

Facilitate

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STAIRWAY TO SUCCESS

Grip systems benefit railway station health and safety

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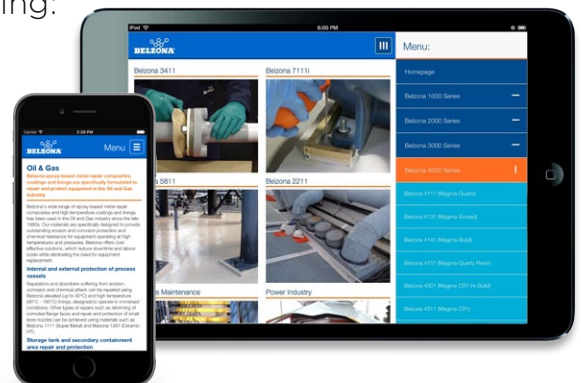


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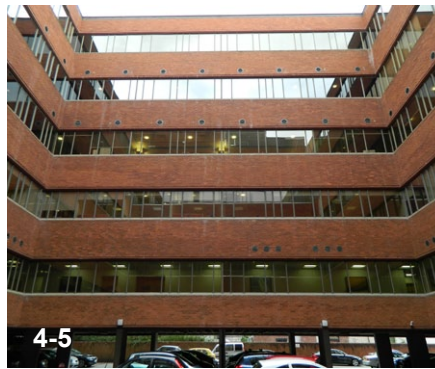
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WELCOME

Belzona would like to welcome you to the 2016 edition of Facilitate magazine. This year, we have compiled an excellent array of case studies and featured articles which journey into the world of facilities maintenance, whether it is protruding vegetation, crumbling masonry or leaking roofs. Enjoy reading this edition of Facilitate, which explores some of the global solutions used to maintain the facilities we use daily.

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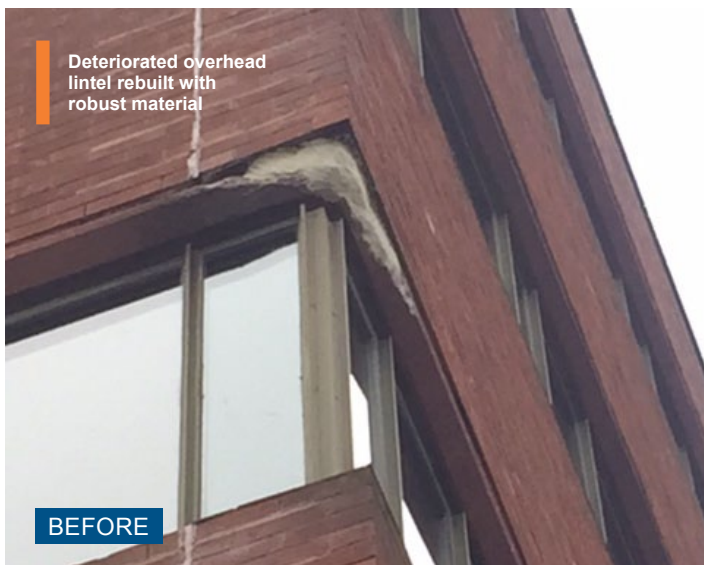
For more application examples visit khia.belzona.com



1970s office building and car park in urgent need of maintenance

DURABLE POLYMERIC SYSTEM REPAIRS OVER 300 SPALLED SURFACES

Falling debris and concrete tackled with hard-wearing rebuilding system



Deteriorated overhead lintel rebuilt with robust material

BEFORE



AFTER

When Belzona representatives went to visit a large office building with car park in Manchester, UK, it was clear that urgent repair work was needed. Chunks of concrete were falling from various cracked and spalled areas of the building façade, causing concern for the public below. In the underground parking area, concrete stalactites, formed by calcium oxide in the concrete reacting with rainwater leaking through the building, had formed in numerous places. This was obviously a concern for car park users and their vehicles. Needless to say, the building, originally constructed in the 70s, required significant repair work to be carried out urgently in order to prevent any potential injuries or damage to vehicles.

BELZONA SPECIFICATION

As Belzona has over 60 years of experience in the repair and maintenance sector and was able to offer a comprehensive and competitive solution, the owner decided to deploy a combination of Belzona systems to repair all the deteriorated areas in the building. Hard-wearing, durable Belzona materials were specified to rebuild over 300 damaged areas.

Due to its lightweight properties, Belzona 4141 (Magma-Build) was specified to repair vertical and overhead concrete areas while the non-porous polymeric screed, Belzona 4131 (Magma-Screed) was specified to repair larger areas. The elastomeric expansion joint sealant, Belzona 4521 (Magma-Flex Fluid) was selected to repair damaged expansion joint areas. For the damaged drain areas, these would be firstly rebuilt with a Belzona 4000 Series material. They will then be coated with Belzona 3131 (WG Membrane) to provide additional protection from rainwater, followed by the incorporation of a Belzona safety aggregate to create a grip surface.

As these systems cure in a matter of hours, achieving full mechanical hardness soon after, the application will avoid any excess downtime and disruption to the building's daily operations.

“ Needless to say, the building required significant repair work to be carried out urgently in order to prevent any potential injuries or damage to vehicles. ”



BEFORE



AFTER

Drain area repaired and protected with a combination of polymeric systems

APPLICATION METHOD

In order to access exterior areas high up on the building, a Spider MEWP was used. For the application, after preparation and conditioning of all surfaces to be rebuilt, each Belzona rebuilding material was mixed and firmly pressed into the repair area. To ensure air pockets did not form, the concrete repair system was firmly compacted into each area. As the building's façade is made of red brick, Belzona was able to add a powder tint to the construction polymer, ensuring the system blended in with the surrounding substrate and provided an aesthetic finish.

Temporary formers were used to support the Belzona material during application and to assist in reforming edge details. However, the lightweight composite used for overhead and vertical repairs did not require shuttering during cure and only minimal support during application, further minimising disruptions and downtime.



Spider MEWP used to access higher areas

As the application was carried out during the winter months, it was not possible to perform repairs on the exterior areas of the building. However, due to the simplicity of Belzona applications, the procedure was simply rescheduled so that when the bad weather came, applications could still be carried out in the underground area and when the weather was good, the exterior areas were treated.

The combination of Belzona systems will protect the building against environmental attack for many years to come. All the extensive repair work was completed in three months, (working weekends only), a small amount of time considering over 300 applications were carried out.

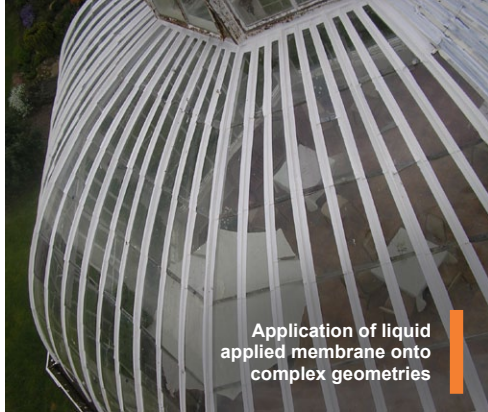
THE IMPORTANCE OF REGULAR MAINTENANCE

Due to climatic conditions and every day wear and tear, it is essential that regular maintenance checks, coupled with prompt action to pre-empt or remedy problems are carried out. Routine maintenance checks help to ensure the health and safety of the building users and the general public. Not only this, but regular maintenance also proves to be highly cost-effective: the time and money spent on routine care, regular surveys and minor repairs helps to protect the value of the building and avoid unnecessary costs.

Belzona's cold and fast curing systems are ideal for facilities maintenance as they allow for a simple application procedure that can be carried out in a matter of hours. This is a fraction of the amount of time required for conventional repair methods, such as concrete repairs (which take 28 days to cure), keeping downtime to an absolute minimum.

BREAKING TRADITION: THE EVOLUTION OF ROOFING MAINTENANCE

Liquid applied roofing membranes boast breathable technology



Application of liquid applied membrane onto complex geometries



Rain resistant immediately after application



Low odour material ensures minimal disruption

The evolution of materials to protect roofs against the elements is a constant process. Historical repair materials such as tar and lead have been eclipsed on flat roofs by roll on materials such as rubber sheeting and felt. Typical motivations for change include ease of use, longevity and safety in use. Today, these materials are evolving again with the advent of polymeric membranes for repair of roof damage which have enhanced these key attributes even further.

CHALLENGES FOUND WITH TRADITIONAL ROOFING PROTECTION METHODS

Rubber sheeting is a widely used material for roof repair but presents several complications in terms of application and longevity. As the system is pre-formed in sheets, it must be cut and laid in place before being adhered using contact adhesive. On large areas, the joints required between rolled out sheets, as well as those present as the sheet is cut to fit around roof detail such as cable tray supports, upstands and skylights, increase the number of potential failure points. Poor finishing of just one joint can result in water ingress and issues associated with internal damp.

An essential factor in any successful roofing solution is breathability, as this allows any vapour trapped inside a building to escape. However, rubber

sheeting will not allow this venting of moisture and so, if inadequately ventilated, moisture will tend to become trapped behind the rubber sheet and result in rot and damp issues.

Reliance on contact adhesive and lap sealant to limit leaks at joints can be thwarted as these glue types can become damaged over years of exposure to UV rays and the elements. As the rubber ages, it will lose flexibility and stress these joint areas - increasing the risk of joint failure. Should a joint fail, tracking a leak on a complex roof with tens or hundreds of joints can result in lost time and investment. Should another joint fail, the process repeats and continues.

Limiting stretching and wrinkling of rubber roofing materials used for repair of damage at roof edges is carried out using corner fixings and gutter fixings whose installation usually necessitates nailing, thus penetrating the rubber roof cover. Additional, fixings have to be cut and fit to shape and pinned in, requiring extra work after the roof protection has been applied.

Just as rubber sheeting and other similar materials succeeded older methods as the first choice for roofing repair, so polymeric membranes have come to the fore today and are taking over as the go-to system for repair and protection of deteriorated roofs.



BEFORE

Leaking asphalt roof



AFTER

Liquid applied polymeric membrane

POLYMERIC MEMBRANES: KEY ADVANTAGES

Polymeric membranes are commonly liquid applied, single component materials. When compared to rubber sheeting, they feature several key advantages.

- They can be applied on to glazing, metal upstands and gutters, as well as a variety of other natural and man-made materials.
- They will bond strongly to many current and traditional roofing materials including rubber sheeting, felt, asbestos, mineral felt, profiled metal sheets amongst others.
- They are liquid applied and cure (or 'dry') to form a single, truly seamless barrier.
- They are designed to be microporous in nature. This means that there is no risk of trapped moisture building up behind the system as vapour can permeate via the micropores.
- They are safe to use with no flame torches, aggressive solvents or chemicals used in their application.
- In the event of a defect arising, repairs can be performed using the same systems and the area requires only washing and application of a simple conditioner to prepare.
- Liquid applied systems can be applied to many complex geometries, and can also be used for sealing glazing bars across glass and aluminium or steel.
- They remain flexible in service, ensuring they move in sympathy with the roof natural movement without opening up cracks or voids.

Polymeric membrane in service for over 20 years



The simple application process is a key benefit of polymeric membranes. A recent refurbishment project which was completed at a customer's facility in the UK demonstrates this.

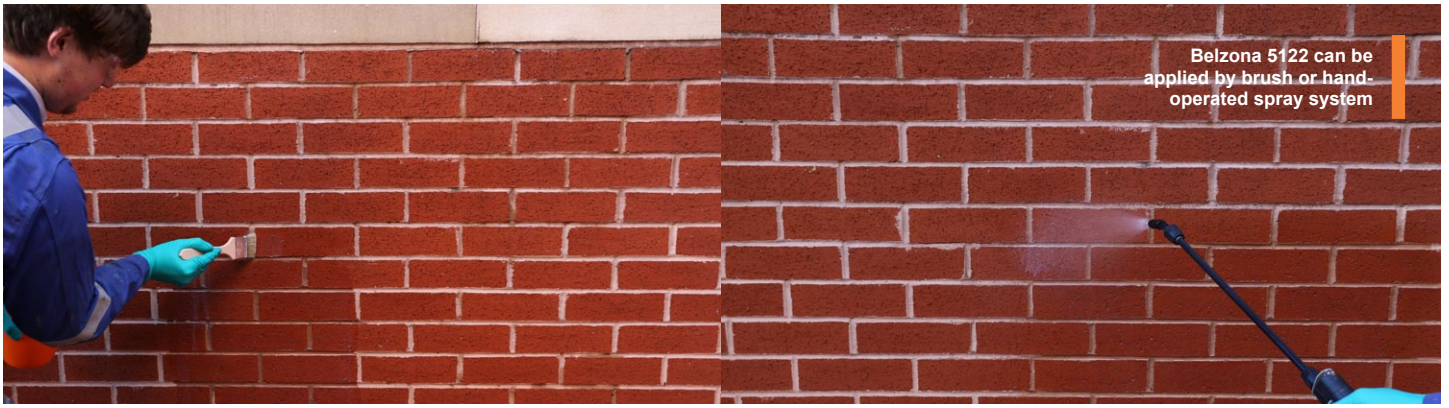
General degradation of the previous system required refinishing of the roof with a new barrier to prevent water ingress into the building below. The local Belzona representative attended site and recommended Belzona 3111 (Flexible Membrane), a water based polymeric liquid roofing material. The roof was prepared first by washing and cleaning. Following this, Belzona 3911 (PSC Surface Conditioner) was used to prepare the surface for the application.

Once the conditioner had dried (approximately one hour depending on weather conditions), the polymeric coating was applied directly to the roof surface. Edges and detailed areas such as skylights were handled first followed by the larger areas. A reinforcement sheet was incorporated into the first layer of Belzona 3111 to provide tensile strength.

The Belzona system was applied on to a range of different materials, from rendered walls, to sheeting and glass, achieving high adhesion to all surfaces. For the final stage, a top coat was applied to complete the system. As Belzona 3111 carries a 25 year BBA certificate, this project is expected to enjoy a long, trouble-free service life.



Flat roof protected in London city centre



Belzona 5122 can be applied by brush or hand-operated spray system

DETERIORATING MASONRY WALLS? THERE IS A CLEAR SOLUTION

Transparent, water-repellent treatment prevents wall deterioration

Frequently, external walls are exposed to rain and adverse weather conditions, allowing water to enter the porous masonry surface and travel to the internal walls, creating damp areas. Dampness also encourages mould growth, as condensation on internal walls builds up, deteriorating the walls even further and posing potential health risks. In terms of damage to the external walls, these can be affected by freeze-thaw cycles, where water penetrates the masonry and freezes, creating cracks and gradually eroding the wall.

Evidently, to protect walls from external and internal degradation in the long term, they need to be protected against water penetration, whilst simultaneously letting internal moisture escape. Meanwhile, it is important to ensure that the external appearance of the building is not altered by the protective system. A clear masonry treatment, in the form of an aqueous penetrating liquid, is the solution developed by Belzona in answer to this maintenance challenge.

When brush or spray-applied to porous surfaces, Belzona 5122 (Clear Cladding) forms an invisible, micro-porous, water repellent barrier that allows the passage of air and water vapour, ensuring that moisture is not trapped in the wall. This single component material is supplied as a concentrate for dilution with water prior to use.

INVISIBLE STONE PROTECTION - JORDAN

This breathable and impermeable treatment has been applied all around the world, successfully protecting commercial, industrial and private buildings against dampness whilst reducing the effects of erosion and efflorescence.

At a private building in Amman, Jordan, the external stone facade was experiencing a serious problem due to weathering. Water was penetrating the stonework, creating damp areas on several places on the internal walls. The owner of the building required a long-term solution that would successfully waterproof the structure while retaining the natural appearance of the stone.

Following an inspection by a Belzona representative, Belzona 5122 (Clear Cladding) was specified to waterproof the structure. With a fast and simple application procedure, the Belzona system successfully protected the wall against water penetration and further damage, while successfully maintaining the appearance of the stonework.





POLYMERIC MEMBRANE PROTECTS ROOF FROM WATER PENETRATION

Roof and seams coated with liquid applied, waterproofing system

At an administrative building in Skopje, Macedonia, a concrete roof overhang was in an extremely deteriorated condition and in need of urgent protection. The roof was situated above the entrance to the building, which meant that as the previous coating failed, water had begun to penetrate through the roof and into the entrance area below. As well as a long-term, watertight solution, it was imperative that the material and the application method itself incurred as minimal disruption as possible, as the repair needed to be carried out within a busy public space.

SYSTEM SELECTION

The European Technical Assessment ETA 05/0075, issued by the British Board of Agreement (BBA) for the Belzona 3111 (Flexible Membrane) system, provides an assumed life of 25 years, giving the client confidence that the solution will provide long-term protection.

With a simple application procedure involving no hot-work, this liquid applied, microporous coating will successfully fortify the roof, providing outstanding weatherproofing and waterproofing properties. Applied in conjunction with a Belzona reinforcing sheet, this will give the repair added durability, flexibility and strength. Prior to the application of these materials, Belzona 3911 (PSC Conditioner) and Belzona 3921 (GSC Surface Conditioner) were specified to condition the concrete and aluminium areas respectively, ensuring maximum adhesion will be achieved.

APPLICATION METHOD

Firstly, all of the previous coating was removed using hand held tools and the area was swept clean. Once the surface was clean and dry, in order to ensure a neat and tidy application, masking tape was fixed inside the prepared areas. For the seam areas, a plastic backed adhesive tape was used to bridge the joints. The Belzona conditioners were then brushed onto the substrate up to the masking tape.

Next, Belzona 9311 (Reinforcing Sheet) was covered over the conditioned areas. Belzona 3111 was then applied with a soft bristled, good quality brush through the reinforcing sheet. The material was smoothed over to ensure complete wetting and to leave a finish free from stretches or creases in the reinforcing sheet. Once dry, the masking tape was removed and the second and final coat of Belzona 3111 was applied. All pinholes and areas not wetted out previously were fully encapsulated and filled by this second layer to produce a continuous, unbroken film.



SAFE APPLICATION ACHIEVED WITH COLD APPLIED AND ODOUR FREE MATERIALS

The cold applied and odour free characteristics of the Belzona roofing membrane system allowed for the application to be carried out without causing any inconvenience to the people working in the building or to the general public, even during busy working hours. Following an inspection after one year, the roof was confirmed to be in good condition. Belzona was able to provide a comprehensive repair that was cost-effective, non-intrusive, long-lasting and exceptional in terms of durability.

METAL ROOF SEAMS SEALED WITH LIQUID APPLIED MEMBRANE

Belzona seals government building leaks



Government building, Oklahoma

On metal roofs, seams are one of the main areas of concern as they can quickly develop leaking problems. Being usually the weakest part of the roof, leaking seams require correcting at the initial stage of the problem in order to avoid further deterioration and costly consequences. At a government building in Guthrie, Oklahoma, several leaks had arisen due to a number of deteriorated seams on a galvanised metal roof. 365m (1,200ft) of seams had severely deteriorated, leaving the roof in urgent need of waterproofing.



Leaking seams leading to water penetration

Conventional seam sealing methods include thermoplastic membranes (PVC, TPO, KEE), which involve heating the membrane with hot air until it melts and fuses to the next section or flashing. Modified-bitumen seals, by mopping hot asphalt onto the seam. Both of these methods require hot work for their installation, with resulting Health and Safety implications. EPDM rubber, including adhesives and sealant tapes, can also be used; however, these rubber materials can fail due to shrinkage, poor adhesion and aging.

While these three methods may repair damaged seams, they incur a number of drawbacks. In addition to the hazards caused by hot work and odour, particularly within a public environment, many of these methods require a specialist applicator and equipment to carry out the maintenance work, which can be expensive and time consuming. If the repair is carried out without the correct procedure or personnel, it is likely to fail before its expected service life.

The owner required a solution that would successfully repair the roof for the long term without incurring any of the drawbacks found with conventional methods.



Deteriorated seams

“ The owner required a solution that would successfully repair the roof for the long term without incurring any of the drawbacks found with conventional methods. ”

BELZONA SPECIFICATION

Based on the outstanding waterproofing and weatherproofing properties of Belzona 3111 (Flexible Membrane), the owner decided to seal the leaking seams with this single component, solvent-free system. Its microporous properties allow trapped moisture to escape while the liquid applied technology ensures a safe, heat-free installation can be achieved. This was selected in conjunction with Belzona 9311 (Reinforcing Sheet), which combines to form a tough, polymeric membrane which tightly follows the seam contours whilst moving in sympathy with the substrate. The Belzona 3111 system provides an odour free application, ensuring no disruptions to the public building operations.



Roof successfully protected against potential leaks

APPLICATION METHOD

Firstly, any loose subject matter was removed and the surface was cleaned. Once dry, the substrate was conditioned with Belzona 3921 (GSC Surface Conditioner) in order to ensure optimum adhesion of the Belzona membrane.

To ensure a neat and tidy application, masking tape was fixed inside the prepared area and the conditioner was applied up to the masking tape. Onto the conditioned substrate, a soft bristled brush was used to apply the Belzona 3111 through the Belzona reinforcing sheet laid onto the substrate. This was done without stretching or creasing the sheet, ensuring that it followed the seam contours.

The masking tape was then removed and the first layer of Belzona 3111 was left to dry thoroughly before applying the second layer. Using the reinforcement sheet as a clear indicator, all pinholes and areas not wetted out previously were fully covered and filled with this second layer, ensuring that a continuous, unbroken film was produced. Using this flexible liquid applied membrane, which demonstrates excellent adhesion, the complex seams and contours of the roof were able to be sealed effectively. Once fully cured, the Belzona system provided a seamless, flexible and waterproof layer.

The customer was satisfied that the Belzona membrane met their original requirements of a long-term solution, whilst causing minimal disruption.



Seams sealed with breathable membrane



Complex seams and contours sealed effectively



Concrete loading bay area successfully resurfaced

PREPARATION BREEDS SUCCESS: CONCRETE PREPARATION TECHNIQUES

A step-by-step guide on how to achieve optimum concrete preparation

‘By failing to prepare, you are preparing to fail’. A term not commonly associated with surface preparation, but one that neatly summarises its importance. Surface preparation is critical to the success of an application, particularly in terms of concrete preparation. When applying any Belzona coatings to a concrete surface, there are three key points that must be met. In order to achieve the desired optimum bond, it is necessary to have:

1. A clean surface, free from fluids, moss or lichen
2. A dry substrate, free of excess moisture
3. A firm surface, with any loose concrete removed

Without adhering to these recommendations, the likelihood of achieving a successful application is diminished, leading to application failure and vulnerabilities such as holidays. This article will explore the importance of concrete preparation, the methods available to applicators and how the recognised standard can be achieved.



Decontaminating concrete is essential

CLEANING THE SURFACE

Whether it is ingrained dirt, organic growth, or industrial contamination, cleaning the surface of the concrete is vital to ensure an uncontaminated substrate before any application. Common to Belzona concrete preparation is removing oil, grease and dirt by treating the surface with a concrete cleaner, followed by vigorous scrubbing and thorough rinsing with water to remove all residues. High-pressure water cleaning or water-jetting methods, as described in SSPC-SP12/NACE NO.5 ASTM D4263, can also be used to a similar effect. This method consists of directing a high-velocity, high-pressure water jet to the concrete surface, sweeping back and forth across the concrete surface as the equipment advances incrementally.

A common misconception when cleaning concrete concerns its pH balance; predominantly in chemical containment areas such as bunds. Notably, alkaline solutions are often used to increase the pH levels of the substrate and then halted after reaching a neutral level. In actual fact, the normal pH range of concrete is closer to 13-14; therefore a neutral reading would indicate a vast amount of residual contamination. Chemically contaminated concrete must be cleaned thoroughly, several times before beginning an application, until a minimum of pH 10 is achieved.

DRYING THE SURFACE

Naturally, concrete is a very porous material, therefore removing the excess moisture is essential to eliminate the chances of application failure. But how is the level of moisture determined when carrying out concrete preparation?

The simplest methods available are often just indicative, qualitative tests that just highlight the presence of moisture during concrete preparation. Amongst these, there are plastic sheet tests and moisture meters, the latter of which uses electrodes to penetrate the concrete. These types of electronic moisture meters will actually provide a reading, but they merely measure the moisture presence in the surface of the concrete. Realistically, the overall reading could be much higher just a few inches under the surface.

Following these indicative tests, a quantitative method is required to accurately determine the entire moisture content of the concrete. One such test uses anhydrous calcium chloride. In principle, this uses a known weight of desiccant to absorb moisture vapour exiting the surface of the concrete. The desiccant's change in weight from the beginning to the end of the test is a measure of the amount of water vapour passing through the concrete. This gain in weight of the desiccant can be converted into an equivalent evaporation rate over 1000ft² (93m²) of concrete in a 24 hour period. Subsequently, this conversion will highlight in pounds weight of water, the moisture content of the concrete; the target for which is below 3lbs per 1000ft² (1.36kg per 93m²).

Ultimately, a Relative Humidity probe is the final method Belzona specify for establishing moisture content. This method provides the most accurate assessment in terms of relative humidity, by dropping small electronic probes into drilled holes in the concrete. They are then left to equilibrate and following the recommended equilibration time, the probe can be read either directly or with a specially made reader. This should reach a target relative humidity reading of 75%. As highlighted, this method provides a very accurate measurement of the concrete's moisture content, at the recommended 40% depth of the concrete slab thickness. However, the negative of this method is that the probes are left entombed in the concrete. Once the method has been chosen and the tests have been completed, the preparation can then be moved on to the next stage, whether that involves moisture level reduction or continuing with the appropriate concrete preparation.



Relative Humidity test is the most accurate

STARTING FROM A SOLID PLATFORM

Loose concrete and debris jeopardises the success of any application, thus requiring a firm and stable surface. Typically, mechanical devices are used to achieve this finish and they come in two types: rotary and impact. The choice of equipment and subsequent techniques can vary depending on several factors. Age of the concrete determines whether it is necessary to remove the laitance, commonly found on newly formed surfaces. In addition, the concrete's density affects the final finish. For example, rotary equipment is usually used on low compressive strength concrete substrates, yet is not effective on hard dense concrete, which they are likely to polish rather than abrade.

Under rotary equipment selection, there are various scarifiers and scabblers that can be used to attain the desired substrate. Utilising interchangeable cutters, scarifiers apply a rotating circular cutting wheel to the concrete surface; however, the depth of cut can be more precisely controlled using a scabber. Both devices are noisy, produce vibrations and generate a great deal of dust, although the former can be controlled by using a dust collector attachment. These machines are effective on old floors, and will successfully remove old paint or curing compounds, but are relatively expensive, heavy and require skilled operators. Conversely, impact devices such as centrifugal shot blasting, in addition to dry, wet and vacuum-assisted abrasive blasting, may be used. These can remove contaminants, laitance and weak concrete, in order to expose subsurface voids and produce a concrete surface with adequate profile and surface porosity.

As a final note, the significance of the three main points of concrete preparation, before applying a coating, must be reiterated. Obtaining a dry, clean and firm surface is the only way of gaining the optimum bond to the concrete substrate. Every year, Belzona will hear of some form of disbondment and 99% of these are usually a result from non-existent or partially completed surface preparation. Therefore it is vitally important to take the time and effort to prepare the area before undertaking any application.



Blasting provides the optimum substrate for bonding

BELZONA SYSTEMS TAKE ON LARGE AIRPORT PROJECT

Floor damage repaired and expansion joints installed with polymeric materials

400 metric tonnes (450 US tons) of aluminium, steel and carbon fibre repeatedly driving across floor areas, approximately 270 times a day, had left 150m (492ft) of concrete floor and expansion joints at an airport in Dammam, Saudi Arabia, in urgent need of repair.

The deteriorated areas, situated in 40 different locations including aircraft taxiways and ramps, were exhibiting severe signs of wear and damage. The concrete had become cracked and spalled and the previous expansion joint sealant had peeled away from the edges of the joint. Due to the high turnover of aircraft, it was imperative that the repair solution incurred as minimal downtime and disruption as possible, ensuring it would not impact on the day-to-day running of the airport.

SYSTEM SELECTION

Following an inspection by Belzona representatives, Bobby Satheesh, QA/QC Manager at Hajjan Trading & Industrial Services Co. Ltd., Belzona authorised Distributor in Saudi Arabia, specified a solution. Mr Satheesh explains, *“In order to give the airport complete confidence in the Belzona materials, we conducted a sample application to demonstrate the flexible and robust properties of the systems.”*

“A number of concrete areas were rebuilt with Belzona 4111 (Magma Quartz) and the expansion joints were repaired with Belzona 2221 (MP Fluid Elastomer). The two component epoxy resin system, Belzona 4111, contains selected quartz particles to create an extremely durable rebuilding material with a compressive strength (when tested in accordance with ASTM D695) of 92.7 MPa (13,450 psi). As the material is stronger than concrete, the substrate is able to withstand heavy loading without fear of degradation.”

“For the expansion joints, Belzona 2221, a tough polyurethane resin with outstanding flexible properties, was specified. This material will accommodate high levels of movement and enable the expansion joints to successfully absorb any shock or impact and return to their original shape undamaged.”

The sample application took 18 labour hours to complete and was left to cure for three days. In order to assess its performance, fork-lift trucks were then driven over the repaired areas. As the combination of epoxy and polyurethane systems successfully withstood these loads, the airport decided to continue with the application to complete the 150 linear meters (492ft) of damaged area.



Pouring of flexible elastomer into sample piece



Cracked and spalled concrete



Deteriorated expansion joint

“ *The two component epoxy resin system, Belzona 4111, contains selected quartz particles to create an extremely durable rebuilding material with a compressive strength (when tested in accordance with ASTM D695) of 92.7 MPa (13,450 psi).* ”

APPLICATION METHOD

Firstly, the concrete was prepared to reveal a sound substrate. Any old coating or previous patch repairs were fully removed. Loose contamination was brushed away and the substrate was then cleaned using Belzona 9111 (Cleaner Degreaser). The surface was then treated with a Belzona conditioner to ensure maximum adhesion was achieved. Where the concrete edges or nosings were damaged, timber battens wrapped in polyethylene sheets were installed before direct application of Belzona 4111 using a trowel. The material was then tamped down firmly so as to ensure maximum contact with the surface.

For the expansion joints, any loose contamination was brushed away and the substrate was cleaned using Belzona 9111 to remove any dirt, oil and grease. Where the elastomer was to be applied directly onto Belzona 4111, the Belzona 4111 was slightly abraded using emery paper. After conditioning of the surface, a foam backer rod with a diameter of approximately 20% greater than the width of the joint was installed. Where the depth was greater than 4cm with no support below, filler boards were placed to control the application depth. Belzona 2221 was applied using a simple pouring technique at a nominal thickness of 1cm (0.4 in), and the system was left to cure.



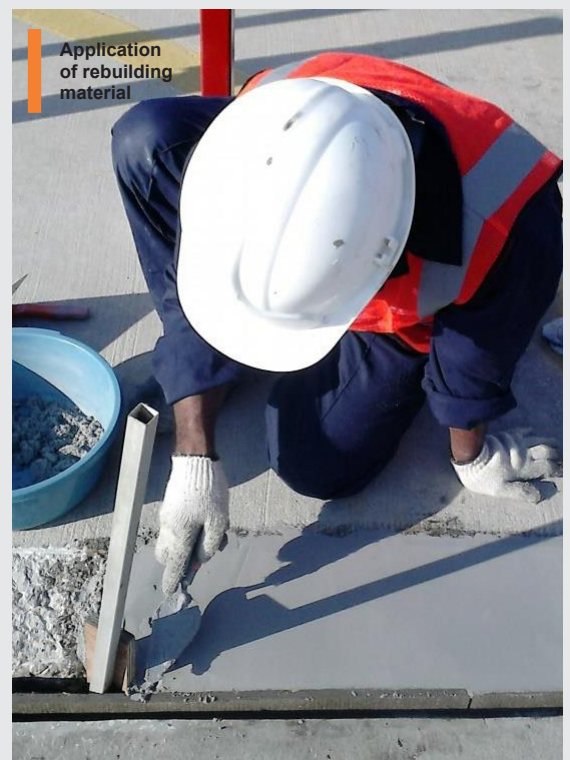
LEFT TO RIGHT
Concrete rebuilt and expansion joints installed



QUICK APPLICATION PROCEDURE KEEPS AIRPORT RUNNING SMOOTHLY

The extensive repair work was completed over a period of 126 days. The extremely quick cure time of the Belzona systems, (just 2-3 days instead of the 28 days required had the repairs been carried out using concrete) enabled over 40 areas suffering from various degrees of damage to be fixed with no hindrance to the airport operations. Furthermore, as the simple, cold-curing application procedure required minimal equipment during the installation, this meant that the application could be easily rescheduled to the night time, when the day time temperatures reached a scorching 55°C (131°F).

Thoroughly satisfied with the material's performance and the simple application procedure, the airport commissioned an additional 50 linear meters of damaged area to also be repaired by the Belzona systems.



Application of rebuilding material



BEFORE

AFTER

Deteriorated concrete floor

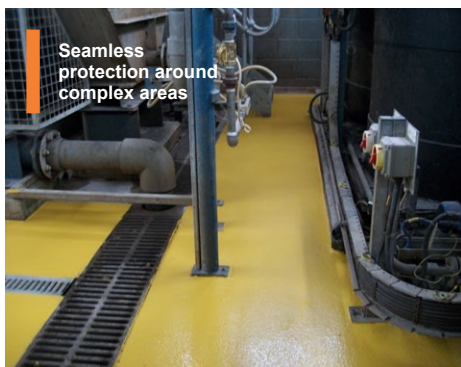
Polymeric floor coating with grip system successfully installed

SAFETY RESTORED WITH VIBRANT PROTECTIVE FLOOR COATING

Floor repaired and protected with durable polymeric systems

Ensuring the integrity of floors in production plants and commercial facilities is key to accident prevention. At a water treatment plant in Worcestershire, UK, a critical Health and Safety issue had arisen concerning 148m² (1,593ft²) of floor area in the site’s centrifuge dosing plant. The existing floor coating had failed due to wear and delamination in numerous places, with damage also identified on the actual concrete itself. This posed a clear safety concern for the plant’s operator as the floor presented a major slip and trip hazard to personnel working on the site.

A conventional solution to this problem would have involved resurfacing the deteriorated areas with more concrete. However, as the company required the repair project to incur as minimal downtime as possible, new concrete was not a viable option as it takes 28 days to fully cure. Crucially, the plant required a solution that could not only be installed and operative within a few days, but would also provide robust and durable floor protection.



Seamless protection around complex areas

SYSTEM SELECTION

The plant’s operator decided to use a combination of Belzona systems to level and protect the damaged floor. As specified by Belzona representatives, the polymeric repair composite, Belzona 4131 (Magma Screed), was chosen to rebuild and resurface any deteriorated concrete areas. This non-porous material will provide excellent abrasion and wear resistance as well as protection from impact. Far stronger than concrete, the polymeric screed will offer an extra strong top layer to the existing concrete, levelling the complete floor area.

To ensure long-term protection of the floor area, Belzona 5231 (SG Laminate), was specified to coat the entire area after repair. This solvent free epoxy coating has been specially developed for heavy duty sealing of concrete floor areas, ensuring the floor will achieve outstanding wear resistance. Belzona 9231 (Surefoot Aggregate) was incorporated into this coating system in order to provide a positive safety grip and minimise slip and trip hazards.

APPLICATION METHOD

Initially, the surface was scraped to remove any loose coating and failed concrete, followed by abrading using a floor scarifier. All dust and debris was then vacuumed away and the surface was cleaned. A Belzona conditioner was applied to the prepared damaged areas

in order to ensure excellent molecular adhesion is achieved between the Belzona screeding material and the substrate. Any heavily damaged concrete was then rebuilt back to profile using Belzona 4131. Once cured, the first coat of Belzona 5231, incorporating the Belzona aggregate, was coated onto the entire floor area using rollers. After the first coat had cured, the second coat was then applied to give a seamless, monolithic finish.

SYSTEM INSTALLED WITH MINIMAL DISRUPTION

Fulfilling the company’s requirement for a fast application, the complete Belzona application and full cure took just 6.5 days to complete. Unlike concrete, which takes 28 days to cure, the Belzona application ensured downtime and disruption was kept to an absolute minimum. Additionally, due to the low odour properties of the floor coating, this material ensured minimum disruption to the plant’s operations during application.

In terms of Health and Safety requirements, the bright yellow colour combined with the positive grip system dramatically minimises risk of accidents, which will help to keep personnel safe.



RISK OF SLIPS, TRIPS AND FALLS MINIMISED WITH POSITIVE GRIP SYSTEM

Railway steps benefit from hard-wearing grip system

As part of a major renovation project at a railway station in Wakefield, UK, 368 linear metres (1207ft) of newly built steps were in need of a positive grip system in order to ensure safe use of the stairway.

The station required a solution that, despite regular daily use, would continue to provide a safe surface for many years, with minimal need for maintenance or replacement. It was also essential that the application procedure was hazard free and incurred minimum disruption, so it would not pose any risks or major inconvenience to pedestrians using the station.

BELZONA SPECIFICATION

Based on decades of experience within the facilities maintenance industry, the station operator opted for a Belzona solution. The staircase was originally manufactured to a previous specification which involved inserting a grip system into a pre-cut groove; therefore, as the client decided to change the specification to the Belzona system, Belzona 4131 (Magma Screed) was specified to fill the grooves.

After the initial preparation work, the positive grip system, consisting of Belzona 4411 (Granogrip) incorporating a Belzona aggregate, was chosen. Consolidating the repair, this hardwearing epoxy resin system provides a durable safety surface with excellent adhesion and abrasion resistance, enabling the stairs to successfully withstand regular wear caused by pedestrians.

APPLICATION METHOD

The surface was firstly prepared to ensure it was clean, firm, dry and well roughened, followed by the application of a Belzona conditioner to provide a good adhesion of Belzona 4131 to the substrate. The polymeric mortar was then applied directly into the prepared grooves. This was applied by spreading to a general level using normal screeding techniques and using a metal straight edge to achieve a flush finish. The application was then smoothed using a steel float, prior to being left to cure.

Once fully cured, the surface was abraded and cleaned with Belzona 9111 (Cleaner Degreaser). Next, the Belzona 4411 resin was mixed and applied directly onto the prepared surface with a stiff bristled brush to give an even film thickness of 300-500µ (12-20mil). The Belzona aggregate was immediately sprinkled on top of the resin system and pressed into the substrate using a wooden block. The system was lightly swept over using a brush to remove excess aggregate and left to cure.

“ *Excellent adhesion and abrasion resistance, enabling the stairs to successfully withstand regular wear caused by pedestrians.* ”

SAFE APPLICATION ENVIRONMENT MAINTAINED

The solvent-free and low odour Belzona system allowed the work to be carried out in this public area with minimal disruption and risk to pedestrians. In addition, due to the cold-curing properties of the materials, this avoided the need for hazardous hot work, ensuring a safe application environment was achieved.

The hard-wearing properties of these combined Belzona materials will ensure the grip system will remain intact for the long term, not peeling or wearing away like adhesive strips.



CRUMBLING WALKWAY POSES MAJOR SAFETY HAZARDS

Handrail posts secured with non-porous grouting material



Erosion of concrete caused by freeze-thaw creates serious safety hazards

Continuous freeze-thaw damage can result in severe deterioration of concrete, which if left unattended, can lead to the failing of concrete grouts and loosening of handrail posts. This poses a major safety hazard with further damage and costly implications if not corrected immediately.

Freeze-thaw damage is an inherent problem of concrete due to its porosity. When water freezes, it expands by roughly 9%. Water penetrates the porous concrete and freezes, producing pressure in its pores. If the pressure developed exceeds the tensile strength of the concrete, the cavity will dilate and rupture. The accumulative effect of freeze-thaw cycles can eventually cause expansion and cracking, scaling and crumbling of the concrete.

This type of regular freeze-thaw action led to severe concrete spalling at a water treatment plant in Strathroy, Ontario. As the deteriorated concrete, situated in 30 different areas next to the clarifier tanks, affected two sets of stairways and was also securing a number of handrails, this had led to a series of health and safety issues. Not only did the problem areas require urgent repair and resurfacing, but the repair solution needed to provide outstanding durability in order to withstand regular environmental attack within this vulnerable area.



Deteriorated concrete stairway



Wooden forms ensure correct shape achieved



Curing of hard-wearing screed

BELZONA SPECIFICATION

In order to stop the problem from reoccurring, a non-porous material was required. With excellent adhesion to concrete, the epoxy resin system, Belzona 4131 (Magma-Screed), was chosen to rebuild the damaged areas. Comprising of high molecular weight polymers and oligomers, this hard-wearing material will fortify the substrate with robust environmental protection for the long-term. As the system is non-porous, this will ensure that water will not be able to penetrate the surface and lead to problems associated with freeze-thaw damage. To ensure maximum surface adhesion, Belzona 4911 (Magma TX Conditioner) was specified to be coated on the substrate prior to the application of Belzona 4131.

APPLICATION METHOD

Firstly, a needle gun and grinder were used to prepare the surface and any loose concrete was removed. Once the substrate was clean and dry, the two-part conditioner, Belzona 4911, was then mixed and then applied to the surface using a stiff bristled brush. Wooden forms wrapped in plastic were fixed in place to ensure the correct shape was achieved.

Next, Belzona 4131 was mixed until an even colour and consistency was achieved. The mixed material was then applied directly onto the conditioned surface, initially spreading to a general level using normal screeding techniques and then using a metal straight edge to achieve a uniform thickness prior to smoothing off using a steel float. After 24 hours, the wooden forms were removed and the application was left to cure for 48 hours.

“ The repair solution needed to provide outstanding durability in order to withstand regular environmental attack within this vulnerable area. ”



Handrail secured for long-term protection against freeze-thaw

NON-POROUS SYSTEM AVOIDS LENGTHY CURE TIMES OF CONCRETE

The applications onto numerous damaged areas were completed in just 11 days, successfully avoiding the lengthy downtime required for concrete to cure, which is 28 days per application. The robust and durable properties of Belzona 4131 ensure the substrate will remain protected against freeze-thaw cycles for the long term.

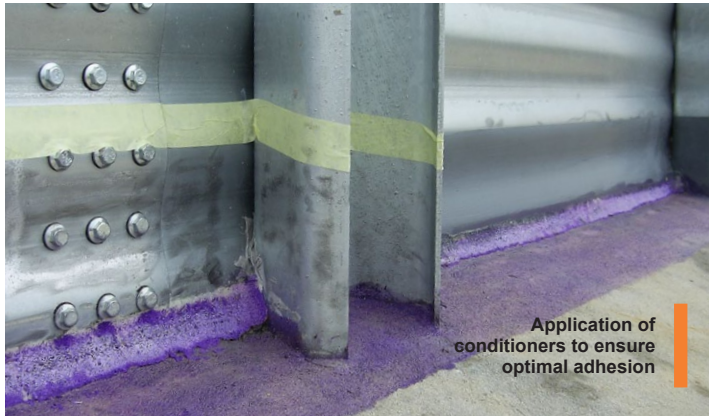


Surface successfully rebuilt and handrail post secured



LEAK STEMMED AND SILO PROTECTED WITH POLYMERIC TECHNOLOGY

Grain silo base sealed with flexible membrane



As a result of adverse weather conditions and condensation, the tank base on a 18m (59ft) diameter grain silo at an agricultural company in Devnya, Bulgaria, was in a severely deteriorated condition and in need of urgent sealing. Moisture had accumulated at the track under the base of the silo, which had led to corrosion and leakage. If left unrepaired, this would have caused severe structural degradation of the silo and, eventually, complete replacement would have been required.

While conventional methods such as welding may appear to solve the problem, their limitations must be taken into account. Welding can cause the substrate to warp, create weld defects and even damage the internal lining, leading to further problems. Also, as this method employs hot work, it can incur numerous Health and Safety issues and lead to highly dangerous situations considering the contents of the tank.

The operator required an alternative solution that would successfully protect the silo against environmental effects and corrosion for the long term, without incurring the drawbacks associated with welding. They sought a solution that would bypass the lengthy downtime required for hot work to be carried out, and would also ensure no damage was caused to the existing internal lining of the silo while carrying out the exterior application. It was also essential that the sealing material was breathable and would allow trapped moisture to escape whilst waterproofing the tank base.



No need for hot work with liquid applied polymeric technology

SYSTEM SELECTION

Following an inspection by a Belzona representative, the owner decided to repair the silo base with the liquid-applied roofing coating, Belzona 3111 (Flexible Membrane). As this system is impermeable to liquid water, but permeable to water vapour, this will allow the substrate to breathe, successfully keeping the tank base dry.

The liquid base binds to Belzona 9311 (Reinforcing Sheet) to form a tough, flexible polymeric film which tightly follows the contours of the tank base. As the system is cold-applied and cold-curing, this will ensure a simple and safe application procedure is achieved with no risk to the existing internal lining.

To prepare the surfaces prior to the application of Belzona 3111, Belzona 3921 (GSC Surface Conditioner) and Belzona 3911 (PSC Surface Conditioner) were specified to condition the steel and concrete substrates, respectively.

Unlike hot work, minimal equipment is required to apply this waterproofing system, facilitating a quick installation with minimal downtime and ensuring capital expenditure is kept to an absolute minimum.

APPLICATION METHOD

Firstly, the substrate was thoroughly cleaned and any surface contamination was removed. To prevent application beyond the prepared area and to ensure a neat and tidy application, masking tape was fixed inside the prepared area. Next, the conditioners were applied to prepare the surfaces prior to the application of Belzona 3111 and to ensure optimal adhesion of the polymeric system to both the concrete and steel surfaces.

The reinforcement sheet was then applied over the conditioned areas and, using a good quality soft bristled brush, the Belzona 3111 material was applied. The system was then smoothed over with the brush to ensure complete wetting and to leave a finish free from stretches or creases in the reinforcement sheet. After curing, a second layer of Belzona 3111 was applied to give a finish free from pinholes, and the breathable system was left to cure.



Reinforcement sheet applied without creases



First coat complete

BREATHABLE TECHNOLOGY INCREASES LIFE OF SILO

The Belzona tank base sealing system will successfully protect the tank for years. With its unique breathable technology, Belzona 3111 will play a major role in increasing the operating life of the silo, minimising any potential disruptions that could occur due to an insufficient sealing system. The applied system remains flexible in service, ensuring no further issues are expected by movement of the dissimilar substrates.

INNOVATIVE POLYMERIC SOLUTION REPAIRS AND PROTECTS LARGE CHEMICAL BUND

Deteriorated bund restored with impermeable, chemically resistant solution



At a major spirit supplier in Glasgow, UK, extensive repair and protection work was required on a large bund area, which was providing secondary containment to 15 spirit tanks. 1,173m² (12,626ft²) of floor and wall areas were in a severely deteriorated condition due to corrosion caused by the chemicals used in the spirit storage process.

The containment area comprises of an inner section with concrete floor with render on the walls. Wooden panels were in place between the tank supports and the outer section was comprised of tiles. While many localised areas required extensive rebuilding work, the entire bund needed an impermeable and robust coating system that would provide an exceptional level of chemical protection for the long term.

One potential solution would involve the use of drip trays. Once a leak has been identified, these can be placed in the location of the leak to capture the liquid. However, they only provide a temporary, short-term solution and many drip trays fall short in their ability to store aggressive and corrosive chemicals. Also, this method of secondary containment can be highly impractical as they only allow limited access to the bund area whereas the spirit company required full access at all times.

BELZONA SPECIFICATION

Following a site survey by Belzona representatives, a combination of Belzona systems was selected to repair and protect the bund. Belzona Engineer, Douglas Potts said, *“Due to its lightweight properties, the polymeric mortar Belzona 4141 (Magma-Build) was specified to repair the vertical surfaces. As no shuttering is required during the cure of this material, this will help to keep the application procedure quick and simple.*

Specially designed for resurfacing large areas of concrete, Belzona 4131 (Magma-Screed) was chosen to rebuild the horizontal surfaces. This solvent-free epoxy material will fortify the bund with excellent abrasion resistance and will also provide impact protection.

Prior to the application of the rebuilding materials, a Belzona conditioner will be applied to prepare surface in order to ensure optimal adhesion. In order to fortify the bund area with a further layer of protection, the 2-part epoxy coating, Belzona 5811DW2 (DW Immersion Grade), was specified.

This coating, certified to NSF/ANSI 61 and WRAS for contact with potable water, will provide the outstanding level of chemical protection required within the highly corrosive environment.”

APPLICATION METHOD

Firstly, the wooden panels were removed and the substrates were power washed and ground to achieve a sound substrate. The Belzona conditioner was then applied to all the deteriorated areas. Once the rebuilding materials were mixed using a forced action mixer, a trowel was used to rebuild and level the damaged areas. 410 linear metres of horizontal and 18 linear metres of vertical edges were filleted with the Belzona 4141 and Belzona 4131, respectively, before the system was left to cure. The first coat of Belzona 5811 DW2 was then mixed and applied to the prepared surface of the bund area, followed by the second coat once the first coat had cured.



RAPID CURE SYSTEM DELIVERS SAFE APPLICATION

Each section took around 24-36 hours to fully cure, allowing a fast application procedure with minimal disruption and downtime. As the work was carried out in stages, Belzona Technosol, Belzona's application service division, was also able to coat an area under a large sprinkler tank in the opposite room while the project was proceeding. As the Belzona systems are solvent-free, this facilitated a safe application environment which was essential due to the small space and lack of ventilation in the room.

With years of experience and materials specifically designed for the repair and protection of chemical containment areas, Belzona was able to deliver a full solution package, from product specification to application inspection, ensuring the smooth running of the project and long term results.



BUILDINGS AND STRUCTURES APPLICATION TRAINING PROGRAMME

Get to grips with Belzona's full range of protective coatings and engineering composites for facilities maintenance

BUILDINGS AND STRUCTURES CONTRACTOR AWARENESS TRAINING

This course is a completely free, one-day event designed to give a **comprehensive overview of Belzona solutions for the repair and protection of buildings and structures**. Areas covered include surface preparation, fabric maintenance of roofs, walls and floors, as well as other common problem areas in building maintenance. The training event is practically focussed and aimed at contractors and applicators that carry out these repairs.

VALIDATED BUILDINGS AND STRUCTURES TRAINING

Following on from the Buildings and Structures Awareness Training, this validated training course provides in-depth technical know-how on how to perform a selection of key Belzona facilities maintenance applications. Focusing on Belzona solutions for roofs, walls and floors, at the end of the two-day training course participants are tested on their skills and knowledge and upon successful completion receive **Validated Belzona Applicator status**.

To book a space on a Buildings and Structures Course today contact training@belzona.com or call 01423567641

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