ABSTRACT

Collapse of building resulting from blast load often causes injuries and fatalities since fragments were flung very fast because of the blast. One part which is particularly susceptible to fragmentation is the wall, so it must be strengthened in order to withstand the blast. To strengthen it, which was undertaken through this research, is by adding rattan and bamboo as its reinforcement.

Specimen being used in this experiment was a concrete slab with a size of 100 cm x 40 cm x 8 cm. The components of specimen were concrete slab without reinforcement (T_T), bamboo-reinforced concrete slab with 20 cm (T_{B1}), 15 cm (T_{B2}), 10 cm (T_{B3}) of spacing, rattan-reinforced concrete slab with 20 cm (T_{R1}), 15 cm (T_{R2}), 10 cm (T_{R3}) of spacing, bamboo with an average of 8.6 mm width and 8.4 mm thickness, and also rattan with an average of 9.6 mm diameters. All slab specimens were given nomenclature and divided into 40 plots measuring 10 cm x 10 cm for each. The all specimens were tested based on the resistance level of blast by gluing TNT weighing 0.5 kg in the middle of slab specimen. The next is analyzing the failure mechanism of the slab to blast.

Based on the results of this research, the all specimen were shattered in the middle in the first few miliseconds of the response due directly to shock load pressure. According to the analysis, the punching shear capacity of all the slab specimens is 33.179 kN, deeply under the shear force due to 68558.4 kN of blast, so that all the slab specimens were shattered in the middle. While the flexural strength of slab specimens T_T, T_{B1}, T_{B2}, T_{B3}, T_{R1}, T_{R2}, T_{R3} were 21.72 kN; 32.22 kN; 42.49 kN; 7.86 kN; 11.74 kN; 15.59 kN respectively, the all slab specimens had a flexural strength capacity under flexural strength load caused by the TNT blast which amounted to 137,116.8 kN. Thus, it made the slabs crack or split on the support area. The all slabs on the upper side were split, whereas on the lower side only TR1 and TT were split into several parts. The results of this experiment showed that the concrete slab T_T, T_{B1}, T_{B2}, T_{B3}, T_{R1},T_{R2}, T_{R3} respectively left 19, 24, 26, 27, 22, 24, 26 plots. The reinforcement by using bamboo-reinforced concrete and rattan-reinforced concrete could reduce the fragmentation that occurred on the concrete slab. Bamboo-reinforced concrete slab could prevent fragmentation more effectively than rattan-reinforced concrete slab. However, due to 19 044 MPa strength of the blast, all the concrete slab specimens with both bamboo-reinforced and rattan-reinforced were shattered in the middle of the slabs.

Key words: Slab, Bamboo Reinforcement, Rattan Reinforcement, Blast Resistance

INTISARI

Keruntuhan bangunan akibat adanya beban ledakan sering kali menimbulkan korban luka dan korban jiwa karena fragmen yang terlempar sangat cepat akibat ledakan. Salah satu bagian rentan terjadi fragmentasi adalah dinding, sehingga harus diperkuat agar tahan terhadap ledakan. Upaya perkuatan yang dilakukan melalui penelitian ini adalah dengan menambahkan rotan dan bambu sebagai tulangan dinding.

Benda uji yang digunakan berupa pelat beton dengan ukuran 100 cm x 40 cm x 8 cm. Benda uji yang dibuat meliputi pelat beton tanpa tulangan (T_T), Pelat beton bertulang tulangan bambu dengan jarak antar tulangan 20 cm (T_{B1}), 15 cm (T_{B2}), 10 cm (T_{B3}), Pelat beton bertulang tulangan rotan dengan jarak antar tulangan 20 cm (T_{R1}), 15 cm (T_{R2}), 10 cm (T_{R3}), dengan lebar rata-rata bambu 8,6 mm dan tebal rata-rata bambu 8,4 mm serta diameter rata-rata rotan 9,6 mm. Seluruh benda uji diberikan nomenklatur dan dibagi menjadi 40 petak, masing-masing berukuran 10 cm x 10 cm. Seluruh benda uji di uji tingkat ketahanan terhadap ledakan dengan menempelkan TNT seberat 0,5 kg pada tengah pelat uji. Selanjutnya dilakukan analisis terhadap pola kerusakan yang terjadi.

Berdasarkan hasil pengujian seluruh benda uji hancur pada sisi tengah, hal ini diakibatkan daerah tersebut mengalami geser pons pada beberapa mili detik pertama peledakan. Menurut analisis yang dilakukan, kapasitas geser pons semua pelat uji adalah 33,179 kN, jauh di bawah gaya geser akibat ledakan sebesar 68.558,4 kN, sehingga semua pelat uji hancur pada bagian tengahnya. Sedangkan kapasitas lentur pelat uji T_T, T_{B1}, T_{B2}, T_{B3}, T_{R1}, T_{R2}, T_{R3} berturut-turut adalah 21,72 kN; 32,22 kN; 42,49 kN; 7,86 kN; 11,74 kN; 15,59 kN, seluruh pelat uji memiliki kapasitas lentur di bawah beban lentur yang diakibatkan ledakan TNT yaitu sebesar 137.116,8 kN, sehingga mengakibatkan pelat uji mengalami retak atau terbelah pada daerah tumpuan. Seluruh benda uji pada sisi atas terbelah, sedangkan pada sisi bawah hanya T_{R1} dan T_T yang terbelah menjadi beberapa bagian. Hasil pengujian menunjukkan bahwa pelat beton T_T, T_{B1}, T_{B2}, T_{B3}, T_{R1}, T_{R2}, T_{R3} berturut-turut menyisakan 19, 24, 26, 27, 22, 24, 26 petak. Perkuatan dengan tulangan bambu dan rotan dapat mengurangi fragmentasi yang terjadi pada pelat uji. Pelat dengan perkuatan bambu dapat mencegah fragmentasi lebih efektif dibandingkan pelat dengan perkuatan rotan. Namun karena kekuatan ledakan sebesar 19.044 MPa sehingga semua pelat beton uji baik dengan tulangan bambu maupun tulangan rotan hancur pada sisi tengah pelat.

Kata kunci : Pelat, tulangan bambu, tulangan rotan, ketahanan ledakan.