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SEISMIC PERFORMANCE OF A PRECAST CONCRETE COLUMN WITH
THREADED MECHANICAL SPLICES

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Engineering Program in Civil Engineering

Department of Civil Engineering

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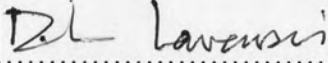
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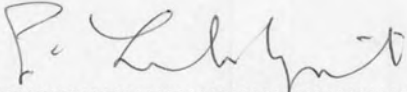
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
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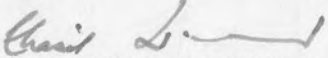
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ผศ. ดร. อาณัติ เรืองรัมย์. 126 หน้า.

กำลังและความเหนียวที่ไม่เพียงพอที่บริเวณรอยต่อเป็นสาเหตุหลักหนึ่งของการวิบัติของโครงสร้างหล่อสำเร็จ ข้อต่อที่มีความเหนียวที่เพียงพอได้ถูกพัฒนาให้ขึ้นสำหรับโครงสร้างหล่อสำเร็จเพื่อปรับปรุงพฤติกรรมด้านความเหนียว การดูดซับพลังงาน และกำลังหลังการโก่งเดาะของเหล็กเสริมในแนวตั้ง โดยข้อต่อเชิงกลได้ถูกออกแบบให้มีระดับการดูดซับพลังงานที่เพียงพอและเกิดความเสียหายก่อนเหล็กเสริมหลัก เพื่อที่จะได้เปลี่ยนได้หลังจากเกิดแผ่นดินไหว

ในการวิจัยได้เปลี่ยนความหนาและระยะช่องว่างของข้อต่อที่ผลิตจากเหล็กเหนียว SS400 โดยทำการทดสอบรับแรงอัด แรงดึง และรับแรงสลับไปมา จากการทดสอบรับแรงอัดพบว่าเหล็กที่มีข้อต่อมีกำลังเพิ่มขึ้น 11.8% และมีระดับการดูดซับพลังงานเพิ่มขึ้นเป็น 4.9 เท่าของเหล็กเสริมปกติ แต่จากการทดสอบรับแรงดึงพบว่าเหล็กปกติมีความเหนียวเป็น 5 เท่าของเหล็กที่มีข้อต่อ โดยระดับการดูดซับพลังงานมีค่ามากขึ้นเมื่อระยะช่องว่างของข้อต่อมีค่ามากขึ้น จากนั้นได้ทำการวิเคราะห์หน้าตัดของเสาคอนกรีตเสริมเหล็ก (ใช้เหล็กเสริมปกติ) และคอนกรีตหล่อสำเร็จ (ทำการต่อเหล็กด้วยข้อต่อ) โดยออกแบบตามแบบสะพานของกรมทางหลวงชนบท พบว่าเสาที่มีการต่อเหล็กมีความเหนียวเป็น 2-2.5 เท่าของเสาที่ใช้เหล็กปกติ ทั้งนี้เป็นเพราะเหล็กที่มีข้อต่อสามารถชะลอการตกลงของแรงหลังเกิดการโก่งเดาะได้ และผู้วิจัยได้ตรวจสอบความไวของค่าโดยเพิ่มปริมาณการโอบรัดด้วยเหล็กปลอกจาก 0.77% เป็น 1.78% โดยพบว่าเสาที่ใช้เหล็กปกติมีความเหนียวมากกว่าเล็กน้อย ทั้งนี้เป็นเพราะการขาดเนื่องจากแรงดึงในข้อต่อ

ภาควิชา.....วิศวกรรมโยธา.....

สาขาวิชา.....วิศวกรรมโยธา.....

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ลายมือชื่อนิสิต

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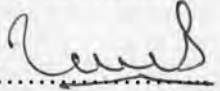
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PHONEPHETH MOUNNARATH: SEISMIC PERFORMANCE OF A
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
One of the main reasons for the failure of precast structures under seismic actions is insufficient strength and ductility of their connections. The use of ductile mechanical splices in precast connection is expected to provide sufficient ductility and energy dissipation to the structure as well as to improve the buckling behavior of the column reinforcing bars. In this study, threaded mechanical couplers were developed. The splices are allowed to fail with a sufficient amount of energy dissipation in prior to the main reinforcements. Hence, the repair of structures after an earthquake event will be simplified by replacing new couplers. The coupler thicknesses and the gap lengths between the coupler and threaded bars were set to be the main parameters in this study. The couplers are produced from SS400 steel and the threaded bars are made from 20-mm-diameter steel bars with the SD50 grade. The coupler thickness is varied from 3.0 mm to 4.5 mm and the coupler gap length is varied from 30 to 102 mm, equivalent to 1.25 to 4.25 times coupler thread size, 24 mm. In compression, the mechanical splices exhibit higher compressive strength with more post-buckling resistance than the plain control bar by about 11.8%. In addition, the energy dissipation of the splice is 4.9 times the plain bar. However, in the monotonic tensile test, the ductility of plain bars is approximately 5 times of the splices. The energy dissipation of the mechanical splices increases when the coupler gap length increases.

The section analysis of the monolithic and precast columns was conducted. The curvature ductility of the precast columns with mechanical splices is approximately 2-2.5 times the curvature ductility of the RC column. In addition, the difference of maximum moment capacity is 10%. The failure of both RC and precast column is due to the buckling of the bar and splice under compression. The sensitivity study is conducted by increasing the volumetric ratio of lateral reinforcement from 0.77% to 1.78%. The RC column has slightly more curvature ductility than the precast columns. It is because the tension rupture of couplers limits the ductility in columns.

Department Civil Engineering

Student's Signature 

Field of Study..... Civil Engineering

Advisor's Signature 

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