TECHNICAL REPORT

Design of wire loop systems for the connection of precast and in-situ concrete elements

TR 074

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1 SCOPE OF THE TECHNICAL REPORT

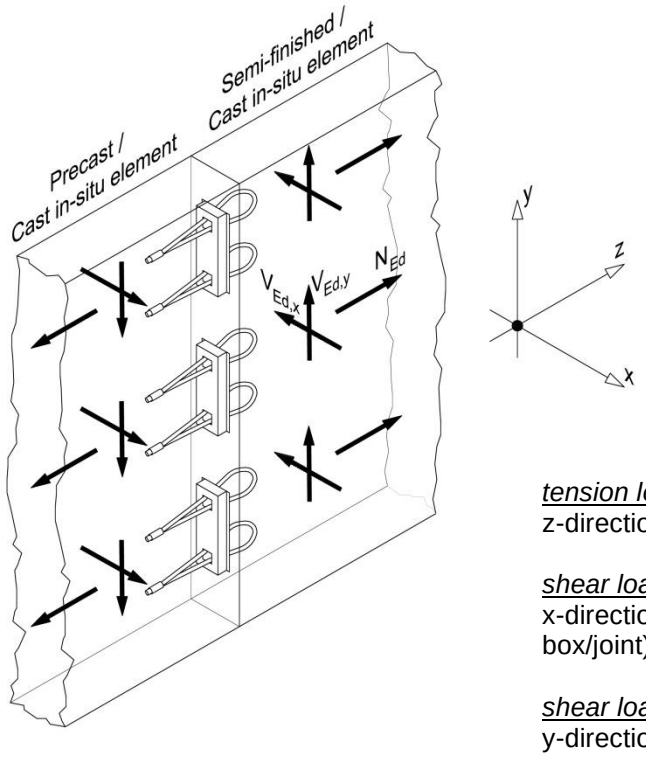
The design rules in this Technical Report (TR) are valid for wire loop systems for the connection of precast and in-situ concrete elements with a European Technical Assessment (ETA) in accordance with EAD 3302589-00-0601 [1]. This document relies on design resistances stated in the ETA and referred to in this TR.

This Technical Report covers the design of wire loop systems for the connection of precast and in-situ concrete components or for connecting of two in-situ concrete components.

The proof of local transmission of the loads from the first concrete component to the wire loop system and further into the second concrete component is ensured by using the design methods described in this document.

The design and construction of concrete components in which the wire loop systems are to be embedded shall be comparable with the general rules and rules for buildings of concrete structures according to EN 1992-1-1 [2] and the relevant national regulations.

The wire loop system is intended to be used under static or quasi-static loads. The system can be used to transmit tension loads, shear loads perpendicular to the longitudinal axis of the joint, shear loads acting in direction of the longitudinal axis of the joint or any combination of these loads in accordance with Figure 1.1 into the concrete.



tension load
z-direction (in direction of wire loop)

shear load
x-direction (perpendicular to longitudinal axis of box/joint)

shear load
y-direction (in longitudinal axis of box/joint)

Figure 1.1: Load directions: tension load, shear load and any combinations of these

Specific terms used in this TR

E_d	=	design value of action
R_d	=	design value of resistance
N_{Ed}	=	acting tension load
N_{Rd}	=	design resistance under tension load
$N_{Ed,x/y}$	=	acting tension load components of shear action in direction x/y
$V_{Ed,x/y}$	=	acting shear load in direction x/y
$V_{Rd,x/y}$	=	design resistance under shear load in direction x/y
$k_{x/y}$	=	load combination factor in direction x/y

2 DESIGN AND SAFETY CONCEPT

2.1 Design concept

The design of anchorages shall be in accordance with the general rules given in EN 1990 [3]. It shall be shown that the value of the design actions E_d does not exceed the value of the design resistance R_d.

$$E_d \leq R_d \tag{2.1}$$

with: E_d design value of action
R_d design value of resistance

Actions to be used in design may be obtained from national regulations or in the absence of them from the relevant parts of EN 1991 [4].

The partial factors for actions may be taken from national regulations or in the absence of them according to EN 1990 [3].

2.2 Required proofs

2.2.1 Resistance to tension loads

$$N_{Ed} \leq N_{Rd} \tag{2.2}$$

The resistance of the wire loop system N_{Rd} is given in the relevant ETA.

2.2.2 Resistance to shear loads perpendicular to the longitudinal axis of box/joint

$$V_{Ed,x} \leq V_{Rd,x} \tag{2.3}$$

The resistance of the wire loop system $V_{Rd,x}$ is given in the relevant ETA.

2.2.3 Resistance to shear loads in the longitudinal axis of box/joint

$$V_{Ed,y} \leq V_{Rd,y} \tag{2.4}$$

The resistance of the wire loop system $V_{Rd,y}$ is given in the relevant ETA.

2.2.4 Resistance to combined shear loads perpendicular to the longitudinal axis of box/joint and shear loads in the longitudinal axis of box/joint

For combined shear loads the following equations shall be satisfied:

$$V_{Ed,x} / V_{Rd,x} + V_{Ed,y} / V_{Rd,y} \leq 1{,}33 \tag{2.5}$$

2.2.5 Resistance to combined tension loads, shear loads perpendicular to the longitudinal axis of box/joint and shear loads in the longitudinal axis of box/joint

For combined tension and shear loads the following equations shall be satisfied:

$$N_{Ed} + N_{Ed,x} + N_{Ed,y} \leq N_{Rd} \tag{2.6}$$

The tension loads $N_{Ed,x}$ *and* $N_{Ed,y}$ are load components resulted from shear actions.

$$N_{Ed,x} = k_x \cdot V_{Ed,x} \tag{2.7}$$

$$N_{Ed,y} = k_y \cdot V_{Ed,y} \tag{2.8}$$

The load combination factors k_x and k_y are given in the relevant ETA.

3 REFERENCE DOCUMENTS

[1] EAD 332589-00-0601: Wire loop systems for the connection of precast and in-situ concrete elements

[2] EN 1992-1-1:2004 + AC:2010: Design of concrete structures. Part 1-1: General rules and rules for buildings

[3] EN 1990:2002 + A1:2005 / AC:2010: Eurocode: Basis of structural design

[4] EN 1991:2002 + AC:2009: Actions on structures