

Cem-FIL® GRC Permanent Formwork

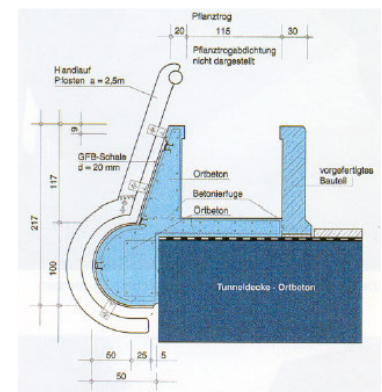
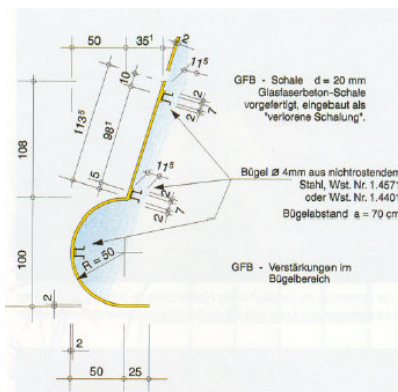
Bridge Parapet Formwork, Germany

INTRODUCTION:

The high flexural and tensile strength, and the relatively high modulus of elasticity of GRC permit the manufacture of thin, but nevertheless strong and tenacious components. These properties make GRC eminently suitable for use as permanent or "lost" formwork. The mouldability of GRC in a fresh state also enables the casting of components of complex geometry. On a bridge in the German federal state of Schleswig-Holstein the elegance of permanent formwork is demonstrated.

FACTS:

- Produced and inspected under factory-controlled conditions
- Complex geometry
- Protects structural concrete from carbonation and road salt ingress
- Construction time and money saved



THE PROJECT:

Federal Highway 76 on the northern German Baltic Sea coast is heavily trafficked by tourists and was upgraded in conformity with the landscape. Apart from improvements in traffic engineering, this also involved better integration of the highway into the landscape by by-passing towns, sound protection measures and lowering of the level of the road.

In a section where the highway by-passes the city of Kiel, the client, (Neumünster Highway Construction Board), decided to lay the road in a trench. Near kilometer 3.6 of the project, two roads and a secondary railroad line cross the four-lane Federal Highway 76. All three traffic routes cross the highway on a common bridge.

The architect preferred round forms for the bridge design. Motorists enter the bridge construction gradually, through horizontal and vertical arches. In the third spatial direction, the bridge capping forms a round belly. In the upper connection on this belly is the conically ending wall of the trough that will later be planted with greenery to decorate the completed bridge. And, finally, the architect had provided for four ornamental joints in the bridge capping - that would later also become the structural joints - which require five different pouring sections on each side of the bridge. The initial plans for the twice-rounded bridge capping had specified the manufacture of in-situ constructed formwork. The construction of this formwork would have been possible, if at considerable expense, but, given the rough operating conditions at the construction site, would hardly have survived the five pouring sections. Multiple construction of the formwork would have led to a cost explosion.

The proposal of DYWIDEX® - Faserbetonwerk Flintbek (near Kiel) to use a permanent formwork of glass fibre reinforced concrete manufactured under controlled factory conditions was therefore accepted and successfully implemented.

MANUFACTURING:

The mould construction department of DYWIDEX® - Werk Flintbek built a formwork, based on the drawings provided, that met both the requirements of the horizontal curvature of the bridge capping (radius = 49.20m) and the vertical camber of the components (radius = 50.08cm). The ornamental joints specified by the architect resulted in a different length for each capping part. By variably restricting the mould it was moreover possible to manufacture the ten parts of between 5.76 to 8.30m length on a single formwork. Under factory-controlled conditions, the requirements of the architect with regard to the textured finish of the sight-exposed surfaces could also be met without problem. Here, in the round section, a formwork constructed of 4cm wide planed strips had been specified and, for the upper tapered section, 10cm wide strips, likewise planed.

Cem-FIL® GRC Permanent Formwork

Bridge Parapet Formwork, Germany

The 10 parts of the integrated formwork were produced by manual spray process. A proprietary matrix with low alkalinity was used. The Cem-FIL® AR glassfibres were cut to 50mm length and added with a content of 3.5 percent by volume.

At a width of over 2m, the parts were so large that sideways spraying was not possible. The worker holding the spray gun, standing on a platform, therefore travelled several times to and fro over the parts until the required thickness of 20mm was achieved.

The longest component had a developed surface of 25m². At a weight of 40kg/m² it thus weighed about 1000kg. These magnitudes call for careful planning and calculation of the transport methods.

Into the rear sides of the still fresh GRC parts 3 stirrup retainers were inserted, spaced 70cm apart, one on top of the other. Into the stirrups a threaded sleeve was integrated so that the retainers could meet two functions at the same time. Upon installation, they anchor the permanent formwork in the backfilled concrete.

INSTALLATION ON THE CONSTRUCTION SITE:

The bridge across the B 76 was built on an originally level terrain. The three retaining walls had been sunk as subterranean curtains. Subsequently, the formwork for the roadway was erected on the ground and backfilled. Next - still on ground level - the reinforcement for the bridge capping and the supporting scaffold for the permanent formwork were installed.

The formwork components arrived at the construction site only at this point. They were mounted on the scaffold by crane, directly from the truck, and precisely positioned. Due to the complex geometry, casting in one cycle was not possible. Multi-layer casting considerably reduced the concrete loads imposed on the GRC shell.

CONCLUSIONS:

The use of GRC integrated formwork resulted in savings, both in terms of time and money for this construction project. This solution moreover has also significant technical advantages:

- The shape and the texture of the finished surface, produced under factory-controlled conditions, precisely matches the specifications given by the architect.
- The bridge capping now has an extremely close-textured surface obtained with closely matching material.
- As DYWIDEX® GRC is impervious to water and resistant to weathering as well as to aggressive environmental actions, it offers effective resistance to carbonation of loadbearing concrete components.

(Information kindly provided by Holger Fürstenberg, DYWIDEX® - Faserbetonwerk Flintbek)

www.cem-fil.com

DELIVERING SOLUTIONS – TRANSFORMING MARKETS – ENHANCING LIVES

NORTH AMERICA
James PATTERSON
TEL: +1 623.566.0260
FAX: +1 208.730.4581
Cem-fil@owenscorning.com

EUROPE
Holger ZORN
TEL: +32.2.674.8318
FAX: +32.2.674.0815
Cem-fil@owenscorning.com

ASIA PACIFIC MIDDLE EAST AND AFRICA
Peter RIDD
TEL: +44 1275 390 968
FAX: +44 117 370 1075
Cem-fil@owenscorning.com



OCV™ Reinforcements

OWENS CORNING
COMPOSITE MATERIALS, LLC
ONE OWENS CORNING PARKWAY
TOLEDO, OHIO 43659
1.800.GET.PINK™
www.owenscorning.com
www.ocvreinforcements.com

EUROPEAN OWENS CORNING
FIBERGLAS, SPRL.
166, CHAUSSEE DE LA HULPE
B-1170 BRUSSELS
BELGIUM
+32.2.674.82.11

OWENS CORNING – OCV ASIA PACIFIC
SHANGHAI REGIONAL HEADQUARTERS.
2F OLIVE LVO. MANSION
620 HUA SHAN ROAD
SHANGHAI 200040
CHINA
+86.21.62489922

This information and data contained herein is offered solely as a guide in the selection of a reinforcement. The information contained in this publication is based on actual laboratory data and field test experience. We believe this information to be reliable, but do not guarantee its applicability to the user's process or assume any responsibility or liability arising out of its use or performance. The user agrees to be responsible for thoroughly testing any application to determine its suitability before committing to production. It is important for the user to determine the properties of its own commercial compounds when using this or any other reinforcement. Because of numerous factors affecting results, we make no warranty of any kind, express or implied, including those of merchantability and fitness for a particular purpose. Statements in this publication shall not be construed as representations or warranties or as inducements to infringe any patent or violate any law safety code or insurance regulation.

Pub. No. 10012229 Owens Corning reserves the right to modify this document without prior notice. ©2010 Owens Corning

Case Study_Parapet Formwork, Germany_ww_11-2008_Rev1