

# Facilitate

## FOCUS ON: The Water and Wastewater Industry

4-5

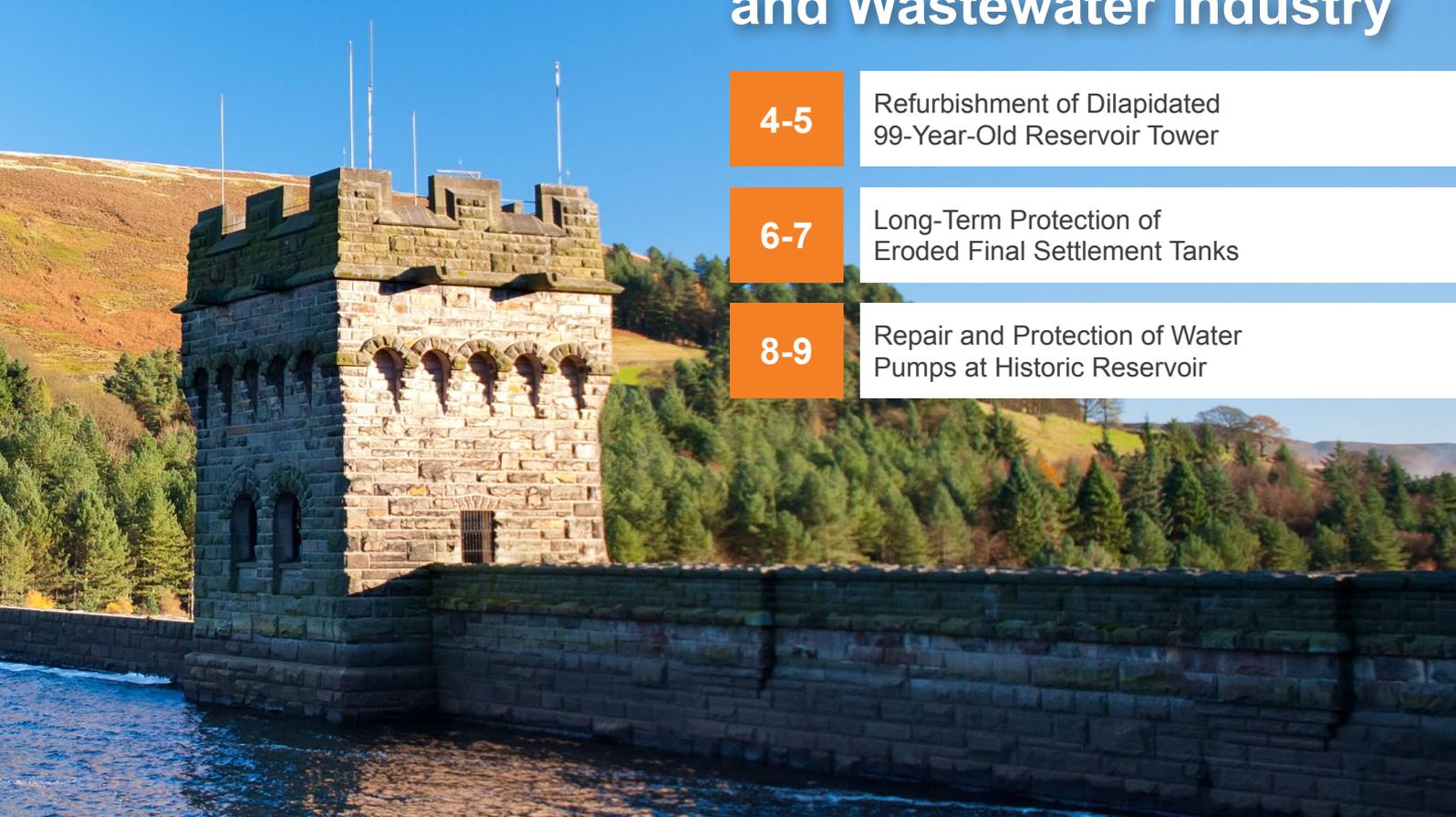
Refurbishment of Dilapidated 99-Year-Old Reservoir Tower

6-7

Long-Term Protection of Eroded Final Settlement Tanks

8-9

Repair and Protection of Water Pumps at Historic Reservoir



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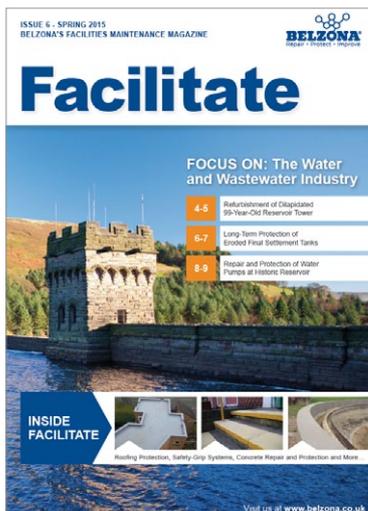
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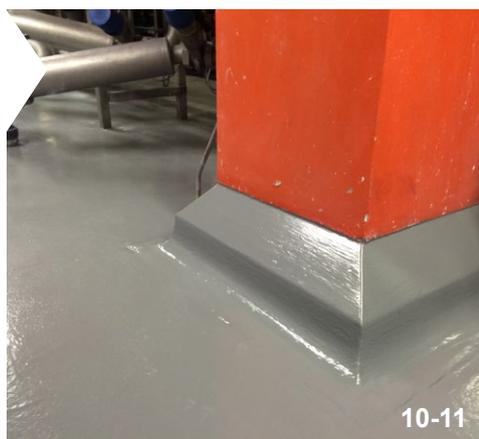
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# DILAPIDATED 99-YEAR-OLD RESERVOIR VALVE TOWER GETS THOROUGH REFURBISHMENT, LANCASHIRE

Ceiling and roof repaired with durable, long-term system

Nearly a century of environmental wear and tear had left the valve tower at a reservoir in Blackburn in urgent need of extensive interior and exterior refurbishment. Decades of weathering combined with vast amounts of plant and root growth had caused concrete spalling throughout the roof and ceiling areas. If left unchecked, this could have led to complete replacement of the entire roof therefore the need for a quick, long-lasting repair was imperative.

Built in 1916, the reservoir was originally used to supply water to the people of Blackburn. With a capacity of 891,034,008 liters, it is now used as a feeder for Dean Clough reservoir in Great Harwood, which is used for drinking water supply. As the reservoir has played an integral role in the supply of drinking water for nearly a century, it was more than ready for a thorough refurbishment.

Environmental damage to the asphalt coated concrete roof was causing water ingress resulting in spalled concrete on the ceiling underneath. Alongside this, severe plant growth was also visible across the roof area, further contributing to the damage of the substrate. The reservoir required a maintenance solution that would not only fix the damaged areas but would also provide long-term protection against future environmental challenges.

“The reservoir required a maintenance solution that would not only fix the damaged areas but would also provide long-term protection against future environmental challenges.”



Roof repaired and protected with hard-wearing material and waterproof coating

## BELZONA SPECIFICATION

Following a thorough site inspection by a Belzona representative, the company decided the roof would be rebuilt with a non-porous resurfacing screed, Belzona 4131 (Magma Screed), followed by a Belzona 3131 (WG Membrane) liquid applied roofing system. While these systems would repair the damaged substrate, their weatherproofing properties also ensure the roof will remain protected from the harsh environmental conditions.

Belzona 4141 (Magma-Build) was specified to repair the ceiling as its lightweight properties enable application onto the overhead masonry surface without the need for shuttering. To complete the application, Belzona 5151 (Hi-Build Cladding) with its water repellent and self-cleaning properties was chosen to coat the ceiling.

**APPLICATION METHOD**

Firstly, the application team got green fingered and began to eradicate all the roots and vegetation from the application area along with the damaged asphalt. On removal of the asphalt, it became clear that some of the concrete substrate had also been badly affected by the vegetation and water damage, thus requiring all the friable concrete to also be removed.

Once this was all cleared away, the damaged concrete was then rebuilt using Belzona 4131. This is a non-porous system consisting of high molecular weight polymers and oligomers incorporated with an aggregate mix; a durable combination that will provide a hard-wearing repair to the roof.

The Belzona 3131 membrane system was subsequently applied to the entire area to prevent further water ingress. This moisture activated urethane coating bonds strongly to all types of roofing materials and will not be damaged by rain, even immediately after application. The system incorporates a reinforcement sheet to add strength to the repair and allow the easy control of the coating thickness during application. Its excellent elasticity will also ensure the repair will adapt to the movement of the roof.

For the ceiling, the damaged materials were removed and the rebars were appropriately cleaned and prepared before rebuilding with Belzona 4141. The entire ceiling was then coated with Belzona 5151 to provide further protection and an aesthetically pleasing finish.



Standing water leading to water ingress



Deteriorated asphalt substrate



Preparation of the ceiling



Lightweight material used to rebuild ceiling

**BELZONA NIPS IT IN THE BUD**

Due to the extent of the damage, if left unrepaired, this could have resulted in complete replacement of the entire roof, causing the project to run into tens of thousands of pounds. The Belzona systems employed facilitated fast and effective repair and protection at a fraction of this cost, leaving the reservoir tower protected from the elements for many years to come.



Ceiling successfully repaired and protected

# DETERIORATED FINAL SETTLEMENT TANK UNDERGOES MAJOR REFURBISHMENT, HAMPSHIRE

## Settlement tank wall rebuilt with hard-wearing epoxy repair composite

A water utility company in Bordon was experiencing severe erosion on the reinforced concrete walls of a final settlement tank. If left unchecked, this damage could have eventually led to the complete demolition and rebuilding of the tank wall. The company required a solution that would bypass this expensive and time-consuming procedure and not only repair the damaged substrate, but also protect it against any future damage.

During inspection by a Belzona Engineer, it was found that erosion damage had occurred to the top of the reinforced concrete tank walls, resulting in the loss of the smooth wall cap. The damage had been caused progressively by the weight of the agitator arm, which is supported by a wheel travelling on a track on the top of the wall. In addition to this, freeze-thaw damage had also occurred as a result of recent harsh winters. The culmination of damage had resulted in the formation of potholes which caused the wheel to become trapped. If left unrepaired, this eventually would have led to severe damage to the agitator motor, which would be extremely expensive to replace.

The conventional solution to this problem would be to remove the wheel rotating arm, demolish the existing reinforced concrete wall and rebuild it with concrete. This expensive method would require the tank to be out of service for long periods of time and could potentially lead to sewage storage issues. The company required a solution that would avoid this expensive process while successfully repairing the settlement tank and fortifying the concrete substrate against future damage.

“ The company required a solution that would bypass this expensive and time-consuming procedure while successfully repairing the settlement tank... ”



Substrate rebuilt and protected with rapid curing epoxy system

### BELZONA SPECIFICATION

For the repair and resurfacing of the substrate, the company chose the non-porous, hard wearing epoxy repair composite, Belzona 4131 (Magma Screed). This material has been proven to exhibit excellent abrasion resistance. When tested in accordance with ASTM D4060 with a 1kg load the typical loss per 1,000 cycles is just 685mm<sup>3</sup>. This means once the Belzona system has cured, the tank walls will be able to withstand continuous impact caused by the weight of the agitator arm.

To prevent cracking on the movement joints, Belzona 2131 (D&A Fluid Elastomer), a flexible rubber material, was further specified. This flexible rubber

material is ideal for joint reconstruction as its elasticity will respond sympathetically with the movement in the joints.

The application would also incorporate Belzona Fungicidal Wash and Belzona 4911 (Magma TX Conditioner) to prepare and reconstitute the friable substrate prior to application. The thixotropic resin conditioner is specially designed to provide strong adhesion of the Belzona material to masonry surfaces.

As these Belzona systems achieve full load bearing capacity in just three days for Belzona 4131 and two days for Belzona 2131, this will avoid the need for lengthy downtime.

“ As these Belzona systems achieve full load bearing capacity in just three days for Belzona 4131 and two days for Belzona 2131, this will avoid the need for lengthy downtime. ”

**APPLICATION METHOD**

Firstly, the interior and exterior walls of the tank were cleaned using the Belzona Fungicidal Wash in order to remove any mosses, lichens and other organic growth. This was then followed by grit blasting and mechanical preparation of the corroded metal and of the old concrete.

Once the substrate was thoroughly cleaned and prepared, Belzona 4911 was then applied to condition the surface ready for the repair application. Belzona 4131 was subsequently applied to repair and resurface general areas of the settlement tank. The movement joints were then repaired using Belzona 2131. As this was applied simply by pouring, this further facilitated a quick application procedure.



Badly eroded substrate



Area rebuilt with durable material



Substrate prepared with conditioner

**FAST CURING MATERIALS DIMINISH DOWNTIME**

By choosing to repair and rebuild the settlement tank walls with a durable, rapid curing epoxy material, the utility company was able to bypass the time-consuming and expensive procedure of installing a new settlement tank wall. In addition to these savings, as the Belzona system exhibits a strength that is five times stronger than concrete, the substrate will remain robustly protected for many years to come with minimal need for maintenance work.



Tank wall repaired and protected with epoxy materials



Repair and resurfacing



Long-term protection of eroded settlement tank



Substrate protected against abrasion

# BELZONA REPAIRS AND PROTECTS WATER PUMPS AT HISTORIC RESERVOIR, SURREY

Pumps restored with erosion-corrosion protective coating



Efficiency restored to pump

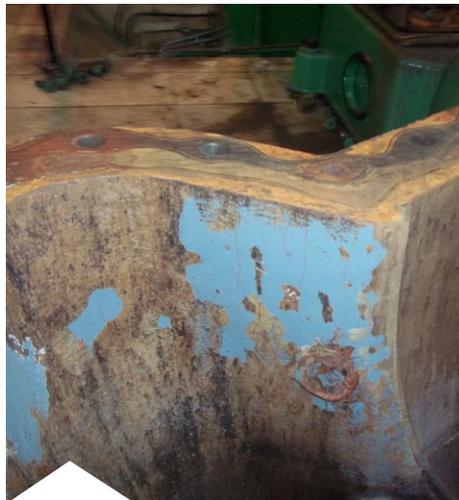
Every day, a major reservoir in Littleton holds 910,000,000 litres of water. The water is drawn in from an intake channel fed from the Thames, before it is turned into enough fresh water to supply one of the busiest cities of the world.

The pumps were originally commissioned in 1924 for the Metropolitan Water Board and were driven by uniflow steam engines. Since the reservoir was officially opened in 1925 by King George V and Queen Mary, the machinery has been upgraded several times and the pumps are now driven by electric motors. Whilst the reservoir is situated in Littleton, a Saxon place name meaning 'a small settlement', the reservoir itself bears little comparison to its location's namesake. Covering a water area of 723 acres and a circumference of roughly 4 miles, at the time of its completion the reservoir was the largest free-standing reservoir in the world and to this day continues to supply water to a large area of London as well as the surrounding counties.

After years of frequent use, certain areas of the pumping equipment were suffering from cavitation damage, which in turn was seriously reducing the efficiency of the pumping system. This needed to be promptly addressed and so a thorough inspection including a hydraulic profile was arranged.



Pump casing severely corroded



Pump casing prior to removal of existing coating

Due to the physical size and weight of the top half of the pump casing, it was not practical to turn the casing over, therefore, the casing was mounted on blocks (supported by the crane for safety) and scanned from underneath. During this inspection, each casing was identified as having Substrate Corrosion To Rust Grade D. This is the highest level of corrosion grade on the scale, indicating severe rusting of the cast iron and pitting (ISO-8501-1).

### BELZONA SPECIFICATION

Once the hydraulic profile was completed and all the equipment had been scanned, it was decided that several refurbishment applications should be carried out on three of the pump volutes, totalling a surface area of 282m<sup>2</sup>. Due to the extent of the damage (some areas of each volute exhibited up to 50% corrosion) complete metal repairs using Belzona 1111 (Super Metal) were prescribed. This repair composite provides robust corrosion resistance and has excellent adhesion characteristics.

This would be followed by a protective coating of Belzona 1341 (Supermetalgilde). This coating was specified as it will provide long-term erosion and corrosion protection to the equipment and improve the efficiency of the pump. In fact, Belzona 1341 has been proven to increase efficiency by up to 7% on new equipment and up to 20% on refurbished equipment, leading to significant energy savings.

After inspecting the impellers, each of them consisting of a surface area of 44.5m<sup>2</sup>, it was decided that once each had undergone a thorough cleaning, they could be put back into service.

### APPLICATION METHOD

Firstly, all machined faces were protected from the blasting process before Sponge Blasting equipment was used on the upper and lower casings. This was used to remove the previous coating, create a substrate cleanliness of at least SA 2 ½ and produce a surface profile of no less than 75µm. The application area was then vacuumed and examined to make sure it was dust free and all the blast media was removed.

Once the substrate had been tested for salt contamination, the repair areas were masked out ready for the application of Belzona 1111. Applied using a Belzona applicator, this cold applied material was used to rebuild the areas of undulation and pitting damage.

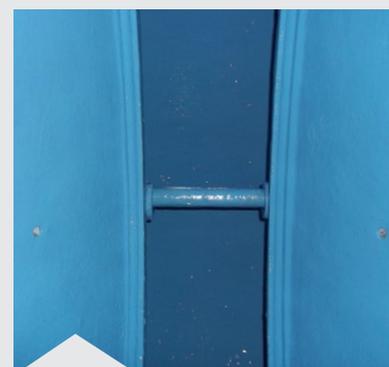
After Belzona 1111 had cured and within the two-hour coating window, the first coat of Belzona 1341 in a grey colour was brush applied. This was followed by the second coat in blue to achieve a total dry film thickness of 500µm. Once cured, the coated surfaces were thoroughly checked over for any misses or pin holes.

### EFFICIENCY RESTORED TO CENTRIFUGAL PUMPING EQUIPMENT

By using modern polymer technology, Belzona was able to restore the centrifugal pumping equipment and ensure the historic reservoir was back to running as smoothly and efficiently as possible.



Pump casing after sponge blast

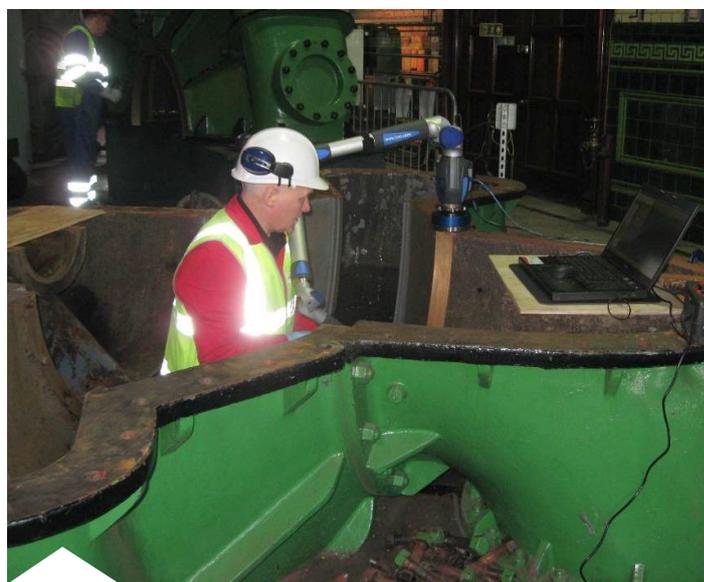


Long-term protection

“ Belzona 1341 has been proven to increase efficiency by up to 7% on new equipment and up to 20% on refurbished equipment, leading to significant energy savings. ”



Pump casing mounted on blocks for screening



Lower casing being scanned to capture hydraulic details

# EPOXY COATING HALTS CHEMICAL ATTACK AT PHARMACEUTICAL COMPANY, BERKSHIRE

Floor protected with solvent free, chemical resistant material

A leading pharmaceutical company in Maidenhead was experiencing severe chemical attack on a pressure pot room floor. The originally applied polyurethane protective coating on the steel/aluminum checker plate floor had failed due to the spillage of flavour oils and the use of caustic soda to clean the room two to three times a day.

The company required a solution that would not only repair the damaged floor areas but also provide robust protection against future chemical attack. As access to some of the areas was restricted by pipe work and plant, the company required an application method that could be carried out easily, without the need for specialist tools or equipment.

## BELZONA SPECIFICATION

A two-part, corrosion resistant epoxy coating, Belzona 5811 (Immersion Grade) was applied to a trial area of 50m<sup>2</sup> for the client to determine its suitability. Due to the simple application method involving just an every-day roller, this coating system avoids the need to install specialist equipment thus keeping the application quick and simple, and downtime to an absolute minimum. Thoroughly satisfied with the trial area, the customer proceeded with the application to the complete 2,000m<sup>2</sup> area.

“As access to some of the areas was restricted by pipe work and plant, the company required an application method that could be carried out easily, without the need for specialist tools or equipment.”



Corrosion caused by flavour oils and caustic soda



Corroded steel/aluminium chequer plate floor



Floor protected against chemical attack

## APPLICATION METHOD

As the existing polyurethane coating was in most part still intact and showed good adhesion to the substrate, only the areas where the floor was most exposed to the chemicals, such as drain areas and flow paths, were treated with the Belzona system.

Firstly, all contamination and debris was cleared away. Once mixed, the first coat of Belzona 5811 was then applied in beige colour onto the prepared surface using a roller.

After the first coat had been applied, the second coat was then brushed onto the substrate in grey colour to create a minimum thickness of 400µm. This technique avoided the need for hot work as the system cures quickly at room temperature 20°C, reducing health and safety risks. After just five days, the substrate achieved a full mechanical cure and after one week the floor was ready to be subjected to chemical contact, saving the company valuable downtime.



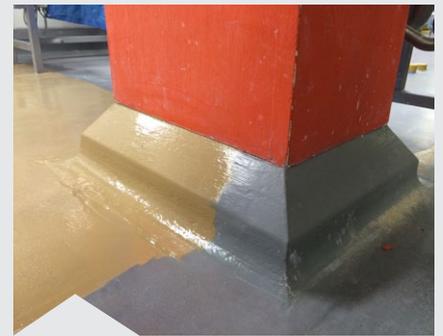
Damage caused by aggressive chemicals

## FLOOR SUCCESSFULLY PROTECTED AGAINST CHEMICAL ATTACK

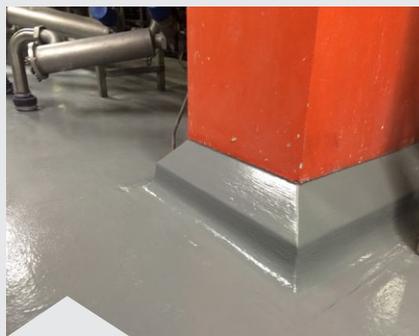
The Belzona system successfully restored the protection on damaged areas of the floor, fortifying the substrate with excellent chemical resistance for many years to come. The cold curing properties of Belzona 5811 allowed for a rapid and safe application method with reduced health and safety risks.



Substrate cleaned prior to application



Application in process



Robust protection against chemical attack



Full chemical protection after just one week



Long-term protection from aggressive chemicals



# LIGHTWEIGHT EPOXY REPAIR COMPOSITE REBUILDS ERODED STONework, WEST YORKSHIRE

Damaged stonework rebuilt with lightweight, hard-wearing system

Eroded stonework identified on a school building presented a potential hazard to staff and pupils. Over the years, the stonework had been continuously subjected to multiple erosive effects such as salt crystallisation and freeze-thaw cycles, leaving the substrate badly damaged. The erosion had led to a risk of falling debris, which if left unchecked could have caused serious injuries to staff and pupils.

## BELZONA SPECIFICATION

Following an inspection by a Belzona representative, Belzona 4141 (Magma-Build) was specified. This hard wearing epoxy repair composite is specifically designed for stone repairs as it allows application onto vertical surfaces due to its lightweight characteristics.

A two-component system containing a high molecular weight polymer filled with low density, non-metallic aggregate, Belzona 4141's robust properties will ensure the substrate will remain protected from the erosive effects of freeze-thaw cycles. These hard-wearing characteristics will ensure the substrate will remain intact, even when subjected to harsh conditions, thus minimising the risk of falling debris.



Weathered stonework on school building



Application of lightweight repair material

## APPLICATION METHOD

Firstly, the substrate was manually prepared to remove any loose material and debris. Once this was cleared away, the application area was conditioned using Belzona 4911 (TX Conditioner), a system designed specifically for priming masonry surfaces prior to application of Belzona 4000 Series materials.

Next, Belzona 4141 was applied to repair and rebuild the damaged areas of the substrate where the stonework had eroded away. The lightweight properties of this material enabled its application up to 5 inches (127mm) thick on the vertical surface with minimal support during application and curing. The material was shaped by hand to match in with the existing stonework, thus ensuring the repair was in keeping with the aesthetic of the building. Its odourless properties further ensured the application could be carried out causing minimal disturbance to staff and pupils.

“ These hard-wearing characteristics will ensure the substrate will remain intact, even when subjected to harsh conditions, thus minimising the risk of falling debris. ”

**BELZONA QUICKLY ERADICATES FALLING DEBRIS HAZARD**

Due to the health and safety implications of the situation, the school required a solution that could be carried out as soon as possible in order to eliminate any potential accidents. Belzona was able to facilitate this, carrying out a site survey and conducting the application over a course of just two weeks with minimal disruption to the school's operation.



Stonework sucessfully rebuilt with hard-wearing system



Seamless application on overhead stonework



**BELZONA 4141 (MAGMA-BUILD)**

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- Lintels
- Columns
- Archways
- Bridges
- Decorative areas
- Cosmetic repairs

Please visit [www.belzona.co.uk/4141](http://www.belzona.co.uk/4141) for more information

# LIQUID APPLIED COATING PROTECTS 28 ROOFS AT HOUSING ASSOCIATION, LOUGHBOROUGH

## Roofs coated with liquid applied waterproofing membrane

At a large housing association in Loughborough, a number of weathering problems were identified on a series of 28 flat roofs. Each of the roofs was deteriorated to varying degrees. In some areas, failing mineral felt and cracked asphalt substrate had led to water ingress. In other areas, the mortar between the parapet coping stone joints was failing, allowing water to penetrate through the brickwork below. On some of the parapets, strips of flashing tape had been installed over the coping stones joints to seal them but these had started to fail and required replacement using a more durable system.

The company required a robust, waterproof and weatherproof repair solution that would not only repair the damaged areas, but continue to protect the substrate against any future damage.

### BELZONA SPECIFICATION

Following an inspection by a Belzona representative, a cold applied liquid coating for long-term roof protection, Belzona 3111 (Flexible Membrane), was specified to repair the damaged roof areas. This coating was prescribed in conjunction with Belzona 9311 (Reinforcing Sheet), a specially woven, open mesh fabric designed to give the repair added durability and strength.

Belzona 3911 (PSC Surface Conditioner), a surface conditioner designed to prepare porous surfaces prior to application of a Belzona roof protection system, was also specified for the application, while Belzona 3921 (GSC Surface Conditioner) was also chosen to prepare non-porous areas.



Microporous structure allows surface to breathe



Standing water leading to water ingress



Long-term roof protection

## APPLICATION METHOD

Firstly, all surface water, fungal growths, vegetation and loose debris were cleared away from the application area prior to conditioning with Belzona 3911 and Belzona 3921. The failed flashing strips were also removed from the roofing area.

In order to effectively deal with the preparation of the entire roof, the team was split into groups; each having a different role in the application process. For example, a pair was assigned to clearing away the debris, whilst another began to lay down a conditioning coat. If a pair completed their job, they moved onto the next stage. This method ensured the application procedure was carried out quickly and efficiently, keeping downtime to an absolute minimum.

After all the debris was cleared away, the Belzona conditioners were applied using a roller to provide a quick coverage. Once the conditioner had dried, the reinforcement sheet was laid out and

coated with Belzona 3111. A soft bristled brush was used to apply this material, smooth over the system for complete wetting and to leave a finish free from stretches or creases.

For larger spaces, the 1m<sup>2</sup> rolls of reinforcement sheet were rolled out. As before, working in pairs helped to make this process more efficient. One person was in charge of setting the reinforcement sheet up, placing a thin coat of Belzona 3111 over any joints or gaps, whilst the other rolled product on the top.

Once the system was thoroughly dry, in most of the areas this took two to four hours and 24 hours in areas subjected to standing water, the second layer of Belzona 3111 was applied. This final layer is designed to achieve a smooth finish free from pinholes.

In each area, different obstacles would arise. As the application areas were part of

a fully functioning building, air conditioning units, satellite dishes and pipes were all attached to the surface. In order to ensure the functionality of Belzona 3111 wasn't compromised, any equipment attached to the roof itself needed to be included in the coating.



Application onto conditioned surface



## VERSATILE SYSTEM PROVIDES LONG-TERM ROOFING PROTECTION

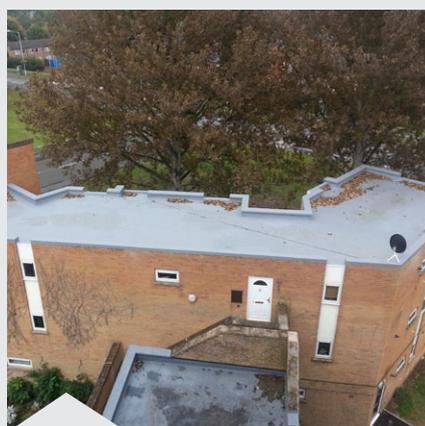
Due to the versatility of the Belzona roofing system, the application team were able to facilitate a series of bespoke repairs specially designed for each different application situation. The tough, flexible and elastic polymeric film tightly follows all roof contours, encapsulating and providing long-lasting protection to every area of the roof.



Outstanding waterproofing properties



After



Roof protected from standing water



Tough material follows all roof contours

# BELZONA REBUILDS DAMAGED LOADING BAY FLOOR, WEST SUSSEX

## Floor repaired with hard-wearing epoxy repair composite

Heavy traffic floor areas in industrial environments are constantly subjected to aggressive wear which can eventually cause operational issues as well as health and safety risks. Belzona was recently contacted by a manufacturer in West Sussex who required a repair and protection solution for a damaged loading bay floor.

The loading bay had a gradient levelling off down to road level. When the lorries are loading and unloading, they have to reverse from the road up the gradient and into the loading area. At the start of the gradient, the lorries wheels lose traction causing abrasion and damage to the concrete substrate. To overcome this, the lorries take a run-up to the loading bay. However, this repeated action had led to damage on the loading bay and also presented a potential injury hazard to personnel. Over time, the damage to the concrete slab had significantly worsened, making the loading and unloading process much more hazardous and in need of an urgent solution.

The company required a solution that would fortify the substrate with a strong grip for the lorry drive up along with excellent abrasion resistance to withstand any wheel spins from the lorry. The application had to be carried out very quickly and be completed in just two half days. The repair also needed to have

a bright, identifiable colour for safety purposes.

Conventional solutions often involve the replacement of damaged concrete with more concrete. However, by using the same material to replace the damaged substrate leaves the area susceptible to similar damage occurring again. Therefore the need for an alternative and more durable solution was imperative.

### BELZONA SPECIFICATION

Following an inspection by a Belzona Engineer, the company decided to repair the damaged substrate using Belzona 4131 (Magma-Screed), an extremely durable epoxy repair composite specifically designed for resurfacing and protecting large areas of concrete. As Belzona 4131 exhibits excellent grip properties in both wet and dry conditions, this will ensure the loading bay area will remain thoroughly protected no matter how harsh the environmental conditions are.

The repair would also incorporate Belzona 4911 (Magma TX Conditioner) to prepare the surface prior to application. This two-component thixotropic resin system is specifically designed for conditioning masonry surfaces prior to application of Belzona 4000 Series materials. These combined systems would fortify the substrate with outstanding abrasion

resistance, ensuring long-term protection against regular daily use by the lorries. As Belzona 4131 can be subjected to pedestrian and vehicle traffic in just nine hours, this will further ensure the repair will be in keeping with the strict time-scale allocated to the project.

### APPLICATION METHOD

After surface preparation to remove any loose concrete and contamination, Belzona 4911 was mixed and applied to the substrate using a stiff bristled brush to ensure maximum adhesion of Belzona 4131 to the existing concrete.

Following this, Belzona 4131 was then mixed and applied directly onto the conditioned surface, initially spreading to a general level using normal screeding techniques. Next, a metal straight edge was used to achieve a uniform thickness prior to smoothing off using a steel float.

### APPLICATION COMPLETED IN JUST ONE DAY

Due to the quick cure time of Belzona 4131, the entire application was completed in one day. This enabled the loading bay to be reopened the following day, saving the company valuable downtime.



Abrasion damage on concrete substrate



Loading bay fortified with abrasion resistant repair composite

# LONG-TERM NON-SLIP SURFACE AT SCHOOL ENTRANCE, DERBYSHIRE

Steps resurfaced with long-lasting safety grip system



Badly damaged school steps



Long-lasting safety grip system

Years of wear and tear had left concrete steps at a school entrance badly damaged and in need of urgent protection. The eroded substrate presented a potential slip hazard to staff and pupils as the majority of the previous grip system had worn away. The school sought a long-lasting safety grip system that could be installed quickly and with minimum disruption to the school's operation, so as not to impede on the day-to-day usage of the steps.

## BELZONA SPECIFICATION

Belzona 4411 (Granogrip), a hard-wearing epoxy resin, was specified in conjunction with Belzona 9221 (Surefoot Aggregate White) as this liquid applied system would provide the steps with a durable, safety surfacing positive grip without causing any unnecessary disturbances to the school during the application procedure.

## APPLICATION METHOD

To begin the repair, the previous coating was firstly removed and the substrate was thoroughly cleaned. The areas to be coated were masked out before application of the Belzona system. As Belzona 4411 and Belzona 9221 can be easily be mixed and applied with a simple 2:1 mixing ratio, this facilitated a quick application procedure, taking just one day to complete the installation. The low-odour properties of the materials

further proved beneficial to the school as it enabled the application to be carried out without disturbing staff and pupils in the nearby classrooms. Further adding to the ease of application, Belzona 4411 will cure in just six hours at 20°C, minimising the out-of-service time. Also, unlike adhesive strips, the hard-wearing properties of Belzona 4411 and Belzona 9221 system will ensure the grip aggregate will not peel or wear away, providing a long-lasting, durable repair.

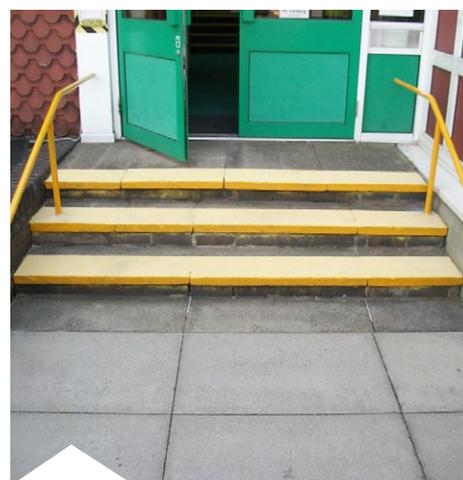
## MINIMISED RISKS OF SLIPS, TRIPS OR FALLS WITH BELZONA GRIP SYSTEM

Not only did the Belzona materials provide a robust grip system to the stairway, but the bright yellow thixotropic base further added to the safety package as this feature will ensure the steps remain highly visible to its users preventing any potential slippage.

“ The school sought a long-lasting safety grip system that could be installed quickly and with minimal disruption to the school's operation... ”



Safety grip system required for damaged steps



Positive grip system fully installed on the stairway

# EPOXY COATINGS RESTORE STEAM TRAIN ENGINE, LONDON

Engine repaired and protected with heat resistant system



Badly corroded steam chest



Plates bonded with epoxy repair composite



Acid and heat resistant epoxy system

As a part of the celebration of the London Underground's 150th anniversary, the steam locomotive Metropolitan No. 1, built in 1898, was scheduled to make a number of trips on the city's Metropolitan line. After a steam leak in the original cylinder block was detected, Belzona was contacted to see whether a high temperature resistant epoxy coating could solve the problem.

Following an inspection by a Belzona Engineer, it was detected that the steam chest, which is part of the main cylinder block on the engine, had corroded and had several holes due to steam pressure and exposure to corrosive chemicals over many years. Without fixing these holes, the engine would lose pressure and fail to run. Replacing the steam chest would have required a massive amount of work, both in dismantling the engine and removing the cylinder block as well as having another cylinder block made. This process would not only be highly time and labor intensive but cost prohibitive as well. To bypass this time-consuming and expensive process, the client chose to repair the damaged steam chest with a combination of long-term, Belzona repair and protection systems.

## BELZONA SPECIFICATION

To seal the holes in the steam chest, Belzona 1511 (Super HT-Metal), a high temperature repair system specifically designed for rebuilding metals damaged by corrosion, was specified to bond steel plates over the damaged areas. Following this, Belzona 1391 (Ceramic HT) was then specified to coat the application area as this will provide further erosion and corrosion resistance to the high temperature area. Finally, to seal and level the repair, the extremely durable, heat resistant epoxy repair composite, Belzona 4181 (AHR Magma-Quartz) was specified.

## APPLICATION METHOD

The first step in the repair of Met 1's steam chest was to bond steel plates over the holed areas of the cast iron substrate. Prior to this, the area was cleaned and grit blasted before the plates were bonded into place. Belzona 1511 was applied all around the plate edges to bond and seal the plates as they were tightened into place by the bolt heads. The edges of the plates were then profiled smoothly with the same material to remove any sharp edges around the plates and to give a neat finish.

Next, one coat of Belzona 1391, which is designed to operate under continuous immersion up to 120°C (248°F), was applied. This system was used over the entire top of the steam chest at a thickness of 813–1,016µm.

At this point, it was time to apply Belzona 4181, an acid and heat-resistant screed. The system was applied at around 50mm thick to seal and level the area as well as to provide extra protection from corrosive chemicals and steam vapor produced by the coal and combustion process.

## BELZONA RESTORES A PIECE OF LONDON'S HERITAGE

The application of a modern, epoxy polymer system made it possible to continue operating the locomotive which is more than 100 years old. This is particularly significant considering the Met 1 is the only working steam train left in the United Kingdom that was actually built in London. Therefore the use of a Belzona repair and protection system played a vital role in preserving an important piece of London's heritage.



# CONTRACT SERVICES WITH BELZONA TECHNOSOL



## Belzona Technosol provides:

- One point accountability
- Nationwide service
- Site surveys
- Quotation and proposal
- Risk assessments
- Method statements
- Experienced application technicians
- Quality documentation
- Warranties
- Safe working practices



Through a direct labour force, or through a comprehensive network of Subcontractor Specialists, Belzona Technosol is able to deliver reliable, problem free, quality assured projects, safely, on time and on budget.

## SERVICE

Through a nationwide network, Belzona Technosol can provide a full 24 hour on-site service with guidance and technical advice on the application of Belzona products.

## EXPERIENCE

Since 2002, Belzona Technosol has provided expertise in the application of innovative repair and protection solutions. Across a range of industries Belzona's track record has gained the confidence of countless engineers, contractors and maintenance personnel throughout the world.

## TECHNOLOGY

Belzona systems are engineered to withstand the most aggressive environments such as erosion, corrosion, abrasion, chemical attack and mechanical damage, extending equipment life and improving efficiency.

## RELIABILITY

Industries can count on Belzona Technosol to provide a prompt response, whether it is an emergency repair or simply a routine maintenance issue.

## PEOPLE

From the chemists and engineers in the Belzona centres, to the network of Application Technicians, each person is part of the Belzona team, knowledgeable and trained in solving the problems of each specific industry.

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