

Structural permanent GRC formwork revisited

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Summary

Over twenty years ago the author presented a paper on a series of preliminary tests carried out on some U-shaped GRC permanent formwork units. The aim was to develop a precast permanent formwork system that could be used with insitu concrete infill to form a composite GRC/in situ concrete beam. It is considered that the same principle could be extended to other structural elements such as columns and slabs. As with all forms of composite construction the shear connection between the two materials acting compositely was a primary consideration. This was achieved in two ways. The simplest form of shear connection was through the bond developed between the insitu concrete and the as-cast surface of the GRC. An alternative, more reliable, form of shear connection was also investigated in the test programme. This consisted of steel reinforcement in the form of a simple arrangement of links and longitudinal bars cast into the GRC. Although the main reinforcement was surrounded entirely by GRC, the links extended into the insitu concrete thereby creating a strong shear connection.

The results of the preliminary tests were very positive. In particular excellent flexural crack control under applied loading and very low carbonation depths were observed. In spite of the very encouraging results, with a few exceptions, GRC has not gained widespread use as a permanent composite structural formwork system. This may be as a result of several factors including lack of awareness, high initial costs and a perceived lack of a clear market for such products. As client organisations focus increasingly on sustainable construction and low life cycle costs, the author proposes that the potential benefits of GRC permanent formwork systems should be reviewed.

This paper briefly reviews the original tests carried out by the author and considers the potential benefits of structural GRC permanent formwork in the modern market place. The various additional protective measures (referred to in EN 206) or rehabilitation systems (referred to in EN 1504) that have been developed to minimise the risk of deterioration and the need to carry out costly and disruptive repair or strengthening works are also examined. The case is made for GRC, a low permeability, low carbonation, high quality surface finish material with excellent crack control characteristics to be used more in new construction as a possible means of reducing the cost of ownership. The case is further enhanced by the reduction in construction time afforded by a structural permanent formwork system.

Keywords: permanent formwork system, GRC/in situ concrete beam.