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Jurnal Jalan Jembatan adalah wadah informasi bidang Jalan dan Jembatan berupa hasil penelitian, studi kepustakaan maupun tulisan ilmiah terkait yang meliputi **bidang bahan dan perkerasan jalan, geoteknik jalan, transportasi dan teknik lalu-lintas serta lingkungan jalan, jembatan dan bangunan pelengkap jalan**. Terbit pertama kali tahun 1984, dengan frekuensi terbit tiga kali setahun pada bulan April, Agustus, dan Desember. Mulai tahun 2016 terbit dengan frekuensi dua kali setahun, edisi Januari - Juni dan edisi Juli - Desember, dalam versi cetak dan versi elektronik.
Sesuai dengan Surat Keputusan Direktorat Jenderal Pendidikan Tinggi, Riset, dan Teknologi Nomor: 0173/C3/DT.05.00/2025, Jurnal Jalan - Jembatan telah **Terakreditasi Peringkat 3**.

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Prakata

Dengan mengucap syukur, Jurnal Jalan Jembatan kembali hadir menyajikan enam artikel penelitian terkini yang mencerminkan perkembangan ilmu pengetahuan dalam bidang infrastruktur jalan dan jembatan. Edisi kali ini mengetengahkan tema strategis, mulai dari material berkelanjutan, mitigasi risiko bencana, hingga evaluasi kinerja struktur, yang relevan dengan tantangan pembangunan infrastruktur di Indonesia.

Artikel pembuka oleh Syukri dkk. (2025) mengusung inovasi beton self-healing berbasis bakteri (Bacillus megaterium) dengan memanfaatkan limbah beton sebagai substitusi agregat kasar. Studi ini membuktikan bahwa kombinasi bakteri dan limbah beton tidak hanya meningkatkan kuat tekan hingga 5,39%, tetapi juga memulihkan keretakan secara alami, menjadikannya solusi berkelanjutan untuk konstruksi jalan dan jembatan.

Selanjutnya, Simbolon dkk. (2025) menanggapi urgensi mitigasi likuifaksi pada tanah *subgrade* pascagempa melalui stabilisasi berbasis bioteknologi (*microbially induced calcite precipitation*). Dengan menggunakan bakteri *Sporosarcina Sp*, penelitian ini berhasil meningkatkan nilai CBR tanah pasir pantai Anyer dari 2,25% menjadi >3% serta mereduksi risiko likuifaksi hingga kedalaman 1 meter.

Pada aspek perkuatan struktur, Hakiki (2025) menguji performa balok komposit kayu-beton berpelapis carbon fibre-reinforced polymer (CFRP). Hasilnya menunjukkan bahwa meskipun CFRP meningkatkan kekakuan, jumlah lapisan perlu dioptimalkan untuk menjaga daktilitas, mengingat energi serap turun drastis dari 5.773,27 Joule (tanpa CFRP) menjadi 451,59 Joule (3 lapis CFRP).

Artikel keempat oleh Anggraeni (2025) menyajikan studi kasus evaluasi dan perkuatan Jembatan Kawah Ijen 2 yang menghadapi beban berlebih (109 ton vs kapasitas 56 ton). Melalui pemodelan SAP2000, tim merekomendasikan perkuatan dengan CFRP dan portal baja, yang berhasil menekan lendutan maksimal hingga 3,582 mm (di bawah batas aman 15 mm).

Sur et al.(2025) membandingkan metode AHP-TOPSIS dan Entropy-TOPSIS untuk prioritas perbaikan jalan. Temuan mengungkap bahwa Entropy-TOPSIS lebih akurat (27,5%) daripada AHP-TOPSIS (21,25%), dengan rekomendasi perbaikan utama pada ruas STA 3+401–3+500 di Jorong Beach.

Terakhir, Putri dan Firdaus (2025) menganalisis dampak Jalan Tol Trans Sumatra (JTTS) terhadap pertumbuhan ekonomi wilayah. Meski kabupaten/kota yang dilintasi mengalami kenaikan PDRB rata-rata 1,28%, studi menegaskan perlunya strategi konektivitas kewilayahan sebagai pendekatan utama dalam pengembangan jalan untuk memaksimalkan manfaat ekonomi jangka panjang.

Kami mengucapkan terima kasih kepada para penulis, mitra bestari, dan pihak terkait yang telah berkontribusi pada terbitan ini. Semoga makalah dalam edisi ini dapat menjadi rujukan bagi akademisi, praktisi, dan pemangku kebijakan dalam menjawab kompleksitas pembangunan infrastruktur di Indonesia.

Ketua Dewan Redaksi,
Gede Budi Suprayoga, PhD

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UDC: 616.637

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Kuat Tekan pada Campuran Beton dengan Bakteri yang diinokulasi dan Limbah Benda Uji

Jurnal Jalan Jembatan
Vol. 42 No. 1 Januari – Juni 2025, hal. 1-10

ABSTRACT
Concrete is a material commonly used as road and bridge structure and is very prone to cracking in hard-to-reach areas. Innovation in the form of self-healing concrete (SHC) can repair its cracks. Meanwhile, concrete waste remains a challenge that needs to be addressed and utilized to reduce the reliance on natural materials. This study utilises Bacillus megaterium bacteria as a self-healing agent and concrete waste as a substitute for coarse aggregate applied in regular concrete (20 MPa) with a mix design based on ACI 211.1-91. Variations in bacterial content are 2% and 4% of the weight of water, and variations in concrete waste are 25%, 50%, and 75% of the weight of coarse aggregate with a substitution of 10% fly ash and 2% calcium lactate of the weight of cement. The results showed an increase in compressive strength of 5.39% from 21.5 MPa for waste concrete to 20.4 MPa but a decrease of 0.46% from 21.6 MPa for regular concrete. Then, the bacteria showed self-healing or covered the cracks on the seventh day after testing. Additionally, the bacteria were able to restore the strength of the concrete by 80.22% to 99.19% after retesting on the 28th day. Therefore, concrete with bacteria based on concrete waste has the potential to be applied to road and bridge construction

Kata kunci: *Bacillus megaterium*, beton normal, kuat tekan, limbah beton, *self-healing concrete*

Keywords: *Bacillus megaterium, compressive strength, regular concrete, self-healing concrete, waste concrete*

UDC: 550.34

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Analisis Potensi Likuifaksi Pasir Pantai Anyer sebagai *Subgrade* Jalan yang Distabilisasi dengan Bakteri *Sporosarcina Sp*

Jurnal Jalan Jembatan
Vol. 42 No. 1 Januari – Juni 2025, hal. 11-21

ABSTRACT
Earthquakes are natural disasters that can cause significant damage to infrastructure, particularly the subgrade layer, and induce secondary effects such as liquefaction. This impact phenomenon is indicated by loose soil material, such as sand, losing its strength and exhibiting a fluid-like behaviour due to specific shocks or pressures. As a result, the soil becomes unstable so that it is unable to support the load above it. The use of loose sand as a subgrade requires repair or replacement with stronger, more stable soil, which can be addressed with the proper stabilisation method. Currently, a more environmentally friendly soil stabilisation method has been found, known as bio-grouting or microbially induced calcite precipitation (MICP). This study was conducted to develop and apply Sporosarcina Sp bacteria on Anyer beach sand with four methods, including A (injection, 10 ml of bacteria), A1 (soaking, 10 ml of bacteria), B (injection, 100 ml of bacteria), and C (injection, only nutrients). The results of soil stabilisation using four methods in a 14-day incubation period can increase the CBR value of the soil by more than 40% compared to the initial condition. The CBR value of the soil, which was originally around 2.25%, became 3.156% (method A), 3.016% (method A1), and 3.367% (method B). The increase in the SF value, which was previously around 0.20-0.21, was shown after stabilisation, and the SF value was obtained with a range of 2-5.6 in methods A, A1, and B. This value has increased significantly and can reduce the potential for liquefaction in sand as a road subgrade with a depth range of 0-1 m, as shown at the research location.

Kata Kunci: gempa bumi, likuefaksi, tanah pasir pantai, *Sporosarcina Sp, subgrade*

Keywords: *earthquake, liquefaction, coastal sandy soil, Sporosarcina Sp, subgrade*

UDC: 624.072.2
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Evaluasi Kinerja Energi Serap Balok Jembatan Komposit Kayu Laminasi-Beton Berlapis CFRP pada Beban Statis

Jurnal Jalan Jembatan
Vol. 42 No. 1 Januari – Juni 2025, hal. 22-30

ABSTRACT
This study aims to analyse the ability of a glulam-concrete composite bridge beam coated with carbon fibre-reinforced polymer (CFRP) to absorb energy under static loading conditions. The glulam-concrete composite structure was chosen due to the combination of concrete's compressive strength and laminated wood's flexibility, which provides optimal performance in bridge applications. CFRP is used to enhance the beam's resistance to deformation and damage caused by the applied load. The test was conducted by gradually applying static loads to beams coated with 1 Layer, 2 Layers, and 3 Layers of CFRP, as well as to beams without CFRP for comparison. The absorbed energy was calculated by measuring the area under the load-deflection curve, which indicates the amount of energy that the beam can absorb before reaching failure. The results showed that CFRP reinforcement increased the stiffness and strength of the beam but decreased the energy absorption capacity. The beam without CFRP has the highest absorption energy (5773.27 Joules). In comparison, the beam with three CFRP layers has the lowest absorption energy (451.59 Joules), indicating the tendency of brittle and shear failure in laminated beams. Therefore, the number of CFRP layers should be optimised to balance the increase in strength and ductility, thereby preventing sudden failure in structural applications.

Kata Kunci: energi serap, balok jembatan, komposit kayu laminasi-beton, CFRP, beban statis.

Keywords: *energy absorption, bridge beam, glulam-concrete composite, CFRP, static loa*

UDC: 624
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Analisis Perkuatan Struktur Jembatan dalam Kondisi di Bawah Beban Muatan Melebihi Kapasitas

Jurnal Jalan Jembatan
Vol. 42 No. 1 Januari – Juni 2025, hal. 31-43

ABSTRACT
Bridges are sometimes crossed by vehicles with loads exceeding their capacity. For example, the Ijen Crater Bridge 2 in East Java will be crossed by heavy vehicles loaded with 109 tons of generators, while the bridge load capacity is only 56 tons. Therefore, a comprehensive condition evaluation and appropriate reinforcement recommendations are needed. The research methods used include visual inspection, non-destructive testing (NDT), and structural modelling using SAP2000 software. Through visual inspection, general damage to the bridge was identified. NDT was used to obtain quantitative data on the material's condition. The results of both methods are input into structural modelling to analyze bridge behaviour under operational loads. The analysis results indicate that the maximum capacity ratio of the structure is 0.796. This value is below 1, which means that the structural capacity has met the requirements after reinforcement. The maximum deflection value of the structure stiffness is 3.582 mm or less than the allowable deflection of 15 mm, which means it has met the criteria. The moment analysis after reinforcement produces a Mu value of 121.387 kNm, or still greater than the Mn value of 69.6 kNm. Therefore, it is recommended to strengthen the concrete floor slab structure according to the results, including the use of Carbon Fibre Reinforced Polymer. Steel portals are installed in the middle of the bridge span, and shallow foundations are built in the river flow area. This study demonstrates that bridge reinforcement necessitates a comprehensive analysis and solutions to ensure the safety of the bridge structure is maintained.

Kata Kunci: Jembatan Kawah Ijen, perkuatan jembatan, portal baja, muatan khusus, kapasitas struktur.

Key words: *ijen crater bridge, bridge reinforcement, steel portal, special load, structure capacity.*

UDC: 551.438.5:625.74
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Comparative Study of Integrated Multicriteria Decision Making: AHP-TOPSIS vs Entropy-TOPSIS for Prioritizing Road Damage Repair

Jurnal Jalan Jembatan
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ABSTRACT
This study compares two integrated methods, specifically the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), to determine prioritized road sections for repair. The first method, AHP-TOPSIS, assigns weights to damage criteria based on the characteristics of road damage types. The second method, Entropy-TOPSIS, determines the weights of damage criteria using the Entropy formula. The accuracy of both methods is assessed by comparing their ranking results to the Pavement Condition Index (PCI) assessment based on the percentage of similarity. Based on the accuracy percentages, Entropy-TOPSIS demonstrates higher accuracy (27.5%) compared to AHP-TOPSIS (21.25%). Meanwhile, the road sections prioritized for repair yielded the same ranking results between AHP-TOPSIS and Entropy-TOPSIS, specifically the road sections on Jorong Beach, from STA 3+401 to 3+500 (Alternative 70). The results of this study support the development of more accurate and efficient decision-making models for infrastructure maintenance, which can be applied to broader transportation management systems.

Keywords: *road damage, PCI, AHP, entropy, TOPSIS*

UDC: 330.35
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Dampak Pengoperasian Jalan Tol Trans Sumatra (JTTS) terhadap Dinamika Pertumbuhan Ekonomi Pulau Sumatra

Jurnal Jalan Jembatan
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ABSTRACT
Toll road development is one of the key instruments for driving regional economic growth through increased connectivity and accessibility. The development of the Trans Sumatra Toll Road (JTTS) is a strategic effort in realising economic transformation on Sumatra Island. The transformation occurs due to a shift in the economic structure from the dominance of the primary sector to a more competitive one, resulting in greater economic and social benefits of development. This study aims to identify the impact of JTTS operations, including their implications for regional economic growth on Sumatra Island. The quantitative descriptive analysis method is employed, which involves analysing the economic profile, regional network, and economic growth, as well as conducting correlation analysis. The results of the study show that the regencies/cities crossed by JTTS experienced an average increase in gross regional domestic product (GRDP) of 1.28% and contributed 3.3% to the GRDP of Sumatra Island. The study found no significant relationship between economic growth and the JTTS length variable (correlation coefficient of 0.092) or road network density (correlation coefficient of 0.305). This finding suggests that the toll road network development strategy should still prioritise creating new connectivity between regions as the primary approach to developing regional infrastructure.

Kata Kunci: jalan tol, pertumbuhan ekonomi, pengembangan wilayah, produk domestik regional bruto, Pulau Sumatra, analisis statistik deskriptif

Keywords: *toll road, economic growth, regional development, gross regional domestic product, Sumatra Island, descriptive statistical analysis*