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Analisis Sisa Masa Layan Fungsional Dan Struktural Perkerasan Lentur (Studi Kasus: Jalan Congot-Ngremang)
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INTISARI

Jalan berperan penting dalam mendukung mobilitas, distribusi barang dan jasa, serta pertumbuhan ekonomi. Banyak ruas jalan di Indonesia mengalami kerusakan dini akibat keterbatasan anggaran dan pesatnya pertumbuhan kendaraan. Ruas Jalan Congot–Ngremang di Kabupaten Kulon Progo merupakan pendukung Jalur Jalan Lintas Selatan (JJLS) yang menghubungkan pesisir selatan dengan pusat ekonomi Yogyakarta dan Purworejo, namun kondisinya menurun dan termasuk kategori rawan kecelakaan (*blacklink*). Penilaian pemeliharaan jalan umumnya masih berfokus pada kondisi visual tanpa analisis struktural yang memadai, padahal kerusakan struktural akibat beban berulang tidak selalu tampak visual. Penelitian ini bertujuan menganalisis dan membandingkan sisa masa layan fungsional serta struktural perkerasan lentur pada ruas tersebut.

Analisis fungsional dilakukan menggunakan metode *Pavement Conditon Index* (PCI) berdasarkan survei visual tiap segmen kilometer untuk menentukan tingkat kerusakan dan sisa masa layan fungsional. Analisis struktural diawali dengan pengujian *Falling Weight Deflectometer* (FWD), diolah melalui *backcalculation* ELMOD 7 untuk memperoleh modulus elastisitas tiap lapisan. Nilai modulus tersebut menjadi *input* program KENPAVE (KENLAYER) untuk menghitung tegangan dan regangan kritis akibat beban lalu lintas, kemudian menghitung repetisi beban izin (N) dan memprediksi sisa masa layan struktural melalui pendekatan mekanistik-empirik berbasis AASHTO 1993.

Hasil analisis PCI menunjukkan kondisi perkerasan Ruas Jalan Congot - Ngremang bervariasi dari kategori *serious* hingga *fair*, dengan nilai PCI 35,75–65 dan sisa masa layan fungsional 0,32–3,95 tahun. Analisis mekanistik-empirik menggunakan KENPAVE menghasilkan regangan kritis *fatigue cracking* sebesar $5{,}21\times10^{-4}$–$5{,}48\times10^{-4}$, *rutting* sebesar $3{,}82\times10^{-4}$–$5{,}12\times10^{-4}$ dan *permanent deformation* sebesar $5{,}03\times10^{-4}$–$5{,}86\times10^{-4}$. Hasil tersebut menunjukkan bahwa kinerja struktural perkerasan lebih dikendalikan oleh *permanent deformation* dibandingkan *fatigue cracking*. Prediksi sisa masa layan struktural menunjukkan bahwa perkerasan existing pada kilometer 1, 2, 5, dan 6 diperkirakan mencapai keruntuhan struktural pada tahun 2025 (sisa masa layan 0 tahun), sedangkan kilometer 3 dan 4 diperkirakan mencapai keruntuhan pada tahun 2026 (sisa masa layan 1 tahun).

Kata Kunci : Kondisi Perkerasan, Masa Layan, *Pavement Condition Index* (PCI), Analisis *Backcalculation*, Mekanistik-Empirik

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ABSTRACT

Roads play a vital role in supporting mobility, the distribution of goods and services, and economic growth. Many road sections in Indonesia suffer from premature deterioration due to budget constraints and rapid growth in vehicle numbers. The Congot–Ngremang road section in Kulon Progo Regency serves supporting the Southern Cross Road (JJLS) connecting the southern coast to the economic hubs of Yogyakarta and Purworejo yet its condition has deteriorated, and it is classified as an accident-prone area (blacklink). Road maintenance assessments typically focus on visual condition rather than adequate structural analysis, even though structural damage caused by repeated loading is not always visually apparent. This study aims to analyze and compare the remaining functional and structural service life of the flexible pavement on this road section.

Functional analysis was conducted using the Pavement Condition Index (PCI) method based on visual surveys of each kilometer segment to determine the level of deterioration and remaining functional service life. Structural analysis began with Falling Weight Deflectometer (FWD) testing, with data processed via ELMOD 7 backcalculation to obtain the modulus of elasticity for each layer. These modulus values served as input for the KENPAVE (KENLAYER) program to calculate critical stresses and strains resulting from traffic loads; subsequently, the allowable load repetitions (N) were calculated, and the remaining structural service life was predicted using a mechanistic-empirical approach based on the 1993 AASHTO guidelines.

PCI analysis results indicate that the pavement condition of the Congot–Ngremang section ranges from "serious" to "fair," with PCI values between 35.75 and 65 and a remaining functional service life of 0.32 to 3.95 years. Mechanistic-empirical analysis using KENPAVE yielded critical strain values of 5.21×10^{-4}–5.48×10^{-4} for fatigue cracking, 3.82×10^{-4}–5.12×10^{-4} for rutting, and 5.03×10^{-4}–5.86×10^{-4} for permanent deformation. The results indicate that the structural performance of the pavement is governed more by permanent deformation than by fatigue cracking. Predictions of remaining structural service life suggest that the existing pavement at kilometers 1, 2, 5, and 6 is expected to reach structural failure in 2025 (0 years of remaining service life), whereas the pavement at kilometers 3 and 4 is expected to reach failure in 2026 (1 year of remaining service life).

Keywords: *Pavement Condition, Service Life, Pavement Condition Index (PCI), Backcalculation Analysis, Mechanistic-Empirical*