

## St Pancras: Rebuilding of the west elevation

**The rumour around the British construction industry for some considerable time has been that we just don't have the necessary craft skills in this country any more, to handle difficult large-scale projects with intricate detailing. The half dozen companies who have combined their skills and expertise to complete the rebuilding of the west elevation of St Pancras, on time and on budget, would however take issue with that assertion**

It is of course extremely unusual to allow part of a grade 1-listed building to be dismantled and re-built with new materials, rather than repaired and renovated. Alastair Lansley, Chief Architect on the project, explains: "In order for us to accommodate the new Thameslink underground line and station, we just needed extra space, and the requirements for the technical plant required to run a 21<sup>st</sup> century railway are considerably greater than those for a steam operation. The original building could not have been made to work in a practical sense."

But before any construction could begin, demolition of the original building had to be carried out with extreme care, to enable the maximum amount of material to be salvaged, recorded, labelled, photographed and eventually recycled.

The main contractor at St Pancras is a joint venture of four major construction companies: Costain O'Rourke Bachy Emcor Rail – otherwise known as CORBER. Their contract is with Union Rail North, on behalf of ultimate project manager, Rail Link Engineering. In turn, the brickwork contract was awarded by CORBER to Irvine Whitlock, whose first task was to work with the companies who had been appointed to deliver the raw materials and ensure the client was satisfied with regard to the original specifications.

The ultimate responsibility for ensuring that the building matches the original as closely as is humanly possible is English Heritage, whose representatives have been involved at every stage of construction, together with the London Borough of Camden and the design team.



Irvine-Whitlock, the brickwork contractors on the site, have worked closely with James & Taylor and Charnwood Brick, suppliers of the unique Charnwood bricks used in the building, Bulmer Brick & Tile Ltd and Bulmer Brick Cutting, who have supplied the arches, and Lime Technology and CPI Euromix, who supplied the lime mortar, to create a close replica of the original grade 1-listed elevation.

The technical challenges facing the project were considerable, yet many who have seen the new building can testify to the fact that the end-product is, in many respects, built to a higher and more consistent standard than the original, due to the care which has been given to the sourcing of original materials and the quality control systems in place at every stage of the production and construction process. The original elevation was built by up to 80 three- and four-man teams of differing craft levels. Irvine-Whitlock has completed the works with just 30 highly skilled bricklayers and 8 stonemasons on site.

### Background

St Pancras, the magnificent terminus of the Midland Railway, opened in 1876. The arch of the glass-and-iron train shed spans 240 feet and is over 100 feet high at its apex. This superb construction was an outstanding feat of Victorian engineering. When it was completed, the massive roof, designed by William Henry Barlow, was the largest in the world. The roof is supported at ground-floor level by 690 cast-iron columns. This level was designed as a huge storage area for beer, transported from Burton-on-Trent. To reach St Pancras, the Midland Railway had to bridge the nearby Regent's Canal and as a result, the station ended high above the Euston Road, with its platforms at first-floor level. The construction of the bridge across the canal meant that the Midland Railway had to level the large burial

ground of old St Pancras church. The architect A W Blomfield sent Thomas Hardy, then a trainee architect, to supervise the carrying away of the human remains. Towering above St Pancras Station is the former Midland Grand Hotel, built in 1868 - 73 and designed by Sir George Gilbert Scott. It was the first hotel in London to have lifts (called 'ascending rooms'). The hotel opened in 1874 as one of the most up-to-date hotels of its era. The cathedral-like structure is the most spectacular of the railway stations along the Euston Road. The red-brick building, not technically part of the station, is an example of High Gothic architecture, with a great clock tower, spires, gables and turrets. From 1935 to the early-1980s the Midland Grand Hotel was used as offices.

One of the biggest issues revolved round the gothic arches. High levels of supervision were needed at all levels to ensure the standards required were achieved, in terms of the fine gauged jointing particularly, where lime putty was used rather than mortar in the 2mm joints.

It is of course virtually impossible to create a 100% accurate replica: the original brick makers have long since gone out of business, and their clay workings exhausted. The key is to find the closest possible matches, and to harness modern workshop practices to traditional craft skills, to produce a consistency of product at an affordable price, within the time-frames envisaged. The technical specifications were extremely rigorous too: the gauged brickwork in the arches, with its fine jointing, requires far tighter tolerances than most modern brick projects. The facing bricks had to be much more consistent in size too. A strong ethos of teamwork between on-site staff and the brick suppliers at Charnwood and Bulmer was essential to the smooth running of the project.

Before any building work could begin, sample panels had to be produced and approved for quality control purposes. One of the biggest questions to be answered was, "What exactly are we replicating?" The original Gilbert Scott-designed building is over 150 years old, so should it be a match to what is there now, or what we think was there originally?

Given that modern brick-making techniques – even hand-made ones – make an exact match an impossibility, an element of compromise in the eventual decisions made was inevitable. Take the main facing bricks as an example: St Pancras was built by Midlands industrialists, and the original product came from two independent brickworks: Thomas Gripper's Nottingham Patent Brickworks, and when they could not keep up with demand, Tuckers in Shepshed, Leicestershire (whom Gripper's eventually acquired). Finding the right Keuper Marl clay with which to make them was not the difficult part: finding a company that could match the shape, colour and texture most definitely was.

Apart from the fact that it was an unusual size brick (229 x 69mm, compared with current UK standard of 215 x 65mm), weathering over the years had badly affected the original brickwork, leaving a textured surface that made a facsimile match virtually impossible.

Extensive investigations were carried out throughout the industry, to try to solve the problem and develop a specification and brief; brick factors, James & Taylor, working with brick



consultant Philip Mason, made recommendations on which companies were best placed to fulfil all the key criteria – not just the technical excellence of the product, but also the ability to produce a hand-made product in very large quantities, to unforgiving schedules.

Peter Mulholland, Marketing Director at James & Taylor, takes up the story: "When the team reviewed the technical specification, and the requirement to closely replicate the existing brickwork in terms of colour, texture and character, we believed, from an early stage, that the only manufacturer able to meet all of these requirements would be Charnwood Brick. But there were still significant technical difficulties and product development to overcome, before an acceptable end-product was achieved.

Martin Warner, Managing Director of Charnwood, confirms the technical challenges presented by the project: "By throwing the brick sideways, we achieved the three key criteria – consistency and accuracy of size, a face and colour that matched the original and two frogs – but at a cost; we could only produce them at a third the rate we normally achieve, because of the time-consuming nature of the production method.

It is Martin's view that modern production techniques produce a much more even and consistent product than the originals. New tunnel kilns mean an even heat at every stage of the firing process, whereas the old beehive kilns meant that bricks in different parts of the oven received differing levels of heat – and therefore ended up as different colours, densities and textures, from a single firing.

By contrast, the red rubbers that were

needed to produce the replica Gothic arches – a total of 45 of them in four different styles have been delivered to date, produced in a polychromatic mix of brick and stone – were a little easier to source. The Bulmer Brick & Tile Company in Suffolk has been making red rubbers for over a century, and their Eocene clay, and therefore their product, is nearly identical to that produced for the original building by Allen of Ballingdon – not surprising since Allen's, which stopped producing bricks at the turn of the century, was only a mile and a half away down the hill towards Sudbury.

As Managing Director, Tony Minter, confirms, "We had to submit various samples in terms of colour and cut, making adjustments to the washed clay mixes to get as close to the original as possible; then we had to refine the making process to arrive at an acceptable brick profile. Once we had achieved that, we had to time the entire process, including cutting and trimming, to arrive at a cost – with hand trimming and finishing, we can only make around 120 a day, so an order for some 17,000 for phase one of the project alone kept us busy. Luckily, we had built up our stock levels in advance, in optimistic anticipation of obtaining the order." The bricks themselves are only half the story, though. Creating the arches was an art in itself. Colin Pinnegar runs sister company, Bulmer Brick Cutting, and was responsible for specifying and cutting the component parts of the arches. The major challenge was to work out how to supply the arches in a manner that would enable bricklayers to work logically through the arch building process with

confidence.

As he explains, "In the end, we devised a 'building by numbers' system, providing diagrams of each arch, with the correct number shown on each brick to be laid; then we designed and produced a self-stacking tray, with minimum footprint for storage, onto which we loaded each brick to be laid – individually numbered in chalk – in the order in which they were to be laid, with a blue card between bricks, to mark each new course. The larger arches comprised two pallets (left & right hand side), each containing 13 trays of sixteen hand or machine-cut soft red rubbers."

The final piece in the jigsaw is the lime mortar itself. Lime Technology, working with English Heritage, produced over 150

coarseness came from a works in Shillingstone, Dorset, which went out of business some six years ago. Luckily, we still had 30 tons of it in stock, which we were able to utilise!"

Once the final specifications were agreed and approved, Lime Technology and CPI Euromix manufactured the various pre-blended dry mortars, in the industrial quantities required, for the first time on such a major commercial development. It was then delivered in tankers and put into mobile silos on-site.

So how did the brick-laying contractors manage, with all this unique product, at the sharp end of the project? Barry Johnston, the site manager for Irvine-Whitlock, admits that for the first few weeks there were many challenges to

project, "everyone agrees that the quality of craftsmanship that we have achieved with the finished product is absolutely outstanding, and a testament to the teamwork between the many parties involved, that was essential to the project's success."

"There is of course much still to do: Eurostar is due here in 2007, and it will be 2009 before the hotel is finished and the Kent Express starts running." (The latter, it is alleged, was critical to the success of the 2012 Olympic bid, with the Japanese-style bullet trains due to take passengers from St Pancras to the Stratford, East London, Olympic site in under 10 minutes.)

"However, with phase one complete, and Midland Mainline now relocated in its



different mortar samples to try to meet the challenging specification of matching the original: a good visual match in terms of both colour and texture, and workability with new bricks – which may be a good visual match to the originals, but still have different build characteristics.

When the original mortar was analysed, it was realised that the lime and sand that had been used was no longer available: with thousands of limeworks in the Victorian era contracting to just a handful, the closest match found was a French hydraulic lime, distributed in the UK by Castle Cement.

Lime Technology's Ian Pritchett takes up the story: "We eventually narrowed down the 150 samples to around 20 variants that were used in test panels, before the final selection was made." "For the fine gauged arch work, however, we had to produce a pure lime putty, with no sand at all. The closest match for colour and

overcome, and it took them a while to get into their stride.

"We've learned a number of things that will help enormously with any similar future projects. For example, experience has shown that mixing the mortar, and leaving it to stand for a while, before remixing, makes it creamier and easier to use. If the brick is too dry, it absorbs the mortar too quickly, and soaking the bricks before use means the mortar takes that bit longer to set, and leaves a bit more room for manoeuvre if repositioning is necessary. This is particularly important, given the tightness of the jointing.

"With the arches, as you'd expect, the first one was the most difficult. With only 2mm joints, they really do have to be spot on. Once we got used to the process, though, and thanks to Bulmer's labelling system, we were able to get an arch a week up by the end."

"In the end," says Steve Nuttall, CORBER's Building Director on the

new home, we can look forward with confidence to completing the project, on time and on budget – unlike some major high-profile projects I could mention.

"Perhaps the final word should go to Geoff Irvine, Managing Director of Irvine Whitlock. "Many architects seem reluctant to design buildings involving detailed brickwork, apparently because of a perception that there is a serious shortage of craftsmen capable of carrying out skilled work of this nature. I personally do not believe that there is such a skill shortage in the UK, and the proof is in the quality of workmanship on show in the rebuilding of the west elevation at St Pancras, which I fully expect to last a lot longer than the original building it replaced. We have clearly demonstrated, with this project, that difficult large-scale projects can be achieved, using a combination of skills to produce a consistency of product from start to finish."



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