

ABSTRAK

Ruas Jalan Ranah Sigading – Koto Padang Laweh merupakan akses penting penghubung antar nagari dan pendukung kegiatan ekonomi masyarakat, namun peningkatan volume serta beban kendaraan berat menyebabkan penurunan kualitas struktur jalan eksisting sehingga memerlukan perencanaan ulang menggunakan perkerasan kaku beton bertulang agar lebih aman dan berdaya tahan tinggi. Penelitian ini bertujuan merancang struktur perkerasan yang memenuhi syarat teknis dan umur rencana 20 tahun dengan mengacu pada standar Bina Marga serta analisis mekanistik berbasis teori Westergaard. Data yang digunakan meliputi panjang jalan 4.000 m, lebar 4 m, pertumbuhan lalu lintas 6% per tahun, nilai CBR tanah dasar 6%, dan mutu beton rencana $f'_c = 25$ MPa. Analisis beban dilakukan menggunakan konsep *Equivalent Single Axle Load* (ESAL) untuk menghitung total repetisi beban selama masa layanan. Hasil perhitungan menunjukkan ketebalan pelat beton yang aman dan memenuhi kriteria kekuatan adalah 160 mm dengan tebal pondasi bawah 100 mm. Evaluasi tegangan menghasilkan nilai *Stress Ratio* < 1 , menandakan struktur aman dari retak lentur, sedangkan analisis kelelahan menunjukkan persentase kerusakan sebesar 13,16% yang masih dalam batas aman. Dimensi tulangan, batang pengikat (*tie bar*), dan ruji (*dowel*) juga telah direncanakan sesuai standar teknis. Berdasarkan hasil tersebut, desain perkerasan beton bertulang yang dihasilkan dinyatakan aman secara struktural, memenuhi persyaratan teknis, dan layak diterapkan pada ruas jalan tersebut.

Kata kunci: Perkerasan kaku, CBR, ESAL, tebal pelat.

ABSTRACT

The Ranah Sigading – Koto Padang Laweh road segment serves as a vital access route connecting various villages and supporting local economic activities. However, the increase in traffic volume and heavy vehicle loads has led to deterioration in the performance of the existing road structure, necessitating a redesign using reinforced concrete rigid pavement to ensure improved safety and long-term durability. This study aims to design a pavement structure that meets technical requirements and a 20-year design life, referring to the standards set by Bina Marga (Indonesian Directorate General of Highways) and employing mechanistic analysis based on Westergaard's theory. The design parameters include a road length of 4,000 m, width of 4 m, an annual traffic growth rate of 6%, a subgrade CBR value of 6%, and a specified concrete compressive strength of $f'_c = 25$ MPa. Traffic load analysis was conducted using the Equivalent Single Axle Load (ESAL) concept to calculate the total cumulative load repetitions over the service life. The calculation results indicate that a concrete slab thickness of 160 mm with a 100 mm thick subbase layer is structurally safe and satisfies strength criteria. Stress evaluation yields a Stress Ratio value of less than 1, signifying that the structure is safe against flexural cracking, while fatigue analysis shows a damage percentage of 13.16%, which remains within acceptable safety limits. Dimensions for reinforcement steel, tie bars, and dowel bars were also designed in accordance with technical standards. Based on these results, the proposed reinforced concrete pavement design is deemed structurally safe, compliant with technical specifications, and suitable for implementation on this road segment.

Keywords: Rigid pavement, CBR, ESAL, slab thickness.