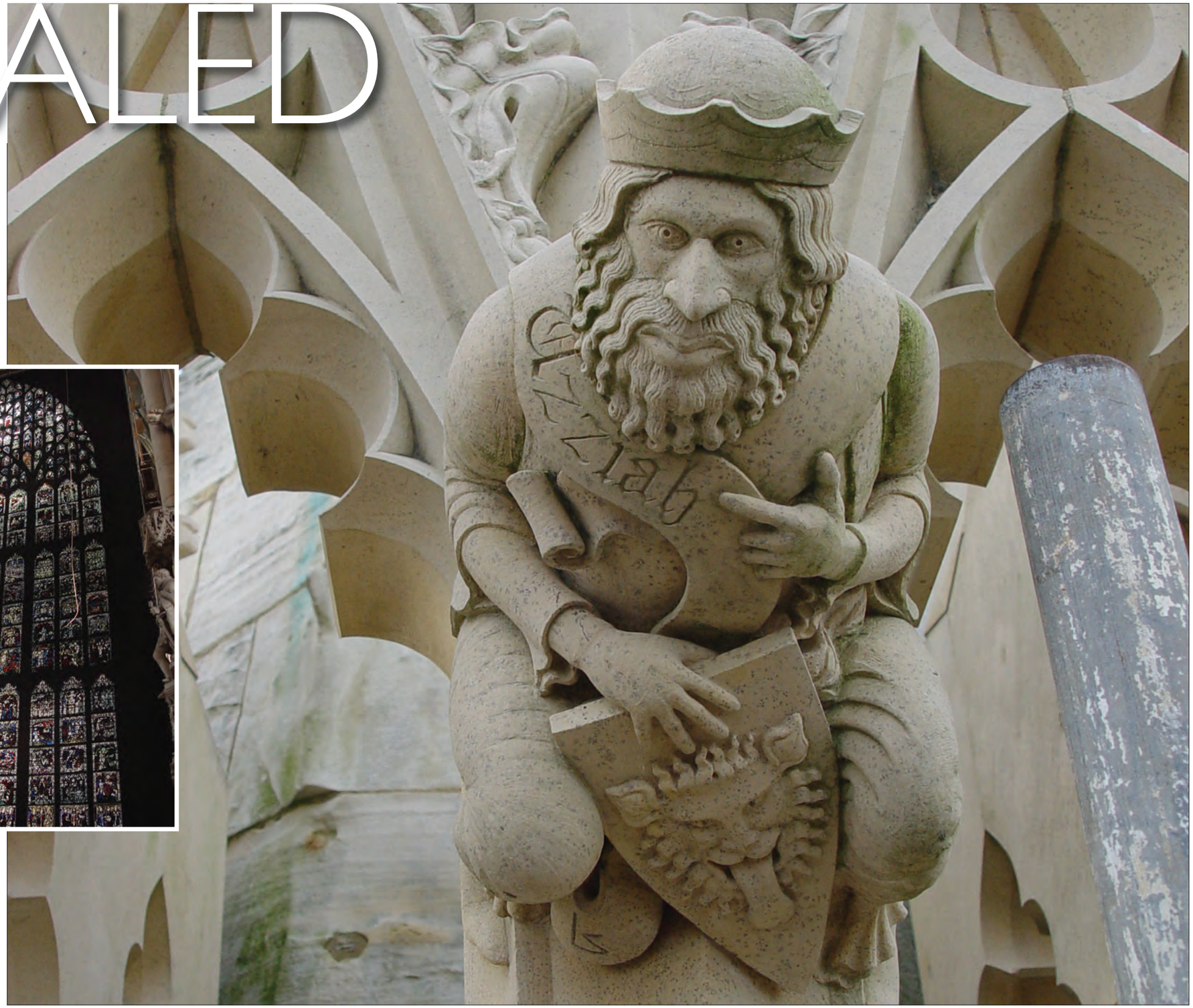
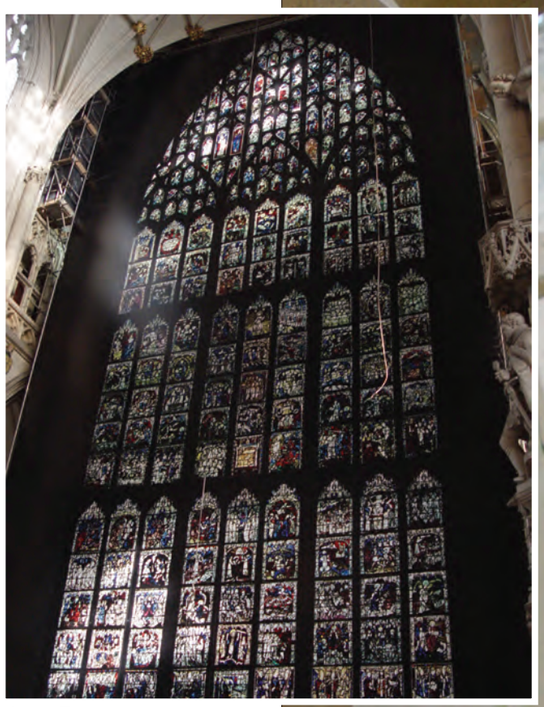
# York Minster

# REVEALED



York Minster Revealed is a £20million, five-year project (the largest of its kind currently under way in the country) to restore the East Front of the Minster and improve access. The work includes a major restoration of the magnificent tracery window with its 145 stained glass lights.



Above. The drape over the window at the East Front of the Minster behind which masons are restoring the magnesium limestone tracery.

Right. One of the carvings and new masonry on the rebuilt southern buttress of the East Face of the Minster that gained the Minster's masons top honours in the Craftsmanship category of the Natural Stone Awards in November.

# York Minster

Above. The masons at the Minster have learnt from their predecessors and are using moulten lead to create the joints between the stones of the tracery on the Great East Window. This is Lindsay Hogarth pouring the lead.

Below. Keim fillers are being used to repair the stone where it is still structurally sound. Nanolimes are also being used. John Sutcliffe is pictured here carrying out repairs.


York Minster is one of the UK's great cathedrals and the £20million, 5-year renovation of the East Front currently underway there – including work on the huge Great East Window constructed from more the 300 individual pieces of masonry – is the largest project of its kind currently in progress. In November, work so far undertaken on the East Front won the Minster's masons the Craftsmanship category of the Natural Stone Awards (see the December issue of *NSS*). The quality of the masonry and carving was "exemplary", said the judges.

The current project goes under the name of York Minster Revealed, because an integral part of it is to inform and educate the public. One aspect of that has involved building an open air mason's lodge at the bottom of the scaffolding so the public can watch as the magnesium limestone is worked into new elements of masonry.

There will also be state-of-the-art, multi-media galleries with interactive interpretation and new displays of historic collections, while access to the South Transept, Undercroft, Treasury and Crypt is being improved to incorporate ramps and lifts and open more areas of the Minster to a wider audience.

The Undercroft and Treasury will open in late spring, when visitors will be able to take a journey into the underground chambers, where new displays will reveal the significance behind the Minster's most treasured artefacts.

For now, there is The Orb, which was installed inside at the bottom of the Great East Window in October. It includes interactive displays that allow visitors to see at close quarters some of the magnificently restored glass panels of the window, which the Minster describes as England's artistic equivalent of the Sistine Chapel.

The window itself has been covered by a drape containing a full-size picture of the stained-glass and tracery it hides. Behind the drape, the galss has been removed and masons are working, replacing some of the masonry and consolidating other sections.

The York Minster Revealed project has attracted £10.5million backing from the Heritage Lottery Fund (HLF). That's not the largest contribution the HLF has ever made to a project but it was most welcome. In order to qualify for the money the work must be completed to schedule, which means it has to be finished by the summer of 2016.

York is one of the cathedrals that still has its own works department, including masonry and stonecarving workshops that normally employ 15 masons/carvers. In order to ensure the schedule is adhered to, that has been increased, with as many as 27 employed at a time last year, including some travelling journeymen from Germany who spent two or three months each in the workshops and on the scaffolding as they sought to improve their skills.

Heading the stonemasonry aspect of the renovation is Master Mason John David. He explains that the East Front was built on to the Norman Cathedral in 1360. It used stone from the Norman building at the lower levels but extended the footprint of the building out on to virgin land. Even as it was being built it started to lean, so the walls higher up were set back from those lower down to correct the lean, although over the centuries they have also leaned out. The wall is now leaning out about two degrees at the bottom and half a degree further up. One degree is about a foot of lean.

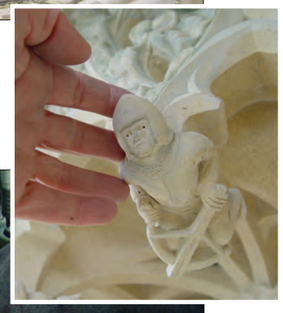
A brief aside: Although this magazine usually uses metric measurements, at the Minster measurements are always Imperial because that's how it was built. The original masons worked to a tolerance of less than $^{1}/_{16}$in and so do the masons working there today.

Further movement of the east front was prevented in the late 1960s when the walls were underpinned. Careful measurements are taken of the position of the walls these days under the direction of consultant architect Andrew Arrol to detect any further movement.

Before the scaffolding went up on the East Front, photogrammetry carried out by the Downland Partnership mapped each stone in the building. The repair work identified during the quinquennial inspection was more extensive than had originally been expected, which is why the Minster decided to seek help from the Lottery.

There can be some tension between the masons, who cannot see why all weathered stone should not be replaced, and others who





Top. The Orb, with its interactive displays, inside the Minster.

Above. The Mason's Lodge, where the public can watch the masons shaping the magnesium limestone.

Below. Payson Muller carving a hood for a niche. There is great attention to detail.

# York Minster

want to see original fabric retained. John David: "It's always a difficult decision about what to replace and what not to replace."

The cathedral has a Fabric Advisory Board of architects, engineers and accountants, which wants to know the reasons behind proposals to replace every stone. Scrutinising the Advisory Board's decisions is the Cathedral Fabric Commission of England. English Heritage and the Society for the Protection of Ancient Buildings also have their various inputs, as does the City planning authority. None of the work is carried out arbitrarily.

Being a religious building, there is a significance to much of the original design of the masonry beyond being simply constructionally sound. For example, the Great East Window has 145 lights in it. Some of them are quite small and the masons might be inclined to leave them blind with a solid piece of masonry. But there are 145 lights because they represent the 144 thousand servants of God (plus God at the top) mentioned in Revelations in The Bible.

Replacing the slender stone tracery in the window is an engineer's nightmare. At York, it is not only the outside front of the stone that is being replaced but whole stones are being taken out. The window was installed after the walls were built, so it is not supporting the structure above it, but, nevertheless, nobody wants the window to collapse. The masons sometimes have more confidence in the material they are familiar with and the work of their predecessors than the engineers do.

The stone is worked with mallets and chisels again these days because of concerns about vibration injuries resulting from pneumatic tools that were used in the workshops for a while. And all the new stone is worked to the lines the original masonry would have had. "It's not a ruin," says John David. "It's a living building." The edges of the new stone are blended into the line of worn stones with mortar to avoid ledges where water can collect.

There has also been a debate about the finish on the stones. Weather surfaces of masonry and carvings are given fine finishes, but elsewhere it was decided to leave a fine claw-tooled finish on the masonry. Masons in the past had left tooling marks and it was considered that there might have been a purpose to that other than simply saving the time that would have to be spent smoothing it. The small peaks and troughs help the new stone to blend in with the original, so it does not look so starkly bright, and it has been suggested that the increase in the surface area created by the tooling could aid migration of moisture out of the stone.

In fixing, too, today's masons are following the example of their predecessors. The joints between the stones in the tracery of the window are filled with lead. Lead spacers hold the stones apart when they are positioned in the window, clay is pushed into the gap at the edges and moulten lead is poured into the joint. Experience has shown the lead always fills the joint before it solidifies. The clay is then removed and the joint is pointed with hydraulic lime mortar.

There are some concessions to the 21st century. The Minster even borrowed a laser cleaner from Lincoln for the south door, but decided it was not very practical for a large area because it is too slow. Gentle abrasive and high pressure superheated water systems are more usually used.

Modern Keim mortar repair products are also being used and the Minster has been experimenting with nanolimes with the help of conservation consultant David Odgers. John David says it seems to be successful, although if too much is used it develops a bloom. It is not the first time the Minster has used stone treatments. It experimented with Brethane on the West Door a few years ago and in the 19th century the stones were coated with linseed oil, perhaps to stop soot accumulating. But it sealed the stone, preventing moisture migration and leading to the growth of magnesium sulphate crystals that created spalling.

In November there were reports that the Minster is using olive oil on the stone, but it is not true. It was involved with York university on the analysis of mortars, which led on to some research of oleic acid, derived from olive oil, to protect the stone. The department at York then moved to Cardiff. Different people were involved and one of them decided to publicise the olive oil experiments. The story was picked up by the national press. "I think it would block the pores, like the linseed oil did," says the Master Mason.

The plastic repairs being made are necessary in some cases to enable the stained glass to be secured in the window, but it is also a question of aesthetics, creating a consistant profile to the window. In places on the building, the original configuration of the stones has been changed, either to improve weathering or simply to enable a repair to be made without damaging the retained or the new stonework.

The replacement stone being used is Highmoor magnesium limestone from Tadcaster and sometimes from Warmsworth. John David says it is an excellent stone to work, taking a fine edge. It is from the Permian geological age and, says John, is similar to the Jurassic Portland limestone to work but without the smell. "The stone we are getting now is very good quality," he says.

It is tested from time to time although there is not a regime of testing as such. Someone from the Minster goes to the quarries to chose the blocks they want and yard manager Danny Sampson checks each of the sawn-six-sides blocks as they arrive. Experience is what they rely on most.

John's only complaint about magnesium limestone is that the magnesium reacts with sulphur in the air to create magnesium sulphate, crystals of which are comparatively large and can eventually cause spalling on the face of the stone, as they did under the stones sealed with linseed oil. Perhaps, with falling levels of pollution, that will be less of a problem in the future.

One of the most important carvings on the current project is the replacement of a heavily weathered statue at the top of the East Front. The general consensus of opinion is that it was originally St Peter, especially as the Minster is the Cathedral Church of St Peter. The statue looks as if it might be holding a church, which is how St Peter is often depicted.

Other contenders for what the statue might represent were Archbishop Thoresby, who was in the post when the East Front was built, or perhaps even God, as the top light of the window just below the statue has the words 'alpha omega' in it, which is how God is often represented.

The height of the head of what remains of the original statue suggests it might originally have sported a papal coronet rather than a bishop's mitre, which would fit with the age of the statue, thought to date from the time the East Front was built. However, it is thought unlikely that a papal coronet would have survived the Reformation and the new carving, being produced by Martin Coward, has the mitre of an Anglican bishop.

Work is progressing well on a full size clay maquette of St Peter following the approval of sketches. The clay of the maquette is being built up over a cast taken from the original statue to help maintain the original proportions. Once the maquette is approved, work can begin on the three pieces of stone that will form the finished statue. Great care has been taken to ensure water will run off it rather than collect anywhere on it.

Because it is so high up, it will have to be elongated to look in the right proportions from below. "It will be a difficult one, getting it just right," says John David. "It's one of the most important figures on the building."

There is a substantial amount of replacement stone and it is clear that a significant amount was replaced in the early 1800s when another major renovation was carried out. But John David believes the majority of the stone, even after the current repairs, will still be the original, not least because the inner leaf of the walls is in good condition. The walls were built using stones of about two feet thick inside and out with a rubble infill.

Above. Martin Coward creating the clay maquette for the new carving of St Peter.

Left. The weathered remains of the original carving.

Above. Carvings around the edge of the Great East Window have been sheltered by the moulding and are still largely in good condition. These two at the top are generally considered to be the coronation of the Virgin Mary on the left and Christ in Majesty on the right.

Left. Tooling on new stonework replicates that on the original. There is some suggestion it might have been intended to add character to the building and blend stones into each other. It is also thought the increased surface area of the stone possibly aids the migration of moisture.

Below. Master Mason John David has been at York Minster for more than 30 years. "I have often said this building is so enormous nobody lives long enough to understand it all. I am still learning something every day."