ABSTRAK

VALIDASI EKSPERIMENTAL LABORATORIUM PERILAKU LENTUR STRUKTUR BALOK BETON *SANDWICH* TERHADAP PENGARUH TEMPERATUR TINGGI

Penelitian ini bertujuan menganalisis perilaku lentur balok beton *Sandwich* terhadap pengaruh temperatur tinggi melalui pemodelan numerik menggunakan perangkat lunak ANSYS, yang disesuaikan denan hasil uji eksperimental laboratorium. Parameter yang dianalisis meliputi kapasitas beban, distribusi tegangan berdasarkan kriteria *von mises*, dan *deflection* balok pada berbagai kondisi suhu. Pemodelan dilakukan dengan metode elemen hingga *(finite element method)* dalam bentuk tiga dimensi yang disesuaikan dengan spesimen uji di laboratorium. Variasi model terdiri atas balok beton normal dan balok beton *Sandwich* dengan dimensi balok 200×300×4000 mm serta kolom 300×300×1000 mm. Pemodelan dibagi menjadi elemen berukuran 20×20×50 mm. Mutu beton untuk balok normal adalah 25 MPa, sedangkan beton *sandwich* 15 MPa, dengan selimut beton 20 mm. Tulangan baja sesuai pengujian laboratorium terdiri dari tulangan tarik 3Ø12 mm, tulangan tekan 2Ø12 mm, dan kekuatan leleh *(yield strength)* baja 300 MPa. Beban diletakkan pada dua titik masing-masing di 1/3 bentang balok, sesuai referensi penelitian terdahulu. Hasil simulasi menunjukkan bahwa kapasitas beban balok beton normal pada suhu 20°C, 100°C, 200°C, 400°C, 500ºC, 600°C, 700ºC dan 800°C berturut-turut adalah 15,419 KN; 15,010 KN; 13,657 KN; 11,153 KN; 8,300 KN; 7,381 KN; 6,541 KN dan 6,074 KN. Sementara itu, kapasitas beban balok beton *Sandwich* pada suhu yang sama berturut-turut adalah 14,804 KN; 14,591 KN; 13,442 KN; 11,877 KN; 10,079 KN; 8,710 KN, 8,665 KN dan 7,750 KN. Analisis memperlihatkan bahwa balok beton *Sandwich* memiliki performa yang relatif lebih stabil dibandingkan balok beton normal dalam mempertahankan kapasitas beban pada variasi temperatur tinggi.

Kata Kunci: balok beton, suhu tinggi, tegangan, kapasitas beban

ABSTRACT

EXPERIMENTAL LABORATORY VALIDATION OF FLEXURAL BEHAVIOR OF *SANDWICH* CONCRETE BEAMS UNDER HIGH TEMPERATURE EXPOSURE

This study objective to analyze the flexural behavior of *sandwich* concrete beams under elevated temperature exposure through numerical modeling using *ANSYS* software, validated by experimental laboratory tests. The investigated parameters include load-carrying capacity, stress distribution based on the *von Mises* criterion, and beam *deflection* under various temperature conditions. The modeling employed the finite element method (FEM) in a three-dimensional configuration consistent with laboratory test specimens. Two beam types were modeled: normal concrete beams and *sandwich* concrete beams, with dimensions of 200×300×4000 mm, and columns measuring 300×300×1000 mm. The model was discretized into elements measuring 20×20×50 mm. The concrete compressive strength was 25 MPa for the normal beams and 15 MPa for the *sandwich* beams, with a concrete cover of 20 mm. Reinforcement detailing followed the laboratory specimens, consisting of 3Ø12 mm tensile reinforcement, 2Ø12 mm compressive reinforcement, and steel yield strength of 300 MPa. The loading configuration adopted two-point loading positioned at one-third of the beam span, based on previous research. The simulation results showed that the load-carrying capacity of normal concrete beams at 20°C, 100°C, 200°C, 400°C, 500ºC, 600°C, 700ºC and 800°C was 15.600 KN, 15.361 KN, 14.052 KN, 13.842 KN, 10.625 KN, 7.381 KN, and 6.074 KN, respectively. Meanwhile, the *sandwich* concrete beams achieved load capacities of 14,804 KN; 14,591 KN; 13,442 KN; 11,877 KN; 10,079 KN; 8,710 KN, 8,665 KN and 7,750 KN at the same temperature levels. The analysis indicates that *sandwich* concrete beams exhibit relatively more stable performance in maintaining load capacity compared to normal concrete beams when subjected to elevated temperature variations.

Keywords: concrete beam, high temperature, stress, load-carrying capacity