ABSTRAK

Judul: Evaluasi Kekuatan Rel Tipe R60 Terhadap Pembebanan Kereta Api Kecepatan Tinggi, Nama: Septa Ade Dermawan, NIM: 41121120108, Dosen Pembimbing: Dr. Ir. Nunung Widyaningsih, Pg.Dipl.Eng. IPM., 2024

Saat ini Indonesia telah memasuki fase baru dalam pembangunan infrastruktur transportasi modern yaitu kereta api kecepatan tinggi yang diprakarsai oleh PT Kereta Cepat Indonesia China. Desain sarana yang dioperasikan yaitu Electrical Multiple Unit (EMU) CR400AF yang dapat melaju hingga kecepatan 350 km/jam. Tentunya dengan kecepatan kereta yang tinggi tersebut diperlukan keandalan prasarana jalan rel kereta api meliputi geometri dan komponen jalan rel.

Spesifikasi teknis jalan rel kereta api kecepatan tinggi telah diatur dalam Peraturan Menteri Perhubungan No. 7 tahun 2022. Jenis rel yang umum digunakan untuk komponen jalur kereta api kecepatan tinggi dengan lebar jalan rel 1435 mm adalah rel tipe R60. Tetapi, penentuan tipe rel kereta api kecepatan tinggi di Indonesia belum dilengkapi dengan analisis kekuatan struktur rel dalam menahan beban yang bekerja di atasnya. Sehingga, penelitian ini membahas pengaruh geometri jalan rel terhadap kecepatan sarana dan evaluasi perhitungan kekuatan struktur rel Tipe R60 dalam menerima beban kereta api kecepatan tinggi. Metode analisis menggunakan metode Beam on Elastic Foundation (BOEF) yang mengasumsikan perilaku rel sebagai balok kontinu yang menerima beban di atas tumpuan pondasi elastis.

Hasil penelitian didapatkan nilai radius realisasi dan radius minimal lengkung horizontal berturut-turut sebesar 9.500 m dan 8.502,94 m lebih besar dari radius ijin lengkung horizontal sebesar 7.000 m sedangkan untuk nilai radius ijin dan radius vertikal lengkung vertikal sebesar 25.000 m. Sehingga optimalisasi pada radius lengkung horizontalnya menjadi 8.502,94 m agar lebih sesuai dengan kemampuan jalur dalam melayani sarana yang melintas serta diharapkan dapat lebih efektif dan efisien dalam perencanaannya. Beban statis dan beban dinamis roda EMU CR400AF sebesar 81.662,50 N dan 243.522,90 N. Tegangan maksimum dan tegangan ijin rel didapatkan sebesar 134,53 N/mm^2 dan 228,57 N/mm^2. Kekuatan rel dituliskan dalam bentuk angka faktor keamanan (SF). Hasil perhitungan menunjukkan bahwa nilai SF terkritis rel dalam menerima beban kereta api kecepatan tinggi adalah sebesar 1,70. Berdasarkan hasil perhitungan BoEF, rel tipe R60 memiliki nilai keamanan yang tinggi dalam menahan beban statis dan beban dinamis kereta api kecepatan tinggi.

Kata Kunci: *EMU CR400AF, geometri, jalan rel, kecepatan tinggi, faktor Keamanan*

ABSTRACT

Title: Strength Evaluation of Type R60 Rail Against High-Speed Railway Loading, Nama: Septa Ade Dermawan, NIM: 41121120108, Advisor: Dr. Ir. Nunung Widyaningsih, Pg.Dipl.Eng. IPM., 2024

Indonesia has now entered a new phase in the development of modern transportation infrastructure, namely the high-speed railway initiated by PT Kereta Cepat Indonesia China. Design of facilities operated is Electrical Multiple Unit (EMU) CR400AF which can travel up to 350 km/h. Of course, with such high train speeds, the reliability of railroad infrastructure including railroad geometry and components is required.

Technical specifications of high-speed railways have been regulated in the Minister of Transportation Regulation No. 7 of 2022. The type of rail commonly used for high-speed railway components with a railroad width of 1435 mm is type R60 rail. However, the determination of the type of high-speed rail in Indonesia has not been completed with an analysis of the strength of rail structure to withstand the loads acting on it. Thus, this research discusses the effect of railroad geometry on the speed train and evaluates the calculation of strength of the Type R60 rail structure in accepting the load of high-speed train. The analysis method uses the Beam on Elastic Foundation (BOEF) method which assumes the behavior of the rail as a continuous beam receiving loads on an elastic foundation.

The research results showed that the realized and minimum horizontal curve radius values were respectively 9,500 m and 8,502.94 m, which were greater than the permitted horizontal curve radius of 7,000 m, while the permitted radius and vertical radius values for vertical curves were 25,000 m. So that the horizontal curve radius is optimized to 8,502.94 m to be more in line with the line's ability to serve passing facilities and is expected to be more effective and efficient in planning. The static load and dynamic load of the EMU CR400AF wheels are 81,662.50 N and 243,522.90 N. The maximum stress and allowable rail stress are found to be 134.53 N/mm^2 and 228.57 N/mm^2. Rail strength is written in the form of a safety factor (SF). The rail strength results are written in the form of safety factor (SF) numbers. The calculation results show that the critical SF value of the rail in accepting high-speed train load is 1,70 Based on the BoEF calculation results, the R60 type rail has a high safety value in resisting static load and dynamic load of the high-speed train.

Keyword: *EMU CR400AF, geometry, railroad, highspeed, safety factor*