UNIVERSITI PUTRA MALAYSIA

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By

NABILA BINTI ROSSLEY

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science.

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Chair: Farah Nora Aznieta Abdul Aziz, PhD
Faculty: Engineering

Connection design is one of the most important considerations for the successful construction of precast reinforced concrete structures. There are two types of connections known as loop steel bar is used as vertical connection, to connect wall to wall and exterior-interior wall and the horizontal connection refers to grouted splice sleeve connection which is used to connect top and bottom wall and tested on wall-slab-wall specimens.

12 specimens were prepared which consisted of three wall to wall specimens, three exterior-interior wall specimens and six exterior wall-slab specimens. To study the vertical connection, the wall to wall connection specimens (WWC) were subjected to in plane shear load, whilst the exterior-interior wall connection specimens (EIWC) were subjected to out of plane shear load. On the other hand, the horizontal connection is by the wall-slab-wall connection specimens (WSW) when subjected to lateral load. The aim of this research is to determine the behaviour of these two connections.

WWC specimens have shown that the loop connection that is used to connect adjacent walls was considered as brittle. The connection tends to collapse abruptly when it was overloaded. Although it is brittle, the test results have proven that the loop connection is able to give crack lines at the interface before failure occurred. The maximum shear stress attained for loop steel bar connection for these specimens were higher than the maximum design shear stress allowed. Hence for this size of specimens, the size of the loop bar connection should be reduced.

The strut and tie model of the loop joint was used to model flow of forces in the vertical connection through EIWC specimens. The crack showed a zigzag pattern and it was developed as the force from one precast element to the other was transmitted by inclined compressive struts between overlapping loop bar. The average ductility factor of EIWC specimens was 2.43, which was below the range of

requirement for seismic ductility normally between 3 and 6. Therefore, this connection could be categorise as a brittle connection.

The horizontal connection known as grouted splice sleeve connection was used to connect WSW specimens. The specimens were subjected to out plane loading to represent possibility of wind load on the wall. The maximum moment obtained is larger than the required moment for 8 stories building. From the lab test, it shows that this connection only able to transfer compression between the upper and lower walls whilst the connection bar was only suitable for positioning.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

KELAKUAN STRUKTUR SAMBUNGAN KERANGKA KONKRIT DINDING PRATUANG DI BAWAH BEBAN SATAH RICIH

Oleh

NABILA BINTI ROSSLEY

April 2014

Pengerusi: Farah Nora Aznieta Abdul Aziz, PhD
Fakulti: Kejuteraan

Reka bentuk sambungan adalah salah satu pertimbangan yang paling penting bagi pembinaan struktur konkrit pratuang bertetulang. Terdapat dua jenis sambungan dikenali bar keluli gelung digunakan sebagai sambungan menegak untuk menyamabung dinding ke dinding dan dinding luaran-dalaman dan sambungan melintang digunakan untuk menyambung dinding atas dan bawah dan diuji ke atas spesimen dinding-papak-dinding.

12 spesimen disediakan yang terdiri daripada tiga dinding untuk spesimen dinding, tiga spesimen dinding luar-dalaman dan enam nombor luaran spesimen dinding papak. Untuk mengkaji sambungan menegak, dinding untuk spesimen (WWC) dinding dikenakan beban satah ricih, manakala spesimen dinding luar-dalaman (EIWC) dikenakan beban ricih luar dari satah. Sebaliknya, sambungan mendatar adalah dengan spesimen dinding papak dinding (WSW) apabila dikenakan beban sisi. Tujuan kajian ini adalah untuk menentukan tingkah laku kedua-dua sambungan.

Spesimen WWC telah menunjukkan bahawa sambungan gelung yang digunakan untuk menyambung dinding bersebelahan dianggap sebagai rapuh. Sambungan cenderung untuk runtuh tiba-tiba apabila ia melebihi bebant tertentu. Walaupun ia adalah rapuh, keputusan ujian telah membuktikan bahawa sambungan gelung mampu memberikan garisan retak pada antara muka sebelum kegagalan berlaku. Tegasan ricih maksimum yang dicapai untuk sambungan bar keluli gelung untuk spesimen ini adalah lebih tinggi daripada tekanan reka bentuk ricih maksimum yang dibenarkan. Oleh itu untuk saiz ini spesimen, saiz sambungan bar gelung boleh dikurangkan bagi mencapai tegasan ricih di dalam had.

Tupang dan model ikat sendi gelung itu digunakan untuk memodelkan aliran kuasa-kuasa di sambungan menegak melalui spesimen EIWC. Retak menunjukkan corak zigzag dan ia telah terhasil apabila daya dari dipindahkan dari satu elemen pratuang kepada yang lain melalui cenderung topang mampatan antara bar gelung yang bertindih.. Purata faktor kemuluran spesimen EIWC adalah 2.43, iaitu dibawah lingkungan keperluan untuk kemuluran diterima struktur, biasanya antara 3 dan 6.

Sambungan mendatar dikenali sebagai sambungan lengan sambat diturap telah digunakan untuk menyambung spesimen WSW. Spesimen ini dikenakan beban melintang iaitu mewakili beban angin yang bertindak ke atas dinding. Kapasiti maksimum yang didpati adalah lebih besar daripada kapasiti yang diperlukan untuk bagi 8 tingkat bangunan. Daripada ujian makmal, ia menunjukkan bahawa lengan sambat diturap dengan paip licin adalah dicadangkan hanya untuk memindahkan mampatan antara dinding atas dan bawah manakala bar menonjol itu hanya sesuai untuk kedudukan.

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I certify that a Thesis Examination Committee has met on 10 April 2014 to conduct the final examination of Nabila binti Rossley on her thesis entitled "Structural Behaviour of Precast Concrete Wall Frame Connections Under Shear Load" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Date: 23 June 2014

DECLARATION

Declaration By Graduate Student

I hereby confirm that:

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DECLARATION

This is to confirm that:

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