

A corrosion time-bomb is ticking away inside many of Birmingham's most distinguished city centre buildings, causing steel frameworks to expand and crack. But a little-understood electrical procedure, pioneered in the 1820s to preserve warships, could well provide a cost-effective solution



Steven Jelfs, of Fusion Building Consultancy

No papering over the cracks

Like many other major cities in Britain and around the world, Birmingham is home to hundreds of steel-framed buildings.

Taking their ideas and technology from the United States, designers and builders in the early 20th century saw steel frames as the key to buildings that could be cheaper, safer, higher and lighter than their traditional counterparts.

Using encapsulated steel columns, the building frame became the principal load-bearer, with stone now used for cladding and decorative effect.

What began as a pioneering technique to rebuild Chicago following its great fire of 1871 had soon helped transform dozens of city centres across America and Europe.

"If you look at any major building in Birmingham constructed between 1910 and 1930, the chances are it will be steel-framed," says Steven Jelfs, of Fusion Building Consultancy.

"And we now know that there is a recognisable cycle, which dictates that corrosion will occur and demand remedial treatment over a given period.

"This means that we have an entire generation of fine buildings, typically those in the financial district, which are now reaching a critical stage."

According to specialist corrosion engineer Paul Noyce, the rate and degree of damage varies widely, but the end result is inevitable:

"Corrosion is a slow process, particularly when steel columns are embedded in thick masonry, as this provides immunity from the elements. However, some penetration is inevitable over time.

"The corrosion is caused by the breaking down of the pH [acid/alkaline balance] which occurs through exposure either to chlorides such as salt, or through carbonation. When this happens, the steel begins to rust. This becomes critical because the rust – or corrosion product – is much larger than the original material, typically expanding to seven or eight times its original dimensions.

"The fact that the steel is embedded within masonry or concrete is irrelevant to the damage it will cause.

"Nothing will stop it expanding once exposed to the corrosive elements. So as the steel beams expand, it exerts immense pressure on the surrounding stonework and cracks will inevitably appear."

Cracks are one thing – but the real danger occurs when expansion from within the framework causes cladding materials to loosen and fall.

"In the past, many building owners have responded to cracks by simply filling them in," says Mr Jelfs.

"Unfortunately, where the problem is a corroded steel frame, this is not a cure.

"The only lasting solution is to actually tackle and reverse the corrosion process. This

is achieved by a procedure known as cathodic protection."

A fusion of electrical and chemical principles, cathodic protection effectively restores the steel's pH balance through the application of an electrical current. This is physically achieved through a series of wires attached to the steelwork at regular intervals, carrying a small but constant current.

Originally developed over 150 years ago in the marine industry, cathodic protection is in fact not new to Birmingham, yet is almost unknown in the world of building maintenance.

For many years it has been applied to concrete bridges, says Paul Noyce: "With their far greater exposure to chlorides, due to salt on the roads, steel-framed bridges were prone to corrosion far faster than buildings. So the lessons learned treating bridges in the 1980s are going to become increasingly relevant in maintaining our buildings in the 21st century."

With the property sector only just waking up to the realities of steel-frame corrosion, cathodic protection is just beginning to appear on the radar of local surveyors, agents and developers.

"We are currently helping a client employ cathodic protection to deal with corrosion issues at Cavendish House in Waterloo Street," says Jelfs.

"This is probably only the second or third example of its use on buildings in the Midlands. But it certainly won't be the last."

The good news for building owners is that cathodic protection is a far cheaper environmental option than most traditional construction remedies.

"The system entails attaching anodes to the building framework," adds Mr Jelfs. "Compared to the physical trauma of removing blocks of masonry – not to mention all the surrounding historical and structural complications this involves – cathodic protection is easy and economical."

The most remarkable feature however, is that far from replacing existing materials, cathodic protection actually restores them.

"By restoring the chemical balance in the steel and its immediate environment, we literally reverse the ageing and corrosion processes," says Noyce.

"If applied in time, it restores the steelwork to its original condition and will give your framework another 40 to 50 years of service. Then it can be repeated for as long as the building remains.

"If you own or occupy a steel-framed building then the issue of corrosion simply has to be faced. But by bringing in a suitably experienced surveyor before the damage becomes too great, you not only save a fortune in maintenance – but quite possibly the building itself."