Innovative concrete to facilitate building rehabilitation

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The Structural Technology Group of the Universitat Politècnica de Catalunya, BarcelonaTech (UPC), in collaboration with the company PROMSA, is participating in the rehabilitation of the Gaudí House Museum in Barcelona's Park Güell. The project is the first to make use of a new lightweight, self-compacting, fibre-reinforced concrete that the group has developed and patented. The new product represents an improvement over existing alternatives for the rehabilitation of old buildings because it is lighter and more durable, easier to apply, and more economical. The material will be presented at the Construmat 2013 International Construction Show, which runs from 22 to 24 May at Fira de Barcelona's Gran Via Exhibition Centre.

HALF concrete adds rigidity to the structure of a building, reduces overall bulk, and is quick, easy and safe to apply because it spreads uniformly over the surface. The concrete can be walked on 48 hours after it is applied. The main use is to rehabilitate or complete existing slabs, particularly in combination with the typical 'Catalan vault'. It is also ideal for use on structures with slabs where decking is used, because it delivers the weight required for elements of this type, offers the necessary strength, and ensures that elements can be filled and are solid.

Innovative application

The new concrete is currently being used for the first time in the rehabilitation of the Gaudí House Museum in Barcelona's Park Güell, a

project directed by Joan Giribet and Jordi Coll, an architect who plays a key role in the Sagrada Família project. As in the case of many old buildings in Barcelona's Eixample district, the slabs of the Gaudí House Museum are composed of unidirectional beams with a small ceramic vault between them and backfilling, which usually consists of ceramic material and construction waste. Buildings of this type often suffer from problems related to movement, which causes tiles to become detached. This poses a risk to users and adversely affects the durability and safety of the building.

With the passage of time, or when a change in the function of a building requires that rehabilitation actions be carried out, it is important not to add to the weight of the structure, and to ensure that filling material is installed in a way that takes into account the urban setting and minimises the time that the public thoroughfare is occupied.

Because it is self-compacting, HALF concrete completely fills the space where it is used. Any air pockets are eliminated as the product settles under gravity. The material is also self-levelling, which ensures that a flat surface is obtained at the desired level. It has a lower density than conventional concretes (less than 2000 kg/m^3 versus 2400-2500 kg/m^3) and therefore minimises the added weight load. The product is also stronger than conventional lightweight concretes.

One of the most important innovative features of HALF concrete, though, is that it contains polymeric fibres, which can replace traditional welded reinforcing mesh. This feature also prevents cracks from forming on surfaces.

When HALF is used in a rehabilitation project, the strategy is to remove any superstructure elements that do not perform a support function, while maintaining the ceramic arch and beams. HALF is then applied, and finally the tiling can be restored.

Another advantage of this type of concrete is that when specific additives are used it can be deposited at the point of application using a pump-and-hose system, which is very difficult in the case of conventional lightweight concrete. Access to rehabilitation works is often difficult. As a result, it is important to provide a product that is pumpable, so that the concrete can be quickly and easily transferred from the mixer truck to the point of use, even using small pumps, which facilitate access to all types of work sites.

HALF is the result of a research project led by Antonio Aguado of the UPC's Structural Technology Group, based at the Barcelona School of Civil Engineering, and carried out in collaboration with PROMSA. Extensive tests and trials have been performed to determine the right formula and ensure that the product has the desired properties. The research has also led to a doctoral thesis by Nayara S. Klein.

Gaudí House Museum

The Gaudí House Museum, which opened on 28 September 1963, served as a residence for the architect Antoni Gaudí (1852-1926) from 1906 until the end of 1925. The building, which is open to the public, houses a private collection that offers a more intimate view of Gaudí. The building has been closed for rehabilitation work since December 2012.

The house conserves the memory of Gaudí and serves as a space to exhibit furniture and other objects he designed. These pieces offer a valuable insight into the architect's work and his approach to design, as well as allowing visitors to learn about the craft production system that operated in Catalonia when Modernisme was in vogue.

The original purpose of the building—to act as a 'show house' for Park Güell—gives the site added value. Park Güell, one of Gaudí's major projects, was originally planned as a private residential area but is today

a public space.

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