PERFORMANCE ANALYSIS OF REDESIGNED STEEL GIRDER STRUCTURE FROM PCI GIRDER ON THE RENGAT PEKANBARU HIGHWAY PROJECT PEKANBARU RING ROAD SECTION USING SAP2000.

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ABSTRACT

The 30.57 km Rengat–Pekanbaru Toll Road Section of the Pekanbaru Ring Road is part of the Trans-Sumatra Toll Road which mostly crosses peatlands, thus requiring a lightweight bridge structure to reduce the load on the substructure. This study aims to analyze the performance of the bridge structure through redesigning the girder from PCI Girder (Prestressed Concrete I-Girder) to a composite steel plate girder using SAP2000. The research object is a single span bridge with a length of 40.80 m with 11 girders spaced 1.10 m apart. The redesign produces a BJ 50 grade steel cross-section (fy = 345 MPa) using a WB profile of 2000 × 400 × 32 × 28 which works compositely with a 250 mm thick K-350 grade concrete floor slab. The analysis was conducted using SAP2000 version 26 with frame and shell elements based on SNI 1725:2016, SNI 2833:2016, SNI 1729:2020, and AASHTO LRFD Bridge Design Specifications as a comparative reference. The structural performance was evaluated based on internal forces, stress, deflection, shear capacity, and structural weight. The analysis results for the Strength I loading combination showed an ultimate moment of 3894,69 kNm and an ultimate shear force of 658,83 kN. The ratios of steel flexural stress, concrete compressive stress, and shear capacity were 0.521, 0.772, and 0.090, respectively, thus meeting the strength requirements. The live load deflection of 43.43 mm was very close to the L/800 allowable limit (51.00 mm), while the girder self-weight was reduced by approximately 71% compared to the PCI Girder. The results of the study indicate that steel girders are suitable for use as an alternative to PCI Girders because they are able to meet strength requirements and provide significant structural weight reduction.

Keywords: *Bridge, PCI Girder, SAP2000, Steel Girder, Structural Performance, Structural Redesign.*