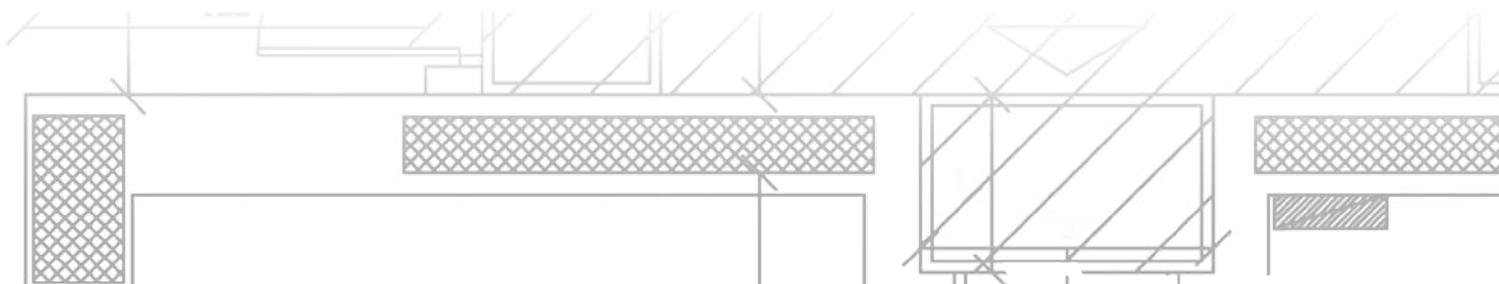




Technical Notebook

LAYING STONE MATERIALS

Materials and systems to lay natural
and recomposed stone correctly



Technical Notebook

LAYING STONE MATERIALS

Materials and systems to lay natural
and recomposed stone correctly

Front cover image:

MARINA BAY SANDS RESORT - SINGAPORE

page	04	1.	INTRODUCTION
page	04	2.	TYPICAL PROBLEMS WHEN LAYING STONE MATERIALS
page	05	2.1	DIMENSIONAL INSTABILITY AND WARPING
page	05	2.1.1	DIMENSIONAL STABILITY TEST: CLASSIFICATION OF STONE MATERIALS
page	08	2.2	STAINING AND EFFLORESCENCE
page	09	3.	PREPARATION OF THE SUBSTRATE
page	12	4.	THE BEST LAYING SOLUTIONS ACCORDING TO MATERIAL CLASSIFICATION
page	12	4.1	CHOOSING THE ADHESIVE SYSTEM
page	12	4.1.1	CLASS A NATURAL AND RECOMPOSED CEMENT-BASED MATERIAL NOT SENSITIVE TO THE FORMATION OF STAINS AND EFFLORESCENCE
page	13	4.1.2	CLASS A RECOMPOSED RESIN-BASED MATERIAL NOT SENSITIVE TO THE FORMATION OF STAINS (FOR INTERNAL APPLICATIONS)
page	14	4.1.3	CLASS A NATURAL, RECOMPOSED CEMENT-BASED AND RECOMPOSED RESIN-BASED MATERIAL (FOR INTERNAL APPLICATIONS) SENSITIVE TO THE FORMATION OF STAINS AND EFFLORESCENCE
page	15	4.1.4	CLASS B* STONE MATERIALS
page	15	4.1.5	CLASS C** STONE MATERIALS
page	16	4.2	CHOOSING THE RIGHT GROUT AND SEALANT FOR THE JOINTS
page	16	4.2.1	PRODUCTS FOR GROUTING JOINTS
page	16	4.2.2	PRODUCTS FOR SEALING EXPANSION JOINTS

Technical Notebook

LAYING STONE MATERIALS

**Materials and systems to lay natural
and recomposed stone correctly**

page	17	5.	SPECIAL LAYING CASES
page	17	5.1	LAYING DECORATIVE ELEMENTS IN CEMENT-BASED RECOMPOSED MATERIAL
page	17	5.2	LAYING PORPHYRY AND ROUGH-CUT STONE
page	18	5.2.1	DRAINING PRODUCTS FOR LAYING AND GROUTING PORPHYRY AND ROUGH-CUT STONE
page	19	5.2.2	PRODUCTS WITH VERY LOW WATER ABSORPTION FOR GROUTING PORPHYRY AND ROUGH-CUT STONE
page	25	6.	SPECIFICATIONS
page	25	6.1	LAYING STONE MATERIALS FOR INTERNAL APPLICATIONS
page	25	6.1.1	LAYING DIMENSIONALLY-STABLE STONE OR RECOMPOSED MATERIAL (MAPEI CLASS A) NOT SENSITIVE TO STAINING
page	33	6.1.2	LAYING STONE OR RECOMPOSED MATERIAL MODERATELY STABLE (MAPEI CLASS B) OR STABLE (MAPEI CLASS A) IN THE PRESENCE OF WATER AND SENSITIVE TO STAINING
page	37	6.1.3	LAYING STONE OR RECOMPOSED MATERIAL UNSTABLE IN THE PRESENCE OF WATER (MAPEI CLASS C)
page	39	6.2	LAYING STONE MATERIALS FOR EXTERNAL APPLICATIONS
page	39	6.2.1	LAYING DIMENSIONALLY-STABLE STONE OR RECOMPOSED CEMENT-BASED MATERIAL (MAPEI CLASS A) NOT SENSITIVE TO STAINING
page	42	6.2.2	LAYING STONE OR RECOMPOSED CEMENT-BASED MATERIAL MODERATELY STABLE (MAPEI CLASS B) OR STABLE (MAPEI CLASS A) IN THE PRESENCE OF WATER AND SENSITIVE TO STAINING

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

1. INTRODUCTION

The aim of this Technical Notebook is to offer useful guidelines to help lay natural and recomposed stone materials correctly with long-lasting results using technologically advanced products and systems made by MAPEI, thanks to the company's experience gained over the years, as well as constant technical support from the company's Research and Development laboratories.

To solve typical problems encountered when laying stone materials, MAPEI offers a complete range of products including screeds, smoothing and levelling compounds, adhesives, grouting mortars and special-purpose sealants.

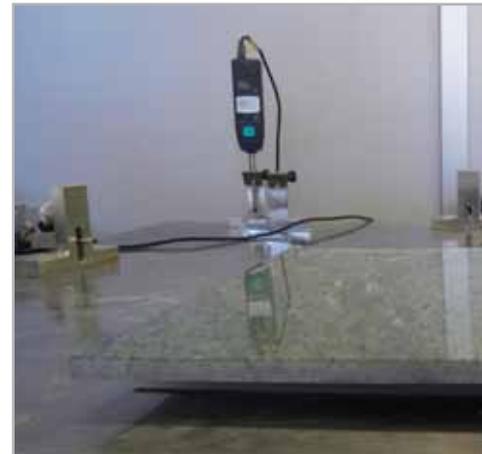
This pamphlet also illustrates examples of quality, long-lasting laying methods for marble, granite, porphyry and agglomerates for various types of applications and service uses.

2. TYPICAL PROBLEMS WHEN LAYING STONE MATERIALS

Over the years, the market has introduced thinner natural stone slabs compared with conventional thicker slabs, and artificial stone products and various types of binders. This has resulted in new problems being encountered when laying such products.

It is quite common for stone materials to warp or expand due to the presence of damp in the substrate and installation materials, or due to the effect of temperature variations. Also, when water is present, stains or unsightly efflorescence may form on certain grades of stone.

These two problems are not necessarily connected and, therefore, must be approached separately.



2.1 DIMENSIONAL INSTABILITY AND WARPING

How sensitive certain types of stone are to warping in the presence of water or temperature variations is a determining factor when choosing which type of adhesive to use for laying—if the wrong adhesive is used, the functionality of the coated surface may be compromised (Fig. 2.1).

A material's tendency to warp involves particularly certain types of green marble (such as Alpine Green), certain types of slate and Pietra Serena and certain recomposed materials made using polyester resin (more sensible to thermic variations), and depends highly on the shape, dimensions and thickness of the slabs. This problem, therefore, is influenced by both the nature of the stone and its geometric characteristics, which makes it practically impossible to predict the material's behaviour when laying and when in service without carrying out in-depth testing on the material before use.

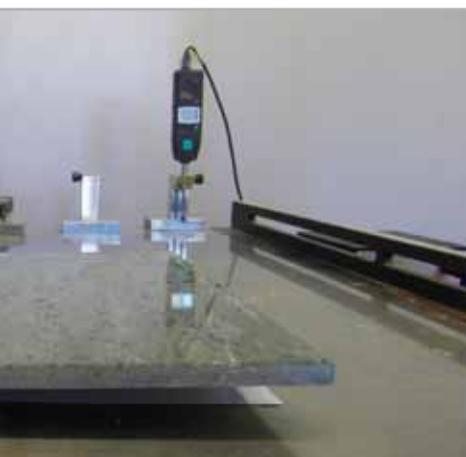


Fig. 2.1 - Warping of a stone slab which is sensible to humidity

2.1.1 DIMENSIONAL STABILITY TEST: CLASSIFICATION OF STONE MATERIALS

MAPEI IS THE ONLY COMPANY IN THE WORLD to have designed and developed an analytical classification system for stone materials according to their sensitivity to water (Table 1). The test method used to develop the classification system is a test rig with a metal support bed and high-precision digital measuring devices, connected to a terminal which carries out a continuous registration of any dimensional variations as they occur.

The test simulates the laying of a slab and then continuously measures any movements at the edges of the slab with electronic sensors. The slab is positioned upside-down and is supported on three of its four sides, and is then wetted with a piece of saturated felt on the back face of the slab.

The test is carried out as follows:

1. The slab is overturned and supported on three of its four vertical faces on a metal bed. A piece of felt saturated with water is placed on the back face (Fig. 2.2) to simulate the damp in the laying surface (sand and cement mortar or conventional adhesive);

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

2. The digital sensors, positioned in various points on the slab to record deformations in all directions at the edges of the slab, continuously transmit all the movements in the slab due to the damp felt to the terminal;

3. According to the entity of the deformations (δ), measured 6 hours after applying the damp felt, the stone is divided into three classes:

a) **Class A:** $\delta < 0.3$ mm

b) **Class B:** $0.3 < \delta < 0.6$ mm

c) **Class C:** $\delta > 0.6$ mm

4. Materials in the class A group are considered stable and the choice of which adhesive used does not depend on its tendency to warp. Other factors will have to be considered, such as its sensitivity to staining or the formation of efflorescence, the size of the slabs, the type of substrate and the service conditions of the dressing.

5. For those materials which are not in class A after simulating their bonding with a damp felt, the test described previously must be repeated by replacing the damp felt with a layer of quick-hardening cementitious adhesive (class F in compliance with EN 12004) (Fig. 2.3).

6. According to the entity of the deformation (δ) measured 6 hours after applying the adhesive, the material is classified as follows:

a) **Class B*:** $\delta < 0.3$ mm – materials become class A after simulating bonding with rapid adhesive.

b) **Class C**:** $\delta > 0.3$ mm – materials are still classified as class B or C, even after simulating bonding with rapid adhesive.

According to the results of the dimensional stability test, combined with other particular characteristics or foreseen service conditions, it is possible to define the most suitable laying system to guarantee a durable coating.

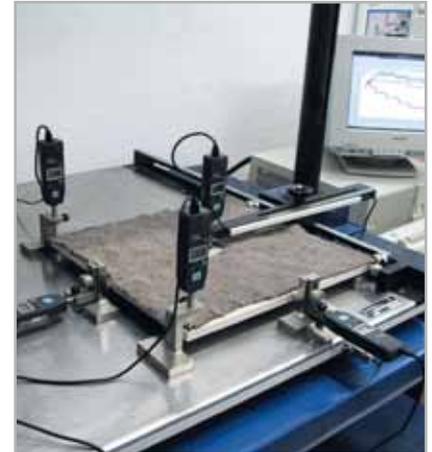


Fig. 2.2 - Dimensional stability test by simulation with damp felt



Fig. 2.3 - Dimensional stability test by bonding with quick-hardening adhesive

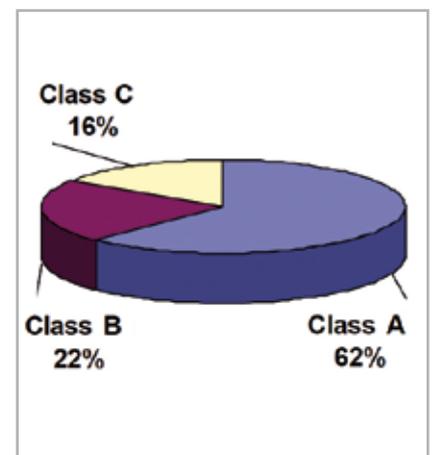
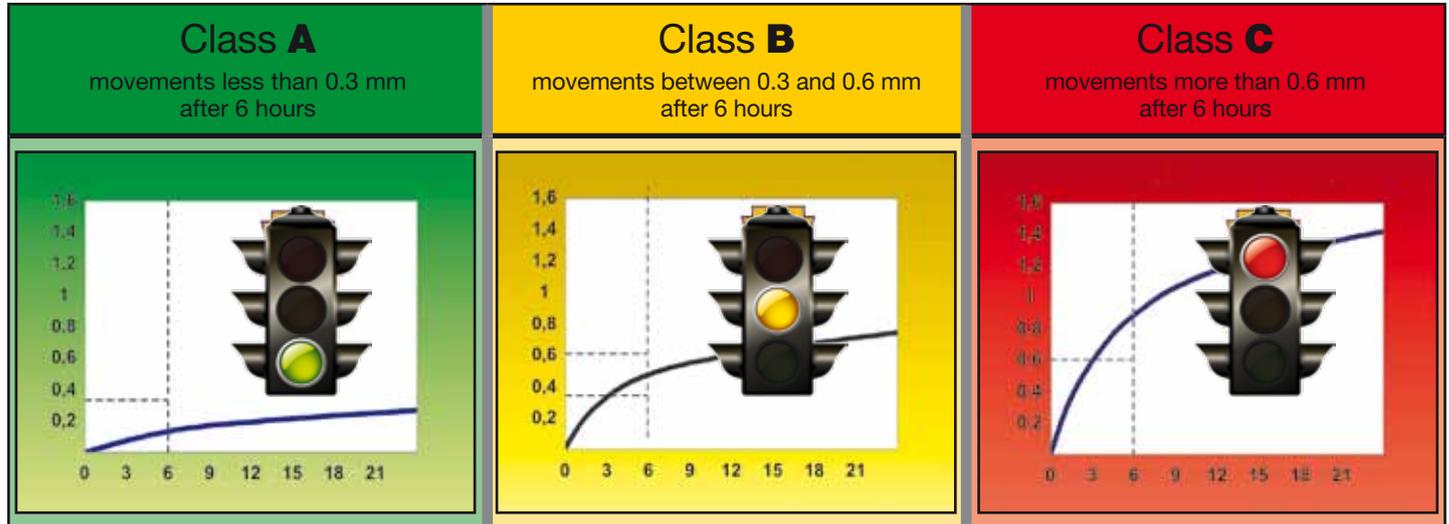


Fig. 2.4 - Spread of materials tested for dimensional stability in MAPEI's research laboratories (updated to 2010)

GENERAL OUTLINE OF THE MOVEMENTS OF MATERIALS DURING DIMENSIONAL STABILITY TESTING



EXAMPLES OF MATERIALS TESTED IN MAPEI'S RESEARCH LABORATORIES (MAPEI CLASSIFICATION):

Class A		Class B*		Class C**	
Granite:	Impala Blue Black Red Green Aosta Green	Granite:	Byzantine Green	Granite:	Grey-Green Peruvian Porphyry Predazzo Red Speranza Green Purple
Various:	Pietra Lara Piedra del sol Volvic Stone (France) Mexican Stone (pink) Brazilian Pink Quartzite Crystalline Alabaster Onyx	Various:	Sardinian Red Ignimbrite Brazilian Ardesia Carniglia Stone	Various:	Cantera Stone Matraia Stone Pietra Serena Ardesia Green Jade
Marble:	Carrara White Rose African Red Botticino Orbis Arabesque White Brazilian Classic White Venetian Yellow Motrico Grey Jacaranda Jura blaugelb gemischt Marquina Black Shiny Paradise Portuguese Rose Laguna Red Verona Red Valmalenco Serpentine Veined Statuario S. Pietro Travertin	Marble:	Amethyst Italian Green Aver Green Saint Denise Green Rio Branco	Marble:	Pearl White Alpine Green Veined Alpine Green Issoire Green Mergozzo Green Guatemala Green
Recomposed:	White Bianco Carrara (cement) Botticino (cement) Breccia Aurora (resin) Levanto Red (resin)	Recomposed:	Diorite (cement) Zandobbio White (cement) Amarelo (resin) Onyxed Breccia (resin)	Recomposed:	Carnico Grey (cement) Ruby Red (cement) Copper Red (resin) Portoro (resin)

Tab. 1 -The classifications in the table above correspond to Mapei's test results carried out on samples of materials and must be considered, therefore, as merely an indication and must not be considered as representative of all types of stone material from the same mineral group.

* Materials which are in class B and C after simulation of bonding with damp felt and come back to class A ($\delta < 0.3\text{ mm}$) after repetition of dimensional stability testing with rapid adhesives.

** Materials which are in class B and C after simulation of bonding with damp felt and remain in class B ($0.3 < \delta < 0.6\text{ mm}$) or C ($\delta > 0.6\text{ mm}$) after repetition of dimensional stability testing with rapid adhesives.

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

2.2 STAINING AND EFFLORESCENCE

Staining and /or the formation of efflorescence on the surface of stone may occur when there is water present and may be due to various factors:

- stone laid conventionally on a bed of mortar or with a normal-setting adhesive;
- material laid on a substrate which is not sufficiently isolated from rising damp from the ground;
- material laid on a substrate which is not completely dry with a high level of humidity while laying.

The formation of efflorescence may occur on all types of stone, although only certain types of stone are prone to staining, such as marble, quartz, granite and light-coloured recomposed stone (such as Carrara marble, Thassos, pink Quarzite, etc.).

The problem may be traced to the presence of substances in the stone itself which dissolve in alkali water rising from the substrate or laying bed (in the case of soluble salts) or which react with the water (mainly in the case of ferrous minerals).

In the first case, the soluble substances are transported towards the surface of the material by the water on the back face of the slabs and form widespread staining or efflorescence. In the case of reactive substances, the combined action of the water, oxygen and light cause them to oxidise and cause unsightly stains on the coating.

The use of quick-hardening cementitious adhesives, which reduce the period of time in which the stone is in contact with the water and stops it rising to the surface of the stone, or of reactive adhesives, may avoid such defects showing up.

Staining and efflorescence may show up, however, if the substrate has not been correctly prepared.



Fig. 2.5 - Example of stains caused by pyrite on white Carrara marble



Fig. 2.6 - Example of stains on a granite floor



Fig. 2.7 - Example of efflorescence caused by rising damp from the substrate



Fig. 3.1 - Mixing MAPECEM PRONTO screed



Fig. 3.2



Fig. 3.3 - Carrying out a MAPECEM PRONTO screed

3. PREPARATION OF THE SUBSTRATE

Substrates must be prepared according to specific requirements to make them suitable for laying stone coatings, which vary according to the final use of the floor. There are indications with reference to the final use of the floor in the UNI 11322 standard “Stone coatings for floors: guidelines for design, laying and maintenance”.

The most significant characteristics of the substrate which must be assessed before laying are as follows:

- **thickness:** the most suitable thickness depends on the type of substrate. For materials sensitive to water and, therefore, prone to staining and warping, the substrate must always be checked to make sure there is no rising damp. Make sure that screeds have a suitable vapour barrier or, with new screeds, form a layer at least 4 cm thick which is isolated from the substrate with polyethylene sheets to block rising damp.

- **mechanical strength and compactness:** mechanical strength requirements must be assessed according to service conditions and final use. A value of 20 MPa is generally considered sufficient for substrates for residential applications, which should be increased to around 30 MPa in commercial and industrial environments. For render on façades, check strength by tear tests with a dynamometer. The value must be at least 1 MPa.

- **curing:** before laying the material, make sure the substrate is well cured. The curing time for cementitious substrates is around 7-10 days per centimetre of thickness. During this period, screeds and render are subject to hygrometric shrinkage which may form cracks. If coatings are laid without respecting curing times, therefore, the cracks may be transferred to the coating with the risk of detachment.

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

Curing times may be reduced if required by using quick or rapid-drying pre-blended mortar or binders such as:

- **TOPCEM**, special hydraulic binder used to make normal-setting, quick-drying (4 days), controlled-shrinkage screeds.
- **TOPCEM PRONTO**, ready-to-use, pre-blended, normal-setting, quick-drying (4 days), controlled-shrinkage mortar, classified CT-C30-F6-A1fl according to EN 13813 standards and certified by GEV Institut as a product with very low emission levels of volatile organic compounds (EMICODE EC1R).
- **MAPECEM**, special quick-setting and drying (24 hours), controlled-shrinkage hydraulic binder for screeds.
- **MAPECEM PRONTO**, pre-blended, ready-to-use, quick-setting and drying (24 hours), controlled-shrinkage mortar, class CT-C60-F10-A1fl according to EN 13813.

- **drying**: especially when laying materials sensitive to water, or to avoid the risk of efflorescence forming on the surface, it is extremely important to check that the substrate is dry.

- **cleaning**: surfaces on which materials are to be laid must be sufficiently clean and free of dust, grease, oil, paint, loose portions and any other substance which could compromise the bond.

- **no cracks**: all cracks must be sealed before laying coatings with a suitable product, such as **EPORIP**, **EPOJET** or **EPORIP TURBO**. As an alternative, an anti-fracture layer may be applied on cracked substrates, such as **MAPETEX** (Progress 1).

- **flatness**: if the laying surface is particularly uneven, it may be levelled off using a suitable product such as:

FOR INTERNAL SURFACES

- **NIVORAPID**, ultra quick-drying, thixotropic cementitious smoothing and levelling compound for thicknesses from 3 to 20 mm on horizontal and vertical surfaces. Class CT-C40-F10-A2fl according to EN 13813 standards, certified by GEV Institut as a product with a very low



Fig. 3.4 - Using a straight-edge on the screed



Fig. 3.5 - Floating the screed's surface



Fig. 3.6 - Applying a primer as bonding promoter



Fig. 3.7 - Levelling a cementitious screed with ULTRAPLAN



Fig. 3.8 - Evening out a concrete wall with NIVOPLAN+PLANICRETE



Fig. 3.9 - Evening out a wall with PLANITOP FAST 330

emission level of volatile organic compounds (EMICODE EC1R). When mixed with **LATEX PLUS** instead of water, it forms a highly flexible smoothing and levelling compound with excellent bond strength even on metal surfaces and old floors in rubber, PVC, chipboard, parquet, linoleum, etc.

- **ULTRAPLAN/ULTRAPLAN MAXI**, self-levelling, ultra quick-drying smoothing and levelling compound for thicknesses from 1 to 10 mm and 3 to 30 mm respectively, classes CT-C30-F7-A2fl-s1 and CT-C35-F7-A2fl-s1 according to EN 13813 standards, certified by GEV Institut as products with a very low emission level of volatile organic compounds (EMICODE EC1).

FOR EXTERNAL APPLICATIONS

- **ADESILEX P4**, cementitious smoothing and levelling compound for thicknesses from 3 to 20 mm on internal and external surfaces, certified by GEV Institut as a product with a very low emission level of volatile organic compounds (EMICODE EC1R).

- **PLANITOP FAST 330**, fibre-reinforced, quick-setting cementitious mortar, applied at a thickness from 3 to 30 mm to even out internal and external horizontal and vertical substrates.

- **NIVOPLAN**, smoothing mortar for internal and external walls and ceilings applied at thicknesses from 2 to 30 mm. When mixed with 1 or 2 kg of **PLANICRETE** per sack, it improves its consistency when it is applied in thin layers.

For more detailed information on the preparation of a new screed, please consult the relevant technical notebook.

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

4. THE BEST LAYING SOLUTIONS ACCORDING TO MATERIAL CLASSIFICATION

4.1 CHOOSING THE ADHESIVE SYSTEM

4.1.1 CLASS A NATURAL AND RECOMPOSED CEMENT-BASED MATERIAL NOT SENSITIVE TO THE FORMATION OF STAINS AND EFFLORESCENCE

When laying this class of materials, the adhesive must be chosen according to the size of the slabs, the type of substrate and the service conditions of the coating.

We recommend the following products:

- **KERAFLEX** high-performance cementitious adhesive with no vertical slip and long open-time, for ceramic tiles and stone materials, class C2TE according to EN 12004. Especially suitable for laying on internal floors and walls and on external surfaces not subject to deformation or high stresses.
- **KERAFLEX MAXI S1** high performance, deformable cementitious adhesive with no vertical slip and extended open time with Low Dust technology for ceramic tiles and stone material, class C2TES1 according to EN 12004. Particularly suitable for uneven substrates and for slabs with slightly irregular back (Progress 2).
- **ADESILEX P4** high-performance, self-buttering, quick-setting cementitious adhesive for laying ceramic tiles and stone materials, on floors, class C2F according to EN 12004. This adhesive guarantees total buttering of the back of tiles and is quick setting, recommended for laying floors subject to intense traffic or polished after laying.
- **KERABOND + ISOLASTIC** high-flexibility adhesive system, particularly suitable for laying on external surfaces and façades, class C2 S2 according to EN 12004 (Progress 3).



Fig. 4.1 - Example of installation of stone material on floor with KERAFLEX MAXI S1 - Spa Rác & Hotel, Budapest - Hungary

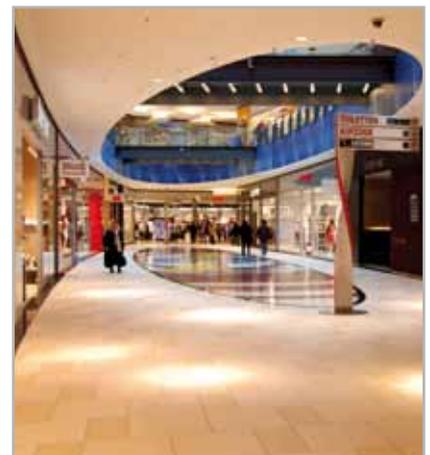


Fig. 4.2 - Example of installation of stone material with KERAFLEX MAXI S1 - "Loop 5" Shopping Centre - Weiterstadt - Germany



Fig. 4.3 - Example of installation of natural stone on façade - "La Llotja" Congress Centre, Lleida - Spain

4.1.2 CLASS A RECOMPOSED RESIN-BASED MATERIAL NOT SENSITIVE TO THE FORMATION OF STAINS (FOR INTERNAL APPLICATIONS)

For this type of stone material, which is only suitable for laying on internal surfaces, we recommend the use of the following adhesives:

- **KERAFLEX MAXI S1** high-performance, flexible cementitious adhesive with no vertical slip, long open-time and Low Dust technology, applied in thicknesses from 3 to 15 mm for ceramic and stone tiles, class C2TES1 according to EN 12004. The increased thickness of adhesive which may be applied makes it particularly suitable for laying on uneven surfaces or for laying tiles with an uneven back face.
- **ULTRALITE S1** mono-component, high-performance, flexible lightweight cementitious adhesive with no vertical slip, long open-time and Low Dust technology, extremely high yield, easy to apply by trowel, class C2TES1 according to EN 12004. This product guarantees better buttering of tiles than conventional adhesives, which makes it particularly suitable for use in environments subject to intense traffic or, in general, when a continuous bed of adhesive is required.

When choosing which laying system to use for these materials, the final use of the coating must always be taken into consideration. Some of these products are characterised by a high coefficient of thermal expansion which, under certain laying conditions such as surfaces exposed to direct sunlight, may generate high strains due to the coating's tendency to expand being impeded. In such cases, to avoid the sides of the tiles and slabs pressing against each other and lifting due to the effect of expansion, they must be laid with wide joints between them and low-pitch flexible expansion joints must be formed using a highly flexible adhesive, such as:

- **KERALASTIC** two-component, high-performance polyurethane adhesive for ceramic tiles and stone materials, class R2 according to EN 12004.

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

4.1.3 CLASS A NATURAL, RECOMPOSED CEMENT-BASED AND RECOMPOSED RESIN-BASED MATERIAL (FOR INTERNAL APPLICATIONS) SENSITIVE TO THE FORMATION OF STAINS AND EFFLORESCENCE

For these types of stone, we suggest the use of the following adhesives to avoid the formation of stains:

- **GRANIRAPID** two-component, high-performance, flexible, quick-setting and drying cementitious adhesive for ceramic tiles and stone, class C2FS1 according to EN 12004 (Progress 4).
- **KERAQUICK** high-performance, quick-setting cementitious adhesive with no vertical slip for ceramic tiles and stone, class C2FTS1 according to EN 12004 (Progress 5).
- **ELASTORAPID**, high performance, two-component cementitious adhesive, highly deformable, rapid setting and hydrating, with no vertical slip and extended open time, class C2FTES2 in compliance with EN 12004.
- **KERAQUICK + LATEX PLUS** quick-setting, high-flexibility adhesive system, class C2FTS2 according to EN 12004. The high flexibility of this adhesive system makes it particularly suitable for laying on external surfaces, on façades or on surfaces more subject to deformation.

The aforementioned adhesives are efficient in solving the problems mentioned above thanks to the quick hydration of the binder with which they are formed. This property limits the humidity content in the adhesive in just a few hours to a level which does not provoke the formation of unsightly stains on the slabs of stone laid. Also, the use of quick products reduces the risk of the formation of efflorescence.

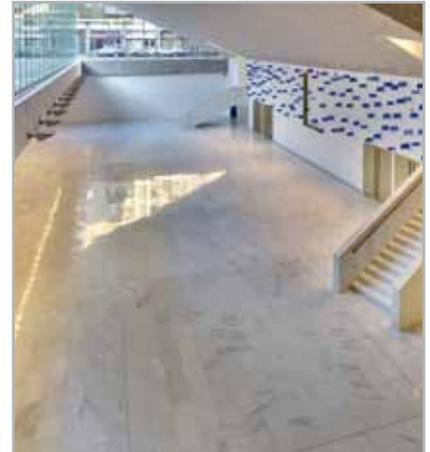


Fig. 4.4 - Example of installation of White Carrara marble with GRANIRAPID white – University Bocconi, Milan – Italy



Fig. 4.5 - Example of installation of granite with GRANIRAPID – Bloor Street, Toronto – Canada



Fig. 4.6 - Example of installation of natural stone with GRANIRAPID – Train station of Marseille – France



Fig. 4.7 - Example of installation of marble with ELASTORAPID – Marina Bay Sands Resort – Singapore



Fig. 4.8 - Example of installation marble flooring with KERAQUICK – Casinò Hall, Feuchtwangen – Germany



Fig. 4.9 - Example of installation of Verde Alpi marble flooring with KERALASTIC – Rolex Hall – Bienne – Switzerland

4.1.4 CLASS B* STONE MATERIALS

This class includes all the types of stone with deformation less than 0.3 mm following the bonding test with a quick-type adhesive (class C2F or C2FT).

Use one of the following adhesives to lay this category of materials:

- **GRANIRAPID** two-component, high-performance, quick-setting and drying cementitious adhesive for ceramic tiles and stone materials, class C2F according to EN 12004.

- **KERAQUICK** high-performance, quick-setting cementitious adhesive with no vertical slip for ceramic tiles and stone materials, class C2FT according to EN 12004 (Progress 9).

- **ELASTORAPID** two-component, high-performance, high-flexibility, quick-setting and drying cementitious adhesive with no vertical slip and long open time, class C2FTES2 according to EN 12004.

- **KERAQUICK + LATEX PLUS** quick-setting, high-flexibility adhesive system, class C2FTS2 according to EN 12004. The high flexibility of this adhesive system makes it particularly suitable for laying on external surfaces, on façades or on surfaces more subject to deformation.

4.1.5 CLASS C** STONE MATERIALS

This class includes all the types of stone with deformation higher than 0.3 mm even after the bonding test with a quick-type adhesive.

The extreme sensitivity of these products means they may only be laid with adhesives which contain absolutely no water:

- **KERALASTIC** two-component, high-performance polyurethane adhesive for ceramic tiles and stone materials, class R2 according to EN 12004 (Progress 6).

- **KERAPOXY** two-component, high-performance, acid-resistant epoxy adhesive with no vertical slip for ceramic tiles and stone materials, class R2T according to EN 12004.

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

4.2 CHOOSING THE RIGHT GROUT AND SEALANT FOR THE JOINTS

MAPEI has a wide array of grouting mortars and sealants for expansion joints which are suitable for application on natural stone coatings.

4.2.1 PRODUCTS FOR GROUTING JOINTS

- **KERACOLOR** improved, polymer-modified cementitious grout, available in a choice of versions: **SF** in white, for joints up to 4 mm wide; **FF** in 18 different colours, water-repellent with DropEffect® for joints from 4 to 15 mm wide. In the case of stone floors to be polished after laying, **KERACOLOR** may be mixed with **FUGOLASTIC** (polymer latex for **KERACOLOR SF, FF** and **GG** to reduce the absorption of water and to improve the bond of the grout). **KERACOLOR** and **KERACOLOR + FUGOLASTIC** are class **CG2** according to EN 13888 and are certified by **GEV** as products with a very low emission level of volatile organic compounds (**EMICODE EC1R**).

- **ULTRACOLOR PLUS** high-performance, anti-efflorescence, quick setting and drying polymer-modified mortar for joints from 2 to 20 mm wide. It is water-repellent (DropEffect® technology), has anti-mould properties (BioBlock® technology) and is available in 26 different colours. **ULTRACOLOR PLUS** is class **CG2** according to **EN 13888** and is certified by **GEV** as a product with a very low emission level of volatile organic compounds (**EMICODE EC1**).

4.2.2 PRODUCTS FOR SEALING EXPANSION JOINTS

Special care must be taken when choosing the product to seal joints in stone material, because certain sealants, and in particular the acetic-reticulation type, may stain the stone (Fig. 4.10 and 4.11).

In the MAPEI product range, the most suitable sealants for this application are:

- **MAPESIL LM** mono-component, solvent-free, odourless, neutral-reticulation silicone sealant for stone and ceramic, with movements in service of up to 25%, available in 7 different colours. Suitable for applications on internal and external walls and floors.

- **MAPEFLEX PU20** and **MAPEFLEX PU21** two-component, self-levelling polyurethane sealant for floor joints with movements up to 10% and 5% respectively when in service. Available in grey.



Fig. 4.10 - Example of staining on natural stone installed with acetic cross-linking silicone sealant



Fig. 4.11 - Example of staining on natural stone installed with acetic cross-linking silicone sealant



Fig. 4.12 - Sealing joint on façade with MAPESIL LM



Fig. 5.1 - Laying recomposed decorative elements with FIX & GROUT BRICK



Fig. 5.2 - An example of an application using FIX & GROUT BRICK for both bonding and grouting

5. SPECIAL LAYING CASES

5.1 LAYING DECORATIVE ELEMENTS IN CEMENT-BASED RECOMPOSED MATERIAL

MAPEI also has a solution for laying this type of material:

- **FIX & GROUT BRICK** (Fig. 5.1 and 5.2) ready-to-use, synthetic resin adhesive in water dispersion with selected fillers and additives, class D2T according to EN 12004. The special characteristics of this adhesive makes it suitable for bonding decorative elements in lightweight cementitious conglomerate and synthetic resin. Excess adhesive which seeps out from joints may also be smoothed over with a damp brush to act as a grout for the joints.

5.2. LAYING PORPHYRY AND ROUGH-CUT STONE

The solutions proposed previously are for laying natural stone cut to regular shapes with an almost constant thickness. There are also cases in which rough-cut stone with different and variable thicknesses is to be laid. In these cases, conventional laying methods can not be applied so other laying systems must be applied. When choosing a suitable laying system for this type of material, it is important that the congruency of the criteria for strength and deformability of the laying bed and grout must be respected, as defined in UNI 11322 "Stone coatings for floors: guidelines for design, laying and maintenance".

MAPEI also has solutions available for this type of material.

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

5.2.1 DRAINING PRODUCTS FOR LAYING AND GROUTING PORPHYRY AND ROUGH-CUT STONE

Rough-cut stone is typically laid outside, and especially to create footpaths, driveways, courtyards and public squares and car-parks.

In such environments, this type of paving needs to maintain its drainage properties. For this type of application, MAPEI has created a range of products called **MAPEDRAIN**.

The range comprises the following:

- **MAPEDRAIN MORTAR** (Fig. 5.3) pre-blended drainage mortar for laying beds for porphyry subject to low and medium stress.
- **MAPEDRAIN 1K GROUT** (Fig. 5.4) mono-component, ready-to-use polybutadiene drainage mortar for grouting paved surfaces subject to low intensity stress and lightweight traffic, such as courtyards, footpaths, etc.
- **MAPEDRAIN 3K GROUT** (Fig. 5.5) three-component epoxy drainage mortar for grouting paved surfaces subject to medium intensity stress and traffic, such as paths and drives where lightweight vehicles occasionally pass.
- **MAPEDRAIN BINDER** (Fig. 5.6) mono-component, solvent-free polyurethane binder used for preparing drainage mortar and grout for paved surfaces. When this product is mixed with quartz sand or even-grained grit, it may be used to form mortar for both drainage laying beds at least 2 cm thick and grout for drainage joints (minimum width 10 mm) for external floors subject to pedestrian traffic (terraces, pathways, courtyards and pedestrian areas).

The combined use of these products enables drainage laying beds to be created which do not deteriorate due to freeze-thaw cycles and drainage joints resistant to high-pressure hydro-cleaning cycles and de-icing salts, which are not subject to the formation of surface mould and weeds and which resist to leaching.



Fig. 5.3 - Installation of porphyry cubes with MAPEDRAIN MORTAR



Fig. 5.4 - Application of MAPEDRAIN 1K GROUT



Fig. 5.5 - Application of MAPEDRAIN 3K GROUT



Fig. 5.6 - Mixing of drainage mortar and grout for paved floors with MAPEDRAIN MORTAR



Fig. 5.7 - Application of KERACOLOR PPN



Fig. 5.8 - Example of installation and grouting of porphyry paved floor with MAPEDRAIN MORTAR and MAPEDRAIN 1K GROUT

5.2.2 PRODUCTS WITH VERY LOW WATER ABSORPTION FOR GROUTING PORPHYRY AND ROUGH-CUT STONE

In those cases where it is more important to guarantee quick turn-around times, good resistance of the grouted joints to water absorption and higher mechanical strength rather than an efficient drainage surface, the following product may be used:

- **KERACOLOR PPN** (Fig. 5.7) quick setting pozzolanic mortar with very low water absorption and high mechanical strength, for grouting paved surfaces subject to medium to heavy stress.

The use of this grout allows paved surfaces to be created with good resistance to wear and to cleaning cycles using road-cleaning equipment and high-pressure hydro-cleaning equipment. Its extremely low water absorption capacity also gives the joints better resistance to de-icing salts, the formation of surface efflorescence and leaching.

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

Laying on an anti-fracture membrane

Travertino



ULTRACOLOR PLUS

- Fast setting and drying, high performance, anti-efflorescence grout, polymer modified, for joints from 2 to 20 mm. Water repellent with **DropEffect®** and anti-mold with **BioBlock®** technology, class **CG2** (EN 13888) and **EC1**



KERAQUICK white + LATEX PLUS

- Two component, high-performance, highly-deformable, quick-setting adhesive system with no vertical slip, class **C2FT S2** (EN 12004)



MAPETEX

- Non-woven fabric used to form an anti-fracture and isolating layer when laying on old, damaged floors without having to observe the existing distribution joints



KERAQUICK grey + LATEX PLUS

- Two-component, high-performance, highly-deformable, quick-setting adhesive system with no vertical slip, class **C2FT S2** (EN 12004)



Old screed

Old flooring in ceramic material with micro cracks



Progress 1

Laying interlocking stone on concrete

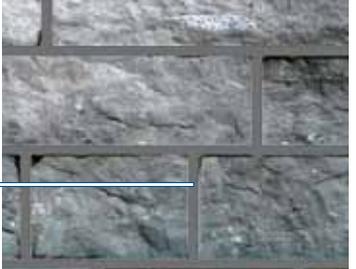
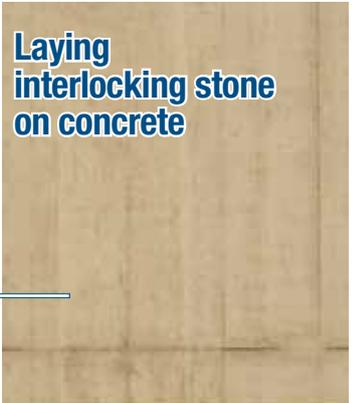
Concrete

Interlocking stone



KERAFLEX MAXI S1

- High performance, cementitious adhesive, with no vertical slip and with extended open time, with **Low Dust** technology, flexible, for ceramic tiles, particularly suitable for laying large format porcelain tiles and natural stones, of class **C2TE S1** (EN 12004)



KERACOLOR GG

- High-performance, polymer-modified cementitious mortar for grouting joints from 4 to 15 mm, class **CG2** (EN 13888) and **EC1R**

Progress 2

Laying on façades

Verona Rosso

MAPESIL LM

- Solvent-free, odourless neutral cross-linking silicone sealant for natural stone and ceramic tiles on façades.



KERACOLOR GG

- High-performance, polymer-modified cementitious mortar for grouting joints from 4 to 15 mm, class **CG2** (EN 13888) and **EC1R**



KERABOND + ISOLASTIC

- High performance, highly deformable cementitious adhesive, class **C2E S2**

NIVOPLAN (+ PLANICRETE)

- Levelling mortar for walls and ceilings



Progress 3

Carrara marble

Laying on heated screeds



KERACOLOR FF

- High performance, polymer-modified, water-repellent cementitious mortar with **DropEffect**® technology for grouting joints of up to 6 mm, class **CG2** (EN 13888) and **EC1R** (with very low emission of volatile organic compounds)



GRANIRAPID white

- Two-component, deformable, high-performance, quick-setting and quick-drying cementitious adhesive, class **C2F S1** (EN 12004), and **EC1**



TOPCEM PRONTO

- Pre-blended, ready-to-use, normal-setting and quick-drying (4 days), controlled-shrinkage mortar for screeds, class **CT-C30-F6-A1f** (EN 13813) and **EC1R**



System with heated elements

Progress 4

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

Granite



ULTRACOLOR PLUS

- Fast setting and drying, high performance, anti-efflorescence grout, polymer modified, for joints from 2 to 20 mm. Water repellent with **DropEffect®** and anti-mold with **BioBlock®** technology, class **CG2** (EN 13888) and **EC1**

"Eco" System



KERAQUICK

- High performance, deformable, rapid setting cementitious adhesive with no vertical slip, class **C2FTS1** (EN 12004) and **EC1**



ULTRAPLAN

- Ultra-fast hardening self-levelling smoothing compound, class **C30-F7-A2fl-s1**, **EC1**



PRIMER G

- Synthetic-resin-based water-dispersion primer with very low volatile organic compound (**EC1**)



TOPCEM PRONTO

- Pre-blended, ready-to-use, normal-setting and quick-drying (4 days), controlled-shrinkage mortar for screeds, class **CT-C30-F6-A1fl** (EN 13813) and **EC1R**



Verde Alpi marble

Laying dimensionally-unstable stone material



KERACOLOR FF

- High-performance, polymer-modified, water-repellent cementitious mortar with **DropEffect®** technology for grouting joints of up to 6 mm, class **CG2** (EN 13888) and **EC1R** (with very low emission of volatile organic compounds)



KERALASTIC

- Two-component, high-performance, epoxy-polyurethane adhesive, class **R2** (EN 12004)



MAPECEM PRONTO

- Pre-blended, ready-to-use, quick-setting and quick-drying (24 hours), controlled-shrinkage mortar for screeds, class **CT-C60-F10-A1fl** (EN 13813)



Marble mosaic

Waterproofing and laying in bathrooms and shower cubicles



KERACOLOR GG

- High-performance, polymer-modified cementitious mortar for grouting joints from 4 to 15 mm, class **CG2** (EN 13888) and **EC1R** (with very low emission of volatile organic compounds)



ELASTORAPID white

- Two-component, high-performance, highly-deformable, quick-setting, quick-drying cementitious adhesive with no vertical slip and extended open time, class **C2FTE S2** (EN 12004)



MAPEGUM WPS

- Quick-drying, flexible liquid membrane for indoor waterproofing applications



NIVOPLAN + PLANICRETE

- Levelling mortar for walls and ceilings



Progress 7

Granite



ULTRACOLOR PLUS

- Fast setting and drying, high performance, polymer modified, anti-efflorescence, water repellent grout for joints from 2 to 20 mm. With **DropEffect**® and anti-mould with **BioBlock**® technology, belonging to class **CG2** (EN 13888) and **EC1** (with very low emission of volatile organic compounds)



MAPEFLEX PU50 SL

- One component, fluid, polyurethane sealant with a low modulus of elasticity, for flooring joints subject to movements of up to 25%.

MAPEFOAM

- Closed-cell, extruded polythene strip used as a support for elastomeric sealants for the correct sizing of flexible joints



ELASTORAPID grey

- Two-component, high-performance, highly-deformable, quick-setting, quick-drying cementitious adhesive with no vertical slip and extended open time, class **C2FTE S2** (EN 12004)

MAPEBAND

- Two-component, flexible cementitious mortar for waterproofing concrete, balconies, terraces, bathrooms and kitchens



MAPELASTIC

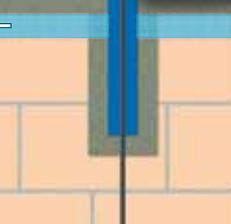
- Two-component, flexible cementitious mortar for waterproofing concrete, balconies, terraces, bathrooms and kitchens

MAPENET 150

- Alkali-resistant glass fibre mesh in compliance with ETAG 004 guides for reinforcing waterproof protections, anti-fracture membranes and insulation coatings.

Old flooring in ceramic material with micro cracks

Waterproofing and laying on balconies and terraces



Progress 8

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

Laying over existing cementitious ceramic flooring

Marble mosaic



MAPEFLEX PU20

- Two-component self-levelling, polyurethane sealant for floor joints with maximum 10% expansion of the initial size.



ULTRACOLOR PLUS

- Fast setting and drying, high performance, anti-efflorescence grout, polymer modified, for joints from 2 to 20 mm. Water repellent with **DropEffect**® and anti-mold with **BioBlock**® technology, class **CG2** (EN 13888)® and **EC1**



KERAQUICK grey + LATEX PLUS

- Two-component, high-performance, highly-deformable, quick-setting adhesive system with no vertical slip, class **C2FT S2** (EN 12004) and **EC1**



Existing ceramic flooring

Granite



ULTRACOLOR PLUS

- Fast setting and drying, high performance, polymer modified, anti-efflorescence, water repellent grout for joints from 2 to 20 mm. With **DropEffect**® and anti-mould with **BioBlock**® technology, belonging to class **CG2** (EN 13888) and **EC1**



ULTRALITE S1

- Single component, lightweight, flexible high performance cementitious adhesive with **Low Dust** technology; easy to apply by trowel, no vertical slip, extended open time and extremely high yield, for ceramic tiles and stone material, belonging to class **C2TE S1** (EN 12004)



Contiene più del 30% di materiale riciclato
Contains > 30% recycled content

Water-repellent gypsum board



6. SPECIFICATIONS



6.1 LAYING STONE MATERIALS FOR INTERNAL APPLICATIONS



6.1.1 LAYING DIMENSIONALLY-STABLE STONE OR RECOMPOSED MATERIAL (MAPEI CLASS A) NOT SENSITIVE TO STAINING

On cementitious screeds without heated elements, cementitious render and well-fixed plasterboard without a gypsum smoothing layer.

- With high-performance cementitious adhesive with no vertical slip and long open-time, class C2TE according to UNI EN 12004 standards (such as KERAFLEX made by Mapei S.p.A.), laid with open joints. The joints must be grouted with improved cementitious grout, class CG2 according to UNI EN 13888 standards (such as ULTRACOLOR PLUS made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as MAPESIL LM of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Density (kg/m³): 1,500

pH: 13

Pot life of mix: > 8 h

Open time: > 30' (EN 1346)

Adjustment time: approx: ca. 60'

Set to foot traffic: 24 h

Waiting time before putting into service: 14 days

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

Pot life of mix: 20' - 25'

Set to foot traffic: 3 h

Waiting time before putting into service: 24 h

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

- (quick laying) with high performance, rapid, deformable cementitious adhesive, with no vertical slip, class C2FTS1 according to UNI EN 12004 standards (such as KERAQUICK made by Mapei S.p.A.), laid with open joints. The joints must be grouted with high-performance, anti-efflorescence, quick-setting and drying, water-repellent anti-mould grout, class CG2 according to UNI EN 13888 standards (such as ULTRACOLOR PLUS made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as MAPESIL LM of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Density (kg/m³): 1,500

pH: 11

Pot life of mix: 30 mins.

Open time: 15 - 20 mins.

Set to foot traffic: 2 - 3 hours

Waiting time before putting into service: 24 hours (3 days for basins and swimming pools)

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

The price includes all costs for the preparation of the substrate, supply and application of the adhesive, the formation of flexible separation joints to be sealed with a suitable flexible sealant, pre-drilled brass profiles where required to separate different floor surfaces, sealing of cavities using pre-blended grouting mortar in the colour indicated by the Works Director, cleaning of the surface with suitable detergents, rinsing of the surface and removal of excess water using suitable equipment, trimming, cleaning and disposal of waste material after completion of the work, separation and disposal of waste materials, transport to authorised waste-disposal sites, waste-disposal taxes and costs and all other activities to consign the work ready and perfectly fit for use.

On heated cementitious screeds, waterproofing membranes (such as MAPELASTIC or MAPEGUM WPS) or on old ceramic or stone floors and coatings.

- With high-performance, deformable cementitious adhesive

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

with no vertical slip and long open-time, class C2TES1 according to UNI EN 12004 standards (such as KERAFLEX MAXI S1 made by Mapei S.p.A.), laid with open joints. The joints must be grouted with improved cementitious grout, class CG2 according to UNI EN 13888 standards (such as ULTRACOLOR PLUS made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as MAPESIL LM of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Density (kg/m³): 1,500

pH: > 12

Pot life of mix: more than 8 hours

Open time: > 30 mins.

Set to foot traffic: 24 hours

Waiting time before putting into service: 14 days

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

- (quick laying) with high performance, rapid, deformable cementitious

adhesive, class C2FS1 according to UNI EN 12004 standards (such as GRANIRAPID made by Mapei S.p.A.), laid with open joints. The joints must be grouted with high-performance, anti-efflorescence, quick-setting and drying, water-repellent anti-mould grout, class CG2 according to UNI EN 13888 standards (such as ULTRACOLOR PLUS made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as MAPESIL LM of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Density (kg/m³): 1,600

pH: 11

Pot life of mix: 45 mins.

Open time: approx. 20 minutes (according to EN 1346)

Set to foot traffic: 3 - 4 hours

Waiting time before putting into service: 24 hours (3 days for basins and swimming pools)

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

The price includes all costs for the preparation of the substrate, cleaning of the base support with caustic products if laid on an old floor, supply and application of the adhesive, the formation of flexible separation joints following the pattern of those on the old floor to be sealed with a suitable flexible sealant, pre-drilled brass profiles where required to separate different floor surfaces, sealing of cavities using pre-blended grouting mortar in the colour indicated by the Works Director, cleaning of the surface with suitable detergents, rinsing of the surface and removal of excess water using suitable equipment, trimming, cleaning and disposal of waste material after completion of the work, separation and disposal of waste materials, transport to authorised waste-disposal sites, waste-disposal taxes and costs and all other activities to consign the work ready and perfectly fit for use.

Laying stone material on anhydrite screeds, gypsum render, well-fixed plasterboard with a gypsum smoothing layer or cellular concrete.

- **With high-performance cementitious adhesive with no vertical slip and long open-time, class C2TE according to UNI EN 12004 standards (such as KERAFLEX made by Mapei S.p.A.),** laid with open joints. The joints must be grouted with improved cementitious grout, class CG2 according to UNI EN 13888 standards (such as **ULTRACOLOR PLUS** made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 116000 norm ((such as **MAPESIL LM** of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Density (kg/m³): 1,500

pH: 13

Pot life of mix: > 8 hours

Open time: > 30 mins. (EN 1346)

Adjustment time: approx. 60 mins.

Set to foot traffic: 24 hours

Waiting time before putting into service: 14 days

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

- **With high-performance, rapid cementitious adhesive, class C2F according to UNI EN 12004 standards (such as ADESILEX P4 made by Mapei S.p.A.), laid with open joints. The joints must be grouted with improved cementitious grout, class CG2 according to UNI EN 13888 standards (such as ULTRACOLOR PLUS made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as MAPESIL LM of Mapei S.p.A.).**

The product used for laying must have the following characteristics:

Density (kg/m³): 1,700

pH: 12

Pot life of mix: 60 mins.

Open time: approx. 15 minutes (according to EN 1346)

Set to foot traffic: 4 hours

Waiting time before putting into service: 24 hours

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

The price includes all costs for the preparation of the substrate by applying a suitable synthetic resin-based primer in water dispersion to promote bonding with a very low content of volatile organic compounds (VOC) (such as **PRIMER G** made by Mapei S.p.A.), supply and application of the adhesive, the formation of flexible separation joints to be sealed with a suitable flexible sealant, sealing of tile joints using pre-blended grouting mortar in the colour indicated by the Works Director, cleaning of the surface with suitable detergents, rinsing of the surface and removal of excess water using suitable equipment, trimming, cleaning and disposal of waste material after completion of the work, separation and disposal of waste materials, transport to authorised waste-disposal sites, waste-disposal taxes and costs and all other activities to consign the work ready and perfectly fit for use.



6.1.2 LAYING STONE OR RECOMPOSED MATERIAL MODERATELY STABLE (MAPEI CLASS B) OR STABLE (MAPEI CLASS A IN THE PRESENCE OF WATER AND SENSITIVE TO STAINING

On cementitious screeds without heating elements, cementitious render and gypsum-board without gypsum smoothing layer

- With high performance, rapid, deformable cementitious adhesive, class C2FS1 according to UNI EN 12004 standards (such as GRANIRAPID made by Mapei S.p.A.), laid with open joints. The joints must be grouted with high-performance, anti-efflorescence, quick-setting and drying, water-repellent anti-mould grout, class CG2 according to UNI EN 13888 standards (such as ULTRACOLOR PLUS made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as MAPESIL LM of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Density (kg/m³): 1,600

pH: 11

Pot life of mix: 45 mins.

Open time: approx. 20 minutes (according to EN 1346)

Set to foot traffic: 3 - 4 hours

Waiting time before putting into service: 24 hours (3 days for basins and swimming pools)

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

The price includes all costs for the preparation of the substrate, supply and application of the adhesive, the formation of flexible separation joints to be sealed with a suitable flexible sealant, pre-drilled brass profiles where required to separate different floor surfaces, sealing of cavities using pre-blended grouting mortar in the colour indicated by the Works Director, cleaning of the surface with suitable detergents, rinsing of the surface and removal of excess water using suitable equipment, trimming, cleaning and disposal of waste material after completion of the work, separation and disposal of waste materials, transport to authorised waste-disposal sites, waste-disposal taxes and costs and all other activities to consign the work ready and perfectly fit for use.

On heated cementitious screeds, waterproofing membranes (such as MAPELASTIC or MAPEGUM WPS) or on old ceramic or stone floors.

- **With high performance, slip-resistant highly deformable rapid cementitious adhesive with extended open time, class C2FTES2 according to UNI EN 12004 standards (such as ELASTORAPID made by Mapei S.p.A.),** laid with open joints. The joints must be grouted with high-performance, anti-efflorescence, quick-setting and drying, water-repellent anti-mould grout, class CG2 according

to UNI EN 13888 standards (such as **ULTRACOLOR PLUS** made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as **MAPESIL LM** of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Density (kg/m³): 1,650

pH: 11

Pot life of mix: 60 - 75 mins.

Open time approx. 30 minutes (according to EN 1346)

Set to foot traffic: 3 - 4 hours

Waiting time before putting into service: 24 hours (3 days for basins and swimming pools)

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

The price includes all costs for the substrate, cleaning of the base support with caustic products if laid on an old floor, supply and application of the adhesive, the formation of flexible separation joints following the pattern of those on the old floor to be sealed with a suitable flexible sealant, pre-drilled

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

brass profiles where required to separate different floor surfaces, sealing of cavities using pre-blended grouting mortar in the colour indicated by the Works Director, cleaning of the surface with suitable detergents, rinsing of the surface and removal of excess water using suitable equipment, trimming, cleaning and disposal of waste material after completion of the work, separation and disposal of waste materials, transport to authorised waste-disposal sites, waste-disposal taxes and costs and all other activities to consign the work ready and perfectly fit for use.

On anhydrite screeds, gypsum render, well-fixed plasterboard with a gypsum smoothing layer or cellular concrete.

- **With high performance, rapid, deformable cementitious adhesive, with no vertical slip, class C2FTS1 according to UNI EN 12004 standards (such as KERAQUICK made by Mapei S.p.A.),** laid with open joints. The joints must be grouted with high-performance, anti-efflorescence, quick-setting and drying, water-repellent anti-mould grout, class CG2 according to UNI EN 13888 standards (such as **ULTRACOLOR PLUS** made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as **MAPESIL LM** of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Density (kg/m³): 1,500

pH: 11

Pot life of mix: 30 mins.

Open time: 15 - 20 mins.

Set to foot traffic: 2 - 3 hours

Waiting time before putting into service: 24 hours (3 days for basins and swimming pools)

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

The price includes all costs for the preparation of the substrate by applying a suitable synthetic resin-based primer in water dispersion to promote bonding with a very low content of volatile organic compounds (VOC) (such as **PRIMER G** made by Mapei S.p.A.), supply and application of the adhesive, the formation of flexible separation joints to be sealed with a suitable flexible sealant, sealing of tile joints using pre-blended grouting mortar in the colour indicated by the Works Director, cleaning of the surface with suitable detergents, rinsing of the surface and removal of excess water using suitable equipment, trimming, cleaning and disposal of waste material after completion of the work, separation and disposal of waste materials, transport to authorised waste-disposal sites, waste-disposal taxes and costs and all other activities to consign the work ready and perfectly fit for use.

6.1.3 LAYING STONE OR RECOMPOSED MATERIAL UNSTABLE IN THE PRESENCE OF WATER (MAPEI CLASS C)

On any type of substrate.

- With two-component, high-performance polyurethane adhesive,

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

class R2 according to UNI EN 12004 standards (such as **KERALASTIC made by Mapei S.p.A.**), laid with open joints. The joints must be grouted with high-performance, anti-efflorescence, quick-setting and drying, water-repellent anti-mould grout, class CG2 according to UNI EN 13888 standards (such as **ULTRACOLOR PLUS** made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as **MAPESIL LM** of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Mixing ratio by weight: Component A: Component B = 94 : 6

Density (kg/m³): 1,450

Pot life of mix: 30 – 40 mins.

Open time: 50 mins.

Set to foot traffic: 12 hours

Waiting time before putting into service: 7 days

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

The price includes all costs for the substrate, supply and application of the adhesive, the formation of flexible separation joints following the pattern of those on the old floor, to be sealed with a suitable flexible sealant, pre-drilled brass profiles where required to separate different floor surfaces, sealing of cavities using pre-blended grouting mortar in the colour indicated by the Works Director, cleaning of the surface with suitable detergents, rinsing of the surface and removal of excess water using suitable equipment, trimming, cleaning and disposal of waste material after completion of the work, separation and disposal of waste materials, transport to authorised waste-disposal sites, waste-disposal taxes and costs and all other activities to consign the work ready and perfectly fit for use.



6.2 LAYING STONE MATERIALS FOR EXTERNAL APPLICATIONS

6.2.1 LAYING DIMENSIONALLY-STABLE STONE OR RECOMPOSED CEMENT-BASED MATERIAL (MAPEI CLASS A) NOT SENSITIVE TO STAINING

On external cementitious screeds or waterproofing systems (such as MAPELASTIC or MAPELASTIC SMART).

- With high-performance, highly-flexible cementitious adhesive, class C2S2 according to UNI EN 12004 standards (such as **KERABOND+ISOLASTIC** made by Mapei S.p.A.), laid with open joints. The joints must be grouted with high-performance, anti-efflorescence, quick-setting and drying, water-repellent anti-mould grout, class CG2 according to UNI EN 13888 standards (such as **ULTRACOLOR PLUS** made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as **MAPESIL LM** of Mapei S.p.A.).

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

The product used for laying must have the following characteristics:

Density (kg/m³): 1,500

pH: >12

Pot life of mix: 8 hours

Open time: 20 – 30 mins. (EN 1346)

Adjustment time: approx. 45 mins.

Set to foot traffic: 24 hours

Waiting time before putting into service: 14 days

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

- **With a quick-type, high-performance, flexible cementitious adhesive resistant to slip, class C2FTS2 according to UNI EN 12004 standards (such as KERAQUICK+LATEX PLUS made by Mapei S.p.A.), laid with open joints. The joints must be grouted with high-performance, anti-efflorescence, quick-setting and drying, water-repellent anti-mould grout, class CG2 according to UNI EN 13888 standards (such as ULTRACOLOR PLUS made by Mapei**

S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as **MAPESIL LM** of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Density (kg/m³): 1,550

pH: 11

Pot life of mix: 30 mins.

Open time: 10 – 15 mins.

Set to foot traffic: 2-3 hours

Waiting time before putting into service: 24 hours (3 days for basins and swimming pools)

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

The price includes all costs for the preparation of the substrate, supply and application of the adhesive, the formation of flexible separation joints at a pitch of 4.0 x 4.0 m, and never larger than 20.0 m², to be sealed with a suitable flexible sealant, sealing of tile joints using pre-blended grouting mortar in the colour indicated by the Works Director, cleaning of the surface

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

with suitable detergents, rinsing of the surface and removal of excess water using suitable equipment, trimming, cleaning and disposal of waste material after completion of the work, separation and disposal of waste materials, transport to authorised waste-disposal sites, waste-disposal taxes and costs and all other activities to consign the work ready and perfectly fit for use.

6.2.2 LAYING STONE OR RECOMPOSED CEMENT-BASED MATERIAL MODERATELY STABLE (MAPEI CLASS B) OR STABLE (MAPEI CLASS A) IN THE PRESENCE OF WATER AND SENSITIVE TO STAINING

On cementitious screeds or waterproofing systems (such as MAPELASTIC or MAPELASTIC SMART).

- (quick laying) with quick-type, high-performance, flexible cementitious adhesive resistant to slip, class C2FTS2 according to UNI EN 12004 standards (such as KERAQUICK+LATEX PLUS made by Mapei S.p.A.) laid with open joints. The joints must be grouted with high-performance, anti-efflorescence, quick-setting and drying, water-repellent anti-mould grout, class CG2 according to UNI EN 13888 standards (such as ULTRACOLOR PLUS made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as MAPESIL LM of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Density (kg/m³): 1,550

pH: 11

Pot life of mix: 30 mins.

Open time: 10 – 15 mins.

Set to foot traffic: 2 - 3 hours

Waiting time before putting into service: 24 hours (3 days for basins and swimming pools)

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: ± 25%

Shore-A-Hardness: 20

The price includes all costs for the preparation of the substrate, supply and application of the adhesive, the formation of flexible separation joints at a pitch of 4 x 4 m, and never larger than 20.0 m², to be sealed with a suitable flexible sealant, sealing of tile joints using pre-blended grouting mortar in the colour indicated by the Works Director, cleaning of the surface with suitable detergents, rinsing of the surface and removal of excess water using suitable equipment, trimming, cleaning and disposal of waste material after completion of the work, separation and disposal of waste materials, transport to authorised waste-disposal sites, waste-disposal taxes and costs and all other activities to consign the work ready and perfectly fit for use.

LAYING STONE MATERIALS

Materials and systems to lay natural
and recomposed stone correctly



6.2.3 LAYING STONE OR RECOMPOSED MATERIAL UNSTABLE IN THE PRESENCE OF WATER (MAPEI CLASS C)

Laying on any type of substrate.

- With two-component, high-performance polyurethane adhesive, class R2 according to UNI EN 12004 standards (such as **KERALASTIC** made by Mapei S.p.A.), laid with open joints. The joints must be grouted with high-performance, anti-efflorescence, quick-setting and drying, water-repellent anti-mould grout, class CG2 according to UNI EN 13888 standards (such as **ULTRACOLOR PLUS** made by Mapei S.p.A.). The sealing of fracture joints must be carried out with a neutral cross-linking silicone sealant, class F-25LM in compliance with ISO 11600 norm (such as **MAPESIL LM** of Mapei S.p.A.).

The product used for laying must have the following characteristics:

Mixing ratio in weight: Component A: Component B = 94 : 6

Density (kg/m³): 1,450

Pot life of mix: 30 – 40 mins.

Open time. 50 mins.

Set to foot traffic: 12 hours

Waiting time before putting into service: 7 days

The product used for grouting must have the following characteristics:

Density (kg/m³): 1,980

pH: 11

Pot life of mix: 20 – 25 mins.

Set to foot traffic: 3 hours

Waiting time before putting into service: 24 hours

Flexural strength (N/mm²): 9 (after 28 days)

Compressive strength (N/mm²): 40 (after 28 days)

Resistance to abrasion (mm³): 700 (according to EN 12808-2)

The product used for sealing joints must have the following characteristics:

Elongation at break: 600%

Movements under working conditions: $\pm 25\%$

Shore-A-Hardness: 20

The price includes all costs for the substrate, supply and application of the adhesive, the formation of flexible separation joints following the pattern of those on the old floor to be sealed with a suitable flexible sealant, pre-drilled brass profiles where required to separate different floor surfaces, sealing of cavities using pre-blended grouting mortar in the colour indicated by the Works Director, cleaning of the surface with suitable detergents, rinsing of the surface and removal of excess water using suitable equipment, trimming, cleaning and disposal of waste material after completion of the work, separation and disposal of waste materials, transport to authorised waste-disposal sites, waste-disposal taxes and costs and all other activities to consign the work ready and perfectly fit for use.

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly



BOCCONI UNIVERSITY, MILAN – ITALY

Installation of white Carrara marble with TOPCEM PRONTO, MAPELASTIC, ELASTORAPID and GRANIRAPID



SHEIKH ZAYED BIN SULTAN AL NAHYAN GRAND MOSQUE, ABU DHABI - UAE

Installation of marble slabs in interiors and marble mosaics on the main dome with ADESILEX P10, KERABOND T, ISOLASTIC, KERACOLOR FF, FUGOLASTIC, KERAPOXY, MAPESIL LM



**CENTRAL TRAIN STATION,
FRANKFURT AM MAIN -
GERMANY**

Installation of natural stone on platform with EPORIP, MAPECEM, MAPESTONE 1, KERALASTIC, ULTRACOLOR PLUS



**HOTEL KEMPINSKI,
ŠTRBSKÉ PLESO -
SLOVACCHIA**

Waterproofing and installation of marble slabs with TOPCEM PRONTO, PRIMER G, MAPELASTIC, MAPELASTIC SMART, KERAFLEX MAXI S1, GRANIRAPID, KERAPOXY, MAPESIL AC

Technical Notebook

LAYING STONE MATERIALS

Materials and systems to lay natural and recomposed stone correctly

HEAD QUARTERS

MAPEI SpA

Via Cafiero, 22 - 20158 Milan

Tel. +39-02-37673.1

Fax +39-02-37673.214

Internet: www.mapei.com

E-mail: mapei@mapei.it