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EFFECT OF CONFINEMENT OF CONCRETE ON THE SPLICE REGION

BY

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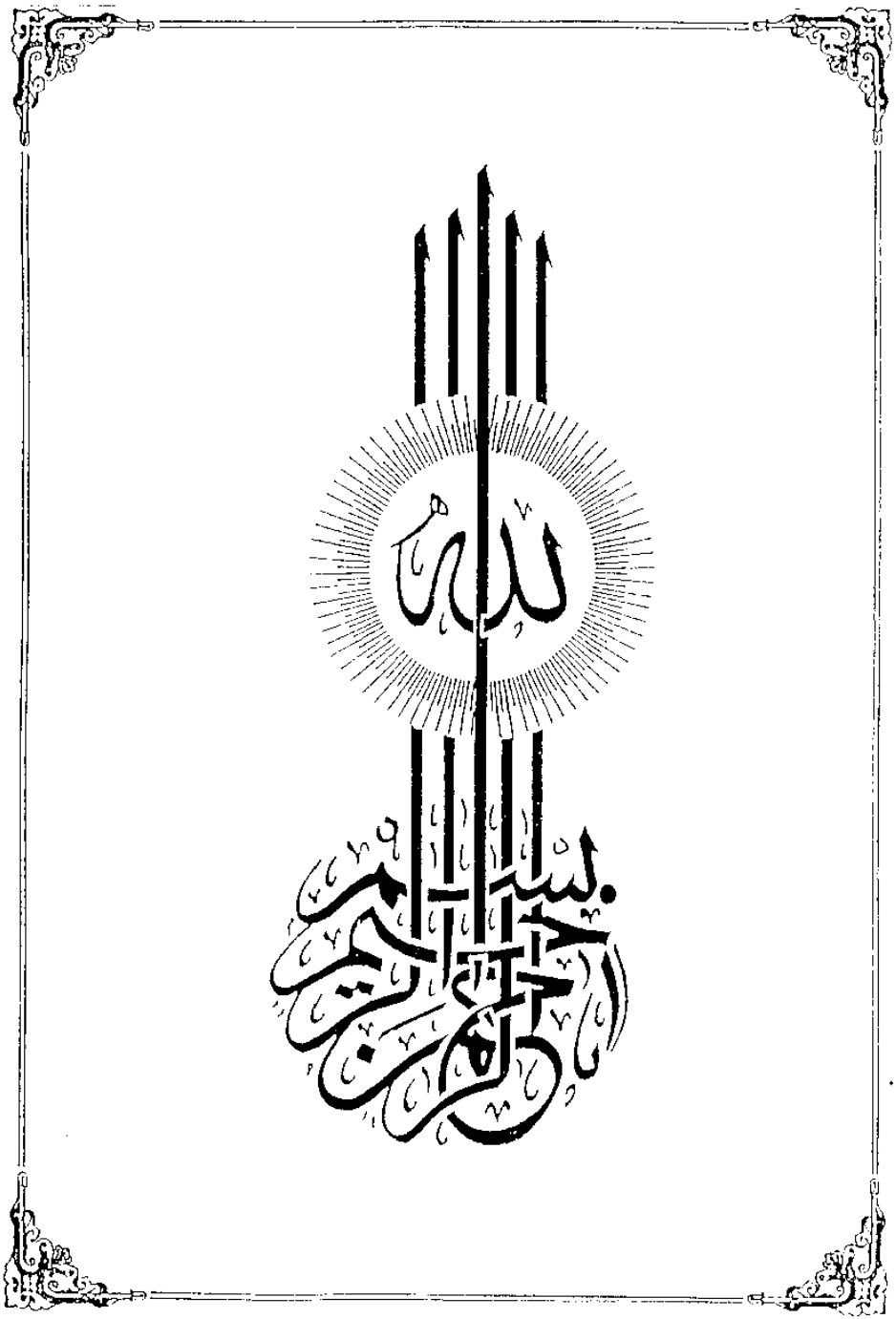
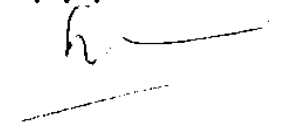


TO MY DAUGHTER, ..HADIR.

WITH LOVE ???



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I N T R O D U C T I O N

1.1. General

Reinforced concrete structures most frequently contain lap splices. Splices take place because of the length of the reinforcing bars, which produced normaly in a standard dimensions. In general, bars are cut to a shorter lengthes, and lapped, mostly, at the location of minimum bending moments.

The forces in the spliced bars are transmitted, as normal, to the concrete by bond. The classical concept of bond is that it consists of adhesion between the reinforcement and the surrounding concrete, and the bond failure is caused by the failure in this adhesion. Traditional design methods and code provisions concerning bond and anchorage of reinforcement are based upon this concept and result in provisions for allowable bond stress values or corresponding development length necessary for developing the full design strength in the bars.

The confining of concrete by using stirrups, improves the bond resistance by improving the properties of concrete at the regions of splices. Moreover, the stirrups across the longitudinal splitting cracks decrease this splitting, and hence restrain the width of crack. However, most national building codes disregard the effect of the lateral confinement of concrete on the

behaviour of structural element, although they all contains clauses limiting the size and spacing of ties. It appears that most code recommendations are based on the assumption that the main function of the lateral reinforcement is to prevent the longitudinal reinforcement from buckling, and to resist the shear stresses exist in these elements.

Some investigators examined the behaviour of the splice region, to obtain the required informations for evaluating the bond-stress characteristics at these regions, and determine the critical lap length, either for narrow beams[9], or for wide sections[12,13,14,31]. The effect of confinement on th concrete properties has been the main subject of some investigations[23,26]. However, the effect of the transverse reinforcement at the splice region, on the behaviour of these structures, did not have enough attention till now, and hence, more studies are needed in this area.

Along the splice length, bond between concrete and steel, enables the tensile forces of the concrete to transfer from one bar to another . Continuous cooperation between concrete and the reinforcing bars is hence insured. However, cracks will occure mainly in the region of the splice, mostly, at both ends of the splice.

The essential purpose of the theories of cracking of reinforced concrete, is studying the distribution of cracks and the width of cracks, which are assumed to be

perpendicular to the direction of the reinforcement. However, these theories are unable to take the longitudinal crackes, which extend parallel to the reinforcing bars, into consideration. These cracks normally occures at the splice location when the splice length is not enough. The formation and spreading of these cracks depends upon the density of the concrete, the cover of concrete to the bars, the width of the member, and the confinement of concrete, (the transverse reinforcement).

The presence of the transverse reinforcement, forms points of discontinuity in the bond between the concrete and the steel, because it is equivalent to a local reduction of the section, and particulary to lowering the quality of the concrete cover, and further more present an obstacle to the displacement of the reinforcing bar in relation to the concrete. Although this local impairment is considerably increases the probability that a crack will form, the transverse reinforcement will increase the confinement of the concrete in this region, and hence its strength will increase, accordinglly the probability of crack formation will decrease.

1.2.Object

The main questions arising with the performance of splices in reinforced concrete structures are:

1. What is the effect of the splice length, of the main steel reinforcement, on the general deformational

behaviour of concrete beams.

2. What is the effect of the bar surface, (ribbed or smooth), and the steel strength on the cracking behaviour of concrete beams at the location of the splice.
3. Is the confinement of concrete, at the splice region, has a significant effect on the deformational behaviour of concrete beams with steel splices.
4. What is the effect of the degree of confinement in reducing the length of the lapped splices.

A large amount of work has been carried out to answer the first and the second questions. But according to the available literatures, there are leakage of informations about the other two questions. However, some national building codes reduces the required development length, when using stirrups with limited spacing[A].

In the present work, an experimental and theoritical programs have been carried out as an attempt to give more informations about the third and the forth questions. The present work was limited to investigate the effect of confinement on the behaviour of beams with a splice for the main steel reinforcement. The specific objectives of the present work are as follows:

1. To study the effect of different ratios of the transverse reinforcement, (stirrups), at the splice region on the following:
    a. The general deformational behaviour from zero up to the failure load, and mode of failure.