

Durability and Safety Concerns for UK Canopies Built Pre-1989

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Following on from their September 2013 article which discussed the benefits of employing a canopy repair and maintenance specialist at UK filling stations, Global-MSI's Managing Director Martin Steggles describes the company's growing concerns regarding durability and safety of ageing canopy structures, particularly those built before 1989 that have exceeded their intended 25 year design life. This article sets out the main issues that influence the long term performance of a canopy and explain how age related degradation combined with maintenance neglect can dramatically reduce the life span of a canopy.

Traditionally a filling station canopy in the UK will have a design working life of 25 years. Over this period an owner will be expected to commission a specialist to carry out regular maintenance on their canopy to reduce the effects of deterioration particularly to steelwork, cladding sheets, guttering, fixings and sealants. After 25 years in service, it is generally recommended a canopy is dismantled and replaced with a contemporary structure preferably supported by new foundations.



This photograph was taken following the winter storms of 2013/14. During windy conditions, image fascias and sheeting became detached from the canopy. The extensive corrosion of the canopy steelwork was a major contributing factor."

As the UK's leading forecourt canopy, maintenance and repair specialist, Global-MSI annually encounters several hundred existing canopies. Using our extensive archive library we can establish the year the majority of these canopies were installed. The undertaking of archive checks over the past 18

months has highlighted a considerable number of UK canopies that remain in service longer than their intended 25 year design life. Alarmingly, our archive checks have indicated that there are several hundred canopies on UK filling stations that were built more than 40 years ago and a number that were built in the 1960's.

Presented with these facts, Global-MSI believes the UK filling station industry should share our concern that at least one of these ageing canopies will suffer a partial or full structural collapse in the future. In fact during the winter storms of February 2014, the canopy at a former filling station premises now being used as a car wash centre suffered a partial collapse. The canopy was supplied by a company that ceased trading many years ago, but their



The above photograph shows a former filling station canopy at a car wash premises in Greater Manchester following collapse in February 2014 (the 'A-frame' is still visible protruding above the collapsed structure). The external appearance of the canopy would have given little indication of the endemic deterioration the main canopy deck steel members had suffered. It is cases such as this that strengthen Global-MSI's belief that in the near future an ageing UK filling station canopy will suffer a sudden structural collapse.

structures still exist on filling stations to this day, and can be distinguished by a double-gutter either side of a steel 'A-frame' arrangement protruding above the roof line. Old and poorly maintained canopies now pose a genuine threat to the safety of filling station customers and employees. The industry should take the necessary steps to promote the importance for canopy owners to commission regular condition checks by a specialist. The external appearance of a canopy deck with new branding, fascia signage or underlining may often give the

impression the canopy structure is in "good health". However, such elements often disguise the poor condition a canopy deck is actually in, particularly the main support steelwork positioned within the deck void. Only following a specialist's inspection of the canopy deck void can an accurate assessment of the canopy's condition be made.

In view of this genuine threat to safety on several UK filling station sites, an owner of a canopy that has exceeded its 25 year design life yet remains in service should pay serious consideration to the following question:



The above photographs show the extent of accelerated corrosion due to air pollution on a series of profiled steel roof sheets. The resulting damage has caused the roof deck to lose watertightness exposing the supporting steelwork below to acidic rainfall and increased moisture

"Can future durability and safety of the canopy be relied upon?"

The answer for any canopy owner that has financed its regular upkeep by a specialist over the full 25 year period should be a resounding "YES". Through conscientiousness and consideration for the safety of those people using their site, the canopy owner will typically be rewarded with an assurance from a specialist that, despite its age, their canopy remains fit for purpose. If the owner ensures regular inspections and maintenance work on the canopy continues, it is possible their canopy could remain in service for a further 10 years. Unfortunately, there are many ageing canopies Global-MSI encounters in the UK that have not been well maintained resulting in significant loss in a canopy's durability to resist deterioration by weathering, air pollution, chemical attack, vegetation growth and general wear and tear. Any owner of a canopy that has not been well maintained, no matter its age, should employ a canopy specialist to carry out a condition survey and act on the specialist's recommendations.

A canopy specialist's assessment that specifically concentrates on future durability and safety will focus on several factors that can accelerate the physical deterioration of the canopy structure. These factors are:

1. The environment surrounding the canopy.
2. Quality of the canopy's original design and construction.
3. Level of protection afforded to the canopy's building elements.
4. Maintenance history of the canopy.
5. Future maintenance plan.

The type of environment a canopy is exposed to will have considerable impact on the level of degradation the canopy suffers over 25 years or more. The surrounding environment will also be a major consideration when preparing a maintenance plan for the canopy's intended design life.



These two photographs were taken during recent surveys of filling station canopies that have exceeded their intended 25 year design life and the indicated damage typifies that of ageing canopies that have not been regularly maintained. The first photograph is from the same canopy supplier as the partially collapsed structure featured above. The second photograph shows a loose bolt forming the connection of two primary structural beams – a common occurrence increasingly being witnessed by Global-MSI's surveyors.

Global-MSI has surveyed numerous canopies across the UK that have suffered severe corrosion damage to critical steelwork members as a result of a coastal environment and subsequent high saline content in the atmosphere. Even canopies surveyed several miles inland from the UK coastline have been affected due to sea spray being carried by the wind. Filling station sites situated in built up industrial areas often suffer from air pollution damage where gases such as sulphur dioxide or oxides of nitrogen form acids in rainwater and attack the integrity of metallic building

materials on the canopy such as profiled roof sheeting, fascias and guttering.

Premature deterioration of a canopy can occur if the below ground environment contains contaminated soils or groundwater. Sulphate attack on below ground steelwork and reinforced concrete is particularly common leading to weakening of the canopy columns, holding down bolt connection and supporting foundations. Any weakening of these critical structural elements is a major concern to the future safety of a canopy as they have been designed to resist large

overturning forces and stresses. The likelihood of some below ground contamination occurring on a filling station over a 25 year period is particular high given the propensity for fuel spillages and leaks in the underground pipework.

Poor detailing decisions and incorrect material specifications during the design stage of a canopy will ultimately hinder its longevity reducing the length of time a canopy can safely remain in service. For example, the level of consideration a detailer pays to items such as cladding flashings, sheet lapping, fixing positions and gutter joints will have a huge bearing on how a canopy fares in adverse weather conditions. Likewise, the quality of workmanship employed during a canopy's installation will impact on the length of time a canopy roof deck will remain watertight.

Ageing canopies that were originally specified with aluminium and steel building materials with no measures to prevent bimetallic corrosion will have suffered some level of deterioration, particular where poor detailing of the canopy has led to rainwater or condensation becoming trapped. Bimetallic corrosion can be severe in coastal locations and polluted industrial environments causing steel fixing failure and loosening of cladding sheets.

UK canopies that were constructed in the 1960's and 1970's were subject to design, material specifications and construction practices that have since become out-dated or, over the passing of time, have shown to be detrimental to the long-term performance of the structure. Pre-1980's design and specification of concrete foundations is a classic example where the standard use of amorphous silica aggregates, high alumina cement or ordinary Portland cement led to swelling, cracking and considerable weakening of the foundations. There is no guarantee that some ageing canopies still in service in the UK were built prior to the construction industry gaining a better understanding of defective foundation practices.

A common construction detail in UK canopies built during the 1960's



These two photographs were taken during the dismantling of a filling station canopy in February 2014. Global-MSI's concerns are not just limited to poor condition and lack of maintenance of canopy roof structures. The canopy columns above have no holding-down bolts securing them to foundations. They were simply placed onto the forecourt slab and covered by the pump island.

and 1970's was the dual use of a steel member to act as both main structural beam and central rainwater gutter. A canopy using this detail was typically referred to as a "spine beam" canopy and involved the welding together of two steel H-sections (one on top of the other) with the upper H-section receiving rainwater run-off from the canopy roof sheets. The use of spine beam canopies in the UK was generally phased out during the 1980's as the

detail significantly accelerated corrosion of the main beam steelwork supporting the canopy deck.

Global-MSI has carried out repair works on many spine beam canopies that currently remain in service in the UK. Most of the repair work undertaken dealt with rainwater leaks due to corroded welds around gutter outlets. Unfortunately rainwater leaks into the central core of a spine beam

are concealed from view making it extremely difficult for a specialist to gauge the extent of corrosion damage the spine beam has actually suffered. It is therefore strongly recommended that an owner of an existing spine beam canopy considers a full canopy replacement as the true extent of damage to this type of canopy may only reveal itself through a corrosion induced beam failure. The importance of undertaking regular maintenance and condition surveys on a known spine beam canopy cannot be overstressed given the nature of the canopy's design will ultimately accelerate the structure's deterioration.

All canopies will receive some form of protective system; be it paint applications to steelwork, galvanised components or resistant coatings to cladding. However, no matter how good the protective system, eventually a canopy will need maintenance treatment. As described earlier, the surrounding environment conditions will influence the types of protection afforded a canopy and the recommended maintenance intervals during its 25 year design life. Should the local conditions change or become more aggressive during a canopy's design life, the original maintenance plan will need to change accordingly. The main aims of a canopy maintenance plan are to preserve both its structure and appearance from deterioration and need for repair so that it performs safely, efficiently and economically throughout its design life.

The comments and photographs in this article highlight only some of the disturbing issues that can arise on UK filling station canopies that have exceeded their 25 year design life having received little or no maintenance. We are in no doubt that further concerns exist on a number of canopies we are yet to survey, and these will remain vulnerable to a sudden and potentially fatal failure if their age and condition continues to be ignored.

Please contact Global-MSI on telephone number 01302 361558 or via email info@global-msi.com should you wish to discuss future maintenance of a canopy or to arrange an initial condition survey.