

**Master Builders Solutions  
Construction Chemicals LLC**

**Application Guide  
For  
MasterBrace  
Composite Strengthening  
Systems**

**This guide refers specifically to  
MasterBrace FIB (Fabric)**

**IMPORTANT: READ THIS FIRST**

Master Builders Solutions Construction Chemicals LLC do not warrant the performance of this product unless the instructions of this document and other related **Master Builders Solutions Construction Chemicals LLC** documents are adhered to in all respects.

## 1. GENERAL:

This application guide applies to the **MasterBrace FIB** Composite Strengthening systems and specifically deals with the **MasterBrace FIB** (Fabric) type systems. This application guide shall be read in conjunction with all project specifications (including drawings), by others, and the current technical data sheets (TDS) and material safety data sheets (MSDS).

**Repairs:** Any repairs to the substrate and surface preparation required, shall be done to the satisfaction of the specifying consulting engineer and Master Builders.

**Application Requirements:** All work shall be carried out by adequately trained and skilled sub-contractors, under appropriate supervision.

**Safety:** Always ensure the appropriate use of adequate PPE (gloves, goggles, long sleeves etc.) and comply with all other safety related requirements when applying **MasterBrace** materials.

**Quality Systems:** The applicator shall operate under a fully compliant quality system, to ensure the on-site quality of applied material. The applicator shall keep fully documented work records for all works undertaken.

**Quality Control:** If after application and/or testing, any applied material is deemed as unsatisfactory by the specifying consulting engineer and/or Master Builders Solutions, it may need to be rectified at the applicator's cost.

**Weather:** No product application work is to be carried out in temperatures below 5°C or above 45°C, unless special precautions are taken.

**Continuity of Process:** All applications shall be done in continuous operations, including first primer coat, through to last layer of **MasterBrace FIB**, without significant delay.

### Part A – Preparation

#### A1. Concrete substrate:

A load-bearing substrate is a pre-requisite for the reinforcement with all **MasterBrace FIB** systems. All concrete substrate shall be of at least 28 days old. A tensile bond strength of the substrate of >1.5 MPa is required. Testing of the substrate shall be performed as required utilizing the testing procedure indicated in Appendix A, "General Description of Tensile Pull-Off Test" document. This should be tested prior to work proceeding and to verify the contractor's chosen preparation procedures.

All cement laitance must be removed prior to application. The surface layer of the concrete shall be removed to expose small particles of sound aggregate such that the minimum roughness or surface profile to be achieved is **CSP 3**, as per **ICRI** (International Concrete Repair Institute) Technical Guideline No. 310.2R-2013. The optimum mean surface roughness or profile is 0.5 – 1.0 mm, and must expose soundly bonded aggregate with a surface presenting similar to 60-grit sandpaper.

The surface shall not be roughened excessively, or in a manner that will create unnecessary damage to the substrate concrete. Ideal surface preparation methods are grit blasting, shot-peening or grinding. Any additional water must be avoided. Dirt, oil, grease and other contaminants must be removed. Immediately prior to the application of the **MasterBrace FIB** strengthening system including epoxy primer and/or levelling mortar, the surface must be cleaned with a brush or a vacuum cleaner to remove all loose particles and dust.

Cracks in the substrate concrete need to be assessed and treated depending on their location and movement characteristics. All cracks crossing the fabric strip(s) shall be epoxy injected using suitable high pressure injection equipment and packers etc. and **MasterInject 1315**.

Immediately prior to application, remove all loose dust particles and carry out a visual inspection of the concrete surface.

**Measure the moisture content of the concrete substrate. The moisture content of the concrete must be below 4% when checked with a surface type electronic moisture meter.**

### **A2. Levelling of the Substrate:**

Where required, any voids must be levelled, by either grinding the surface flat, or building it up, with a levelling mortar. Local grinding of high points and removal of formwork edges etc. is mandatory to achieve the required profile.

Generally, minor voids are levelled with an epoxy based levelling mortar (**MasterBrace ADH 4000**) at least 1 day prior to the application of the **MasterBrace FIB** material.

In extreme situations, the epoxy levelling mortar can be bulked out with **MasterTop SR 2** filler 1 / 1 by volume to aid in deep fills, greater than 20 mm. The levelling mortar shall generally be left with a smooth yet open textured, level surface.

Alternatively, fill voids by use of a cementitious based mortar (**MasterEmaco S488 PM**) and utilising a suitable bonding agent (**MasterBrace ADH 1414**) to ensure the minimum pull-off values are exceeded (>1.5MPa). This must be placed at a thickness of not less than 10 mm and cured to a moisture content of <4% prior to application of the **MasterBrace FIB** system.

When **MasterBrace FIB** Fabric is running perpendicular to an external corner and is to be wrapped around it, the concrete must be rounded to a radius of at least 12 mm. Internal corners must be smoothed by forming a cove or chamfered detail. No special detailing is required if fabric material is running parallel to the corner.

### **A3. Environmental conditions:**

The presence of moisture may inhibit the adhesion of the primer. Do not apply **MasterBrace FIB** system materials when rainfall or condensation is anticipated.

In general, for application of **MasterBrace FIB** systems, the ambient temperature must be at least 5°C and may not exceed 45°C. The temperature of the substrate concrete must be higher than 8°C.

Determination of dew point, air and substrate temperatures and of relative humidity of air, immediately prior to the application is required, if the substrate is exposed to the weather or is in an external environment. If the dew-point temperature differs by less than 3°C from the substrate temperature, the substrate must be warmed up, or the relative humidity of the air must be reduced. Application may proceed if the "concrete surface" temperature is > Dew point + 3°C.

## Part B – General Application

### B1. Working with epoxy resins:

Do not dilute any epoxy resins used with the **MasterBrace FIB** systems with solvent.

After the resin has been mixed with hardener, the mixed resin batch must be used within its pot-life. This sometimes referred to as open-time or batch-life. The mixed batch of resin must not be used after expiration of its pot-life, as the adhesion may be affected. In the case of **MasterBrace SAT 4500**, an increased resin viscosity will prevent proper impregnation of the **MasterBrace FIB** Fabric materials.

### B2. Priming with MasterBrace P 3500

Research has indicated that long term bond strengths to the substrate, especially in wet-dry cycles, will be improved by priming with **MasterBrace P 3500**.

Priming shall be applied in **MasterBrace FIB Composite Strengthening** applications for fabric systems, unless directed otherwise.

Always apply the next layer of **MasterBrace FIB** resins (**MasterBrace SAT 4500**) onto the **MasterBrace P 3500** primer, whilst it is still tacky. If the primer is allowed to dry, the surface must be re prepared and re-primed prior to any work proceeding.

When required, grind the hardened primer to give a roughened surface and solvent wipe using **Xylene / Acetone / MEK type solvent**, allowing the solvent to completely flash off.

**DO NOT DILUTE PRIMER OR RESIN WITH SOLVENT.**

## Part C - MasterBrace Fabric

### C1. Handling

- Handle with care: **MasterBrace FIB** Fabric can be fragile if improperly handled.  
Manual handling should always be with protective gloves.
- Delivery: **MasterBrace FIB** Fabric is normally delivered to site in rolls, which are wrapped in plastic and contained within cardboard boxes, loaded onto pallets.



Storage: **MasterBrace FIB** Fabric requires protection against heat, sun and weather. It must be stored on a solid, flat and dry surface, inside a ventilated shelter. If stored in the open, protect with opaque waterproof covers.

- **Rolls must be stored only in the horizontal position.**
- Minimum Roll diameter: **MasterBrace FIB** Fabric rolls are delivered with a specific roll diameter (100mm in most cases). This specific diameter is the minimum diameter that should be used for any re-rolling that may be required during application.

**Cutting:**

- **MasterBrace FIB** Fabric should ONLY be cut with good quality sharp shears (scissors), designed to cut cleanly through the fibre. Do NOT cut with a blade.

**C2. Preparation of MasterBrace Fabric**

The **MasterBrace FIB** Fabric is available in three material types: Carbon, Aramid and Glass.

**MasterBrace FIB** Fabric must be cut beforehand into prescribed sizes using appropriate scissors. The maximum size of sheet to be cut is preferably less than 3 m in length, but may be longer if access allows.

When multiple lengths of fabric materials are to be adhered to a concrete surface, a minimum of 100 mm overlapping length must be applied in the longitudinal fibre direction, unless otherwise noted. No overlapping is required in the lateral direction.

### C3. Application of MasterBrace FIB Fabric

#### Dry Lay Up Method for 230 – 300 g/m<sup>2</sup> MasterBrace FIB Fabric

- a) Apply a coat of **MasterBrace SAT 4500** (saturant) to the still sticky primed surface (**MasterBrace P 3500**) using a medium nap roller (approx. 10 mm) to approximately 300 - 500 microns' wet film thickness or sufficient to achieve a wet-out of the **MasterBrace FIB** material. This value will vary depending on the weight of the **MasterBrace FIB** Fabric used (230-300 g/m<sup>2</sup>) as well as the ambient conditions and wastage. A trial on site prior to full application is advisable to establish actual usage rates and to ensure complete wet out of the **MasterBrace FIB** Fabric is achieved.
- b) The **MasterBrace FIB** Fabric is then placed onto the prepared and epoxy coated concrete surface. Always work in the direction of the fibres and work from the centre of the length of the sheet to the ends, to remove any entrapped air. After smoothing down by hand, a soft rubber squeegee or hard roller may be used, over the outside surface to enhance the impregnation of the fabric material. The surface of the adhered fabric must then be squeezed in the fibre longitudinal direction **ONLY** using a ribbed roller in order to impregnate resin into the fabric material and remove any air bubbles. Then go over the surface with a rubber squeegee to smooth out any remaining imperfections. Finally use a de-foaming roller to de-foam the resin coat if required.
- c) For joining strips of **MasterBrace FIB** Fabric Sheets in the fibre longitudinal direction, a 100mm overlapping length is required. At the overlapping location, additional resin is applied to the outer surface of the fabric layer to be overlapped. No lapping is required in the fibre lateral direction.
- d) When wrapping columns ensure the "overlaps" in each band of material are equally "staggered" and do **NOT** line up.
- e) Minimise the elapsed time between mixing and application of the **MasterBrace SAT 4500** saturant to ensure the material is applied to the fabric at least 15 minutes prior to any thickening or gelling.



- f.) Allow sufficient time between the application of **MasterBrace FIB** Fabric on the first coat of wet saturant and the application of the second coat of saturant. This is to allow for epoxy impregnation and is suggested at around 15 minutes (depending on ambient conditions). Any lifting or delamination that may occur during this period, must be corrected by pressing down the **MasterBrace FIB** Fabric using a de-foaming roller or rubber squeegee.
- g.) The second coat of **MasterBrace SAT 4500** saturant must then be applied onto the surface of the **MasterBrace FIB** Fabric. Apply the next coat of saturant whilst the first coat is still wet to the touch/ tacky. The resin must be applied in the **MasterBrace FIB** Fabric longitudinal direction. In order to impregnate and replenish resin into the **MasterBrace FIB** material, use a medium nap roller, with the same amount of saturant applied to achieve a wet film thickness as per the first coat above. Apply the **MasterBrace SAT 4500** saturant from the middle outwards and only roll in one direction, reversing the direction of rolling can cause delamination of the fabric.
- h.) In the case where more than one layer of **MasterBrace FIB** Fabric must be applied, the processes as detailed in items a) through f) must be repeated in a “wet-on-wet”, continuous process.
- i.) In the case of outdoor applications, the work must be protected from rain, sand, dust, etc. by using protective sheeting and other barriers until fully cured. The curing rate of the adhered **MasterBrace FIB system** is temperature dependent.
- j.) If there is to be a top-coat application of a UV-stable acrylic paint (**MasterProtect 300**), provide a sand-seeding, broadcast onto the still-wet, last layer of saturant applied to the **MasterBrace FIB** Fabric material. Prior to applying the acrylic top-coat, remove any loose sand from the surface. The acrylic top-coat may be applied after a minimum of 48 hours curing of the last coat of saturant.

#### C4. Application of MasterBrace Fabric

##### Wet Lay Up Method Recommended for MasterBrace FIB 450-600 g/m<sup>2</sup>

- a) Apply a coat of **MasterBrace SAT 4500** (saturant) to the still sticky primed surface (**MasterBrace P 3500**) using a medium nap roller (approx. 10 mm) to approximately 300-400 microns wet film thickness. This value will vary depending on the ambient conditions and wastage. A trial on site prior to full application is advisable to establish actual usage rates and to ensure complete wet out of the **MasterBrace FIB** fabric (Wet lay-up method is normally restricted to fabrics >300 grams/m<sup>2</sup>).
- b) The **MasterBrace FIB** Fabric material is then laid out and cut to the required length on a suitable long-table. **MasterBrace SAT 4500** is then applied to the upper face of the **MasterBrace FIB** Fabric material using a short nap roller or rubber squeegee ensuring the entire surface is fully coated and all fibres are saturated. IF the length of material is excessive it will require rolling onto a short section of Ø100mm PVC pipe for ease of handling and placement.



- c) The impregnated **MasterBrace FIB** Fabric material (wet face to wet face) is then offered up to the **MasterBrace SAT 4500** (still wet) coated concrete surface. Carefully adhere the fabric and roll out across the surface using hands or a squeegee to loosely place the fabric. Always work in the direction of the fibres and once in place work from the centre of the length of the sheet to the ends, to remove all entrapped air. After initially smoothing down by hand, a squeegee or hard roller may be used, over the outside surface, to enhance the impregnation of the fabric material. The surface of adhered fabric must then be squeezed in the fibre longitudinal direction using a ribbed / washer roller in order to impregnate resin into the fabric material and remove any air bubbles. Then go over the surface with a rubber squeegee to smooth out any remaining imperfections.

Finally use a de-foaming roller to de-foam the resin coat if required.

- d) For joining strips of **MasterBrace FIB** Fabric material in the fibre longitudinal direction, a 100 mm overlapping length is required. At the overlapping location, additional resin is applied to the outer surface of the fabric layer to be overlapped. No lapping is required in the fibre lateral direction.
- e) When wrapping columns ensure the “overlaps” in each band of material are equally “staggered” and do NOT line up.
- f) Minimise the elapsed time between mixing and application of the **MasterBrace SAT 4500** saturant to ensure the material is applied to the fabric at least 15 minutes prior to any thickening or gelling.



- g) Allow sufficient time between the application of **MasterBrace FIB** material on the first coat of wet saturant and the application of the second coat of saturant. This is to allow for epoxy impregnation and is suggested at around 15 minutes (depending on ambient conditions). Any lifting or delamination that may occur during this period, must be corrected by pressing down the **MasterBrace FIB** Fabric using a de-foaming roller or rubber squeegee.



- h) The second coat of **MasterBrace SAT 4500** saturant must then be applied onto the surface of the **MasterBrace FIB** Fabric material. Apply the next coat of saturant whilst the first coat is still wet / tacky to the touch. The resin must be applied in the **MasterBrace FIB** Fabric longitudinal direction. In order to impregnate and replenish resin into the **MasterBrace FIB** Fabric material, use a medium nap roller and squeegee / spatula, with the same amount of saturant applied to achieve a wet film thickness as per the first coat above.
- i) In the case where more than one layer of **MasterBrace FIB** Fabric must be applied, the processes as detailed in items a) through f) must be repeated in a “wet-on- wet”, continuous process.
- j) In the case of outdoor applications, the work must be protected from rain, sand, dust, etc. by using protective sheeting and other barriers until fully cured. The curing rate of the adhered **MasterBrace FIB** system is temperature dependent.
- k) If there is to be a top-coat application of a UV-stable acrylic paint (**MasterProtect 300**), provide a sand-seeding, broadcast onto the still-wet, last layer of saturant applied to the **MasterBrace FIB** Fabric material. Prior to applying the acrylic top-coat, remove any loose sand from the surface. The acrylic top-coat may be applied after a minimum of 48 hours curing of the last coat of saturant.

#### Other Considerations:

#### E1. Quality control

After allowing at least 24 hours for initial resin cure to occur, perform a visual and acoustic tap test inspection of the layered surface. Test all the areas where **MasterBrace FIB** is applied to check for voids, bubbles and delamination. Repair all voids, bubbles and delamination by approved methods as per the requirements of the specification and to Master Builders Solutions satisfaction.

In addition, the evenness of the **MasterBrace FIB** Fabric surface shall be checked. Deviations within a test length of 300mm may not exceed 1mm. If the test length measures over 2m, the maximum deviation is 5mm.

Direct pull-off tests shall be conducted to verify the tensile bond between the **MasterBrace FIB** Fabric material and the concrete substrate. For further information, refer to Appendix A, “General Description of Tensile Pull-Off Test”. These should be conducted on approved “test areas” and not sections of the actual work – unless absolutely necessary (requires detailed patching afterwards).

- a.) Unless otherwise directed by the project specification, perform a minimum of one pull-off test per 10 m<sup>2</sup> of fabric (or a minimum of two per project), to surfaces strengthened with the **MasterBrace FIB** Fabric materials. The test is to be completed prior to the application of finishes on the **MasterBrace FIB** Fabric materials.

- b.) An average of 1.5 MPa minimum shall be obtained from these adhesion tests. Inspect the failure surface of the core specimen to ensure that failure is in the concrete substrate. Failure at the bond line at tensile stress below 1.35 MPa is not acceptable.

## E2. Repair Techniques

When required, repair of defective works within **MasterBrace FIB** systems may be done by a number of means. The choice will depend on the size and location of defect and the **MasterBrace FIB** system being used. Repair systems may include:

- a) Small delamination, less than 25 mm x 25 mm and which are isolated (maximum two (2) defects in a 300 mm x 300 mm area), do not normally require any corrective action. If the size or number of defects is greater than this, corrective action will need to be taken as per below or as otherwise directed.
- b) Corrective Action may consist of two general methods:
- i. Injection of resin into voids.

This process involves the careful filling, by injection of **MasterBrace P 3500**, into the voids, without causing more damage than exists in the void. The techniques will vary but may include the use of a large needle arrangement, with an inlet and outlet hole, to ensure that any air can escape. Always aim to minimize any damage to the **MasterBrace FIB** Fabric.

- ii. Cut-out and replacement of defective area.

This method is the preferred method for all repairs.

For extreme cases where option i) is not deemed appropriate, areas of large defects may be cut-out and replaced with new material. The repair procedures should be as per clause D4. In this document, the material referred to as "putty" would be **MasterBrace ADH 4000**.

Repair of all the defective work after the minimum cure time for the **MasterBrace FIB system**. Comply with material and procedural requirements defined in this document and any related specifications. Repair all defects in a manner that will restore the system to the designed level of quality. Repair procedures for conditions that are not specifically addressed in this document or the specification, shall be approved by the Owner's representative. All repairs and touch ups shall be made to the satisfaction of the Owner's representative.

## E3. Heat protection measures

Since 2-component epoxy resins withstand temperatures of up to 70°C approximately, special attention may be required for heat protection measures (e.g. under fire exposure)

#### E4. Hot Weather Application

For applications in warm weather or where retarded curing is desirable, a number of methods are recommended.

- a) Pre-cool the epoxy resins in an air-conditioned environment at 15- 20°C for at least 8 hours prior to mixing.
- b) Work during the cooler parts of the day and shade materials and application surfaces wherever possible.
- c) Minimize heat build-up in the epoxy materials by mixing smaller portions and/or spreading mixed material out into smaller volumes prior to use. Discard any material that has changed consistency since first mixing.

#### Appendix A - General Description of Tensile Adhesion Test

The following is a description of a field test for concrete surface soundness and overlay bond (ex-ACI 503R, Appendix A: Manual of Concrete Practice, Part 5 and Concrete Society TR 57), are to serve as the in-situ QA/QC testing guidelines of the **MasterBrace** Composite Strengthening System.

The tests are carried out on actual structural members strengthened with the composite **MasterBrace FIB** system. Although there are variations in the equipment for carrying out pull-off tests, the general procedure can be summarized as follows:

1. After the composite strengthening system has hardened, core drill through the composite material and down 3 – 6 mm into the concrete substrate by means of an electric drill fitted with a diamond core bit. The core bit should be of such size as to produce a core the same diameter as the testing dolly, and which will have the appearance of a small island of composite material. The normal size of the dolly is 50 mm diameter. Ensure that the drilling operation does not cause any detrimental effects on the system by using wet drill techniques to minimise heat exposure, and ensure it is perpendicular to the surface.
2. Prepare the top of the core surface to be tested. Preparation includes cleaning of the composite material surface, roughening it with sandpaper, and final cleaning of any dust.
3. Place an aluminium dolly onto the surface of the core with epoxy adhesive (**MasterBrace ADH 2200** or similar). The bottom surface of the dolly has to be sandblasted or sufficiently roughened with sandpaper, and be cleaned and free from any grease or dust. Mix the epoxy components according to the recommendations just prior to use. Apply a small amount of the mixed adhesive to the core surface and to the bonding (properly prepared) face of the dolly by spatula. Place the dolly on the core.
4. Allow epoxy adhesive to cure sufficiently (usually 24 hours or as required).
5. Attach a loading frame (Proceq or similar) to the dolly such that a load can be applied at right angles to the surface. A frame around the test area provides the reaction force to the load. Ensure that the attachment of the loading frame does not induce any lateral sideways force onto the dolly, either prior or during testing.

6. Zero the machine and increase the load until a specified level is reached or the specimen fails.
7. At failure, the maximum pull-force is registered and the pull-off tensile strength is calculated by dividing the force by the cross-sectional area of the core. The mode of failure shall be recorded i.e., within the concrete substrate, within the composite material, between substrate and composite material, between composite material and dolly, or any combination of the above.
8. Pull-off tests shall be carried out on each selected area. The average of the values shall be taken as a pull-off strength result.
9. Unless otherwise indicated by project specification requirements, most composite strengthening applications require minimum tensile strengths of the substrate of:
  - a. 1.0 MPa for fibre fabric sheet material systems.
  - b. 1.5 MPa for laminate material systems.