CONSTRUCTING THE CRYSTAL PALACE

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In 1851, without computers or modern building techniques, the Victorians completed the largest single building in the world from initial design to public opening in just eleven months. The main contractors for the Crystal Palace were two Midland companies, Fox & Henderson and Chance Brothers. Prince Albert (1819-1861), Queen Victoria's husband, was a major supporter. This article will attempt to explain how this building project was achieved.

General view of the exterior of the Crystal Palace, London, 1851, from *Dickinsons' Comprehensive Pictures of the Great Exhibition*, 1854.

Prince Albert, Henry Cole and the Royal Society of Arts

The nineteenth century saw the growth of exhibitions of arts and manufactures throughout the industrial world. After a number of small exhibitions, the Royal Society of Arts held an exhibition in London in 1847 which attracted over 20,000 visitors, encouraging the Society to hold another in 1848 which brought in 70,000. The following year they attracted 100,000 while starting to plan a much larger international exhibition for 1851.

Leading lights in this plan were Prince Albert, President of the Society, and Henry Cole (1808-1882), a career civil servant active in the Society's exhibition programme. They travelled to see that year's exhibition in Paris. After experiencing hostility as a foreigner who married the young Queen in 1840, Albert was rapidly establishing himself in British society. Active support for a great exhibition was a means of establishing his credentials as a British patriot.

The Society established a number of planning committees which decided that 'The Great Exhibition of the Works of Industry of all Nations' would open on the 1 May 1851. From the start it was to be really large, too large for any existing buildings in Britain, and they discussed plans for the rest of 1849, inviting architects to submit schemes for a building in Hyde Park.

The Royal Parks insisted that the site could only be available for a couple of years and so the building would be temporary; yet it would grow to be, possibly, the largest single building in the world. The committees rejected all 250 architects' designs, then designed their own scheme, which the public ridiculed and did not meet the requirement for fast erection and rapid removal.

Joseph Paxton's Design

By May 1850 - without an agreed building and with as many as 14,000 exhibitors from around the world bringing up to 100,000 exhibits and the world watching - it is probable that panic set in. At this point, Joseph Paxton (1803-1865) entered the picture when, on 7 June 1850, he went to view the newly built Houses of Parliament and witness its acoustical problems. He was with an MP and suggested that too many people had influenced the building, to its detriment. Paxton also mentioned that he had heard of the Exhibition Committee's problems which he blamed in part on 'too many cooks'.

Paxton trained as a gardener at the Duke of Devonshire's estate at Chatsworth in Derbyshire where he became known for the building of the celebrated, and very large, glass and iron conservatory completed between 1837 and 1840. Through the 1840s Paxton moved up in society, becoming a director of the Midland Railway Company and a respected public figure.

He mentioned to Mr. Ellis, the MP, that he had a notion for an acceptable building which would be thirty times the size of his conservatory at Chatsworth. The Exhibition Committee heard of this suggestion and asked for drawings in two weeks, possibly to remove 'this mere gardener' from interfering in such an important project.

At the Midland Railway's directors' meeting on 11 June 1850, Paxton sketched on his blotting pad a building which was to grow into the Crystal Palace in under eleven months. The ambitious plans were completed and submitted, with detailed estimates, on 20 June but the Committee then pondered over it for some days. Paxton went over their heads to let the public see his design in the *Illustrated London News* on 6 July.

Finally on 15 July the Committee gave in and accepted the inevitable. Paxton had already contacted Chance Brothers and Fox & Henderson for detailed estimates of the cost and feasibility of the tight time scale for the building of 830,000 square feet (83,000 square metres) with a mezzanine adding another 30% to the floor area.

Scale

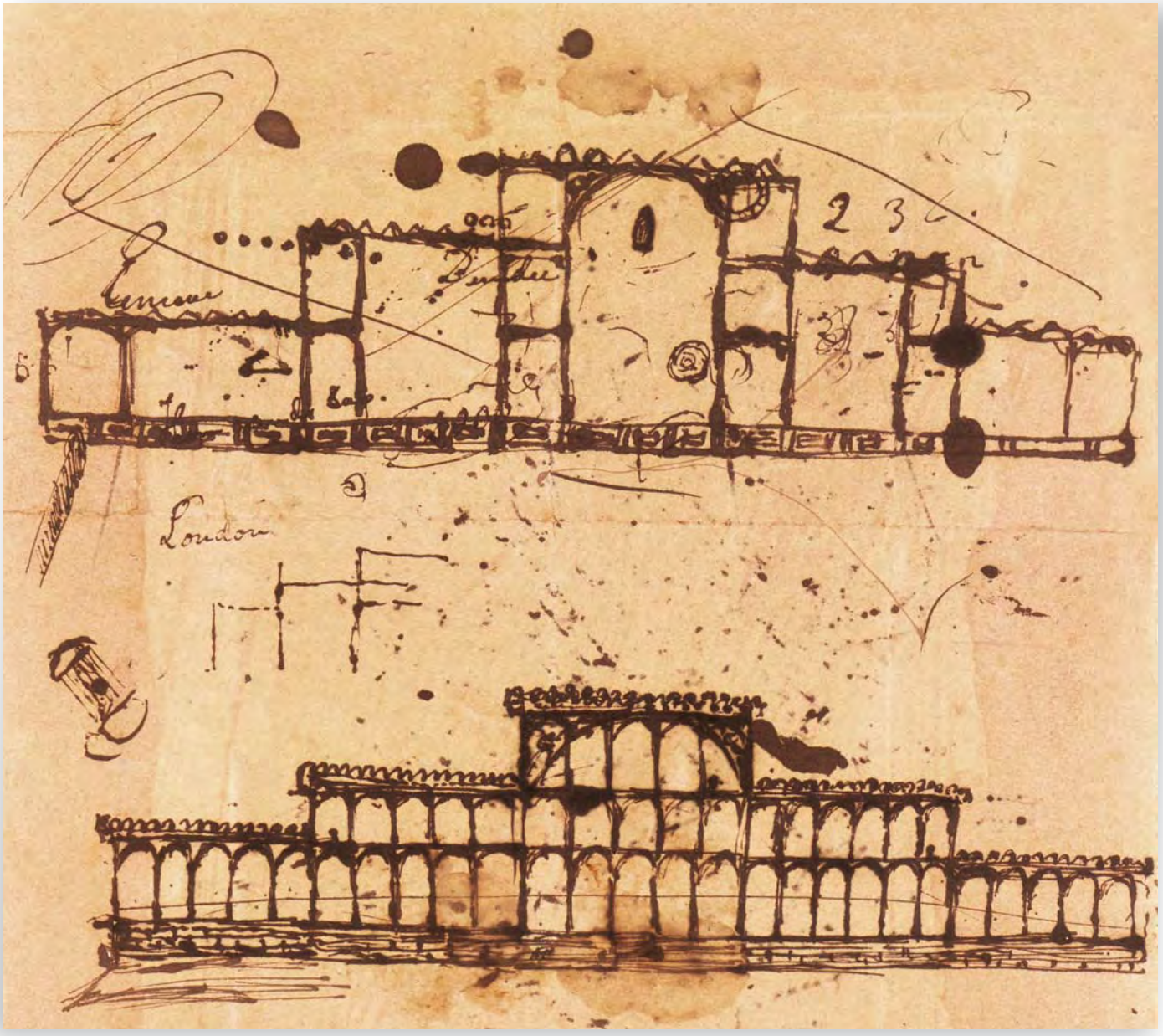
It is difficult to appreciate the extent of this ambitious building which would be constructed on the south side of Hyde Park, where the land is reasonably flat – although three elms, too large to be quietly removed, had to be accommodated in a transept, reaching above the general roof line, across the centre of the building.

Word of the plans, and the trees that were likely to be removed, reached the public and there was great agitation against the scheme led by a particularly outspoken MP. If we compare the structure with well-known buildings in Birmingham, it is possible to judge how big the Crystal Palace was to be. Symphony Hall and the ICC would fit nicely in one end of the building; the transept would be over the Hall of Memory and the entire Council House, Museum and Art Gallery would fit in the other end.

Preparing and Planning

The construction site in Hyde Park was handed over to the project on 30 July and a hoarding erected round the 29-acre (126,600 square metre) site for the 19-acre building. The hoarding was constructed of planks which would be reused as the floor of part of the building. Workshops were established off-site with machinery to produce the twenty miles of gutters needed and nearly fifty miles of glazing bars as well as the many other timber components. There was even machinery to speed the painting of all the timber parts.

Orders were placed with the contractors and their subcontractors for more than 900 columns, many in three sections, which would also form the down-pipes from the gutters between the ridges of the roof. There were over five thousand beams to join the columns and six thousand beams to support the gutters. Twenty miles of drains were needed to connect all the down-pipes to take rain water off site to an outfall, probably into the Serpentine in the Park, as well as drains from the public toilets.



Joseph Paxton's early sketch of the Crystal Palace, drawn on pink blotting paper and showing side elevation and cross section.

Glass and Iron

Chance Brothers brought glass workers from the continent to supplement their workforce, producing the glass panes for the roof and some of the walls. Fox & Henderson had their own foundry but other firms, including ones in the Midlands, are likely to have been subcontractors for the 3,800 tons of cast iron and 700 tons of wrought iron in the building.

A great many other firms supplied the rest of the materials for the building and the whole project showcased both British manufacturers and the quality of their products, including control of dimensions so that the prefabricated building could be assembled quickly. The railways provided the transport necessary to get everything to London, with wagons and drays moving the components to and from the trains.

The first column was set up on 26 September and construction must have progressed from one end, as installing the roof glazing had to start well before the building frame was completed on 11 December. Glazing the roof presented problems because large sheets of glass could not be manufactured quickly enough, and so each pane in the roof was some 10 inches by four feet (25 x 120 cm) and there were 290,000 of these panes in the roof.

The panes were installed from wagons running along the gutters and the workers on those wagons located up to 18,000 panes a week, each with its glazing bar. It is unlikely that there was any decent sealing between the panes of glass but the slope from ridge to valley of each pane and subsidiary gutters below the slopes seem to have removed all leakage.

View of the foreign nave from the American Gallery by J McNeven, 1851.

Completion and Use

The building was completed with walls constructed of timber or glass panels and with ventilating grilles fitted top and bottom. There was a boiler house, which was to provide steam to the working exhibited engines and to the engines driving exhibited machinery, but the building was without general heating or lighting because it would only be open from May to October during daylight.

Exhibit installation started in mid-February and this, along with building fit-out, was completed in time for the opening on 1 May 1851. The workers employed on the building rapidly rose from some 500 as frame erection started to 2,000 with opening approaching. Concerns about the strength of the floors and the building frame were allayed, to some extent, by military personnel marching, and even jumping, up and down in unison, but were finally set to rest when 92,000 visitors were in the building at one time.

It was not just the exhibits which showed the state of innovative and new ideas: most visitors had probably never used a flush toilet, but there were four spaces 24 ft by 48 ft (7 metres by 14 metres) providing public toilets for visitors. Many visitors made several visits to the toilets just to see them flushing.

The building contained suitable refreshment rooms and in these spaces some of the park's trees were left, growing through the roof, to create a 'palm court' effect. Almost half the exhibition space was devoted to foreign exhibitors. Security was provided partly by the considerable crowds policing themselves and also by a force of 300 police officers. At night the police patrolled in felt slippers which enabled them to monitor any exhibitors staying behind as well as apprehend any intruders.

Adverts and Images

Many companies, including Midland-based ones, capitalised on having exhibited and won medals at the Exhibition. Many firms' adverts for the rest of the century included reproductions of the medals which were awarded to them.

There were several grades of catalogues and guides to the exhibits with varying amounts of detail, but the full catalogue in four volumes – occupying nearly ten inches of shelf space – is a wonderful indication of both the range of exhibits which reached the Crystal Palace and also of the state of industrial design, style and production industry in the mid-nineteenth century.

A significant aspect of the Exhibition's impact was the many colourful illustrations of the Exhibition's galleries, and exhibits in those galleries, as well as monochrome illustrations where appropriate. All these illustrations were, of course, artistic interpretations of the view and events but with a new element.

Unlike previous national occasions, it was not possible for illustrators to re-proportion their interpretation of the building, because there were also photographs of both the outside and inside of the building, within a decade of the invention of photography. These 'calotypes' needed a very long exposure and so there are no people to be seen, but the graphic illustrations also do not show the obvious crowds attending because the illustrations were also intended to show the exhibits in some detail. The only illustrations which show crowds are those of the entrance and ticket desks when, if anything, the artist exaggerated the numbers present.

Visitors

Over three hundred committees were established around the country to encourage local firms to exhibit and to arrange the transport necessary to carry the expected crowds to London. Well over six million visitors came to the Exhibition and there were accounts of some people walking prodigious distances to visit, while even travelling to London by train was quite an expedition.

A special train was laid on from Carlisle which started at 1.00 am with a 3rd class seven-day return costing thirty shillings, a good weekly wage for a skilled worker. Entrance to the Exhibition cost 5 shillings for Saturday, 2 shillings and 6 pence for Friday and one shilling for the other weekdays. The Exhibition was closed on Sundays.

Initially the government, worrying about royal security, intended the opening ceremony to be in private, but were persuaded that it should be open to those paying a pound each together with the exhibitors, contractors and special guests. 25,000 are thought to have witnessed the Queen open the Exhibition, while another large crowd attended the closing ceremony on 15 October. The official figure for attendance during the Exhibition was 6,039,195 and they paid some £522,000 for admission.

Achievements and Aftermath

The building itself cost £170,000 and fit-out was £165,000, giving a profit of £186,000 which translates to about £74 million today. This money allowed the purchase of the land south of Hyde Park which, in 1862, included the site used for another International Exhibition, and the land then became the location of the Albert Hall, the South Kensington Museums and colleges. Other parts of the purchase were to produce rent or income which, to this day, pays for various educational scholarships.

The building was dismantled in 1852 and the site returned to park landscape, but a further part of the legacy of the exhibition was the reuse of undamaged components, augmented by many more component parts to enable a new Crystal Palace to rise in Sydenham. This building was a place of public entertainment, with proper foundations, heating system and artificial lighting. It had an area some 30% larger than the Hyde Park building.

This gave the name of Crystal Palace to an area of Sydenham, a railway station and a football team. This Crystal Palace was on that site for over seventy years until a disastrous fire in 1936 reduced it to piles of debris. Currently there are plans for another Crystal Palace along the same lines but at very considerable cost, so this scheme may founder.

Despite some obvious problems over the timetable and the reaching of decisions, there is little doubt about the extraordinary achievement of those involved in the creation of a suitable building to house this 'Great Exhibition of the Works of Industry of all Nations'. ●

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