VITROGLAZE

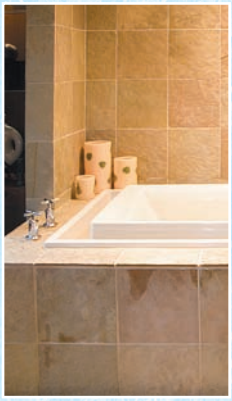
The clear solution

A breakthrough in glass protection

Technical Manual

August 2008

FPB
FUTURE-PROOF BUILDING



Windows

Conservatories

Balustrades

Skylights

Bathrooms:
Shower doors
Tiles/grout

Kitchens:
Splash-backs
Granite and marble benchtops

Marine glass

FUTURE-PROOF BUILDING

VITROGLAZE
Coating Adhesion Principles

ABSTRACT

Organic-inorganic (hybrid) reagents can be formed from various combinations of metal and silicon alkoxides to create a nanoscale admixture of inorganic-oxides that can covalently bond to silica, metal, ceramic and stone substrates.
The process of bonding (adhesion) at the nanoscale level is made possible by the sol-gel method.
Adhesion generally occurs when the substrate and the coating are held together by interfacial molecular contact in such a way that a unit is formed. Adhesion is a complex phenomenon related to physical effects and chemical reactions at the interface. Adhesive forces are set up as the coating is applied to the substrate and during curing or drying. The magnitude of these forces will depend on the nature of the surface and the binder used in the coating.
VITROglaze bonds onto silane (glass) surfaces both mechanically and chemically. In doing so it modifies the physical and chemical properties of the surface.

THE MECHANICAL THEORY

This mechanism of coating action occurs when the silane surface upon which VITROglaze is spread contains pores, holes, crevices, and voids into which VITROglaze solidifies. In this manner it acts as a mechanical anchor. Adhesion of VITROglaze to old and weathered glass as well as to sand blasted glass is increased (as against new float glass) by this mechanical mechanism. Surface roughness affects the interfacial area between the VITROglaze and the glass substrate. Because the forces required to remove coatings is related to the geometric surface area, whereas the forces holding the coating on to the substrate are in part, related to the actual interfacial contact area, increasing the surface area will increase the difficulty of removing the VITROglaze coating.
The VITROglaze Pre Cleaner, which is an integral part of the application on float glass, will remove surface contamination by microscopically etching the glass surface, leaving no residue upon evaporation. This also goes to preparing the surface for better mechanical adhesion as a result of the increased topographical surface area afforded by the etching process. Generally with other NON nanoscale coatings, as the viscosity and coating stiffness increase and as the coating adhesion to the glass develops, substantial stress is accumulated and retained in the dry film. Under the fixed application parameters of wet and dry film thickness, the film thickness on top of the hills will be less than in the valleys, thus creating variable physical prope The VITROglaze coating is not subjected to these types of forces due to the fact that it is about 600nm thick.rties. The resultant non-uniform film with high levels of internal stress will enter the service environment where it will be further subjected to solvent attack from repair coatings or weathering, often pushing such coatings beyond their capacity for stress. Cracking or delaminating or other evidence of lost coating integrity will be the result.

THE CHEMICAL BOND THEORY

The formation of covalent chemical bonds across the interface takes place between VITROglaze and the silane surface. This type of bonding is the strongest and most durable. As is the case, it is requisite that there be mutually reactive and identical chemical functional groups between the coating and the substrate. Therefore contaminated or impure (dirty) surfaces will produce chemical bonds of inferior strength with the coating.Chemically, VITROglaze is generically defined as an organoflurosilane. Industrially organosilane analogues are widely used as primers on glass fibres to promote the adhesion between the resin and the glass in fibreglass-reinforced plastics. Essentially during application, silanol groups are produced which then react with the silanol groups on the glass surface and form extremely strong ether linkages.

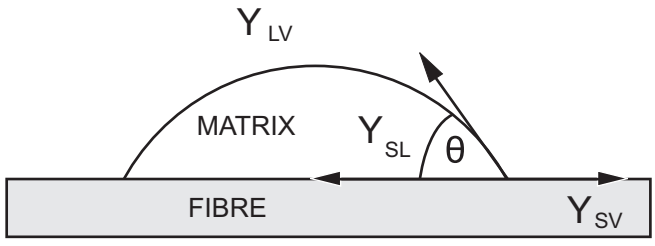
MECHANICS OF ADHESION DEVELOPMENT

When two dissimilar materials are brought into intimate contact, a new interface is formed at the expense of the two free surfaces in air. The nature of the interaction at the interface determines the strength of the bond, which forms between the coating and the substrate. The extent of these interactions is greatly determined by the wet ability of one phase by the other. In the case of coatings that are applied in liquid state, mobility of the coating phase is also of great help. Wetting, therefore, may be viewed as intimate contact between a coating and a substrate. In addition to initial wetting, in order for adhesion to remain between the substrate and the coating, it is important that intimate wetting and bonds remain intact after the coating has solidified. VITROglaze solidifies as a result of the evaporation of the ethyl alcohol solvent and a chemical cross-linking of the solute.

WETT-ABILITY AND SURFACE ENERGETICS

Wetting is a necessary criterion for adhesion. Mechanisms of adhesion are only operational if and only if, effective wetting is present between the coating and the substrate. For this reason VITROglaze applied onto a glass surface must be adequately spread or smeared consistently before the solvent evaporates off. The wetting of that glass surface can be described in thermodynamic terms. The surface tension of the VITROglaze in its liquid state and the surface energetic of both the glass substrate and the solid coating are important parameters that can influence the strength of the interfacial bond and adhesion development. The degree to which VITROglaze wets a glass surface is measured by the contact angle (Ø).

CONTACT ANGLE: The contact angle model is derived from the concept of surface energy. The following is an illustration of what is meant by the term.



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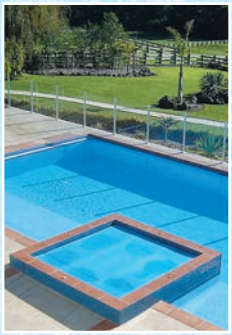
FUTURE-PROOF BUILDING



When a liquid droplet (matrix) interacts with a solid surface (fibre), the droplet attains an equilibrium shape. The droplet can be characterized by the angle formed at its edge where the liquid contacts the solid surface. This angle (Ø) is called the contact angle. For example, when water falls on a freshly waxed car, the drops bead up. This occurs because the water molecules are attracted to each other more strongly than they are to the wax's hydrocarbon surface. In this situation, contact angles are observed to be 150° to 160°.As the wax's hydrocarbon surface is exposed to UV light and oxygen, it is oxidized. After a few weeks, water doesn't bead up as much because it has a greater affinity to the surface. The degree to which the water is attracted to the wax is increasing as the wax is oxidized (increasing the molecular polarity) and so the contact angle is decreasing.

When Ø = 0, this signifies that the liquid is spread freely over the surface and is said to completely wet it. Complete wetting occurs when the molecular attraction between the VITROglaze and the glass molecules is greater than that between the VITROglaze molecules and themselves. The average contact angle measured for water on float glass that has been treated with VITROglaze is 124°.

SUMMARY

Mechanical and chemical models can describe the bonding of the VITROglaze molecule to a glass surface. Mechanically, VITROglaze will physically anchor and 'solidify ' into pores of the glass surface via the sol-gel method. A larger surface area will enhance the mechanical adhesion, of which the action of VITROglaze Pre Cleaner will afford. Being a Nano coating it will not delaminate and can only be removed by removing the surface to which it is attached.

Chemically, hydrolysis of the VITROglaze molecules functional group will form a silane intermediate that then chemically reacts with the activated silane surface of the glass, forming an extremely strong covalent bond. This reaction is thermodynamically (entropy and enthalpy) favourable and hence permanent.

Upon curing, VITROglaze molecules cross-link with one another producing a stabilised matrix that modifies the glass surface yielding hydrophobic properties. Contact angle measurements quantify the efficacy of VITROglaze acting as a hydrophobic coating and have been observed at 124° on float glass.

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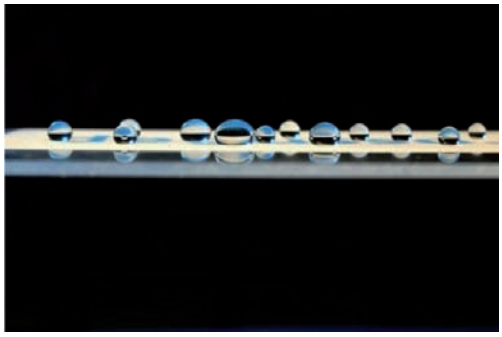
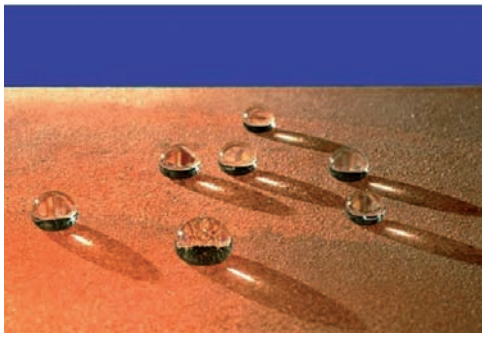
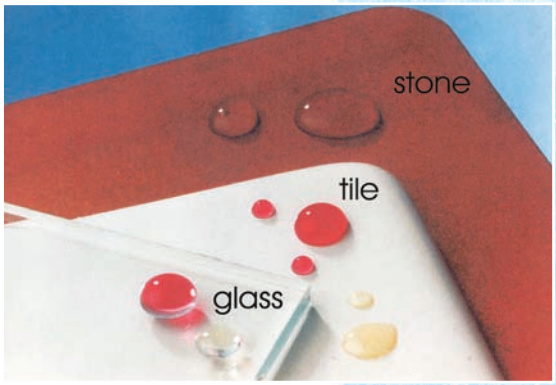




VITROGLAZE
Physical Properties

UV-A stability:
No maccroscopical change of appearance upon accelerated 2000h exposition (irradiation at 300 – 425 nm)

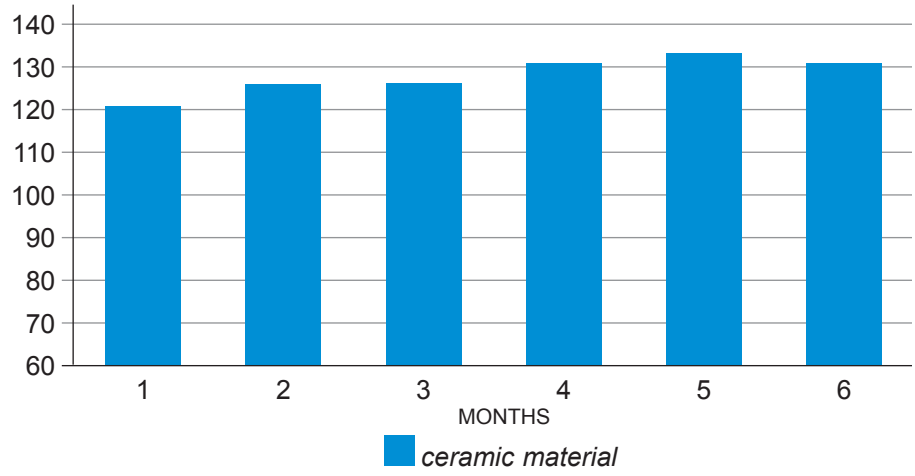
Thermal stability:
Excellent performance up to 300°C over extended periods.



Chemical resistance:
No degradation upon interaction with strong acids and alkaline environment.

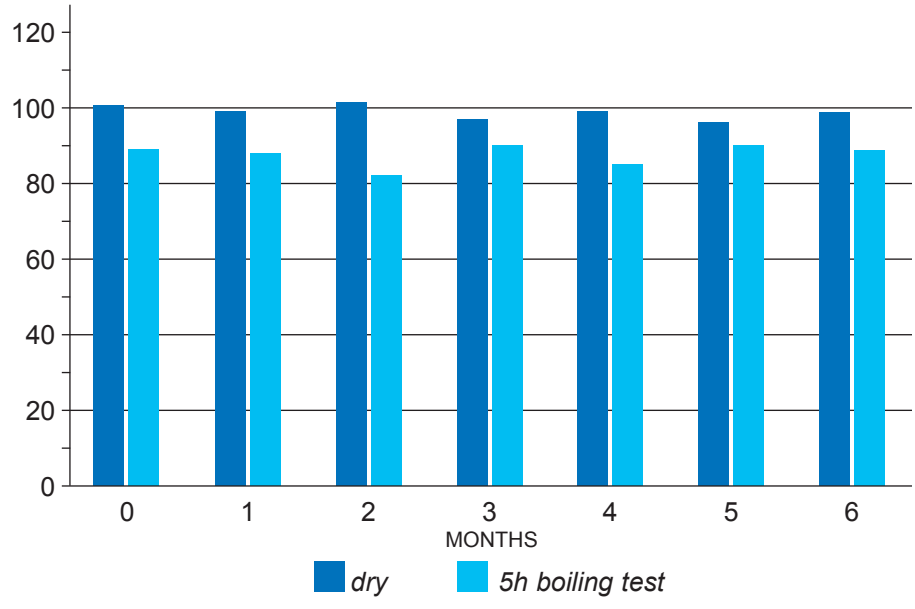
Optical appearance:
Invisible, homogenous, nano-scale film thickness.

Contact angle on ceramic (glass) surface after environmental exposure



Stability testing of Vitroglaze coating on enamel

Contact angle on treatment and after boiling water test



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MATERIAL SAFETY DATA SHEET

COMPANY DETAILS
Company Name & Address
CTG
1/7 Jubilee Ave
Warriewood NSW 2102
Telephone
Regular: (02) 9979 5899 (Office hours)
Not classified as hazardous according to the criteria of NOHSC Australia.

1) IDENTIFICATION

Product Name: Cyndan Vitroglaze
Other Names: Proper Shipping Name is ETHANOL SOLUTION
Product Code: None.
UN No: 1170 Hazchem Code: 2[Y]E
Dangerous Goods Class: 3 Flammable liquids.
Sub Risk Class: None allocated.
Packaging Group: II
Most EPGs may now be substituted by the Initial Emergency Response Guide, available from Standards Australia.
Poison Schedule: Not scheduled.
Chemical Family: Blend of ingredients (see below).
Uses: Water and stain protection for masonry surfaces.

Physical Appearance & Properties

Appearance & Odour: Clear, colourless liquid. Mild alcohol odour.
Melting/softening point: No specific data. Liquid at normal temperatures.
Boiling point and vapour pressure: 81°C at 100kPa
Volatile materials: >80%
Flashpoint: 12°C (Abel)
Flammability limits: Upper Value: 19% : Lower Value: 3.3%
Specific gravity: 0.824
Solubility in water: Completely soluble.
Corrosiveness: Not corrosive.
Viscosity: 1.12mPa.s at 20°C
Vapour Pressure: 0.66kPa at 20°C

Ingredients:

		Worksafe Exposure Limits		
Chemical entity	CAS No	Proportion	TWA	STEL
	%	mg/m3	mg/m3	
ethanol	64-17-5	>60	1880	not set
Acetic acid	64-19-7	<1	25	37
Other non-hazardous ingredients	secret	to 100	not set	not set

This is a commercial product whose exact ratio of components may vary. Trace quantities of impurities are also likely.

2) HEALTH HAZARD DATA

Health Effects

No specific data is available for the product for chronic exposure symptoms. The ingredients are not listed as carcinogenic in Worksafe's document "Exposure Standards for Atmospheric Contaminants in the Occupational Environment" (May 1995), nor in NOHSC's "List of Designated Hazardous Substances" (April 1999).

Acute Effects

Swallowed: Single dose oral toxicity is considered to be low. No hazards are anticipated from swallowing small amounts incidental to normal handling operations.
Eye: This product is mildly irritating to the eyes. It is likely to cause mild discomfort such as watering and redness of the eyes. However, this should quickly disappear once exposure is over.
Skin: This product may be mildly irritating to skin. However, it is unlikely to cause any more than mild transient discomfort. It is also unlikely to cause any lasting effects.
Inhalation: No inhalation hazards incidental to normal handling operations are anticipated from this product when used at room temperatures.

First Aid

If poisoning occurs, contact a Doctor or Poisons Information Centre. Phone 13 1126 from anywhere in Australia. If possible have this MSDS or product label with you.
Swallowed: If swallowed, do NOT induce vomiting. Wash mouth with water and give a glass of water to drink.
Eyes: If product gets in eyes, wash material from them with running water. If they begin watering or reddening, take special care in washing thoroughly.
Skin: If product gets on skin, thoroughly wash contacted areas. No further measures should normally be required unless irritation is noticed. If irritation persists, seek medical attention.
Inhalation: No first aid measures normally required. However, if vapours or mists have been inhaled, and irritation has developed, remove to fresh air and observe until recovered. If irritation becomes painful or persists more than about 30 minutes, seek medical advice.
Advice to Doctor: Treat symptomatically. Note the nature of this product.

3) PRECAUTIONS FOR USE

Exposure Standards:
A time weighted average (TWA) has been established for ethanol, present in significant quantities in this product. This value is 1880mg/m3. The corresponding STEL level is "not set". The STEL (Short Term Exposure Limit) is an exposure value that should not be exceeded for more than 15 minutes and should not be repeated for more than 4 times per day. There should be at least 60 minutes between successive exposures at the STEL. The exposure value at the TWA is the average airborne concentration of a particular substance when calculated over a normal 8 hour working day for a 5 day working week. See ingredients section on page 1 of this data sheet.

Engineering Controls: In industrial situations, concentration values below the TWA value should be maintained. Values may be reduced by process modification, use of local exhaust ventilation, capturing substances a the source, or other methods. If you believe air borne concentrations of mists, dusts or vapours are high, you are advised to modify the process or environment to reduce the problem.
Personal Protection: The following instructions are meant for people coming into frequent and lengthy contact with this product. For occasional use, take precautions suitable for the conditions under which the product is being used.
Respiratory Protection: It is usually safe to not use a dust mask or respirator protection on account of this product. However, if the product is being used in dusty or confined conditions, use of a mask or respirator may be preferred. For help in selecting suitable equipment, consult AS/NZS 1715.
Protective Gloves: Impermeable protective gloves (eg rubber, PVC) should be worn when you are using this product, to prevent irritation. For help in selecting suitable equipment, consult AS 2161.
Eye Protection: Protective eyewear is suggested when using this product. It is always prudent to use protective eyewear. Consult AS1336 and AS/NZS 1337 for advice on Industrial Eye Protection.
Clothing: This product is essentially safe to use without special protective clothing. However, its use is recommended as a good industrial practice. Consult AS2919 for advice on Industrial Clothing.
Safety Boots: Wearing safety boots in industrial situations is advisory. Consult AS/NZS2210 for advice on Occupational Protective Footwear.
Always wash hands before smoking, eating or using the toilet. Wash contaminated clothing and other protective equipment before storing or re-using.

4) SAFE HANDLING INFORMATION

Storage & Transport:
This product is classed as UN1170, Dangerous Goods Class 3 Flammable liquids. Proper Shipping name is ETHANOL SOLUTION.
Class 3 Flammable Liquids shall not be loaded in the same vehicle or packed in the same freight container with Classes 1 (Explosives), 2.1 (Flammable Gases where flammable liquids and flammable gases are both in bulk), 2.3 (Toxic Gases), 4.2 (Spontaneously Combustible Substances), 5.1 (Oxidising Agents), 5.2 (Organic Peroxides), 6 (Toxic Substances, except Flammable Liquid is nitromethane), and 7 (Radioactive Substances).
They may however be loaded in the same vehicle or packed in the same freight container with Classes 2.1 (Flammable Gases except where the Flammable Liquids and Flammable Gases are in bulk), 2.2 (Non-Flammable Non-Toxic Gases), 4.1 (Flammable Solids), 4.3 (Dangerous When Wet Substances), 6 (Toxic Substances, except where Flammable Liquid is nitromethane), 8 (Corrosive Substances), 9 (Miscellaneous Dangerous Goods), Foodstuffs or foodstuff empties. Not a Scheduled Poison.
Containers should be kept closed in order to minimise contamination. Keep from extreme heat and open flames, and make sure that the product does not come into contact with substances listed under “Materials to avoid” below.

Spills & Disposals
In the event of a major spill, prevent spillage from entering drains or water courses. Evacuate the spill area and deny entry to unnecessary and unprotected personnel. Immediately call the Fire Brigade. As a minimum, wear overalls, goggles and gloves. Stop leak if safe to do so, and contain spill. Absorb onto sand, vermiculite or other suitable absorbent material. Avoid using sawdust or other combustible material. Sweep up and shovel or collect recoverable product into labelled containers for recycling or salvage, and dispose of promptly. Recycle containers wherever possible.
After spills, wash area preventing runoff from entering drains. If a significant quantity of material enters drains, advise emergency services. This material may be suitable for approved landfill. Dispose of only in accord with all regulations.

Fire & Explosion Hazard
This product is classified as a C1 combustible product. There is a moderate risk of an explosion from this product if it is involved in a fire. Firefighters should take care and appropriate precautions.
Flashpoint: 12°C (Abel)
Flammability limits: Upper Value: 19% : Lower Value: 3.3% (ethanol)
Extinguishing Media: carbon dioxide, dry chemical, foam, water fog. Water fog or fine spray is the preferred medium for large fires.
Special Fire Fighting procedures: If a significant quantity of this product is involved in a fire, call the fire brigade. Immediately evacuate the area of unnecessary personnel. When fighting fires involving significant quantities of this product, wear safety boots, non-flammable overalls, gloves, hat, goggles and respirator. All skin areas should be covered. Ensure that no spillage enters drains or water courses.
Unusual Fire & Explosion Hazards: Fire decomposition products from this product may form toxic mixtures in confined spaces. Vapours from this product are heavier than air and may accumulate in sumps, pits and other low-lying spaces, forming potentially explosive mixtures. They may also flash back considerable distances.

Stability: This product is unlikely to spontaneously decompose.
Polymerisation: This product is unlikely to spontaneously polymerise.
Decomposition Products: Carbon dioxide, and if combustion is incomplete, carbon monoxide and smoke. Water.
Materials to avoid: Strong oxidising agents.
Note: This product is classed as a Dangerous Good. We suggest you consult your state’s Dangerous Goods laws in order to clarify your obligations regarding the storage of this product.

5) OTHER INFORMATION

This MSDS is prepared in accord with the Worksafe Australia document “National Code of Practice for the Preparation of Material Safety Data Sheets”, 1994.
Contact Point: David Lewis
Phone: Business Hours: (02) 9979-5899
Fax: (02) 9999-2086
National Poisons Information Centre:
Dial 13 1126 (from anywhere in Australia)
NZ contact

http://www.kilford.com.au/ Phone (02)9251 4532

FUTURE-PROOF BUILDING

Two new products being released very soon to complement our range...

VITROGLAZE
The clear solution

VITRO SLIP-FREE TREATMENT

Industrial Strength Slip-Free Floor Treatment

POISON

KEEP OUT OF REACH OF CHILDREN

READ SAFETY DIRECTIONS BEFORE OPENING OR USING

Contains Ammonium Bifluoride 3g/L

Vitro Slip-Free Treatment is effective on the glazed ceramic and vitrified tiles, polished granite, terrazzo, marble, quarry tile, concrete, slate, porcelain bath tubes and several other hard floor surfaces. Vitro Slip-Free Treatment is not a coating, therefore will not delaminate, yellow or wear off, as other coatings do. One application will last for up to 5 years even under high traffic.

When applied correctly, the treated floor surface when wet will comply with the Australian Standard safety level outlined in AS/NZS 4586:2004. (Wet Pendulum Test having mean BPN values between 45 – 70, Co-Efficient or Friction exceeding 0.6 for most areas). One litre will cover approximately 15 square metres.

VITROGLAZE
The clear solution

MICROSCOPIC INVISIBLE MASONRY SHEILD

The application of Vitro MIMS causes a chemical reaction in the capillaries of the substrate and becomes an integral part of the substrate it is protecting. Vitro MIMS is not a surface or barrier coating. Surfaces would need to erode to reduce the effectiveness of Vitro MIMS. Cleaning procedures will not reduce the product's effectiveness. Vitro MIMS allows the substrate to breathe thus allowing gases and water vapour to escape out of the substrate. This is particularly beneficial when treating material such as sandstone or similar stone surfaces. Vitro MIMS can be applied to a damp surface.

The treatment has a wide pH tolerance and provides an effective shield against the ingress of foodstuffs and common waste materials into the substrate whilst not affecting the surfaces non-slip characteristics. Chewing gum does not adhere to Vitro MIMS treated surfaces. There is no change in the appearance of the treated surface. Vitro MIMS will also provide a shield on concrete or masonry walls that attract bill posters. We have found that there is reduced adhesion for normal posters and they are easily peeled off. It has been found that some paints will not easily adhere to surfaces treated with Vitro MIMS which suggests some potential benefit in an anti-graffiti role; this will require specific site testing.