

NTMA

Technical Manual



— THE NATIONAL —
TERRAZZO
— & MOSAIC ASSOCIATION —

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General Conditions



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COVERING A DEFECTIVE SUBSTRATE

When the substrate to receive a terrazzo system is unacceptable, the prevailing deficiencies must be brought to the attention, in writing, of the general contractor (GC) and/or other concerned parties.

Normal substrate readiness/preparation by the terrazzo contractor is confined to minor loose debris and dust removal. Special surface treatments, such as shot blasting, are commonly required for the particular terrazzo system specified.

Therefore, the cost of leveling/flatness compliance and the repair of cracks or any other defects should be the responsibility of the substrate provider.

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PREPARATION PROCEDURE for FIBER CONCRETE

The primary issue with filament reinforced concrete preparation is to remove any exposed glass or plastic fibers.

1. Shot blast the surface for a maximum profile meeting CSP 4 or 5
2. Razor scrape, cut or burn exposed fiber with a flame gun to remove any exposed fibers
3. Broom/vacuum the residue
4. Prime and install the proposed epoxy system *per manufacturer's instructions*

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Concrete flatness: Standards for poured-in-place terrazzo

The NTMA poured-in-place terrazzo specifications call for a subfloor not to vary more than 1/4 inch in a ten-foot span. The NTMA recommends the flatness of the substrate be evaluated using the method outlined in ACI 117-10.

ACI 117-10 PROCEDURE: A ten-foot straightedge is placed on the floor parallel, perpendicular, and then again at a 45-degree angle to the joints in concrete slabs. Ten samples shall be taken for each 1,000 square feet. No sample readings should have a gap of more than 3/8 of an inch and 90% of readings shall be 1/4 inch or less (Table 4.8.6.1 Manual Straightedge Method).

ASTM E 1155 (Standard Test Method for Determining FF Flatness and FL Floor Levelness Numbers)

In some cases, the concrete installer is asked to meet the flatness requirements as listed in ASTM E 1155. This test method is not currently recognized by the NTMA for the following reasons:

1. ASTM E 1155 restricts the measurement across any construction joint, isolation joint, block out or similar discontinuity. Terrazzo will be placed up to construction joints, isolation joints, and block-outs. Terrazzo may even be placed over some joints. These areas must also meet the 1/4 inch in 10-foot rule.
2. ASTM E 1155 restricts the measurement within two feet of the slab boundary. In most cases terrazzo is placed up against partitions. The concrete must also be flat up to the partition or boundary.
3. Per ASTM E 1155, measurements must be taken within 72-hours of concrete placement. Terrazzo can be poured over concrete that has been in place for months. Concrete can and will curl as it cures. Curing can take a month or even longer. The 72-hour requirement is not practical or acceptable to the NTMA for poured-in-place terrazzo on concrete. It is normal to expect the terrazzo veneer to follow the contour of the substrate.

Conclusion: Measurements to determine the flatness of concrete must be taken at the time when placement of terrazzo shall occur. Methods to remediate a concrete slab that does not meet flatness requirements of ACI 117-10 should be discussed with the terrazzo contractor to avoid potential conflicts. This technical paper covers the flatness and does not address the levelness of concrete.

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PREPARATION OF CONCRETE SLABS TREATED WITH CURING AGENTS

Concrete surfaces to receive terrazzo should not be treated with curing agents with the exception of slabs to accept sand cushion terrazzo. Do not rely on the curing compound to degrade or dissipate.

Any slab cured with a liquid-applied compound should be shot blasted to remove any bond-preventing substance. Acid washing is not recommended.

Testing of the substrate is recommended after-shot blasting as some curing compounds are difficult to remove and may interfere with the bond of the terrazzo

Concrete can be successfully cured without using liquid curing compounds. See ACI recommendations. A three-to-seven-day wet cure is recommended with the slab specifications.

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ALIGNMENT OF TERRAZZO DIVIDERS OVER CONCRETE JOINTS

The standard for terrazzo strip straightness is $\frac{1}{8}$ inch in 10 ft. However, strips located over concrete joints must precisely follow the concrete joint even if the joints vary beyond the $\frac{1}{8}$ inch in 10 ft. straightness because the terrazzo will crack away from the strip if the strips do not follow the concrete joint. It is dangerous to try to straighten the crooked concrete joint by adjusting the strip to where the horizontal leg of the divider is over any part of the joint because it would create a crack in the terrazzo off the toe of the horizontal leg of an L-divider strip. The terrazzo contractor should always follow with the vertical member of the terrazzo divider strip being set consistent with the edge of concrete joint.

Imprecise divider strips over irregular concrete joints beyond the $\frac{1}{8}$ inch in 10 ft. tolerance for strips not located over concrete joints, then the only known solution is to replace the concrete panels on both sides of the concrete joint in question and redo the concrete joint so it is straight. Alternatively, depending on the severity of the crooked joint, the strip spacing can be increased to accommodate the widest points. This would be filled with flexible filler that matches the matrix color of the adjacent terrazzo, and then ground and polished in the normal method.

An alternative option to the above would be to epoxy mortar fill the original crooked joint and make a new straight concrete joint with a saw cut 100% through the slab. All concerned should be aware that the original crooked joint has a high probability of re-cracking and reflecting a fissure through the terrazzo topping.

Unightly as it may appear, unless the concrete is replaced, an irregular line divider in appearance is superior to having a straight divider with an adjacent crooked crack in the terrazzo. Only in sand cushion terrazzo, where the terrazzo system is isolated from the concrete joints, would there not normally be a concern for the straightness of the concrete joint.

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TECHNICAL BULLETIN #G-6

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ABRASIVE AGGREGATE NON-SLIP LINES FOR RAMPS & STAIRS

This bulletin deals with new and existing terrazzo floor systems where it is necessary to create a non-slip system for safety purposes, such as a ramp, entrance area or stairs.

Abrasive aggregate non-slip lines are a possible solution. Normally, such strips are positioned about 6 inches apart across the ramp perpendicular to traffic, and stop about 8 inches from the wall line. The width of each line is normally 3/8 inch, and each strip is elevated about 1/16 inch above the terrazzo surface.

On stair treads, a designer can opt to specify one to three safety lines. The first line typically begins 1 inch from the nosing and, depending on the design intent, spans end-to-end or stops about 3 inches from the ends.

There are various methods of installation of such safety lines, including;

- (1) the prefabricated strip that is placed in a void created by saw cutting
- (2) the poured system, using the proper epoxy and silicon carbide or aluminum oxide material mix and placing it in the void created by saw-cutting.

For new installations, place U-channels before the initial installation. Fill with backer-rod foam material to avoid overspill. After the final seal, remove backer rods and clean channel. Fill with resinous abrasive mix.

With the prefabricated system, it is necessary to cut a groove 3/8 inch wide and 3/8 inch deep to insert the strip. In the second system, it is normal to cut 1/4 to 3/8 inch wide but only 1/4 inch deep.

ABRASIVE AGGREGATE NON-SLIP LINES FOR TERRAZZO TREADS

There are two recommended procedures for installing such inserts:

1. Placing a metal U-channel in the proper locations before placing the terrazzo topping. Each channel is filled with a material, such as a backer rod, to prevent the composition from penetrating the voids. After the installation and completion of the grinding, grouting and polishing, the temporary backer rod shall be removed along with any foreign materials from the U-channels.
2. Upon completion of the terrazzo work, saw cut lines 1/4 inch to 3/8 inch wide by 1/4 inch deep according to the abrasive strip pattern. Alternatively, you may place a wooden or durable foam filler strip 3/8 x 3/8 inch in the tread, removed after final finishing.

INSERTION OF RESINOUS ABRASIVE MIX

1. Carefully mask terrazzo surface on either side of the open channel to protect the surface and to establish the proper elevation with one or two layers of the masking tape.
2. Trowel blended epoxy/abrasive granular mortar mixture into the channels and tool to the height of the masking tape, a minimum of 1/16 inch above the adjacent terrazzo surface.
3. Immediately remove masking tape from the terrazzo surface while the mix is still in a plastic condition and allow the abrasive mix to cure before opening the stairway for traffic.

Note: Prefabricated abrasive strips are an option.

SEALING TERRAZZO WITH ABRASIVE STRIPS

When abrasive inserts are utilized, the terrazzo surface can be sealed with the proper acrylic sealer to enhance aesthetics. No sealers should be applied to the abrasive strips.

RECOMMENDED COLORS

We do not recommend using light-colored abrasive strips due to maintenance factors.

Please refer and adhere to all building codes for placement of abrasive strips

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AGGREGATE CHARACTERISTICS

The Los Angeles Abrasion Test ASTM C131-89 is used to determine values for each type of chip available. Care should be exercised in this selection of chips to ensure proper performance of the finished surface.

The following broad classifications are suggested as a guide:

1. Relatively soft chips: 36-26
2. Moderately hard chips: 25-20
3. Harder chips: 19-11 (able to receive a polish)
4. Extremely hard aggregates: 10 and below (usually not marble and requiring special grinding procedures).
These are usually used in unpolished form such as rustic terrazzo and textured mosaics. Where polished terrazzo floors containing these hard aggregates are required for design or functional reason, additional grinding costs must be anticipated. Specifiers should be notified accordingly.

ABSORPTION

Any chip with high absorption should be used with caution. A high absorption rate can cause an unsightly appearance and a maintenance problem. If improper cleaners are used on a highly absorbent chip, soluble salts may penetrate and cause fracturing. This “pitting” manifestation sometimes gives the surface an appearance of not having been grouted.

Aggregate with a high absorption rate may show a halo around each chip when used in epoxy terrazzo. The aggregate absorbs the epoxy during the curing process. The aggregate will have the original color at the center and a darker outline.

DUSTING

Dust content can change the color and character of a terrazzo floor, and in extreme cases, has caused rejection of a terrazzo floor. Minimal handling will help to keep dust content down.

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PROCEDURE FOR PATCHING TERRAZZO STEP NOSING

Since the nosing of a stairway takes major abuse, the nosing will sometimes get chipped. Epoxy resin material is suggested since a quick set can be achieved in a short time with little inconvenience to the owner and tenants.

PREPARATION

With a wax or sealer stripper, remove all foreign matter from the area to be patched.

Remove all loose material from the void with a fine tool or drill bit. The walls of this hole should be undercut so that the base is larger than the surface opening. This assures good anchoring and further reinforces the patch. Normally, the depth of the hole would be about 1/2 inch.

Clean dust from void, but do not wet with water or you will be compelled to wait until this void will dry because the resin is sensitive to moisture.

If required, blend epoxy resin with liquid coloring to match original terrazzo matrix color.

Blend #0 size marble chips to match original marble chip blend for color only and not the size of the marble chip. Using smaller chips makes better performance achievable.

The epoxy resin is mixed per manufacturer's instruction.

Once the epoxy blend is ready, immediately proceed to add by volume 1 to 2 parts of the marble chip blend. Once this composition is mixed, immediately fill each void, pressing or tapping lightly to fill the entire cavity. Finish off each patch by smoothing with a putty knife or a small trowel and filling all voids.

The patch should be slightly raised over the existing terrazzo surface to allow for grinding to expose the marble chips. Very little grinding will be necessary due to the use of the fine marble chips.

Finish with sandpaper or rubbing stone of a fine grit. If required, wash and then seal the nosing with an acrylic sealer. Sealer enhances the color of the marble chips.

Note: The patch will have a new look compared to the existing terrazzo. Precaution should be taken in the grinding operation to result in a neat patch.

Proper technique is a requirement for rewarding results.

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TECHNICAL BULLETIN #G-9

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PINHOLES IN A TERRAZZO FINISH

Pinholes are commonly defined as spheres or bubbles that have half or more of their shape revealed and are normally filled by the grouting process. They are reasonably defined as 1/16 or less in size. Micro-voids are defined as spheres or bubbles that have only the upper half removed. These create a smaller appearance and are more difficult to fill as the resin cannot displace the air in the bubble effectively. Therefore, these microspheres may not be completely filled, more likely closed with a skin coat of resin. Use of abrasives may open these again.

Pinholes are the result of air that has been incorporated into the system during the mixing process. This same condition exists in concrete and other resin-based floors but the air pockets are not significantly exposed since the surface is not ground. However, when the terrazzo is ground to reveal the marble chips, the pinholes are exposed.

A grouting process is used in an attempt to fill as many holes as possible. Various processes are used but basically, a resin coat is applied to fill these voids. After the grout has cured, the floor is polished to again expose the aggregate.

During polishing, these holes are impossible to see while the floor is wet but become noticeable as it dries.

The number and size of the micro-voids will depend but not limited to a number of factors including the installation temperature, the type and size of the aggregate blend, the viscosity and color of the resin.

It should not be construed that the appearance of pinholes indicates a lack of integrity or a loss of performance; it is the nature of the product. Relative to industry standards for such conditions, when such pinholes appear to a minor extent in various areas of the floor installation, they would be considered normal.

It is not uncommon for there to be random mini-pores about the diameter of a standard wire paper clip or the head of straight pin. Pinholes and micro-voids are inherent in terrazzo flooring surface.

With a regular maintenance program, sealers will ordinarily fill and significantly close the majority of finer pinholes.

Note: All evaluations are to be made looking straight down from a standing position without extraordinary magnification.

Terrazzo is an in situ created product by human craftsmanship and the installer must endeavor to meet the standards for the entire project. However, the terrazzo should not be arbitrarily rejected for relatively minor non-compliance. This is especially true if the overall functional and aesthetic values were satisfied.

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TECHNICAL BULLETIN #G-10

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DISCOLORATION OF METAL DIVIDER STRIPS

Metal divider strips in various types and gauges have been used extensively in terrazzo floors for many years. Initially, the strips may tarnish or temporarily discolor.

This temporary discoloration is beyond the control of the terrazzo contractor because the problem is created by the water and cement combination used in the terrazzo installation.

A discoloration will often appear after the polishing and sealing operation has been completed and before the owner starts a maintenance program. The owner should not be alarmed, as this temporary condition has developed from the trapped moisture remaining in the system.

It is necessary to explain some details of installation to understand what is developing. The cement terrazzo system is made up of marble chips, Portland cement and water. A chemical reaction takes place that hardens these materials without absorbing all the water. A grinding, grouting and polishing procedure follow, all in the presence of water. This saturates the floor system with water.

Immediately after the final polishing, an application of the specified sealer is applied. The normal cure time of a terrazzo floor varies and is sometimes extended due to this sealing process.

The moisture used in the flooring system must dissipate during the cure period. With the sealer on the surface, the moisture moves laterally to the nearest divider strip to escape. This moisture can temporarily discolor the divider strips.

This discoloration will disappear with normal maintenance procedures, but to speed the process, we suggest that the owner's maintenance crew employ a screen mesh.

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DECORATIVE METAL INSERTS IN TERRAZZO

Where decorative metal inserts are specified, architects, designers and owners need to be aware of the following:

1. Very hard metals such as stainless steel are extremely difficult to grind and polish. Swirl marks from rough grinding are usually not removable and it is not possible to restore a very smooth polished surface with stainless steel. Accordingly, we do not recommend stainless steel inserts.
2. Because the metal of the insert is usually of greater resistance to the grinding equipment than the surrounding terrazzo, the insert is typically higher than the floor. This phenomenon is more prominent with the harder and larger metal inserts. White alloys of zinc or brass are the best insert materials.
3. Aluminum should not be used with Portland cement terrazzo because of the chemical reaction that discolors and potentially deteriorates the aluminum.

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GRINDING & POLISHING HEAVY TOP/WIDER STRIPS

It has been the experience on some terrazzo installations that when a heavy top/wider metal divider strip 1/8 inch to 1/4 inch has been utilized, during the grinding and polishing process, small amounts of particles are ground off the heavy top brass or zinc strips and are deposited in the terrazzo adjacent to the strip.

These particles adhere to or become embed in the terrazzo surface and often are not noticed until the floor is clean and sealed.

In the event this occurs, clean the floor using a diamond pad or screen mesh pad and by hand-rubbing small areas.

As a result of the conventional grinding process, swirl marks may occur in metals used for divider strips.

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STAINLESS STEEL METAL DIVIDER STRIPS

Due to manufacturing limitations and difficulties in grinding, stainless steel strip is not recommended for use in polished terrazzo systems. If a white metal strip is specified and/or desired it should be aluminum or zinc.

This grinding precaution is not applicable to rustic terrazzo applications.

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INSTALLATION OF A TERRAZZO FLOOR WITHOUT ADEQUATE ROOF PROTECTION

This bulletin deals with the installation of a terrazzo floor in an open or only partially covered roof deck system.

The terrazzo installation is subject to damage without adequate weather-tight roof protection in the event of rain or cold weather during the process. Once damaged, patching may not be acceptable to an owner. Therefore, proper measures must be taken to protect the terrazzo surface if the work area is exposed to the elements.

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TECHNICAL BULLETIN #G-15

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MARBLE CHIP SELECTION

Terrazzo is known for its versatility. A wide color range of marble chips and matrix combinations available, but with certain blends of marble chips, some words of caution should be brought to the attention of all persons involved.

It is the intent of the established terrazzo contractor to strive for the quality demanded of this job-manufactured product. The ingredients of the terrazzo composition further require the best of available materials, but since the marble chips are provided from nature, we have learned from trade experience that certain colors can be a problem. This can be related to hardness, veining or color.

Often a new terrazzo floor does not have the immediate aesthetics we all desire, and there is nothing the terrazzo contractor can do but request that proper maintenance and reasonable patience be indulged. During the cure of any cement-type product, its by-products, called efflorescence, are released. It is very important that good housekeeping procedures remove this efflorescence as it appears.

When certain marble chips are selected, such as 100% black marble chips in a black Portland cement matrix, the floor will possibly not immediately result in the desired appearance. However, the true color and patina will emerge after a period of normal traffic service and maintenance.

Furthermore, be aware that the available black marble chips have some white veining. Therefore, the chips will contain a small amount of white, usually less than 5%.

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TECHNICAL BULLETIN #G-16

8/13, 9/16

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BLACK TERRAZZO

An all black terrazzo surface or a very dark terrazzo surface will show more visible variations in the marble aggregates, matrix colors, pinholes and polishing swirl marks that are inherent to all other terrazzo colors, but are just not as noticeable. The following are a few things to consider:

1. Portland Cement Matrix: In order to obtain as deep a black color as possible, it is necessary to use the maximum permitted amount of black pigment. Please consult with the pigment supplier for maximum amount of pigment and the expected color. Portland gray cements vary in color. Therefore, the intensity of the black color may also be slightly different from one brand of cement to another. It should also be noted that black Portland cement binder's efflorescence is more noticeable and it may take longer for the terrazzo to lose the blotch look as occurs with new terrazzo.
2. Epoxy Matrix: It is possible to achieve a good deep black binder for terrazzo using a factory formulated epoxy matrix.
3. Black Chips: Being a product of nature, the intensity of the color may vary and the proportions of white veining in the marble may vary from one section of a quarry to another. Being sensitive to grinding and sealers, they may often appear to be various shades of dark gray.

Futhermore, it should be noted that the fine (120 grit) swirl marks from polishing and pinholes may remain visible for some time after the floor is finished. Over time, good maintenance and use will diminish these condtions.

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TECHNICAL BULLETIN #G-17

9/13

COLOR OF TERRAZZO

Portland Cement Terrazzo

The finished terrazzo must have a reasonably uniform color. Hazy or milky areas ordinarily caused by grout film and diamond pad scratches are not acceptable. Especially with Portland cement terrazzo systems, it is not uncommon to notice some variations in the matrix color caused by the hydration of the Portland cement. During the curing/drying cycle, particularly in sand cushion terrazzo, this is often a darker tone along the strips. This condition will dissipate over time.

Epoxy Terrazzo

The finished epoxy terrazzo must have a reasonably uniform color. Shade differences caused by curing of the resin during cool/damp conditions and the resulting blush are acceptable.

Aggregate blends can have a great effect on the appearance of the terrazzo. Small differences in aggregate concentration or composition can give the terrazzo matrix a different appearance. This is not a reason to reject the floor

Note: All evaluations are to be made looking straight down from a standing position without extraordinary magnification.

Terrazzo is an in situ created product by human craftsmanship and the installer must endeavor to meet the standards for the entire project. However, the terrazzo should not be arbitrarily rejected for relatively minor non-compliance. This is especially true if the overall functional and aesthetic values were satisfied.

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TECHNICAL BULLETIN #G-18

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NON-SLIP SAFETY LINE TREATMENT FOR TERRAZZO

This bulletin outlines a procedure that can be used to create safety lines in an existing terrazzo floor or stairway. These are usually $\frac{3}{8}$ inch wide and spaced 4 to 6 inches on center for ramps. Stair treads may have up to 3 lines starting 1 inch from the nose and spaced 1 inch apart. Portland cement terrazzo must have a cure of at least 30 days prior to the application of this system, while this treatment can be applied immediately with epoxy terrazzo. Terrazzo surfaces in either case must be free of sealers and other foreign matter for proper adhesion.

Surface shall be dry before using masking tape to form the desired pattern of the non-slip strip. Use two thicknesses of masking tape to provide the proper thickness for the liquid epoxy to be applied.

Once the pattern has been formed with the masking tape, apply the epoxy liquid blended with a minimum amount of the non-slip aggregate included. Additional aggregate can be seeded once the epoxy liquid has self-leveled.

Remove masking tape immediately following the application. If this is ignored, it will be difficult to remove the following day.

Light foot traffic can be allowed over these inserts after a 24-hour cure.

Light color abrasive lines will usually exhibit dirt accumulations and are, therefore, not recommended.

These abrasive lines are not suitable where heavy foot traffic is anticipated.

Please consult all local building codes and safety regulations.

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TECHNICAL BULLETIN #G-19

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(Formerly TB#53)

RE-ANCHORING A TERRAZZO FLOOR SYSTEM

The terrazzo industry has successfully used the following procedure to repair the delamination of directly bonded Portland cement terrazzo toppings from the substrate by the injection method.

During the past several years, this industry has learned new methods for the correction of loss of bond in isolated, small areas. When this procedure is considered, it is best to evaluate the percentage of areas to be re-anchored. If the areas are large, re-anchoring may not be the best choice due to the costs involved. This injection system is designed for smaller, isolated areas of delamination.

EXECUTION

Drill a series $\frac{1}{4}$ - $\frac{3}{8}$ inch holes spaced about 8 inches apart over the distressed area. The depth of the hole should penetrate the substrate slab approximately $\frac{1}{2}$ to 1 inch. Once the hole has been drilled, it is essential to clean all debris from these holes with air pressure. Low viscosity epoxy or polyurea products designed for this purpose are generally used to achieve the necessary penetration. Fill all voids where the separation has occurred, using approximately 5 to 10 lbs. of pressure. (There are several types of suitable materials/techniques/equipment; check with NTMA member suppliers.)

While injecting the epoxy into the holes, it is necessary to check the surrounding holes to make sure they are filling up with this epoxy mix. If no epoxy appears in a hole, change the location of the injection to an adjacent hole. Fill all holes to $\frac{1}{8}$ inch from the terrazzo surface, leaving this space for the insertion of a marble chip to disguise the repair. Place weights on the terrazzo surface to effectively compress the topping to the epoxy inserted for several hours per manufacturer's instructions. The use of TapCons "self fasteners" are also useful to most positively "clamp" down the loose terrazzo until the polymer bonding agent has set.

After cure of bonding agent, remove the weights or screws and place the marble chip in the holes using an epoxy matrix that matches the original floor color. The chips should be slightly above the adjacent terrazzo surface to allow for some sanding or grinding to smooth the repair areas.

If this work is done neatly and leaves a clean surface while the epoxy is fluid, it will reduce the effort when the patch is sanded.

When the re-anchoring process is completed according to instructions, the floor system will give the owners the expected longevity of terrazzo but still sound hollow when it is tapped with a solid tool. The degree of the hollow sound will depend on the gravity flow of the epoxy blend liquid as it seeks any openings that exist at the junction of where the loss of bond occurred.

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TECHNICAL BULLETIN #G-20

8/13, 6/19, 4/22

(Formerly TB#66)

THERMAL SYSTEMS UNDER A TERRAZZO FLOOR SYSTEM

Heating coils embedded in Portland cement terrazzo floor system have been used successfully for many years.

Whether the heating units are a circulating warm water inside tubes or a parallel series of electric wiring or matt system; these have used primarily traditionally with Portland cement terrazzo.

Some radiant heat systems can be used with epoxy terrazzo. In most cases, the epoxy terrazzo is bonded to the slab. Job conditions may dictate the use of epoxy membrane should be applied over the existing cracks only. However, in some cases, a complete coverage of the area receiving epoxy terrazzo may be necessary. Consult with the epoxy formulator prior to installation.

The elevation of the heating medium must be within a certain specified distance from the finished surface to achieve the greatest efficiency. Normally, this required distance is less than 2 inches.

The heating units must be embedded in the slab or under-bed, not in the terrazzo topping. Consult with the supplier of the epoxy terrazzo for recommendations for the underbed that is compatible with the terrazzo and will meet the demands of the job conditions.

The tubing should be elevated to the proper height with chairs to prevent disturbing the elevation during the under-bed concrete placement.

Regardless of what system of heating is being employed in the concrete or under-bed, the metal divider strips should not touch the heating elements. Depending on the elevation of the units, a maximum 1- inch depth divider strips may be required.

For hydroponic radiant systems, water temperatures must not exceed 100°. Temperatures should be raised or lowered slowly, commonly 1-degree F per hour to avoid thermal shock.

The system should be charged before the application of the terrazzo. If possible, the system should remain on and at a constant temperature during the application of the terrazzo and during the use of the building. Temperatures should not be allowed to flux.

Electric heating units with a series of wires may necessitate placing the under-bed in two layers. The first layer should be placed to the required height to allow the electrical contractor to place his heating mat system. It is essential that the terrazzo contractor bond the two under-bed layers together. If a long delay is anticipated between the placements of the two, it may be necessary to apply the second layer with a bonding agent on the second day.

It may be necessary for the electrical contractor to work over a hardened surface to test for short circuits or breaks both before and after the placement of the second layer. The thickness of **each layer must not be less than 1 1/4 inches**. Extreme care must be taken in the placement of the second concrete layer and the insertion of the divider strips to prevent damage to the heating mats.

The terrazzo topping along with the grinding, grouting, and polishing is performed as usual.

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TECHNICAL BULLETIN #G-21

8/13

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OIL STAINS ON TERRAZZO FLOORS

Oil will stain all types of terrazzo floor systems regardless of whether they are Portland cement or epoxy type binders.

With cement systems, both the Portland cement matrix and the marble chips can be stained with oil spills due to the nature of these materials.

An epoxy binder will resist oil penetration if good housekeeping procedures are in effect. The marble chips that normally make up the higher proportion of the floor's surface will be stained only if oil is spilled and not removed promptly.

The following method is effective for removing oil stains from cement terrazzo:

Saturate a white flannel cloth with equal parts of acetone and amyl acetate. Place over stain and cover with a panel of glass long enough to draw out the stain. This is not recommended for use on epoxy terrazzo.

Concentrated citrus solutions used according to manufacturer's recommendations have also been successful. There are also numerous proprietary poultice stain removal systems available.

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TECHNICAL BULLETIN #G-22

8/13

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CURING AGENTS

This bulletin deals with cure seal/membrane type evaporation retarding agents used on concrete substrates to which a terrazzo or industrial floor system is to be applied. The following information is a caution for terrazzo contractors.

Liquid curing agents are designed to control the rapid cure of the concrete substrate. Some manufacturers claim that the agent will not interfere with the bond of the finished floor surface since it will reportedly dissipate within a short period.

Regardless of the type, manufacturer or application method, use of curing compounds will create a surface that may not allow the subsequent flooring materials to bond. If used before the terrazzo contractor can proceed with his installation, this floor surface will have to be mechanically abraded by a grinder, shot blasted or scarified to open the pores of the concrete surface to allow a good bond. Obviously, there is an additional cost to for this extra work. However, if this procedure is ignored, there will be a probable loss of adhesion once the finished floor material is installed.

New concrete should not be cured with a topical chemical agent that becomes a barrier to proper bonding of the terrazzo system.

Accordingly, the terrazzo contractor or **owner's** representative must check on the substrate before commencing the application. A suggested simple test would be to pour water on the surface. If it does not immediately penetrate or if it beads up, this normally indicates some form of sealer is on the surface. Better yet, place a test patch of your materials. If it does not bond appropriately, go on record immediately with your general contractor and refuse to proceed further until a surface that will achieve a bond is provided. A direct tensile bond test may be necessary to provide a quantitative result.

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SELF-LEVELING UNDERLAYMENTS

Self-leveling underlayments are commonly used to flatten/correct an irregular concrete surfacing. These products are extensively used under “soft” floor coverings, such as carpeting and sheet vinyl, etc.

These products may include cement as well as gypsum material. These are reportedly designed to develop a cured compressive strength greater than 4000 psi and a flexural strength of over 1,000 psi.

However, none of these products have proven to be universally compatible when used as an underlayment for thin-set terrazzo systems.

These products have a history of problems when used in conjunction with epoxy terrazzo. A common problem is a cohesive or internal failure of the self-leveling material. Additionally, products used in the presence of water, such as cement terrazzo, exhibit a weakened substrate surface that creates the bond failure.

The NTMA does not recommend these type products be used in combination with thin-set terrazzo products.

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TECHNICAL BULLETIN #G-24

8/13

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MARBLE DUST RESIDUE

It is essential to understand that when making a sample in the shop, the person reduces the amount of the materials blended to produce the requested formula by using several handfuls of marble chips taken from the top of a bag that does not contain marble dust that accumulates during the shipping and handling. The residue of dust created by the abrasion of the chips rubbing in transit is automatically screened through the marble chips and is deposited on the bottom of the sack where it is retained.

When mixing these materials for the placement of the job, each bag of marble chips is dumped into the mixer. Due to the manner of turning the sack upside down, this dust falls into the mixer and tints the matrix.

This creates a slight color difference between the sample and the floor. The amount of marble dust will vary dependent on the hardness of the marble.

Many marble chips used in terrazzo are washed and dried prior to the bagging process but will collect additional dust during the shipping process.

This color difference occurs and is normally beyond the control of the terrazzo contractor.

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TECHNICAL BULLETIN #G-25

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PURPOSE OF DIVIDER STRIPS IN TERRAZZO FLOORS

Whether they are plastic or metal, such as a white alloy of zinc or brass, thin or heavy gauge, divider strips have a function in all terrazzo systems. This function varies with each system to minimize or control structural and shrinkage cracks, permit creation of design or provide a neat transition between terrazzo and other materials.

Strips made specifically for terrazzo are to be used. Tile/stone strips are not to be used.

PORTLAND CEMENT SYSTEMS

Because of varying thicknesses, the divider strips are essential to the performance of the floor. The position of such strips is dictated by system thickness. Normally, sand cushion requires a panel grid of 5 ft. or less on centers, while for the bonded or monolithic systems; the strips can be positioned to the expanded spacing of 6 or 8 ft. centers.

EPOXY SYSTEMS

Epoxy terrazzo systems can allow greater spacing between divider strips. Being a veneer-type system bonded to a concrete slab, its behavior is wholly dependent on the slab movement. Strips are essential to be positioned directly over all breaks in the substrate, such as construction or expansion-type joints.

Brass strips are generally not recommended for universal use with epoxy system unless the epoxy formulator and strip supplier approve.

RUSTIC SYSTEMS

Rustic terrazzo systems are normally Portland cement with various thicknesses. Divider strips or control joints are essential to the performance of the finished product. The position of the strips or joints, normally set at 4 to 8 ft. on centers, is wholly dependent on the thickness of the system. For exterior use, plastic and brass strips are recommended. In addition, the method of temporary wood filler, later removed and the void filled with a flexible sealant on all working joints is fine. Non-working joints can be filled with a grout. White alloy of zinc strips is not recommended for exterior use.

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AFFIXING DIVIDER STRIPS

GENERAL: Divider strips are used to honor joints in concrete, as terminations and to separate colors or add aesthetic features. For general guidelines, refer to Technical Bulletin # G-29.

AFFIXING PRODUCTS: Divider strips can be adhesively adhered to the concrete slab. Most panel adhesives state “Not for use on Concrete”. Many adhesives are affected by slow cure in cold weather and alkaline exposure or vapor migration. The NTMA generally recommends using hot melt glues only as the temporary spot hold. Use one of the recommended procedures below for a permanent hold.

EPOXY TERRAZZO: The NTMA suggests a continuous ribbon or bead of a suitable viscosity epoxy compatible with the epoxy matrix to be used.

CEMENT TERRAZZO: The NTMA advises using a polymer thin-set mortar or a cement/sand mix with a latex additive.

INSTALLATION: Divider strips must be set tight to the concrete substrate. It is not recommended to shim divider strips. This can occur when concrete floors are not within specified tolerances and a flat, level terrazzo floor is desired. The gaps under the divider strips or the edge of the terrazzo are susceptible to crushing.

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TECHNICAL BULLETIN #G-27

8/13

(Formerly TB#43)

REMOVAL OF SWIRL MARKS ON NEW TERRAZZO

Terrazzo is a handcrafted product manufactured and installed at the job site. The composition is a combination of marble chips, which are quarried from deposits provided by nature and a matrix that can be cement or epoxy based.

Once this composition has hardened, the marble chips are exposed to the desired density by grinding. This requires the use of abrasives on the surface. The initial cut is made with a coarseness type abrasive and graduates to the finer grades to create the smoothness desired.

In the process of the fine-grinding, the weight of the grinding machine and the fineness of the abrasive hugs the floor surface, which often results in the appearance of swirl marks on the surface that are not noticeable until the floor has thoroughly dried.

There should be no concern, as these markings will disappear with normal foot traffic. If they are objectionable, they can be removed by using a scrubbing machine with either a 3M type screen mesh #100 grit pad or equivalent diamond pads.

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Technical Bulletin G-28

9/13

Finish of Terrazzo

Unless specified otherwise, the standard finish is a #80 or #120 silicon carbide stone or diamond equivalent to generally match approved mock-up installation area and samples.

Small areas and internal corners of terrazzo that cannot be readily reached and ground with the conventional production equipment must utilize specialty hand tools to uniformly expose the aggregate. Areas that will not allow for the use of hand tools due to space restrictions should be precast.

Areas that will not be visible when the building is complete may not be finished. Such as areas as under column covers or baseboards may be left in the unfinished state

Note: All evaluations are to be made looking straight down from a standing position without extraordinary magnification.

Terrazzo is an in situ created product by human craftsmanship and the installer must endeavor to meet the standards for the entire project. However, the terrazzo should not be arbitrarily rejected for relatively minor non-compliance. This is especially true if the overall functional and aesthetic values were satisfied.

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TECHNICAL BULLETIN #G-29

9/13

Divider Strips

Divider strips are used to honor joints in the concrete, as terminations and to separate colors or other aesthetic features

Divider strips must be a straight and aligned within the specified pattern. The tolerance for placement for strip alignment must be no greater 1/8-inch deviation from straight in a 10 ft. span. Exceptions must be made for dividers over concrete joints that must align directly over the joint even if beyond the tolerance. Continuous long runs of strips should be abutted, and properly aligned. Cross strips or offsets should be connected.

Mitering is required for 3/16 inch or wider heavy top gauge strips for transition to angled strip lines.

Full gauge of the divider strips must be exposed in the finished product. Heavy top strips may not be split exposing the leg.

Strips may be damaged during the installation process and not noticed until the final inspection. Due to job site conditions, building movement or shrinkage; some connections may not remain abutted. The contractor shall be given the opportunity to repair any strips if the repair can be made effectively and without causing more damage.

Strips must be tightly bonded to the substrate for epoxy terrazzo.

Note: All evaluations are to be made looking straight down from a standing position without extraordinary magnification.

Terrazzo is an in-situ product created by human craftsmanship and the installer must endeavor to meet the standards for the entire project. The terrazzo contractor shall be given the opportunity to repair the random or occasional strip that does not meet the above criteria. The repair should not in any way jeopardize the overall aesthetics of the floor.

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TECHNICAL BULLETIN #G-30

9/13

AGGREGATE CONCENTRATION

Aggregate concentration should in general match the density as exhibited in the in-situ mock-up. Mock-ups are the preferred method but if these are not available, the aggregate density should in broad terms match the submittal samples.

Areas that are resin rich and without aggregate are not acceptable.

Cement terrazzo is installed by sprinkling aggregate into the surface and working this aggregate into the floor. Epoxy terrazzo is applied by adding the aggregate to the resin and trowel applying. In some cases, additional aggregate may be sprinkled into the surface but in neither case will the aggregate density of epoxy match that of cement terrazzo.

Note: All evaluations are to be made looking straight down from a standing position without extraordinary magnification.

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TECHNICAL BULLETIN #G-31

8/13

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UNDERLAYMENTS TO FLATTEN SUBSTRATE FOR TERRAZZO

It is a better practice to grind or scarify to flatten the surface where possible. In some cases, the filling of low areas may be necessary. The following is recommended:

Where an epoxy system is specified, the underlayment is a mixture of sand, marble, pea gravel or other appropriate aggregate and epoxy troweled to flatten the surface at the recommendation of the epoxy formulator.

For monolithic terrazzo, use the same procedures as described above, but use a cement/polyacrylate/sand mortar for the leveling underlayment. The edges should not be feathered, but the edges should be cut vertically, and the concrete should be chipped to ensure the underlayment does not become less than 1/4 inch thick.

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TECHNICAL BULLETIN #G-32

04/2015

AFTERMARKET POLISHING TREATMENTS

Over the years there has been an increase in the degrees of polish of terrazzo floors by owners to increase the NTMA standard 120 grit finish to achieve a much greater shine. These finishes go by names such as crystallization, natural high hone, and high diamond polishing. For the most part the results have been very positive in **eliminating the normal “strip and reseal”** maintenance of topical sealers, as well as reducing the use of floor finish coats to produce a very shiny as well as less scuff-able floor.

However, these grinding processes can expose pinholes and leave a floor pitted if an aggressive honing is necessary to produce the desired results. If some aftermarket finishes, high heat is produced and can cause an “orange peel” effect on an epoxy terrazzo finish. As an association we advise owners to have any of these initial treatments performed by an experienced terrazzo contractor who can determine if the floor will need to be re-grouted after this first-time aggressive grinding/polishing treatment. Subsequent super fine polishing treatments or maintenance could be accomplished by others (**owner’s maintenance staff or contractor**) trained in these processes.

If the **owner’s** chooses to bypass the NTMA terrazzo contractor for the initial diamond grinding/polishing treatment, after the floor has been finished to the 120 grit NTMA finish standard, the floor should be thoroughly inspected and accepted prior to the process starting. Transferring this process by someone other than the installing terrazzo contractor would mean acceptance of the original floor installation finish.

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TECHNICAL BULLETIN #G-33

6/16, 9/16, 9/17

MONOCHROMATIC TERRAZZO – Caveats and Recommendations

Overview: Terrazzo is created by combining aggregates with a binder of either cement or epoxy, grinding to expose aggregates and then polishing. The aggregates may be marble, granite, glass, plastic, or Mother of Pearl to offer a wide variation of colors, patterns, and aesthetic nuances. Designers sometimes desire a monochromatic terrazzo floor by selecting the same size and color aggregate with a matching-colored binder.

Caveats: The NTMA cautions designers the aesthetic results on monochromatic terrazzo may vary through the inherent natural characteristics of aggregates. Some aggregates may not display a wide variation of shadings and veining and are selected for this specific reason. However, all aggregates will have some variation of shade. This inherent and natural shading can lead to a final appearance in the finish terrazzo that may show minor and subtle variations that may appear eye catching, since most of the terrazzo flooring is more stable in shading and density.

Samples: A sample or mock-up may not accurately reflect the potential spotty or shading in monochromatic terrazzo. These color and tone issues may only become apparent once in larger terrazzo floor spaces. This is the result of slight variations in color, shade, tonality, dust content pigments used and their concentration of shading values.

Aggregates: Variation in aggregate size generally produces best and more consistent results. Using more than one size of aggregate will benefit the terrazzo matrix with greater uniformity of chip density. This results in more even distribution and greater chip density, which is also helpful in preventing overly resin rich spots. The NTMA cautions designers in using 100% glass or marble aggregates of the same color that lack consistent variation.

Recommendations: To obtain optimum aesthetics, combinations of different colors of aggregate as well as varying sizes are recommended. Various colors of aggregates will help avoid potential spotty appearance that can be problematic with monochromatic poured-in-place terrazzo flooring.

Using chips of a general "angular and non-elongated" in proportion of the size desired (e.g., #0, #1, #2, etc.) will help designers achieve a more uniform terrazzo appearance and result in a better performing aggregate over the life span of the terrazzo floor. If aggregate chosen lacks consistent variation, the potential of the final appearance to contain minor and subtle variations is greatly increased.

The NTMA urges Architects/Designers to work with their NTMA Terrazzo Contractor to create a design mix that will meet the aesthetic needs and the function of the terrazzo flooring that produces the desired results.

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TECHNICAL BULLETIN #G-34

9/19, 01/21

Reflective Finishes in Terrazzo

General:

Today's highly reflective finishes are very popular in terrazzo flooring. This can look very sleek, modern, and indeed have mirror like qualities. However, as with all things in life there are tradeoffs. The higher degree of reflectivity on the floor surface, the greater the likelihood of highlighting the appearance of waves in the terrazzo floor. Terrazzo is poured, allowed to set and then ground in place. It requires skill and special equipment. Perfection is unattainable and unrealistic to demand. Floors should be appealing and within industry tolerances.

Light:

Overhead lighting or critical illumination for a highly reflective Terrazzo floor will have an impact on how the floor appears.

Highly reflective floors may make terrazzo floors that are within established tolerances, appear wavy. This is due in part to the reflective or refractive values of light and the high reflectivity.

Tolerances:

Epoxy and monolithic terrazzo are typically an overlay on concrete slabs. The flatness of the slab will have an impact on the flatness of the finished terrazzo. 1/4 inch under a ten (10) foot straight edge (not cumulative) is the industry standard for the tolerance of flatness for concrete and finished terrazzo floors.

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Building Code Requirements for Stair Treads

Overview: The International Building Code (IBC) establishes minimum requirements for building systems using prescriptive and performance-related provisions. This building code is updated every three years, then each state and municipality adopt the code with implementation of that state's statutes.

Caveats: A state, city, or county may establish more restrictive standards because of local climatic or geological conditions. In many cases, related provisions from various chapters must be considered simultaneously or reconsidered later in the process to arrive at a correct classification or determination. The following notes are based on the 2018 International Building Code Stairways (Chapter 10- Section 1011). Note: There are exceptions and more explicit language in the code.

Treads and Risers shall comply with Sections 1011.5.1 through 1011.5.5.3. Riser height shall be 7 inches maximum-4 inches minimum. Tread depth shall be 11 inches minimum. Nosing shall have a curvature or bevel of not less than 1/16 inch but not more than 9/16 inch from the foremost projection of the adjacent treads. The leading edge (nosings) of treads shall project not more than 1/8 inch beyond the tread below.

Stairway walking surface: shall comply with Section 1011.7 and Section 1003.4. Circulation paths of the means of egress shall have a slip-resistant surface and securely attached. Treads Not be sloped steeper than one unit vertical in 48 units horizontal (2% slope) in any direction.

NTMA Interpretations: While many designers require and are in their right to require abrasive strips on the treads, the IBC makes no reference to a requirement for these abrasive strips. If strips are desired, aluminide oxide strips are generally preferred over metal strips for cost and in-service use. Stainless Steel strips are set in grooves filled with epoxy resin. Stainless steel typically does not bond as well to epoxy as aluminum oxide.

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The NTMA is a not-for-profit trade association and can offer no warranty, express or implied using this guide paper. This paper does not address OSHA, ADA or specific regional requirements. Local building officials have the final word on all code interpretations.

Standard Terrazzo



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TECHNICAL BULLETIN #S-1

8/13

(Formerly TB#09)

SUB-SURFACE COMPACTION

This bulletin deals with structural terrazzo systems placed on a compacted earth/fill base.

The general contractor will perform in accordance with the specifications and prepare the substrate surface with granular and/or sand fill to the required 95% of maximum density compaction per modified Proctor Test, ASTM-D 1557-70. This is normally before the mechanical contractors commence underground preparation for their work.

Thus, trenches and holes are dug throughout the area where the structural terrazzo is to be installed. The backfill provided by others is compacted to the required standard.

If it appears the disturbed areas have not been properly compacted, it should be brought to the attention of the architect and the general contractor.

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TECHNICAL BULLETIN #S-2

8/13

(Formerly TB#44)

COLOR VARIATIONS IN CEMENT TERRAZZO

This bulletin provides an explanation of why there is often a difference in color or shading between the field and the border on a completed cement terrazzo application when the same formula has been used for both. This condition is quite normal with most terrazzo applications but is more noticeable with darker formulations.

Terrazzo is manually installed at the job site, and the process is often modified to fit varying job conditions. When the terrazzo topping is placed, it is compacted by rollers or machines to extract excess cement and water. This process creates the density of marble chip exposure for the ultimate surface finish of the product. Obviously, with this type of equipment, the field or open areas get more attention than the wall or border areas. Thus, there can be a varying density of chip exposure between the two areas.

In the grinding operation, there are several types of machines designed for various functions in finishing a terrazzo application. Each machine operates at varying revolutions per minute. The field grinder operates at a slower rate than a border grinder. The difference in speeds can produce a variation in color in the marble chips. This difference cannot be detected while the floor is in a wet or damp condition; it is noticeable only after the floor is thoroughly dry.

This variation in color usually will even out and eventually be almost inconspicuous with the normal recommended maintenance program. The machines used for maintenance will give uniformity to the surface in a short amount of time.

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TECHNICAL BULLETIN #S-3

8/13, 4/18

(Formerly TB#10)

ASHLAR STRIP PATTERN IN SAND CUSHION TERRAZZO

Architects or designers sometimes insist on using this strip pattern even after warned of possible cracking problems across the intermediate voided panel. This is usually for aesthetic reasons.

The NTMA does not recommend an ashlar pattern in sand cushion terrazzo.

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TECHNICAL BULLETIN #S-4

8/13, 9/17

(Formerly TB#12)

SAND CUSHION TERRAZZO

Because of its long history of excellent performance, the sand cushion terrazzo system has been traditionally classified as the premier version of cement terrazzo systems.

The sand cushion terrazzo system is designed to be installed in a minimum thickness of 2 inches. If conditions allow, a full 3-inch depression is much preferred.

The execution consists of a dusting of sand over the concrete substrate, which is covered with an isolation membrane: (ASTM A 185 D 2103 Type 13300, 4 to 6 mils. polyethylene sheeting, or ASTM D 226, 15 lb. non-perforated roofing felt). The dusting of sand applied under the membrane sheeting provides separation from the concrete substrate. A 2-inch thickness of low slump mortar underbed under-bed reinforced with a 16 or 18 self-furring gauge galvanized welded wire mesh is placed over the membrane and pulled up into the under-bed. Metal or plastic divider strips are vertically inserted and tightly troweled into the under-bed while this material is still in a plastic condition.

These divider strips perform two essential roles in this system. The first reason is aesthetics since they provide design color changes; the second is that they control the anticipated shrinkage that results from curing the floor. The recommended spacing of the divider strip is 4 ft. on centers, or 5 ft. if the under-bed thickness is increased to 3 inches or more. The standard 1/2-inch thick terrazzo topping is placed in the panels formed by the strips when the under-bed has properly hardened. Supported by the concrete slab, the system is designed to perform independently from the substrate.

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TECHNICAL BULLETIN #S-5

8/13

(Formerly TB#14)

POURED CEMENT TERRAZZO WITH A PRECAST LOOK

To create a precast look with a poured in place terrazzo system without using metal divider strips, insert the following as a rider to your NTMA specifications.

JOINTS

In lieu of metal divider strips, use the following method:

After placing and screeding the under-bed to the desired elevation and while the under-bed is still in a semi-plastic stage, cut lines approximately 1-1/2 inch deep into the surface in the desired locations of the joints. After the material has hardened, place pre-treated beveled wood strips 3/8 inch X 1/2 inch align directly over the cut lines. Anchor with finishing nails to hold straight lines. After placing all temporary wood strips, proceed with the installation of the terrazzo topping. (See detail on the following page.)

CONTROL JOINTS

Place a foam material 3/8 inch wide by the depth necessary to separate the under-bed material at this point. Attach to this foam a 3/8 inch X 1/2 inch beveled wood strip. This can be taped to the foam. Be sure to cut all mesh 1 inch short of this control joint. (See detail.)

GROUTING OR FILLING OF JOINTS

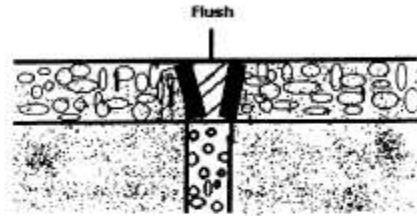
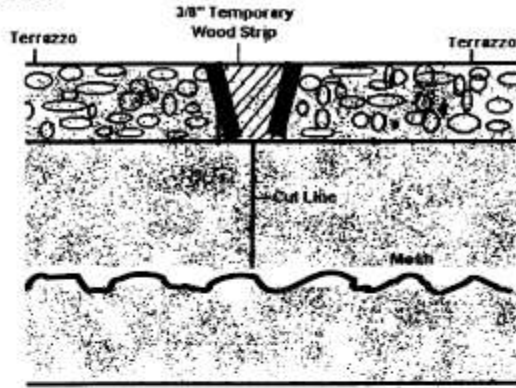
Removal of wood strips shall not commence until several days after the terrazzo floor has been polished. It is most important that the wood strips have had sufficient time to dry and shrink away from the walls of the joints before the removal of same.

After the wood has been removed, place a pourable sealant or a mixture of the desired color of cement grout into the voids. In either product, tool these joints to the finish desired.

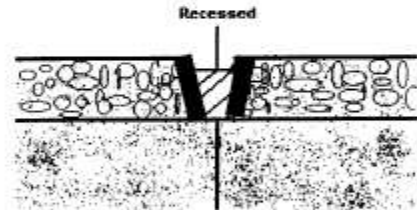
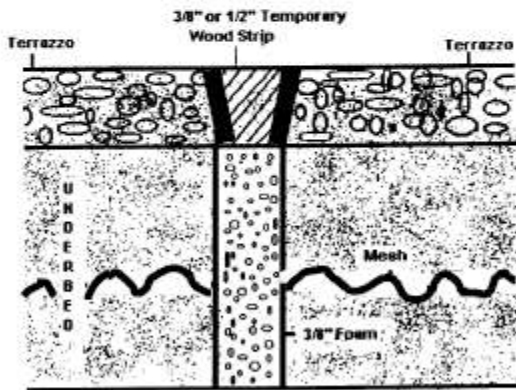
OPTION

Polishing of the terrazzo can be completed after joints are filled.

Joint



Control Joint



Terrazzo Poured on Site with a Precast Look

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TECHNICAL BULLETIN #S-6

8/13

(Formerly TB#15)

CONTROL JOINTS IN SAND CUSHION TERRAZZO

The position of the divider strips is essential to the performance of sand cushion terrazzo. The metal strips are inserted into the under-bed furnished by the terrazzo contractor. If and where further control joints are required, double divider strips placed back-to-back will handle practically any slab movement. PRE-FORMED NEOPRENE FILLER BETWEEN TWO METAL DIVIDER STRIPS FOR THESE SYSTEMS ARE NOT RECOMMENDED. While it typically has adequate compressive strength, the downside is high tensile properties and virtually no elongation properties. If the neoprene separates from the metal strips on either side during shrinkage, the results are unsightly and commonly lead to maintenance problems.

Many terrazzo contractors use temporary filler in lieu of neoprene. Upon completion of the terrazzo system, remove this temporary filler and fill it with a pourable flexible sealant. This normally occurs several weeks after the initial placement of the terrazzo topping after the majority of the shrinkage has taken place.

In a sand cushion terrazzo system, it is not normally necessary to position control joints directly over the slab joints since the sand and polyethylene sheeting are utilized.

Where a metal expansion plate has been designed into a floor slab, it is normally positioned to be a part of the finished surface. This would indicate that the designer expects considerable movement at these junctions. The terrazzo should butt these plates with a metal strip between the terrazzo and the plate.

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TECHNICAL BULLETIN #S-7

8/13

(Formerly TB#16-B)

CEMENT TERRAZZO SYSTEM USING FINE AGGREGATE

The NTMA does not recommend a 100% fine aggregate system.

This bulletin deals with terrazzo floor systems using 100% fine aggregate in sizes 1/8 inch or less.

If a system of fine aggregate in a terrazzo topping is specified and installed, the following may result:

Surface checking may occur. These shrinkage-type hairline fissure “mud cracks” normally develop during the initial cure period.

There may be dislodging of the fine aggregate during the initial grinding operation. When using 100% fine aggregate, the matrix could lose some of the strength normally provided by the larger aggregate. Furthermore, the fine aggregate does not achieve the necessary bond with the cement binder to withstand the initial shock of the grinding. Thus, the chips are potentially more easily dislodged.

Discoloration may occur. The surface may appear to cure unevenly due to the 1/8 inch thickness of the terrazzo topping. Cement terrazzo systems are designed to incorporate #1 and #2 size chips. A maximum of 15% fine chips can be considered in combination with the larger size chips.

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TECHNICAL BULLETIN #S-8

8/13

(Formerly TB#17)

DIVIDER STRIPS FOR THIN-SET CEMENT TERRAZZO SYSTEMS

This bulletin deals with the two designed strips used with thin-set terrazzo systems: the T-strip and the L-strip, which is also known as the angle strip.

A performance study of the T-strip concluded that this strip should not be used with cement terrazzo for the following reasons:

The design of this strip provides a wide horizontal metal flange that projects out on both sides to support the vertical portion of this strip. Although it provided an excellent surface to adhere to the substrate, it also provided a weak factor to terrazzo systems. It is generally understood that cement products do not bond as well to metal. Thus, when this strip is used, the material bridging over the metal flange becomes a possible problem. If the finished surface area receives a sharp impact, this could result in a crack running parallel to the strip. If the impact covers the overall area of this strip line, both sides could be affected in the same manner.

We are now suggesting the use of the L-strip, which has a single horizontal foot or flange. We suggest that the epoxy-adhesive be spread on the upper side of the flange while anchoring such strips to the substrate. While the epoxy is still in a plastic state, sprinkle fine grit, such as fine sand/marble chips, to create a mechanical bond for the terrazzo topping on the horizontal flange.

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TECHNICAL BULLETIN #S-09

8/13

(Formerly TB#18)

INITIAL APPEARANCE OF NEW CEMENT TERRAZZO FLOORS

There can be a significant difference in appearance between a new floor and one that has been given time to age.

Terrazzo traditionally improves with age. While a terrazzo floor may initially lack the outstanding aesthetics expected, generally the client can be assured that with the natural cure and the passing of time, the floor will soon manifest the beauty for which terrazzo is recognized.

With some terrazzo floors, the finished aspect of shading can vary especially darkened areas along divider strips or in corners. Substantial water is used in the composition of the terrazzo system as well as the curing, grinding, grouting, and polishing stages. The excess water will dissipate and escape through the finished surface.

To ensure a good cure, it is necessary to retard this moisture evaporation. Therefore, the terrazzo is sealed with a penetrating-type sealer. This further increases the system's curing time. The trapped moisture will migrate to the area adjacent to the strips where there is a break in the sealer, which causes some discoloration. It is also not unusual for this moisture to create efflorescence that may tarnish metal dividers. In some terrazzo colors, this efflorescence will appear as an even color when compared to the normal color of a completely cured and moisture-free installation.

This can be remedied by maintenance personnel using an 80 grit or finer 3-M type screen mesh pad under the scrubbing machine during their normal maintenance procedures.

The building must be climate controlled, and the floor thoroughly cured before this is effective. Curing time will vary depending upon temperature, humidity, and ground water conditions. The screen pad should not be used after the efflorescence, or the tarnish is removed.

Although the surface may appear dry, the entire terrazzo system contains a great amount of moisture that must dissipate to achieve a uniform color. Sometimes this moisture will wick laterally until it finds a point of least resistance at the divider strips, which has minute openings along the strip lines. Therefore, the terrazzo surface adjacent to the strips will often be a different color from the balance of the panel, which may also have a cloudy, mottled appearance.

Depending on job conditions, the moisture creating the non-uniform appearance will disappear within a 3-to-6-month period with normal maintenance.

There is no need for alarm when a mottled appearance is seen. This non-uniformity is a normal characteristic of the product and will correct itself. It is beyond the control of the terrazzo installer.

Over time, the aesthetics of your terrazzo floor will increase with normal maintenance.

Note: This does not apply to epoxy terrazzo systems

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TECHNICAL BULLETIN #S-10

8/13

(Formerly TB#19)

COMPRESSIVE STRENGTH OF CEMENT TERRAZZO UNDER-BED & TOPPING

UNDER-BED

This material is normally mixed on the job site, although transit mix is used in some cases. Transit mix consists of 4 parts of coarse concrete sand and 1 part of type 1 Portland cement. Sufficient potable water is added to produce a 2-to-3-inch low slump.

This low slump material is required for two primary reasons: to minimize the amount of anticipated shrinkage and to enable the installer to walk on this concrete surface immediately in order to insert the divider strips.

When properly mixed, this under-bed material will have a compressive strength between 1,800 and 3,000 psi. This depends on the coarseness of the sand available in the area.

TERRAZZO TOPPING

The under-bed supports the terrazzo topping. The compressive strength of the topping varies between 4,000 and 7,000 psi.

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TECHNICAL BULLETIN #S-10

8/13

(Formerly TB#19)

COMPRESSIVE STRENGTH OF CEMENT TERRAZZO UNDER-BED & TOPPING

UNDER-BED

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TECHNICAL BULLETIN #S-12

8/13

(Formerly TB#25)

SUBSTRATE FOR BONDED TERRAZZO

This system's performance is wholly dependent on the concrete substrate to which it is attached. The terrazzo contractor should inspect such substrates before commencing work. If the condition of the surface will adversely affect the performance of the finished terrazzo, such defects should be brought to the attention of the general contractor and the architect. Some common problems are:

1. Use of a liquid curing agent on the substrate will prevent bonding of the terrazzo. To obtain a bond when a curing agent is used, it is necessary to open the pores of the concrete slab by abrading the surface by grinding. Expenses for the abrading, unless called for in the terrazzo specifications, should be the responsibility of others. Claims that a curing agent will dissipate with water or air are seldom true. Do not rely on the curing compound dissipating with water or air.
2. A common substrate problem is the presence of structural cracks. The terrazzo contractor is cautioned to photograph, chart and report in writing any structural cracks that could interfere with the performance of the floor. Such open cracks should not be ignored since these cracks will eventually appear on the surface of the finished terrazzo.
3. The minimum thickness for bonded terrazzo is 1 3/4 inches. Less thickness will compromise the performance. Less than the desired thickness should be brought to the attention of the general contractor.

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TECHNICAL BULLETIN # S-13

8/13

(Formerly TB#28)

Monolithic Terrazzo Over Metal Deck Construction

Monolithic terrazzo has two limitations: it will precisely follow the flatness profile of the substrate and it will show all shrinkage and/or moving concrete cracks as they will inevitably transfer into the terrazzo topping. We presently have no categorical remedy for the latter.

Monolithic terrazzo is best used when it can be installed over a slab on grade that has been properly designed and installed in a manner to prevent or at least minimize random concrete cracks.

Typically, metal deck concrete construction has no controls for cracking and is therefore not a good substrate to receive monolithic terrazzo.

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TECHNICAL BULLETIN #S-14

8/13

(Formerly TB#29)

MONOLITHIC TERRAZZO SYSTEM

Monolithic terrazzo is bonded directly to a concrete substrate, which is typically installed by others. The performance is wholly dependent on the integrity of that substrate.

The directly bonded terrazzo's behavior will coincide with that of the substrate. Any control or construction joints in the substrate should be referenced directly into the terrazzo.

Any cracking that develops in the slab will reflect to the terrazzo's finished surface. It is beyond the control of the terrazzo contractor to prevent these cracks. By following the recommendations of the ACI 36OR-10, plus curing, substrate cracks and curling can be kept to a minimum.

If cracks do develop, it is recommended that filling these cracks be delayed until several months after the completion of the job to allow the building to acclimate.

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TECHNICAL BULLETIN #S-15

8/13

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FILLING PINHOLES IN A CEMENT TERRAZZO FLOOR AFTER THE SEALER HAS BEEN APPLIED

It is essential to remove all sealers and other foreign matter from the floor surface. A stripper will remove a water-based acrylic terrazzo sealer. Follow by scrubbing the floor surface with a coarse brush or using an approximately 60 grit screen mesh pad or equivalent diamond pads. Four passes, two in each direction, should be enough to assure a clean surface. Vacuuming is recommended to remove all dislodged foreign matter from the holes. When re-grouting affected area, it is important that there is no water in the pinholes and the grout is of drywall spackle or mayonnaise consistency. Residual water in the porosity can result in grout shrinkage, and the problem will re-appear after polishing is complete.

To ensure proper curing of grout, either the use of latex admixture and/or covering of grout with plastic are recommended.

Remove all surface grout from the terrazzo surface, preferably by using a standard-sized scrubber equipped with diamond pads or a screen mesh pad. Clean up and allow the surface to dry before applying terrazzo sealer.

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CRACK DETAILING & JOINT TREATMENTS FOR MONOLITHIC TERRAZZO SYSTEMS

MONOLITHIC TERRAZZO

Monolithic terrazzo has many years of successful history as cement terrazzo system. These systems are traditionally placed directly onto a prepared structural concrete slab.

CONCRETE JOINTING: SETTLEMENT & CRACK CONTROL

Concrete has been the standard flooring substrate in the commercial construction industry for many years. The concrete industry has developed many industry guidelines and recommendations to minimize cracking.

Cracks in concrete are a result of any number of issues, including volume change during the curing process, load deflection, settlement cracks and cracks induced from thermal stresses, which are typically due to non-climate-controlled environments during the construction process. While shrinkage cracks, which account for most concrete cracking, become static once the volume change from curing is complete, any crack has the potential to become a dynamic, moving crack under thermal and load movement stresses. To accommodate dynamic loading, slabs should be designed for maximum deflection of $L/360$.

DISCLAIMER

The details contained herein provide general information to use as a starting point for detailing site conditions that frequently occur on monolithic terrazzo projects.

They represent generally accepted practices of terrazzo contractors and suppliers across the United States under typical circumstances. These details do not replace the direction or advice of an architect or engineer regarding a specific project or for specific project conditions. The architect or engineer must specify movement joints and show location and details on drawings.

It is not the intent of this guide to make movement joint recommendations for a specific project. For your project(s), you should consider contacting an NTMA Contractor Member in your area to discuss details that may be most applicable for a given circumstance/location.

To mitigate cracking and curling in concrete at thin set cement terrazzo areas follow recommendations in ACI 36OR-10.

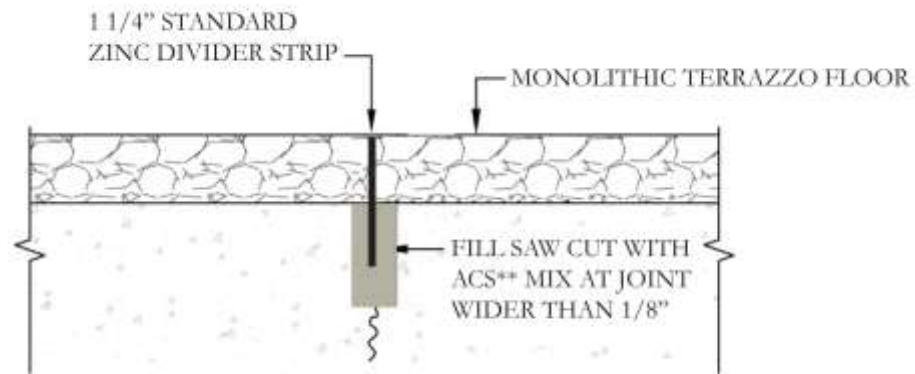
Terrazzo divider strips must precisely follow the concrete joint – even if crooked.

Terrazzo divider strips are not flattening or leveling devices. They must adhere tightly to the concrete.

Tooled edges on concrete joints are not to be used at areas to receive thin set cement terrazzo systems.

Detail 1. Contraction Joint (also called saw cuts)

The term "Contraction Joint" is taken from ACI 302 document to maintain consistent nomenclature with the concrete and engineering industry.

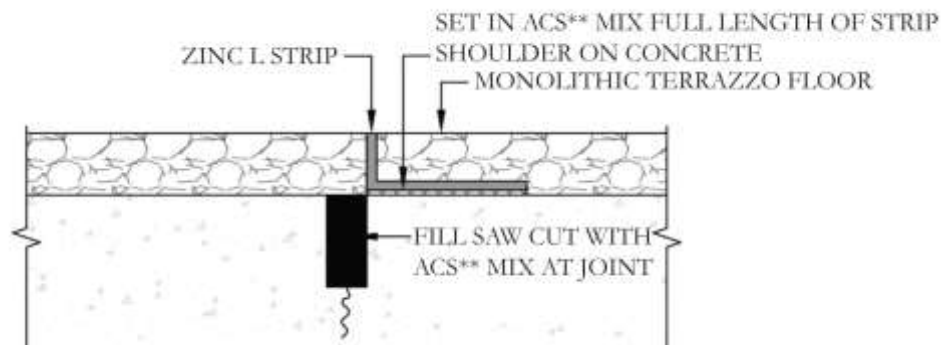


*Care should be taken by concrete contractor to provide a straight joint, placed in coordination with design teams consideration of final grid pattern. Square edges encouraged, tooled edges discouraged.

**ACS stands for Acrylic Cement Sand

Detail 2. Optional Joint Detail for Contraction Joints (Wider than 1/8")

This detail provides the designer the option of installing a low profile 16 gauge divider strip, in lieu of the filled back strip in detail 1. This detail provides limited movement compared to detail 1.

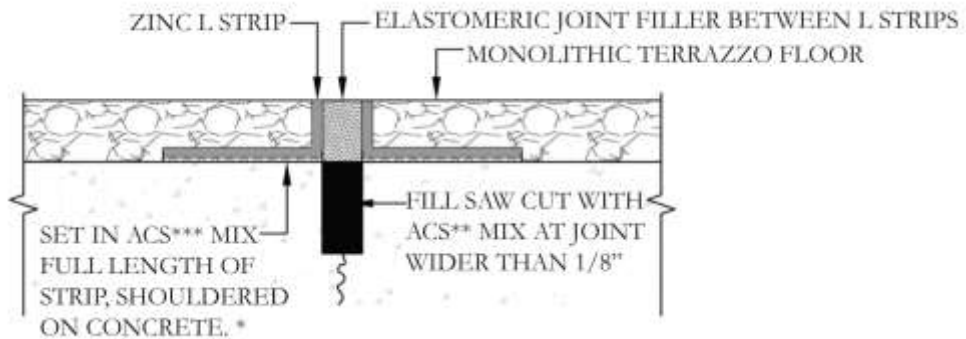


*Care should be taken by concrete contractor to provide a straight joint, placed in coordination with design teams consideration of final grid pattern. Square edges encouraged, tooled edges discouraged.

**ACS stands for Acrylic Cement Sand

Detail 3. Optional Contraction Joint (also called saw cuts/control joints)

The term "Contraction Joint" is taken from ACI 302 document to maintain consistent nomenclature with the concrete and engineering industry.



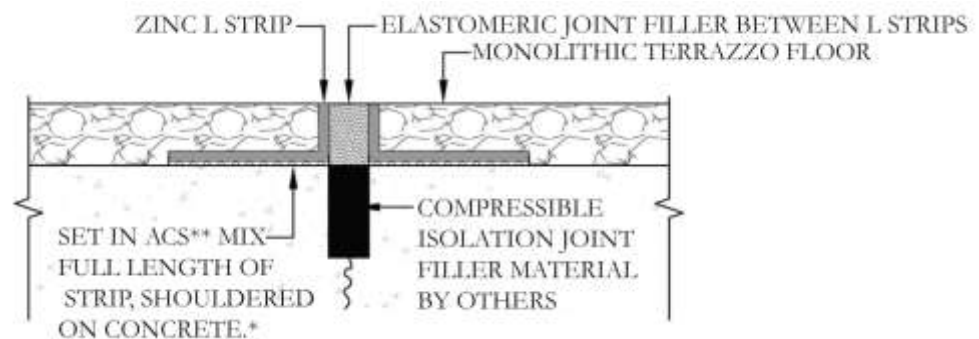
*Care should be taken by concrete contractor to provide a straight joint, placed in coordination with design teams consideration of final grid pattern. Square edges encouraged, tooled edges discouraged.

** This detail must be used for radiant heated floors

***ACS stands for Acrylic Cement Sand

Detail 4. Isolation Joint

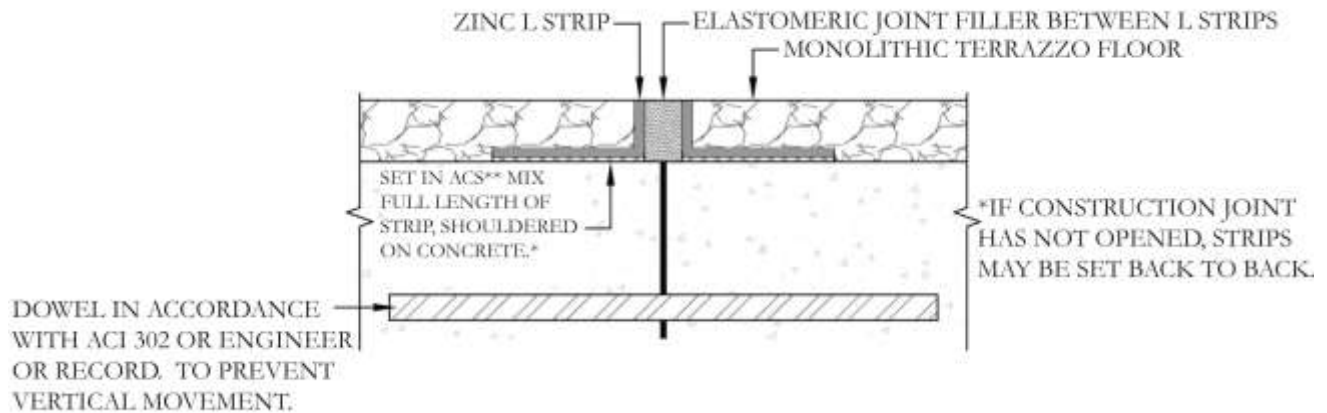
Slabs to receive terrazzo flooring should accommodate Isolation Joints where the slab is separated from the load bearing columns or walls for this specific purpose.



*Care should be taken by concrete contractor to provide a straight joint, placed in coordination with design teams consideration of final grid pattern. Square edges encouraged, tooled edges discouraged.

***ACS stands for Acrylic Cement Sand

Detail 5. Construction Joint (Next Day Pour Where Joint Has Eased Shoulders or Has Opened.)



*Care should be taken by concrete contractor to provide a straight joint, placed in coordination with design teams consideration of final grid pattern. Square edges encouraged, tooled edges discouraged.

***ACS stands for Acrylic Cement Sand

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TECHNICAL BULLETIN #S-17

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CLEANING CEMENT TERRAZZO

A problem that frequently occurs with new terrazzo floors is a cloudy or milky surface appearance. Contractors often meet with little success in their efforts to eliminate clouding because they most often attempt to correct the situation with repeated applications of the same materials and procedures that permitted the original difficulty.

The condition is created by the basic chemistry relating to the hardening of cement.

The components of Portland cement powder change their physical and chemical form when combined with water. The result is calcium hydroxide, better known as lime, which is produced at a rate of about 0.6 of a lb. for each pound of cement used. Most of this converted lime is used to bind the terrazzo together, but there is a certain amount of free lime that remains on the surface and in the pores of the floor after the final grinding.

Water by itself is capable of dissolving only about one-sixtieth of the free lime. The remainder must be disposed of by other means. Clear water flushing and scrubbing will not be totally effective in removing all the free lime from the pores of a new terrazzo surface. A detergent action is needed.

Terrazzo cleaners should be neither acidic nor highly alkaline; they should be neutral.

Clouding is created when cleaners react with the residue of free lime on the floor, which causes insoluble calcium scum. Repeating the cleaning procedures with the same materials only adds to the condition. Applying a sealer or wax on top will lock in the scum under the transparent shield. This makes everything worse, for the sealing film must then be removed to expose the source of the problem for corrective treatment. This magnifies the problem as now the sealer must be removed to correct the problem.

This situation can be minimized by thoroughly cleaning the floor with proper chemicals before using any sealers or other film forming surface treatments. Neutral detergents thoroughly clean a floor without reacting to or combining with any free lime deposit or residue.

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TECHNICAL BULLETIN #S-18

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(Formerly TB #42-C)

CEMENT COLOR & SHADE VARIATIONS

It is important to understand the nature of Portland cement and what to expect in a new cement terrazzo floor.

Gray Portland cement is relatively economical and works well in terrazzo; but because it is not color-controlled in manufacturing, it is virtually impossible to fully control the shading in the field during terrazzo installation. These variations are more pronounced when used in conjunction with an aggregate or an aggregate blend that is monotone in color. It is best used when an economical floor is desired, and a color blend of at least 50% white aggregate with the remaining aggregate a distinct contrast in color. Even with this, day-to-day pours can sometimes be distinguished.

White Portland cement is more color-controlled in manufacturing. This type of cement works especially well when pigments are desired to achieve a particular matrix color. Therefore, white Portland cement is recommended in most cement terrazzo installations. When field conditions are controllable, white Portland cement terrazzo should be reasonably consistent after it is completely cured.

Both white and gray Portland cement can be affected by field conditions beyond the installer's control. These include temperature and humidity during curing and variations in aggregate moisture content. For instance, an area installed during winter months is likely to vary from an adjacent area installed during warmer months. It is important that areas likely to be subject to intense scrutiny, such as building lobbies, be installed in one phase if possible.

As the cement terrazzo cures and is well maintained, it will usually mellow into a more consistent appearance regardless of the color of the cement.

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MOTTLED APPEARANCE OF A CEMENT TERRAZZO FLOOR

It is not always possible to produce a terrazzo floor with an overall uniform color. This is due to various reasons, most of which are beyond the control of the terrazzo contractor.

Due to the characteristics and chemistry of the terrazzo composition, a certain curing period must take place after installation before the true color will be realized. This cure period will vary from job to job, depending on the job location, substrate, and atmospheric conditions.

It should be recognized that terrazzo and the under-bed are products created at the job site by blending several ingredients, including coarse sand, marble chips, Portland cement and water. When the under-bed is properly mixed and spread to an established level, it provides the support for the terrazzo topping which is 1/2 inch in thickness. This topping consists of Portland cement blended with marble chips and water to form a dense paste. During the installation and execution of the topping, all excess cement and water is extracted by a compaction method of rolling the surface with steel rollers. Once installed, one of the several recommended methods of retarding the cure is employed.

When the initial grinding and polishing takes place to expose the aggregate and finish the floor system, water is used to lubricate the process. Once the polishing is completed, it is essential to protect the floor surface from spills and stains during the balance of the construction period. A penetrating sealer designed especially for terrazzo should be applied.

This sealer does not only protect the finished terrazzo surface from construction abuse, but it also acts as a retarder that prevents rapid dissipation of the moisture used in the installation process.

This sealer will penetrate the terrazzo surface, but occasionally not uniformly. This is due to the variation of the porosity of the terrazzo. Thus, this penetrating sealer is not intended to produce a uniform finish on the surface. To achieve a uniform sheen to this floor, it is necessary to apply a surface water-based sealer. A solvent-based sealer is not recommended initially on a cement terrazzo floor system, as it is a non-breathing material. It prevents the moisture from moving upwards, thereby trapping the moisture. To escape, the trapped moisture must move laterally under the sealer to the weakest junction in the terrazzo system, which is the divider strip area.

This slow cure will result in a structural sound system, but the surface will initially have a mottled appearance. There may be a pattern of darker color at the strip lines compared to the center of the panel. Once this floor system is allowed to completely cure, it will reach a uniform color.

To speed up the cure, it may be necessary to remove the solvent-based sealer and allow the terrazzo surface moisture to dissipate vertically. A solvent-based sealer cannot usually be removed by stripping with a chemical. The only means of removal is polishing the entire surface.

Allowing the surface to remain open for as long as possible will produce a more uniform appearance.

In the initial year after installation, only water-based sealers should be applied to this floor. In the second year and beyond, a solvent-based sealer may be considered.

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TREATMENT OF CRACKS IN TERRAZZO

A thin-set terrazzo system's performance depends on the condition of the existing concrete slab. Quite often, the slab quality is less than desirable. Even attempts to repair cracks before applying the terrazzo topping result in many of the cracks still appearing on the finished surface. Epoxy resin applied over fiberglass cloth does rectify the problem in some cases but is not always completely effective. Where there is extensive cracking of a slab to receive epoxy terrazzo, it may be prudent to cover the entire area with a flexible liquid-applied crack suppression membrane.

If open cracks appear in the terrazzo surface, they can normally be traced back to the slab surface. It is characteristic of cement products to have surface shrinkage cracks so fine that they can be only seen when the surface is damp. This should not be construed to be an inferior application, as it has no effect on the integrity of the floor system. With this type of crack, it is suggested that they not be disturbed. With normal maintenance, such minute voids tend to close and eventually disappear as routine floor sealers penetrate/fill the voids.

SUGGESTED PROCEDURE FOR REPAIRING CRACKS IN TERRAZZO

1. Remove all sealers from the surface adjacent to the void. Rout the void and remove all loose material.
2. Blend the materials to match the color matrix by adding marble dust or pigment.
3. Place mixed materials into the void.
4. If the void is large enough and the intent is to disguise the line so it will blend into the rest of the floor, place aggregate matching the floor blend along the line. Tool off surface and allow it to cure.
5. When the material has hardened, sand the surface with a hand sander or small grinding tool using fine stones and then seal.
6. For some time, this area will be noticeable. With normal maintenance, however, the area will blend into the balance of the floor.

If there is continued movement the crack may re-open or move to a new location.

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CRAZING OF CEMENT TERRAZZO

Crazing is the development of fine random cracks or fissures on the surface of concrete caused by the surface layer shrinking.

In a new concrete slab that has been properly installed and cured, minute fractures often appear on the finished surface. This surface behavior, known as crazing, is related to cement product shrinkage and is beyond the control of the installer. This condition should not be construed as an inferior application as it is the nature of the product and has no effect on the integrity or performance of the system.

The same holds true for cement terrazzo. Through normal maintenance procedures of cleaning and sealing, such minute voids tend to close and eventually disappear as the routine sealers penetrate and reasonably fill such voids.

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TECHNICAL BULLETIN #S-22

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(Formerly TB#55)

PROCEDURE FOR PATCHING CEMENT TERRAZZO

Proper technique provides rewarding results. Be advised before commencing such work that a new terrazzo patch or added section will not initially match the existing floor. While the terrazzo contractor may have used the identical formula as the original floor, the results will not always be an exact match due to the following reasons:

The existing floor will have been subjected to maintenance procedures including sealers, waxes, and cleaners, all of which contribute to a change in floor color. The new terrazzo has yet to experience the sealers and cleaners that will change the overall color of the floor.

Marble is a product of nature. Although the new and the old have been mined from the same quarry, veining characteristics of the marble can change. **The color of the marble is beyond anyone's control.**

Because of UV light, maintenance and the natural aging process, the initial appearance of a patch may be different from the existing floor. However, it will eventually blend to attain a close match with normal maintenance and use.

It is suggested that consideration be given to resurfacing the entire old floor to restore the original finish, which will result in a closer match for the new patch.

Prepare void to receive new terrazzo by using a power saw or hand tools to cut a vertical wall into the existing terrazzo surrounding the void.

If the void or patch is of a small size, such as a 6-inch square or less, slightly undercut at the base of this edge. In some instances, a strip may be added next to the saw cut line for aesthetics or for cracking and movement purposes.

Remove all foreign matter from the surface to achieve proper bond and saturate void. Apply cement paste and scrub into the surface. Do not allow cement paste to dry before placing terrazzo composition.

Predetermine color of existing marble chips and matrix. Make any necessary modifications to achieve a close match of the existing terrazzo. We recommend a sample be made and submitted for approval before terrazzo placement.

With a ratio of 2 parts blended marble chips to 1 part of cement, add enough water to make plastic, place composition and level with a trowel. Seed additional marble chips of the same blend over the patch. Compact and extract excess cement and water from the composition.

Cover with paper or polyethylene sheeting to prevent rapid dehydration.

In the initial grind, use a 40 or finer grit stone until aggregate is exposed. Next, pass over area using 80 grit stone. Then thoroughly clean the area before grouting with the matching cement mixture. Cover the grouted surface with paper or polyethylene for at least 72 hours unless a cement accelerator is used. Perform final polishing with an 80 or finer grit stone. Seal patch with a penetrating type of terrazzo sealer.

Given time and proper maintenance, the new patch will ordinarily blend virtually inconspicuously into the balance of the existing terrazzo.

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TECHNICAL BULLETIN #S-23

08/13, 9/19, 01/21

(Formerly TB#56, 56-C)

RESTORATION OF TERRAZZO FLOOR & BASE

Prior to beginning the restoration process, all topical sealers and finishes must be removed. Once all sealers and finishes have been removed, grind with coarse grit stones or diamonds. Fine mesh silica sand can also be used if needed, all in the presence of water. Initial grinding for base can be done dry if needed with a vacuum attachment for dust collection.

Follow the initial coarse grind with medium grit stones or diamonds in the presence of water. This step for base can be done dry, if necessary, with a vacuum attachment for dust collection.

Cleanse the floor and base with clean water. Rinse thoroughly.

Remove excess rinse water and machine or hand-apply appropriate grout, to fill pinholes and other voids in the surface matching the matrix of the terrazzo floor. Make sure voids and pinholes are filled. Allow grout to cure prior to proceeding with the polishing process. Epoxy grout must cure for a minimum of 24 hours unless an accelerated hardener is used.

For cement terrazzo systems, cover the floor with polyethylene to prevent rapid dehydration of the grout.

The grout shall remain on the surface for a minimum of 72 hours unless a cement modifier is used.

Polish with fine grit stones or diamonds until all traces of the grout have been removed from the terrazzo surface. Base can be polished dry, if necessary, with a vacuum attachment for dust collection.

Thoroughly wash all surfaces with a neutral cleaner. Rinse with clean water and allow it to dry thoroughly.

Apply sealer per manufacturer's directions.

Optional: In toilet rooms, apply one or two coats of a UV stable chemical resistant sealer beneath and around the urinals to protect against the staining from urine.

Note: All work shall be executed with conventional terrazzo grinding equipment according to trade practice.

Note: Many options for high finish systems are available. The above instructions are the NTMA's baseline standard for refinishing terrazzo. Consult your local NTMA Terrazzo Contractor for additional information regarding other high finish options for terrazzo.

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TECHNICAL BULLETIN #S-24

09/13

GLASS & PLASTIC AGGREGATE IN CEMENT TERRAZZO

Precautions should be taken when considering the use of glass or plastic aggregates with a cement terrazzo system.

The design professional is encouraged to consult with the terrazzo contractor to determine options for aggregates, including color, shape, and size.

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TECHNICAL BULLETIN #S-25

8/13

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LINSEED OIL APPLIED TO CEMENT TERRAZZO SURFACES

This bulletin deals with the vintage use of a blend of linseed oil and turpentine or mineral spirits, which have sometimes been used successfully by terrazzo contractors on interior and exterior terrazzo surface.

Using this material on a cement terrazzo surface will permanently darken the aggregate and matrix and is impossible to remove. The linseed oil is diluted with the turpentine or mineral spirits, allowing the oil to penetrate but, not always in a uniform manner. The lower the concentration of oil in the turpentine, the more uniform the appearance will be. The depth of the penetration is dependent on the hardness and porosity of the surface materials.

CAUTION: Excessive amounts in any given area will result in a darkened shade, which is impossible to control. There are no protective qualities in such treatment. If this is the desire of the owner, there should be a solvent-based sealer applied over this oil treatment, especially in areas that use chemicals on exterior surfaces during winter months.

There is no way a contractor can guarantee the results as far as color uniformity is concerned.

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TECHNICAL BULLETIN #S-26

8/13, 9/19, 01/21

(Formerly TB#70)

PROTECTION OF SAND-CUSHION CEMENT TERRAZZO

The NTMA Specifications recommend that during the grinding and polishing procedures of a cement terrazzo application and after the initial grinding has been completed, the floor surface be grouted with cement to match the matrix used in the floor system. It further indicates that this grout material is properly cured to retard the cure for a minimum period of 72 hours before final polishing. The final polishing can be completed at any time beyond this 72-hour period, even several additional days or months, without affecting the final finish.

Very often demands are made of the terrazzo installer to polish the floor too early in the construction process when there are many trades yet to install or finish their work. By doing so, the general contractor should accept the responsibility of protection and maintenance of these floors when they are polished prematurely. If the finished terrazzo is not protected from other trades, it will often be badly soiled and marred. This creates difficulty in getting the owner to accept the floor. Accordingly, under these circumstances, it is best to delay final polishing and removal of the grout for as long as possible.

A second method of protecting a newly finished terrazzo floor is to cover the floor with a plastic sheeting material and plywood or other protection board. It is essential that all parties involved recognize that such covering will greatly retard the cure of the terrazzo floor. The floor is unable to breathe if the circulation of air is closed off. This often oxidizes the strips and creates a definite mottled appearance. Applying a sealer before covering further retards the curing.

Thus, the floor surface is protected, but it is now a matter of patience to allow enough time for the floor to cure. The installation contractor can do nothing to speed up the curing process.

- Note: Cement Terrazzo systems must cure for a minimum of seven (7) days prior to general construction from other trades working over top of the terrazzo floor. After the initial seven (7) day cure process, all heavy equipment being used over top of the Terrazzo floor (both during construction as well as once the building is in use) must be used over 3/4" thick plywood."

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TECHNICAL BULLETIN #S-27

8/13

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PAN-TYPE TERRAZZO TREADS

Screeding concrete for poured terrazzo stair treads without mechanical anchoring to the steel pan runs the risk of the tread becoming loose and hollow sounding. The terrazzo at the abutments to the metal will soon deteriorate under these conditions.

To avoid this situation, we recommended a method of anchoring using 1/4 inch metal rods in two directions (total of four) to act as a chair that elevates the wire mesh. Tack welding the mesh to the pan will allow the screed material to flow through the mesh and create a solid base for the terrazzo topping. TapCon type fasteners or welding a metal lath to the pan is also quite effective.

Precast terrazzo is generally more appropriate for many stair configurations.

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TECHNICAL BULLETIN #S-28

8/13

(Formerly TB#72)

CREATING ACCENT PANELS IN AN EXISTING CEMENT TERRAZZO FLOOR

This bulletin deals with an existing terrazzo floor where there is a desire to create design or a color change using accent panels. The accent panels are often different versions of terrazzo, marble, hard tile, granite, or metal inserts.

The required procedures are:

1. Remove the existing terrazzo where the accent panels are to be positioned by saw cutting straight lines to the size desired. The depth of the saw cut should be a minimum of 1/4 inch for terrazzo with an under-bed like sand cushion or 1-1/4 inch with a monolithic terrazzo system. With this depth of the cut, divider strips can be inserted.
2. With the saw cutting completed, remove the terrazzo topping. If the under-bed appears distressed by the removal, remove the under-bed down to the isolation membrane.
3. Place divider strips into saw cuts, replace the under-bed if required and follow with the material to be used for the accent panel. If a different terrazzo color is used, place the terrazzo topping 1/8 inch higher than the adjacent existing terrazzo to allow the grinding procedure to follow.

Since the grinding of the terrazzo will require the overlap of the existing terrazzo, it is necessary to establish a straight-line stopping point.

It is suggested that the entire terrazzo surface be polished to result in an overall uniform appearance.

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TECHNICAL BULLETIN #S-29

8/13

(Formerly TB#82)

TEMPERATURE REQUIREMENTS FOR INSTALLATION OF CEMENT TERRAZZO

Portland cement terrazzo systems contain water that is subject to freezing. Thus, it is a requirement that the room temperature be a minimum of 60°F and rise when pouring terrazzo.

It should be noted that the floor temperature is normally approximately 10 degrees below the existing room temperatures.

The temperature should also be maintained during the curing process, which is normally a minimum of 72 hours.

It is extremely important to strictly observe this temperature limitation.

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GRINDING CEMENT TERRAZZO

The initial grinding exposes the marble chips or other aggregates used in the composition of the 1/2 inch terrazzo. The initial grinding creates a shock to the aggregate used. Thus, the aggregate must be well anchored by the finishing process. The normal rolling seats will compact the aggregate as well as extract the excess water and cement. This produces the required density and reduces shrinkage.

The time lapse between placing and grinding depends on humidity and temperature. It is essential that terrazzo be placed in an ambient temperature above 60°F. Commence the initial grinding 1 to 5 days after placement. White Portland cement usually requires a shorter cure period than grey Portland cement.

Any delay in the initial grinding creates an increase in grinding costs. The hardness of the marble chips does not change, but cement binder does. The labor and material cost factors increase, with a decrease in productivity.

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FIXED PROJECTIONS IN SAND CUSHION TERRAZZO

A floating, un-bonded terrazzo system is listed in Association publications as the sand cushion system. The design requires that this 2-1/2-inch-thick system must be free to move independent of the supporting substrate. This is accomplished by a dusting of sand that acts as a parting agent.

Fixed embeds in the substrate, such as metal ducts or electrical conduits, will defeat the intent of this designed system. If this condition does exist, it is the responsibility of the terrazzo contractor to alert his general contractor to the potential problem.

It is trade practice to wrap galvanized diamond metal lath or wire reinforcement mesh over such projections. Regardless of how you prepare these areas, cracks are a distinct possibility and beyond the control of the terrazzo contractor.

If these obstructions are limited and exist only in remote areas, it is still possible to maintain the floating terrazzo system in areas away from the conduits. Create two control joints parallel to the sides of the conduits and bond the terrazzo system directly over and around the obstructions. Although there is no guarantee, the vicinity of the bond at these junctions would isolate the bonded areas from the balance of the floating floor system. Thus, it could help prevent any distress that might develop in the terrazzo at these points from creeping beyond the control joints.

If the obstructions are general throughout the entire area where terrazzo is required, you have no choice other than bonding the terrazzo system to minimize the cracking possibilities. If the obstruction cannot be buried in the concrete substrate, which is normal when this system of terrazzo is selected, they must be anchored tight to the slab and followed by the wrapping of the metal lath or wire mesh.

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TECHNICAL BULLETIN #S-32

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SHADE VARIATIONS IN CEMENT TERRAZZO FLOOR & BASE

White and gray Portland cement may not be uniform in color and may produce a shade variation in the matrix of the terrazzo floor and base.

The installation process of terrazzo base and the border is executed in a different manner compared to the terrazzo floor. When Portland cement is used in the topping, it is normal to expect some variations in the color between the two areas even if the same formulation has been duplicated.

The floor system is a fluid mixture placed, seeded, and compacted with heavy steel rollers that extract the excess cement and water. The base and border installation process requires a drier mix using a minimal amount of water in the terrazzo composition for attachment to the vertical surface. When working this material with hand tools only, the vertical base does not receive the same compaction that is present in the floor work. Aggregate density difference can often create a noticeable color variation between the floor and the base.

Precast base and stair treads may present this same issue of color variances because they are cast and finished in a shop rather than on site.

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TECHNICAL BULLETIN #S-33

8/13

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CEMENT TERRAZZO TOPPING PLACED ON UNDERBED

If the terrazzo installation is an interior application, it is essential the divider strips be anchored adequately into the cement/sand under-bed to prevent any movement. Frequently, the strips can be moved the second day after the under-bed placement. The terrazzo contractor must decide whether the placement should be delayed for another 14 to 48 hours to prevent bending of the strips in the compaction process of the terrazzo topping.

Normally, the terrazzo topping is placed over the under-bed within four days after the under-bed placement to create a good bond between the two systems.

Care should be taken to prevent damage to the exposed metal dividers strips. Steps should be taken to prevent construction dust from settling on the concrete under-bed as this will create a film that would cause bond failure between the topping and the under-bed.

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TECHNICAL BULLETIN #S-34

8/13

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CONCRETE MIX FOR STRUCTURAL TERRAZZO

The following is a suggested mix for the 3500-psi concrete under-bed in structural terrazzo.

430 lbs. Cement

100 lbs. Fly-Ash

16 oz. Admixture (Water Reducer)

1555 lbs. Fine Aggregate (Coarse Sand)

1600 lbs. Coarse Aggregate (Pea Gravel 3/8 inch - #8)

265 lbs. Water

Air Content, Calculated 3.5%

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TECHNICAL BULLETIN #S-35

9/16, 9/17

DIVIDER STRIPS IN DIRECT BOND SYSTEMS

Divider strips have three functions.

1. Divider strips allow for movement at the concrete joints.
2. Divider strips are used at the end of the day pours.
3. Divider strips create decorative panels and color patterns.

Divider strips do not prevent all reflective cracking. Divider strips are not to be used as flattening aids. They need to be tightly bonded to the surface of the concrete. Concrete slab installation shall follow ACI 302.1R recommendations including concrete depth, reinforcement, curing, joint spacing, joint depth and timeliness of installation. The concrete subsurface should be at the required flatness prior to the strip installation. Shimming of the divider strips to attempt this purpose is not recommended.

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Epoxy Terrazzo



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TECHNICAL BULLETIN #T-1

8/13

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SUGGESTED PROCEDURES FOR PREPARATION OF CONCRETE FOR EPOXY TERRAZZO SYSTEMS

New concrete surfaces to receive a resinous type thin-set terrazzo or industrial floor system shall have a light steel trowel finish. Before starting work, shot blast or aggressively abrade/roughen the surface per manufacturer's recommendations.

With a terrazzo thickness of 1/4 inch to 1/2 inch to be applied, it is necessary to create any pitch desired for slope requirements in the substrate.

If flatness of the surface is a priority, the substrate should not exceed 1/4 inch flatness tolerance in a 10 ft. span. If the slab exceeds this condition, it is suggested that these facts be submitted in writing to the general contractor and architect before commencement of application. Written approval from these sources is required before proceeding.

New concrete shall not be cured with a chemical agent and shall have a cure of at least 28 days when a resin thin-set is being applied. In renovation work, all residual grease, oil and other foreign matter shall be removed. Then vacuum blast, shot blast or scarify the slab.

Check- on- grade slabs for moisture vapor transmission (MVT) before starting installation. If present, bring to the attention, in writing, of all parties concerned, including your resin supplier.

Substrate cracks should be charted and brought to the attention of all concerned, indicating that such slab defects can reflect into the finished surface.

When faced with such defects that would hinder the performance of the terrazzo floor, suggest use of a crack isolation membrane. This involves labor and material costs to others. It should be understood that employing such procedures will not assure that any or all substrate defects will not surface because these are strictly precautionary measures.

REPAIRS

All cracks shall be reported in writing to the general contractor and architect before installation commences. Cracks should be repaired by others according to approved trade practices.

Patching and leveling of the slab shall be made using materials that are compatible with terrazzo topping materials before proceeding with the installation.

Note: The flatness tolerance of 1/4 inch in a 10 ft. span shall be determined by the following method:

Place a 10 ft. straightedge anywhere on the surface. At no point should the gap between the straightedge and the surface exceed 1/4 inch.

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TECHNICAL BULLETIN #T-2

8/13

(Formerly TB#113)

RIDGES IN EPOXY TERRAZZO

The NTMA office is occasionally informed of a terrazzo installation demonstrating an interesting phenomenon that the industry has labeled “mole trails.” This condition is typically noticed well after thin-set epoxy terrazzo has been installed and the building is occupied.

Some of the areas where this phenomenon may occur include:

- A slab with saw cuts type control joints, typically at column lines.
- An artistic terrazzo where the saw cuts do not purposefully align with the terrazzo divider strips.
- Other random substrate cracking.

A common installation practice would be as follows:

- Saw cuts and/or cracks are cleaned out and filled with a rigid epoxy.
- Saw cuts and/or cracks are then bridged with a fiberglass reinforced specialty flexible epoxy crack suppression membrane system per manufacturer’s directions.
- The thin-set epoxy matrix terrazzo system is finally installed normally over the crack suppression membrane with the rest of floor areas.

Epoxy terrazzo has a greater coefficient of thermal expansion than the concrete. Depending on the direction of temperature change the epoxy terrazzo will move to a greater degree than the concrete. If the temperature is rising, the result is a ridging of the terrazzo. This typically but not always occurs at the saw cuts, cracks or other breaks in the concrete resulting in a ridging of the terrazzo. This condition is so minute that it often is barely detected with a straight edge. Certain critical lighting conditions might show a line through the terrazzo that appears as a mini-crease or as if a mole is burrowing under the terrazzo. Thus, the NTMA has given the name “mole trail” to this condition.

This condition should not be recognized as a defect in the terrazzo. By reviewing the installation procedures demonstrated by terrazzo contractors, it would be concluded that the crack suppression membrane is working as intended, bridging the moving joint in the slab, and keeping the joint from reflecting up through the terrazzo as a fissure.

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TECHNICAL BULLETIN #T-3

8/13

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MOISTURE VAPOR TRANSMISSION FOR EPOXY TERRAZZO

Moisture vapor transmission (MVT) tests should be performed on all slabs that are to receive epoxy terrazzo. HVAC systems should be in full operation for test results to be valid. To obtain predictive results, the test must be conducted at use temperature and humidity.

The preferred test is the ASTM-F-2170 deep probe test. The threshold is commonly 75% to 80% relative humidity.

In some cases, such as a post-tensioned slab, the ASTM-F-2170 cannot be done. In these cases, the ASTM-F-1869 Anhydrous Calcium Chloride test is performed. The MVT should be below 3 lbs. per 1000 sq. ft. /24 hrs.

Thresholds and readings should be confirmed with the resin supplier

The ASTM 1869 Anhydrous Calcium Chloride test is not recognized as valid for lightweight aggregate concrete.

MVT or RH above the threshold values mentioned above has been known to result in blistering and or even result in a loss of bond of epoxy terrazzo floors.

Record the ambient temperature and humidity during the test period.

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TECHNICAL BULLETIN #T-4

8/13

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EPOXY TOPPING WITH CEMENT UNDER-BED

The industry has met with demands for an increase in the availability of deeper colors than those normally available in cement terrazzo. The recommended 2% maximum of color pigment in a 94# bag of Portland cement does not create the deep color saturation that may be desired.

With Portland cement colors having limitations, it is now possible to use an epoxy topping with its unlimited colors successfully over a cement under-bed. This can sometimes be within a 3-to-5-day period after placement of the underbed.

It is essential to perform a calcium chloride and/or deep probes RH test to assure that the under-bed has cured sufficiently to allow the placement of the epoxy terrazzo topping. A moisture control system is usually recommended. It may be necessary to consult the epoxy supplier for their requirements.

When using only a part of this floor system with epoxy binder, place the epoxy first wherever marble chips/cement is used. This system is to be used with logos, inserts or small areas for the epoxy portion. Full coverage of the under-bed with the epoxy is not recommended. Place the under-bed up to the normal $\frac{3}{8}$ inch depression while holding the cement type material at the $\frac{1}{4}$ inch thickness

In the grinding process, the grinding procedure is the same as the conventional terrazzo systems. When wet grinding, measures must be taken to avoid wetting of the terrazzo under-bed from introducing excessive moisture. The grouting is required to use an epoxy grout on the resin sections and the cement on the conventional areas. Polish as usual.

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TECHNICAL BULLETIN #T-5

8/13

(Formerly TB#06)

WATERPROOF MEMBRANES FOR EPOXY TERRAZZO

Some specifications require that a thin cross-section terrazzo system of 1/4 inch or 3/8 inches in thickness to be applied over a waterproof membrane.

Where this occurs, it is essential that the waterproof membrane and the veneer topping material be compatible. If the proper bond is not achieved from both a mechanical and a chemical adhesion, you can generally predict that the system will not perform satisfactorily as designed.

Asphaltic or sheet-type products are not recommended as waterproof materials under thin cross-section terrazzo. The recommendation is to use liquid applied membranes only. Consult your resin supplier for further information.

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TECHNICAL BULLETIN #T-6

8/13

(Formerly TB#O6-A)

ISOLATION MEMBRANES FOR EPOXY TERRAZZO SYSTEMS

To prevent minor cracking from mirroring to the finished terrazzo surface, it is the terrazzo installer's responsibility to inspect all surfaces to be covered with the terrazzo product and inform the general contractor about any defects that could interfere with the expected performance of the product. If distress of the substrate exists, it is the responsibility of others to correct this surface to the satisfaction of the terrazzo installer. It is a prudent practice that the distressed areas are photographed and charted for future reference.

The acceptable method of correction available is to use flexible epoxy membranes.

With either method, the preparation of the substrate must be completed prior to executing the following:

1. In a situation where only a few cracks in the substrate require attention, they should be appropriately repaired with a bandage approach.
2. If the distress is general and extensive or in cases of intricate patterns, such as artwork, 100% coverage with a liquid-applied flexible membrane is suggested. Some manufacturers recommend a reinforcing medium be incorporated in their system. Check with the producer/supplier for specific details.

ISOLATION SHEET MEMBRANE SYSTEMS

Several isolation membrane sheet systems are available for a distressed concrete substrate. Sheet membrane systems are not recommended.

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TECHNICAL BULLETIN #T-7

8/13

(Formerly TB#07-A)

EPOXY TERRAZZO OVER CEMENT TERRAZZO

This bulletin details requirements for installing an epoxy terrazzo floor system over an existing cement terrazzo system.

CLEANING THE SURFACE

The preparation of the floor requires removal of all foreign matter, such as chemical coatings, waxes, and sealers. This should be done by terrazzo grinding machines abrading the existing surface or by shot blasting. An acid bath will not remove sealers or waxes from this surface.

MOISTURE CONSIDERATIONS

Existing terrazzo, particularly sand cushion and bonded systems can hold a lot of moisture. It is imperative that moisture tests be performed, and, if needed, a manufacturer-recommended moisture vapor control system applied.

SELECTING AN UNDERLAYMENT

Once the floor is cleaned and any moisture issues are dealt with, it is essential to use a manufacturer-recommended liquid-applied membrane.

This membrane prevents the divider strips used in the original floor from mirroring or cracking on the new surface. If the existing strip pattern is used in the new work, a membrane over these strips is not required. However, since it is difficult to line up the strips directly, it may be prudent to use the membrane anyway.

FINISHING YOUR SYSTEM

Once the membrane is placed and cured, bond the angle-type divider strips to the membrane in the architect's pattern choice. Once the strips are set, place the topping in accordance with the NTMA specifications for epoxy terrazzo.

SUMMARY

While there is no guarantee that cracks will not appear, the above procedures should be considered a preventative measure. This system has performed successfully on many similar applications.

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TECHNICAL BULLETIN #T-8

8/13

(Formerly TB#07-B)

EPOXY TERRAZZO OVER CONCRETE SUPPORTED BY A METAL DECK

DEFLECTION CRACKS

It is common to discover during the preparation of the substrate that the surface has a series of deflection cracks that develop after the placement of the concrete. The terrazzo contractor is responsible for inspecting the surface to be covered. They need to alert the general contractor in writing about any defects that would hinder the terrazzo's performance. Terrazzo installation should begin only after the defects have been corrected by others. Ignoring this could result in such cracks mirroring to the terrazzo surface.

TREATING DEFLECTION CRACKS

Although there are proven methods for overcoming most cracks from reflecting, it is a precautionary measure and cannot absolutely guarantee prevention. An additional cost will be incurred for this procedure unless a flexible isolation membrane has already been specified and included in the bid of the system.

The flexible liquid membrane system is optionally applied over the entire surface approximately 40 mil in thickness.

If there are only a few deflection cracks, it is commonly recommended that each crack be isolated and treated independently. The liquid membrane would be applied over the crack. The epoxy terrazzo system supplier should recommend the most suitable flexible liquid membrane to ensure undivided, single source responsibility.

Follow the epoxy formulator's recommendations for priming.

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TECHNICAL BULLETIN #T-9

8/13

(Formerly TB#07-C)

EPOXY TERRAZZO & LIGHTWEIGHT CONCRETE

Metal pan composite decks are ideally topped with conventional mix designs of Portland cement/ordinary aggregates for structural concrete. On occasion, “haydite” (commonly expanded shale) or other lightweight aggregates are substituted for pea gravel or other dense stone to reduce the dead loads of slabs in a specific structural design.

Lightweight structural concrete retains moisture and significantly extends the drying time. As with any concrete substrate, proper testing for moisture content is critical to ensure slabs are sufficiently dry to receive the terrazzo flooring.

For epoxy matrix terrazzo systems on lightweight structural concrete, the NTMA recommends the following factors be considered and followed for the benefit of all parties involved. The mandatory requirements for the moisture mitigation system must comply with the resin manufacturer’s recommendations.

Additional precaution: Lightweight aggregate concrete slabs often experience extraordinary degrees of shrinkage cracking, such as when higher than optimum water to cement ratios mix design slabs are placed on steel decking, which usually occurs to facilitate easier pump-ability in larger, open areas without some provision of control joints.

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TECHNICAL BULLETIN #T-10

8/13

(Formerly TB#08)

CRACK ISOLATION MEMBRANES & THERMAL EXPANSION

OVERVIEW

Membranes have been used to minimize epoxy terrazzo fissures due to concrete crack propagation caused by substrate moving and cracking. Other issues, such as thermal changes below or even above the slab as in the case of solar exposure through window walls, may contribute to heaving and shrinkage in the terrazzo independent of the substrate.

To aid in diminishing the conditions noted above, the epoxy terrazzo should be directly bonded to the slab whenever possible.

The use of a membrane and reinforcement should generally be confined to conspicuous cracks in the substrate and to joint treatment.

CRACK TREATMENT

Cracking of the concrete, mainly due to slabs shrinkage, is inherent with most large area projects. After cleaning the fissures, fill them with an epoxy and then treat them with a liquid-applied membrane and approved reinforcement as a bandage technique. The membrane manufacturer can recommend the installation thickness and suggested width of the applied membrane.

JOINTS TREATMENT

Control joints and saw cuts should be honored in the terrazzo overlay whenever possible. Refer to the NTMA architectural details for divider strip placement.

Where design issues prevent this, substrate joints are normally filled with a 100% solids epoxy and then treated with a membrane and reinforcement per manufacturer's recommendations.

Note: Floor slabs that manifest excessive cracking may require full coverage of the membrane, with or without reinforcement, per manufacturer's recommendations. When doing this, it is important to have appropriate joints incorporated in the terrazzo to accommodate potential movement in the slab.

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TECHNICAL BULLETIN #T-11

8/13, 9/16, 9/17

(Formerly TB#120)

GLASS AGGREGATE IN EPOXY TERRAZZO

Glass aggregate has become prevalent chip for the design mixtures of terrazzo flooring. Glass chips offer a unique color palette not available with from marble chips, throw in the “green” benefits of recycled glass and you have a very compelling argument for incorporating glass aggregate in your terrazzo design mix.

It is important to understand the technical and performance characteristics of such new products. The National Terrazzo and Mosaic Association (NTMA) has discovered isolated examples of fractured glass in an already installed terrazzo floor.

When 100% or much of the aggregate is either clear glass or very light-colored glass (without contrasting colored aggregates of either glass or marble) and is often used in a dark matrix, the result may be less than desirable. Some of the aggregate may fracture, leaving a “frosty or crystal-like appearance”. This phenomenon may be aggravated by large size and shape of glass such as #2.

The cause of these conditions may be:

- 1) Excessive point load
- 2) Heavy objects being rolled or dropped on the floor.
- 3) Construction abuse.
- 4) Heat/friction during burnishing of floor.

The NTMA suggests you share these “field observations” with designers. The NTMA recommends that clear and light-colored glass in dark matrices be kept to a “design minimum.”

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TECHNICAL BULLETIN #T-12

8/13

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RELEASE OF TRAPPED MOISTURE FROM A CONCRETE SUBSTRATE COVERED WITH EPOXY TERRAZZO

Drill 1/4 inch or larger holes through the terrazzo topping and penetrate the substrate 1/2 to 1 inch in depth. It is suggested that these holes be positioned about 8 to 12 inches apart. This distance would depend on the existing conditions.

Clean all debris from these holes.

Allow holes to vent for several days to permit moisture to escape or evaporate. Increasing air circulation and/or heat will speed the process.

When the trapped moisture has dissipated, proceed with the following:

Use breathable tile grout to closely match the matrix color or blend a combination of the following:

1 part Portland Cement Type 1 (Color to match original floor matrix color)

3 parts fine mason or white silica sand

The liquid ratio should contain water, acrylic or latex additive.

The composition should be blended and forced into the drill holes. On the surface of each hole, a marble chip that has been used in the original floor system should be positioned according to trade practice. Once this material has hardened, grind or sand each marble chip flush with the floor surface. Seal the surface with an acrylic-type sealer,

Each filled hole can often allow vapor accumulation to be relieved through the permeable grouting material.

While used successfully in certain situations, this process is not an absolute remedy for conditions of excessive moisture entrapment or transmission.

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TECHNICAL BULLETIN #T-13

8/13

(Formerly TB#32)

BRASS DIVIDER STRIPS IN EPOXY TERRAZZO

While innumerable jobs are installed without significant blue/green staining with brass divider strips, occasionally epoxy matrix and chips can be stained blue/green due to the reaction of brass with some epoxy curing agents, water, and oxygen. This corrosion triangle of the copper content in brass, an amine curing agent and water, in the presence of oxygen creates a blue/green, water-soluble cuprammonium complex. This material can stain epoxy matrix and/or aggregates and adjacent materials. It is more easily seen on light colors of matrix or light colors of aggregate. The phenomenon affects not only brass, but also bronze or any other alloy containing copper.

Other factors including humidity and duration of wet grind pacerina *in situ*, flash cooling and condensation caused by evaporation of some trowel lubricants, and high pH compounds present in sealers or cleaners.

Extraordinary diligence by the terrazzo contractor will lessen the probability of discoloration. However, one cannot always guarantee the total absence of some degree of blue/green staining in epoxy projects where copper-alloy strips and/or inserts are used.

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TECHNICAL BULLETIN #T-14

8/13

(Formerly TB#55-B)

PROCEDURE FOR PATCHING EPOXY TERRAZZO

The terrazzo contractor may have used the identical formula as the original floor, the results will not always be an exact match due to the following reasons:

The existing floor will have been subjected to maintenance procedures including sealers, waxes, and cleaners, which contribute to a change in floor color. The new terrazzo has yet to experience the sealers and cleaners that will change the overall color of the floor.

Marble is a product of nature. Although the new and the old have been mined from the same quarry, veining characteristics of the marble can change. The color of the marble is beyond anyone's control.

Because of UV light, maintenance and the natural aging process, the initial appearance of a patch may be different from the existing floor. However, it will eventually blend to attain a close match with normal maintenance and use.

It is suggested that consideration be given to resurfacing the entire old floor to restore the original finish, which will result in a closer match of the new patch.

PROCEDURE

Prepare areas where terrazzo will be placed. Saw cut the edges of the existing terrazzo with power tools. If a divider strip is near the termination point, place cut approximately 1/8 inch inside of the strips and use hand tools to remove balance of terrazzo to the strip.

Where no strip exists, cut a straight line and shark tooth edge with hand tools to create an irregular edge. All edge cuts should be created at 90 degrees.

Remove all foreign matter from the concrete substrate. After the surface is completely dry, apply the recommended primer and immediately follow with the placement of epoxy terrazzo topping.

Color matching is essential for quality work. Predetermine the color of existing aggregate and matrix. Make any necessary modifications to achieve a close match to existing terrazzo. We recommend that a sample be made and submitted for approval before terrazzo placement.

Mix patching material according to epoxy supplier's specifications and direction.

In normal climate conditions and with the temperature meeting specification guidelines by manufacturer, the epoxy terrazzo will have a cure period of approximately 12 to 24 hours.

In the initial grind abrade until aggregate is exposed. Thoroughly clean area before grouting with the matching epoxy grout supplied by epoxy manufacturer. Once grout has set, the final polishing can be performed with 120 grit stone. Seal new patch with the appropriate type of terrazzo sealer.

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TECHNICAL BULLETIN #T-15

8/13

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EPOXY TERRAZZO OVER AN EXISTING EPOXY FLOOR

Normally, the reason for covering an existing epoxy terrazzo floor is to change the color or strip pattern.

The preparation of this substrate surface is essential for the performance of the new flooring system. It must be ground or mechanically abraded to remove all foreign matter from the surface. Acid washing will not remove maintenance chemicals from this surface.

CAUTION: While it has been normal practice to position divider strips in large size panels, there are many cases where small panels were used. Where the latter exists, use fiberglass-reinforced liquid membrane over the existing joint lines/pattern. Alternatively, you may cover 100% of the existing floor surface with a flexible liquid membrane to prevent the existing divider strips from telegraphing to the finished surface.

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TECHNICAL BULLETIN #T-16

8/13

(Formerly TB#75-A)

VAPOR BARRIER PLACEMENT

Whenever an epoxy terrazzo system is to be installed directly onto a slab on grade or below, a sand layer must be below the vapor barrier.

If the sand bed system is specified, the architect should be advised of the potential problem of latent moisture being retained in the sand bed. With temperature changes, such as the building being heated or cooled, the moisture in the sand may migrate to the surface and may cause random blistering and often significant loss of bond of the terrazzo system.

The current recommendation of ACI 302.1 and ACI 302.2 is an efficient vapor barrier must be placed immediately below the concrete slab. The concrete should be placed with a low water-to-cement ratio, and it should be allowed to hydrate sufficiently before placing a non-breathing floor system. Moisture vapor transmission (MVT) testing is necessary before installing to determine if the slab is ready to be topped.

To be completely prudent, unless full waivers absolving the terrazzo system are in hand, do not take the risk of installing epoxy terrazzo on slab on-grade or below that is not poured directly on an effective vapor barrier. Cases of loss of adhesion of the epoxy have become very common.

Have the provider of that substrate or owners' independent inspection service give the assurances of readiness and performance, especially for moisture, but also cracking and flatness.

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TECHNICAL BULLETIN #T-17

8/13

(Formerly TB#76)

EPOXY TERRAZZO TO REPLACE AN EXISTING FLOOR COVERING

An epoxy terrazzo floor system can be installed over a concrete substrate that originally had another flooring material adhered to its surface. Some of these adhesives can have a penetrating action, thus often saturate the concrete slab. To avoid problems, the concrete surface must be properly prepared to receive the epoxy flooring system.

The concrete substrate must be mechanically abraded to the point that there is no trace of the previous floor's adhesive or contaminants.

If the floor is not cleaned properly, contamination from the adhesive can migrate into the liquid epoxy prior to its curing. This causes discoloration and creates weaker bonds with the concrete surface.

Once the floor has been properly prepared and there are no moisture problems present, the epoxy system can be installed.

There is no simple remedy for correction of an epoxy flooring system which has discolored because of being installed over an improperly prepared floor.

The best solution to prevent costly and repeated callbacks is to take time to properly prepare the surface before installing the epoxy flooring system.

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TECHNICAL BULLETIN #T-18

8/13

(Formerly TB#78)

EPOXY TERRAZZO OVER EXISTING CEMENT TERRAZZO

The existing terrazzo surface must be abraded after all sealers and waxes have been removed. Once this surface is cleaned, apply a flexible liquid membrane recommended by the epoxy supplier 30 to 50 mils in thickness over 100% of the floor surface. This is called an isolation membrane that prevents the metal divider strips in the old terrazzo from shadowing or cracking the new surface.

Once the membrane has cured, apply a bonding agent to this surface as recommended by the epoxy matrix supplier.

Install and finish the epoxy terrazzo as outlined in the Association's guide specifications.

This preparation procedure is essential to the performance of the finished product. No short cuts should be taken.

Note: Where the strips are placed directly over existing divider strips, the membrane will not be necessary.

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TECHNICAL BULLETIN #T-19

8/13

(Formerly TB#82-A)

TEMPERATURE PARAMETERS FOR EPOXY TERRAZZO

The installation of thermo-setting reactive materials is significantly affected by ambient factors and especially substrata conditions. Extreme heat and cold will change the viscosity, cure time and workability, all of which affect the quality of the terrazzo installation.

The NTMA recommends the installation of thin-set epoxy terrazzo, including ancillary components like primers, moisture mitigation, crack suppression membranes, etc., proceed only when surface and ambient temperatures are maintained between 60°F and 90°F.

It also should be noted that temporary heating systems, typically called “salamanders” or fuel oil fired blowers, should be properly engineered to avoid build up of CO² or hydrocarbons residue. Such elevated levels of marginal air quality can cause the curing resins to amber or otherwise discolor. This ambering is usually topical and possibly removed in the grinding steps. However, it can be a stubborn stain and may become a particular issue, especially in light colors if it occurs in the grouting phase on the final floor finish.

Consult with your terrazzo contractor to discuss in more detail any temporary heating and other applicable site conditions for a quality installation.

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TECHNICAL BULLETIN #T-20

8/13, 9/16

(Formerly TB#88)

EPOXY TERRAZZO SEALER

A typical epoxy terrazzo system consists of marble chips and epoxy resin. The marble chips may have porosity, whereas the matrix is essentially non-porous. Thus, a sealer applied to this surface normally penetrates only the marble chips. The sealer on the matrix would have little or no penetration. Sealing is an essential requirement to exhibit the true color of the marble chips and maintenance is required to keep the color and gloss.

The NTMA recommends that all terrazzo is sealed. NTMA guide specification for epoxy terrazzo indicates that a sealer is applied as recommended by the manufacturer. The terrazzo contractor installs this product. It is trade practice that the terrazzo installers use a sealer that meets the NTMA specifications. This sealer will produce the desired aesthetics if properly applied.

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TECHNICAL BULLETIN #T-21

8/13

(Formerly TB#96)

EPOXY TERRAZZO OVER PLYWOOD AND CEMENT BOARD

While concrete is the most common substrate, this Association suggests favorable experience with an epoxy terrazzo system being applicable for interior use over a double layer of exterior grade plywood or plywood/cement board.

EXECUTION

It is assumed that whenever this system is considered, wood joists or trusses are involved with occupied space below. Thus, consideration may be given to sandwiching a damping board or sheet membrane between the exterior plywood sheets to reduce the noise created by activities over this floor.

It is recommended that the wood joists are a minimum of 2x10s, spaced 12 to 16 inches on center—the 12 inches is preferred to lessen deflection with heavy loads. The exterior plywood layers should be at least 3/4-inch in thickness. The second sheet should be staggered – no joints aligned with that below – or lap-joined from the joints in the initial sheet and adequately screwed. The use of an adhesive along with the mechanical fasteners assures positive bond between the plywood and better flexural strength of the system. The sound damping layer is placed between these two plywood sheets.

The upper layer of plywood is best positioned with 1/8-inch gaps around all edges versus a tight joint.

This is to be followed by filling all open joints with epoxy mortar and then covering with approximately a 4-inch width of liquid epoxy membrane with fiberglass mesh embedded, all according to manufacturer's directions. The results of this procedure will make the joints at least as strong as the plywood itself.

Cement board has been used as the top layer in this system. Extremely stringent fire ratings or moisture resistance may be a consideration.

Place dual "L" angle-type divider strips "bookended", back-to-back with a 1/8-inch space between around the perimeter and at column lines. This void is filled with a selected colored flexible sealant after the placement/finishing of the terrazzo.

All divider strips are anchored in the desired design to the plywood with an epoxy adhesive compatible with the epoxy matrix. It should be understood, all divider strips employed play no role in the control of the epoxy terrazzo system unless they are used in the control joint position. They are strictly for aesthetics, separating various colors or forming a design.

The epoxy terrazzo matrix is applied to the clean and dry plywood or cement board surface per standard trade practices and selected manufacturer's directions.

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TECHNICAL BULLETIN #T-22

8/13

(Formerly TB#97)

TERRAZZO FOR ELEVATOR CABS

Epoxy terrazzo offers a system that can be used for elevator cabs; cement systems may not accommodate the abuse/stresses of the movement anticipated. Consider the following when using epoxy terrazzo.

1. The epoxy terrazzo must be 3/8-inch in thickness.
2. We do not recommend using a coved vertical epoxy terrazzo base in such cabs. If straight base without a cove is desired, it should be separated from the floor by a flexible caulked joint.
3. Exterior grade plywood at least 3/4-inch thick—the 1-1/4-inch-thick tongue/groove board is even better—which in turn should be firmly attached to the metal steel deck of the cage. This requires not only a screw attachment, but also an adhesive between the metal and the plywood.
4. Their Association suggests the following plywood placement: The longer joints on the 8 ft. sides that butt adjacent sheets should be spaced 1/8 to 1/4-inch apart; on the 4 ft. side, the space should be 1/16 to 1/8-inch.
5. Once the plywood is anchored, the surface must be sanded to remove all foreign matter from the board opening the pores of the wood.
6. All joints must be filled with an epoxy and a 4-inch-wide band of liquid epoxy membrane and fiberglass mesh placed over each joint.
7. Depending on the size of the cab, angle divider strips can be positioned and anchored to the plywood with the epoxy material. The use of dividing strips is optional, as these strips are not necessary in this system.
8. The epoxy terrazzo is placed in the color of your choice and finished in the normal way.
9. Alternatively, large panels of precast epoxy terrazzo may be poured and finished in a shop and set with an epoxy thin-bed mortar.

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TECHNICAL BULLETIN #T-23

8/13

(Formerly TB#109)

HEAVY TOP ANGLE STRIPS IN EPOXY TERRAZZO

This bulletin deals with 1/8-inch, 1/4-inch or any two component “heavy top” strips when used in a 1/4-inch-thick epoxy terrazzo system. The strip design is such that it is virtually impossible to properly grind and polish the terrazzo without destroying the integrity of the exposed strip. There is only a thin layer of metal above the top edge of the 20-gauge L-shaped lower section, and it is often completely removed during the grinding process.

Consequently, the strip is split into three sections and has an undesirable appearance. This Association recommends that only single component strips be used in 1/4-inch-thick epoxy terrazzo.

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TECHNICAL BULLETIN #T-24

08/13, 09/16, 04/17, 10/18, 09/19, 01/21, 04/22

(Formerly TB#111)

CRACK DETAILING & JOINT TREATMENTS FOR EPOXY TERRAZZO

Thin-set epoxy was traditionally placed directly onto a prepared structural concrete slab. The crack resistance of the terrazzo was based primarily on two functions. First, the epoxy terrazzo formulations were extremely high in tensile strength and second, they did not contain excess water that leads to shrinkage cracks or volume change during the curing process.

Epoxy formulators introduced flexible epoxy membranes that are installed at a nominal 40 mils. Thickness and engineered for high tensile strength and high elongation, relative to the epoxy binder matrix. These membranes have become industry standard for crack detailing and, in some cases, full slab coverage prior to the installation of the thin-set epoxy terrazzo.

CONCRETE JOINTING: SETTLEMENT & CRACK CONTROL

Concrete has been the standard flooring substrate in the commercial construction industry for many years. The concrete industry has developed many industry guidelines and recommendations to minimize cracking.

While there have been many improvements in mix designs, placement techniques and industry standards, the concrete industry has not perfected the placement of slabs without cracks.

Cracks in concrete are a result of any number of issues, including volume change during the curing process, load deflection, settlement cracks and cracks induced from thermal stresses, which are typically due to non-climate-controlled environments during the construction process. While shrinkage cracks, which account for most concrete cracking, become static once the volume change from curing is complete, any crack has the potential to become a dynamic, moving crack under thermal and load movement stresses. To accommodate dynamic loading, slabs should be designed for maximum deflection of $L/360$. Cracks should be filled with low modulus epoxy. Not flexible epoxy membrane.

***Tile/stone type divider strips are not to be used in either
cement or epoxy terrazzo installations.***

DISCLAIMER

The details contained herein provide general information to use as a starting point for detailing site conditions that frequently occur on epoxy terrazzo projects.

They represent generally accepted practices of terrazzo contractors and suppliers across the United States under typical circumstances. These details do not replace the direction or advice of an architect or engineer regarding a specific project or for specific project conditions. Architect or engineer must specify movement joints and show location and details on drawings.

It is not the intent of this guide to make movement joint recommendations for a specific project. For your project(s), you should consider contacting an NTMA Contractor Member in your area to discuss details that may be most applicable for a given circumstance/location.

To mitigate cracking and curling in concrete at epoxy terrazzo areas follow recommendations in ACI 36OR-10.

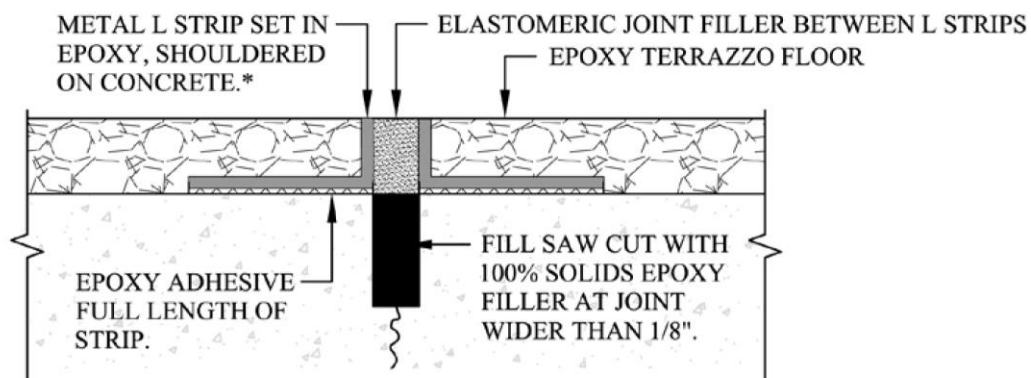
Terrazzo divider strips must precisely follow the concrete joint – even if crooked, to mitigate cracking in the terrazzo system.

Terrazzo divider strips are not flattening or leveling devices. They must adhere tightly to the concrete.

Tooled edges on concrete joints are not to be used at areas to receive epoxy terrazzo.

Detail 1. Contraction Joint (also called saw cuts/control joints)

The term “Contraction Joint” is taken from ACI 302 document to maintain consistent nomenclature with the concrete and engineering industry.



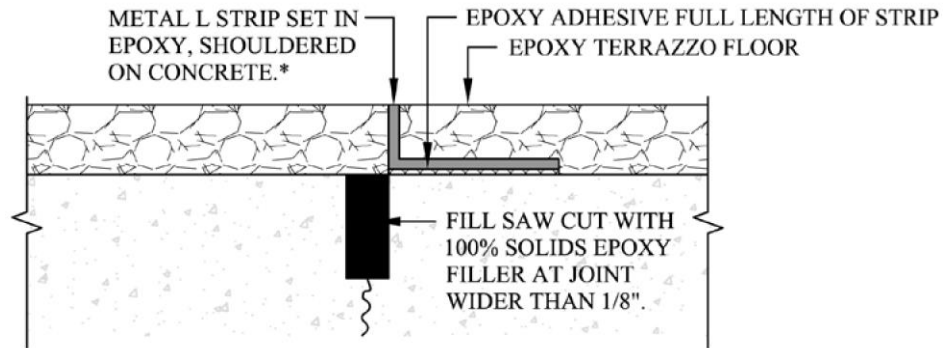
Scale: Full Scale

*Care should be taken by concrete contractor to provide a straight joint, placed in coordination with design teams consideration of final grid pattern. Square edges encouraged, tooled edges discouraged.

**This detail must be used for radiant heated floors.

Detail 2. Optional Joint Detail for Contraction Joints

This detail provides the designer the option of installing a low profile 16-gauge divider strip, in lieu of the filled back strip in detail 1. This detail provides limited movement compared to detail 1.

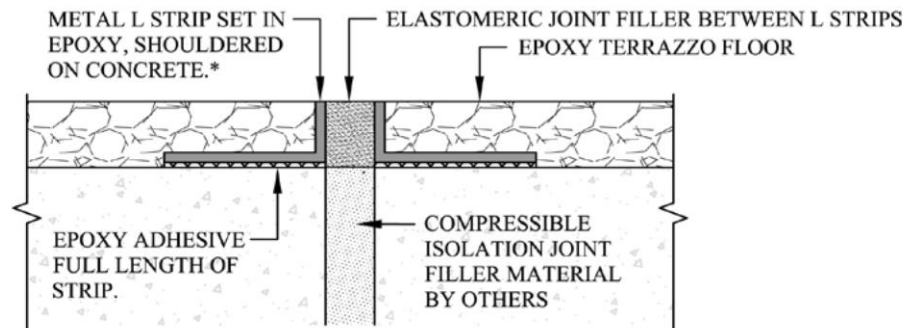


Scale: Full Scale

*Care should be taken by concrete contractor to provide a straight joint, placed in coordination with design teams consideration of final grid pattern. Square edges encouraged, tooled edges discouraged.

Detail 3. Isolation Joint

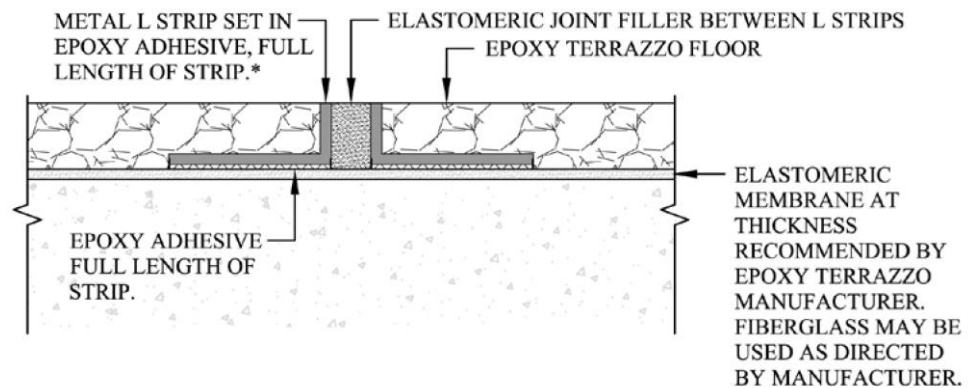
Flexible epoxy membranes are engineered to accommodate movement in the horizontal plane. They are not engineered to accommodate movement in the vertical plane, because of vertical shear due to substrate settlement or excessive deflection. Slabs to receive terrazzo flooring should accommodate Isolation Joints where the slab is separated from the load bearing columns or walls for this specific purpose.



Scale: Full Scale

*Care should be taken by concrete contractor to provide a straight joint, placed in coordination with design teams consideration of final grid pattern. Square edges encouraged, tooled edges discouraged.

Detail 4. Terrazzo Control Jointing Over Full Elastomeric Membrane



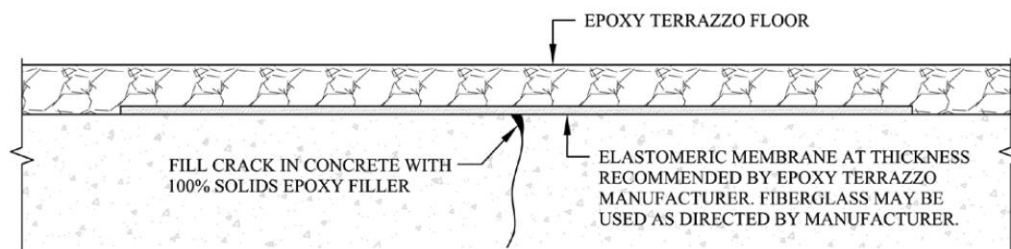
Scale: Full Scale

The use of divider strips (L strips) should be considered in areas where floor temperature changes may occur.

Such as glass walls and/or sky lights if joints are to be used, the design teams must determine spacing.

For spacing contact local manufacture or contractor.

Detail 5. Random Crack Detail: For Cracks over 1/16" Width before Surface Preparation



Scale: Full Scale

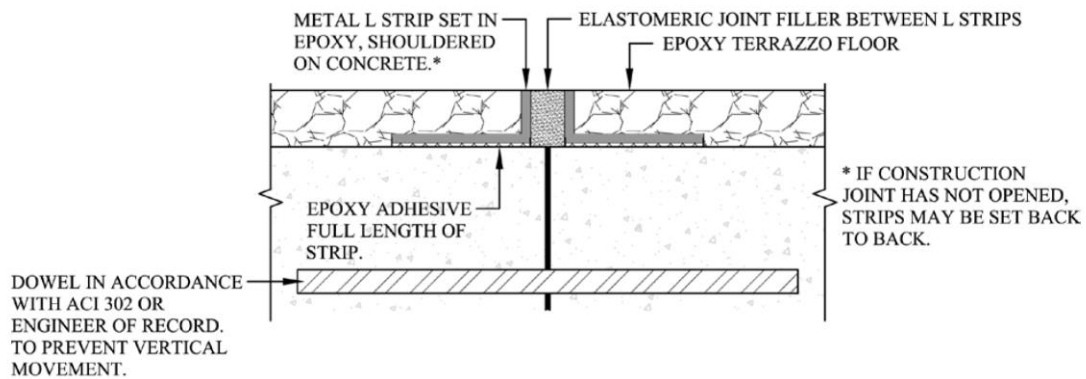
Treatment of cracks is in anticipation of horizontal movement.

Vertical movement will reflect through epoxy terrazzo.

Moving cracks may reflect through terrazzo, often seen under critical lighting as micro-crease or mini-mole trail, even though no actual fissure

has opened, the membrane has performed as intended. If the joint is straight, you can place strip (control joint) over the crack, but no overhang.

Detail 6. Construction Joint (Next Day Pour Where Joint Has Eased Shoulders or Has Opened)



Scale: Full Scale

See buried contraction joint. Refer to detail 3.

*Care should be taken by concrete contractor to provide a straight joint, placed in coordination with design team's consideration of final grid pattern. Square edges encouraged. Tooled edges discouraged. Detail can be used to elevated slab where construction joints occur and at relative stress cracking over beams and column lines.

Tile/stone type divider strips are not to be used in either cement or epoxy terrazzo installations.

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TECHNICAL BULLETIN #T-25

8/13, 10/21

(Formerly TB #112)

USE OF ALUMINUM OR ALUMINUM ALLOY DIVIDER STRIPS IN EPOXY TERRAZZO

Aluminum or aluminum alloy divider strips are acceptable to use in epoxy terrazzo if the strip does not come in direct contact with an uncured cement substrate. Where the substrate is not cured, it is imperative that the contact surface of the strip be fully covered with a non-cement adhesive or setting material.

Because of the potential for corrosion due to a negative reaction with Portland cement, the use of aluminum or aluminum alloy divider strips is not recommended with cement terrazzo systems.

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TECHNICAL BULLETIN T-26

11/2012

(Formerly TB 16-C)

Fine Aggregate in Epoxy Terrazzo

If using #0 or finer aggregates, the NTMA generally recommends a maximum of 50 percent in the terrazzo mix design.

Epoxy terrazzo installations where other than the traditional sizes and proportions of aggregates have been used, may result in less than satisfactory results. When using more than 50 percent #0, or finer size aggregate, pinholes are unavoidable beyond what would be normally be acceptable in a terrazzo floor. The pinholes will not only be highly visible in ordinary light but in a light color matrix these will fill with dirt and be easily visible.

It is very difficult to achieve color uniformity, especially in larger panels particularly with extensive use of clear glass, where disparate batch mixes abut with a fine line but distinct delineations. A contrast of multiple colors of fine aggregates is preferred over one-color aggregate. The use of a small amount of a dark color aggregate can make these issues less pronounced.

The liberal use of trowel lubes can also exacerbate the color disparities of batches within a panel of divider strips.

The result normally appears more like a monochromatic floor, except having no pigmented topcoat to camouflage the inherent imperfections in the terrazzo.

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TECHNICAL BULLETIN #T-27

9/19, 07/21

FILL UNDER EPOXY TERRAZZO

In many cases, there is a need for fill material under epoxy terrazzo to bring the subfloor to the proper elevation. The NTMA recommends a blend of epoxy resin and hard aggregates such as sand, marble chips and pea gravel. The exact blend or ratio of products will depend on the depth of the fill. Consult with the epoxy manufacturer to get a recommended blend and aggregate loading.

These blends will produce the best in properties such as compressive strength, tensile strength, and flexural strength. Epoxy will cure faster resulting in a shorter downtime than cement. In addition, no moisture needs to leave the system.

Joints in the concrete should be referenced through the fill material. This can be accomplished using a temporary partition or by marking the existing joint, installing the fill and saw cutting through the fill.

CAVEAT: Epoxy has very good water resistance if the water remains on the surface. However, water that enters the composite will cause the very thin coating surrounding the aggregate particle to swell and lose integrity. Cracking, swelling and loss of adhesive properties may occur. Fill materials that have been subjected to water infiltration are subject to removal.

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TECHNICAL BULLETIN #T-28

7/21, 10/21

HALO effect in aggregates

Overview: The terrazzo industry refers to a slight shadow or darker ring that can develop around the perimeter of aggregates (see picture) as a halo. This is typically the result of epoxy that can migrate into the stone. This phenomenon is common particularly with light color or larger Venetian aggregate.

The factor that can have a major impact is the stone itself. Some stones are softer and more porous. While it can occur in terrazzo, it is not a common problem.

Optics: There are no detrimental, maintenance or life cycle concerns with haloing. Since floors should be judged from a standing position, haloing should also not be an aesthetic concern to building owners and designers. Haloing is not a common issue but also is not 100% avoidable. It is most common with white marble aggregates as they tend to be more porous in nature.



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TECHNICAL BULLETIN #29

10/21

"Blushing"

OVERVIEW

The term "Blushing" refers a terrazzo floor that has a film or amber discoloration. Depending on the formulation, epoxy materials can and will blush under certain job site conditions due to environmental conditions.

CAUSE: The hardener used in a two-part epoxy resin reacts with the moisture and carbon dioxide in the air to form an oily, greasy film on the surface of the flooring system. The greater the humidity and or lower the temperature, the more this blush will occur.

Primers are typically prone to blushing due to the chemistry. However, epoxy grout coats can blush due to the chemistry and the very thin film in which they are applied. Epoxy terrazzo can blush, but the grinding procedure will remove this film.

FIX:

Any blush must be removed before the application of the next layer. Blush will interfere with the adhesion of the next coat. Check with suppliers for specific recoat times. Blushed epoxy can be cleaned with hot soapy water.

If removal of the blush is not practical, a broadcast of sand into the uncured epoxy can be used to provide mechanical tooth and therefore a good bonding surface.

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Rustic Terrazzo



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TECHNICAL BULLETIN #R-1

8/13

(Formerly TB#60)

EXTERIOR RUSTIC TERRAZZO JOINTS

The following is a suggested treatment of joints in exterior rustic terrazzo applications in cold climates.

Metal or plastic divider strips are not recommended for exterior systems because the composition of the terrazzo will shrink away from the divider strip during the initial curing stage, which allows moisture to penetrate the system. This will cause problems, especially in cold weather climates. The system that we suggest reduces the problem of such openings occurring.

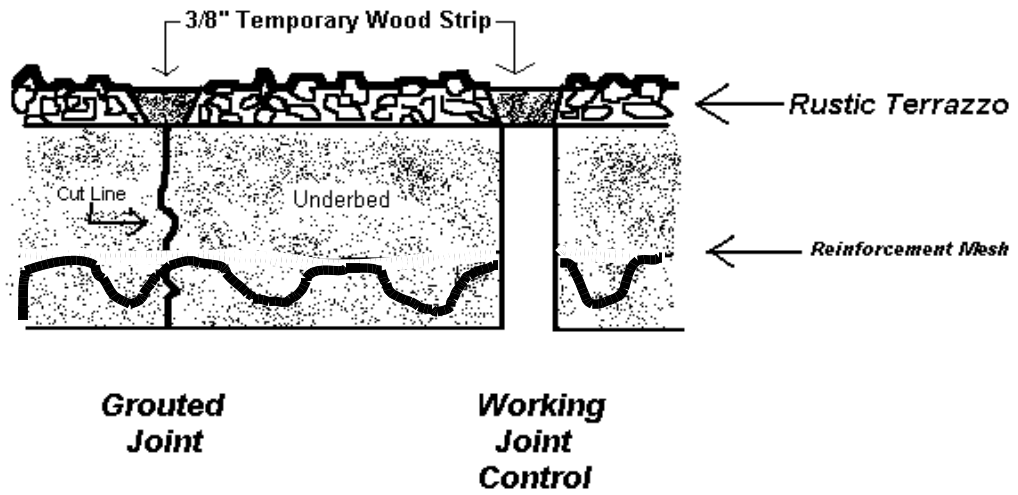
In lieu of the use of divider strips, we suggest that temporary wood strips especially designed for this purpose be positioned in the desired locations and removed after the topping has cured as outlined below:

After placing and screeding the under-bed to the desired elevation and while the under-bed materials are still in plastic stage, cut lines approximately 1 · inch deep into the surface at the desired joint locations. After the under-bed has hardened, the next day place and anchor special wood strips, $\frac{3}{8}$ inch X · inch, aligned directly over the cut lines. Anchoring is suggested by means of using finishing nails through the wood into the cut line. This holds the strips straight during pouring of the topping.

Where it is necessary to position such a working joint, place a foam material of $\frac{3}{8}$ inch thickness by the depth of the under-bed. Attach a special wood strip to this foam using a tape method. Be sure to cut all mesh 1 inch short of this type of joint. (See detail.)

Removal of the wood strips shall not be considered until several days after the pour of the topping, which depends on the weather and job conditions. With sufficient time, the wood will separate, providing ease of strip removal. Place a pourable joint sealant in these voids of the desired color. Tool joint to desired finish.

(Detail on next page)



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RUSTIC EXTERIOR TERRAZZO SYSTEMS AIR-ENTRAINING AGENT

When rustic terrazzo systems are used in cold weather climates, it is essential that an air-entraining agent be added to the system.

It should always be added to your under-bed mix and in the rustic terrazzo topping when the blend includes fine aggregate or fine sand.

It has proven to be ineffective when added in the mixture of aggregates sized #1 or larger with cement. If used in such a formula, it would not affect the finished product and would be a waste of material.

There are several air-entraining agents available. This Association recommends using the liquid additive that provides the proper amount for the system, which is between 3% and 5% of air.

The following formulation has been used with success in this industry:

Under-bed: Add 3/4 fluid ounces of this agent per 94 lbs. of Type 1 cement along with the proper amount of coarse sand.

Topping: 200 lbs. of aggregate
 94 lbs. of Type 1 cement
 5 to 9 lbs. of fine sand
 3/4 ounce of air-entrainment
 4 to 5 gallons of potable water

Screed Coat: Add 3/4 fluid ounces of air-entrainment per sack of cement.

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TECHNICAL BULLETIN #R-3

8/13

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RUSTIC TERRAZZO SYSTEMS

Rustic terrazzo installed according to this Association's published guide specifications will provide an exterior walking surface with the longevity, aesthetics and safe walking surface for which terrazzo systems are known. The following are items of caution. To achieve the desired results, it is essential that the installer have the necessary expertise to execute this work. The rustic terrazzo system involves being able to create a uniform texture of the aggregate on the finished surface along with tightness and flatness of the aggregate. Etching the matrix between the aggregate takes skill to avoid loss of aggregate. Too little etching can affect the aesthetics.

If the location of the installation is in a cold climate, a liquid air-entraining agent should be incorporated (6% air plus or minus 1%) to minimize freeze-thaw cycle damage in the under-bed. Packaged air-entraining cement should not be considered. Air-entraining agent has no effect on the rustic topping unless 8% of fine silica sand is added to the cement/aggregate composition. Installation temperature should be maintained at a minimum of 45°F around the clock to assure quality results.

There is a choice to be considered relative to control joints in this system. Due to the texture of the finished surface, metal or plastic strips will be exposed on the sides as well as on the top surface. This is often considered a pipeline for moisture penetration. The use of a plastic zip strip provides the means to control the anticipated shrinkage and moisture penetration. The removal of the cap of this strip provides a neat void in which to insert a backer rod and a flexible sealant that would be slightly recessed below the height of the adjacent aggregate surface. The latter system provides function as well as aesthetics to these necessary joints.

The second choice is a saw cutting procedure that must be executed within a 24-hour period following the placement of the rustic terrazzo system. Like the other choice, the saw cuts receive a sealant for function and aesthetics.

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TECHNICAL BULLETIN #R-4

8/13

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RUSTIC TERRAZZO WITH VEHICULAR TRAFFIC

It is necessary to strengthen the slab and rustic terrazzo system wherever vehicle traffic is expected. Assuming that the area in question is placed over graded, compacted soil, the total thickness of the slab and the terrazzo system should be a minimum of 9 inches. The concrete slab requires a minimum 4,000 psi and the terrazzo system under-bed should be of equal strength.

The terrazzo topping should be bonded using an epoxy bonding agent at least 30 mils. in thickness. The topping should be of a minimum of $\frac{1}{8}$ inch in thickness, using aggregate suitable to take the expected traffic load. The aggregate should be $\frac{3}{8}$ inch to $\frac{1}{2}$ inch in size to provide proper anchoring. Smaller aggregate could become dislodged.

In a bonded system, the essential control joints can be positioned 6 to 8 ft. apart. It is not recommended that metal or plastic strips be used in such areas. In lieu of these, we suggest temporary wood filler be positioned to form the panel size. The wood strips used for this purpose should be pre-soaked and pre-waxed before installation to allow ease of removal. The created voids can then be grouted with a pourable sealant.

Where vehicle traffic is expected, it is essential that a permanent sealer be applied to the surface. This will prevent penetration of dripping oil or gas. It is recommended that a solvent-base clear aliphatic polyurethane sealer be used.

In cold climates, air entrainment additives should be incorporated into the concrete under-bed.

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TECHNICAL BULLETIN #R-5

8/13

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MAINTENANCE OF EXTERIOR RUSTIC TERRAZZO

This bulletin suggests a maintenance procedure for use on the textured surface of rustic terrazzo. In most cases, this application is on an exterior surface, so this bulletin only deals with exterior maintenance.

The composition of the rustic terrazzo topping is a combination of cement, aggregates, sand, and water. The NTMA guide specifications indicate that upon final cleaning of the rustic terrazzo surface, a suitable acrylic or non-yellowing clear aliphatic polyurethane urethane solvent-based sealer be applied to protect and enhance the aesthetics.

Exposure to the elements of rain and wind alone usually keeps the rustic surface reasonably clean. However, if the rustic surface becomes littered with dirt and debris, a vacuum or an air blower should suffice in removing most of the loose foreign matter.

The cleaning is quite simple. Use any type of machine scrubbing equipment with a coarse, stiff-bristled brush attachment. Remove the foreign matter by passing over the surface several times in the presence of a good cleaner and water. Follow by rinsing with clean water and allowing the surface to dry.

Upon completion of the installation of rustic terrazzo, the terrazzo contractor will usually apply a sealer. In most cases, the sealer will be an acrylic type, but on certain rustic installations, a clear non-yellowing aliphatic polyurethane type sealer is necessary to provide a longer time span before having to recoat the surface. The sealer on the rustic surface not only provides aesthetic value, but it also protects the aggregate and matrix from foreign matter impregnation. The high points of the textured surface will take most of the abuse from foot or auto traffic and the sealer will eventually abrade. The crevices between the aggregate will take no abuse from foot or auto traffic and, therefore, the longevity of the sealer in these areas is considerably greater.

The requirements for applying additional sealers, normally several years between applications, depend on the aesthetics desired. If an additional coat of sealer is to be applied, be sure the surface is clean and dry before application; prepare rustic terrazzo surface per sealer manufacturer's written recommendations.

CAUTION: Do not use chemicals or acids on this surface for cleaning purposes unless you have experience using them. Ignoring this caution can result in damage to your rustic terrazzo.

Ice melting chemicals and/or salt should not be used on exterior rustic terrazzo to avoid damage to the cement/aggregate surface.

If an ice melting chemical or salt was allowed to remain on an unsealed surface it could erode the cement matrix and even dislodge the aggregate from the surface.

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