New Assessment Method on Shear Resistance of Perfobond Shear Connectors in Steel-Concrete Composite Structure

Xing WEI
Associated Professor
Southwest Jiaotong University
Chengdu, China
We_star@swjtu.cn

Xing Wei, born 1976, received his bridge engineering PhD degree from Southwest Jiaotong University

Yadong LI
Professor
Southwest Jiaotong University
Chengdu, China
yadongli2009@qq.com

YadongLi, born 1956, received her bridge engineering degree from Southwest Jiaotong University

Summary

The behaviour of shear connectors will have a major impact on the global behavior of steel-concrete composite structure. Perfobond shear connector has been developed during last two decades and has become popular due to their advantageous properties. Longitudinal shear strength is considered as a major constraint in the design of composite structure and it can be assessed by expensive and time consuming experimental techniques. Longitudinal shear resistance of perfobond shear connectors is depends on some design parameters. In this paper, considering its powerful prediction ability on nonlinear problem, artificial neural networks was induced to investigating and a new intelligent evaluation method on shear resistance of perfobond shear connectors was proposed. Choosing the diameter of holes, the yield strength of steel plate, concrete compressive strength, the ratio of transverse rebar, depth of steel plate and thick of steel plate as input values, Back Propagation Neural Networks (BPNN) model was developed for determination of the longitudinal shear resistance of perfobond shear connectors. It is demonstrated that, with the same design parameters as test specimens, the longitudinal shear resistance generated by the BPNN model is quite close to test result after proper training of the BPNN. Furthermore, Instead of three-dimensional FEM Analysis or Push-out test, the BPNN model is computationally efficient tool used to predict shear resistance of perfobond shear connectors in different parameters..

Keywords: steel–concrete composite structure; Perfobond shear connector; shear resistance; intelligent evaluation, BPNN.

1. Introduction

Steel-concrete composite structures are widely used in buildings and bridges in recent decades. The shear connector between steel and concrete member is of great importance as it resists separation and transmits longitudinal shear force between the two. Including stud shear connector, channel shear connector and angle shear connector, etc., many types of shear connectors have been proposed and used in composite structures. Stud shear connectors are the most common type of shear connectors and are used in composite structures due to their easy and rapid construction and non-directional properties subjected to shear force. However, such connectors have certain limitations, especially when fatigue loads are present, because their high flexibility allow for deformations under service loads. Perfobond shear connector was developed by the firm Leonhardt, Andrå and Partners in the 1980s for the design of a bridge over the Caroni River in Venezuela. Its development was based on the need for a system that sustained only elastic deformation under service loads with a specific bond behaviour and higher fatigue strength. Perfobond shear connector is made of a steel plate with a number of uniformly spaced holes, If the holes in the perfobond rib are filled with concrete, concrete dowels are formed, which provide longitudinal shear resistance between the steel and the concrete. With the application and development of steel-concrete composite structure, perfobond shear connector has become popular due to high shear resistance and good fatigue performance.

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