

MapeWrap® and Carboplate®

Installation/Maintenance Guide



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Introduction

MAPEI's *MapeWrap* and *Carboplate* fiber-reinforced polymer (FRP) structural strengthening systems are used worldwide for added protection in addition to strengthening of concrete structures and elements, concrete masonry unit (CMU) walls, timber beams and steel shafts. MAPEI offers a full line of glass and carbon fiber fabrics in a variety of fiber orientations to provide solutions for the various strengthening applications required in the industry. Additionally, MAPEI has a full line of precured laminate plates and bars available for adding versatility to the system. Epoxy primer, putties and saturants are used with various reinforcement materials to provide a cost-effective, efficient and versatile means of strengthening. Whether strengthening a structure or its elements due to a change in use, damage or deterioration, seismic or blast upgrades, confinement or simple protection, the *MapeWrap* and *Carboplate* systems offer a complete range of options.

This guide will provide detailed instruction related to the proper installation and maintenance of the *MapeWrap* and *Carboplate* systems. It will discuss in detail the various products that comprise the system as well

as providing guidance for typical issues that may arise during a typical FRP installation. Additional products – such as concrete repair mortars, epoxy injection resins, elastomeric decorative coatings and cementitious renders – are also available from MAPEI to support a comprehensive system approach for your project. Discussion of these products will be limited to only those that are directly involved in the *MapeWrap* or *Carboplate* installation processes. For MAPEI products outside the scope of this document, contact your local sales professional or MAPEI's Technical Services Department.

While every effort has been made to make this guide as complete as possible, the nature of FRP installations are such that unique circumstances will arise on a project-to-project basis. When circumstances arise that are outside the scope of this document, MAPEI's technical team stands ready to provide industry-leading support services to ensure the success of your FRP strengthening project. Feel free to contact MAPEI's Technical Services team at 1-888-365-0614 (USA) for guidance outside the scope of this guide.



Preparation

Concrete repair

Most FRP strengthening projects will also involve the repair of cracked, spalling and/or delaminated concrete. Because FRP systems rely on an adequate bond to the substrate in order to perform properly, it is imperative that all damaged or deteriorating concrete is adequately repaired before installation of MAPEI's FRP systems. Simply applying any of MAPEI's FRP systems over damaged or delaminated concrete will not prevent the continued degradation of the substrate, and will also lead to delamination of the FRP system from the substrate.

All concrete repairs should be completed in accordance with current International Concrete Repair Institute (ICRI) guidelines, specifically the ICRI 320.1R and ICRI 320.2R documents. Additional guidance can also be found in the ACI 562 Repair Code. Concrete repair procedures are outside the scope of this guide and will not be discussed herein.

MAPEI has a full line of concrete repair materials available for use on your project. Because of moisture concerns related to installation of FRP systems, the product selected can greatly affect the amount of curing time required before the FRP system may be successfully installed. While MAPEI's *Planitop*® line of repair mortars include products that are ready for FRP installation in as little as one hour, some products require up to four weeks before the *MapeWrap* system can be installed. Consult with your local sales professional for additional guidance in selecting an appropriate repair mortar.

When corrosion is involved with damaged or deteriorating concrete, MAPEI has a variety of products available to mitigate the corrosion issues. These products include *Mapeshield*™ I galvanic anode, *Mapefer*™ 1K and *Planibond*® 3C rebar coatings, and *Mapeshield*™ CI 100 surface-applied corrosion inhibitor. For additional information regarding these products and selection of the appropriate system, contact MAPEI's Technical Services Department or a local sales professional.

Surface preparation

As perhaps the most important aspect of the installation process, adequate surface preparation is essential to achieve a successful installation of an FRP system. Because bond is so important to the performance of FRP systems, adequately opening the pore structure of the concrete to allow penetration of the epoxy components is essential.

The recommended surface profile for the *MapeWrap* or *Carboplate* system ranges from an ICRI concrete surface profile (CSP) of #3 to #4. An ICRI CSP #3 ensures that the weak cement-paste layer that typically forms during the curing process of concrete is sufficiently removed, and adequately opens the pore structure of the concrete to provide for proper bonding of the epoxies. An ICRI CSP #4 may be required of some denser concrete substrates.

An ICRI CSP #3 may be achieved by using a hand-held grinder with a coarse disc such as those used for masonry. High-pressure or ultra high-pressure water blasting, needle scaling, shotblasting (for horizontal surfaces only) or abrasive blasting may also be used. Because excess moisture in the concrete can lead to blistering or delamination of the *MapeWrap* system, if water blasting is used to achieve the required surface profile, it is imperative to allow adequate time for the substrate to dry before completing the FRP installation. Moisture content in the concrete must be below 3 lbs. per 1,000 sq. ft. (1.36 kg per 92.9 m²) or a maximum of 4% per ASTM F2659 before proceeding with installation. This equates to approximately 75% to 80% relative humidity. It is also important to consider the current dew point, as this can also contribute moisture to the substrate. Applicators should be aware of the dew point and its possible contribution to moisture content. The substrate and ambient temperatures should be between 50°F and 90°F (10°C and 32°C) and at least 5 degrees Fahrenheit (2.8 degrees Celsius) above the dew point.

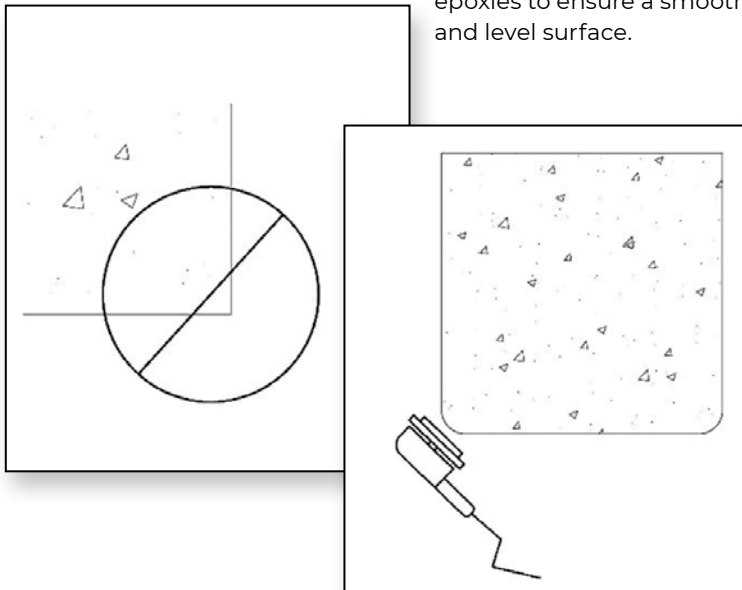
Abrasive blasting tends to be the most efficient means of surface preparation for most FRP applications. However, environmental concerns

for exterior applications and issues with dust for interior applications often prevent the use of abrasive blasting. Because of the issues associated with water blasting and abrasive blasting, as well as the size of the equipment involved, hand-held grinders are most often used. Be sure to consult with the applicable parties to ensure that your desired method of surface preparation is permitted in your project location. It is imperative to utilize the appropriate personal protective equipment (PPE) for the desired surface-preparation procedures.

When the *MapeWrap* system is wrapped around a corner, such as for beam shear strengthening or column wrapping, the corner must be rounded to allow for load transfer through the fabric. Use a hand-held grinder as mentioned above to round the corner to a minimum radius of 3/4" (19 mm).

Once all surface preparation has been completed, the surface should be cleaned of any remaining dust, dirt and laitance that will negatively impact the bond of the *MapeWrap* system. This can be achieved using oil-free compressed air. If a bond-inhibiting coating, oil, grease, paint or other surface contaminant is present on the concrete, this must be fully removed before application of the *MapeWrap* fiber and epoxies. A greater ICRI CSP, up to as much as a CSP #5, may be required to fully remove such coatings. While CSPs deeper than #3 will not negatively impact the performance of the FRP system, it may require additional

epoxies to ensure a smooth and level surface.



Crack injection

Once a minimum ICRI CSP #3 has been achieved and the substrate cleaned, the concrete substrate must be inspected for cracks. All cracks larger than 10 mils must be epoxy-injected before the installation of the *MapeWrap* or *Carboplate* system can proceed. Cracks of this size are susceptible to movement. Differential movement behind a cured FRP system may lead to failure of the epoxy and fabric, compromising the strength provided. While inspecting for these cracks after surface preparation has been completed makes crack injection a difficult item to bid on, completing the inspection before surface preparation may incorrectly identify cracks as not requiring injection. Cracks in concrete tend to open wider as they go deeper, so a crack that looks to be less than 10 mils on the surface may be larger once surface preparation is complete. MAPEI's *Epojet*™ family of injection materials may be used for crack injection; contact your local sales professional for additional information.

Pre-installation planning and inspection

Because of the rapid-setting nature of epoxies, particularly in warmer temperatures, it is strongly recommended to pre-cut the *MapeWrap* fabric to the length and width specified on the shop drawings before mixing and applying epoxy materials. *MapeWrap* fabrics can be cut with scissors or a utility knife. When determining the correct length of fabric, be sure to consider any laps required as detailed on the drawings.

After the fabric is cut, it must be stored in a clean, dry location to ensure adequate bond to the substrate. *MapeWrap* fabric should be stored flat or loosely rolled as it came in the packaging, as any folds or creases will likely remain in place when the fabric is laid flat.

The concrete substrate should also be inspected for any potential sources of water infiltration. For example, a crack on the deck above or a leaky expansion joint could allow for the collection of moisture behind the installed FRP system. Over time, this could develop sufficient hydrostatic pressure to cause blistering or delamination of the fabric. Any potential issues identified should be adequately repaired before installation of the *MapeWrap* system.

MapeWrap priming and repair

MapeWrap Primer 1 mixing

- a. Once all surface preparation has been completed, mixing of the two-component *MapeWrap Primer 1* epoxy can commence.
- b. Add the contents of Part B to the Part A component and mix for 3 minutes, utilizing a low-speed drill with a standard paint-mixing paddle to a smooth, homogenous consistency.
- c. *MapeWrap Primer 1* is pre-proportioned at 3 parts by weight of Part A and 1 part by weight of Part B, and must be mixed as a full unit. Partial mixing is not permitted.
- d. Working time for the *MapeWrap Primer 1* is 90 minutes at 73°F (23°C) but is highly temperature-dependent. Expect significant reductions in time at higher temperatures.

MapeWrap Primer 1 application

- a. Apply *MapeWrap Primer 1* to the prepared substrate utilizing a 3/8" (10 mm) nap roller or brush.
- b. Coverage rates vary based on substrate porosity and surface profile, but generally range from 150 to 190 sq. ft. per U.S. gal. (3.67 to 4.65 m² per L).
- c. Apply *MapeWrap Primer 1* only to those locations on the substrate that are to receive *MapeWrap FRP* fabric to ensure breathability of the substrate.
- d. In cases of a very porous substrate, a second coat of *MapeWrap Primer 1* may be necessary to ensure adequate coverage.

MapeWrap 11 and MapeWrap 12 mixing

- a. Once the *MapeWrap Primer 1* has been applied, mixing of the two-component *MapeWrap 11* or *12* epoxy putty can begin.
- b. *MapeWrap 11* is a two-component, 100%-solids epoxy putty used to level the substrate after surface preparation and application of *MapeWrap Primer 1*. It is intended for use at temperatures ranging from 41°F to 73°F (4°C to 23°C).
- c. *MapeWrap 12* is a two-component, 100%-solids epoxy putty used to level the substrate after surface preparation and application of *MapeWrap Primer 1*. It is intended for use at temperatures ranging from 73°F to 90°F (23°C to 32°C).
- d. Pre-mix Part A for 3 minutes, utilizing a low-speed drill with a standard paint-mixing paddle.
- e. Add the contents of Part B to the Part A component and mix for 3 minutes, utilizing a low-speed drill with a standard paint-mixing paddle to a smooth, homogenous consistency.
- f. *MapeWrap 11* and *12* are pre-proportioned at 3 parts by weight of Part A and 1 part by weight of Part B, and must be mixed as full units. Partial mixing is not permitted.

- g. Working time for *MapeWrap 11* is 40 minutes at 73°F (23°C) but is highly temperature-dependent. Expect significant reductions in time at higher temperatures.
- h. Working time for *MapeWrap 12* is 60 minutes at 73°F (23°C) but is highly temperature-dependent. Expect significant reductions in time at higher temperatures.



MapeWrap 11 and MapeWrap 12 application

- a. If less than 24 hours have passed since application of *MapeWrap Primer 1*, application of *MapeWrap 11* or *12* can begin immediately. If more than 24 hours have passed, lightly abrade the surface of the applied primer with 100-grit sandpaper to remove any surface contaminants, taking care not to damage the applied *MapeWrap Primer 1*.
- b. Apply *MapeWrap 11* or *12* with a steel trowel or putty knife held tightly to the substrate to only fill in the low areas of the substrate at a thickness ranging from 1/32" to 1/16" (1 to 1.5 mm).
- c. Coverage rates vary based on the surface profile of the substrate, but generally range from 50 to 150 sq. ft. per U.S. gal. (1.22 to 3.67 m² per L).

MapeWrap 21 and MapeWrap 31 mixing

- a. Following application of *MapeWrap 11* or *12*, mixing of the two-component *MapeWrap 21* or *31* epoxy resin can begin.
- b. *MapeWrap 21* is a 100%-solids, low-viscosity epoxy resin used to saturate the fabrics used as part of the *MapeWrap* FRP strengthening system. It is best suited for use when a mechanical saturation device is utilized for installation of *MapeWrap* fabrics.
- c. *MapeWrap 31* is a 100%-solids, medium-viscosity epoxy resin used to saturate the fabrics used as part of the *MapeWrap* FRP strengthening system. It may be used for horizontal, vertical and overhead installations utilizing the "dry" lay-up method. *MapeWrap 31* may not be used with mechanical saturation devices.
- d. Pre-mixing of the Part A component may be required if segregation is apparent in the pail. If required, pre-mix Part A for 3 minutes, utilizing a low-speed drill with a standard paint-mixing paddle.
- e. Add the contents of Part B to the Part A component and mix for 3 minutes, utilizing a low-speed drill with a standard paint-mixing paddle.
- f. *MapeWrap 21* and *31* are pre-proportioned at 4 parts by weight of Part A and 1 part by weight of Part B, and must be mixed as full units. Partial mixing is not permitted.
- g. Working time for *MapeWrap 21* is 2 hours and for *MapeWrap 31* is 40 minutes at 73°F (23°C) but is highly temperature-dependent. Expect significant reductions in time at higher temperatures.

MapeWrap fabric installation – Dry lay-up method

MapeWrap 31 basecoat application

- a. If less than 24 hours have passed since application of *MapeWrap 11* or *12*, application of *MapeWrap 21* or *31* can begin immediately. If more than 24 hours have passed, lightly abrade the surface of the applied putty with 100-grit sandpaper to remove any surface contaminants, taking care not to damage the applied *MapeWrap 11* or *MapeWrap 12*.
- b. Apply the first coat of *MapeWrap 21* or *31* to the substrate with a 3/8" (10 mm) nap roller or brush at a rate of about 18 to 20 mils. Heavier fabrics will require additional material.
- c. Coverage rates for *MapeWrap 31* vary based on the weight of the *MapeWrap* fabric being used, and are approximately as follows:
 - *MapeWrap C Uni-Ax 300*: 70 sq. ft. per U.S. gal. (1.75 m² per L)
 - *MapeWrap C Uni-Ax 600*: 60 sq. ft. per U.S. gal. (1.5 m² per L)
 - *MapeWrap C Bi-Ax 230*: 39 to 43 sq. ft. per U.S. gal. (0.96 to 1.05 m² per L)
 - *MapeWrap G Uni-Ax 900*: 55 sq. ft. per U.S. gal. (1.35 m² per L)

MapeWrap fabric application

- a. Following application of basecoat of *MapeWrap 31*, the dry fibers may be applied to the substrate. The fabric must be applied while *MapeWrap 31* is still wet.
- b. Initially, use gloved hands to place the *MapeWrap* fabric into its correct position and orientation. Lay the fabric into the wet epoxy, ensuring that the fiber axis remains oriented per the contract drawings.
- c. Once the *MapeWrap* fabric is correctly positioned, start rolling along the direction of the fibers in the middle of the fabric using a rib roller tool. Work any wrinkles or air bubbles toward the ends of the fabric. Continue rolling with the rib roller until the *MapeWrap 31* shows visible signs of bleeding through the fabric.



MapeWrap 31 topcoat application

- a. If additional *MapeWrap 31* is required, mix per this guide's section on *MapeWrap 31* mixing.
- b. Immediately after placing the dry *MapeWrap* fabric into the basecoat of saturating epoxy and after eliminating all air pockets, wrinkles and voids, place a second topcoat of *MapeWrap 31* onto the top of the fabric using a 3/8" (10 mm) nap roller or brush.
- c. The topcoat should consist of 10 to 15 mils of *MapeWrap 21* or *31*.
- d. If this is the final layer of *MapeWrap* fabric to be placed and a coating is to be used for UV protection or aesthetics, apply a light broadcast of oven-dried silica sand that is 20 to 30 mesh in size and meets ASTM C33 into the still wet *MapeWrap 21* or *31*. This will provide a profiled surface for better coating adhesion.
- e. Cover it with a protective coating – such as *Mapelastic*, *Elastocolor Coat* or *Elastocolor Flex* – to provide an effective barrier against UV rays, particularly in direct sunlight. The system should not be exposed to UV rays for more than 3 days.

Additional layers of MapeWrap fabric

- a. When more than one layer of *MapeWrap* fabric is specified in the contract drawings, repeat the previous two sections of this guide as required until all layers are installed.
- b. If less than 48 hours have passed since application of the previous layer of *MapeWrap* fabric/saturant combination, application of the next layer may begin immediately. If more than 48 hours have passed, lightly abrade the surface of the applied *MapeWrap 21* or *31* with 100-grit sandpaper to remove any surface contaminants, taking care not to damage the applied *MapeWrap 21* or *31* topcoat.



MapeWrap fabric installation – Wet lay-up method

Some contractors may prefer to pre-saturate the *MapeWrap* fabric using a saturating machine. This is particularly true when using heavier fabrics. For example, it would be extremely difficult to use the dry lay-up method to install *MapeWrap C Uni-Ax 1200*. Due to the viscosity of the material, when using a saturator, you must use *MapeWrap 21*. In no case should *MapeWrap 31* be used with a saturator, as it is too thick.

While saturating machines (or other alternative methods such as a plastic basin) may differ slightly depending on the manufacturer, most function in a similar manner. First, a trough is filled with *MapeWrap 21* saturant, and the *MapeWrap* fabric is pulled through the trough to wet both sides of the fabric. It is then run through a set of rollers set to the correct width to ensure full saturation of the fabric. The fully saturated fabric is then placed by hand on onto the substrate. Note that the substrate must be preconditioned with *MapeWrap Primer 1* and *MapeWrap 11* or *12*.

Coverage rates for *MapeWrap 21* vary based on the weight of the *MapeWrap* fabric being used and are as follows:

- *MapeWrap C Uni-Ax 300*: 55 sq. ft. per U.S. gal. (1.35 m² per L)
- *MapeWrap C Uni-Ax 600*: 50 sq. ft. per U.S. gal. (1.22 m² per L)
- *MapeWrap C Uni-Ax 900*: 45 sq. ft. per U.S. gal. (1.10 m² per L)
- *MapeWrap C Uni-Ax 1200*: 35 sq. ft. per U.S. gal. (0.86 m² per L)
- *MapeWrap G Uni-Ax 900*: 50 sq. ft. per U.S. gal. (1.22 m² per L)

Once the fully saturated *MapeWrap* fabric is placed onto the substrate, a ribbed roller is used to stretch the fabric and remove any wrinkles, bubbles or blisters that may have formed. As discussed previously, always roll the ribbed roller in the direction of the primary fibers, not across them.

The process is repeated for additional layers of material that may be required. Once the final layer has been placed, if a coating is required it is necessary to apply a light broadcast of oven-dried silica sand that is 20 to 30 mesh in size and meets ASTM C33 into the still wet *MapeWrap 21*. This will provide a profiled surface for better coating adhesion.

Coating application

- MapeWrap* systems exposed to UV light must be protected with a coating, as the epoxy materials are not UV-stable. Often a coating will be used for aesthetic purposes as well.
- The *MapeWrap 21* or *31* saturant must be cured to a tack-free state before a coating may be applied. While this is temperature-dependent, allowing 24 hours will be more than enough time for the saturant to adequately cure.
- Consult with your local MAPEI sales professional for information related to MAPEI coatings compatible with the *MapeWrap* system. *Elastocolor® Coat* is most often used, as it is a breathable, 100%-acrylic coating that provides UV stability.



Carboplate installation

Concrete repairs

Refer to the general information on Page 3.

Surface preparation

Refer to the general information on Page 3.

Crack injection

Refer to the general information on Page 4.



Pre-installation planning

Carboplate E 170 carbon fiber plates come in standard widths of 2" (5 cm), 4" (10 cm) and 6" (15 cm), and thicknesses of 0.047" and 0.055" (1.2 and 1.4 mm). *Carboplate* comes in lengths of 82 and 328 ft. (25 and 100 m). They are shipped in coils that are under extreme tension. Very special care must be taken when cutting the packaging straps off the *Carboplate* laminates. It is recommended that a containment box be built to prevent the laminate from violently uncoiling itself, which could lead to injury. The containment box can also be built to include a dispenser sleeve, simplifying the cutting of the laminates to length and the application of the correct amount of *MapeWrap 11* or *12* to the back side of the laminate. Be sure to remove the peel-ply from the face of the laminate that will receive *MapeWrap 11* or *12* before applying the epoxy to the laminate. The *Carboplate* laminates can be cut to length using a guillotine-type cutting tool or industrial shears.

Carboplate installation

- Mix the required number of units of *MapeWrap Primer 1* per this guide's section on *MapeWrap Primer 1* mixing. Be cognizant of temperature and curing times, as high temperatures may warrant mixing smaller amounts.
- Apply *MapeWrap Primer 1* to the areas of the substrate that are to receive a *Carboplate* laminate per this guide's section on *MapeWrap Primer 1* application.
- Mix the required number of units of *MapeWrap 11* or *12* per this guide's section on *MapeWrap 11* and *12* mixing. Be cognizant of temperature and curing times, as high temperatures may warrant mixing smaller amounts.
- Apply 40 mils of *MapeWrap 11* or *12* to the clean, dry and primed substrate in the location that will receive the laminate, using a 3/32" (2.5 mm) V-notched trowel.
- If a pre-built containment/dispenser box is not used, use a putty knife of the appropriate width to apply a uniform thickness of 40 mils of *MapeWrap 11* or *12* to the side of the *Carboplate* that has the peel-ply removed.
 - Alternately, a pre-built containment/dispenser box can be used. A trough can be built and filled with *MapeWrap 11* or *12*. The *Carboplate* can be pulled through a slit of the appropriate thickness to allow for the thickness of the plate along with 40 mils of *MapeWrap 11* or *12*.
- Install the *Carboplate* on the substrate using a hard-rubber roller. Apply constant pressure to the laminate until some excess epoxy escapes on both sides of the laminate. Remove this excess epoxy using a steel trowel, taking care not to move the installed *Carboplate*.



MapeWrap repair guidelines

Even when the *MapeWrap FRP* strengthening system is installed per this guide, it is possible that small air voids or delaminations may occur between layers of FRP fabric, or between the FRP system and the substrate. Unanticipated moisture issues or failure to follow this guideline may result in rather large delaminations. To minimize delaminations of all sizes, the applicator should ensure that the *MapeWrap* fabric material is tightly pressed to the substrate. It is also recommended to install the *MapeWrap* system during periods of falling temperature, as this will minimize vapor transmission from the substrate. Because voids, wrinkles and delaminations have the potential to affect the structural integrity of the *MapeWrap* system, any damage should be evaluated. Applicators are required to perform corrective action based on the guidelines below, which are predicated upon the recommendations of ACI 440.2R-17.

Small delaminations or voids

- Total area is less than 2 sq. in. (1 290 mm²).
- Total area of damaged areas is less than 5% of the total area of the installed *MapeWrap* fabric.
- Installed *MapeWrap* fabric has no more than 10 damaged areas per 10 sq. ft. (0.93 m²).

If all the above requirements are met, small delaminations or voids may be left in place without corrective action being taken, as they will not affect the structural integrity of the *MapeWrap* system. However, if either the total area or frequency of voids is more than the requirements listed, the damaged areas must be repaired by resin injection. Refer to the "Repair by resin injection" procedure below for additional guidance.

Moderate delaminations or voids

- Total area is greater than 2 sq. in. (1 290 mm²)
- Total area is less than 25 sq. in. (16 129 mm²)
- Cannot be classified as small damage

Damaged areas that are classified as moderate must be repaired to maintain the structural integrity of the *MapeWrap* system. These areas may be repaired by resin injection or by cutting and patching the damaged area. The method chosen will depend on the size and frequency of the damaged areas as well as their location

on the *MapeWrap* fabric sheet. Refer to the procedures on the following page for additional guidance.

Large delaminations or voids

- Total area is greater than 25 sq. in. (16 000 mm²)
- Cannot be classified as small or moderate damage

Large voids or delaminations will adversely affect the structural integrity of the *MapeWrap* system, and must be repaired by cutting and patching the damaged area. Resin injection is not an acceptable method of repair for damage classified as large. Refer to the procedures below for additional guidance.

Repair by resin injection

For damaged areas that meet the criteria for small or moderate damage as defined in the previous two sections of this guide, resin injection is an acceptable method of repair. The repair procedure described below applies to small or moderate damage to a fully cured *MapeWrap* system. It may be utilized before or after application of a topcoat. Refer to Detail MP-1000 at the end of this guide for a visual representation of the procedure defined below.

- Drill two 1/16" (1.5 mm) diameter holes into the top and bottom of the damaged area.
 - Ensure that each hole penetrates completely through the *MapeWrap* system and into the air void.
- Mix units of *MapeWrap 21* or *31* as required for filling the voids or delaminations.
 - Refer to the appropriate Technical Data Sheet for proper mixing and handling instructions.
- Fill a plastic syringe with the properly mixed *MapeWrap 21* or *31*.
- Place the tip of the syringe into the drilled hole on the bottom of the damaged area and begin expelling the *MapeWrap 21* or *31* epoxy into the void.
 - Continue filling the void until the *MapeWrap 21* or *31* epoxy begins to excrete from the hole on top of the void or delamination.

- e. Allow adequate time for the *MapeWrap 21* or *31* epoxy to fully cure.
 - f. Ensure that the void or delamination is completely filled with epoxy by the coin-tap test or another method.
 - g. If necessary, repeat the previous six steps until the damage is completely repaired.
- Repair by patching**
- For damaged areas deemed large per the requirements of the crack-injection information on Page 4, or for moderately damaged areas where resin injection is not well suited, the damage must be repaired by patching the *MapeWrap* system. This procedure must be completed before application of a MAPEI topcoat. Refer to Detail MP-1001 at the back of this guide for a visual representation of the procedure defined below.
- a. Begin by using a utility knife to remove a rectangular area of the *MapeWrap* system immediately surrounding the edges of the void.
 - Be sure to remove all layers of *MapeWrap* fabric down to the substrate.
 - b. Using 100-grit sandpaper, lightly abrade the surface of the *MapeWrap 21* or *31* that remains around the removed portion of fabric.
 - c. The exposed substrate must be re-profiled to a minimum ICRI CSP #3.
 - d. Re-apply *MapeWrap Primer 1* and *MapeWrap 11* or *12* to the exposed and properly prepared substrate per the instructions on the relevant Technical Data Sheet.
 - e. Using *MapeWrap 21* or *31* and the same type and number of layers of *MapeWrap* fabric originally installed, apply a patch of the *MapeWrap* system over the exposed substrate
 - The patch must extend to a minimum of 4" (10 cm) onto the existing *MapeWrap* system in all four directions.
 - f. If necessary, allow adequate time for the *MapeWrap* system to cure to a tack-free state before application of the MAPEI topcoat material.

Appendix 1

Recommended Tools and Equipment

- Safety glasses
- Nitrile, latex or other chemical-resistant gloves
- Disposable coveralls (Tyvek, etc.)
- Plastic or tarp to protect from epoxy spillage
- Table for measuring and cutting *MapeWrap* fabrics
- Utility knife or scissors (plenty of extras recommended)
- Measuring tape
- Clean 5-gallon (18.9-L) buckets for mixing and cleaning tools
- Clean rags or towels
- Duct tape (for marking installation areas if desired/required)
- Approved solvent for cleaning (xylene, MEK, acetone, etc.)
- 100-grit sandpaper
- Margin trowels
- 6" (15 cm) putty knives
- Rib roller (also sometimes referred to as laminating roller)
- Paint roller frames
- 3/8" (10 mm) nap rollers
- Paint trays
- Hand grinder with masonry discs
- Low-speed drill
- Paint mixing paddle
- Preferred surface-preparation equipment (abrasive blasting, water blasting, etc.)

Appendix 2

NOTES:

1. LOCATE THE DAMAGED OR DELAMINATED AREA OF THE INSTALLED MAPEWRAP FRP SYSTEM BY ACOUSTIC TAP TESTING.
2. DRILL TWO 1/16" DIAMETER HOLES AT THE TOP AND BOTTOM OF THE DAMAGED OR DELAMINATED AREA.
3. USING A SYRINGE, FILL THE DAMAGED OR DELAMINATED AREA WITH THE SAME MAPEWRAP SATURANT THAT WAS USED ON THE PROJECT.
4. VERIFY THE REPAIR HAS BEEN ADEQUATELY REPAIRED BY PERFORMING AN ACOUSTIC TAP TEST ON THE REPAIRED AREA.

MAPEI Corporation
1144 East Newport Center Drive
Deerfield Beach, Florida 33442

Technical Service: 888-365-0614
Customer Service: 800-426-2734

www.mapei.com

MAPEWRAP FRP SYSTEM
REPAIR OF MODERATE DELAMINATIONS
TYPICAL DETAIL

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Appendix 3

STEP 1:

STEP 3:

STEP 2:

REMOVE A RECTANGULAR AREA OF THE THE MAPEWRAP SYSTEM AROUND THE DAMAGED OR DELAMINATED AREA BACK TO THE SUBSTRATE

WITH 100 GRIT SANDPAPER LIGHTLY ABRASE THE SURFACE OF THE WELL-BONDED MAPEWRAP SYSTEM AROUND THE DAMAGED AREA

MAPEI Corporation
1144 East Newport Center Drive
Deerfield Beach, Florida 33442

Technical Service: 888-365-0614
Customer Service: 800-426-2734

www.mapei.com

MAPEWRAP FRP SYSTEM
REPAIR OF LARGE DELAMINATIONS
TYPICAL DETAIL

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**MAPEI Headquarters
of North America**

1144 East Newport Center Drive
Deerfield Beach, Florida 33442
1-888-US-MAPEI (1-888-876-2734) /
(954) 246-8888

Technical Services

U.S. and Puerto Rico:

Flooring: 1-800-992-6273

Concrete and heavy construction:
1-888-365-0614

Customer Service

1-800-42-MAPEI (1-800-426-2734)

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