RNG Consultancy

Providing an Independent 3rd Party Glazing Investigation Service

Spontaneous Breakage

Energy Peformance

Glazing Quality

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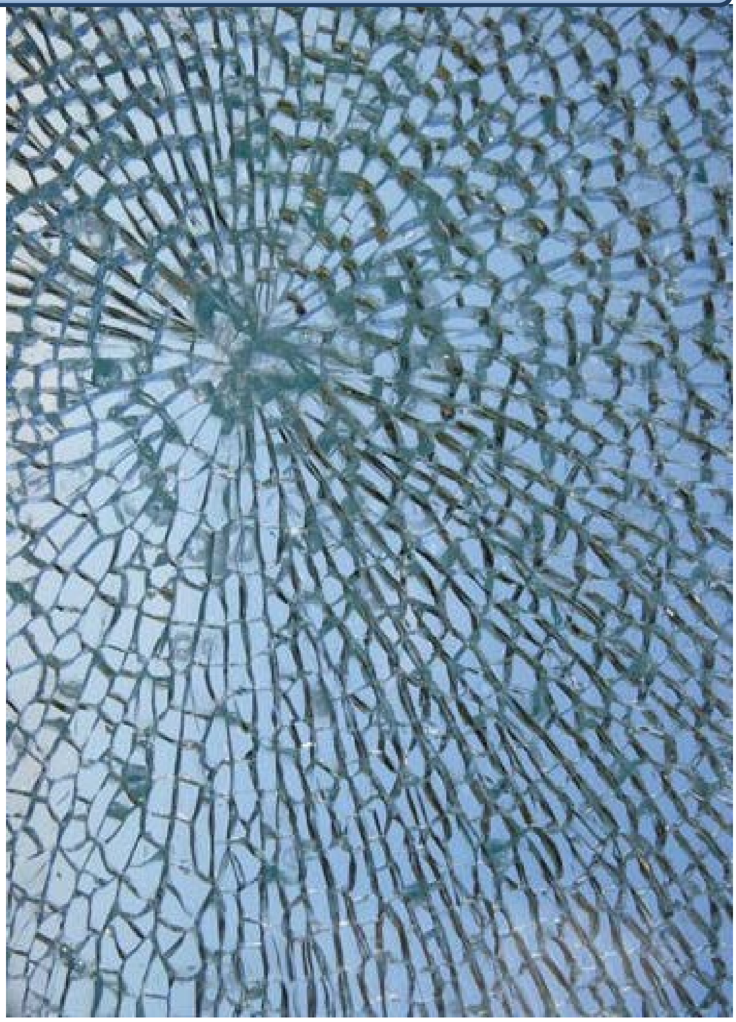
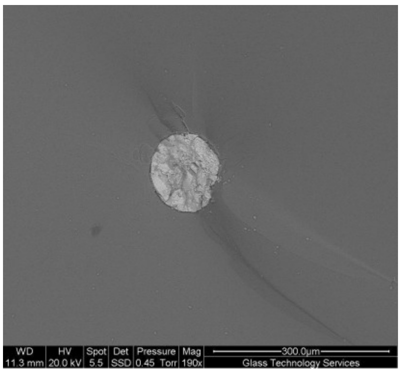
Spontaneous Breakage of Toughened Glass

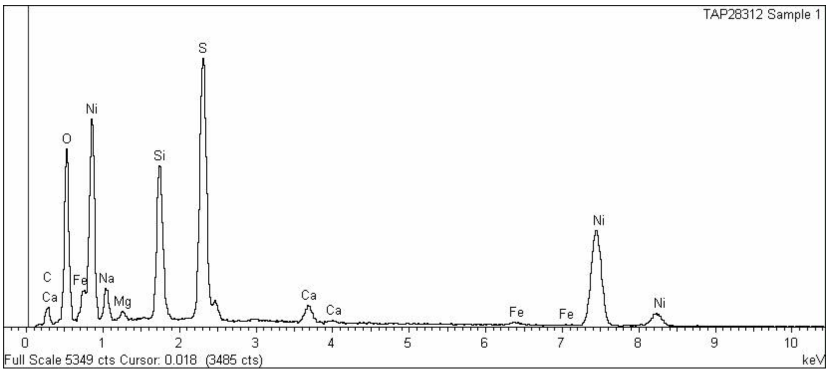
Spontaneous breakage of toughened (tempered) glass is immediately noticeable because an initial crack exceeding a critical size (depending on its location within the thickness of the glass). It causes complete fracture of the plate, typically into very small particles approximately cube shaped. Clumps of these small particles tend to stay together, much like a jig-saw puzzle, after breakage unless additional forces are applied. In annealed glass an initial crack may not have a sufficiently large applied load or stress to propagate it completely, and so even a relatively large crack may go unnoticed for some time. Some of the possible causes of initial cracking in toughened glass can include: hard body impacts; glass-to-glass contact, especially where edges can bump during installation; weld splatter; deep scratches, just into the tensile stress zone, which slowly grow (static fatigue) under the locked-in tempering stress; building movement - concrete floor creep etc, which takes up the edge clearance in a frame and causes localized bearing pressure and crushing, especially if the glass and frame sizes were not correct; differential expansion/contraction stresses from stiff adhesives (epoxies) used to glue items to toughened glass; and Nickel Sulphide (NiS) inclusions in the central half of the glass thickness.



RNG Consultancy can investigate the reasons for the spontaneous breakage, determine the root cause and advise on the best way forward to reduce the risks for users and visitors of the property.

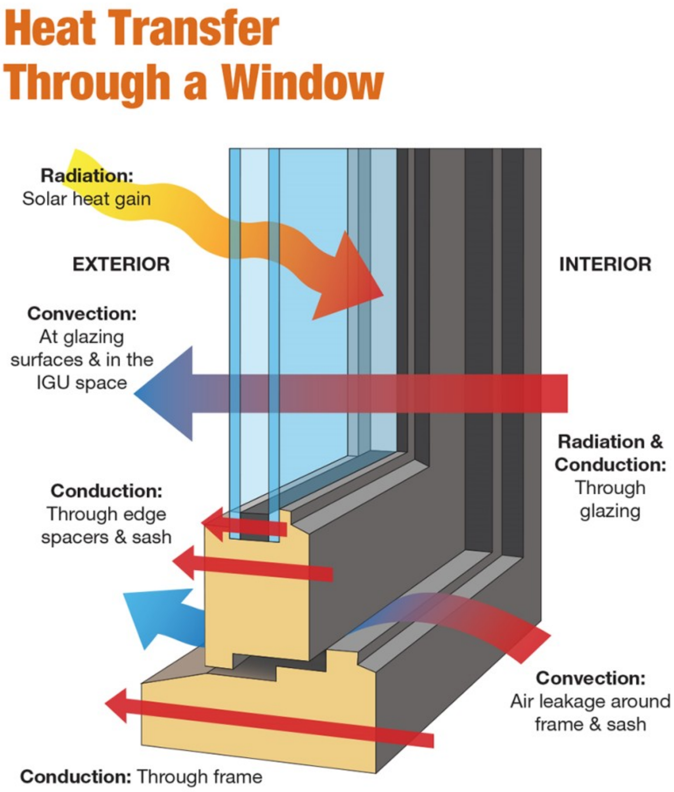
If Nickel Sulphide inclusions are deemed to be the main cause of failure, it is always recommended to have the point of fracture analised by an acredited test laboratory. Using a scanning electron microscope (SEM) which uses a beam of electrons to achieve magnifications much higher than is possible using light (up to 100,000x). In addition, the SEM is fitted with an energy dispersive spectrometer (EDS) which allows pinpoint elemental analysis down to a few microns across for elements between carbon and uranium.





Energy Performance of the Glazing System

There is an increasing determination in the United Arab Emirates (UAE) to reduce CO2 emissions as part of the global effort to reduce greenhouse gases and mitigate the effects of global warming. The focus until now has been on regulations for new buildings. As a young country, compulsory building regulations relating to energy savings and conservation were only introduced in the past decade (2003 in Dubai and 2007 in Abu Dhabi). This means that even if all new buildings were to adhere to significantly high energy conservation standards, the UAE would still have a large stock of buildings, some just completed, which have excessive cooling loads and thus are not environmentally friendly. This can be seen from the data that shows that the UAE has one of the highest electricity consumptions per capita in the world. This reflects negatively on the CO2 emissions as the UAE has the 2nd highest CO2 emissions per capita in the world. If the UAE is to significantly reduce its CO2 footprint, the energy inefficiencies in the existing building stock needs to be addressed.



Using laser technology, we are able to measure the glass and air space thickness of triple, double and single pane windows. Furthermore, we are able to determine the presence, location and type of Low-E coatings, including laminated glass with the Low-E coating next to the PVB interlayer. Carrying out this measurement enables us the compare the actual glazing against the specified product and advice on any appropriate action that may be required.

PANE 1: 6mm STANDARD	PANE 1: 6mm ACTUAL	LOW-E SURFACE: 2
AIR 1: 12mm	PVB W/ LOW-E	
PANE 2: 6mm	PANE 2: 6mm	PROPERTIES: SOFT COAT
TOTAL: 24mm METRIC	TOTAL: 13.52mm METRIC	SILVER LAYERS: DOUBLE

Glass transmits solar radiation from the sun by three mechanisms: reflection, transmission and absorption, which for solar control purposes are defined in terms of the following parameters:

Direct Solar Energy Transmittance (ET) is the proportion of solar radiation at near normal incidence that is transmitted directly through the glass.

Solar Energy Reflectance (ER) is the proportion of solar radiation at near normal incidence that is reflected by the glass back into the atmosphere.

Solar Energy Absorptance (EA) is the proportion of solar radiation at near normal incidence that is absorbed by the glass.

Using an advanced light censoring system, we can measure the amount of solar transmission passing through the glazing system and advise on the best methods for reduction which intern will help reduce energy costs.

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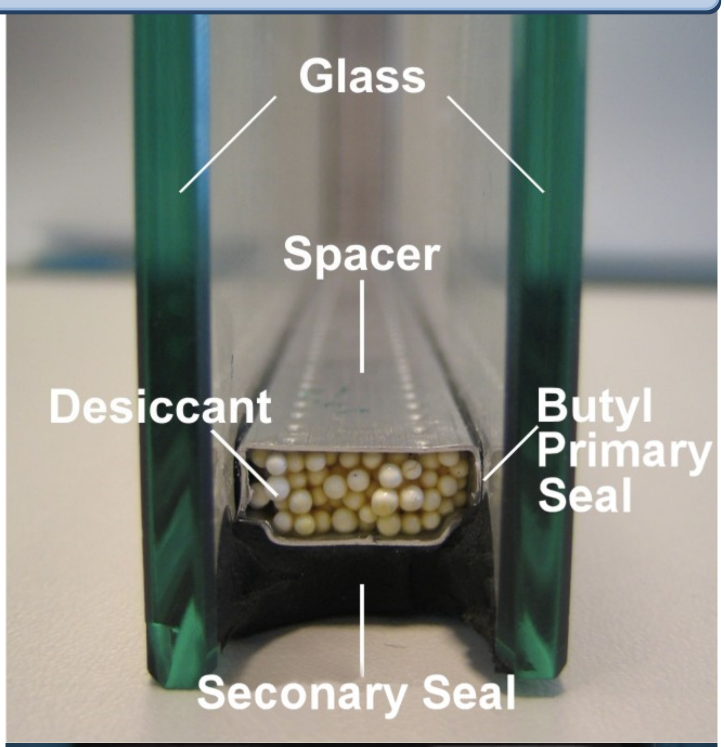
Offering an advisory service in support of those stakeholders who desire to take positive action to address the many challenges that they face in managing their built environment.

A member of the GGF Glass & Glazing Federation

Glazing Quality - Insulated Glazing Unit



To better understand why insulated glazing units fail and fog up, we need to look more in depth to the basic construction of insulated glazing unit. Looking at the image, the inner and outer glass are held together by a primary and secondary sealant. The sealant is designed so that desiccant is placed inside the glazing unit as well. The desiccant is a substance that removes any moisture inside the double pane area by absorption. A spacer bar is used to keep the desiccant in place and to maintain a consistent distance between the inner and outer glass.

When the glazing unit is installed, it is subjected to wide fluctuations in temperature changes. These temperature changes will expand the glass panes when heated and contract when cooled. This expansion and contraction eventually compromises the glazing unit seal and it cracks. Air is then allowed to enter the space between the inner and outer glass panes and this air contains moisture vapour. The moisture in the air will condense based on the temperature changes and for a specific length of time, the desiccant material will absorb this moisture and keep your glazing unit clean and clear.

When the desiccant has saturated and can no longer absorb the incoming moisture. Water droplets then start to form on the inside glass panes and we end up with foggy or cloudy windows. This condensation will cause considerable damage to the window framing and additionally, the moisture will lead to the formation of mold and this can be harmfull to the people inhabiting the building.

We can survey the glazing system and advise on the best remedial action required to extend the life of the of the insulated glazing units that do not currently show signs of fogging.

Examining hazing that could not be cleaned
(Corrosion of silver low-e coating inside IGU)

Volatile fogging occuring during periods of warm weather in direct sunlight

Spacer bar displacement into glazing unit obstructing view

Spacer bar movement, corrosion damage to the Low-E coating and volatile fogging are all signs of a failing IGU. Once failed the unit can no longer act as a thermal barrier, increasing energy costs and reducing the integrity of the building Envelope.

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Glazing Quality - Optical Distortion

Optical distortion can ruin the aesthetic appearance of a building, destroying the original design intent.

Due to safety or thermal requirements it may be necessary to specify toughened safety glass or heat strengthened glass.

During the production of toughened safety glass and heat strengthened glass in an oscillating roller hearth furnace, the glass is heated close to its softening point.

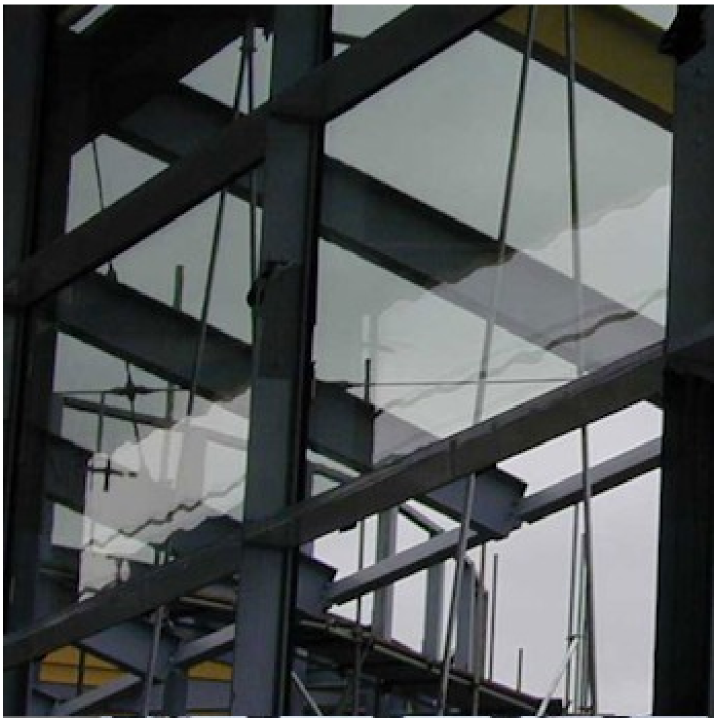
The heating occurs in a furnace section where the glass is continually transported back and forth on fused silica rollers. As the glass temperature increases, the glass becomes pliable and tends to sag slightly between the rollers during reversals at each end of the furnace.

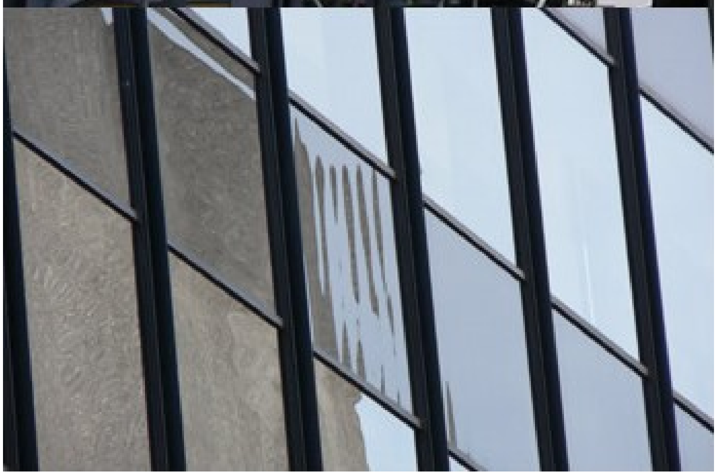
The result is a reduction in surface flatness known as ‘roller wave’, a periodic wave running at right angles to the direction of travel, and is measured from the highest peak to the lowest trough of the waves.

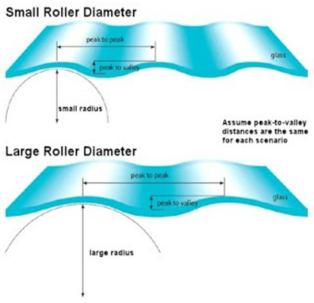
Roller wave is most easily identified, when viewing the glass in reflection from the outside of a building in which it is installed.

Using specialized test equipment, we can measure the roller wave present and by reviewing the relevant project glazing specification or specified international quality standard we can determine if the roller wave is of an acceptable level.

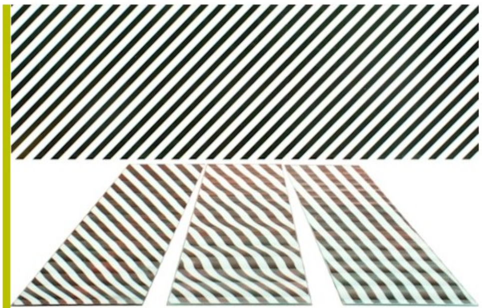
The ends of each piece of glass tend to sag to a greater degree due to the cantilever effect of the unsupported ends of glass at the leading and trailing edges, this deformation is known as ‘edge lift’.







Peak to valley roller wave caused by glass to roller contact in the toughening process

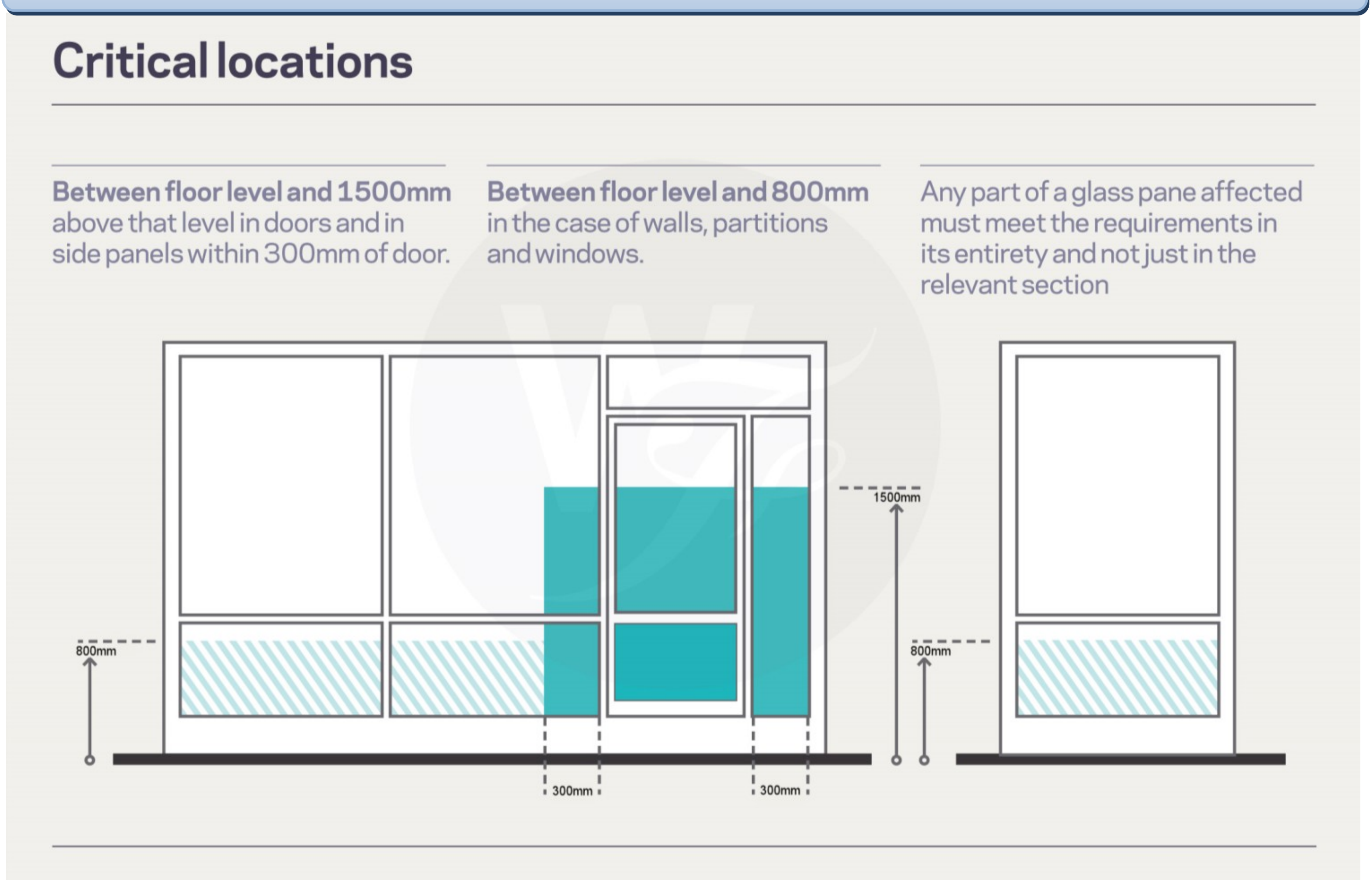


Online zebra board optical distortion detection showing left: edge lift, middle: roller wave, right: large end curve

In situ measurement of roller wave distortion

If the project is still in construction and not all glazing panels have been manufactured, we can assist the glass processor to reduce the visible optical distortion to acceptable agreed levels enabling design goals to be met.

Glazing Quality - Critical Glazing



The right glazing in the right place is an essential aspect of our safety and enjoyment of life both at home and work.

Certain areas of internal and external walls are considered 'critical locations' in terms of glazing safety, and require the installation of glass that meets various minimum safety standards. These critical glazing locations are:

- *Between the finished floor level and 1500mm above that level* in **doors** and also in **side panels** which are *within 300mm of either side of the door*.
- *Between the finished floor level and 800mm above that level* in the case of **walls, partitions and windows.**
- Mirrored doors and panels.

In all those parts of buildings where the planned activity generates a special risk, for example indoor sports facilities, all glazing should conform to Table 1 within BS 6262 part 4. In these situations, additional safeguards such as protective rails or screens, or manifestation, are necessary.

In accordance with the UAE fire and life safety code of practice and the industry recognized international standard BS 6262 part 4, we can inspect the property and determine if the codes are satisfied and advise on remedial work that may be required to improve the safety and protection of the occupants and visitors to the building.