

solutions

The Lafarge Ductal® newsletter - no. 3 - March 2006

In brief

Client:

**Protection of swimming pools:
Floreo® combines privacy and safety**

Numerous owners of swimming pools are currently seeking to implement protective fences to prevent from accident usually affecting children, particularly in France to comply with the norm NFP 90-306 recently issued.



In Floreo®, designer Gérard Tuduri has created an original, innovative solution.

The combination of minerals and vegetables makes efficient barrier but one forget that the fence exists. The container, made of Ductal®, combines fines lines, lightness and great strength.

The fencing slides into the posts and requires no hardware. The gate is then fitted with a double lock.

This new product is distributed by the precaster Bonna Sabla to professionals serving the swimming pool and landscaping markets.

Contact:

floreo@bonnasabla.com

editorial

Footbridges: When engineering structures lose weight

Seoul, London, Tokyo, Paris, Kyushu, Sherbrooke, ... the list of cities with emblematic footbridges that enhance their images of modernism and architectural creativity is rapidly increasing around the world.

The rebirth of the footbridge in these growing cities can be attributed to a common necessity to smoothly and safely accommodate pedestrian traffic to the cities of tomorrow, as well as plus architectural creativity and exceptional advancements in new material technologies.

The fact that an architect as creative as Rudy Ricciotti considers "this fundamental change in architecture comparable to the invention of the jet engine for aviation", is indicative of the technological revolution that concrete has undergone in recent years. Offering creativity and freedom of design without compromising strength, lightness and ease of installation, Ductal® has opened the way to architects and contractors with a passion for innovation and a common desire for structural durabi-

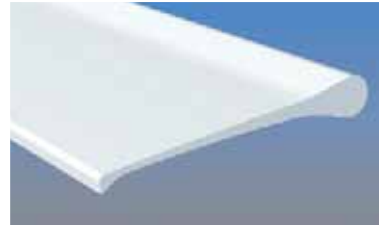
lity and superior aesthetics. This issue describes details of these new footbridges and enhances the development of partnerships between Lafarge and innovative designers. These partnerships involve important joint research and amazing new designs, which deserve to be called "Structural Art"!

Jean-François Batoz.
Director of Development

techno

Sun shade: a design for all façades

Designer Woytek Sepiol wanted to imagine a sun shade that would be capable of fitting most architectural projects. Therefore, in collaboration with the precaster Betsinor, he has designed a Ductal® sun shade that is positioned away from the façade and secured using stainless steel clips. This arrangement favours the entry of natural light and its diffusion upwards, whilst limiting the direct entry of sunlight. These sun shades are suited to all types of façades (concrete, metal or curtain walls). The mineral texture of the Ductal® sun shades helps to reduce glare due to reflection and reduces noise disturbances due to wind, rain, hail, etc. The narrow slats



also avoid the "caged" effect; and are available in lengths ranging from 1.20 m to 3.00 m. Ultimately, these sun shades can be arranged as needed, to limit almost any visual discomfort while preserving sufficient internal lighting and external visibility.

Contact: www.betsinor.com

Le Moniteur - Dec. 2005

An ecological high rise building for the Chinese

Architect Jacques Ferrier, in partnership with Lafarge, has developed a concept for an ecological tower intended for China. This concept, which could be as much as 250 m high, is based on a self-supporting facade made of a Ductal® web, to ensure stability.

d'Architecture - Dec. 2005

Lafarge "Young Architects" Prize: won by the H2O team

Intended to promote the most original and contemporary designs, this competition, organized by Lafarge, awarded the prize to Charlotte and Jean-Jacques Hubert of the H2O team, for their urban furniture and equipment made of Ductal®.

Enjeux Les Echos - Nov. 2005

Very well reinforced concrete

With an arch spanning 120 m, a deck less than 3 cm thick and no middle supports, the Footbridge of Peace in Seoul, Korea (designed by Rudy Ricciotti), symbolizes gracefulness... Constructed entirely in Ductal® including metallic fibres reinforcement, this innovative concrete footbridge is lighter, stronger and more flexible; capable of supporting loads up to 10 times more than bridges made with conventional concrete.

Canadian Journal for Civil Engineering Dec. 2005

Ultra-thin Ductal® Canopies: a world first

The Shawnessy LRT Station in Calgary has the world's first thin-shelled precast Ductal® canopy roof system (see p. 4). As a "world first", the City of Calgary required that a full-scale prototype be sent to the University of Calgary's Centre for Innovative Technology, for a series of extensive load tests. The tests concluded that the canopy carried full-factored live and dead loads without cracking and easily surpassed the test criteria.

Bridges in Ductal®: Tested and approved by the American Federal Highway Administration

Faced with the need to replace a large number of deteriorating road bridges in the USA, the Federal Highway Administration (FHWA) decided to test the performances of Ductal® with a full scale demonstration!



The test bridge in Wapello County Iowa: 3 girders with a span of 33 m: The simplicity of installation considerably reduces costs.

"Today, it is almost impossible to build a bridge that will last for more than a century or even 75 years, using conventional techniques", explains Benjamin Graybeal of PSI, a construction company working for the FHWA. The scene is set: the replacement of aging bridges and the necessary construction of new bridges demanded a solution which would both increase the life of bridges and reduce maintenance costs. In order to subject this new material to a series of tests (to confirm the durability and economics that Ductal® bridges or footbridges in France, South Korea, Japan and Canada have demonstrated), the FHWA approved two pilot bridges; one in Iowa and the other in Virginia.

In the first place, the composition of Ductal® alters the perspective of its performances in relation to conventional concretes and even

metal structures. "Ductal® contains 2 % of metal fibres"; noted Dean Bierwagen of the Iowa Transport Department.

"These fibres, 0.2 mm in diameter and 12.7 mm long, are the secret to the strength of this concrete. In addition, the density of the material ensures a level of imperviousness which considerably reduces the risk of corrosion in time." In building the first bridge in Ductal® in the United States, in Wapello County in Iowa, the FHWA's intention was to test the material's performances one-by-one, starting with strength, permeability and the cost of maintenance.

"One of the series of tests enabled us, for example, to show that Ductal® involves the use of far fewer materials, thereby enabling us to build sleeker bridges, comparable to steel bridges: which are lighter and stronger at the

same time" confirms Benjamin Graybeal. "Furthermore, the girders are much easier to transport and install, which means saving time and money."

The FHWA subjected Ductal® to compression tests at 196 megapascals, a long way from the usual 28 megapascals for conventional concrete. Similarly, the salt and chloride resistance tests for roads, revealed performances 100 times better than those of conventional concretes.

"Lastly", concludes Benjamin Graybeal, "in terms of cost, if Ductal® at first appears to be more expensive, it is essential to consider each project on its benefits. The lower cost of construction and extended life of the structure often make it very attractive in economic terms."

Durability/strength/cost of maintenance

The Shepherds Bridge in Australia opens the way

The world's first Ductal®, road bridge, the Shepherds Bridge, was built 150 km north of Sydney (Australia), to replace an old wooden bridge. With a span of 15 metres and a width of 21 metres, the bridge is made up of 16 Ductal® girders, 1.3 m apart, which support a reinforced concrete slab cast directly on a

stay-in-place form, also made of Ductal®.

The originality of this structure, which was designed and validated by tests carried out by the University of New South Wales, combines exceptional resistance to bad weather and traffic with a particularly low weight: 280 kg/m

for the girders and a thickness of only 25 mm for the Ductal® left in place formwork. Designed and built by VSL-Australia, on behalf of the Australian (RTA) Roads and Traffic Authority, the Shepherds bridge provides durability, strength and low maintenance costs.



The footbridge at Yokemuri consists of a single span, 35.30 m long. The box cross-section has a constant height of 0.95 m and a total width of 3.50. The durability of Ductal® enables it to withstand the region's extreme climates.



The Sakata Mirai footbridge in Japan: no passive reinforcement for this footbridge with a span of 50 m, a width of 2.4 m and a deck 50 mm thick.

Footbridges built with Ductal®: No limit to creativity

More than any other engineering structure, a footbridge can give a city an identity and is, therefore, one of the most sensitive infrastructures. For instance, the Millennium footbridge in London, the Solférino footbridge in Paris or the Ductal® footbridge in Seoul. The architectural aspect takes pride of place and the rules of aesthetics associated with slenderness ratio, colour or texture take priority in the choice of materials. And, whilst steel structures meet many of these requirements, it is often to the detriment of maintenance costs. Laminated wood, which is sometimes an alternative, is far less durable than concrete structures. In its conventional composition, concrete does not allow for the thin, elegant lines the imagination of architects demand. By combining strength, lightness and ductility, ultra-high performance Ductal® has opened the door to new possibilities, with footbridges of innovative design and creativity.

Slenderness, fineness and colour

Civil engineering structures are generally designed to support their own weight at 65 % of the bearing capacity. The reduction of dead load of struc-

tures made with Ductal®, by an average of 3, increases the usual slenderness of footbridges. The primary condition for designing the structure had become the deformation of materials and not their strength. Ductal® now offers a significant advantage, since all geometrical shapes are possible, arches, rigging structures, isostatic bays, mesh structures, etc. Furthermore, the bending strength of this material allows for the design of structural elements without passive reinforcements, allowing for very thin decks of approximately 3 cm instead of the usual 12 cm with other concretes. Ductal® may be coloured, leaving designers to use their imagination.

Durability and little maintenance

Ductal® consists of a very dense, closed matrix which prevents the ingress of aggressive elements. With its exceptional durability, Ductal® applications typically require little or no maintenance; another argument for local authorities seeking structures that reflect a modern image, without committing themselves to maintenance budgets in the long term.

Saint-Pierre-la-Cour: A railway bridge that is twice as light

The "Conseil Général" of the Mayenne ordered a bypass from the town of Saint-Pierre-la-Cour.

It was in this context that the first bridge in France made of Ductal® was built to cross a railway line. This bridge, with a span of 19 m and 12.6 m wide, supports a continuous reinforced concrete road of 7.6 m, a pavement and a cycle track.



The advantage of its design is that it uses all the properties of Ductal® to a maximum.

gain in materials, thanks to a lighter structure and an increase in the slenderness ratio of girders. The 10 girders are pre-stressed by pre-tensioned strands. With the exception of the linking steel with the slab cast on site, the girders contain no secondary reinforcement or shear reinforcement.

A technique which results in a bridge twice as light as a conventional concrete solution. The weight of each girder is 9 tonnes, making handling on site easier. The Saint-Pierre La Cour project required only one day for casting and one day for the bonding of the concrete slab.

Durability: the characteristics of the structure are enhanced by the fact that the underside of the concrete deck and its reinforcements are protected against any damage.

Durability that limits maintenance budgets and provides a more globally economic solution.

Technical data sheet

The characteristics of Ductal®-FO certified by the CSTB

To make Ductal® easier to use with organic fibres for architectural applications, Lafarge has had a complete technical evaluation of the material carried out a French certification body, the CSTB. This evaluation, which has been in place since November 2005, sets out all the characteristics of Ductal®-FO, both in terms of mechanical strength and durability.

The properties certified by the CSTB prove the advantage of Ductal®-FO for the manufacture of non-structural elements, such as:

- thin architectural panels and shells
- cornice outlines
- urban furniture, etc.

This technical evaluation of the material will greatly facilitate obtaining Technical Opinions, Atex or other certification for products or structures made of Ductal®-FO.

This CSTB certification is available on our internet site: www.ductal-lafarge.com

In brief

dabadabada, the star of the Idéo Bain Show

Architects & Designers Anne Durand and Patrick Millet exhibited their first collection of bathroom furniture at the Idéo Bain Show, under their trademark, "dabadabada". "Aware of the fact that the new concretes could be used for things other than sinks and square shower trays, we have imagined and designed a bathroom collection, the design of which should be strong enough to express the potential of this new material Ductal®", they explained. Each sink, may be made from a colour palette that is renewed every year. Their work was awarded the Idéo Bain Show special prize by a jury of professionals.
Contact : www.dabadabada.fr



Idéo Bain: The rough cast bathroom

Composites pour le Sanitaire et Industrie (CSI) presented a new range of wall cladding and floor panels made of Ductal® at the Idéo Bain shows, which was held at Porte de Versailles, January 17t - 22. This wall cladding demonstrates an incredible range of textures and colours, allowing for the design of truly new bathrooms.
Contact : www.csi-sas.com

Greenbuild 2005 Atlanta: Lafarge platinum sponsor of EcoSmart Condo

Ductal® ramps were displayed Nov. 8-10 at the EcoSmart Sustainable Condo, during the "Greenbuild International Conference & Expo" (annual conference of the U.S. Green Building Council). The Expo, with 600 exhibitors, attracted nearly 10,000 participants (specifiers, architects and engineers) seeking the latest technologies for LEED-certified buildings. Lafarge is Platinum sponsor of the EcoSmart Condo: designed by *Busby & Associates, to address the challenges of urban sustainability.



Pour en savoir plus : www.greenbuildexpo.org
www.substainablecondo.com

Prizes and distinctions

Ingenuity, creativity, innovations, The United States do honour to Ductal®

The 24 off-white Ductal® canopies at the Shawnessy LRT Station in Calgary, Canada (designed by Enzo Vicenzino), demonstrate a technological revolution and continues to win awards on the other side of the Atlantic; and, recently, was named one of two "Finalists", competing for the prestigious 2006 CERF/Charles Pankow Prize for Innovation This award acknowledges technological innovation and design with construction materials that increase productivity and performance in industry.

To date, the project has received awards from: APEGGA (Association of Professional Engineers, Geologists and Geophysicists of Alberta), ACI (American Concrete Institute) 2 from PCI (Precast/Prestressed Concrete Institute) and was also a 2005 ASTech (Alberta Science & Technology Foundation) Finalist.



Concrete is the guest of honour at the furniture show



"Mad" furniture from the "Atelier du Béton"

Ductal® was used for many of the creations exhibited, January 6th to 9th in the brand new "concrete home" area of the Salon du Meuble (furniture trade fair). Entirely given over to concrete furniture and objects, it brought together (in a space of 300 m² devoted to furniture designed from Ductal®), ten designers, architects and decorators, who exhibited their prototypes of indoor or outdoor furniture, baths, sinks, floor tiles, light fittings, etc.



"Arlequin" Table from Béton Concept

By exhibiting their latest creations: tables, chairs, vases, planters, etc., they proved that this enthusiasm is now shared by the general public, which are increasingly bringing concrete into their homes, with solid and unique creations.

Contacts :
www.atelierbeton.com,
www.beton-concept.com