



**BEHAVIOUR AND DESIGN OF PRECAST COLUMN-BASE
POCKET CONNECTIONS WITH ROUGH SURFACE INTERFACE
FOR RC BRIDGES**

by

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سلوك وتصميم وصلات الجيب ذات الأسطح البينية الخشنة بين الأعمدة سابقة الصب والقواعد فى الكبارى الخرسانية المسلحة

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ملخص الرسالة

يتم تنفيذ الكبارى الخرسانية فى المعتاد عن طريق الخرسانة المصبوبة فى الموقع وعلى الرغم من المميزات الواضحة لهذه الطريقة (مثل سهولة النقل و سهولة تنفيذ الوصلات المستمرة) إلا أن لها عيوب أساسية مثل زيادة زمن التنفيذ وإشغال الموقع وزيادة متطلبات العمالة مما يؤدى لإعاقة الحركة المرورية وزيادة تكاليف الإنشاء. يعتبر استخدام الخرسانة سابقة الصب لتنفيذ عناصر الكوبرى أحد أهم البدائل لتلافي العيوب الناشئة عن الخرسانة المصبوبة فى الموقع بتقليل زمن التنفيذ والحد من الإعاقات المرورية.

تعتبر الوصلات بين العناصر الخرسانية سابقة الصب من أهم العوامل المؤثرة على مقاومة المنشأ لصعوبة الحصول على نفس جودة تصنيع العناصر أثناء تنفيذ الوصلات بين العناصر سابقة الصب فى الموقع.

فى هذا البحث، تم عمل دراسة معملية و نظرية لتقييم ثلاثة أنواع من وصلات الجيب ذات الأسطح البينية الخشنة بين الأعمدة سابقة الصب والقواعد يتم انتقال الحمل من خلالها عن طريق الارتكاز وقوى الاحتكاك بدون الحاجة لعمل وصلات لحديد التسليح.

اشتملت الدراسة المعملية على سبعة عينات بواقع عينتين لكل نوع من الثلاث انواع: الوصلة الخارجية، والوصلة الدفونة والوصلة المدفونة جزئيا مع استخدام قيمتين للطول المدفون داخل الوصلة وهما بنسب ١,٦ و ١,٠٦ من بعد العامود، وهذا بالإضافة الي عينة تحكم مصبوبة ميليثيا من أجل المقارنة. أظهرت نتائج الاختبارات تحقيق الوصلة لمقاومة وصلت الى ٩٥% من المقاومة الميليثية كحد أدنى.

ومن أجل الوصول لصورة أوضح عن سلوك العينات، تم إعداد نماذج عددية لا خطية ثلاثية الأبعاد لدراسة سلوك الوصلات، كما تم مطابقة نتائج النماذج مع النتائج المعملية بنسبة خطأ لا تتجاوز ٩% ولتقديم نموذج حسابي تصميمي ليعبر عن سلوك العينات المختبرة، تم تطبيق نموذج الضاغط والشداد لكل عينة من العينات المختبرة وتم التأكد من موافقة النماذج للنتائج المعملية ونتائج النماذج العددية.

إقرار

هذه الرسالة مقدمة لكلية الهندسة، جامعة عين شمس، للحصول على درجة ماجستير العلوم في الهندسة الإنشائية. تم القيام بالعمل المذكور في الرسالة بواسطة الباحث ولم يتم تقديم هذه الرسالة أو جزء منها للحصول على درجة علمية من أى مؤسسة أخرى.

وهذا إقرار منى بذلك

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التوقيع:

STATEMENT

This thesis is submitted in partial fulfillment of the requirements for the degree of Master of Science in Structural Engineering, Faculty of Engineering, Ain Shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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ABSTRACT

Rapid construction of bridges has become a priority as traffic volumes are expected to increase exponentially in the next years all over the world. Precast concrete construction technique facilitates rapid construction of bridges with an improvement in constructability and reduction in traffic disruption and environmental impact. This research presents experimental and analytical studies to evaluate column-base pocket connections with rough surface interface. Three types of pocket connections have been investigated in this research as: external pockets, partially embedded pockets and internally embedded pockets. To compare the three types of pocket connections with the monolithic behavior, an experimental study was conducted including seven test specimens subjected to vertical and horizontal loads at column top with different eccentricities. The tested specimens included: two specimens with external pockets, two specimens with internally embedded pockets and two specimens with partially embedded pockets in addition to a pilot monolithic specimen. The embedded length to column width ratios were 1.6 and 1.06 for each type of the connections. The experimental observations and results show that a minimum of 95% of monolithic connection capacity was obtained for the six tested specimens. In order to have a better understanding regarding the tested pocket connection, nonlinear finite element analysis was carried out. Verification of the generated finite element models was conducted for the tested six specimens resulting in an acceptable simulation to the experimental results with maximum deviation in analytical capacity of 9%. From experimental results and finite element analysis, the failure criteria for

each specimen was obtained and the difference in behavior between the investigated three types of pocket connections was clarified.

Using the experimental results and the verified finite element models, three strut and tie models are proposed to be used for the design of the three studied types of pocket connections.

Keywords: Pocket connections, strut and tie, rough surface, finite element

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