100.48 \text{ mm}^2$ seperti yang diperlihatkan pada [Gambar 7](#). Hal ini menunjukkan efek dimensi tulangan bambu yang terlalu kecil dan cacatnya tulangan bambu akibat pengencangan klem-selang. Adanya cacat pada tulangan bambu menyebabkan terjadi konsentrasi tegangan tarik dan putusnya tulangan. Hal ini menunjukkan bahwa pemasangan klem-selang pada tulangan bambu dengan dimensi terlalu kecil menjadi tidak efektif

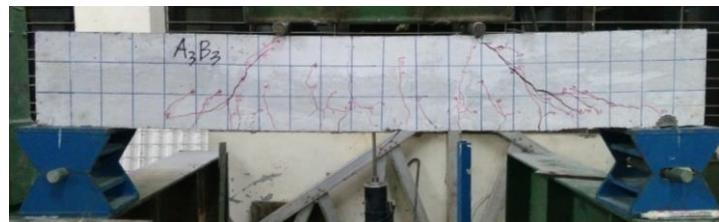
Kontribusi klem selang terhadap tegangan lekat dapat dilihat pada perbedaan dalam pola retak dari hasil penelitian ini dengan penelitian [Agarwal \(2014\)](#) seperti ditunjukkan pada [Gambar 8](#) dan [Gambar 9](#). Moyoritas rambatan retak menuju ke arah tulangan bambu membuktikan slip antara tulangan bambu dan beton masih terjadi. Terjadinya slip membuktikan bahwa modulus elastisitas bambu lebih rendah dari modulus elastisitas beton. Treatment dengan perekat masih belum menjamin tidak adanya celah-celah terjadinya saling serap air antara bambu dan beton, terutama pada saat pengecoran benda uji. Hal ini menyebabkan tegangan lekat rendah. Oleh karena itu, perhitungan kapasitas penampang balok BRC harus didasarkan pada luasan geser tulangan bambu, tidak didasarkan pada kekuatan tarik tulangan bambu, hal ini sesuai dengan penelitian [Ghavami \(2005\)](#) pada analisis distribusi tegangan-regangan balok beton bertulang bambu. Untuk balok beton bertulang baja (SRC) pola retak dan keruntuhan adalah retakan lentur dan keruntuhan lentur. Ini membuktikan bahwa tegangan lekat (*bond stress*) tulangan baja lebih tinggi dari tegangan lekat (*bond stress*) tulangan bambu. Setelah retakan awal terjadi, seiring dengan meningkatnya beban, retakan terus merambat ke arah vertikal sampai terjadi keruntuhan sebagaimana ditunjukkan pada [Gambar 10](#).



Gambar 7. Beban ultimit balok BRC dengan variasi jarak klem-selang



Gambar 8. Pola retak balok beton bertulang bambu hasil penelitian terdahulu



Gambar 9. Pola retak balok beton bertulang bambu (BRC)

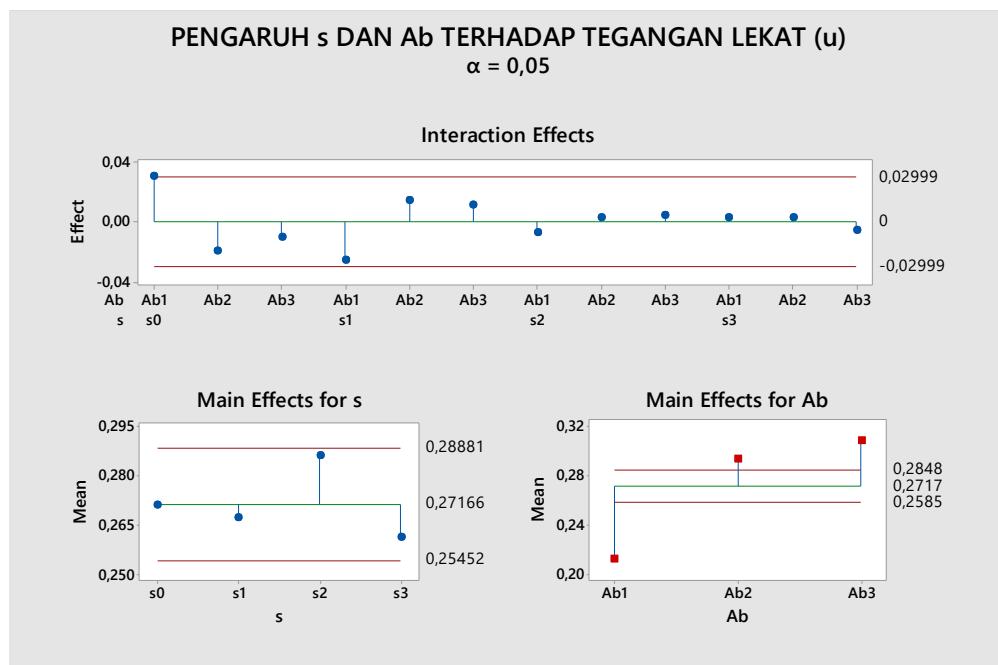


Gambar 10. Pola retak balok beton bertulang baja (SRC)

Analisis statistik untuk menghitung pengaruh variasi jarak klem-selang (s) dan variasi luas tulungan (A_b) terhadap tegangan lekat (u) dianalisis dengan ANOVA dua arah. Untuk mempermudah proses perhitungan digunakan program minitab 18 dengan hasil seperti yang ditunjukkan pada [Tabel 3](#), [Gambar 11](#), dan [Gambar 12](#).

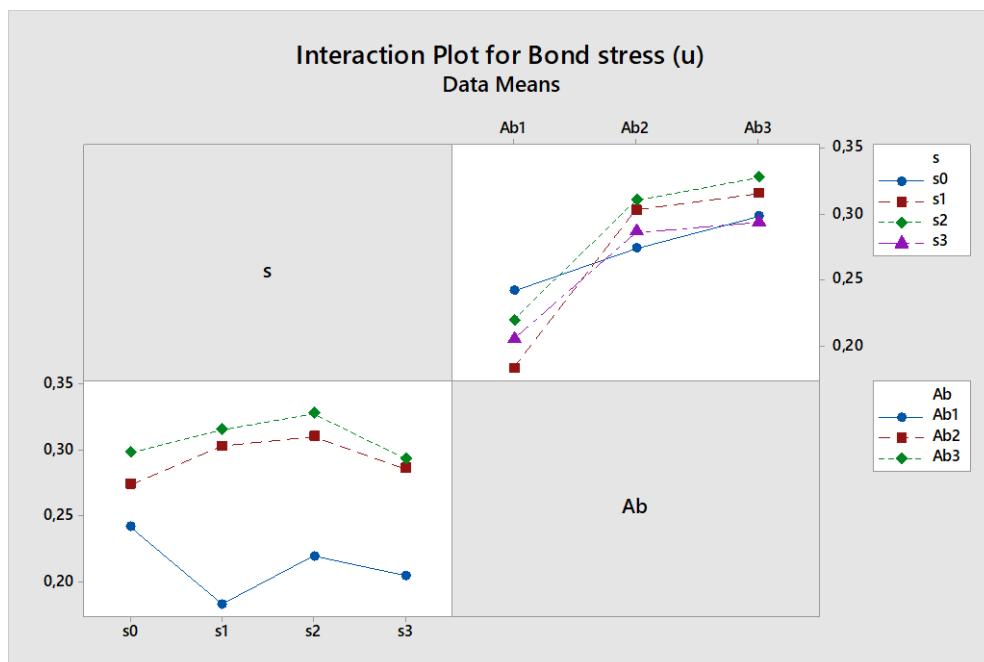
Dari [Gambar 11](#) menunjukkan ploting rata-rata tegangan lekat pada tulangan bambu tanpa klem-selang maupun dengan klem-selang. Pada diagram terlihat bahwa pemasangan klem-selang dengan jarak $s_2 = 20$ cm mempunyai tegangan lekat diatas rata-rata, sedangkan jarak $s_1 = 15$ cm dan $s_3 = 25$ cm mempunyai tegangan dibawah rata-rata. Untuk pengaruh rasio luas tulungan (A_b), semakin naik luas tulungan bambu semakin tinggi nilai tegangan lekatnya. Luas tulungan bambu efektif diatas rata-rata terjadi pada luas tulungan $A_{b2} = 300 \text{ mm}^2$ dan $A_{b3} = 450 \text{ mm}^2$.

Dari [Gambar 12](#) menunjukkan bahwa tidak ada interaksi jarak klem-selang. Luas tulungan bambu A_{b2} dan A_{b3} sama-sama meningkat tegangan lekatnya, dan sama-sama menurun pada jarak klem-selang $s_3 = 25$ cm. Sedangkan luas tulungan A_{b1} cenderung menurun tegangan lekatnya bila menggunakan klem-selang. Untuk variasi luas tulungan (A_b) menunjukkan adanya interaksi. Tegangan lekat meningkat pada jarak klem-selang $s_1 = 15$ cm dan $s_2 = 20$ cm dengan luas tulungan $A_{b2} = 300 \text{ mm}^2$ dan $A_{b3} = 450 \text{ mm}^2$. [Gambar 13](#) menunjukkan tegangan lekat benda uji untuk masing-masing perlakuan. Jarak klem-selang s_2 dan s_3 dengan luas tulungan A_{b3} mempunyai simpangan yang kecil dan kapasitas tegangan lekat yang paling tinggi



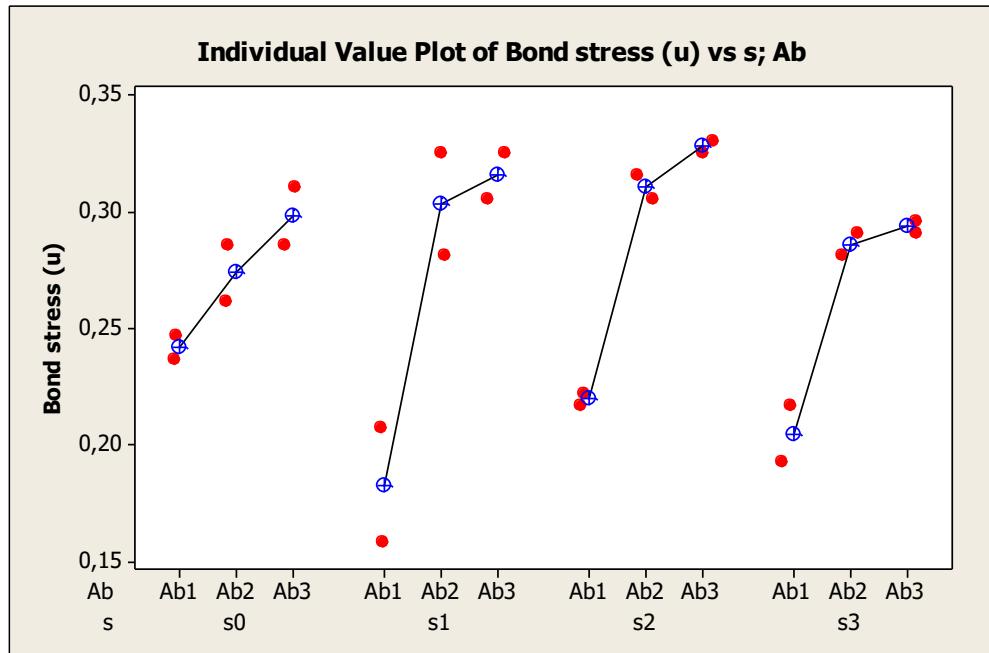
Keterangan: A_b = Luas tulangan bambu (variasi A_b adalah A_{b1} , A_{b2} , dan A_{b3})
 s = Jarak klem-selang (variasi s adalah s_0 , s_1 , s_2 , dan s_3)

Gambar 11. Diagram pengaruh jarak klem-selang (s) dan variasi luas tulangan (A_b) terhadap tegangan lekat (u) rata-rata



Keterangan: A_b = Luas tulangan bambu (variasi A_b adalah A_{b1} , A_{b2} , dan A_{b3})
 s = Jarak klem-selang (variasi s adalah s_0 , s_1 , s_2 , dan s_3)

Gambar 12. Diagram interaksi jarak klem-selang (s) dan variasi luas tulangan (A_b) terhadap tegangan lekat (u)



Keterangan: A_b = Luas tulangan bambu (variasi A_b adalah A_{b1} , A_{b2} , dan A_{b3})

s = Jarak klem-selang (variasi s adalah s_0 , s_1 , s_2 , dan s_3)

Gambar 13. Diagram nilai tegangan lekat masing-masing perlakuan

Untuk mengetahui pengaruh variasi jarak klem-selang (s) dan variasi luas tulangan (A_b) terhadap perilaku lentur digunakan data tegangan lekat (u) dan dianalisis ANOVA dua arah dengan *confidence level* = 95% atau tingkat signifikansi α = 0,05. Dari Tabel 3 menunjukkan bahwa untuk variasi jarak klem-selang (s) diperoleh nilai $p = 0,268 > \alpha$ berarti H_0 diterima, untuk variasi luas tulangan didapatkan $p = 0,000 < \alpha$ maka H_0 ditolak. Dengan kesimpulan bahwa variasi jarak klem-selang (s) tidak mempunyai pengaruh yang signifikan terhadap tegangan lekat (*bond stress*), sedangkan untuk variasi luas tulangan (A_b) mempunyai pengaruh yang signifikan terhadap tegangan lekat (*bond stress*). Namun jika diuji secara parsial, pengaruh jarak klem-selang (s) terhadap tegangan lekat (*bond stress*) mempunyai pengaruh signifikan. Tingkat keandalan model dapat dilihat pada nilai $R-sq$ (R -squared) sebesar 84,33% dan 72,15% untuk R prediksi.

Tabel 3. Hasil analisis ANOVA dua arah

General Linear Model: Bond stress (u) versus s; Ab

Method

Factor coding (-1; 0; +1)

Factor Information

Factor	Type	Levels	Values
s	Fixed	4	s0; s1; s2; s3
Ab	Fixed	3	Ab1; Ab2; Ab3

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
s	3	0,002001	0,000667	1,43	0,268
Ab	2	0,043339	0,021669	46,31	0,000
Error	18	0,008422	0,000468		
Lack-of-Fit	6	0,004927	0,000821	2,82	0,060
Pure Error	12	0,003496	0,000291		
Total	23	0,053762			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0,0216314	84,33%	79,98%	72,15%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0,27166	0,00442	61,53	0,000	
s					
s0	-0,00021	0,00765	-0,03	0,979	1,50
s1	-0,00432	0,00765	-0,56	0,579	1,50
s2	0,01460	0,00765	1,91	0,072	1,50
Ab					
Ab1	-0,05943	0,00624	-9,52	0,000	1,33
Ab2	0,02200	0,00624	3,52	0,002	1,33

Regression Equation

$$\text{Bond stress (u)} = 0,27166 - 0,00021 s_{s0} - 0,00432 s_{s1} + 0,01460 s_{s2} - 0,01008 s_{s3} - 0,05943 Ab_{Ab1} + 0,02200 Ab_{Ab2} + 0,03743 Ab_{Ab3}$$

Fits and Diagnostics for Unusual Observations

Obs	Bond stress (u)	Fit	Resid	Std Resid	R
8	0,1579	0,2079	-0,0500	-2,67	R

R Large residual

KESIMPULAN

Dari hasil uji eksperimental dan pembahasan dapat diambil beberapa kesimpulan tentang pengaruh klem selang yang dipasang pada tulangan bambu, diantaranya:

1. Berdasarkan analisa statistik secara deskriptif menunjukkan bahwa kapasitas dan tegangan lekat (bond-stress) balok beton bertulang bamboo (BRC) dengan rasio luas tulangan bambu 4% meningkat sampai dengan 36% bila dibanding dengan balok beton bertulang baja (SRC) bertulang baja dengan rasio luas tulangan baja 0.89%.
2. Berdasarkan analisa statistik secara deskriptif menunjukkan bahwa jarak efektif pemasangan klem-selang adalah 20 cm pada rasio tulangan 1,8% dan 4% dengan kapasitas beban meningkat sampai 35.71% dari balok BRC tanpa klem-selang, dan sudah dapat melampaui beban ultimit balok SRC bertulang baja sampai 38.54% dengan rasio luas tulangan baja 0.89%. Dimensi tulangan bambu yang terlalu kecil atau ketebalan dibawah 1 cm tidak efektif menggunakan klem-selang.
3. Dari uji statistik secara serentak menunjukkan bahwa pemasangan klem-selang pada tulangan bambu tidak mempunyai pengaruh signifikan terhadap tegangan lekat dan rasio tulangan bambu mempunyai pengaruh signifikan terhadap tegangan lekat, sedangkan jika diuji secara parsial pengaruh klem-selang terlihat signifikan.

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DAFTAR PUSTAKA

- Agarwal, A., Nanda, B., & Maity, D. (2014). Experimental investigation on chemically treated bambu reinforced concrete beams and columns. *Construction and Building Materials*, 71, 610–617. <https://doi.org/10.1016/j.conbuildmat.2014.09.011>
- ASTM C 09. (2002). Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading). In *ASTM International*. ASTM International.
- Budi, A. S., Rahmadi, A. P., & Rismunarsi, E. (2016). Experimental Study of Flexural Capacity on Bambu Ori Strip Notched V Reinforced Concrete Beams. *AIP Conf. Proc. 1788 - International Conference on Engineering, Science and Nanotechnology 2016 (ICESNANO 2016)*, 1788, 030052–1–030052–030057.
- Dey, A., & Chetia, N. (2016). Experimental study of Bambu Reinforced Concrete beams having various frictional properties. *Materials Today: Proceedings*, 5(1), 436–444. <https://doi.org/10.1016/j.matpr.2017.11.103>.
- Ghavami, K. (2005). Bambu as reinforcement in structural concrete elements. *Cement and Concrete Composites*, 27(6), 637–649. <https://doi.org/10.1016/j.cemconcomp.2004.06.002>.
- Islam, S., Afefy, H. M., Sennah, K., & Azimi, H. (2015). Bond characteristics of straight- and headed-end, ribbed-surface, GFRP bars embedded in high-strength concrete. *Construction and Building Materials*, 83, 283–298. <https://doi.org/10.1016/j.conbuildmat.2015.03.025>.
- Lestari, A. D., Dewi, S. M., & Wisnumurti. (2015). Pengaruh penambahan kait pada tulangan bambu terhadap respon lentur balok beton bertulangan bambu. 9(2), 81–87.
- Maity, Agarwal, A., & Damodar. (2011). Experimental Investigation On Behaviour Of Bambu Reinforced Concrete Members. *16th International Conference on Composite Structures*, 1–2.
- Mali, P. R., & Datta, D. (2020). Experimental evaluation of bambu reinforced concrete beams. *Journal of Building Engineering*, 28, 101071. <https://doi.org/10.1016/j.jobe.2019.101071>.
- Muhtar. (2020). Precast bridges of bambu reinforced concrete in disadvantaged village areas in Indonesia. *Applied Sciences (Switzerland)*, 10(20). <https://doi.org/10.3390/app10207158>.
- Muhtar, Dewi, S. M., Wisnumurti, & Munawir, A. (2019). Enhancing bambu reinforcement using a hose-clamp to increase bond-stress and slip resistance. *Journal of Building Engineering*, 26. <https://doi.org/10.1016/j.jobe.2019.100896>.