ABSTRAK

Beton bertulang banyak digunakan pada berbagai struktur namun sering mengalami penurunan kekuatan selama masa layan, sehingga diperlukan upaya perkuatan. Salah satu metode yang menjanjikan adalah *Near Surface Mounted* (NSM), yang memberikan efisiensi perkuatan tinggi, tahan terhadap *debonding* dini, serta meningkatkan durabilitas tanpa penambahan beban mati. Penelitian ini mengkaji pengaruh variasi kuat tekan beton dan strategi perkuatan NSM terhadap kinerja lentur balok beton bertulang dengan analisis elemen hingga menggunakan perangkat lunak ATENA. Sebanyak 11 balok dimodelkan, meliputi balok kontrol, balok dengan perkuatan pelat baja bawah selebar 20 mm dan 40 mm, serta balok dengan perkuatan samping NSM, masing-masing dengan kuat tekan 17,5 MPa dan 50 MPa. Hasil menunjukkan bahwa peningkatan kuat tekan beton meningkatkan kapasitas lentur, kekakuan, dan energi serap, namun menurunkan daktilitas. Balok dengan perkuatan pelat baja bawah (BP2L, BP4L) menunjukkan peningkatan kapasitas dan daktilitas, sedangkan strategi perkuatan samping NSM (BPS2L, BPS4L) tidak secara signifikan meningkatkan kapasitas lentur, tetapi efektif dalam meningkatkan daktilitas dan energi serap. Mekanisme keruntuhan yang teridentifikasi meliputi keruntuhan lentur, tarik diagonal, dan tekan geser, dengan pola retak khas sesuai jenis kegagalan. Secara keseluruhan, mutu beton tinggi berpengaruh utama terhadap kapasitas lentur dan kekakuan, sedangkan perkuatan NSM samping lebih dominan dalam meningkatkan daktilitas dan energi serap.

Kata kunci: Perkuatan balok beton bertulang , *Near Surface Mounted* (NSM), Studi Parametrik, Perilaku lentur balok, Pelat baja.

ABSTRACT

Reinforced concrete is widely used in various structures but often experiences strength degradation under service conditions, making strengthening interventions necessary. One promising method is the Near Surface Mounted (NSM) technique, which provides high reinforcement efficiency, resistance to premature debonding, and improved durability without additional dead loads. This study investigates the effect of concrete compressive strength and NSM strengthening strategies on the flexural performance of reinforced concrete beams using finite element analysis with ATENA software. A total of 11 beam specimens were modeled, including control beams, beams strengthened with bottom-mounted steel plates of 20 mm and 40 mm, and beams with side-mounted NSM reinforcement, each with compressive strengths of 17.5 MPa and 50 MPa. The results indicate that increasing concrete compressive strength improves flexural capacity, stiffness, and energy absorption but reduces ductility. Strengthened beams with bottom-mounted plates (BP2L, BP4L) exhibited improvements in both strength and ductility, while side-mounted NSM strengthening (BPS2L, BPS4L) did not significantly enhance flexural capacity but effectively increased ductility and energy absorption. Failure mechanisms were identified as flexural, diagonal tension, and shear compression, consistent with characteristic crack patterns. Overall, higher concrete strength primarily enhanced flexural capacity and stiffness, whereas side NSM strengthening contributed more to ductility and energy absorption.

Keyword: *Strengthening of reinforced concrete beams, Near Surface Mounted* (NSM)*, Parametric study, Flexural behavior of beams, Steel plate.*