TESTING OF PRE-STRESSED CONCRETE BEAMS PRODUCED USING CONTROLLED DETENSIONING

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Pre-tensioned pre-stressed concrete has been developed to overcome concrete weakness in tension. Generally, there are number of ways for producing pre-tensioned, prestressed concrete beams in practice. Among these, several options can be considered depending on how the structure is constructed, materials used, statical conditions are applied and how prestress is transferred. In the conventional method of pre-stress, radial and longitudinal cracks have been observed due to high tensile stress developed in concrete around the pre-stressing steel. Further, excessive stresses are generated at the two ends when applying this method. Often excessive prestress is reduced by lowering tension stress in the prestressing steel and magnitude of the eccentricity towards the end of the member which is vulnerable to this type of effect. To overcome these problems, control de-tensioning method has been introduced. Debonding of the tendons towards the end of the member, draping of tendon towards the central portion of the member or controlled detensioning approach are applied to achieve the desired bond characteristics by controlling the bond development systematically. The purpose of this study is to identify conventional methods of prestressing and their limitations together with theoretical concepts of controlled detensioning method. An experimental programme has been carried out at a casting yard of ICC (International Construction Consortium, Piliyandala) by modifying the casting bed. The method of controlled detensioning is a stage by stage releasing technique of prestressing and casting thereby varying prestressing force without any accessories buried in concrete other than simple shear keys at locations of changing prestressing force. The final form of longitudinal prestress varies at the end from concave up, towards the central portion of the transfer zone which is the straight followed by concave down towards the end of the transfer length. In these regions in the conventional beam where we find concave up stress profile which has radial cracking along almost entire transfer length up to the surface, however it does not happen in the controlled detensioning method. In fact, most of the prestressing is transferred, in the straight portion where cracking occurs partially but not to the surface. The experimental programme is partly successful as out of the four beams tested it was not possible to compare the theoretical findings entirely but gives a reflection of the advantages. Hence, there is a major improvement in the bond. This type of issue is beneficial when detensioning, is used to prevent deicing salts used in major roads in winter climates and in bridges, in coastal areas where salty environment is present. These harmful effects can be avoided when cracks to surface can be prevented. Otherwise, it may lead to ingress of saline moisture particles, which are corrosive.

Keywords: pre-tensioning; controlled de-tensioning; stage by stage construction; prestress transfer bond

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