

UTILIZATION OF THIN-WALL GLASS FIBRE REINFORCED CONCRETE IN BUILDING INDUSTRY

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Abstract

Thin-wall elements reinforced with glass fibres (GFRC) have a range of advantageous characteristics; especially due to their low weight it is possible to reduce transport, handling and assembly costs. This benefit is used e.g. at reconstructions of panel buildings as well as in a new development. The thin-wall elements with embedded reinforcement are used as very acceptable alternative balcony panels. GFRC elements can be produced in a large shape variability, which is close connected with a form technique. Therefore it is possible to produce various elements of urban and garden architecture. Massive concrete constructions could be in some applications substituted with slight GFRC elements, which are despite tough and durable.

Keywords: glass fibre reinforced concrete; thin-wall element; façade panel; balcony panel

1 Introduction

GFRC elements are recently increasingly used mainly due to their slight profile and therefore a low weight connected with a high level of strength and durability. These elements find their utilization in building industry as well as in urban and garden architecture.

2 Glass fibre reinforced concrete (GFRC)

GFRC elements are produced from fine-grained concrete reinforced with short glass fibres, which provide strength and ductility of profiles cca 10 – 15 mm. The low weight brings a benefit within transport and manipulation. A GFRC construction is based on a slight profile, which is in crucial areas toughened with blocks from the same material for possible anchor fixing. These elements are also frost and weather resistant. Basic characteristics of GFRC are shown in following table.

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Properties	Declared values
Bulk density	2050 kg.m ⁻³
Absorptivity	10 % by weight
Moisture length changes	1,5 mm/m
Flexural strength	min. 11 MPa
Flexural proportional limit	min. 8 MPa
Flexural modulus of elasticity	18 GPa
Impact strength IZOD	8 kJ.m ⁻²
Frost resistance after 150 cycles	100 %
Class of reaction to fire	A 1

Tab. 1 Basic properties of glass fibre reinforced concrete

3 Examples of GFRC utilization

GFRC elements have found utilization as façade panels, balcony panels, sound protection walls, supplementary façade elements. It is possible to make out also quite complicated shapes like benches, bulk flower-pots and other elements suitable for urban and garden architecture.

3.1 Façade panels

Recently the GFRC elements are greatly used as facing materials for façades of new and rebuilt objects as well. A façade panel consists of a thin-wall shell and a reinforcing peripheral frame, which is dimensioned according to static calculation. Necessary anchor elements are fixed in the frame during the panel production. Thickness of the panel ranges about 10 – 15 mm. A back panel side is plained by hand, a front side is smooth from a form bottom. While using a matrix inlayed into forms it is possible to achieve a various surface pattern.

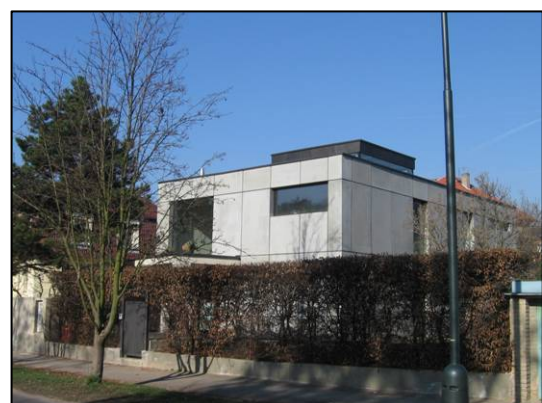


Fig. 2 Airport firehouse, Prague-Ruzyně; Family house, Prague-Ruzyně



Fig. 3 Mendel University, Brno; Airport firehouse, Prague-Ruzyně

3.2 Balcony panels

Balcony panels are manufactured as flat plates with thickness cca 15 mm without the additional peripheral frame and to a balcony railing construction are anchored by means of screws embedded right in the plates. These balcony panels are reinforcing besides glass fibres with an additional glass fabric mesh placed to most exposed areas. Due to this combined reinforcement a higher level of impact resistivity is achieved. Balcony panels fulfil also a strict safety criterion according to CSN 73 0035 and CSN 74 3305. The product has a certificate *TZÚS č. 060_023980*. It is also possible to modify dimensions of balcony panels directly in accordance with customer requirements, inclusive shaped elements production (e.g. curved as an arch).



Fig. 4 Living house, Prague - Letňany; Living house Slunečnice, Prague

3.3 Absorptive sound protection walls

A GFRC shell component as a support and a soundproof part with thickness 10 mm toughened on four sides with a GFRC frame was designed to fulfil the highest wind load. As a covering layer of a sound absorber was selected a solid micromesh glass fabric allowing an air infiltration but not a water infiltration, which is stuck on the sound absorber and on the peripheral frame of the element. Bigger damage is inhibited by a high zinc-coated steel mat, which covers the whole component area.



Fig. 5 Absorptive sound protection wall, Modřice

3.4 Urban and garden architecture

Another utilization of GFRC is possible in urban and garden architecture. As product examples are benches, bulk flower-pots, garden houses, public fountains etc. GFRC products can be manufactured in a large shape variability, which is however directly connected with a forming technique possibility. Advantage of GFRC is a low weight in comparison with standard concrete elements as well as a high flexural and impact strength. GFRC can be also cast as complicated shaped elements displayed in figure 6.



Fig. 6 Figure-bench, Prague – Kampa; bench “Wankel motor”, Brno

4 Conclusion

The glass fibre concrete is a progressive material, which due to its excellent quality finds increasingly further utilization, especially in the applications with the advantageous low weight of elements.

Acknowledgements

This outcome has been achieved with the financial support of *FD – K3/048 “Glass fibre reinforced concrete architectural decorative and supplementary elements”*.