TECHNICAL

Technical Study: Bretton Country Park, Yorkshire

By Amanda Birch 22 March 2018 bd

At the Yorkshire Sculpture Park's new visitor centre, Feilden Fowles has made innovative use of rammed concrete to embed the building into its natural hillside setting

Source: Picture Plane
Visualisation of the completed scheme, which is due to open in September

Overlooking bucolic, rolling pastures, the £4m Bretton Country Park Visitor Centre near Wakefield is emerging from its hillside setting. Nestled in the eastern part of the 200ha Yorkshire Sculpture Park, the 670sq m building, which won't open until September, has a strong connection to its rural surroundings.

Built on a site where an open-cast limestone quarry had operated over a century ago, the building's low, long form and use of materials respond directly to the landscape. "It's very much a piece of the landscape and we wanted it to nestle into the quarry and emerge as a clear, manmade

intervention," says Fergus Feilden, director at Feilden Fowles, the architect for the centre.

Feilden Fowles won an invited competition with its design in 2014 and from the outset the brief was very detailed. The visitor centre had to include a small gallery, restaurant, shop, kitchen and WC facilities, the ambition being to draw visitors to this corner of the park. The estate is already well serviced by Feilden Clegg Bradley Studios' main visitor centre and Tony Fretton Architects' Longside Gallery. However, the FCB visitor centre is often jam-packed and needs another visitor centre to provide relief.

The client was also very precise about the new centre's location. Situated near an existing car park and an under-used entrance off the A637, site investigations had already been carried out, including trial pits. A profile was built up of the site which influenced the new building's footings and foundations.

"We wanted a building to last for centuries and not decades, and with concrete we found visually that we could achieve all sorts"

Fergus Feilden, architect

Feilden describes the single-storey building as having two faces: the arc-shaped west elevation, which embraces the landscape and is glazed at the southern end where the restaurant is located, and the east elevation, which is a 50m-long blank facade of rammed concrete broken in the middle by the main entrance.

"The blank east facade works partly as a buffer given that the building is quite close to the busy Huddersfield Road [A637]. It's like a threshold that visitors have to pass through in order to enter the park," says Feilden.

Source: Feilden Fowles; Jonty Wilde
The architects explored different visual effects on a number of test walls.

Rammed concrete

Given the site's exposure to harsh weather and prevailing winds, the architects decided early on that the building should sit low in the landscape. The presence of a hill influenced the location of the gallery at the north end where the building burrows into the slope, providing a more thermally controlled, protected environment. Sources of inspiration came from the local geology and the vast site-specific art works such as Michael Heizer's Double Negative and Robert Morris's Observatory No. 5.

"A concept emerged of a building constructed of a monolithic material that looked like a cut in the landscape," says Ross Perkin, project architect at Feilden Fowles. Originally, all the solid walls were to be built of rammed earth. But a number of factors, including difficulties in finding a rammed earth expert, meant that rammed concrete was specified instead.

At first, Feilden Fowles wrestled with this change in material. "We did struggle with that decision as we had pursued rammed earth to the nth degree," says Feilden. "But we wanted a building to last for centuries and not decades, and with concrete we found visually that we could achieve all sorts."

The architects discovered that by mixing different pigments and aggregates into the concrete, combined with a retardant on the face of the shuttering and post-striking jet-washing, all sorts of finishes could be achieved. "We did lots of test walls with the concrete supplier and looked at the wider geology of the area, sourcing individual aggregates from the key geological zones which run in that part of Yorkshire," says Feilden.

The test panels were critical to the success of the project. Perkin identified three key variants that had an impact on each layer, creating a different visual effect. The first was the amount of concrete pigment added, which altered the colour; the second was the aggregate type, whether granite, limestone or sandstone; and the third was jet-washing, whether a light, medium or heavy jet-wash, applied after the concrete had cured. A variety of aggregate sizes, varying from 10mm to 30mm in diameter, were also used.

Source: Feilden Fowles; Jonty Wilde
The concrete was poured using 1.2m-high timber formwork sections

“Each layer could have a different combination of these variants, so every day we would end up with something slightly different,” says Perkin. “What we didn’t want was for the walls to have stripes or look contrived. The finished walls on the building look very natural, which is what we wanted and the colour is a fairly neutral, warm brown.”

The architects finally selected the three main local stone types — limestone, granite and sandstone — and laid them in a way that had a historical reference, with the older stones at the bottom. Numerous 1:20 drawings of every section of the wall were also produced as the architects wanted to be specific about the colour, variation, aggregate exposure and the mix used for every layer.

Rammed concrete walls may have been built before, but the complex technique that Feilden Fowles chose, after all its research and testing, has produced a unique finish that subtly resembles layers in the soil strata. “We’ve been calling it layered texture, but it’s still rammed concrete because of the way it’s been laid in shallow layers,” says Perkin.

Once the reinforced and mass concrete trench footings and foundations for the building were constructed, the in-situ rammed concrete external walls were built. This process involved erecting 1.2m-high timber formwork sections fixed with single steel mesh. The mesh was needed for reinforcement, given the heights and spans of the walls and concerns that the walls may bow under pressure. A retardant was applied to the formwork to prevent the surface of the concrete from curing.

Starting from the bottom and working up, the concrete was poured, levelled and tamped down. Each layer within the sections is between 200mm and 400mm thick. After approximately 45 minutes the next layer could be poured to create the desired stratification.

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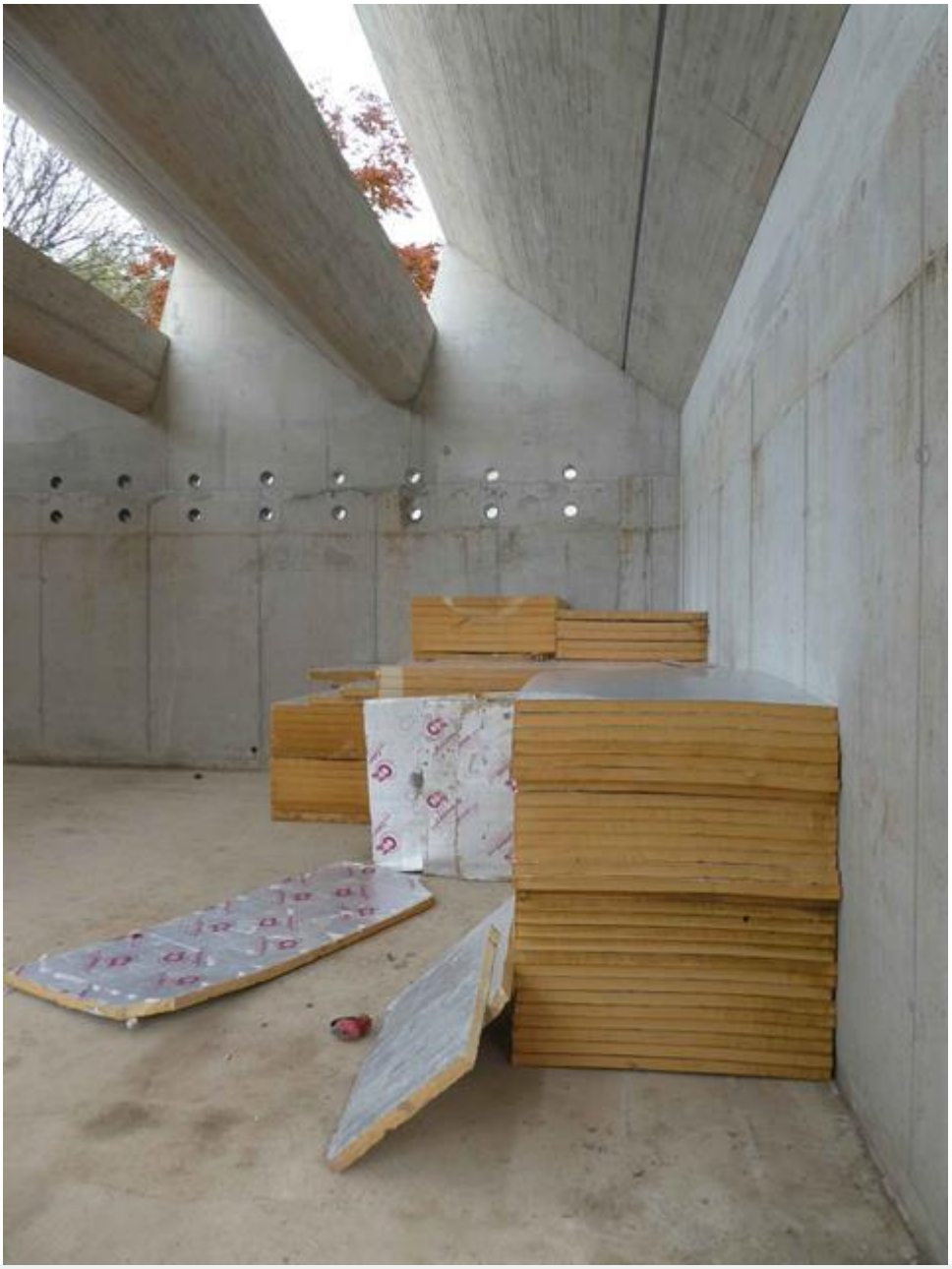
Ross Perkin, Feilden Fowles

Source: Feilden Fowles; Jonty Wilde
The saw-tooth roof was also created using in-situ concrete



Source: Feilden Fowles; Jonty Wilde
The gallery spaces are created from light, board-marked concrete

“We played around with how long we left each pour between each layer because we wanted some bleeding between the layers, so it dried a little and didn’t completely mix together,” says Perkin.

The process was repeated using another 1.2m tall formwork section and mesh, then a third and final layer was built. Within about 24 hours, when the concrete was dry, the formwork was struck and the walls jet-washed. The jet-washing exposes the aggregate, creating a slightly lumpy rather than smooth finish.

“Even when the water was running off, little runnels would form, which was what we wanted because the surface appeared more like sedimentary layers. But we had to be careful because technically we were getting close to the steel mesh reinforcement,” says Feilden. “It was a constant process of juggling these different constraints to get it right.”

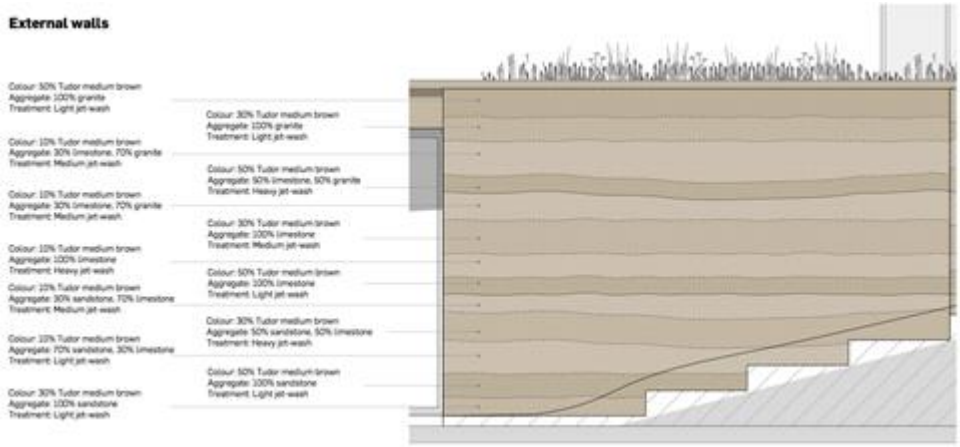
It took around two months to complete all the 300mm-thick rammed concrete walls, which were later lined with insulation and blockwork. Feilden confesses that this technique was one of the biggest technical challenges of the project. “Rammed concrete is not new technology and we could bring other visual precedents to the table, but there were no precedents for the new application we had chosen, which made it hard,” says Feilden.

Concrete is used elsewhere in the building but of a simpler technique. In-situ white concrete, fair-faced and board-marked, is employed to the gallery space, which includes the striking saw-tooth northlights.

Around the rooflights where the building burrows into the hillside, a dense acid moorland planting scheme will be established. This type of roof covering, which will include grasses and gorse, was chosen because the plants are consistent with the local flora, unifying the textures and tones of the building. At the gallery end and above the main roof perimeter, a 2.2m-high glass-reinforced plastic (GRP) screen will be fixed to the main structure via a simple galvanised steel substructure.

“The gallery volume will be expressed as a ‘light-box’,” says Perkin. “The GRP panels will be a milky translucent white, and at night the GRP curtain will glow and show a shadowy silhouette of the saw-tooth northlights within.”

Meanwhile in the restaurant block, warmth is created by employing a bespoke solid Douglas fir structure to the atrium and solid Douglas fir doors and windows which wrap around part of the south and west elevation.



Passive humidity control

As if this building isn't already bursting with technical innovations, there is one more, which concerns the services. The visitor centre may have the first gallery space to employ passive humidity control with a buffer. In this case, the "buffer" is 10,000 unfired clay bricks an idea introduced by environment and services engineer Skelly & Couch, which had been looking at museum projects with passive humidity control systems in archives, but was keen to introduce the concept into a gallery.

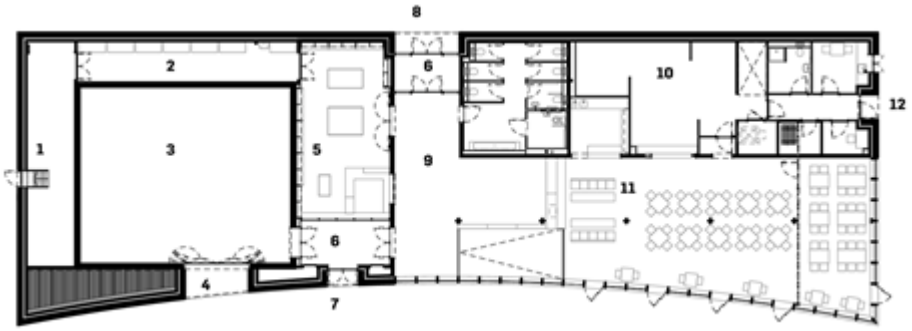
Within a space on the building's west elevation the unfired clay bricks (which are hydroscopic and therefore can absorb moisture) are built into parallel walls to maximise the surface area and to allow the air to pass through. Each brick wall is built up to 4m high with an air gap of 100mm followed by another brick wall.

"Fans controlled by a building management system will draw the air through the brick arrangement," says Julian Cottrill, associate at Skelly & Couch. "The air will then be supplied and extracted through slots at high and low level behind the gallery wall lining to keep it discreet."

Cottrill says that they are aiming for around 50% relative humidity and will allow an annual temperature variation for the gallery of between 16 and 25ºC to reduce the energy required to control the humidity. He adds that once the system is up and running, it will be closely monitored to see how it performs.

As the building nears the end of its construction, the architects can now reflect on the experience. Feilden says it's been one of the most technically challenging projects they've done, requiring a lot more grit and monitoring.

"There are a lot of different materials and components to this building which has required constant co-ordination tying them together," he says. "It's a more muscular building than it appears in the drawings, which is good because our ambition is for the centre to have permanence and stature."



Ground floor plan

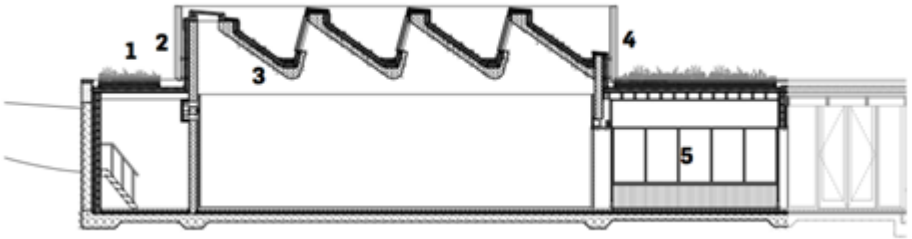
1: Plant 2: Storage 3: Gallery 4: Gallery entrance 5: Shop 6: Lobby 7: Park entrance 8: Car park entrance 9: Interpretation 10: Kitchen 11: Dining 12: Staff entrance

West elevation

1: Waterproof concrete 2: Textured concrete wall 3: GRP screen 4: Single-ply gravel roof 5: Timber curtain wall

East elevation

1: Waterproof concrete 2: Textured concrete wall 3: GRP screen 4: Single-ply gravel roof 5: Timber curtain wall



Section 1: Single-ply green roof 2: Black-out blinds 3: In-situ concrete 4: GRP screen 5: Glazed timber screen

Project team

Architect: Feilden Fowles
Client: Yorkshire Sculpture Park
Structural engineer: Engineers HRW
Environmental engineer: Skelly & Couch
Landscape architect: Jonathan Cook Landscape Architects
Main contractor: William Birch & Sons