



Cairo University

MODELING OF SHEAR BEHAVIOR OF PRECAST PRESTRESSED CONCRETE SEGMENTAL BEAM JOINTS

By
Mahmoud Abdelaal Mabrouk Ibrahim

A Thesis Submitted to the
Faculty of engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Structural Engineering

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Title of Thesis:

" Modeling of Shear Behavior of Precast Prestressed Concrete Segmental Beam Joints"

Key Words:

Segmental Beam; Precast Prestressed Concrete; Shear Keyed; keyed Joints; Shear Strength

Summary:

The shear strength of joints is a very important issue in the design of prestressed concrete segmental systems. In this research, finite element models of these joints under different parameters have been studied. The parameters considered in the Thesis include: (i) types of joints, (ii) number of shear keys, (iii) confining pressure, (iv) concrete strength, (v) shear transfer coefficient for dry joints, and (vi) friction coefficient. Three types of joints were used: dry joints with shear keys and without any filling materials, epoxy joints having a thin layer of epoxy between segments, and monolithic joints with full bond. Single keyed, two keyed, and three keyed joints were considered in this study subjected to three levels of confining pressure (1, 2, and 3 MPa), Concrete strength of 40, 50, and 60 MPa, with six values of friction coefficient for dry joints ranging from 0.1 to 1.0, and eight models with a variable shear transfer coefficient at single keyed joints. The FEM model was first calibrated and validated with the experimental results for single-keyed joints described in the literature. Then, Nonlinear Materials analysis was carried out for different combinations of the above mentioned parameters. In total thirty five FEM models were developed.

The results show shear behavior, shear capacity, crack patterns, and how the loads are transferred from one segment to the other. Among the main conclusions: The shear capacity increases with the increase of either the confining pressure or the concrete strength. The shear capacity of joints increase as the number of keys increase. Coefficient of friction between two segments plays role in increasing the capacity of the shear keys.

...استمارة معلومات الرسائل التي تمت مناقشتها

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١- الدرجة العلمية: ماجستير

٢- بيانات الرسالة:

عنوان الرسالة باللغة العربية :

تمثيل سلوك القص في فواصل الكمرات سابقة الصب وسابقة الاجهاد والمنفذة على مراحل

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٥- مستخلص الرسالة (Abstract)

٥-١ باللغة العربية :

الهدف من هذا البحث هو دراسه سلوك القص فى فواصل الكمرات سابقة الصب وسابقة الاجهاد والمنفذة على مراحل. تم استخدام المتغيرات (نوع الفاصل سواء ان كان جاف او ابوكسى او عينة متصلة)، دراسة تأثير شكل الفاصل وعدد روابط الاتصال (عدد مفاتيح القص)، دراسة تأثير اجهاد الخرسانة، دراسة تأثير قوى الضغط، دراسة تأثير معامل الاحتكاك بين القطع، دراسة معامل انتقال القص). تم دراسة تأثير حمل الكسر وشكل الكسر بداية من التحميل حتى الانهيار والعلاقة بين الانفعال والاجهاد. اظهرت نتائج البحث ان بزيادة قوى الضغط الجانبى ودرجة مقاومة الخرسانة و عدد روابط الاتصال (مفاتيح القص) يزداد حمل الكسر فى القص. وان معامل الاحتكاك فى الفاصل الجاف يؤثر على حمل الكسر.

الكلمات الدالة:

(الكمرات سابقة الصب، سابقة الاجهاد، كمرات منفذة على مراحل، الفواصل، سلوك القص)

٢-٥ باللغة الأجنبية :

The shear strength of joints is a very important issue in the design of prestressed concrete segmental systems. In this research, finite element models of these joints under different parameters have been studied. The parameters considered in the Thesis include: (i) types of joints, (ii) number of shear keys, (iii) confining pressure, (iv) concrete strength, (v) shear transfer coefficient for dry joints, and (vi) friction coefficient. The results show shear behavior, shear capacity, crack patterns, and how the loads are transferred from one segment to the other

(Key Words):

Segmental Beam; Precast Prestressed Concrete; keyed Joints; Shear Strength

٦- أهم النتائج التطبيقية التي تم التوصل إليها:

٦-١ بزيادة روابط الاتصال (مفاتيح القصر) يزداد حمل الكسر .

٦-٢ زيادة قوى الضغط الجانبى نيابة عن الكابلات سابقة الاجهاد وبزيادة درجة مقاومة الخرسانة يزداد حمل الكسر للعنصر.

٦-٣ معامل الاحتكاك فى الفاصل يؤثر على حمل الكسر فى الفواصل الجافة.

٦-٤ حمل الكسر للعينه المتصلة اعلى من حمل الكسر باستخدام الفاصل الجاف والفاصل الايبوكسى

٧- ما هي الجهات التي يمكن أن تستفيد من هذا البحث:

١-٧

يمكن للمهندسين الاستفادة من البحث اثناء التنفيذ و ذلك عن طريق المعرفة بطرق تنفيذ الكبارى المنفذة على مراحل- كما ان البحث يوفر معلومات قد تساعد في اختيار نوع الفاصل المستخدم فى الكبارى المنفذة على مراحل.

٢-٧

يمكن للباحثين من الاسترشاد بهذا البحث اثناء دراسة الكمرات سابقة الاجهاد وسابقة الصب والمنفذة على مراحل و اكمال دراساتهم علي بعض المتغيرات التي لم تدرس في هذا البحث.

٣-٧

يمكن اخذ نتائج هذا البحث في الاعتبار اثناء اعداد الكود لدراسه الكبارى المنفذة على مراحل.

٨- هل توجد علاقة قائمة باحدى هذه الجهات : ☐ نعم ☐ لا ☐

في حالة نعم اذكر هذه الجهات :

١-٨

٢-٨

٣-٨

ما هي طبيعة العلاقة :

☐

مشروع بحثي

☐

تعاون أكاديمي

مشروع ممول من جهة ثالثة ☐ (اذكر ما هي :

أخري ☐ (تذكر

٩- هل توافق على التعاون مع جهات مستفيدة من خلال الجامعة :

لا ☐ (لماذا) ☐ (
 نعم ☐
 (أ) لتطبيق البحث : ☐
 (ب) لاستكمال البحث: ☐
 (ج) أخرى : ☐ (تذكر) (

١٠- هل تم نشر بحوث مستخرجة من الرسالة في مجلات أو مؤتمرات علمية
(تذكر مع جهة النشر و المكان و التاريخ)

١-١٠

٢-١٠

٣-١٠

١١- هل سبق التقدم لتسجيل براءات اختراع (تذكر مع الجهة و المكان و التاريخ)

١٢- هل توافق على إعطاء البيانات المذكورة في هذه الاستمارة لجهات أخرى

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