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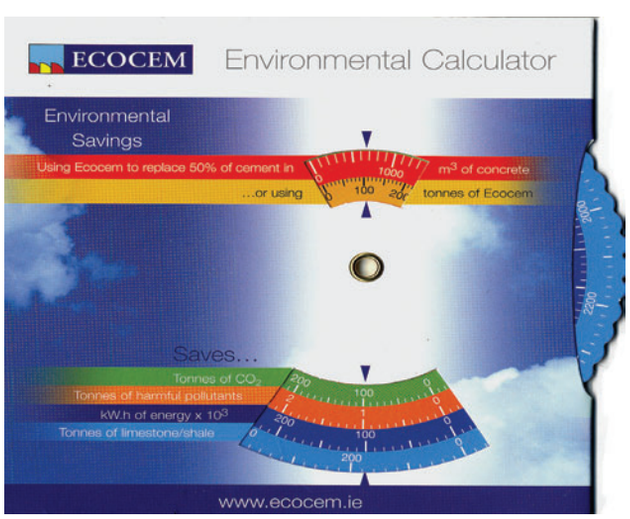
Adding value to granulated slag in European cement markets – experiences in Belgium, Ireland and The Netherlands

Ecocem Ireland Ltd. is leading the way in championing the use of GGBFS in cement manufacture. In this paper, Peter Seymour of Ecocem Ireland discusses Ecocem's business strategy that includes industry-leading research and design, extensive brand promotion and dialogue with EU countries to help change national norms and specifications. A selection of business case studies from the Benelux and UK cement markets are also described. Also featured is an analysis of environmental advantages of Ecocem's pioneering Carbon Neutral Concrete,

Ecocem Ireland and Orcem BV manufacture and sell ground granulated blast furnace slag (GGBFS) in the Irish and Benelux markets respectively. Both companies are wholly-owned subsidiaries of Ecocem Materials Ltd., an Irish company set up in 2001 to undertake industrial developments in Europe in the production and use of GGBFS.

Ecocem Ireland (Ecocem) operates a closed circuit drying and grinding ball-mill for the manufacture of GGBFS. The plant is located in the port of Dublin, and Ecocem has been manufacturing GGBFS at this location since late 2003.



Below: A handy ready-reckoner calculator used to calculate CO_2 savings in concrete

Orcem BV (Orcem) operates a similar closed circuit drying and grinding roller-mill. The Orcem plant is located in Moerdijk, near Rotterdam. Orcem has been manufacturing GGBFS at Moredijk since 2001.

Aims of value-added strategy for granulated slag

Ecocem and Orcem operate a unique strategy to increase the demand for and use of GGBFS in the European construction industry. The three main components of this strategy are to:

- Exploit the superiority of GGBFS concrete

The technical, architectural and environmental benefits of GGBFS concrete are marketed to the end user, i.e. the specifier, developer or building/structure owner. These are the people that will ensure continued growth in the use of GGBFS in concrete.

- Bring about changes in norms and specifications

Many EU national norms are restrictive in the uses of GGBFS in concrete. Changes in these national norms and locally-applied specifications are required in order to realise the full potential of the use of GGBFS in the manufacture of concrete in Europe.

- Create a brand and positive product awareness

Creating a brand and positive product awareness reinforces the superiority of GGBFS concrete. Marketing a single product is simple and effective, and avoids conflict or confusion with other complimentary products, such as blends of cements with GGBFS.

Exploiting the superiority of GGBFS concrete

GGBFS enhances the performance of concrete by providing greater long-term durability and strength, a lighter and better appearance, and greatly-reduced environmental footprint.

The Ecocem/Orcem policy is to promote these three key messages, not to the manufacturer, but to the end-user of the concrete. The end-user creates the demand for GGBFS, and also benefits from the superiority of GGBFS concrete. The end-user is the owner, designer, specifier, builder, operator or user of the concrete structure.

These key messages are communicated through an on-going programme of technical presentations to engineers, architects, policy-makers, developers, contractors and other relevant parties. This is supplemented by continuing advertisements in trade and national media, as well as having a presence at major industry trade shows.

Various innovative marketing tools have been developed to communicate these key messages and reinforce the premium quality of the product. These marketing tools are unique in the slag industry, and have been very well received in our target market. These tools include:

- a detailed technical product manual;
- an environmental calculator;
- a product brochure;
- comprehensive websites.

Ecocem/Orcem provide dedicated GGBFS technical product support to customers as well as a wide-ranging advisory service to industry professionals on all aspects

of the use and application of GGBFS in concrete. This is backed up by an in-house laboratory, funding of university research programmes, and the most up-to-date technical knowledge base on GGBFS.

Ecocem/Orcem make representations to and lobbies senior industry and government decision makers with a view to influencing policy towards use of more environmentally friendly cements such as GGBFS. Ecocem and Orcem are also actively involved in a wide variety of high-level technical committees overseeing the rules and applications for the use of GGBFS in our operating markets.

Bringing about changes in norms and specifications

The current European concrete norm, EN 206, provides no guidance on the uses (and benefits) of GGBFS in concrete. This norm is not due to be revised until 2010. Therefore it will be some time before EU-wide progress can be made on the advancement of the use of GGBFS in concrete. However, changes in several European national annexes to EN 206 have been made to permit the addition of GGBFS as a Type II addition to concrete at the concrete mixer. It is instructive to note that the countries that have made the greatest progress in advancing these changes in favour of GGBFS are those that have an independent GGBFS manufacturing industry. These countries are Ireland, Holland, Belgium and the United Kingdom.

Ireland

It has been the practice in Ireland to add GGBFS at the concrete mixer-stage. No factory-blended GGBFS cements are manufactured in Ireland. The Irish National Annex to IS EN 206-1:2006 establishes specific suitability for the use of GGBFS as a Type II addition in the concrete mixer with the following cement types, as shown in Table 1

This amendment to the Irish National Annex was introduced to permit Irish cement manufacturer to switch from a CEM I to a CEM II/A product. The level of 50% GGBFS addition to CEM II/A is the highest level that is permitted with CEM II/A in any of the CEN member states, and applies across all exposure classes. Also, the k-value of 1.0 is the highest k-value that is applied to the use of GGBFS, and applies equally to both CEM I and CEM II/A. These amendments in favour of GGBFS were achieved by Ecocem, and were based on the results of international research and in-house durability testing on blends of GGBFS and CEM II/A cements.

Holland

The Netherlands have a tradition of using PFA as a Type II additive at the concrete mixer. The standards which were in place for PFA have established a precedent for the use of GGBFS. Table 2 shows the current applications, first with Portland cements only, then with a fly-ash and Portland cement.

Belgium

The levels of GGBFS permitted to be used with CEM I in Belgium – 30% and 15% for differing exposure classes (for BENOR certification) – are much lower than that in Holland and Ireland. In addition, a k-value of 0.9 is also applied, further reducing the maximum permitted amount of GGBFS. Currently a new Belgian norm (NBN B 15-100) is out for public consultation. It is anticipated that this new norm will provide scope for greater usage of GGBFS in concrete.

United Kingdom

The UK has had an independent GGBFS manufacturing industry for over 70 years. As a result, the UK norms permit a high level of GGBFS addition, up to 80%, to CEM I at the concrete mixer, for all exposure classes. A k-value of 1.0 is also applied for all combinations of GGBFS and CEM I. Furthermore, due to the extra durability afforded by the addition of GGBFS, in protecting against sulphate and chloride attack, certain concretes containing GGBFS are permitted to have a lower minimum cement content.

Table 1 (below): Irish rules for the use of GGBFS as Type II addition

Cement types	Maximum permitted percentage of GGBFS	k-value	Exposure classes
CEM I	70%	1.0	all
CEM II/A-L CEM II/A-LL CEM II/A-V	50%	1.0	all

Cement types	Maximum permitted percentage of GGBFS	k-value	Exposure classes
CEM I (min 20%)	80%	1.0	all
CEM I (min 30%) with PFA (max 30%), balance is GGBFS	70%	1.0	XO, XC1, XC2, XC3, XF1, XF3, XA1

Table 2 (above): Dutch rules for the use of GGBFS as Type II addition

Other CEN members' norms

Outside of the above-mentioned EU nations, the remaining countries have much more restrictive rules governing the use of GGBFS in concrete. This is illustrated in the extracts from the CEN TC104/WG15 survey as shown below in Table 3.

Clearly, there are inconsistencies between the rules that are applied for the use of GGBFS across various EU countries. Certain countries have cleared the way for use of GGBFS with CEM II/A and CEM I at percentages varying from 50% up to 80% respectively, whereas others limit its use to as low as 10%, and in some cases there is no guidance given at all for the addition of GGBFS to concrete at the concrete mixer. However there is unanimous evidence from independent research that proves conclusively the technical superiority of concrete containing GGBFS, both in terms of long-term durability and strength, as well as appearance. The more restrictive rules on the use of GGBFS in concrete do not reflect this knowledge base, and these rules are not supported by any technical arguments. Thus there are no technical barriers to providing more open regulations for the use of GGBFS in concrete.

Until restrictive rules are fully relaxed, it will con-

Country	Cements	Maximum permitted percentage of GGBFS	k-value	Exposure classes
Austria	CEM I	25	0.4	All
	CEM II/A	15-20	0.4	All
	CEM II/B	0-10	0.4	All
France	CEM I	30	0.9	All
		15	0.9	XS1, XS2, XS3, XD2, XD3, XF4
		0		XA3
Sweden	CEM I CEM II	70	0.6	XO
		60	0.6	XC1, XC2
		0	0.6	XF4
		20	0.6	All others

Table 2: Examples of other rules for the use of GGBFS as Type II addition

tinue to be necessary to actively market the benefits of adding GGBFS to concrete. To this end, Ecocem and Orcem have implemented a dedicated campaign to promote the benefits of GGBFS in their own markets.

Creating a brand and developing positive product awareness

The brands of Ecocem and Orcem feature strongly in all our promotional material, and are associated closely with the GGBFS product and its benefits. As independent manufacturers of GGBFS, Ecocem/Orcem are able to communicate the message without compromise, avoiding conflict or confusion with other complimentary products or blends of cements with GGBFS.

As independent manufacturers, Ecocem and Orcem are in a position to develop unique links with customers and a strong identity in the industry. This permits development of a strong brand awareness and loyalty.

Carbon Neutral Concrete

Ecocem recently introduced in Ireland the world's first construction projects to use Carbon Neutral Concrete. Carbon Neutral Concrete is the elimination of the carbon footprint of concrete. It is achieved by using a low-carbon cement (contaning GGBFS) in the manufacture of the concrete and the availing of carbon offsets to neutralise the balance of the CO_2 embodied in the concrete, thus reducing the carbon footprint to zero.

Ecocem and Orcem's GGBFS manufacturing operations are recognised as providing additional CO_2 reductions. These CO_2 savings have been verified as Voluntary Carbon Units (VCU) according to the Voluntary Carbon Standard. Ecocem/Orcem sell the carbon offsets in conjunction with their GGBFS to a project to deliver Carbon Neutral Concrete. More information can be obtained at http://www.carbon-neutralconcrete.com.

Achievements

In a short space of time, Ecocem and Orcem have established a very positive marketing programme to promote the benefits of using GGBFS in concrete, and are the only GGBFS suppliers in Europe promoting the value-added message to the market. In addition, Ecocem and Orcem have made significant progress in advancing the national norms in their operating markets to permit a greater usage of GGBFS in concrete. These national norms are now the most liberal in terms of the use of GGBFS in the entire European Union.

Ecocem/Orcem's contribution to the reduction of CO_2 emissions has been certified to the Voluntary Carbon Standard, permitting the sale of carbon credits (VCUs) into the Voluntary Carbon Market. As a clear sign of this progress, the world's first-ever Carbon Neutral Concrete was poured in 2007 in Dublin, Ireland, using Ecocem's GGBFS cement and VCUs.

Ecocem/Orcem are world leaders in promoting the benefits of GGBFS in concrete, and have pioneered many leading initiatives to promote the benefits of GGBFS in construction. Also, Ecocem in Ireland has received several awards for its contribution to sustainable construction.

Below: Ecocem-branded delivery truck; the slogan reads "this load of ECOCEM is saving the emissions of 27t of CO_2."

Conclusions

GGBFS is a high-value product that enhances the quality of concrete construction by delivering superior technical, architectural and environmental performace at no additional cost. Ecocem/Orcem have demonstrated that this message can be successfully communicated to the market, through a range of unique initiatives. One of the reasons for the success of this marketing strategy is that it is being directed to the end-user, as opposed to the concrete manufacturer.

The removal of regulatory barriers in the concrete norms is a key element of the value-added strategy. Ecocem/Orcem continue to have success in removing these barriers. This is helping to create a more liberal market where there is no longer any impediment to the use of GGBFS in the European construction industry.