Chapter

4

Punching Shear Strengthening at the New Station Square in Berne, Switzerland

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Abstract: The reinforced concrete slab of the reconstructed Station Square in Berne needed to be strengthened against punching shear. The case study led to the application of a newly developed post-installed punching shear reinforcement with inclined bonded bars.

Keywords: post-installed punching shear reinforcement; conservation; strengthening; inclined bonded bars; brittle failure; deformation capacity; construction process.

4.1 Introduction

The Station Square in Berne, Switzerland, as it is shown in *Fig. 4.1*, was constructed from 1971 to 1973 and reorganized and rehabilitated in 2007. The main element is an underground passage and shopping centre with an area of 7500 m^2. The ceiling is a 600 mm thick reinforced concrete slab that is mainly supported by steel columns. In front of the station building, a major city road, various tramways, and bus lines cross the square. The underground passage is about 134 m long and 42–61 m wide with a 54 m long and 16 m wide addition to the west. The clearance height is approximately 3.50 m. Several stairways and elevators around the perimeter give access to the underground passage.

There are 81 columns in total, usually in a grid of 8.44 m × 9.00 m. The columns are mainly steel pipes with an outer diameter of 368 mm and a thickness of 35 mm. Some columns consist of other steel profiles or cast-in-place reinforced concrete. The outer edge of the concrete slab is supported by reinforced concrete walls with neoprene bearings. The whole slab is divided into five elements. The initial design is based on the former Swiss codes SIA 160 (1970) [1] and SIA 162 (1968) [2]. The load model for traffic consisted of two axle loads of approximately 200 kN each and an accompanying load of approximately 5 kN/m^2 including a dynamic factor. The total dead load of road bed and pavement is about 30 kN/m^2.

https://doi.org/10.2749/sed012.0035