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Durasi Penyimpanan Maksimum PCI Girder Berdasarkan Batas Toleransi Camber dan Metode Pelaksanaan Erection PCI Girder Pada Proyek Tol Solo-Yogyakarta-NYIA Kulon Progo Seksi II Paket 2.2B
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

ABSTRAK

Pembangunan Jalan Tol Solo-Yogyarkarta-NYIA Seksi II Paket 2.2B menggunakan *PCI girder* 45,8 m yang berpotensi mengalami peningkatan deformasi akibat adendum proyek 1.150 hari. Penyimpanan *girder* di *stockyard* rentan terhadap rangkak dan susut yang dapat melampaui toleransi standar BS EN 15050:2007+A1:2012. Penelitian ini bertujuan menganalisis pola perubahan geometri vertikal dan horizontal (*sweep*) harian serta menetapkan durasi penyimpanan maksimum yang aman di lapangan, serta menganalisis metode pelaksanaan *erection PCI girder* dan merumuskan prosedur control geometri *pre-erection*.

Penelitian menggunakan 6 sampel komponen *PCI girder* dengan Nomor Produksi 365, 369, 370, 371, dan 373 pada bentang *Pier* 55 hingga *Pier* 56. Data primer berupa hasil pengukuran harian terhadap lengkungan vertikal dan kelurusan horizontal dari pasca-*stressing* hingga hari ke-51 menggunakan meteran pita baja, penggaris, paku beton dan benang bangunan. Data dianalisis secara deskriptif menggunakan nilai rata-rata kelompok harian, lalu dimodelkan secara matematis melalui regresi non-linear dengan metode kuadrat terkecil untuk mengekstrapolasi batas durasi penyimpanan.

Hasil evaluasi menunjukkan bahwa perhitungan teoretis berhasil memvalidasi nilai lengkungan rencana awal (Y_0) sebesar -80,592 mm. Pada hari ke-51 masa simpan, rata-rata lengkungan vertikal mencapai 99 mm dan horizontal 21 mm. Analisis regresi logaritmik vertikal menghasilkan koefisien determinasi (R^2) sebesar 0,7715, yang membuktikan laju pertumbuhan deformasi cenderung agresif di awal umur beton lalu melandai seiring waktu. Kesimpulannya, hingga hari ke-51 *girder* masih aman. Ekstrapolasi model regresi eksponensial *Camber* vertikal menetapkan batas durasi penyimpanan maksimum yang aman di *stockyard* adalah selama 152,51 hari (atau ± 5 bulan) sebelum menyentuh batas kritis 136,8 mm. Selain itu, dirumuskan prosedur kontrol geometri *pre-erection* dan tahapan metode *erection* menggunakan *crawler crane* guna menjamin keamanan pengangkatan serta presisi pemasangan *girder.*

Kata Kunci: *PCI Girder, Camber,* Regresi Eksponensial, Durasi Penyimpanan.

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ABSTRACT

The construction of the Solo-Yogyakarta-NYIA Toll Road Section II Package 2.2B utilizes 45.8 m PCI girder, which potentially experience deformation due to a 1.150-day project addendum. Girder storage in the stockyard is susceptible to creep and shrinkage, which may exceed the tolerance limits specified by the BS EN 15050:2007+A1:2012 standard. This study aims to analyze the daily patterns of vertical geometry (camber) and horizontal geometry (sweep) changes,determine the maximum safe storage duration in the field, as well as analyze the PCI girder erection method and formulate pre-erection geometry control procedures.

The research utilized six samples of PCI girder components with Production Numbers 365, 369, 370, 371, 372, and 373 within the span from Pier 55 to Pier 56. Primary data consisted of daily measurements of vertical camber and horizontal alignment from post-stressing up to the 51st day, collected using steel tape measure, a ruler, concrete nails, and building twine. The data were descriptively analyzed using daily group averages and the mathematically modeled through non-linier regression using the least-squares method to extrapolate the storage duration limits.

The evaluation results show that theoretical calculations successfully validated the initial design camber value (Y_0) of -80.592 mm. On the 51st day of storage, the average vertical camber reached 99 mm and the horizontal sweep reached 21 mm. The vertical logarithmic regression analysis yielded a coefficient of determination (R^2) of 0.7715, proving that the deformation growth rate tends to be aggressive in the early stages of concrete age and subsequently flattens over time. In conclusion, the girders remain safe up to the 51st day. Extrapolation of the exponential regression model for vertical camber established that the maximum safe storage duration in the stockyard is 152.51 days (approximately ± 5 months) before reaching the critical limit of 136.8 mm. Furthermore, pre-erection geometry control procedures and crawler crane erection stages were established to ensure lifting safety and installation precision.

Keywords: PCI Girder, Camber, Exponential Regression, Storage Duration.