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GRC stud frames

Overlooked opportunity?

Training and education
Benefits and evolution

Bridge construction
Temporary works

GRC stud-frame construction – an overlooked opportunity

Stud-frame construction is often overlooked when producing and installing glass-fibre-reinforced concrete (GRC), despite offering a superior solution. GRC with embedded stud-frame construction offers savings in both substructure costs and a heavily reduced mounting time. Here, ***Nikolaj Ringberg Brandt*** *of* ***BB fiberbeton*** *argues the case for stud-frame construction and discusses the various systems for its installation.*

GRC can be shaped into almost any thinkable form to accommodate the architectural needs of a project. Many finishes can be achieved by adding iron dioxides to the slurry, exposing aggregate after casting, and by applying matrices to the mould. These qualities – together with the lightweight nature of GRC and its sustainability and durability characteristics – drives the large increase in popularity of the material, with both architects and builders (see Figure 1).

Today, a range of fixing systems exists for GRC, with almost all of them allowing for hidden fixing. However, it is difficult for designers and installers to decide which fixing system to use for a project. A stud-frame construction can prove to be a superior option to other solutions.

Figure 1: Geometry and surface option with GRC.

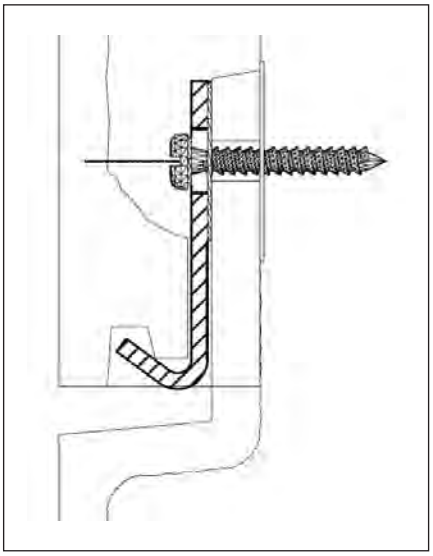

Figure 2: Recess used as part of fixing system, FA1000-system.

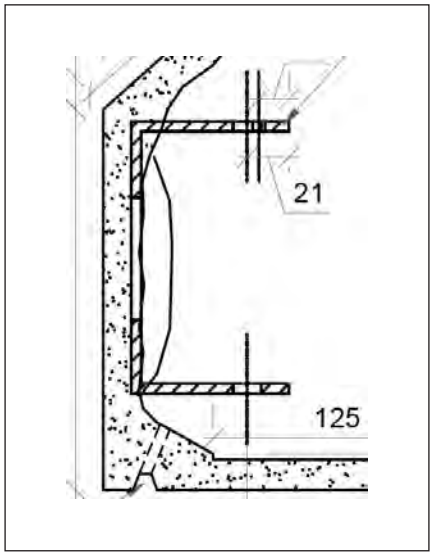

Figure 3: Solution developed for a project in London.

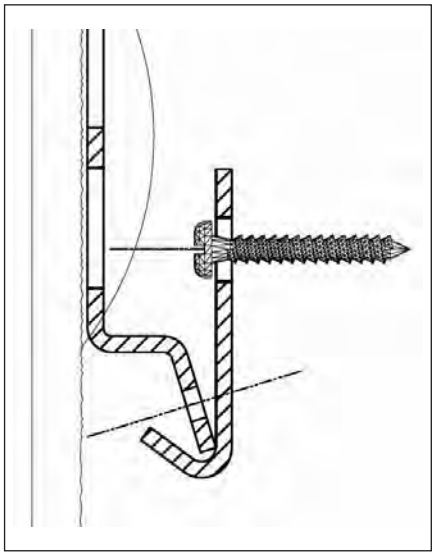

Figure 4: Bracket cast into back of GRC in Copenhagen, Denmark.

Figure 5: Bracket mounted to GRC, Bratislava, Slovakia.

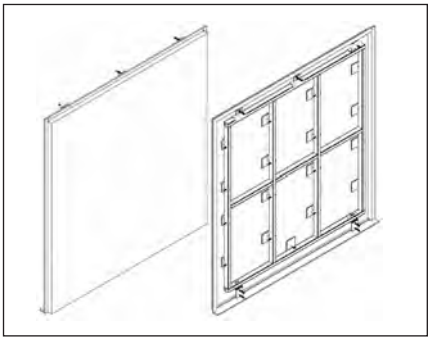

Figure 6: GRC stud-frame construction.

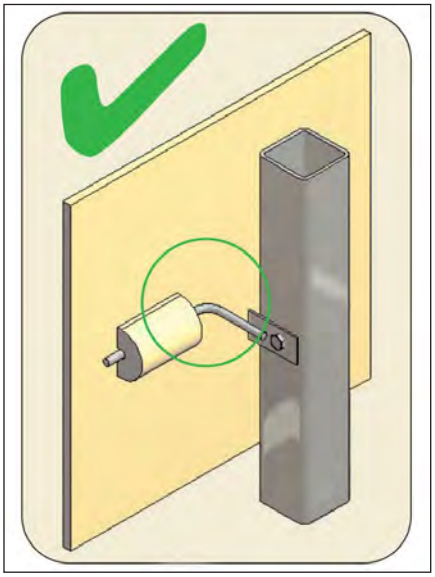

Figure 7 (right): Anchor attached to GRC. *(Image: GRCA.)*

Fixing options

GRC is generally mounted with hidden fixings. Grade 18P GRC, the highest grade according to the International Glassfibre Reinforced Concrete Association, (GRCA), is produced by spraying GRC into horizontally placed moulds, making it easy to cast in inserts or brackets on the back of the elements.

Furthermore, the moulds can be manufactured with recesses, to allow for fixing using the sides or bottom of the GRC elements (Figure 2). However, all types of inserts, brackets and recesses vary. Many projects develop their own fixing system, increasing the costs of design and production, and uncertainty during installation can also become a problem (see Figures 3 and 4). With some projects it is necessary to adapt the chosen fixing, due to the structure of the building, although in most cases tested solutions can be used.

Solutions originating from fixing other materials, such as natural stone, have been used for GRC projects, such as an aluminium subconstruction with a matching C-bracket attached to the GRC (Figure 5). This solution requires an expensive and time-consuming subconstruction and the mounting of the GRC is more cumbersome when trying to get all C-brackets attached at the same time.

Stud-frame construction

An alternative fixing is stud-frame construction, where the substructure is embedded into the GRC; here the substructure and GRC become one element (Figure 6). With this method, only a few mounting points (usually four or five) are needed to attach the GRC to the building.

With GRC stud-frame construction, the GRC element is typically 12mm thick and attached to a bespoke, prefabricated metal frame (typically HDG steel), using L-shaped anchors in stainless steel (Figure 7). These anchors are often placed at 600mm intervals and with correct positioning and design, they act both for wind (flex) and weight (gravity) anchors. Placement and embedding of the anchors allow the correct degree of rotation and moisture movement.

GRC stud-frame construction with an embedded steel frame is a hybrid construction, where each part needs to function statically (individually and together). It is recommended that this is ensured by using finite-element analysis software. The responsibility for this lies with the GRC manufacturer, who has responsibility for the quality, lifespan and statics of the entire GRC stud-frame construction (see Figure 8). A further important consideration is choosing the correct type of steel for a project. A stud frame will allow for easy handling through all stages of construction: on-site; on the production line; during demoulding; quality control; and transportation.

Getting started

"The use of stud-frame construction is often the most economical and preferred method for constructing medium to large panels… At the other end of the scale, stud-

frame construction can often simplify the production and fixing of small panels…"[1] Basically, it often makes sense to use the stud-frame option.

Stud-frame construction is suitable for small elements, due to fixing, and for medium and large elements for both economy and fixing. The design calculations for GRC stud-frame construction are usually made by the manufacturer, rather than the architect, designer or installer. Complexity of the solution should therefore not deter designers from applying it to their projects – instead, the benefits of stud-frame construction should allow more projects to use the method for its fast-mounting capabilities, coupled with its requirement for much less subconstruction (see Figures 9 and 10).

The current push within the construction industry to use more prefabricated materials to limit on-site work may lead to a rise in the use of GRC stud-frame elements. Informing architects and designers of the option of stud-frame construction and ensuring that they specify their requirements to GRC manufacturers during the early phase of design, are key to further growth in the use of the method. The future could see stud-frame construction becoming the default solution for GRC, with the associated cost benefits, for many building projects in the coming years. ■

Reference:

1. INTERNATIONAL GLASSFIBRE REINFORCED CONCRETE ASSOCIATION. *Practical Fixing Guide for Glassfibre Reinforced Concrete (GRC)*. Version 1.1, GRCA, March 2018, available at: *https://grca.org.uk*.

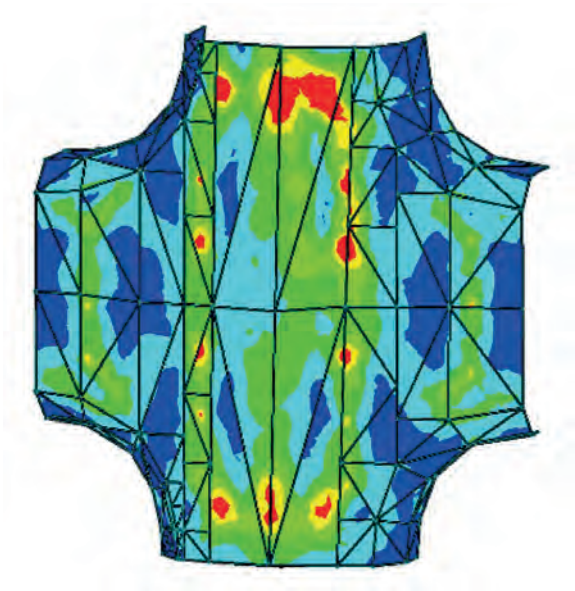

Figure 8: Finite-element analysis, Sky Park by Zaha Hadid Architects.

Figure 9: GRC stud-frame element, Sky Park by Zaha Hadid Architects. *(Photo: KUDIVANI Photography.)*

Figure 10: Example of GRC stud-frame element, Priorn, Malmö, Sweden.