

## INTISARI

Dalam pekerjaan *erection girder* parameter keselamatan pekerjaan menjadi perhatian utama sehingga setiap langkah pekerjaan perlu dilakukan kajian dan analisis secara menyeluruh. Pekerjaan *erection Steel Box Arch (SB Arch) girder* Ahmad Yani terbagi ke dalam tiga fase dimulai dari *erection girder* fase 1, fase 3, dan diakhiri oleh fase 2. Pelaksanaan *erection girder* fase 3 mengalami penundaan selama 10 bulan sehingga *girder* fase 1 yang telah terereksi sebelumnya mengalami pergeseran ke arah *backwall* karena faktor kemiringan *girder* dan gravitasi bumi. Untuk mengembalikan posisi *girder* fase 1 ke posisi semula dilakukan pekerjaan *adjust* untuk setiap *girder* menggunakan *hydraulic jack* kapasitas 50 ton. Analisis perilaku *girder SB Arch* akibat *jacking* dilakukan untuk memastikan keselamatan *girder* akibat gaya *jacking* yang sifatnya terpusat. Pekerjaan *erection girder* dilakukan dengan menggunakan *single crane* kapasitas 800 ton sehingga diperlukan landasan *crane* untuk menjaga stabilitas *crane* saat beroperasi. Selain itu, untuk memastikan keselamatan pekerjaan *adjust girder* fase 1 serta *erection girder* fase 2 dilakukan identifikasi bahaya, penilaian risiko, dan bentuk pengendalian risiko pekerjaan yang disusun dalam tabel *Hazard Identification Risk Assesment and Determining Control (HIRADC)*.

*SB Arch girder* memiliki bentuk penampang *anisotropic* sehingga diperlukan *software* berbasis metode elemen hingga untuk melakukan analisis perilaku *girder* akibat proses *jacking*. *Software* yang digunakan untuk proses *modeling* dan analisis adalah *Solidworks*. Analisis perilaku *girder* dilakukan pada sampel uji berupa *girder* dengan berat sendiri maksimum. Penentuan dimensi landasan *crane* dilakukan dengan analisis kuat dukung tanah serta analisis penurunan segera. Analisis tersebut dilakukan berdasarkan data hasil uji beban pelat di lapangan. Penyusunan bentuk pengendalian risiko pekerjaan dalam tabel *HIRADC* dilakukan berdasarkan hasil pengamatan di lapangan dan mengacu pada Permen PUPR Nomor 10 Tahun 2021.

Berdasarkan hasil analisis menggunakan *software Solidworks*, didapatkan nilai *Von Misses stress* maksimum sebesar 84,447 MPa yang terletak pada bagian *crossbeam* dengan nilai *safety factor* sebesar 2,309. Dengan nilai *safety factor* minimum sebesar 1,51 yang diambil dari kondisi batas elastis material baja sebesar 0,66 dari nilai tegangan lelehnya maka perilaku *girder* sepenuhnya masih berada dalam batas elastis. Berdasarkan hasil analisis kuat dukung tanah dan nilai penurunan segera digunakan landasan *crane* ukuran 6x18 meter dengan nilai SF sebesar 12,251 dan penurunan maksimum yang terjadi sebesar 0,392 mm serta batas penurunan izin sebesar 1,138 mm pada titik *PBT 5*. Selain itu, berdasarkan tabel *HIRADC*, risiko akhir dari setiap item pekerjaan berada pada kategori *low risk* sehingga pekerjaan *adjust girder* fase 1 dan *erection girder* fase 2 telah memenuhi standar keselamatan kerja.

Kata kunci: *Steel Box Arch girder*, *Von Misses stress*, faktor keamanan, landasan *crane*, uji beban pelat, *HIRADC*

## ABSTRACT

*In girder erection work, safety parameters are the main concern so that every step of the work needs to be thoroughly studied and analyzed. The Ahmad Yani Steel Box Arch (SB Arch) girder erection work is divided into three phases starting from phase 1 girder erection, phase 3, and phase 2. The erection of phase 3 girder postponed for over 10 months so that the phase 1 girder that had been erected previously experienced a slide towards the backwall due to the earth's gravity and the girder's orientation. To return the phase 1 girder to its original position, girder adjust was carried out for each girder using a hydraulic jack with a capacity of 50 tons. Analysis of the SB Arch girder performance due to jacking was carried out to ensure girder safety due to the jacking force. Girder erection work is carried out using a single crane with a capacity of 800 tons so that a crane pad is needed to maintain its stability. In addition, to ensure the girder adjust phase 1 and erection girder phase 2 safety, hazard identification, risk assessment, and risk control forms are composed in the Hazard Identification Risk Assessment and Determining Control (HIRADC) table.*

*SB Arch girder has anisotropic section properties so that finite element method-based software to analyze girder behavior due to the jacking process is needed. Solidworks is used for modeling and analysis process with a maximum self-weight girder is being used as a sample in the analysis of girder behavior. The design of the crane pad is performed by analyzing the ground bearing capacity and the immediate settlement of the soil. The analysis was carried out based on the plate bearing test data. The formulation of HIRADC table is performed based on the author's observations and refers to Permen PUPR Nomor 10 of 2021.*

*Based on the analysis results using Solidworks, the maximum Von Misses stress value of 84.447 MPa which is located in the crossbeam section and thus a safety factor value of 2.309 is obtained. With a minimum safety factor value of 1.409 taken from the elastic limit condition of steel material by 0.66 of its yield stress value, the girder behavior is still within the elastic limit. Based on the analysis results of the bearing capacity of the soil and the immediate settlement, a crane pad with a size of 6x18 meters is used with a safety factor of 12.251 and maximum settlement of 0,392 mm with allowable settlement of 1.138 mm. Based on the HIRADC, the final risk for each work items are on the low risks category so that the adjust girder phase 1 and erection girder phase 2 satisfy work safety standards.*

*Key words: Steel Box Arch girder, Von Misses stress, safety factor, crane pad, plate bearing test, HIRADC*