



Asymmetrically reinforced concrete piles in earth retaining systems

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Summary

The asymmetric reinforcement in concrete pile members employed as retaining earth systems has recently been introduced. The use of non-symmetrical piles supposes savings up to 50% in weight of longitudinal reinforcing steel, compared with the traditional symmetrical piles. The behaviour of those new members under service both in short and long term loading is currently under study and new expressions regarding the contribution of concrete in tension have been introduced. Comparison between the behaviour of asymmetrically reinforced piles and its symmetrical counterpart is also presented.

Keywords: reinforced concrete, service behaviour, asymmetric reinforcement, circular cross section, tension stiffening, effective area, deflection.

1. Introduction

Concrete piles employed in earth retaining systems are traditionally reinforced by means of a symmetric layout of bars placed in the perimeter of the cage. Recent works of the TEP-190 research group at University of Granada have presented a new version of concrete piles reinforced with an asymmetric arrangement of longitudinal steel bars, based on previous studies regarding the optimal reinforcement solution of concrete members under flexure [1]–[5].

Although asymmetric reinforcement for circular concrete cross sections was first introduced by Weber and Ernst [6], the provided solution did not correspond with the minimum of reinforcement. The approach presented by Gil-Martín [7] allows bars of different diameter and spacing to be used and the absolute minimum reinforcement required in the ultimate strength design of circular sections can be computed.