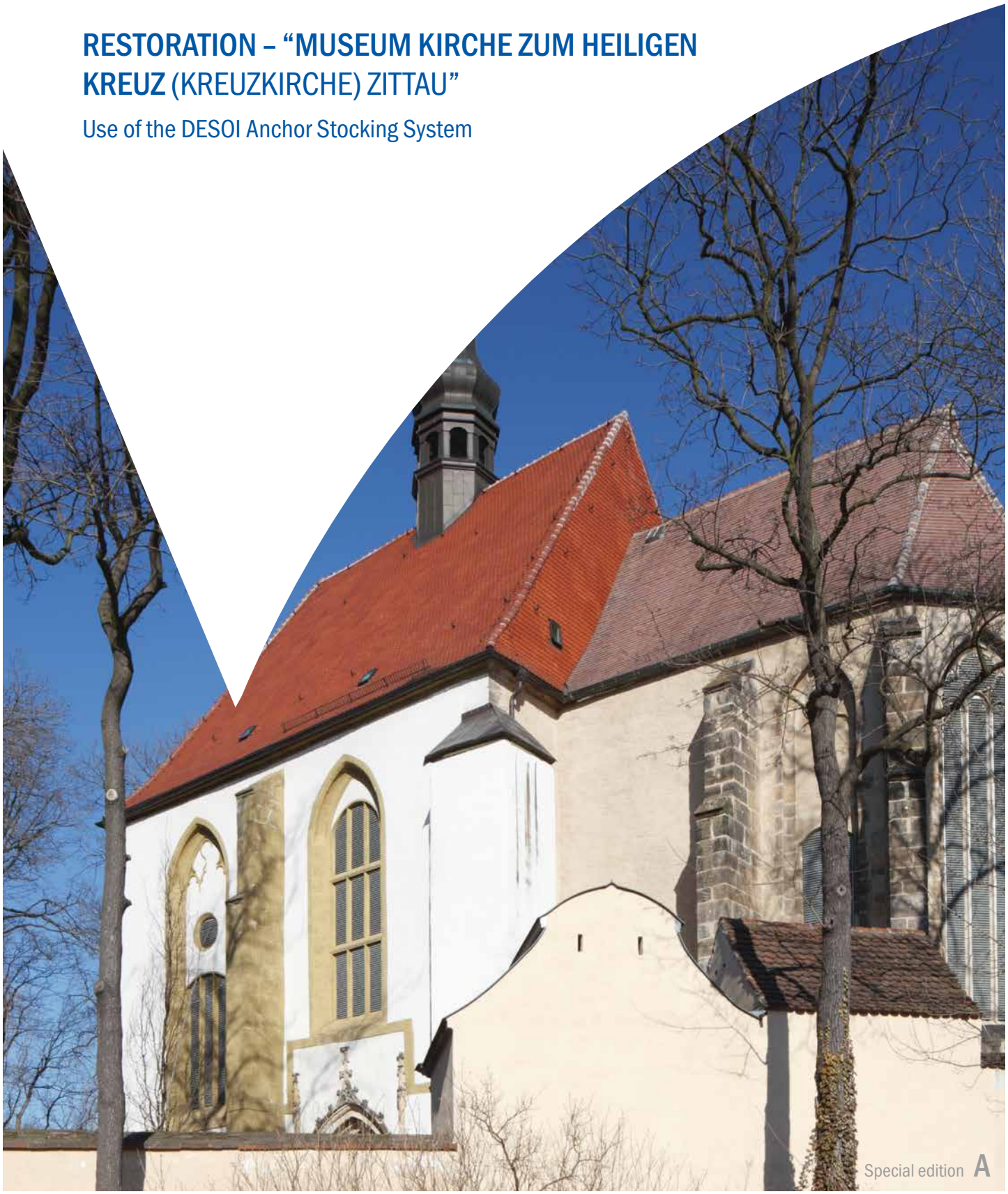
RESTORATION – “MUSEUM KIRCHE ZUM HEILIGEN KREUZ (KREUZKIRCHE) ZITTAU”

Use of the DESOI Anchor Stocking System



Special edition A

“MUSEUM KIRCHE ZUM HEILIGEN KREUZ - ZITTAU”

Building

The “Kreuzkirche” in Zittau is a Gothic church in the Bohemian style and was built in Zittau / Saxony at the end of the 14th century. The two-nave hall church on Frauenstraße has a star vault in its interior, the ribs of which converge in a single central pillar and is considered the largest and tallest single-support church in Germany.
After a fire during the Thirty Years' War, the building, which was being used as a burial church, was restored using late Gothic and early Baroque furnishings. The structure of the church consists of a plastered quarry stone construction with two pillars on the west side and one each on the north and south side, high pointed arch windows and a gable roof, on which a ridge turret with dome and very slender point rest. In 1793, a plaster ceiling was installed in the choir. The sacristy adjoins the choir's north wall. It has a small stair tower on the west side in the corner next to the nave.

Large Zittau Fasting Cloth

One of the most important cultural treasures of the Middle Ages, the “Große Zittauer Fastentuch” (8.20 m x 6.80 m) dates from 1472. Following renovations in 1999, it has been permanently exhibited in the “Museum Kirche zum Heiligen Kreuz” in the largest museum display case in the world (Guinness Book of Records). The fasting cloth, which had been used for more than 200 years during Lent to cover the chancel in Zittau's Johanniskirche [St John's Church], depicts the biblical story from the Creation of the World up to the Last Judgment in 90 pictures. It is considered to be the most valuable exhibit within the museum the Kreuzkirche now houses.

Damage analysis / Problem definition

At the beginning of 2019, employees of Zittau's municipal museums informed the municipal building department that existing cracks in the church's sacristy were widening. A static report was then commissioned without delay. As part of this report, significant static and structural weaknesses were found in the supporting structure of the canopy roof, which covers the sacristy, as a result of which high horizontal shear forces were able to act on the sacristy's longitudinal wall.
These horizontal forces contributed significantly to the sacristy's structure being pushed away from the nave, which was leading to cracks of alarming proportions opening up in both the gable wall and in the sacristy's cross vault.

Crack formation

In addition, it was found that a technical room installed twenty years earlier above the sacristy's cross vault was resting directly on the vault. The additional horizontally directed shearing forces caused by this load were a second significant factor leading to the widening of the cracks in the vault and the gable wall.

Objective

The renovation measures' objective was to minimise or better distribute the loads acting on the building, to neutralise the shearing forces acting on the vault and to stop the sacristy from moving any further from the main nave. The building is a monument of the utmost importance. All work steps had to be carried out with care and with a view to prevent damage to the building and all objects located therein.

Use of the DESOI Anchor Stocking System

Among other things, the use of the DESOI Anchor Stocking System ensured the safeguarding of the historic masonry structure and stabilised the masonry fabric.
Once the construction site had been fully established, the executing specialist company Ansorge carried out all the necessary drilling work using the dry drilling method. Particularly unusual were the two horizontal boreholes along the outer masonry wall, which the company Ansorge from Zittau, known as “Bohrwurm”, created to a depth of 6.50 metres. The boreholes (diameter of 80 mm) were then cleaned by brushing and blowing.
For the pre-defined masonry thicknesses, the anchor stocking systems were partially prefabricated at the DESOI factory and delivered directly to the installation site. A service provided by DESOI that saves a lot of time on construction sites and avoids errors.

“MUSEUM KIRCHE ZUM HEILIGEN KREUZ - ZITTAU”

To protect the valuable murals, the stocking anchors could not be installed from within the church's interior.

Mixing the DESOI AnchorNox® dry mortar before the anchor rods were injected

Fully compressed anchor stocking system

Longer anchor rods were adapted on site to the local conditions. Concrete ribbed steel reinforcements and threaded anchors were installed with diameters of 20 – 22 mm. Depending on the anchors' length, a number of spacers were installed. The anchor stocking was sheathed in a woven protective mesh in the area around the spacers to prevent tears while it was being pushed into the borehole.
The anchor stocking system was then completely backfilled with DESOI AnchorNox® dry mortar using an internal material feed line. The tested anchor mortar from DESOI has good flowability, is sedimentation-free with a stable consistency and machine compatible. It achieves high early and final strengths (compressive strength > 40 N / mm² and flexural tensile strength > 7 N / mm² in each case after 28 days) and meets the conditions required for building material class A1 (non-combustible), while also being resistant to temperature changes (frost-thaw cycles) and sulphates.

Installation purpose / Installation location

- Roof shoring
  - floor above the sacristy's altar room, internal
- Vault protection
  - chancel of the sacristy below the vault, internal and external
- Transverse wall needling
  - gable wall of the sacristy and transverse wall at the stair tower

The operation was accompanied on site by a specialist DESOI application technician as part of a briefing and demonstration.
Another special feature: the stainless steel tie rods used to protect the vault comprised of several parts. Inside the chancel's brickwork, concrete ribbed steel, equipped with an anchor stocking, was anchored on both sides, compressed and then connected to a smooth, stainless steel tension rod, which was stretched across the entire chancel.
For this purpose, it was necessary create anchors equipped with a number of different threads of varying lengths, in advance, at the DESOI plant. This special service, too, is made possible by DESOI's in-house production.

Injection technique used

The DESOI AnchorNox® dry mortar was mixed using a manual DESOI PowerMix HZM-1 mixer (forced mixing). Subsequently, for quality control purposes, a consistency test was carried out with a spreading plate.
The injection took place with the DESOI PowerInject SP20 spiral pump.

More information about the DESOI Anchor Stocking System can be found on our website in the media library.

Application video

Example: Factory-assembled stainless steel anchor with anchor stocking

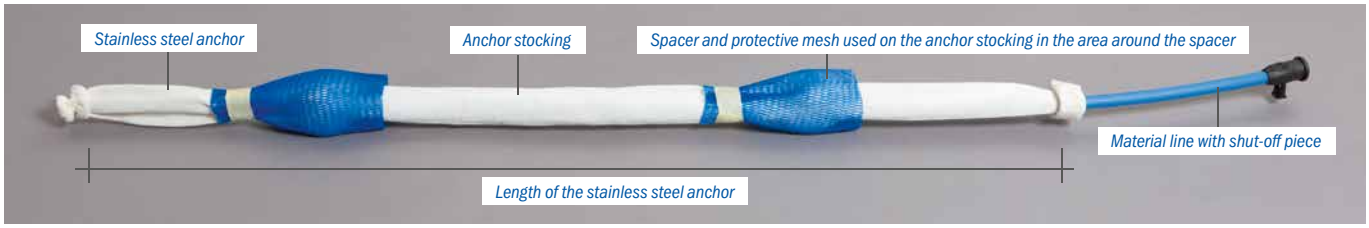


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Photo credit
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