ABSTRAK

Program elektrifikasi *Ship-to-Shore* (STS) *Crane* di Pelabuhan Belawan menghadapi kendala karena dermaga lama belum dirancang untuk mengakomodasi distribusi kabel berdaya besar, sementara pembangunan *cable trench* konvensional berisiko mengganggu struktur eksisting. Penelitian ini bertujuan merancang *Trench Cable Guard* (TCG) berbahan *High-Density Polyethylene* (HDPE) dengan konsep *surface-mounted* menggunakan Pendekatan *Blow Mold Design* (*Design for Blow Molding*/DfBM), serta mengevaluasi performa strukturalnya melalui simulasi *Finite Element Analysis* (FEA). Metodologi penelitian meliputi penetapan spesifikasi desain, penerapan prinsip DfBM pada ketebalan dinding, sudut *draft*, radius sudut dalam, posisi *parting line*, dan fitur *locking* modular, analisis kekuatan mekanik secara analitis, serta simulasi FEA menggunakan SolidWorks Simulation dengan material HDPE ber-*UV stabilizer*. Hasil penelitian menunjukkan TCG berdimensi 1000 × 900 × 125 mm dengan ketebalan dinding seragam 4 mm dan enam alur kabel berhasil dirancang. Hasil FEA menunjukkan tegangan von Mises maksimum 8,71 MPa, lebih rendah dari tegangan luluh HDPE 24 MPa, *displacement* maksimum 0,776 mm, dan *Factor of Safety* minimum 2,76 yang memenuhi target minimum 2,5. Enam dari tujuh parameter DfBM terpenuhi pada model CAD final. Berdasarkan hasil tersebut, Pendekatan *Blow Mold Design* dapat diterapkan sebagai landasan perancangan TCG yang memenuhi kriteria struktural dan sebagian besar parameter DfBM serta berpotensi dikembangkan lebih lanjut melalui proses *blow molding* untuk mendukung proteksi kabel pada elektrifikasi STS *Crane* di dermaga lama.

Kata Kunci : *Design for Blow Molding*; *Finite Element Analysis*; *Trench Cable Guard*

ABSTRACT

The electrification program for *Ship-to-Shore* (STS) cranes at Belawan Port faces infrastructure constraints because the existing older wharf was not designed to accommodate high-capacity power cable distribution, while the construction of conventional *cable trenches* may interfere with the existing structure. This study aims to design a surface-mounted *Trench Cable Guard* (TCG) made of *High-Density Polyethylene* (HDPE) using the *Blow Mold Design* approach (*Design for Blow Molding*/DfBM), and to evaluate its structural performance through *Finite Element Analysis* (FEA) simulation. The research methodology includes establishing design specifications, applying DfBM principles to wall thickness, draft angle, inner corner radius, parting line position, and modular locking features, conducting analytical mechanical strength analysis, and performing FEA simulation using SolidWorks Simulation with UV-stabilized HDPE material. The results show that a TCG measuring 1000 × 900 × 125 mm, with a uniform wall thickness of 4 mm and six cable grooves, was successfully designed. The FEA results show a maximum von Mises stress of 8.71 MPa, lower than the HDPE yield strength of 24 MPa, a maximum displacement of 0.776 mm, and a minimum *Factor of Safety* of 2.76, which meets the minimum target of 2.5. Six of the seven DfBM parameters were fulfilled in the final CAD model. Based on these results, the *Blow Mold Design* approach can be applied as a design basis for a TCG that meets the structural criteria and most DfBM parameters, with further development potential through the *blow molding* process to support cable protection for STS crane electrification on older wharves.

Keywords: Design for Blow Molding; Finite Element Analysis; Trench Cable Guard