## High Performance Fibre Reinforced Concrete for Double-Tee Beams

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## **Summary**

Modern admixtures as well as the addition of fibers allow producing concrete with extraordinary properties. With such high performance concrete it is now possible to establish structural elements perfectly adapted to practical requirements.

Precast prestressed double-tee beams allow building large industrial or commercial floors and parking decks in a fast and economic way. These double-tee beams are highly prestressed by bonded strands and contain only a reduced steel reinforcement. A certain problem thus arises in the design for shear resistance; according to national and international codes, the webs must contain a minimum shear reinforcement (stirrups) for which the laying interferes with production. The opportunity to replace these stirrups by a high performance concrete reinforced, if necessary, by steel fibers therefore seems attractive.

The University of Applied Sciences (UAS), Fribourg, carried out theoretical and experimental research on full-scale concrete double-tee beams in order to analyze the interaction between the quality of concrete, the addition of fibers and prestressing on flexural behavior and shear resistance.

**Keywords:** High performance concrete, steel fibers, double-tee beam, prestressing, prefabrication, flexural behavior, resistance.

## 1. Introduction

Fiber reinforced concrete (FRC) has been subjected to many experimental and industrial developments in recent years. This particular composite material shows characteristics which are more specific than those of ordinary concretes, in particular concerning its tensile strength, its shear resistance, its rigidity in cracked state as well as its ductility. Fiber reinforced concrete is situated between plain concrete and steel bar reinforced concrete. Currently, the use of FRC remains limited to specific fields of application like pavements and roads, precast elements and shotcrete for walls and tunnels [1, 2]. In high performance fiber reinforced concrete (HPFRC), a certain quantity of steel or synthetic fibers is added to the cement matrix which is similar to the one of high performance concrete (HPC). This fiber addition gives a more ductile character to HPC which is often characterized by a fragile behavior [3].