Title: **STUDY OF THE BEHAVIOR OF THE INTERPHASE IN REINFORCED CONCRETE ELEMENTS WITH COMPOSITES MATERIALS**

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ABSTRACT

External bonding of steel plates has been used since 1960s as a system of structural reinforcement of members with deficient strength capacity. During the last years the use of composite materials was introduced in this field due to the facility of setting and its excellent ultimate strength, in substitution of steel plates. The system of fiber-reinforcement polymer consists of externally bonding carbon fiber laminates to the support by means of an epoxidic adhesive.

There are several forms of failure for elements reinforced with this type of material. They can be divided in three groups: classic failure for reinforced concrete structures, failure of the external reinforcement, and failure of the union in the concrete-sticky-laminated interphase, also designated as "peeling off". The failure of the union in the concrete-laminated interphase is the unless desirable form and it originates the sudden loosening of the reinforcement, due to the stress concentration around bending cracks at then end of the laminate.

To obtain an effective reinforcement, the failure of the reinforcement in the zone of anchorage should not take place. The appearance of local phenomena originates in many cases in this zone the premature loosening of the laminate.

In this study a revision of the existing shear tests is shown in the second chapter. Secondly, a summary of the existing analytical models wich describe the behavior of the interphase in a shear state are given. These models are based on experimental adjustments in non-linear fracture mechanics theory. By means of these models the behavior of the interphase between cracks or at the end of the FRP reinforcement can be described. All these models have been compared in this study using a data base of shear tests. The main parameter studied is the maximum tension force of the laminate, Pmax. The Pmax/Pexp average has been calculate, the standard deviation and the coefficient of variation for each one of the studied formulations. Particularly general behavior of reinforcements have been studied, for both FRP-to-concrete and steel-to-concrete bonded joints under shear.

In addition a parametric study of the variables has been made that influence in tensile the fully factored load that can be transmitted between the laminate and the support. The parameters studied: the widthness of the laminate, the thickness of the laminate, the concrete compression strength, the modulus of elasticity of the laminate and the length of laminate.

An experimental program with three double-lap shear test specimen was used to study the transmission of stresses between concrete and laminate of carbon composite material plates adhered to concrete. The shear stresses distributions and strains distributions based on the load of applied tension were obtained. The maximum strain and maximum stresses in the experimental campaign were smaller than predictiones, because the failure was not the hoped one and it took place before the predicted estimates.

The results of tests have been compared with deduced analytical values using Brosens formulae. In this study it is observed that the results obtained analytically are considerably different like the analytical results. As well, distributions of tangential tensions have been obtained until a load next to the breakage. Finally, conclusions have been extracted.