

Research Project „Limits of the applicability of wire anchors for the anchoring of the facing brick to a back wall shell made of calcareous sand blocks or hollow blocks made of concrete or lightweight concrete“ – Abstract

In Germany in double-walled masonry with thick bed mortar usually uses wire anchors (diameter 4 mm) to anchor the front wall shell to the rear wall shell. The installation of the wire anchors with the associated limits is shown in DIN 1053-1, Figure 9 and DIN EN 1996-1-1/NA, Figure NA.9. For solid sand-lime bricks and solid blocks made of concrete or lightweight concrete, pull-out tests show output values > 1.0 kN at a maximum slippage of 1 mm. On the other hand for perforated sand-lime bricks and hollow blocks made of concrete or lightweight concrete the output values are smaller, depending on the holes of the upper stone layer over the wire anchors. In addition to solid bricks, in Germany mainly uses hollow bricks of stone group 2 according to DIN EN 1996-1-1. The boundaries of the perforation and the remaining web thicknesses are relatively broad for the individual types of stone. Individual tests with prepared sand-lime bricks of stone group 2 indicates significantly lower load capacities.

The aim of the research project is to determine the limits of the applicability of wire anchors, in particular with regard to perforation and stone type and to develop a proposal for a correction in the application limits of the design in DIN EN 1996-1-1/NA.

Within the framework of the research project, common hole arrangements in bricks were analyzed according to standardization. Furthermore, comparative tests were carried out on the tensile and compressive capacity of wire anchors depending on the stone type, the perforation and the positioning to the holes. The results of the test series for the tensile and compressive strength of wire anchors can be summarized as follows, depending on the stone type and the perforation, taking into account the limit value of 1.0 kN for 1 mm slippage required in DIN 1053:

- For sand-lime bricks, the load capacity for positioning the wire anchor in the area of the largest holes is below 1.0 kN at 1 mm slippage (outer web thickness 25 or 26 mm), irrespective of the mortar compressive strength.
- For hollow blocks made of lightweight concrete, an adequate tensile load-bearing capacity of the wire anchors is provided in the case of customary web thickness (35 mm) and a normal mortar compressive strength (MG IIa).

The following notes for the practice or application limits for reducing security in the use of wire anchors can be identified:

- A positioning of the wire anchors in the area of the handle hole of the lower row of stones should be avoided.
- In the case of lightweight concrete or concrete hollow blocks, an outer web thickness of at least 35 mm is required.
- For sand-lime bricks, the minimum number (n_{tmin}) of wire anchors per m^2 wall-area required should be increased in accordance with DIN EN 1996-1-1/NA, Table NA.18.