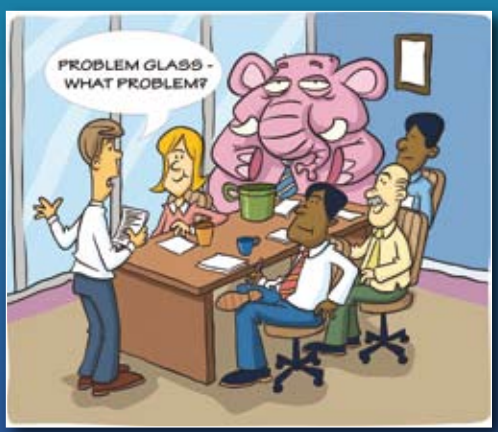
Don't get MAD



The causes of "Problem glass" and proven solutions – are like elephants in the room

Stephen Byers
RITEC International Ltd

When designing, constructing or refurbishing a multi-storey building, overlooking the causes of "Problem Glass" is like having an 'elephant in the room' but paying no attention – the risks are so huge they should not be ignored! Equally important are solutions offered by durable, "non-stick" surface protection – the Added Value opportunities are so great they should not be ignored!

Problem Glass includes any architectural glass that has lost, or is at risk of losing, its original light transmittance (t-Value), "sparkling" appearance and cleanability. These losses are caused by the biggest enemies of glass – moisture, alkalinity and dirt (MAD).

For new glass, proven solutions provide long-term protection against attack by 'MAD'. For glass surfaces already attacked and damaged, renovation solutions bring the glass back to an "as new" appearance and condition, then protect against further damage.

Stephen Byers, Managing Director of Ritec International Limited, London, discusses the causes of Problem Glass and proven solutions, along with the big risks taken and important opportunities missed if either one of these huge 'elephants in the room' is ignored at the time of new construction or building refurbishment.

Overview of the Proven Solutions – Before, During and After

Architects and designers specify glass for its light transmission, clarity and cleanability. These important qualities are easily lost if glass is unprotected against moisture, alkalinity and dirt (MAD), which can damage the surface of any glass – new or old, exterior or interior – before, during or after construction or refurbishment.

Solutions for Problem Glass are high in Added Value because they save much time, effort and money – before, during and after construction or refurbishment. These and other advantages depend on durable protection of the glass surface against attack by 'MAD', and the protection requires:

- high levels of resistance to moisture and alkalinity;
- "Non-stick", easy-clean performance to resist the adhesion of all types of dirt.

Problem Glass causes delays in construction, spoils the appearance of buildings and reduces day-lighting and visibility as well as the productivity and well-being of building occupants. It is a high-maintenance material that requires frequent washing, and sometimes intensive cleaning, generating high levels of emissions and carbon footprints.

Problem Glass solutions help to avoid costly delays in construction or refurbishment caused by damage to glass surfaces by 'MAD' during transport, storage and installation. The solutions also reduce costs of the final builder's clean.

During construction, Problem Glass solutions resist attack by MAD in the form of moisture from building run-off, alkalinity from cement dust, concrete splatter and slurry as well as various types of airborne dirt and other pollution.

After construction, solutions for Problem Glass help to –

- maintain the original light transmittance (t-Value), day-lighting and visibility;
- protect the original "sparkling" appearance of glass and aesthetics of the building;
- reduce by 50% on average the frequency of site visits for routine washing of glass - cutting energy requirements, emissions and carbon footprints by equally large amounts and making the glass "green" in performance.

Solutions for Problem Glass apply at any time during the life cycle of a building, unless the glass has reached a "point of no return" as shown in Figure 1, when the only options are toleration of the problems or costly replacement.

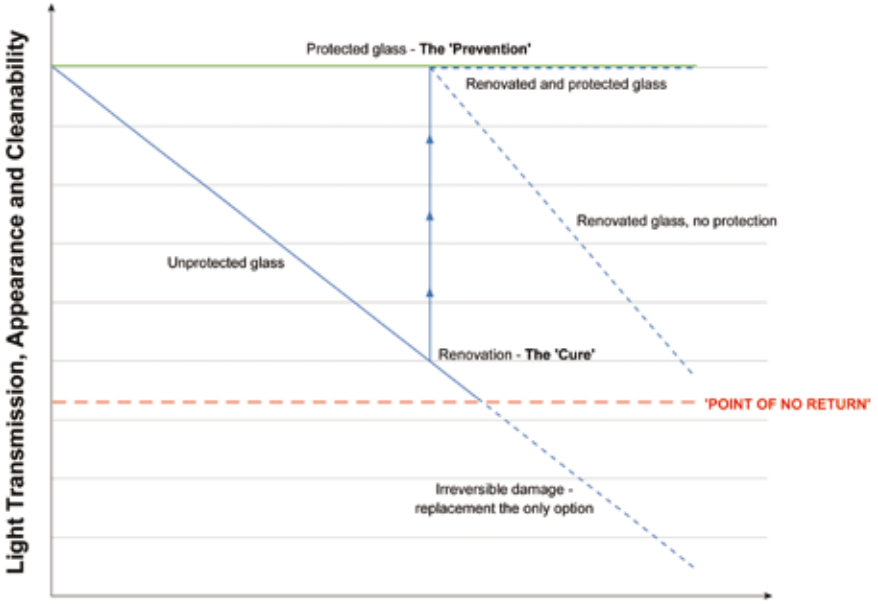


Figure 1.

Proven solutions are also available for glass already installed that has lost its original visibility, clarity or cleanability. These solutions renovate the glass to an "as new" appearance and condition.

Why Unprotected Glass Becomes 'Problem Glass'

Like bare metal surfaces, unprotected glass is "raw" and chemically reactive. These and other properties of glass make its surface susceptible to degradation by 'MAD'. Moisture and alkalinity attack the exposed surface - causing corrosion, etching and staining/ discolouration. Dirt bonds firmly and makes the surface difficult, if not impossible, to clean and keep clean.

Moisture and alkalinity, either individually or together, can etch or dissolve the surface of glass, making it appear dull and sometimes white in appearance. Moisture can be in its liquid form, such as rainfall, or as a vapour in high humidity areas. Alkalinity comes from hard tap water, sea water and construction materials such as cement dust and building run-off from concrete, bricks or mortar.

Dirt can damage the surface of glass in some cases, but most harm is caused by harsh and aggressive cleaning methods. There are two general categories of dirt:

- **Organic dirt,** which does not normally attack glass but can attach firmly to the surface and be difficult to remove. For exterior glass, this includes traffic film, bird droppings and tree sap. For interior glass, organic dirt includes fingermarks and cooking oil vapours.

- **Inorganic dirt** bonds chemically to glass and is difficult, if not impossible, to remove using conventional cleaning methods. Inorganic dirt on exterior glass includes sea spray, industrial emissions, metal oxides from railways and construction materials such as cement dust and building run-off. For interior glass, an example is limescale from hard tap water.

Where is it Found?

Problem Glass is found in any location or installation where 'MAD' is present – before, during or after construction. The most likely places are:

- containers used for shipping glass long distances, especially in wet or humid climates
- construction sites
- sloped glazing - conservatory roofs, roof lights
- buildings with difficult access for routine washing
- glazing exposed to run-off from concrete, bricks, mortar, stonework, lead flashing, silicone sealants
- glazing in polluted areas - city centres, industrial estates, near railways, coastal areas
- interior glass – shower enclosures, sand-blasted glass, kitchen splashbacks.

What are the Consequences?

Problem Glass costs architects, contractors, owners and occupants substantial amounts of time, effort and money worldwide. These and other consequences can happen with any type of glass – new or old, exterior or interior. They can occur at any time – before, during or after construction or refurbishment.

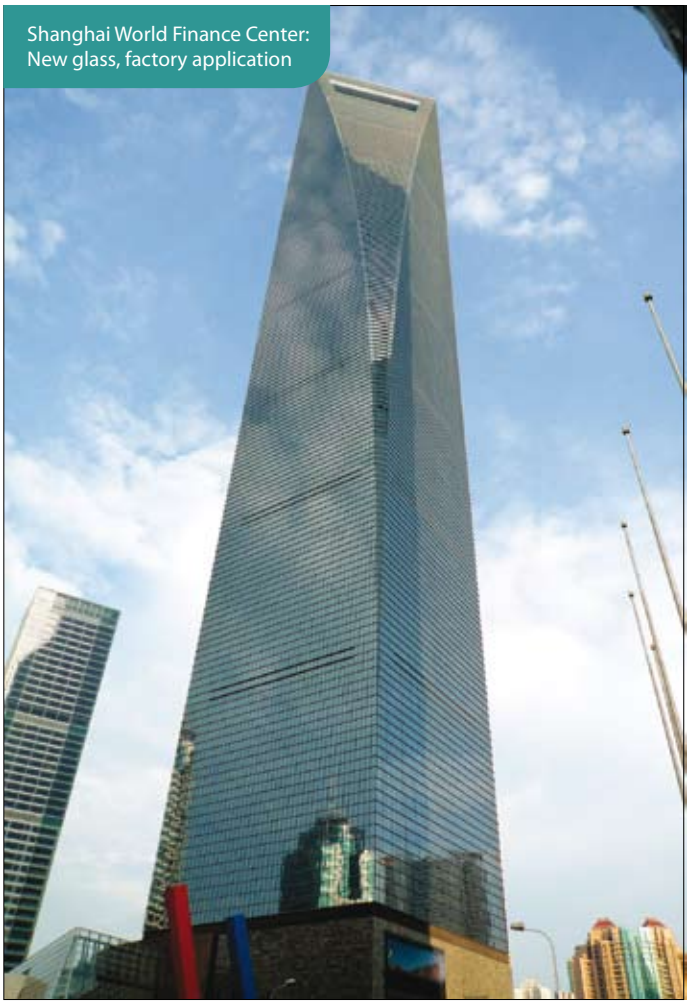
Glass that fails to live up to expectations can result in call-backs and delays in construction, increasing costs for the building contractor and others involved. Problem Glass spoils the aesthetics for building architect and owner, and incurs maintenance difficulties and costs for facility managers and building occupants. For building occupants, dissatisfaction is caused by dirty glass with reduced day-lighting and visibility to the outside world.

As a consequence of attack by 'MAD', glass can easily lose its original light transmittance (t-Value) with negative effects on visibility and day-lighting as well as the productivity and well-being of building occupants. T-Value is an important industry performance standard and, when glass becomes dirty, its light transmittance is reduced and the original t-Value is no longer met.

Lower t-Value means higher energy costs for artificial lighting as day-lighting is reduced, meaning reduced productivity and well-being of building occupants. As a related consequence, glass can easily lose its original bright and "sparkling" appearance, making an entire building look dull and lifeless.

As a further consequence, the loss in cleanability caused by 'MAD' is attracting more and more attention as green building design becomes increasingly important. Problem Glass is not "green" because it requires regular but often ineffective washing with higher energy needs, and it generates substantial amounts of climate-changing emissions of carbon dioxide (CO2) and other greenhouse gases.

Vivaldi, Netherlands:
New glass, factory application



Shanghai World Finance Center:
New glass, factory application

Washing of glass in buildings, both exterior and interior, requires a lot of mechanical, electrical and chemical energy. Major reductions in emissions and carbon footprints can be achieved by cutting the energy requirements as follows:

- site visits for routine glass washing or intensive cleaning
- use of water, a valuable asset in many areas of the world
- manpower
- operation, maintenance and fuel for vehicles
- production and use of cleaning materials
- operation and maintenance of access equipment.

Each of the above requirements generates emissions and carbon footprints which can be significantly reduced by protecting the surface of glass against attack by MAD. Glass surface protection has positive consequences in terms of reduced energy requirements, such as less need for artificial lighting, reduced frequency of cleaning with less trips to job sites with lower consumption of fuel and other costs, reduced costs of operating and maintaining access equipment, reduced consumption of cleaning chemicals and other materials and less risks of delays in completion of projects.

The Proven Solutions for Problem Glass – Prevention or Cure?

Solutions for Problem Glass can apply at any time in the lifecycle of a building, but 'prevention' is clearly better than 'cure'. The best time to apply any form of protection is when a surface is new – ideally in the factory before transportation, storage, installation and use. Labour costs are much lower and there is no need for access equipment or working under adverse weather conditions.

Alternatively, if the glass has already been exposed to its enemies and attacked by them, there are solutions for renovating the glass surface and protecting it. This "cure" restores the surface to an "as new" appearance and condition, then protects it against degradation.

Ritec's ClearShield System™ for glass renovation, protection and maintenance is the solution-provider for both prevention and cure. This innovative system is the only solution for Problem Glass proven in performance and durability through more than 30 years of experience under all types of environmental conditions worldwide.

Applied to new glass in the factory or existing glass on-site, the ClearShield System™ safely and effectively upgrades ordinary, high-maintenance glass into ClearShield® "non-stick", easy-clean glass with durable surface protection.

"Non-stick" glass surface protection helps glass maintain its original light transmission and meet industry standards. It substantially reduces emissions and carbon footprints by cutting the frequency of routine glass washing, reducing energy requirements and lowering maintenance costs. ClearShield® makes glass "green" in performance.


Metropole Building, The Hague:
Existing glass, on-site renovation & protection

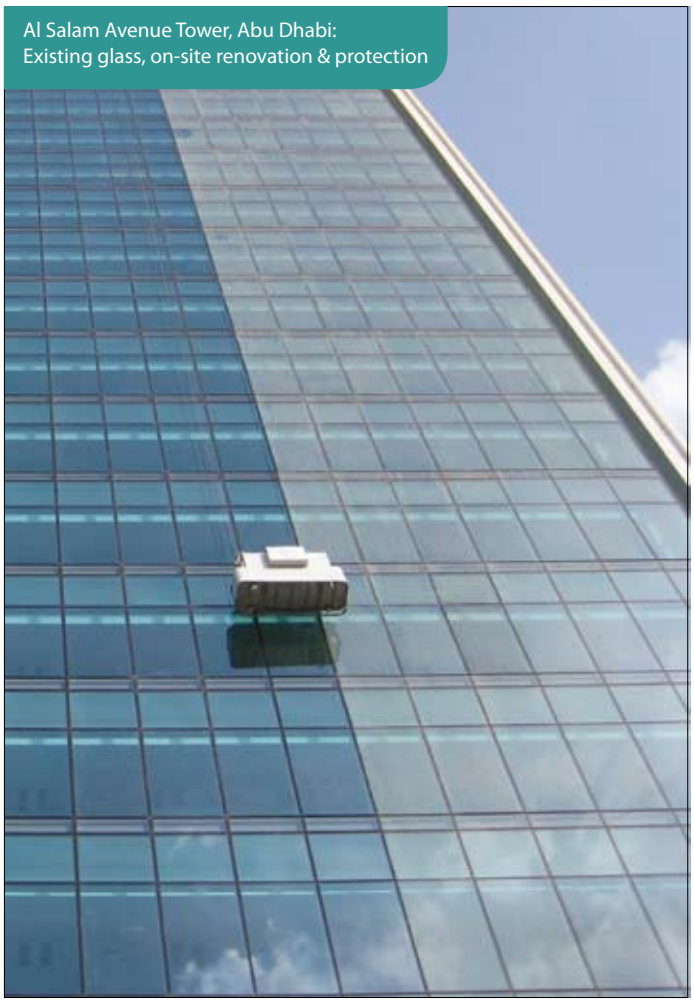

Al Salam Avenue Tower, Abu Dhabi:
Existing glass, on-site renovation & protection

Figure 1 illustrates the effects of renovation, protection and maintenance depending on whether the ClearShield System™ is applied in the factory to new glass or on-site for renovation.

Examples of Long-term Solutions – Durable, "Non-Stick" Surface Protection

a) **New Glass – Factory Application –**
Recent examples of multi-storey buildings with the ClearShield System™ applied to new glass at the factory for durable protection before, during and after construction are:

- Vivaldi Building, Amsterdam –
a 23-storey, eco-friendly office building with a zero emission heating and cooling system using geothermal power. Windows with insulated glass (IG) units made of solar control glass laminated with fire resistant (10,000 m2) and coloured glass panels (5,000 m2) were at risk of attack by 'MAD' in the form of atmospheric pollution (organic), run-off from brickwork (inorganic) and seaspray (inorganic). The solution was application before construction of ClearShield® at Ritec's subsidiary in Holland.

- Shanghai World Financial Center (WFC) –
one of the tallest buildings in the world at 101 storeys (492m). All exterior glazing was at risk of attack during construction by 'MAD' in the form of cement dust, concrete splatters and run-off (inorganic) and urban pollution (organic). The solution was application before construction of ClearShield® at factories of the glazing fabricator.

b) **Existing Glass - On-site Application – Renovation & Protection**
Recent examples of multi-storey buildings with both renovation and protection of the ClearShield System™ applied to existing glass on-site are:

- Metropole Building, The Hague –
a nine-storey apartment building in the city centre and only 18 months old when work was carried out for 850 m2 of Problem Glass caused by urban pollution (organic), run-off from brickwork (inorganic) and seaspray (inorganic). The solution was Ritec's surface renovation process and ClearShield® durable, "non-stick" surface protection applied on-site.

- Al Salam Tower, Abu Dhabi (UAE) –
a 23-storey commercial building with Problem Glass caused during construction by spillages of concrete slurry (inorganic). The glass was not only stained and discoloured, it also suffered etching or physical damage by moisture and alkalinity. The solution was Ritec's surface renovation process, glass polishing to remedy the physical damage and ClearShield® applied on-site from a cradle as shown in the photograph.

Examples of Short-term Solutions – Renovation Only, no Surface Protection

Recently the glass in two prestigious buildings, one under construction and the other more than 80 years old, was renovated by the ClearShield System™ but protection was not applied due to limitations in budgets. Renovation was positive from the standpoint of restoring the "as new" appearance, light transmission and day-lighting. However, this approach is a short-term solution because the renovated glass is "raw" and chemically reactive, so in a relatively short period of time it is likely to become Problem Glass again.

The two buildings with glass renovated but not protected are:

- The Shard, London – now the tallest building in the UK and one of the tallest in Europe with 95 floors (310 metres or 1,016 ft high). During construction, cement slurry (inorganic) spilled over majority of its exterior glazing and dried on the surface with a risk of etching and physically damaging the surface. Technical consultants recommended Ritec's glass renovation process as the safest and most cost-effective solution for removal of the contamination. Application of the renovation process was made by rope access as shown in the photograph.

- Empire State Building, New York City – completed in 1931, this building is famous worldwide and several years ago embarked on a building renovation programme which included removal of all the original glass and using it to make new insulating glass (IG) units which were re-installed. This required in-depth cleaning of glass with more than 80 years of exposure to urban pollution (organic) and building run-off (inorganic). Ritec's surface renovation process was selected as the safest and most cost-effective solution and this was applied at a special workshop set up inside the building.

Conclusions

Like an 'elephant in the room', the causes of Problem Glass – before, during and after construction - are too big to be ignored. Solutions are available at any stage in the life cycle of a building - based on Ritec's innovative ClearShield System™ for glass renovation, protection and maintenance.

These solutions for Problem Glass are cost-effective, eco-friendly and offer major opportunities with real Added Value – so, like another 'elephant in the room', the solutions are too big to be ignored and should be included in new construction and building refurbishment projects.

30 YEARS ClearShield® 1981-2011