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Prestress transfer using controlled detensioning process

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For several decades, the use of prestressed concrete has grown rapidly because of its efficient and economical advantages. These structures are most commonly used in bridges, buildings, piling work and marine structures where large spans and/or corrosive environments are present where cracking of concrete is detrimental. With the use of new high strength materials and larger diameter prestressing strands the benefits of prestressed concrete can be extended further.

Pretensioned prestressed concrete can be produced in a number of ways. Among them several options can be considered depending on the structure constructed and how prestress is transferred. In the recent times radial and longitudinal cracks have been observed due to high tensile stresses developed in concrete around prestressing steel. In practice to eliminate these harmful conditions modifications are required to ensure serviceability functions of the composite high quality material.

Often excessive prestress is reduced by lowering the tensile stress in the prestressing steel or / and the magnitude of the eccentricity towards the end of the member which is vulnerable to this type of effect. In the global context debonding of tendons towards the end of a member, drapping of tendon towards the central portion of the member or controlled detensioning can be applied to achieve the desired outcomes. All these techniques require a sound basis for prestress transfer which is achieved by bond. Some of the practices are prohibitive to developing countries due to the high cost of holding down devices buried in the concrete. Further in third world countries cost of hardware is expensive as opposed to cheap labour encountered in production.

This research is aimed at strengthening our understanding of bond mechanism by extending cohesive cracking approach established by experiment and matched by a sound theoretical basis to complement each other. Currently some of the global practices are carried out by relying on intuition as opposed to theoretical formulations.

This study covers a comprehensive analysis of bond development for the controlled detensioning process. The experimental verification is not part of the present scope. However the parameters influencing such as strand diameter, initial prestress, concrete and concrete strength have been identified.

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