Prolonging the Life of our Concrete Structures: Deep Embedment Shear Strengthening of Continuous RC T-beams

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Abstract

The Deep Embedment (DE) technique is an innovative shear-enhancement retrofit technique for concrete structures that requires introduction of Fibre-Reinforced Polymer (FRP) or Steel bars upwards into vertical or inclined holes which have been drilled through the beam section. An experimental campaign consisting of ten two-span continuous reinforced concrete T-beams designed to fail in shear is presented. Results from these experiments have extended our current knowledge on the behaviour of continuous beams strengthened in shear by the DE technique. This paper provides a brief overview of the results obtained.

Keywords: Shear resistance; Retrofitting; Strengthening; Fibre-Reinforced polymers; Continuous Reinforced Concrete T-beams; Deep Embedment; DE FRP bars; DE steel bars.

1 Introduction

Deficit of structural ductility can be the reason for brittle and catastrophic failure of a structure. Previous studies have shown that the shear capacity of RC beams can be greatly upgraded by using the Externally Bonded (EB) or Near Surface Mounted (NSM) technique (Triantafillou 1998; Barros and Dias 2005). It is important to realise that truss action may not be generated when employing these methods as it is usually not possible to anchor FRP material in the compression zone. Dangerous and unpredictable shear failure led to the development of these techniques, but lack of understanding concerning the shear behaviour before and after strengthening still exists within research. It is crucial that T beams are considered in research, because beams are almost always cast contiguously with the top slab. Continuous beams behave differently to the simply supported beams, because in continuous structures large shear forces co-exist with large bending moments at the same location. The Deep Embedment (DE) technique (Figure 1) has been developed (Valerio et al. 2009) as an alternative strategy for shear strengthening of RC beams. The novelty of the research presented here is focused on the extension of the Deep Embedment technique to consider T sections, GFRP and steel bars besides CFRP bars, angles of drilling other than vertical, and the effects of continuity on shear strengthening.

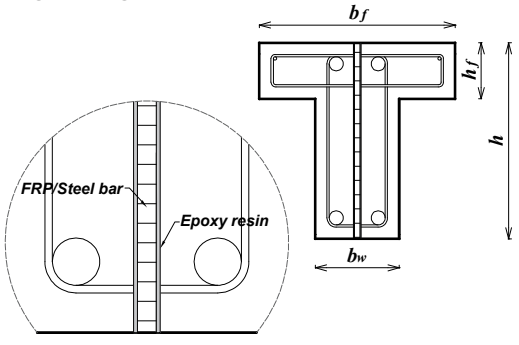

Figure 1. Deep Embedment technique

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