

# “BUILDING BETTER CITIES” AN AMBITION DRIVING OUR INNOVATION



Contributing to “building better cities” is the ambition of Lafarge. It is driving our innovation, and is now embedded in a modernized logo.



By 2050, close to 70% of the world’s population, estimated at 9 billion people, will be living in towns and cities, compared to just over 50% today\*. Urbanization on such a scale will be a challenge and an opportunity for the entire construction industry, and especially for Lafarge, present throughout the world, but most particularly in emerging countries, where the Group is strongly established.

Lafarge, a major player with its Cement, Aggregates and Concrete businesses, has placed Innovation and Performance, at the heart of its strategy. Its ambition is to contribute to building better cities by developing value-added products, and construction systems, as well as solutions and services to meet some of the great challenges of urbanization.

Addressing five main challenges, Lafarge’s ambition to **contribute to building better cities**, includes solutions contributing to...

- **more housing in cities**, to address the issue of housing for all, including affordable housing;
- **more compact cities**, with the construction of vertical buildings which help reduce urban sprawl;
- **more durable cities**, with long-lasting constructions and by taking full account of environmental concerns, including energy efficiency of buildings and water preservation;
- **more beautiful**, enabling architectural creativity and performance;
- **and more connected cities**, with a special offer for roads, airports, stations, bridges, tunnels and all infrastructures in general.

This ambition to contribute to building better cities, will be supported by Innovation, which targets an additional Ebitda of 450 million euros in our 2012-2015 plan. This will be achieved thanks to our new offers, new services, new market approach and through our commercial excellence objective.

\* World Urbanization Prospects, 2011 United Nations Report

# Contribute to building more housing in cities



Contributing to building more housing in cities, includes means addressing the issue of housing for all, and in particular affordable housing.

We are tackling this issue by offering innovative products and solutions for the construction of collective housing and tailored services.

DR Urbanology LLP (photographer)



Enable **2 million** people to have access to affordable and sustainable housing by 2020

**One billion** people around the world do not have access to decent housing

## Slums (India) being transformed through an innovative way of delivering concrete

Delivery of delayed-set concrete in 15 litre bags to one of the 20 slums of in Mumbai by moto-rickshaws, to places where ready-mix trucks can not reach, helps bring about positive changes to housing. Concrete enables the construction of stronger houses, which offer protection from the monsoon. **Launched in April 2012 and developed in close cooperation with builders within the shanty town, this solution can be rolled out to other cities and other countries.**

## City houses... in a single building

Houses with garden spaces built “one on top of the other” will soon see the light of day in Bègles (France) city centre. This unusual design has been made possible by a structure of waterproof slabs, carried by slender beams with very long spans and high strength using a mix of traditional and special concretes.

This ‘vertical housing estate’, known as “Les Hauts-Plateaux”, is the product of close co-operation between the local authority, the architect, Christophe Hutin, the developer, Domofrance, and our Research and Development Centre.

It will offer first-time buyers the opportunity to remain in the city centre and to become the owners of a house with a garden at an attractive price.

The project also helps tackle urban sprawl by using previously unused spaces. **Work will begin in the 2<sup>nd</sup> quarter of 2013, with delivery expected in 2014.**

## Micro-financing with Lafarge: support throughout the project

Lafarge has started a micro-financing project in Indonesia, the Philippines and Honduras and will soon expand this activity to Nigeria and Zambia. Its “Ramakhu!” programme in the Indonesian provinces of Medan and Aceh is enabling hundreds of households to renovate or extend their homes thanks to loans at preferential rates.

Support is provided throughout the project – from design to the completion of building works. Borrowers are therefore able to buy the necessary materials and to benefit from the support of technical advisors.

In all, this Lafarge program should involve around 10 million euros to investors over the next two years. Lafarge has signed two initial partnerships with Global Communities and Agence Française de Développement.

# Contribute to building more compact cities



**We are developing solutions to contribute to more compact cities. Proximity housing between employment, infrastructure and services is an essential factor in the quality of urban living. In order to avoid urban sprawl, our solutions allow for more compact cities that are also beautiful, solid and free the necessary space for flora and fauna and for the agricultural land which feeds a growing population.**

DR Pietri Architecte-JB Pietri (architect)



In France **82,000** hectares of wild and agricultural land has disappeared each year between 2006 and 2010, notably as a result of urban sprawl (source: Ministry of Agriculture)

**90 minutes** per day: that's the average travel time for a worker in the Ile de France region (Paris). The figure can climb as high as 4 hours (report from Technologia)

There are more than **8,500** buildings over 100m tall worldwide, with some 600 added every year

## Marseille (France): renovation of the Euroméditerranée district

### CMA-CGM Tower: self-placing concrete for an asymmetrical structure

In Marseille, our self-placing concrete was used in the construction of the 1,200 columns supporting the 145m-high asymmetrical facades of the headquarters of shipping group CMA-CGM, designed by Zaha Hadid.

### Tower H99: a housing block built to withstand strong winds

Marseille's H99 Tower (so named because it is 99 metres tall) designed by Jean-Baptiste Pietri, will be able to withstand violent winds thanks to 50,000m<sup>3</sup> of Lafarge concrete in its foundations and its cantilever structure. The first high-rise housing development in France since the 1970s, it will feature 26 storeys of apartments.

## High-tech concrete for the world's tallest housing block in India

The Lodha World One Tower will be built in 2014 in the centre of Mumbai. Designed by I.M. Pei's practice (also responsible for the Louvre Pyramid), this tower will

break several records: 442 metres tall, 117 storeys, more than 300 apartments, 150,000m<sup>2</sup> of floor space and 800,000m<sup>3</sup> of concrete. We have been chosen to supply concretes of different strengths depending on their use (slabs, columns and walls), including high-performance concrete designed by our research teams specifically for this project in order to increase the durability of the structure.

## An affordable eco-district in Algeria

To the east of the Bay of Algiers, Lafarge is helping architects Arte Charpentier produce a feasibility study for the Bateau Cassé eco-district, with a focus on tourism and leisure. Thus we were involved in developing a construction solution for a two-level "platform" to house shops, offices and public service facilities. Buildings of between 4 and 7 storeys will be built above this platform, consisting of apartments with two to five rooms, structured around "patio-loggias".



# Contribute to building more durable cities



To reconcile urbanisation and sustainable development, we are optimising our production and providing construction solutions which take into account whole life cycle of buildings and their environmental footprint. More durable cities can be developed with stronger and more sustainable buildings which help reduce CO<sub>2</sub> emissions whilst improving energy efficiency.

DR Herzog and de Meuron, Artefactorylab, Herzog and de Meuron (architects)



**50%** of our R&D budget devoted to sustainable construction

**30%** of emissions of CO<sub>2</sub> worldwide come from the life cycle of buildings

#### Sustainable Development Ambitions 2020:

Reduce by **33%** the CO<sub>2</sub> generated by each ton of cement produced compared to 1990

Use **50%** non-fossil fuels in our cement plants by 2020

Ensure **20%** of our concrete contains reused or recycled materials

## In Roanne (France), a concrete house reduces the environmental footprint and reduce CO<sub>2</sub> emissions.

The ABCD+ House (standing for Affordable, Beautiful, Community-minded, Duplicable and positive energy) combines traditional techniques and innovative materials, allowing it to produce more energy than it consumes. This means that it already meets the 2020 Thermal Regulations. Nominated for the 2012 "House of the Year" awards by Union des Maisons Françaises (UMF), it received a gold medal in the "Urban Challenges" category. This solution will soon be duplicated elsewhere in France thanks to a new Lafarge offer.

## Miami Art Museum: where strength and beauty come together thanks to Ductal®

The architects Jacques Herzog and Pierre de Meuron chose our ultra-high-performance Ductal® concrete to create the vertical elements (up to 5 metres high) which support the large glazed façades of the new Miami Art Museum, being built on the seafront at Biscayne Bay in Florida. Thanks to its

exceptional strength, Ductal® enable the creation of sinuous and slender uprights, providing open views onto the veranda, whilst still meeting the hurricane resistance standards in force in this tropical region and offering increased resistance to corrosion from the sea air.

## Aggneo®, our first global range of recycled aggregates

Worldwide, demolition produces more than 1 billion tonnes of waste every year. Reserves of recycled aggregates are substantial at a time when access to natural aggregate quarries is becoming more difficult. We launched Aggneo®, the first global range of recycled aggregates, which is currently available in Eastern Canada, the UK, the USA and, since September 2012, in France. This range offers consistent quality and reliability over time, throughout the world, thanks to rigorous testing at every stage of the production process, from procurement to delivery. Associated services to optimise the supply chain, such as the storage of construction waste, complete this offering which is expected to be launched in some developing countries in 2013.

# Contribute to building more beautiful cities



Contribute to building more beautiful cities means enabling daring architectural designs by providing concretes that give the designers greater freedom. Our concretes combine technical solutions and flexibility in use and offer a variety of textures and options.



DR Médiathèque Lafarge - Charles Plumey Faye - Rudy Ricciotti (architect)

DR Hufton+Crow

## MuCEM mineral lacework in Ductal® between land and sea, in Marseille (France)

The slenderness achievable with Ductal® allowed one of the latest projects from architect Rudy Ricciotti to be draped in lace. Located at the entry to the Old Port in Marseille, the Museum of civilisations from Europe and the Mediterranean (MuCEM) is encased in a second skin produced entirely from our ultra-high-performance fibre-reinforced concrete, which serves as a sun-screen. It provides visitors a full view, taking in the port, the sea and the interior of the museum. This mineral cube, linked to Fort Saint-Jean and the Panier district by two remarkably slender, moulded, monumental footbridges also in Ductal® creates a link between various areas of the city and breathes new life into the fast-changing Euroméditerranée district.

## Ductal® converts the try at the Jean Bouin Stadium in Paris

By using Ductal®, Rudy Ricciotti has been able to design, after a three-year process, the 23,000m<sup>2</sup> asymmetrical concrete cocoon surrounding the Stade Jean Bouin, the temple of Parisian rugby.

The waving latticework offers a double connection between stadium and city, as well as protection from the weather. It represents a world first, and overcomes a number of technical challenges, particularly when incorporating the glass used to ensure the transparency of the Ductal® roof. Lafarge provided the architect with access to its expertise in order to create this striking structure made up of 3,600 self-supporting, triangular Ductal® panels.

## The fluidity of Agilia® at the Musée du Louvre and the London Olympics

At the new Islamic Art section of the Musée du Louvre, Lafarge's self-placing Agilia® concrete allowed architect Rudy Ricciotti to clad the walls with a black facing and create the majestic black staircase that links the museum's two floors. Agilia® was also selected by architect Zaha Hadid for the pared-down structures of the diving boards in London's Olympic Aquatic Centre, which opened for the 2012 games and is now used by local clubs and schools.



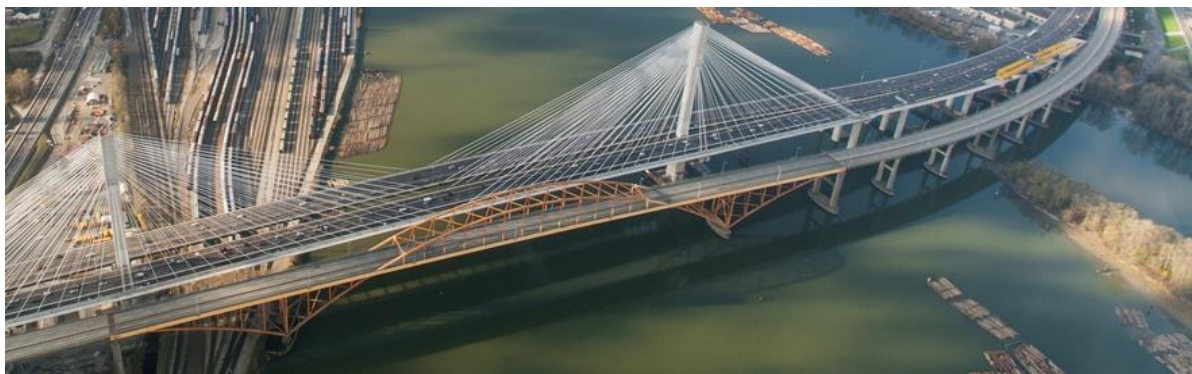
# Contribute to building more connected cities



**Building better connected cities involves the construction of all types of infrastructure:**

**roads, airports, stations, bridges and tunnels to help improve mobility within, and between, cities. Good urban development requires appropriate transport infrastructure to ensure better traffic and reduce travel times for residents.**

**We are contributing to better connected cities by offering infrastructure solutions that are stronger, more environmentally friendly and easier to maintain.**



City dwellers waste an average of **20%** of their daily travel times in traffic congestions

DR Transportation Investment Corporation

## Concrete for efficient infrastructure in Africa

Each day, the Casablanca Tramway, in Morocco, transports 300,000 of the 3.6 million inhabitants on an East-West route over 31 kilometres serving 48 stations. This is the longest ever line constructed as a single project. The project has been completed in record time with our involvement. We supplied 60,000m<sup>3</sup> of self-placing concrete and the same amount of Artevia<sup>®</sup> decorative concrete to produce floor areas, pedestrian walkways and crossings. We were selected for our ability to provide continuous delivery throughout the 30 months of the project (completed in December 2012).

**Cairo Metro:** Africa's largest city and the only one on the continent to have a metro, the Egyptian capital has added a third line to improve coverage. This project required almost 900,000m<sup>3</sup> of concrete of several types (high-strength, ultra-waterproof, self-placing concrete), that we were able to provide thanks to our varied range of special concretes. This new line will allow an additional 1.8 million people to cross the city by 2019, on top of the 3.5 million current passengers.

## Concrete for Canada's record-breaking bridge

The Port Mann Bridge in the west of Canada, is one of the longest cable-stayed bridges in North America (2km) and the widest in the world, at 65m, with 10 traffic lanes plus a cycle

lane and a pedestrian walkway. 180,000m<sup>3</sup> of concrete was needed for the 2,300 deck elements prefabricated from Chronolia<sup>®</sup> for the 300 pier structures, the abutments in Agilia<sup>®</sup> and the two 70-metre horizontal pylons carrying the main cables. We were one of the major companies involved in the construction of this large-scale project, contributing our experience to help a project that went well beyond the ordinary. Drawing on a network of near forty concrete batching plants spread over the 37km of the site, Lafarge helped contribute to this new incarnation of the bridge which has doubled traffic capacity to 800,000 vehicles per week (project completed in 2012).

## An east-west concrete expressway to cross Poland

We supplied concrete for the bridges and roads, aggregates for stabilisation, bulk cement and services such as loading, unloading, testing and pumping for this project which got under way in 2012. This expressway, which crosses central Poland from east to west, will be built of concrete. The lead contractor, Budimex, is Poland's largest construction group. It opted to work with Lafarge because we were the only company able to provide an integrated global offering. We were also able to offer a guarantee of quality and continuous delivery as well as technical support for the design team. The project will require 200,000m<sup>3</sup> of concrete to be delivered to site.

# R&D: at the heart of innovation



**Lafarge's R&D centre is unique within the construction materials sector.**

**The world's leading R&D centre, it develops innovative construction solutions to help build better cities.**

**Our R&D department has a network of more than 1,000 people working in the research centre near Lyon, in technical centres and in development laboratories located in our core markets.**

DR Médiathèque Lafarge-Yves Chanoit (photographer)



We commit nearly **120 million euros** to R&D every year, of which 50% is devoted to sustainable construction.

**The leading holder of patents** in the sector with 154 families of inventions under patent, twice the number of our nearest competitor.

**3 local development laboratories** in 2012 (France, China and India). Two new laboratories in 2013: Algeria and Brazil

**One in every three cubic metres of concrete** sold by Lafarge is a value added concrete

## Depolluting concrete, the latest innovation from our laboratories

Atmospheric pollution is responsible for a large number of health problems, and particularly respiratory diseases. One of the main polluting gases in the atmosphere is nitrogen dioxide (NO<sub>2</sub>), produced mainly by vehicle exhausts. It is therefore particularly present in confined spaces, without natural light, such as car parks and tunnels. The special benefit of the latest generation of depolluting concrete developed by our R&D teams is that it can work even without natural light. A prototype has been created at our Isle d'Abeau research centre and a full-scale test is planned in the Croix Rousse Tunnel, in cooperation with the Grand Lyon authorities.

## Hydromedia™, draining concrete to tackle flooding

Our new draining concrete solution, Hydromedia™, provides excellent permeability and thus allows better drainage of surface water, which can return freely and naturally to the water table.

As an easy-to-use system of managing water recycling, Hydromedia™ is particularly well-suited to large surfaces such as car parks, walkways and areas used by light vehicles.

## Aether®

Developed by our R&D teams, Aether® is a new-generation clinker (basic component of cement) which offers similar properties to traditional Portland cement but helps reduce CO<sub>2</sub> emissions by 25% to 30% due to:

- reduced limestone content
- lower temperatures (around 1,300°C) and easier grinding, which reduces energy consumption.

At the end of 2012, trials conducted by a team of around 100 people over 10 days at the Teil plant (France) produced 10,000 tonnes of Aether® clinker and thus confirmed the viability of industrial scale production using traditional raw materials. The launch of the first products incorporating Aether® is expected in 2014.