



Cementitious Patch Repair

PROCEDURE

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INTRODUCTION

CEMENTITIOUS PATCH-REPAIR SYSTEMS

Bluey Technologies has produced this document to aid our clients in the application of cementitious patch-repair systems that we provide. The specific products in our range include BluCem HB30, BluCem HB60, and BluCem HB70.

WHY AND WHEN TO USE A PATCH REPAIR

A patch-repair system restores structural integrity and renews or preserves steel reinforcement or both in areas where concrete has spalled or is defective.

CHARACTERISTICS OF REPAIR MORTARS

Repair mortars are highly durable, adhesive to the substrate, provide an alkaline environment when reinforcing steel is present, produce minimal shrinkage and cracking, have low permeability, and are chemical-resistant in aggressive environments.

The repair mortars from Bluey Technologies have been modified with polymers and other admixtures in order to promote these characteristics. They constitute a specialist range that accommodates a wide variety of client requirements. In order to maintain these enhanced characteristics it is important to follow the mixing procedure strictly in regard to the amount of water you add to the powder, as incorrectly high volumes of water result in weaker repair mortars with greater shrinkage properties.

We at Bluey Technologies advise the use of BluCem API0 for priming the substrate to increase its adhesion with the mortar. It is an acrylic concrete primer that we specify for use with our high-build cementitious mortars.

The specialist repair mortars that Bluey Technologies has developed provide good workability, extremely low permeability, and excellent non-shrink characteristics.

SELECTING A REPAIR MORTAR

The repair material needs to have properties that are compatible with the substrate material. Such properties include its modulus, strength, and coefficient of thermal expansion, which is the change in unit volume of the material per degree of temperature change, and the substrate's permeability and dimensional stability. The material also needs to be compatible with the environmental conditions and with the primary reason for the repair.

We at Bluey Technologies advise all our clients to review the products thoroughly before purchasing any to ensure that they meet all project requirements. Our technical engineers are always ready to help should you require further advice.

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PREPARATION

GENERAL EQUIPMENT REQUIRED

You will need the equipment presented following as a minimum for the correct application of our repair mortars, but the requirement for certain equipment varies from project to project. The mixers, pumps, and concrete surface-preparation equipment are available for hire or purchase from Kennards Concrete Care. Their website is at www.concretecare.com.au

The minimum protective clothing you need includes protective overalls, safety helmets, safety boots, good-quality gloves, goggles, and face-masks.

The minimum equipment for preparation is water and a power supply; marker chalk or a pen disc saw, an electric or pneumatic concrete breaker, a wire brush, and a high-pressure washer. The minimum equipment for mixing is a measuring jug and a mortar-mixing paddle. Finally, the minimum equipment for application is a hand application trowel but depending on the type of application you may need appropriate spray equipment, pumping equipment, a wheelbarrow or conveyor equipment, a wooden float, and a steel or plastic finishing float.

SURFACE PREPARATION

This process starts with a thorough inspection of the defective substrate, including areas outside the visibly identified area. You should make the defective areas safe and investigate any areas affected by corrosion to determine the amount of concrete removal required. Once you have identified the area for concrete removal you should mark it out so all operators clearly understand where the removal area is. You should remove the concrete with methods that do not leave a feathered edge and that profile the substrate to the correct classification for any given application.

CUTTING METHODS

We at Bluey Technologies recommend the cutting methods described below.

HIGH-PRESSURE WATER JETS

These drive a small jet of water at high velocity, producing pressures of 69 to 310MPa.

SAW CUTTING

This involves using diamond or carbide saws that are available in different sizes, the largest cutting up to depths of 1.3m.

DIAMOND WIRE CUTTING

This involves wrapping a wire containing nodules impregnated with diamonds around the concrete mass to be cut and connecting it to a power pack that completes a continuous loop. The loop rotates through the plane to be cut. This method's obvious limitation is that you need to wrap the wire around the concrete.

MECHANICAL SHEARING

This involves using hydraulically powered jaws to cut the concrete and reinforced steel. This method requires a free edge or hole to start the process.

STITCH DRILLING

This involves drilling overlapping boreholes around the perimeter in order to cut out sections of concrete. It works well in situations in which only one face of the concrete is accessible and the concrete is deeper than you can cut economically with the diamond-blade method.

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APPLICATION

SELECTING A METHOD

It is important to consider all technical, safety, feasibility, and economic factors before selecting the most appropriate technique for removal.

The degree of deterioration should be the primary factor in determining the level of removal. It is essential to remove concrete to a minimum depth of 20 to 30mm behind the steel reinforcement. In situations involving steel that has corroded, you must expose the full surface of the bar, remove the concrete until reaching non-corroded steel, and then continue approximately 50mm beyond that point.

Once you have removed the deteriorated concrete it is essential to prepare the surface of the substrate in the correct manner to optimise its surface for bonding with the mortar. For information on concrete surface-preparation techniques please refer to the Bluey Technologies concrete surface-preparation document on the website. In situations in which the steel reinforcement has been damaged it is important to identify the cause of the damage and evaluate the condition of the steel. The steel should be capable of performing to the original design specification. Once the engineer is satisfied that the steel is still performing adequately, the surface should be cleaned, removing all rust deposits. If the steel is not performing to the required standard you will need to replace it. We at Bluey Technologies recommend the replacement of all exposed steel bars that have lost more than 20% of their diameter. When this is the case you must consult a structural engineer.

You need to consider any carbonation or chloride effects on concrete and take appropriate action to ensure that all effects are removed prior to the repair. It is essential that no carbonated or chloride-contaminated concrete substrate be in contact with, or be within 5 mm of, the reinforcing bars. If carbonation tests show that carbonation has reached within 5 mm of the reinforcing bars you need to remove the concrete, exposing the full circumference of the steel, and then remove more to a further depth of 20 to 30mm.

You need to clean all exposed steel reinforcements to a surface purity of Sa 2.5 for chloride-contaminated concrete and Sa 2.0 for carbonated concrete. You generally do not need to prime reinforced steel. If the steel is to be exposed to the atmosphere for several days after cleaning an acceptable form of priming would be to mix the repair powder into a slurry using BluCem API0 and to apply a cement-rich coating to the steel surface.

APPLICATION OF THE REPAIR MORTAR

Please note that we at Bluey Technologies encourage the use of experienced applicators, since the long-term performance of our products depends upon the correct application procedures. We can also offer technical assistance to clients who wish to apply our products themselves.

The preparation of the substrate, and its reinforcement if necessary, should be the final step before the repair application to ensure that the area to be repaired is free of contaminants. You should mix the repair mortar strictly according to the procedure outlined on the product's technical data sheet (TDS) and only with the appropriate mixing equipment. Failure to adhere strictly to the mixing guidelines could result in a failure in the application procedure. All BluCem high-build products require only the addition of potable water to produce a uniform specialist repair mortar. You should not modify our products in any other way.

You can repair the substrate in any one of several ways, and the correct method depends on the job's parameters. Please note that you should secure any exposed steel reinforcing bars firmly to avoid movement during the application process, as any such movement would affect mortar compaction, build, and bond. A brief explanation of each application method follows.

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SPALL REPAIR BY LOW-PRESSURE SPRAYING

For the concrete surface profile (CSP) requirements please refer to the Bluey Technologies concrete surface-preparation document.

Apply the repair mortar using small concrete pumps or heavy-duty grout pumps. Air is added at the nozzle to impel the mortar onto the prepared substrate. This style of application is useful for vertical or overhead operations to depths of up to 100 mm with each application.

PROCEDURE

Prepare the surface by applying BluCem API0 Acrylic Concrete Primer. Mix the repair grout with potable water in a high-shear mechanical mixer for at least three minutes. Be sure to refer to the correct ratio of water to powder specified in the product's TDS.

Load the mortar into the pump's hopper and work small amounts of repair material into the primed or dampened surface. Spray the mortar to the thickness required, being careful not to exceed the maximum thickness detailed in the product's TDS. If the job requires multiple layers wait until the initial set and roughen the surfaces before applying the next layer.

Finish the repair to the desired standard, whether smooth or as sprayed. Coat the final surface finish with a curing compound.

CHECKING THE REPAIR

Take before and after photos. Ensure that the surface preparation is correct with a visual examination and either pH tests, CSP gauges, or both. Perform in-situ direct tensile-strength and bond tensile tests.

SPALL REPAIR BY HAND APPLICATION

To satisfy the CSP requirements it is important when removing the substrate to keep the shape of the repair cavity simple, being either square or rectangular. For the correct CSP please refer to the Bluey Technologies concrete surface-preparation document.

Apply the repair mortar to the cavity by hand trowelling, building up the layer to the designated depth. Any sagging of the repair mortar is unacceptable. You should remove any material that sags and repeat the preparation process before reapplication. Please refer to the product-specific TDS for the maximum application thickness. This method is ideal for overhead and vertical applications. It uses minimal equipment and is a good method for shallow repairs and repairs in areas that are difficult to access.

PROCEDURE

Prepare the surface by applying BluCem API0 Acrylic Concrete Primer. Mix the repair grout with potable water in a high-shear mechanical mixer for at least three minutes. Be sure to refer to the correct ratio of water to powder specified in the product's TDS.

Scrub a thin layer of the repair mortar onto the substrate to block all pores and ensure strong bonding of the material. Apply the remaining material with adequate pressure before the bond coat dries. You should apply the repair mortar in a compact way that ensures the full encapsulation of the reinforcement. If you require multiple layers wait until the initial set and then roughen the surfaces before applying the next layer.

Finish the repair to the desired standard, whether smooth or as sprayed. Coat the final surface finish with a curing compound.

CHECK THE REPAIR

Take before and after photos; Ensure that the surface preparation is correct with a visual examination and either pH tests, CSP gauges, or both. Check the cured repair for delaminations. Perform in-situ direct tensile strength tests.

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SPALL REPAIR OF HORIZONTAL CONCRETE SURFACES

To satisfy the CSP requirements it is important to cut back enough to have a 20 mm clearance around any corroded steel reinforcement. For the correct CSP please refer to the Bluey Technologies concrete surface-preparation document.

Apply the repair grout to the prepared cavity with a pump, hopper, or other conveying method, then level the surface by screeding off unnecessary mortar and floating and trowelling the finish. Use this method on horizontal surfaces, especially concrete slabs.

PROCEDURE

Prepare the surface by applying BluCem API0 Acrylic Concrete Primer. Mix the repair grout with potable water in a high-shear mechanical mixer for at least three minutes. Be sure to refer to the correct ratio of water to powder specified in the product's TDS.

Apply the repair mortar to the cavity using your preferred method. Screed the repair mortar, float it, then trowel or brush it for the designated finish.

Cure the repair according to the product guidelines outlined in the TDS.

CHECK THE REPAIR

Ensure that the surface preparation is correct with a visual examination and either pH tests, CSP gauges, or both. Run a compressive test on the repair material, then, check the bond using a pull-off test.

We deliver...

- Products developed for civil engineering
- Product technical knowledge
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- Economical solutions for large projects



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