# Numerical evaluation of the shear behavior of a metal shear key used in joining precast concrete segmental bridge girders without epoxy

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Abstrak

The shear key is an important part of a precast segmental concrete bridge. Aside from its function of contributing to the distribution of shear force from one concrete segment to another, it helps to join precast concrete segments to become a complete bridge structure and provide continuity of movement for vehicles and pedestrian traffic. This numerical study discusses the behavior of a full-scale shear key connection without epoxy joining two concrete blocks representing segmental precast concrete at which two external forces load the blocks. Ferro Casting Ductile (FCD) is used as the metal shear key material where the shear key consists of two parts, a male and a female shear key. Numerical simulation is conducted using the ANSYS academic package, with nonlinear analysis implemented accordingly. The appropriate constitutive materials in relation to the numerical program, both for concrete and FCD, are taken from the appropriate literature. Two criteria are employed in the study; failure of the concrete block and yielding of the shear key that follows the von Mises criterion. Shear key connection system capacity is evaluated by applying different magnitudes of horizontal force. The validation of two numerical simulation studies is conducted by two experimental programs that cover laboratory experimentation of full-scale shear keys connecting two concrete blocks. The numerical and experimental results produce an almost similar relation of shear stress at the male shear key and vertical displacements of the upper block relative to the lower concrete block. Finally, a contour of shear key shear stress as a function of the different magnitudes of equivalent prestressing and different quality of concrete compressive strength is proposed.