IN FOCUS: Concrete and Masonry Repairs

BELZONA®
Repair • Protect • Improve

FAST-CURING AND DURABLE REPAIR SOLUTIONS

Both concrete and masonry are fundamental to the construction of buildings and structures worldwide. Yet, as porous materials, they are vulnerable to the threat of fluid ingress, combined with freeze-thaw cycles and other damage mechanisms. Coupled with environmental attack, this can lead to deterioration and potential issues, including crumbling or cracked masonry and spalled concrete.

Belzona's concrete and masonry polymeric repair systems can help to extend the lifetime of buildings and structures, offering comprehensive solutions for a variety of conditions and application situations.

The flaws of like-for-like repairs

Due to the versatile and cost-effective nature of concrete, there is no surprise that it is the most widely used construction material worldwide. However, when damaged, repairing concrete like-for-like does not always represent the most cost-effective and efficient solution.

Significantly, new concrete requires 28 days to sufficiently cure, which guarantees a period of enforced shutdown. Also, when repairing with concrete, due to material shrinkage there will be limited adhesion with the original substrate, leaving it vulnerable to further damage.

In addition, repairing damaged concrete or masonry with the same material still leaves that area vulnerable to the original cause of damage, whether that be water ingress, environmental or chemical attack.

In fact, one of the leading causes of deterioration in concrete results from fluid penetration of the porous substrate corroding the embedded metalwork. Oxidization of the reinforcing bar causes tensile stresses, leading to increased weakness and spalling. Reapplication of the porous material onto the same area does not negate the issue. Overall, like-for-like repairs can prove costly and time-consuming upon reoccurrence of the same issues.

Impact from heavy traffic can damage concrete

Corroding metal leads to spalled concrete

Issue 114

Contents

RANGE OF BELZONA REPAIR MATERIALS

Belzona offers a range of materials for repair of concrete and masonry, which are fast-curing, non-shrinking and highly durable.

Belzona 4111 (Magma-Quartz)
- Excellent chemical resistance
- Long-term abrasion resistance
- High mechanical and impact strength
- Suited to floor problem areas

Belzona 4131 (Magma-Screed)
- Excellent chemical resistance
- Long-term abrasion resistance
- Minimal downtime due to fast-curing time
- Suited to small floor problem areas

Belzona 4141 (Magma-Build)
- Lightweight repair material
- No requirement for shuttering during cure and only minimal support during the application
- Suited to wall and overhead areas

Belzona 4154 (Bulkfill Resin)
- Cost-effective
- Versatility with a variety of locally-sourced aggregates
- High compressive strength
- Suited to deep filling areas

Belzona 4181 (AHR Magma-Quartz)
- Excellent inorganic acid and heat resistance
- Long-term abrasion resistance
- High mechanical and impact strength
- Suited to floor problem areas

Belzona 4301 (Magma CR1 Hi-Build)
- Excellent chemical resistance
- High compressive strength
- Suited to chemical containment areas

BELZONA REPAIRS FOR CONCRETE AND MASONRY

Floor, wall and overhead repairs with non-porous polymeric repair systems

Belzona's 4100 Series polymeric materials provide a range of concrete and masonry repair solutions for floors, walls and even overhead.

All of these materials offer a range of benefits that far exceed like-for-like repairs, both in terms of application and performance. Significantly, these are non-porous solutions, which prevent moisture penetration. As a result, this eliminates the threat of carbonation and freeze-thaw spalling associated with concrete and masonry.

In addition, Belzona materials provide excellent adhesion, bonding to a variety of rigid substrates, including masonry, concrete and metals. Versus traditional concrete repairs, which will crack if applied too thinly, Belzona's 4100 Series range can be feather-edged, retaining high strength and adhesion even when thinly applied.

Importantly, these solutions demonstrate higher tensile strength than concrete, making it far better at resisting impact and abrasion. Combined with superior compressive strength, the Belzona 4100 Series often outlasts the area it was designed to repair.

Floor repairs

Due to both human and vehicular traffic, floors are common to damage from abrasion and impact. This occurs frequently in areas of high compression, such as loading bays, factory floors and steps, where impact can exploit any weaknesses in the substrate. Belzona's repair materials can be used to fill large areas of damage, before rebuilding the profile of floors and raised areas, including ramps and stairways.

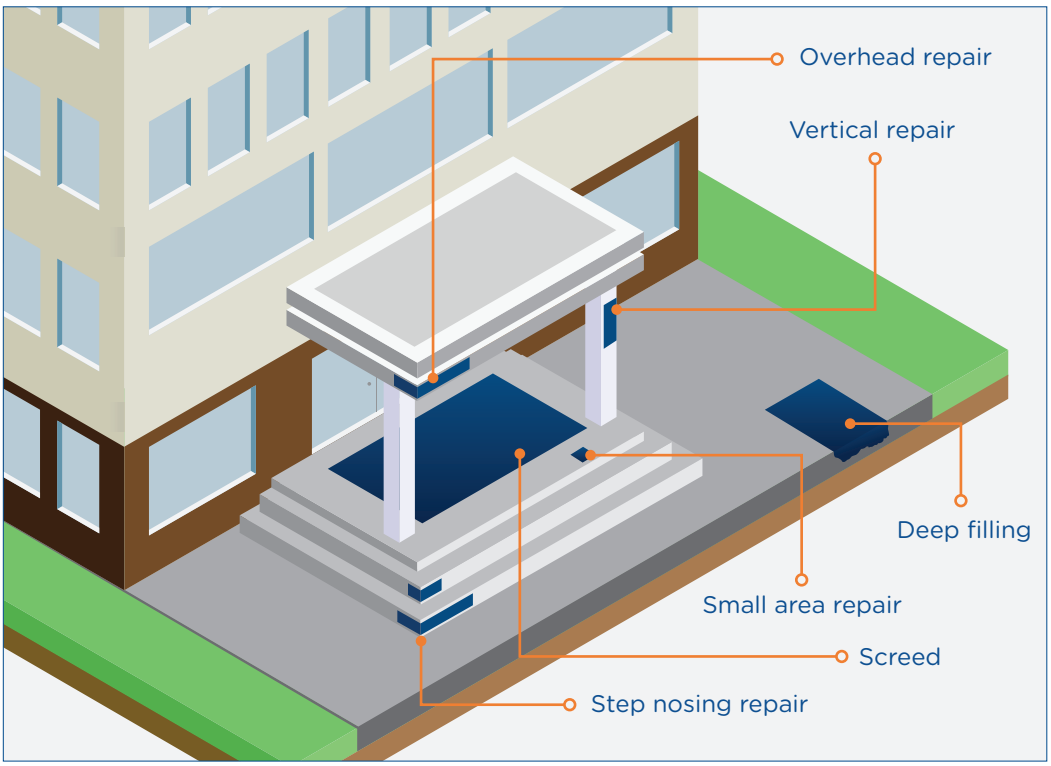
In addition, concrete used in chemical containment areas, such as bunds, sumps, transfer and holding areas, can suffer from exposure to chemical attack. Belzona can resurface these areas with materials designed to withstand high temperatures and aggressive chemical immersion. In addition, Belzona can introduce gradients for sumps and drainage areas.

Wall and overhead repairs

Walls and overhead areas, constructed from concrete and masonry, frequently suffer from issues relating to impact and environmental damage. These issues can stem from spalled concrete, cracked stonework and water ingress, for a variety of areas, including ceilings, columns, frames, lintels, parapets, and towers. Not only does this infringe upon the aesthetics of buildings, but when these forms of damage occur in overhead situations there is a particular risk to safety.

Belzona provides a rapid repair solution for walls and overhead areas using lightweight, fast-curing repair materials. In addition, these materials can be tinted so the correct colouration of brick and stonework can be achieved.

Belzona's Range for Different Application Situations:



CEMENT PLANT BENEFITS FROM RAPID REPAIR

Belzona materials help to rebuild secondary containment wall

When looking to repair their ammonia secondary containment area, engineers at a cement plant in Oregon, US, were initially considering to use concrete before opting for a superior alternative in Belzona.

By using Belzona materials not only does the containment area experience minimal downtime, but it also provides a more permanent solution by eliminating the root problem. In this situation, it was a poorly designed steel rebar and concrete frame which had left the area's walls susceptible to damage and severe cracks had begun to form.

Had the cement plant engineers chosen to repair the containment area with concrete alone, the same problems would have been likely to occur a few years down the line. The very design of the containment area wasn't suitable, and normal concrete was simply not strong enough to support the structure, whereas Belzona's superior strength materials provided an ideal long-term solution.

The Belzona materials chosen to repair the area included the polymeric filling system Belzona 4154 (Bulkfill Resin) and the heavy duty repair composite Belzona 4111 (Magma Quartz).

The repair application started with removing all loose and damaged concrete, including a large section of the wall corner area. To fully prepare the steel rebar, a grinder was used to remove traces of oxidation.

A frame was then created by attaching form boards to the remaining concrete and Belzona 4154 was poured in to fill the space. This polymeric resin has been specially designed to be a cost-effective repair system which, when mixed with local aggregates such as sand, quartz or crushed stone, effectively fills large holes and cracks. It is fast-curing and it can be over-coated after 6 hours at 20°C/68°F, achieving full mechanical hardness after 24 hours. This is in comparison to the 28 days it takes for concrete to fully cure.

After using Belzona 4154 it is always necessary to complete a repair with a top coat. In this instance, Bezlona 4111 was chosen as an over-layer due to its outstanding chemical, abrasion and impact resistance, as well as excellent adhesion even to vertical substrates.

Initially, concrete was going to be used for the repair until the engineers were introduced to the Belzona 4154 and Belzona 4111 system, and were impressed by its bond strength and rapid curing. This system is also extensively used to fill large uneven surfaces, deep holes and cracks with minimum downtime.

The non-porous Belzona materials will eliminate moisture penetration, therefore stopping corrosion of the steel rebar and providing a long-term solution to the containment area.

Removal of all deteriorated concrete

Removal of all deteriorated concrete

Secondary containment wall rebuilt and finished with a layer of Belzona 4111

PERFECT PARTNER FOR PROTECTIVE COATINGS

In environments exposed to contact with aggressive chemicals, Belzona's concrete and masonry repair systems can require additional protection. In this instance, a 4000 Series protective coating is ideally suited for the application.

Belzona coatings offer excellent adhesion to other Belzona materials as well as concrete, masonry and metals.

Belzona 4311 (Magma CR1)
A barrier coating designed for protection against a broad range or chemicals, especially acids and alkalis.

Belzona 4331 (Magma CR3)
A barrier coating optimised for resistance to hot organic acids, such as acetic acid, but with excellent resistance to a broad range of other chemicals.

Belzona 4341 (Magma CR4)
A barrier coating optimised for resistance to hot inorganic acids, such as sulphuric and hydrochloric acid, but with excellent resistance to a broad range of other chemicals.

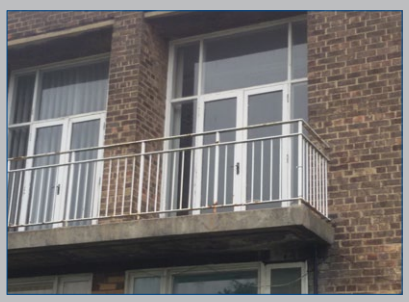
Belzona 4351 (Magma CR5)
A static-dissipative barrier coating with outstanding resistance to a broad range of chemicals.

Belzona 4361
A flexible barrier coating providing crack-bridging properties and outstanding resistance to a broad range of chemicals, especially acids and alkalis.

STILL HOLDING ON AFTER 35 YEARS

Back in 1981, Belzona was contacted by the Department of Education in Newcastle, UK, to assess the failing masonry at one of their colleges. The edges of a balcony were spalling and the rail supports were suffering from erosion-corrosion. Initially, Belzona removed the corroded tubular rail supports, before using Belzona 1111 (Super Metal) to cold bond steel bars, restoring the support's structure. The spalled concrete was then rebuilt using Belzona 4111 (Magma Quartz), encapsulating the new steel supports.

This repair has been periodically inspected, with a visit in 2016 confirming the Belzona repair to still be in perfect condition over 35 years after the original application. This aptly demonstrates the longevity and durability of Belzona's mortar repair systems.



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OFFICE BUILDING RECEIVES WELCOME MAINTENANCE

Polymeric systems repair over 300 spalled surfaces

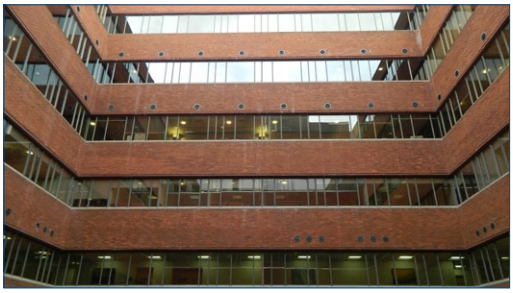
The fast-curing and durable nature of Belzona polymeric materials made them the ideal choice for a severely deteriorated office and car park structure in Manchester, UK. The 1970s building had seen chunks of concrete coming loose from cracked and spalled areas, and concrete stalactites forming due to leaking rainwater. In total, over 300 repairs were needed.

Because of the comprehensive nature of the job, a range of Belzona systems were needed, including:

- **Belzona 4141 (Magma-Build)**
  A lightweight concrete and masonry repair composite for vertical and over-head repairs without requiring shuttering during cure and only minimal support during application
- **Belzona 4131 (Magma-Screed)**
  A non-porous polymeric screed for the repair of larger areas
- **Belzona 4521 (Magma-FlexFluid)**
  An elastomeric sealant for repairing any damaged expansion or construction joints.

Additionally, materials from the Belzona 4000 Series were used to rebuild damaged drain areas and Belzona safety aggregates were added to the floors to create grip surfaces. A powder tint was also added to the construction polymer to blend it into the red brick façade.

Ultimately, the office and car park building experienced minimal downtime with the 300 repairs being completed efficiently using fast curing systems. Now that it is fully repaired, the quality of Belzona products ensures a strong and protected structure for many years to come.

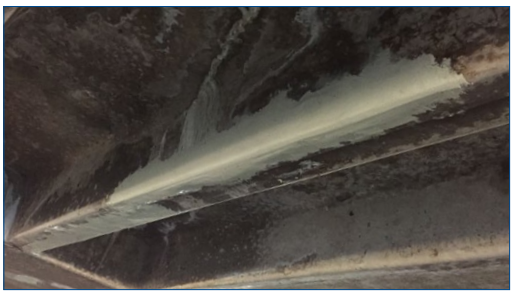


Office block in need of masonry repairs

Deteriorated overhead lintel

Overhead area rebuilt with lightweight material

Deteriorated overhead concrete on car park



Rebuilding of overhead concrete

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