Engemix – Votorantim's concrete business – is currently developing a new type of high-flow concrete

Behind concrete's unwavering popularity, various forces are altering the patterns of demand, as **Thomas Allen** discovers

Solid state

It is an oft-quoted fact that concrete is the most commonly used construction material in the world, and demand is showing no signs of slowing down. However, current shifts towards urbanisation, digitalisation and environmental awareness are determining new trends in the global demand for concrete, according to Urs Bleisch, head of growth & performance and executive committee member at LafargeHolcim.

With the resulting strong demand for infrastructure, housing and commercial buildings, Bleisch said, "These needs drive an evolution in concrete materials, from increased demand for quality and durability with expectations of long service life, to increased demand for higher strength as we build higher and densify our cities."

Bleisch went on to say, "Demand is growing almost everywhere, for different reasons and with different regional priorities that depend on maturities and economic cycles – for example, infrastructure and housing demand in emerging countries and growing cities in mature and emerging countries."

As space in cities becomes increasingly precious and structures grow ever taller, LafargeHolcim has seen a growth in demand for higher-strength concrete – over 80MPa. In addition, high labour costs in some regions have fuelled the demand for self-compacting concrete.

To address the issue of climate change, LafargeHolcim has been developing techniques that use less water and produce fewer CO_2 emissions, as well as putting greater emphasis on the energy performance of buildings and their full lifecycle impact.

Urs Bleisch, head of growth & performance and executive committee member at LafargeHolcim

> "These needs drive an evolution in concrete materials, from increased demand for quality and durability to increased demand for higher strength"

Digital technology is part of the solution, with access to digital information through BIM (building information modelling), GPS systems and sensors embedded in concrete structures streamlining the construction process and driving efficiency gains.

Productivity

A key trend identified by Edmundo Correa, general manager of concrete operations in Brazil at Votorantim Cimentos, is the push to increase productivity on construction sites. This, he said, has led to a rise in demand for such products as self-compacting and high-fluidity concrete, which enable contractors to deliver good results quickly.

As a result, Correa said, "Engemix – Votorantim's concrete business – is currently working on a project to develop high-flow concrete that can be used in the entire structure."

In Brazil, the company has launched its Hi-Mix line, which comprises four types of durable concrete tailored to specific demands.

"Gigamix has special additives that provide greater elasticity and is intended for high structural projects; Pisomix is for floors, where durability and surface finish are important; Adensamix is a high-fluidity concrete with an excellent finish, intended for structures with high frame density; and Cristalmix is a self-healing concrete with high resistance, containing crystals that, upon contact with water, react to refill fissures up to 0.4mm wide," Correa said.

Votorantim has also invested US$2 million in new software that enables the company and its customers to track all trucks in a fleet using GPS.

The new Automax Mulitest is a modular system for concrete, cement and steel re-bar testing

>

Wirtgen's SP 15i slipform paver using the company's new AutoPilot 2.0

> The push to increase productivity on construction sites has led to a rise in demand for such products as self-compacting and high-fluidity concrete


Edmundo Correa, general manager of concrete operations in Brazil at Votorantim Cimentos

"So, it is possible to know where each of the concrete mixer trucks is, how long it takes to load it, how long it takes to travel to the construction site and even the concrete volume discharged per minute," added Correa.

Going digital

The increasing influence of digital technology in the concrete sector is contributing to the growing appeal of pre-fabrication, as can be seen in the work of Elematic, a pre-cast concrete production technology provider.

The company is supporting the move to digitalised industrial production by facilitating greater communication between factories and construction sites to enhance the real-time situational awareness of all parties involved in a project.

Olli Seppänen, professor of practice at Aalto University in Finland, said, "First we need data, then we need to analyse that data and then we need to act based on the data analysis. This way we can make detailed plans and predict the workflow accurately."

Elematic is involved in an ongoing research project at the university called iCONS (Intelligent Construction Site), helping to explore how pre-fabrication can be fitted into an intelligent construction site.

The idea is that a RFID (radio-frequency identification) tag can be placed on a pre-fabricated unit at the factory so that its location in the supply chain can be monitored by both the factory and the construction site. The factory and the contractor both have access to a digital twin of the project, which is updated automatically.

Elematic provides its EliPlan system as a resource planning solution for precast factories. By automatically bringing BIM data directly to the production line, it was said to help the factory to optimise the use of resources and minimise waste.


Wirtgen's AutoPilot 2.0 can test slipforming data for kinks and display them on the system's tablet

Along similar lines, UK-based contractor Laing O'Rourke has been working to better co-ordinate the manufacturing and assembly processes by using the DfMA (design for manufacture and assembly) process in the construction of a hospital in Wales.

Gavin Davies, senior digital engineer at the company, said, "It is a well-established approach in sectors such as the automotive and consumer-products industries that are driven by the need to produce large numbers of consistently high-quality products very efficiently."

Outlining how Laing O'Rourke is applying the method to the construction industry, Davies said, "Our approach is to design a defined set of high-quality construction products, such as concrete floor-slab elements, structural columns or modular plantrooms. These are then manufactured off-site in a factory environment and pre-tested or commissioned before being transported to site. On-site these components are assembled into the completed building or infrastructure asset."

For the £350 million (US$445.9 million) Grange University Hospital project, 4,000 concrete components will be digitally engineered and then manufactured at the contractor's Explore Industrial Park, over 300km from the jobsite.

Better service

Digital technology is also helping materials suppliers to better serve their customers. Cemex, for example, has introduced Cemex Go, which was described as a digital customer integration platform that allows customers to order cement on a smartphone.

Customers can place orders, track shipments, manage invoices and make payments for the company's building products from any location that has phone signal or WiFi. Cemex Go is gradually being introduced to different markets, starting with Mexico and the US in 2017, and now in the UK.

Staying on the theme of digital technology, a new automatic computerised control console for concrete, cement and steel re-bar testing has been introduced by Controls Group.

Coming almost 20 years after the first Automax for standard compression and flexure tests was launched, the new Automax Mulitest is a modular system that includes a range of possible upgrades.

It comes supplied with the company's Datamanager software package for standard failure tests, but additional software modules can be added to determine elastic modulus and Poisson's ratio, to >


Power Curbers & Power Pavers's PC7700 paving with a super elevation of 6.7%

PASSION for PROGRESS

bauma CHINA

November 27-30, 2018

Visit us!
Booth A06 + A13

BAUER MASCHINEN

The BAUER Maschinen Group is the leading supplier of specialist foundation engineering equipment worldwide.

BAUER Maschinen GmbH • BAUER-Strasse 1 • 86529 Schrobenhausen, Germany

bma.bauer.de

test the tensile strength of steel re-bars, and to carry out complex displacement-controlled FRC tests.

Up to four testing frames can be connected, from 15kN to 5,000kN, and it was said that the system was designed so that advanced tests can be performed with minimal training.

By integrating digital technology into the machines that create concrete structures, such as pavers, higher degrees of accuracy can be achieved. This is what Wirtgen claims with its AutoPilot 2.0.

The 3D system can be supplied for the company's SP 15/SP 15i and SP 25/SP 25i models to produce a wide range of offset and inset profiles, including concrete barriers, curbs, traffic islands and road surfaces with a width of up to 3.5m.

The 3D system either uses an existing data model or creates a new, digital data model at the jobsite. It comprises a computer that is integrated into the machine and a tablet that is attached to the Field Rover survey pole. Two GPS receivers mounted on the machine communicate with a GPS reference station on the jobsite, and the satellite-based navigation system (GNSS) controls the steering and cross slope of the slipform paver automatically.

The need for a string line is removed, meaning that concrete >

Roll-out

Concrete-impregnated fabric offers flexible, low-carbon solution

Concrete Canvas has introduced a flexible, concrete-impregnated fabric that was said to eliminate the need for large plant equipment on site. Described as concrete on a roll, the fabric can be laid out and then it hardens on hydration.

The product was used in the £90 million (US$114 million) construction of the Church Village bypass, near Cardiff in Wales, which involved the construction of a new bypass road and extensive surface drainage.

An 8mm-thick variant of Concrete Canvas was used by contractor Costain, with approval from the Environment Agency, to line a drainage channel at the crest of a slope adjacent to the new road. It was said that use of the material allowed for rapid installation, resulting in time and cost savings.

Daniel Powrie, project manager for the scheme, said, "Concrete Canvas provided a means of rapidly installing a low carbon concrete ditch whilst maintaining the natural aesthetic of the overall scheme."

Before and after shots showing the use of Concrete Canvas