ANALISIS OPTIMASI PROPORSI AGREGAT HALUS DAN AGREGAT KASAR TERHADAP KUAT TEKAN BETON DENGAN METODE REGRESI

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untuk memperoleh gelar Sarjana Teknik dari
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2026

ABSTRACT

OPTIMIZATION ANALYSIS OF FINE AGGREGATE AND COARSE AGGREGATE PROPORTIONS ON CONCRETE COMPRESSIVE STRENGTH USING REGRESSION METHOD

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Concrete quality problems due to inappropriate aggregate composition are a major concern because they impact structural strength and material efficiency. This study aims to analyze the effect of variations in the proportion of fine and coarse aggregates on the compressive strength of concrete using a regression method to determine the optimum proportion at a design compressive strength of 17 MPa with SNI 03-2834-2000. Experimental research was conducted at the Construction Laboratory of the Civil Engineering Study Program, Soegijapranata Catholic University. Using 3 variations (3 samples per variation and 27 days of curing). Quantitative analysis to predict the compressive strength of concrete was carried out by modeling in Microsoft Excel. The analysis showed that the regression model had a very good fit to the near-optimal experimental data. Based on these findings, it is concluded that the mathematical relationship of the proportion of coarse aggregate to the compressive strength of concrete y = -0.0041x2 + 0.4516x + 7.7202 (Order 2) with a value of R2 = 0.9836 the optimum proportion of coarse aggregate 55.07% of the total volume weight of aggregate with a compressive strength ratio of 99% produces a maximum compressive strength of 20.1557 MPa, the mathematical relationship of the proportion of fine aggregate to the compressive strength of concrete y = -0.0041x2 + 0.3722x + 11.692 with a value of R2 = 0.9836 (Order 2) the optimum proportion of fine aggregate 45.39% of the total volume weight of aggregate with a compressive strength ratio of 99% produces a maximum compressive strength of 20.139 MPa and y = -0.000041x3 + 0.0021x2 + 0.196x + 12.08 with a value of R2 = 1 (Order 3) the optimum proportion of fine aggregate is 50.1% of the total aggregate volume weight with a compressive strength ratio of 95% resulting in a maximum compressive strength of 22.14 MPa in Order 3 polynomial regression. For further research, it is recommended to increase the proportion variation with smaller intervals, vary the composition of water and cement, vary the size of coarse aggregate and other mechanical parameters of concrete such as tensile strength, modulus of elasticity, porosity, and durability.

***Keywords**: fine aggregate, coarse aggregate, concrete compressive strength, regression, mix design, mortar, porous concrete*

ABSTRAK

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Permasalahan mutu beton akibat komposisi agregat yang tidak tepat menjadi perhatian utama karena berdampak pada kekuatan struktur dan efisiensi penggunaan bahan. Penelitian ini bertujuan menganalisis pengaruh variasi proporsi agregat halus dan agregat kasar terhadap kuat tekan beton dengan metode regresi untuk menentukan proporsi optimum pada kuat tekan rencana 17 MPa dengan SNI 03-2834-2000. Penelitian eksperimental dilakukan di Laboratorium Konstruksi Program Studi Teknik Sipil Universitas Katolik Soegijapranata. Menggunakan 3 variasi (3 sampel tiap variasi dan *curing* 27 hari). Analisis kuantitatif untuk memprediksi kuat tekan beton dilakukan dengan pemodelan di *Microsoft Excel*. Analisis menunjukkan model regresi memiliki kecocokan yang sangat baik terhadap data percobaan yang *near-optimal*. Berdasarkan temuan tersebut, disimpulkan bahwa hubungan matematis proporsi agregat kasar terhadap kuat tekan beton $y = -0{,}0041x^2 + 0{,}4516x + 7{,}7202$ (Ordo 2) dengan nilai $R^2 = 0{,}9836$ proporsi optimum agregat kasar 55,07% dari berat volume total agregat dengan rasio kuat tekan 99% menghasilkan kuat tekan maksimal 20,1557 MPa, hubungan matematis proporsi agregat halus terhadap kuat tekan beton $y = -0{,}0041x^2 + 0{,}3722x + 11{,}692$ dengan nilai $R^2 = 0{,}9836$ (Ordo 2) proporsi optimum agregat halus 45,39% dari berat volume total agregat dengan rasio kuat tekan sebesar 99% menghasilkan kuat tekan maksimal 20,139 MPa dan $y = -0{,}000041x^3 + 0{,}0021x^2 + 0{,}196x + 12{,}08$ dengan nilai $R^2 = 1$ (Ordo 3) proporsi optimum agregat halus 50,1% dari berat volume total agregat dengan rasio kuat tekan 95% menghasilkan kuat tekan maksimal sebesar 22,14 MPa pada regresi polinomial Ordo 3. Untuk penelitian lanjutan, disarankan memperbanyak variasi proporsi dengan interval lebih kecil, melakukan variasi komposisi air dan semen, variasi ukuran agregat kasar dan parameter mekanik beton lain seperti kuat tarik, modulus elastisitas, porositas, dan durabilitas.

Kata kunci: agregat halus, agregat kasar, kuat tekan beton, regresi, *mix design*, mortar, beton porus