



3D Non-Linear Model Describing the Behaviour of Peripheral High Capacity Saw-Tooth Connectors Subjected to Compressive Load

Hussein Al-kroom

Technische Universität Berlin, Berlin, Germany

University of Jordan, Amman, Jordan

Volker Schmid, Andreas Reimer

Technische Universität Berlin, Berlin, Germany

Contact: hussein.al-kroom@mailbox.tu-berlin.de

Abstract

This contribution aims to demonstrate the behavior of a high capacity saw-tooth connectors fixed at the edges of a slender reinforced concrete slab. The connectors are subjected to compressive load and mainly designed to transfer shear forces into the slab either from steel truss or cable, as in truss bridge or cable stayed bridge. A 3D finite element model is carried out in ANSYS Workbench environment to simulate the specimen. The description of non-linear material behavior is implemented by using an elastoplastic model. The material model is defined by adopting Menetrey-Willam failure criterion and non-associated flow rule. Hardening / softening law is obtained by using power hardening function and fracture based function. The model shows a good agreement with the experimental force – displacement relation, with a discrepancy of 2-5%.

Keywords: Composite structures, Failure behavior, Finite element method, Reinforced concrete, Saw-tooth connector.

1 Introduction

Composite steel-concrete structures become widely used due its economy and durability. One of the most important members in the composite structures is the shear connector, where it transfers the forces between concrete and steel. As a common type of shear connectors, shear studs have been used immensely. Shear stud has been a topic of research for many years. Thus its behavior is completely studied to give a full description of its failure modes [1,2]. However, the shear studs have many drawbacks like the difficulties in welding control and its fatigue problems. Therefore, many researchers have been carrying out tests and studies for overcoming shear studs' flaws. Perfobond rib connector has

been developed to enhance the load capacity of the connector and increase the ductility [3,4]. Later on, a development on the shape of the perfobond connector is achieved [5,6]. The new connector's shape, which is called Y-type perfobond rib, shows an increase of both bearing resistance and displacement.

Regarding the shortcomings of the conventional shear connectors, many researchers have been working to develop a very high load capacity saw-tooth connector at both the University of Stuttgart and then the Technical University of Berlin. The saw-tooth connector was described in 1989 by Schlaich and Schäfer. The description was based on the strut and tie model, where the flow forces distributed around the connector [7]. The connector was used in a