

ABSTRAK

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Program Studi : Teknik Sipil S1
Judul : Studi Eksperimental Beton Tembus Cahaya Berbasis Limbah Kertas dan Serat Optik

Beton tembus cahaya merupakan inovasi material bangunan yang menggabungkan kekuatan beton dengan kemampuan meneruskan cahaya alami. Penelitian ini dilatarbelakangi oleh kebutuhan material ramah lingkungan yang memanfaatkan limbah kertas daur ulang dan serat optik untuk mendukung efisiensi energi bangunan. Rumusan masalah berfokus pada bagaimana variasi limbah kertas dan serat optik memengaruhi kuat tekan, transmisi cahaya, dan penyerapan air. Tujuan penelitian ini adalah mengevaluasi kelayakan beton tembus cahaya berbasis limbah kertas sebagai material dinding non-struktural yang estetik dan berkelanjutan.

Metode penelitian dilakukan secara eksperimental dengan benda uji berupa kubus beton ukuran $150 \times 150 \times 150$ mm untuk uji kuat tekan dan transmisi cahaya, serta $50 \times 50 \times 50$ mm untuk uji penyerapan air. Variasi campuran terdiri atas 0% dan 5% limbah kertas sebagai substitusi agregat halus, serta 3% dan 4% serat optik. Total sampel yang diuji berjumlah 24 benda uji. Pengujian meliputi kuat tekan menggunakan alat uji tekan, pengukuran transmisi cahaya dengan lux meter, serta penyerapan air sesuai standar SNI.

Berdasarkan hasil pengujian, disimpulkan bahwa: (1) penambahan limbah kertas sebesar 5% menyebabkan penurunan kuat tekan dan transmisi cahaya serta meningkatkan penyerapan air, sehingga kurang cocok untuk memenuhi standar kuat tekan minimum beton non-struktural meskipun nilai penyerapan air masih di bawah batas SNI; (2) variasi komposisi serat optik memengaruhi kinerja beton, dengan kuat tekan berkisar 2,15–6,67 MPa, transmisi cahaya 387–764 lux, dan penyerapan air 20,1–33,3%; serta (3) penambahan limbah kertas memberikan keunggulan berupa berat isi yang lebih ringan dan peningkatan kemampuan transmisi cahaya, di mana variasi tertentu menghasilkan nilai lux di atas 350 lux sehingga memenuhi standar pencahayaan alami. Dengan demikian, beton tembus cahaya berbasis limbah kertas dapat digunakan sebagai material dinding non-struktural dekoratif yang mendukung konsep keberlanjutan, efisiensi energi, dan estetika arsitektural.

Kata Kunci: Beton tembus cahaya, limbah kertas, serat optik, kuat tekan, transmisi cahaya, penyerapan air

ABSTRACT

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Title : Experimental Study of Light-Transmitting Concrete Based on Waste

Paper and Optical Fibers

Translucent concrete is an innovative building material that combines the structural strength of conventional concrete with the ability to transmit natural light. This research was motivated by the need for environmentally friendly materials that utilize recycled waste paper and optical fibers to support energy efficiency in buildings. The research problem focuses on how variations of waste paper and optical fibers affect compressive strength, light transmission, and water absorption. The objective of this study is to evaluate the feasibility of translucent concrete incorporating waste paper as an alternative non-structural building material that is both aesthetic and sustainable.

The research was carried out experimentally with concrete cube specimens measuring 150×150×150 mm for compressive strength and light transmission tests, and 50×50×50 mm for water absorption tests. The mixture variations consisted of 0% and 5% recycled waste paper as a partial substitute for fine aggregate, combined with 3% and 4% optical fibers. A total of 24 specimens were tested. The tests included compressive strength using a compression testing machine, light transmission using a lux meter, and water absorption in accordance with SNI.

The results lead to several conclusions: (1) the addition of 5% waste paper reduced compressive strength and light transmission while increasing water absorption, making it less suitable to meet the minimum requirements for non-structural concrete, although the absorption values remained below the SNI limit; (2) different optical fiber compositions influenced performance, with compressive strength ranging from 2.15–6.67 MPa, light transmission from 387–764 lux, and water absorption from 20.1–33.3%; and (3) incorporating waste paper provided advantages such as lighter unit weight and improved light transmission, with some variations achieving values above 350 lux, thereby meeting natural daylighting standards. Therefore, translucent concrete made with recycled waste paper is considered feasible for decorative non-structural walls that support sustainability, energy efficiency, and architectural aesthetics.

Keywords: Translucent concrete, waste paper, optical fiber, compressive strength, light transmittance, water absorption