“Regent Street disease” (RSD) is a modern-day problem for some early 20th century steel-framed buildings. If left untreated, it can cause significant structural damage and an expensive repair bill. Discovery of RSD was one of the major factors contributing to delays in the refurbishment of the BBC’s 1932 flagship building in Portland Place.

RSD is not, as the name may suggest, confined to Regent Street in London, but can be found in buildings across the UK and developed cities across the world. In Manchester, the condition is known as “Deansgate disorder”.

While many buildings could now be suffering from the condition, their owners remain oblivious to the threat, having never heard of the condition and the problems it can cause.

What is RSD and how does it occur?

The problem occurs in buildings where a steel frame has been encased with stone and masonry, which were typically built in the first half of the 20th century.

Little thought was given then to the possibility of corrosion of the steel frame and subsequent damage to the surrounding masonry. The protection measures applied to the steel were far less than we would consider acceptable today. After the 1950s, construction techniques changed to ensure a cavity was left between the steel frame and the infill masonry, removing the risk of corrosion.

However, with earlier buildings, over time, failures of the building envelope can allow water to penetrate the fabric and reach the steel. The steelwork then corrodes, causing it to expand by up to 10 times its original volume.

This type of damage can go unnoticed for prolonged periods, only manifesting when the masonry displays cracking, characteristically following the line of the affected steel element concealed behind.

Case study: laser scanning a building with RSD

In this case, Malcolm Hollis was contacted by a client to devise a scheme to monitor 80m of façade on an eight-storey building in Birmingham which had been diagnosed with RSD.

It was not commercially viable or easily accessible to attach monitoring targets to each block of stone due to anti-meshing, so Malcolm Hollis proposed the installation of permanent control stations around the façade and the use of 3D laser scanning.

The 3D laser scanning process captured a full and spatially accurate data set, which was collected quickly, minimising potential disruption to occupiers. This technique captured approximately 800 million co-ordinates along the façade – each accurate to +/- 2-3mm and each identified in the data.

The process was carried out from street level only, which provided health and safety benefits given that no one had to scale the building to capture the data.

An initial set of base readings was taken and compared to a theoretical vertical façade to determine if there was any base deformation. Subsequent readings were taken every two months to allow for comparison of the data sets and these were presented as a deviation map, with 10mm graduations of colours indicating where any movement had occurred.

The 3D scan monitoring solution benefited the client because it required a shorter set up time and the costs to install were lower, while it enabled areas of concern to be highlighted and investigated further. The client could make informed decisions about whether any remedial action was required should public safety be affected.

This technique can also be applied to alternative forms of structural monitoring of existing or potential deformation, such as structural slab and steel/column investigations.

Paul Heyes and Michael Smyth discuss how to protect ageing steel-framed buildings from corrosion.

The rate at which the problem occurs differs from building to building and is affected by the structure itself as well as a range of environmental factors, such as geographical location and exposure to prevailing wind.

While it is difficult to eliminate RSD, there is the potential for it to be managed and limited. A planned maintenance programme can help to stop excess moisture from getting into the steel, limiting the opportunity for the steel to corrode. Carrying out measured surveys using laser scanning techniques can identify where RSD is present in a building and highlight the extent of the problem. From these surveys, an experienced surveyor can advise on how best to contain and treat it.

Treatment for RSD

When the problem first emerged, the only way to avoid demolition of an affected building was to remove the façade and treat the exposed steel before re-cladding the building. This was not only costly but also highly impractical for occupiers.

A newer technique, cathodic protection, is less invasive and potentially cheaper. It is based on the principle that corrosion is an electrochemical reaction and involves either applying a direct electrical charge into the steel frame or connecting sacrificial anodes. It cannot reverse the corrosion already there, but it can suppress the continuation of it.

It is important to monitor the effectiveness of cathodic protection and there are several criteria for doing so. These criteria are based on electrochemical parameters that can be measured and ongoing, regular monitoring and adjustment is required.

There are pros and cons for both methods of protection from RSD and property owners need to decide which works best for them. Some still use the original method because they can physically see the results, whereas with cathodic protection you must have faith that it is doing the job.

RSD can be costly to investigate and treat, so any landlord that thinks their building may have RSD should talk to a surveyor with expertise in this field about how they can take preventative measures.