

# CONCRETE QUARTERLY

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**BOLD AND BEAUTIFUL**

Stunning visual concrete leaves its mark everywhere from the Stirling shortlist to the Shanghai docks

**OXFORD FIRST**

Zaha Hadid adds some snaking curves to the city of spires and quadrangles

**WAVE OF VEGETATION**

The new Paris sustainability research centre with a rolling meadow for a roof



# NOUVELLE VAGUE

A sustainability research centre near Paris has been crowned with a graceful landscaped park on a bed of undulating concrete. Nick Jones reports on one of the most ambitious green roofs in Europe

Just to the east of Paris, there lies a bucolic place of undulating meadows punctuated with wooden cabins and mosaic bursts of red, yellow and white flowers. Office workers can escape the sclerotic sprawl of the suburbs and stroll back and forth along its contoured paths, taking in views of nearby woodland from the higher points. It is reminiscent of a mountain landscape, says Jean-Philippe Pargade, a "soulevement du sol", or uprising of the earth.

Except it's actually a roof. This striking carpet of green, rolled out over three distinct waves of monolithic in-situ concrete, stretches for 200m across the top of the Bienvenüe building, a new centre for sustainable development research in the satellite town of Marne-la-Vallée. For Pargade, the building's architect, the roof is the culmination of a design process that had to reconcile a number of competing demands: the need to create open, public space while bringing cohesion to a disconnected patch of urban realm; the need to cater for a diverse range of demanding functional requirements while also being a model of energy efficiency; and the need to create both a space of quiet contemplation and a showcase of structural virtuosity.

One of the key problems to address was the building's context. Marne-la-Vallée is a 1960s new town that has swollen to house a population of over 280,000. "The public spaces are stretched out and there is no link between the various districts," says Pargade. In recent years, Marne has attempted to create a clearer sense of identity for itself with the development of Cité Descartes, a campus housing faculties for the Université Paris-Est as well as a number of national research centres. The buildings here read like a roll call of France's most renowned

**FOR PARGADE, THE INCLUSION OF MORE GREEN SPACE FOLLOWS A LONG TRADITION OF INTERTWINING ACADEMIA AND FORMALISED NATURE**

architects: there's an ICT faculty by Dominique Perrault, a structural engineering school by Chaix et Morel and an architectural school by Bernard Tschumi. But until now there has been little sense of a connected campus, with each piece of architecture simply expressing its own personality.

The Bienvenüe building is the latest attempt to bring cohesion to both Cité Descartes and the wider town. The 40,000m<sup>2</sup> building incorporates a variety of functions including 25,000m<sup>2</sup> of offices, 10,000m<sup>2</sup> of chemical and material laboratories, a 250-seat auditorium and a 1,700-seat restaurant. These have been arranged in a seven-storey block, which houses the auditorium and many of the labs and offices, and a lower curtain-walled entrance building. The taller block defines the northern edge of the campus, and shields the site from the busy Boulevard Newton, while the lower entrance block presents a long curtain-walled facade directly opposite the structural engineering school, creating a public square.

As the building is the headquarters of the French equivalent of the BRE (see box, overleaf), sustainability was critical. It has achieved France's two main energy performance certificates – NF HQE Bâtiments Tertiaries and Bâtiment Basse Consommation – through a mixture of passive methods, user control and innovative technologies. Key to this strategy are the concrete frames of both blocks, which are left largely exposed to harness thermal mass. Likewise, the vast green roof, with its insulated concrete deck, retains heat in winter and cools in summer. Both buildings are naturally ventilated with openable windows, but extra heating and cooling for the energy-demanding labs is provided by geothermal energy drawn from an underground water table, backed up by mechanical ventilation with air exchangers.

Natural light is maximised through insulated south-facing glazed facades – which are protected by mobile brises-soleils operable by occupants – as well as the lower building's unique roof design. The three undulating waves result in a number of "failles" or faultlines where one hill meets a neighbouring dip, allowing natural light to be drawn



**ABOVE**

The deep-plan building is split in several places to help draw natural light in

**LEFT**

The planting includes long furrows of flowers and evergreens. Wooden cabins by Japanese artist Tadashi Kawamata will also be added to the lawns

**PROJECT TEAM**

**Architect** Pargade et Associés  
**Contractor** Léon Grosse  
**Structural engineer** SNC Lavallin  
**Landscape designer** David Besson-Girard

deep into the building. The concrete deck also cantilevers 2.7m over the entrance, sheltering the facade from the sun.

But sustainability wasn't the only driver for the striking green roof. For Pargade, the inclusion of more verdant space was essential to creating a unified campus, and follows a long tradition of intertwining academia and formalised nature. "I took as a reference point the University of Virginia campus in Charlottesville founded by Thomas Jefferson – a homogenous campus that was designed to symbolise 'the authority of nature and the power of reason'." The roof's raised walkways also created a visual link to areas beyond the campus, such as the woodlands of the bois de Grace et de Grange.

The roof was also a pragmatic solution. The Bienvenüe building's various functions, from offices to the entrance foyer to the vast testing pad for innovative materials (see box, overleaf), required spaces of different heights, and the peaks and troughs of the roof are merely a reflection of this. "I wanted to create a very strong link between the building's design and its contents," says Pargade, "what the English call 'affordance', or the capacity for an object to express its use." ▶



Photo: Laurent Delahousse

## A cathedral of experiments

Named after Fulgence Bienvenüe, the civil engineer behind the Paris Metro, the Bienvenüe building is the headquarters of the Institut Français des Sciences et Technologies, des Transports, de l'Amenagement et des Reseaux, or IFSTARR. This organisation conducts research into transport, infrastructure and various other aspects of sustainable development.

The new building contains labs that explore everything from the impact of noise on health to innovative new materials. But its pièce de résistance is a massive 60m x 10m testing pad, designed to measure the strength and durability of new types of concrete and related materials.

"It is our cathedral of experiments," says IFSTARR director Helene Jacquot Guimbal – "It is rated among the best three in the world." Materials are submitted to intense resistance tests and measured in 3D "to the micron" by high-performance instruments. Due to the high stresses involved, the test slab had to be immensely rigid, so was constructed out of an ultra-resistant C80/95 concrete.

And the testing doesn't stop there. "Our labs are even capable of curing certain diseases within the material and accelerating ageing," says Guimbal, "because it's not possible to wait 30 years to discover a reaction."

**LEFT** The concrete wave overhangs the entrance by 2.7m, shielding the south-facing curtain wall from the sun

Just as important was the need to express a unique structure – in a nod to the structural engineering school across the way. The roof was designed by structural engineer SNC Lavalin essentially as a bridge in three sections, with the central section supported on 1m-diameter fixed circular concrete columns, and the end sections mounted on 70cm-diameter neoprene pads to counter any movement.

Great care was taken in the construction of this curving bridge, in order both to show off the quality of the structural engineering and to ensure a monolithic finish to the exposed soffits and external canopy. The formwork comprised of 20cm-wide steel beams, installed in lengths of

3-4m in a transverse direction; these naturally deformed slightly to follow the curvature. The beams were then covered with 125cm x 250cm Bakelite panels to create a smooth finish to the concrete soffit. Dense steel reinforcement was added, before C40/50 concrete was poured to a depth of 60cm. The whole process took eight months.

The roof was then readied for planting. A 12cm layer of insulation and a waterproofing membrane were added to the concrete deck, followed by a layer of soil between 26cm and 30cm deep, depending on the vegetation. Landscape gardener David Besson-Girard has designed beds of red, white and yellow flowers including tulips and

fritillaries, bordered by long furrows of evergreens, in the manner of a formal French park.

Slightly more unusually, the gardens are also dotted with mysterious organic-looking wood cabins designed by Japanese artist Tadashi Kawamata. Pargade describes these as "a furtive presence that add to the sense that this is a natural environment". It is, but of course it is also entirely man-made, the result of innovative structural engineering and sustainable technologies. As researchers stroll across the lawns, away from the hubbub of the campus below, harvested rainwater irrigates the plants around them – nature and academia working quietly, side by side.