LK 111

Optical-fiber-concrete on curved surface

Optical-fiber-concrete

Based on research of optical-fibre-concrete on curved surface, which was done during a seminar in the architectural faculty of the university of Kassel in the semester of 2006/07, the sculpture light was designed to build for the project "Sign of Walbeck".

This project was guided by Prof. Dipl. Ing. Brigitte Häntzsch from department of design and construction in architectural faculty of the University of Kassel.

The sculpture of light was designed as a cylindrical object set in a room of remembrance following a circle-like deepening in the floor. The aim of this construction process is to create an optical-fibre-concrete with curved surface showing characteristics of exposed concrete.

The sculpture of light was designed and constructed exclusivly for the room of remembrance in cooperation with the concrete labour of the engineering faculty, department of building materials (Fachgebiet Werkstoffe des Bauwesens und Bauchemie) of University of Kassel. Therefore it was necessary to develop a new technique of formwork to solid the optical-fibre-concrete in decorative concrete type with curved surface.

Mock-up of optical-fiber-concrete

The sculpture consists of 7 cylindrical elements, which were prefabricated in the labour and after levelled bearing surface assembled at construction site. The use of special coloured adhesive guaranteed a lightproof connection of the cylindrical concrete elements.

Sign of Walbeck

The room of remembrance is a place of memory of the prisoners of the camp "Gazelle", which was a part of Konzentrationslager Buchenwald, and their forced labour for German armaments industry during World War II in the salt-mine of Walbeck.

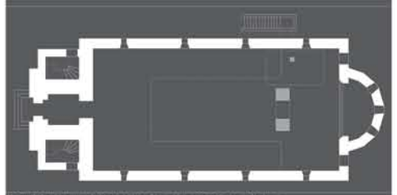
The special position within the inner-german confines, means that these occurrences are little known aspects of history, they have been less explored and discussed, but on the other hand, are not completely disappeared affairs.

Remains of the basement of the camp and the building erected by soviet military to close up manhole after exploiting the mine shafts can be foond in the forest.

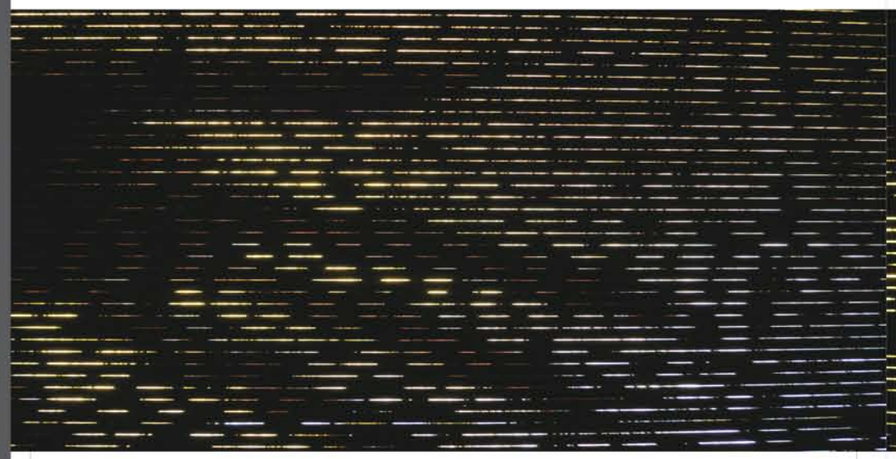
Shaft of Buchberg

The Place

The room of remembrance is located beneath Walbeck community church St. Michael, which can be reached from the outside by stairs. The basement of the church, which contains the room of remembrance, was formerly made to accommodate the heating of the church, and that's why there are wells connecting the basement with the oratory.



Groundplan: nave with position from the room of remembrance



The bench in the room of remembrance

The sculpture of light

Because of the layered organisation of optical fibre the concrete sculpture becomes translucent and a shiny glow from the inside, which can be seen from oratory. The heavy concrete is in opposition to the light glimmering appearance of the luminous sculpture, which can be seen as a symbol of inherent questions of opposition:

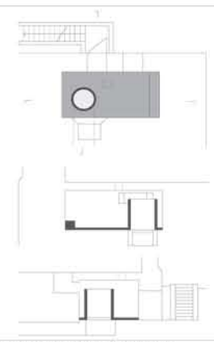
Impervious gets pervious

Opaque gets translucent

Solid seems to be weightless

View: the room of remembrance through a ground-shaft

Wall-shaft with sculpture of light



groundplan, longitudinal-section, cross-section

Concept-modell of the room of remembrance

Room of remembrance

In the 5,00m x 3,00m room of remembrance ends the connection wells from oratory. One of these wells joins in a circular deepening in the floor, another one in a rectangular funnel-shaped wall breakthrough, a third one, a bit smaller than the others is a direct connection as a ceiling opening to the oratory.

Sculpture of light by daylight

Sculpture of light by artificial-light

Concrete-surface with form-work picture

LK 111

Manufacturing-process

Production in form-work (CNC-milling machine)

Build-up from the form-work with inserted optical-fibertextile in all layer

Compresentation from the form-work

Concreting with self-compacting-concrete (SCC)

Silicone expansion-joint

Project-information

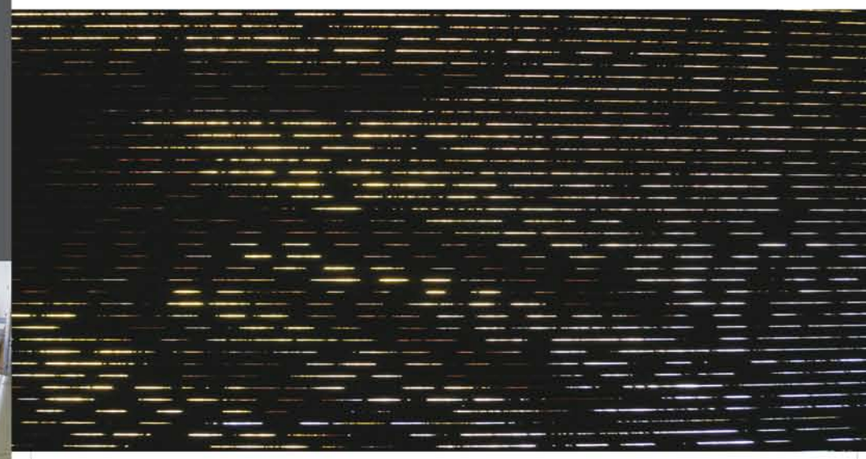
form-work tiling (5mm hard-plastic)

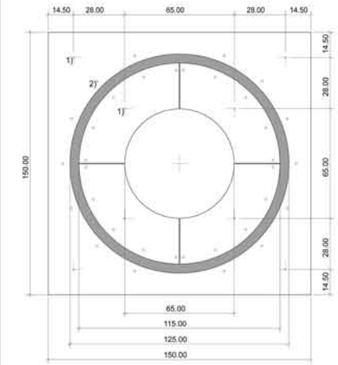
1ring = 54 tilings / 27cm
7rings = 378 tilings / 189cm

fiber-mats
optical-fiber (plastic, Ø70µm)

mats-size 27cm x 10cm, 15 mats/layer

1ring = 810 fiber-mats = 21,87m²
7rings = 5.670 fiber-mats = 153,09m²



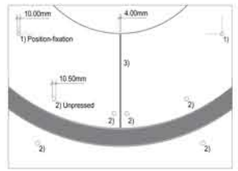


Constructions-plan from inside and outside form-work

Form-work-technique

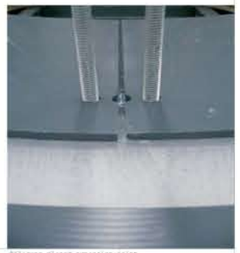
The formwork consists of a rigid exterior and a flexible interior form. These forms align themselves with boreholes, shaping a 5cm-wide ring. The formwork-system consists of 54 dured plastic panels (9mm, CNC-milled) and builds up to a height of 27cm. Optical fibre textils are inserted between every layer.

The interior ring required to be composed of a flexible system, to avoid shrinkage cracks during the setting process. This was detected by experiences, collected while developing the milled formwork technique.



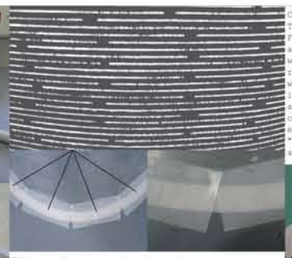
1) Punch-hole 10.00mm for threaded rod to position-fixation
2) Punch-hole 10.50mm for threaded rod to unpressed
3) Expansion-joint in the inside-ring from the form-work

Detail: silicone expansion-joint



Silicone closes expansion-joint

Blackout from optical-fiber-mats



Radial alignment from the fiber-mats with light-intermissions

Concreting
The formwork is poured by self-compacting concrete (SCC). Flow characteristics and aggregates had to be balanced to allow the infiltration of the concrete through the finely woven optical fibre textil. The composition included a retarder, to prevent an untimely concrete setting. This was necessary, because the concreting performed in several interceptions. After concreting the recent concrete was air-proofly covered by a PE-plastic-film. The wetness, caused by the setting process of the concrete, is prevented from evaporation by this plastic-film (the concrete is "transpiring"), so stress cracks on the surface could be avoided.

Fibre-mat insert

The uncompleted intersection of the fibre-mats creates light-intermission in the appearance. The dark digits follow a regular system, what means a displaced laying system, each with 1/2 mats per layer shifted.

To pour concrete with self-compacting concrete (SCC)

Stripping

The overlapping fibres were detached layer by layer, the formliners were stripped off. The flexibility of those thin formliners enables an exterior cylinder elevation without vertical joints.

Stripping

Water-basin

Finishing treatment with water

After the concrete setting the particular ring-segments were stored in a special tempered water basin for at least 7 days. This meant an evaporation protection, which prevents an untimely dehydration (leading to surface cracks) of the concrete.

Finishing treatment of the bearing areas

The bearing areas of the single rings were treated by a grinding process and balanced on each other. The connection and light-proofed coincidence of the rings was effected during the installation by a pigmented concrete-plastic-glue.

Plane the bearing surface