2021-2023
FABRICATION MANUAL

TTMAC ACTTM

TERRAZZO, TILE & MARBLE ASSOCIATION OF CANADA
L'ASSOCIATION CANADIENNE DE TERRAZZO, TUILE ET MARBRE

PROFILE OF TTMAC

The Terrazzo, Tile and Marble Association of Canada was founded in 1944. Its mandate was to develop a method of standardizing terrazzo, tile and marble installation techniques, as well as being a technical resource and liaison for architects, specifiers, designers and engineers. TTMAC honours this commitment today as well as many other services and support of the hard surface industry and its members.

ASSOCIATION ACTIVITIES & BENEFITS

- Produces and distributes specification guidelines.
- Sets standards for installation methods used in the industry.
- Promotes technical research, new materials and techniques.
- Maintains an up-to-date library resource centre.
- Encourages development of new technology and products.
- Is a door to the industry in Canada with a global outlook.
- Publishes newsletters, maintains and circulates an annual Membership Directory and Buyers Guide.
- Provides a liaison with other associations, government departments, trade magazines, trade commissions, and those interested in sharing information for the good of the industry.
- Offers independent arbitration of complaints and site inspections.
- Promotes an annual convention, seminars and workshops. Provides general information to architects, specifiers, engineers, contractors, designers and the building industry in general.
- Encourages and promotes the installation of terrazzo, tile marble, granite, slate and other dimensional stone products and related materials.
- Has full-time technical representative on staff.
- Assists in setting training standards and distributes information to further develop training in the hard surface industry.

FABRICATION MANUAL

The Terrazzo, Tile and Marble Association of Canada provides this Fabrication Manual to assist in clarifying and standardizing materials, methods and procedures for the fabrication of countertops, vanities or worksurfaces.

This general guide refers to the usual circumstances relating to natural stone and manufactured slab fabrication. In case of circumstances out of the ordinary, we suggest that you consult the Manufacturer, Supplier for clarification. The scope of work and methods of fabrication or installation may vary by site conditions and from region to region.

TTMAC ACTTM

TERRAZZO, TILE AND MARBLE ASSOCIATION OF CANADA

Head Office: 163 Buttermill Avenue, Unit 8, Concord, Ontario L4K 3X8
Phone: 905.660.9640 or 800.201.8599 Fax: 905.660.0513
Western Office Phone: 604.294.6885 Fax: 604.294.2406
email: association@ttmac.com

www.ttmac.com

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Terrazzo, Tile and Marble Association of Canada appreciates the assistance of the following in the preparation of this guide:

TTMAC Board of Directors

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Mark Rossl – Ciot

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ORGANIZATIONS

American Society for Testing and Materials (ASTM)
The Marble Institute of America (MIA)
Terrazzo, Tile & Marble Guild of Ontario Inc. (TTMGO)

Canadian General Standards Board (CGSB)
Materials & Methods Standards Association
Terrazzo, Tile & Marble Trade School Inc. (TTMTS)

OTHER AVAILABLE TTMAC SPECIFICATIONS AND GUIDES

Terrazzo Color Plates
Maintenance Guide
Terrazzo Specification Guide 09 66 00

Specification Guide 09 30 00 Tile Installation
Tile Installer Technical Handbook

As members of the TTMAC are continually striving to maintain and improve the standards of the industry, specifications, guides and/or manuals are subject to revision at any time.

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PREFACE

The Terrazzo, Tile and Marble Association of Canada provides this Fabrication Manual to assist in clarifying and standardizing the fabrication process of countertops or worksurfaces made of natural stone and manufactured slabs. This guide is revised periodically to provide current, accurate data on the fabrication process. Quick-reference details and outlines in this manual cover most materials, processes and conditions. Each installation recommendation requires a properly designed, constructed, and prepared substrate using materials and construction techniques that meet nationally recognized materials and construction standards.

Some fabrication methods and materials may not be recognized as they may not be suitable in some geographical areas because of local trade practices, climactic conditions, or construction methods. Every effort has been made to produce accurate guidelines, they should however, also be used only with the independent approval of technically qualified persons.
Data presented in this document is strictly for information to the reader and does not necessarily represent the endorsement of the authors, the Terrazzo, Tile & Marble Association of Canada assumes no responsibility for the success or failure of any countertop fabrication made in accordance with such data. The reader is expected to make judicious use of the data as part of his/her quest to further his/her knowledge. This guide is subject to revisions at any time with the approval of the Terrazzo, Tile & Marble Association of Canada.

As with any building material and technique many variations including, but not limited to design, climate, topography, building and zoning codes, materials, labor costs and quality, markedly affect the safety, cost, utility and appearance of the applications shown in this Manual. Accordingly, they are suggestive only and are not recommended or endorsed by the TTMAC.

Accordingly, the TTMAC disclaims any guarantee or warranty, whether expressed or implied, for merchantability, fitness for a particular purpose, or for any other purpose, or for safety, for anything described or illustrated herein, and assumes no responsibility for errors and omissions. No warranties, express or implied, including warranties arising from course of dealing or usage or trade, are made regarding the information, recommendations and descriptions contained herein. TTMAC is not responsible and will not be held liable in contract or tort (including negligence, strict liability, consumer protection statutes or otherwise) for any special, indirect or consequential damages, including injury or damage caused to persons or property by reason of installation, maintenance or failure of persons to heed caution or safety warnings.

References to ANSI or ASTM standards are merely suggestive and not mandatory and are NOT a TTMAC express or implied endorsement or warranty of the adequacy or completeness of those standards for safety or any other purpose.

For a reference only, some common (rounded nominal) industry metric conversions to the imperial equivalents may be found on page 42.

LEADERSHIP IN ENERGY AND ENVIRONMENT DESIGN
ENVIRONMENTAL STATEMENT
"Green has become measurable"

The construction industry has grown from just talking about "green" to certifying projects and products for providing a durable and sustainable environment for future generations. Today the trend is to focus on the efforts of such programs as LEED v4, the Living Building Challenge (1) and its Red List of unacceptable chemicals for materials used in construction, and the Delos WELL Building standard and its mission to improve human health and well-being through the built environment. In addition, green building codes are formalizing sustainable products as a primary consideration for new construction.

The role of EPDs (2) and HPDs (3). The trend in sustainability reporting it to move away from reporting recycled content and regional manufacturing to the use of product transparency information. Health Product Declarations (HPDs) and Environmental Product Declarations (EPDs) are based on a life-cycle assessment of the environmental impacts of a product or service- from the extraction and processing of raw materials, to the distribution, use and end of life of the product/service. EPDs are providing manufacturers with a uniform template to deliver this transparency information to their customers and end users.

Manufactures participated substantially in helping the Tile Council of North America to establish the first industry-wide EPDs for mortars and grouts used in the installation of porcelain, ceramic and natural stone tiles. The establishment of an industry-average EPD is important because the EPDs for mortars, grouts and tile can contribute 3 of the 20 products that are required for an EPD credit within the LEED v4 rating system.

(1) Living Building Challenge (LBC) "Red List Free": A list within the LBC program that a specifier will often consult to ensure that certain chemicals are not in the products they are specifying (such as isocyanates and phthalate plasticizers.)

(2) Health Product Declaration (HPD), Cradle 2 Cradle (C2C) Manufacturer's Inventory: Programs that focus on disclosure of a products ingredients. More specifically a Healthy Product Declaration (HPD) is an ingredient inventory that lists all the ingredients ("formula transparency") of a finished product and the associated health hazards with both intentional and residual ingredients.

(3) Environmental Product Declaration (EPD): A concise environmental product performance report based on Life Cycle Analysis (LCA) to demonstrate the environmental impacts of a product from extraction of raw materials and processing to distribution use and end of life.

OVERVIEW

The classic beauty and longevity of natural stone or manufactured slabs for use on countertops, vanities and work surfaces are a natural choice. Countertops are continuously evolving and today you can find a wide variety of materials, colours and textures that can single-handedly transform a space aesthetically, functionally and by overall value. It is no wonder why choosing a countertop is something that is done with very careful consideration and thought. However, choosing the right countertop is only the first step. The overall potential of these installations is realized only when the selection, design, fabrication, and installation are completed by, or with the consultation of, qualified and experienced individuals.

MATERIALS

NATURAL STONE CATEGORIES

Natural stone has traditionally been one of the most commonly used materials for countertops. Today natural stone slabs come in a variety of options. Different types of natural stone slabs have specific properties that offer advantages or disadvantages in various applications. The following is a brief overview of the common varieties of materials used for countertops vanities or worksurfaces.

Granites
An igneous granular speckled stone that is extremely durable, with some having a hardness approaching that of a diamond and is well suited countertops. Granite is usually polished but is also available in honed, flamed and water-jet finished. Polished granite will tend to hold its sheen indefinitely, can be used in heavy traffic areas, and is less likely, when compared to marble or limestone, to be stained or damaged when exposed to food spills or normal household products.

Marbles
A metamorphic stone that began as a limestone and through a metamorphic event re-crystalized and became a marble. Aesthetic appeal, veining trends and bold colors make marble a favorite choice. Normally supplied with a polished surfaced, but also common in honed, sandblasted or other select finishes. Most marbles can be prone to surface staining when exposed to food spills and other common household products.

Slates
A metamorphic rock constructed from clay and silt sediment compacted over millions of years. The heat and compression applied during its creation form new minerals like mica and quartz. Due to this intense process, slate has become a tough material that can be used in several areas in the home including countertops. Most come in simple black or gray matte, which has a serenely uniform look. However, it can also come in an array of exciting colors and finishes.

Serpentines
Similarly prized for their veining and color. Historically, this rock type had been commercially grouped with marble. However, serpentine is not true marble geologically. Due to their mineralogical difference, serpentines typically have improved abrasion and chemical resistance over true marbles.

Onyx
Mostly made of calcite and formed in caves in several regions around the world, Known for its translucent properties which allows for dramatic effects when backlit. Like several other rock varieties, onyx was traditionally commercialized as marble, despite its notable differences. Due to its cryptocrystalline grain structure, when compared to true marbles, onyx tends to have lower levels of resistance to both chemical and abrasive exposures.

Soapstone
A metamorphic rock that is comprised primarily of talc with varying amounts of dolomite, magnesite, and other minerals. Soapstone typically has a smooth feel to the touch. Soapstone is a very popular choice for countertops in laboratories and classrooms due to its high resistance to chemicals. Soapstone has limited hardness and is vulnerable to scratches from abrasives. Soapstone is typically top treated with a food grade mineral oil to retain its luster and to mask small scratches that are often common because of its talc content

Limestone
A fine sedimentary stone that may contain fossil remains of plants, animals and other mineral deposits. Limestone has a more simple, non-patterned appearance. This makes limestone slabs ideal for modern bathroom or kitchen countertops. Some limestone slabs cannot take a full polish, so they are only available in honed or other non-polished finishes

Basalt
A dark colored, fine grained, igneous rock? It most commonly forms as an extrusive rock, such as lava flow, but can also form in small intrusive bodies, such as igneous dike or a thin sill. It has a composition similar to gabbro. The difference between basalt and gabbro is that basalt is fine grained while gabbro is coarse-grained. Basalt Slabs are generally fabricated by slicing large basalt columns and applying a polished or flamed finish to the top. The natural crust can either be left on the long edge of the slab or it can be a polished, flamed or chiselled finish.

Travertine
Is a sedimentary stone falling into the limestone family but traditionally has often been referred to as a marble. It is a very porous, often cavernous material, with a palette of various earth tones. The open grains can be filled during the fabrication process or left open in its natural state as desired. Travertine can be honed to a satin surface or finished to a semi-polished surface.

Quartzite
Quartzite is a very hard metamorphic rock that originated as sandstone. Through a process of high heating and pressurization sandstone is transformed into Quartzite, an extremely strong and durable natural stone. When heated, individual quartz pieces recrystallize giving it a beautiful and decorative sparkling pattern. Quartzite is ideal for any countertop surface due to its strength and long-lasting composition and overall durability. Quartzite slabs are supplied in a split face, natural cleft or sawn finish.

MANUFACTURED SLAB CATEGORIES

Natural stone has traditionally been one of the most commonly used materials for countertops. Today natural stone slabs come in a variety of options. Different types of natural stone slabs have specific properties that offer advantages or disadvantages in various applications. The following is a brief overview of the common varieties of materials used for countertops vanities or worksurfaces.

Engineered Stone Slabs
A man-made product created as an alternative to natural stone slabs. Pieces of natural stones are bonded together with a binder to create unique yet highly durable and functional countertop slabs. It is manufactured in a variety of colors including variations not normally found in nature. Strong, durable, and attractive, engineered stone slabs are very consistent in look and pattern. The surfaces are easy to maintain, heat-resistant and do not promote the growth bacteria or mold. Unlike some other surfaces—even natural stones—engineered slabs may resist stains from liquids like wine or coffee fairly well.

Porcelain & Sintered Slabs & Panels
Made up of a natural blend of clays and minerals, porcelain tile slabs are a great choice for countertops. The surface strength of porcelain is achieved in the firing process, Impervious porcelain stoneware is resistant to high temperatures, UV rays and atmospheric stresses. Porcelain countertops resist chipping, scratches, cracks, wear and tear extremely well. Varied pigmentation of the raw

materials creates a wide range of colors and hues. Pigmentation can also be applied to give the porcelain the look of marble or other natural stone that contains veining. Unlike natural stone that may need to be sealed after installation and resealed again every few years, porcelain doesn't ever have to be sealed. The fired glazing, available from matte to highly polished acts as an effective barrier to moisture and provides outstanding stain resistance and extremely easy to clean surface.
Edges can be mitered in several styles to enhance the appearance.

TECHNICAL INFORMATION

Testing evaluates the suitability of a specific material for a particular application. Useful to evaluating the materials behavior through time in adverse environmental settings. Knowing about physical and chemical characteristics can be very useful in understanding its behavior and help ensure appropriate selection.

The American Society for Testing and Materials (ASTM), the American National Standards Institute (ANSI) are industry organizations accepted nationally and internationally that develop and publishes voluntary consensus technical standards

NATURAL STONE TECHNICAL INFORMATION

Stone, being a natural product extracted from various regions of the earth will exhibit extremely different properties or characteristics from product to product. In order to determine whether a material is suitable for a given application, a series of internationally recognized tests have been established. Materials standards help to prevent the use of stone products for unsuitable applications.

These standards are to be used as a guide in preliminary stone assessment. Actual stone properties may vary, and a project specific testing program may be required

NATURAL STONE MATERIAL SPECIFICATIONS

Norm/Standard	Classification
ASTM C503	Standard Specification for Marble Dimension Stone – (exterior)
ASTM C568	Standard Specification for Limestone Dimension Stone
ASTM C615	Standard Specification for Granite Dimension Stone
ASTM C616	Standard Specification for Quartz-Based Dimension Stone
ASTM C629	Standard Specification for Slate Dimension Stone
ASTM C1526	Standard Specification for Serpentine Dimension Stone
ASTM C1527	Standard Specification for Travertine Dimension Stone

NATURAL STONE TESTING STANDARDS

Along with the material standards there are also a series of testing standards, again developed and used to evaluate stone characteristics so that natural stone and stone based manufactured slabs can be compared on a uniform basis.

Absorption (ASTM C97)
This is a measure of the stone's porosity. ASTM C97 is performed by weighing the stone sample dry and weighing it again after immersing it in water for 48 hours. The weight difference between the stone in a dry condition and after immersion is expressed as a percentage and is a measure of the amount of water that a stone will absorb. The lower the percentage, the less the moisture absorption rate of the stone. This can be a measure of the stones ability to perform in wet or freeze-thaw environments.

Density (ASTM C97)
The density of a stone is a measure of the stones weight and is expressed in lb./ft^3 or kg/m^3. The bulk specific gravity as established in ASTM C97 is the ratio of the density of stone to the density of water and is expressed as a whole number. The density of the stone is calculated by multiplying the bulk specific gravity by the density of water (62.4 lb./ft^3 or 1000 kg/m^3) (Example: Bulk Specific Gravity = 2.5 then the stone density is 2.5 x 62.4 lb./ft^3 = 156 lb./ft^3 or 2.5 x 1000 kg/m^3 = 2500 kg/m^3).

Compressive Strength (ASTM C170)

Measuring the compression strength of a stone determines the load a stone can resist before it will crush. The result of this test is expressed in pounds per square inch (psi). Compressive strength is useful in evaluating different stones for floor applications. Other properties like density, hardness and absorption must also be considered. This value is also used to determine minimum bearing area when stacking stones or using stones as lintels.

Modulus of Rupture (ASTM C99)
Modulus of rupture is a measure of the stones bending and shear strength. The test requires that the stone be tested both parallel and perpendicular to the rift or bed. The test requires that a minimum of five samples 100 mm x 200 mm x 57 mm thick with smooth faces be furnished for each condition parallel and perpendicular both wet and dry. A total of 20 samples are required. The specimens are supported at each end and loaded at the center until the stone fails.

Flexural Strength (ASTM C880)
Flexural strength is the measure of a stones ability to resist bending. Unlike the modulus of rupture test standardized at 57 mm thick, the flexural strength test uses the proposed thickness of the stone. The loading conditions are also different. The stone is supported at each end and loaded with 2-point loads located at the quarter points of the stone. This loading condition more truly measures the bending strength as opposed to shear strength. The results are expressed in pounds per square inch (psi). This test is essential when designing wall cladding and is used to determine the maximum span at a given thickness and can be used to determine kerf strength at anchor engagements although some designers feel Modulus of rupture should be used at anchor engagement.

MANUFACTURED SLAB TECHNICAL INFORMATION

Unlike natural stone and the variance that can happen from product to product, with manufactured products, weight and structural properties can be determined and maintained through quality control programs. Technical specifications for manufactured slabs can often be a confusing set of codes and numbers, but they are important pieces of information to understand when evaluating their suitability for the intended purpose.

When a specific material is chosen for a specific installation, certain criteria must be established against which the chosen product can be evaluated. The product must be evaluated on the basis of performance requirements and must ensure it will retain its beauty and functionality.

Common test standards for manufactured slabs are based on aesthetic, functional and dimensional characteristics. The overview below serves as a reference for technical data and explains the different tests and standards that may be used to evaluate manufactured slabs, compact surfaces or porcelain tiles

MANUFACTURED SLAB MATERIAL SPECIFICATIONS

American National Standard Specification A137.3
describes the minimum physical properties and grading procedures for gauged porcelain tiles and gauged porcelain tile panels/slabs. It provides quality criteria for buyers, specifiers, installers, manufacturers, and the public in general. "Gauged" means manufactured to a thickness that is specific and largely associated with installation and use. Tile panels/slabs are those that are one square meter in facial area or larger.

Shade Variations
Tile coloring can range from monochromatic to a random appearance in coloring and shading of individual tiles and from tile to tile. Variation in coloring is classified by the following.

Water absorption

Monochromatic (V0)	Very uniform, monochromatic color
Low (V1)	Consistent color within each tile and from tile to tile
Medium (V2)	Color variation within each tile
High (V3)	Some variation from tile to tile and within each tile
Random (V4)	Considerable variation from tile to tile

This testing is performed to identify if the ceramic, porcelain or manufactured tile is suitable for a specific surfaces or spaces. The lower the absorption rate, the denser the material is. These denser materials offer the most outstanding technical characteristics needed for countertops, vanities or work spaces.

Impervious	0.5% or less	Extremely Dense
Vitreous	More than 0.5% but not more than 3.0%	Highly Dense
Semi-Vitreous	More than 3.0% but not more than 7.0%	Medium Dense
Non-Vitreous	More than 7.0%	Low Dense

Moh's Hardness

To give the consumer a relative measurement of scratch resistance, manufacturers and suppliers use the Moh's Hardness Scale. The Moh's scale uses ten fairly common minerals of known hardness and gives each of them a relative value of 1-10. Each mineral in the scale will scratch those with lesser values and will not scratch those with higher values. As you can see by the Moh's scale below, Talc has the lowest classification and the softest mineral on the list and Diamond has the highest and is the hardest mineral known. To better illustrate the hardness of tile, take note that case-hardened steel, which is used in drill bits to drill holes in steel, is a 6 on the Moh's Hardness scale.

Moh's Hardness	Mineral	Compared to other flooring Materials
1	Talc	resilient flooring (vinyl, asphalt tile)
2	Gypsum	wood flooring
3	Calcite	polished marble, laminate flooring
4	Fluorite	black marble
5	Apatite	glazed ceramic tile
6	Feldspar	glazed ceramic tile
7	Quartz	quarry tile, glazed porcelain tile, some granites
8	Topaz	unglazed porcelain tile, some granites
9	Corundum	no flooring is this hard
10	Diamond	no flooring is this hard

MANUFACTURED SLAB TESTING STANDARDS

ASTM C648: Breaking Strength

Breaking strength measures the load a tile can bear depending on the application—floors and walls. The test is used to determine the force needed to break an unsupported section of tile. TTMAC recommends adherence to industry installation standards as set forth by ANSI A108, A118, and A136 to decrease risk of breakage.

ASTM C650: Chemical Resistance

A tile sample is placed in contact with different chemicals over the course of 24 hours then it is rinsed and inspected for visible damage or variation. It is rated as either resistant or non-resistant.

ASTM C370: Moisture Expansion

Changes in physical dimensions of tile due to exposure to water and water vapor are determined by this method. Such dimensional changes may influence the integrity and stability of an installation. Tile specimens are tested for elongation of size due to rehydration by autoclaving.

Three (3) test pieces of size 1" × 4", cut from the center of whole tiles, are required for one test. The test pieces are measured with a micrometer and subjected to steam under pressure in an autoclave for five hours. After autoclaving, the test pieces are dried to a constant mass and measured again with a micrometer to determine expansion due to moisture exposure.

ASTM C373: Water Absorption

In this test method, water absorption of tile specimens is calculated based on a five hour boiling water method. This test is used to determine the degree of maturation of the ceramic tile body or for evaluating structural properties that may be required during installation.

Five (5) test pieces, weighing at least 50 grams and cut from the center of whole tiles are required for one test. Test pieces are dried to

a constant mass, weighed and placed in boiling water for five hours then soaked in room temperature water for 24 hours. Wet weights are determined after soaking for 24 hours. The difference in weights of test pieces before and after boiling is used to calculate percent water absorption.

ASTM C484: Thermal Shock Resistance
Resistance of tile specimens to thermal shock under normal conditions of use is determined. The test pieces are subjected to alternating low and high temperatures and visually observed for defects with the aid of inks or dyes.

Ten (10) whole tiles are required for a single test. The test pieces are subjected to ten cycles of alternating temperatures of 15 ± 5°C and 145 ± 5°C. Depending on the water absorption value of the test pieces, the test method includes two procedures, with or without immersion in water. The test pieces are inspected for damage as a result of temperature cycling.

ASTM C485, ASTM C499, ASTM C502: Warpage, Facial & Thickness Dimensions, and Wedging
In these test methods, diagonal and edge warpage (flatness), wedging (squareness), facial dimensions and thickness of ceramic tiles are determined. The diagonal warpage, edge warpage, and wedging are all reported as a percentage. Facial and thickness dimensions are reported in inches.

ASTM C674: Modulus of Rupture
Modulus of rupture of tile specimens is determined by this test method. The test method is applicable to both glazed and unglazed tiles.

ASTM C1378: Staining Resistance
In this test method, resistance of ceramic tile surfaces to staining is determined. Staining is achieved by prolonged exposure of the tile surface to test solutions and dry staining agents. Tiles are visually evaluated after the staining agent has been cleaned off using a combination of cleaning procedures.

ASTM G21 Antimicrobial Resistance
Commonly used to test the resistance of materials to fungal attacks. High concentration of spore suspensions of each of the five fungi is prepared. Nutrient Salt Agar is poured into sterile petri dishes. Antimicrobial treated Test specimens are placed on the surface of solidified agar. Composite Spore suspension is sprayed onto the surface of agar and test specimens. Inoculated antimicrobial treated test specimens, Antimicrobial untreated Positive controls (Fungal growth control) and negative control (Solid agar medium without inoculating mold) controls are incubated at 28 to 30 C for 28 days and under more than 90% relative humidity.

ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile
This test method covers the establishment of an abrasive wear index by determination of the loss of weight resulting from abrasion of unglazed ceramic tile. A technician weighs each ceramic tile specimen once it is cut to the correct size for testing. The specimen is mounted onto the abrading machine equipped with H-22 coarse calibrade wheels. A 9.8 N load is applied to each wheel and both wheels are lowered onto the surface of the tile test specimen. The abraser is then run for 1000 cycles and the samples are reweighed to determine the mass lost to abrasion.

GENERAL INFORMATION

Although there are several choices and many differences when it comes to countertop material selections, much of the fabrication and installation processes share the same platform.

Standard Practice
As a good business practice, communications with clients should be documented in writing. Scope of work required to be completed or coordinated by the client, subcontractor or general contractor should be specifically addressed and documented. (e.g. cabinetry installation, plumbing rough-in and electrical rough-in).

Shop Drawings
Shop drawings are provided to the client to convey all relevant information including, material type and finish, layout of pieces, location and size of all seams, details clarifying all corner and edge treatments, location of cut outs, or any other special conditions. They should be reviewed by the client prior to commencement of fabrication. Often a copy of the field measuring technician's sketch and notes is acceptable in place of the shop drawing in the face of time constraints.

Measurements
All measurements should be taken once all cabinets have been installed and in their permanent place. Related components must also be available for measurement: drawer or cabinet doors, end panels, drawer or cabinet hardware, sinks and faucets, cooktops, dishwasher, refrigerator, exhaust vents when a backsplash is required and roughed in electrical outlets.

Templates
It is very common to field verify all dimensions and make templates of the finished countertop shape. Templates must either include material type, sink location, sink type, nosing type, backsplash location, overhangs, and if possible gable locations or accompany the template with a drawing providing all the required information. Tops can be produced from architectural or design drawings, provided all parties are aware of their responsibilities to ensure the tops will fit on site. The owner, architect and/or general contractor must guarantee all dimensions and details for this process to work. All drywall, millwork, appliance cutouts, etc. must all adhere to their respective dimensions and details.

Sampling
Samples of all the specified selections should be submitted to the client for approval. The number and size of samples should be enough to clearly show the color, shading or identify any extreme veining and/or inclusions. It is common for the client to view and select the actual material to be used for the project. It may also be required to invite the client to participate in the actual layout of the slabs. As natural stones are unique, Clients must be made aware that some features; pits, fissures, cracks, or corrosive minerals may become more or less noticeable when the position (vertical or horizontal) of the slab is changed, or also when the lighting intensity is changed.

Mock-Ups
A mock up for the purpose of viewing and approving color and shading and to set the standards for workmanship is often typical in tile or stone installations. However, mock-ups are typically not provided for countertops when slabs are selected.

Cabinets & Substrates
Cabinets to receive stone countertops must be permanently affixed in their final position prior to field measuring for countertops. Fragile stone varieties or thinner porcelain tile slabs may require a full subtop for support. Common acceptable materials for subtops are marine-grade plywood, exterior-grade plywood, waterproofed medium-density particle board, furring strips or extruded polystyrene foam panels and in some instances metal framing. Excessive load-carrying requirements, such as the use of heavy cast-iron sinks, may require the use of auxiliary framing.

DESIGN CONSIDERATIONS

Joints & Joinery Layout

With most natural stone countertops, and even manufactured slabs, seams are unavoidable. The seam is the place where two individual slabs are joined together. In some smaller surfaces, like a bathroom vanity top, a seamless countertop is possible. However, in most kitchen projects you will end up with seams, the most important variable is the finished look. Materials used for countertops will be available in lengths typically ranging from 2.5-3m). Seam location and frequency will be determined by this size.

In general joints should be made as tight as possible (1.5 mm maximum) and filled. Slab to cabinetry or other materials should be 3 mm and caulked. When designing joint locations, they should be carefully located to ensure they are properly supported near gables and a minimum of 100 mm from any cut outs such as sinks or cooktops. Joints should never be placed over a dishwasher or other appliances that emit heat.

Due to various mechanical stresses experienced after installation, many manufactures or suppliers do not recommend installing “L” shaped countertops without a joint at the corner of the “L” shape. Refer to manufactures most updated written recommendations for clarification.

Recommended joint placement for U and L shaped fabrications.

Spans & Cantilevers

Natural Stone
In designs where part of the countertop is spanning between supports, the length of the span shall be no more than 600 mm for 20 mm stone thicknesses and 900 mm for 30 mm stone thicknesses. In designs where the countertop is cantilevered beyond the supports, the cantilever shall be no more than 150 mm for 20 mm thick countertops and 250 mm for 30 mm countertops, but in no case may the cantilevered portion represent more than 1/3 of the width of the countertop. Cantilevered countertops exceeding these dimensions will require corbelled supports beneath the slab. The exposed underside of cantilevered portions of countertops will be sawn or otherwise unfinished surfaces. Materials of lesser soundness may require corbelled supports for cantilevers that are less than those specified herein. Consult supplier or manufacturer for complete recommendations

Manufactured Slabs
Because of the wide variety of materials available, the guidelines for overhangs or cantilevers can vary. Each different product and or thickness has specific guidelines. Consult manufactures for most up to date recommendations.

In general, all counter-top overhangs should individually address the type of cabinetry, drawer pulls and handles. The overhang should not impede the ability to open and close cabinet doors and drawers. Typically, the overhang should extend out from the cabinetry to be flush with the outer edge of the handles and drawer pulls. Flush installations to the edge of the kitchen cabinetry are not recommended.

Sinks, Faucets, and Other Cut-outs

Ensure the sink fits within the clear opening provided in the gables. Ensure that all facets and fixtures are laid out prior to fabrication to ensure adequate clearance from millwork, backsplash and sink flange. Ensure that a minimum distance of 100 mm is left in the front and side of any sink cutouts. Sinks are to be installed by the plumber. Review sink and tap requirements to ensure that any special notches, recessed, or fastening anchors are provided.

Detailing

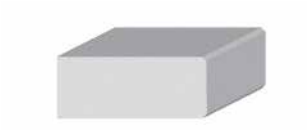
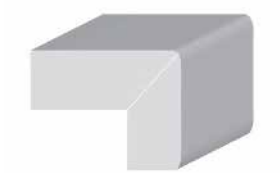
Each type of material has its own unique physical characteristics and will respond differently to detailing. Finishing, cutouts, joint locations and panel size must all be considered in the detailing. Consult supplier or manufacturer for most their most up to date recommendations or special requirements regarding these these items

Edge Profiles

Edge profiles can completely finish the look of a countertop project. Examples of the most common natural stone and engineered slab edge profiles are included on the drawing below. With advancements in machinery, many custom profiles can be created which may not be shown here. Due to the gauge of some manufactured porcelain slabs there are limitations on edge options as seen below. Edge profiles with narrow projections and sharp corners are more susceptible to chipping than those with a larger, curved silhouette. Edge detailing can influence the cost of fabrication and the finished countertops more than any other decision.

Surface Finishes

Common Manufactured Slab Edge Profiles		
 Eased	 Bullnose	 Platner
 Mitred	 Laminated	 Butt

Common Manufactured Slab Edge Profiles		
 Eased	 Pencil	 Bullnose
 Demi Bullnose	 Dupont	 Ogee
 Laminated Pencil	 Laminated Bullnose	 Mitred Pencil

Manufactured Slabs

This material and the countertops made from it offer benefits for appearance, practical use and durability. Although the surfacing options are not as vast as a natural stone, manufactured slabs are available in matte, polished and often a softer finish close to a honed look. These common options give you adequate choice for the finished look of your manufactured counters.

Natural Stone

There are several finishes available for natural stone and new finishes appear in the market regularly keeping pace with consumer demands. A description of a few of the finishes commonly available:

Polished

A polished surface will optimize the color of the stone. Polishing a stone to a high gloss surface closes or reduces the size of the surface pores. Reducing the stones' porosity creates a resistance to soil and staining agents from penetrating the stones' surface. Generally, the higher the sheen or polish, the more resistant the stone will be to damaging conditions such as moisture, acidic solutions, and air pollutants. Unfortunately, the higher the sheen or polish, the lower the slip resistance, or coefficient of friction (COF) of the stone. Harder stones, such as granite will hold their polish longer under traffic than softer stones.

Brushed/Antique/Leather

The use of this series of names is not fully standardized within the industry. From some sources, they are used interchangeably, while from other sources they are distinctly different processes. Most commonly they describe a finished that has been achieved by abrading a smooth or honed surface with an abrasive, often diamond, brush. The resultant finish can have varying levels of sheen and relief. The hardness of the mineral matrix within the stone to which it is applied with also affect the final product

Honed

A honed finish is a semi-polished, smooth, matte surface finish with less sheen when compared to a polished finish. Because the abrasives used are somewhat coarser than those used to produce a high gloss, polished finish, the surface pores of the stone are more open and exposed than the surface of a polished finish. This increased porosity makes the stone less resistant to the effects of moisture, staining agents, acids, etc. However, a honed surface finish is naturally more slip resistant than a high polished surface. This is an important consideration when using the stone in flooring applications, specifically in wet areas or exterior walkways.

Flamed (Thermal)
A flamed or thermal surface finish is achieved by passing a 2800 ºF torch flame over the surface of the stone. This process heats the various minerals and crystals and expands them until they explode or break from the body of the stone. The result of this thermal process is a coarse and irregular surface finish with an exposed pore structure. The flamed finish creates a look and texture which is desirable in certain applications. However, this open porosity also exposes the stone to weathering and other moisture-bearing contaminants.

Natural Cleft
A natural cleft finish is a natural surface texture that is produced by splitting or separating stones which possess natural cleaved planes such as slate. The true color of the stone is maintained during the splitting process and the natural cleft surface creates a unique look for a variety of applications. The amount of surface texture will vary with each stone and is primarily determined by the hardness or density of the stone. Less dense stones will cleave with greater irregularity than harder stones, which will cleave in flat, smoother planes.

Water Jet Finish
Although water jet technology has been used in various facets of stone processing, its use as a finishing tool is quite recent. High pressure water is used to penetrate the micro fissures of the stone loosening and removing the aggregate. The result is a textured finish similar to a flamed finish. Unlike flaming, water jet finishing does not wash out the color of the stone, rather enhances it. The depth of finish can be controlled unlike flaming and does not jeopardize the structural integrity of the stone.

Although several types of surface treatments for natural stone have been mentioned, not all stones are capable of achieving all of the finishes described. Structure, texture, hardness, density, and mineral composition of a specific stone will determine the type of finishes which can be applied. Stone suppliers can provide limitations of the surfaces available for each stone.

FABRICATION

Safety & Work Environment

All technicians involved in the handling and working of stone or engineered slab materials must receive training in safe work practices. Additionally, adhering to the following simple safety rules will help to prevent accidents.

- Keep work areas clean and uncluttered.
- Use the right tools, read instruction manuals before operating. Learn the tools' applications and limitations as well as any hazards specific to them. Keep guards in place when working with them.
- Maintain tools in top condition. Keep tools sharp and clean for best and safest performance. Follow instructions for lubricating and changing accessories.
- Don't force tools. A tool will do the job better and safer at the rate for which it was designed to work.
- Use clamps or a vise to secure work when necessary, freeing both hands to safely operate the tool.
- Don't overreach and keep proper footing and balance at all times. Non-slip footwear is recommended
- Wear appropriate apparel – loose clothing, gloves, neckties, rings, bracelets and other jewelry may get caught in moving parts. Wear hair-protective covering to contain long hair. Wear ear/nose protectors and safety shoes.
- Always use safety glasses or approved eye protection. Everyday eyeglasses only have impact-resistant lenses; they are not safety glasses.
- Always wear a dust mask and follow local regulations for proper ventilation –some dust contains silica which can be hazardous to your health. Always consult the manufacturer or supplier for most up to date recommendations on methods to reduce any airborne particles that may be harmful to one's health.
- Children and visitors should always be kept at a safe distance from the work area.

Layout

A cutting or layout table, permanent in a shop or portable on site is a must. The table should be solid and robust and also must be perfectly flat and level. Using a rubber or wooden surface will buffer any blade vibrations.

Slabs must also be carefully reviewed for any flaws or for the potential of flaws to occur. In the instance that a flaw is identified, it should be reported to the supplier. Once the slab is inspected and cleared of flaws, it is then laid out and the previously created templates are arranged on the stone to ensure the best appearance of veining and color. The templates should be arranged to ensure appropriate flow for the various countertops in your layout. As an example, with an L shaped countertop, or a countertop and an island that is parallel or perpendicular, you want to ensure the overall flow of the countertop pattern will work for the finished project. Veining occurs more often in natural stone than in quartz or manufactured slabs, making this process especially important with granite or marble. This is where an experienced templater is key, it is a mix of experience and artistry. Templates or layout patterns should be marked on the slabs or panels using a temporary mark that will not stain on have any effect on the surface.

Cutting and Processing Methods

With so many options of materials available in natural stone, engineered and manufactured slabs, many options for cutting and processing are also available. Listed below are typical methods used as a guideline for fabrication. Please refer to manufactures most up to date recommendations for complete clarity.

Manual Cutting — On smaller projects, often you can obtain satisfactory results by scoring thin gauged porcelain tiles or panels with high end glass cutters. To achieve good cuts, the operator should never detach the glass cutter from the tile. To score the tile in a straight line, one can use aluminium straightedges normally used in the construction industry. After scoring, it is sufficient to bend the slab to detach the two pieces. Once the tile has been scored and the tile split, the cutting process is completed by cutting any fibreglass that may be attached to the back side of the tile or panel with a sharp knife.

Rail Cutter — Use a rail cutter to score the gauged porcelain tile panel surface from end to end. Begin the scoring process with a small backward motion then proceed forward continuously with a firm downward pressure on the scoring handle. The rail will provide guidance and precision to the cut. Maintain a smooth, firm continuous movement. Do not interrupt or restart. Center the pressure pliers or separator over the score line on one end of the tile panel. Gently apply pressure and the panel will break Once the material starts to break down the score line, you may, depending on the width of the piece you are trying to remove, need to use hand pressure to work the break from the starting point to the other end of the tile. Fold the cut panel past 90 degrees and cut the fiberglass backing using a utility knife. Use a 60-400 grit diamond hand pad to ease the cut edge and remove the excess fiberglass backing

Right Angle Grinder — Engineered or manufactured slabs can be cut using diamond discs fitted onto hand-held electrical grinding machine. Disc rotation speed must be high usually >10000 RPM and a low feed rate usually < 1 m/min. Depending on the type of disc and the length of the cut, it may be necessary to cool the disc with water. Recommended discs are the thin types generally used for cutting porcelain stoneware. Another practical tool for cutting is the tile cutter ruler. With tile cutter rulers, you can use hand-held angle grinders, fitted into special frames that can be fit onto the cutting guide. In this manner, you can provide both 90° and 45° cuts. Often with thin gauged porcelain tile, an extruded form board is used as a supportive substrate. If this is the case many manufacturers recommend installing the tile to the extruded foam board, which should be permanently affixed to the cabinets before cutting or drilling with either a right-angle grinder, or diamond tipped hole saw

Bridge Saw, Water Jet and Saw Jet — Historically, the bridge saw or the water jet have been the favored tools for countertop fabrication. The bridge saw cuts with a diamond segmented blade, and cuts at a feed rate of approximately 7 feet per minute. The water jet cuts with high pressure water with garnet particulate suspended in the water at a feed rate of 1 foot per minute. The benefit of the water jet is that it can cut circles, radius', or any intricate pattern, where the bridge saw cuts only straight lines. Recently, a more specialized tool has come to the marketplace. A saw jet, which has a saw head and a water jet built into it. You program the saw jet with the parts you need cut, it then determines where to use the water jet and where to use the saw, giving you the best productivity of both worlds.

CNC (Computer Numerically Controlled) — The CNC machine is programmed to know the size of the stone or stones on the table. You can put multiple pieces of stone on the table and work on them together. The CNC machine is then programmed to know where the stones are located and what to do to each of those pieces. Since every stone has different working characteristics, it is key to have an experienced and knowledgeable CNC machine operator. It is truly a job where artistry and technology meet to produce the optimal finished product. Some stone materials require the CNC machine to move more slowly, some require stone to be entered in a certain way. Without this industry experience, the fabricating process may not produce the best end result.

The actual finished dimensions of the sawn slabs will be controlled by the sawyer or cutter, and depending on the sophistication of the available equipment, may be a manual or digitally controlled process. Cutting method, cutting tools, blade types, rim speed, saw travel rates, and down feed rates are to be selected and adjusted to provide the smoothest cut with the least amount of chipping possible.

Cutouts and Drilling

Measure, template and confirm all cut outs in the countertop. Cutouts shall conform to equipment templates, with allowable tolerances. In the interest of safe handling, some cutouts will be partially or completely performed in the field after installation of the stone., Cut outs can be made with hand-held or automated tools such as CNC machines, right angle grinders, diamond tipped hole saws and or utility knives. Often there are requirement for special care to keep slabs from getting too hot while cutting or drilling takes place. Some slabs can hold great amounts of tension and there are specific guidelines on the correct method when performing cuts. Likewise, some manufactures require cuts be made from a specific direction or from the top down. Always refer to the respective manufacturer's instructions. Detailed installation guidelines should always be followed.

Edge Profiles

Natural Edge profiles shall be consistent along the entire length of the counter top. The shaping of natural stone edges is normally done by a CNC machine or router. Edges are to be finished to the same type and quality of the top surfaces unless specified otherwise. Due to the gauge of some manufactured porcelain slabs there are limitations on edge profile options, outside corners may need to be formed on site.

Surface Finishing

Stone and Engineered and Slab countertops are most often fabricated with a polished or honed finish. A polished finish generally closes more of the surface offering better resistance to moisture. Honed surfaces have become more popular but typically have a higher absorption rate than polished finished stones. Additionally, some manufactures or fabricators will apply or coat the surface with a treatment to fill any possible open pores, pits or micro-fissures prior to finishing. This helps in make the material resistant to moisture or staining.

Once all cut outs and holes have been made in the stone slab and the edge is shaped by the CNC machine the countertop is ready for final polish. A CNC machine may shape and polish at the same time, leaving the edges shaped and polished in one step.

Porcelain tile slabs are manufactured in a variety of finishes that range for lightly textured to highly polished. They are highly Impervious and therefore very resistance to staining and absorption in any of the surface finishes. There is typically no final polishing required with these types of slabs.

INSTALLATION

Handling and Storage Equipment
All technicians involved in the handling and working of materials must receive training in safe work practices. The following is a brief overview of some of the basic tools and equipment required for handling and storage.

- Fork lift
- Vacuum lifter or slab clamp,
- Lifting boom
- Canvas slings
- Vacuum cups
- Suction Cup Handles
- A-frames
- Slab storage racks
- A-frame carts
- Slab dolly

The equipment listed in this manual is for your consideration and meant as reference only. It is important to evaluate individual needs and set up according to those needs within compliance of all provincial, and local guidelines.

Substrate & Supports
All countertop materials should be placed on a sound and solid frame or base which is perfectly plumb, level, true and satisfactorily installed. The cabinets should be affixed to each other and then secured to the back wall. The support must have suitable features for the intended use and remain stable over time. Any imperfections, cracks or movement must be remediated before installation. The surface area must be clean from debris.

Natural Stone and Full Thickness Manufactured Slabs
Fragile stone varieties may require auxiliary support for the stone. Generally, sound varieties of granites and marbles falling within soundness classifications A or B (see classifications at the back of this manual) can be used in thicknesses of 20 mm or greater without the use of auxiliary support. Common materials for subtops are, minimum 3⁄4" marine-grade plywood, exterior-grade plywood, waterproofed medium-density particle board or 1⁄2" cementitious backer board. Subtop must be flat to within 1/8" in 10'-0". Always consult supplier for clarification on acceptable subtops

Porcelain & Sintered Slabs & Panels
Supporting materials are always used for the installation manufactured slabs of a minimum thickness. These large porcelain panels are ideal for placement over top of wood, cement boards existing tile, stone, or extruded foam boards. Extruded foam boards (1-1⁄2 to 2") are becoming the preferred method of countertop installation. Their ease of installation, inherent water/vapor resistance, and high-density composition eliminate many of the stresses that can be created with the traditional layered approach of plywood, backer boards, and/or high build mortar beds.

With all materials, excessive load-carrying requirements such as the use of heavy cast-iron sinks, may require the use of auxiliary supports to carry the weight of the sink and its contents.

Placement
On the project site, it is recommended that all pieces be “dry assembled” in place to verify satisfactory fit prior to the application of any adhesives.

A perimeter space should always be allowed as natural or manufactured slabs need room to expand. Each countertop requires at least 1⁄8"at each wall for expansion and contraction.

Adhering
As a general rule, there is no one universal product that is suitable for all countertop materials to be bonded in place with adhesive on all kinds of substrate. The method of application of the adhesive differs according to the product being used; follow all guidelines given by the manufacturer of the adhesive.

Natural Stone & Full Thickness Manufactured Slabs
Countertops are generally secured to the substrate with a non-staining adhesive. Common construction adhesives or silicone sealant are the most popular materials used. Construction adhesives generally provide greater bond strength, while silicone sealants offer slightly more forgiveness for movements in the substrate. The adhesive material must have a cure rate that is slow enough to allow final positioning of the stone countertop units. Apply adhesive to within 75 mm of all edges and at 150 mm maximum center-to-center spacing when installing over a subtop. Always confirm choice of adhesion with slab manufacture before commencing.

Porcelain, Sintered and Compact Slabs & Panel
As manufactured slabs and substrates often vary, it is difficult to narrow down an adhesive to one. Typically, the slab manufacturer, the persons responsible for the installation along with the manufacturer of the adhesive will together identify the most adequate adhesive according to all applicable requirements. Types most commonly used are:

- Thin-sets for interior installations that meet or exceed ANSI 118.11, ANSI 118.15
- Epoxy Adhesives
- Polyurethanic - Mastics

Some considerations when working with large sized porcelain slabs or panels. Providing a mortar that has a maximum or extended open time which allows for greater adjustability when the tile panel is placed is beneficial. This will ensure that mortar applied to either the slab or substrate does not skin over before adhering together. Also due to the low porosity and large size of these slabs a mortar with self-drying properties is the best option. This will ensure that mortar sandwiched between a non-porous substrate and a non-porous slab will cure without the need of air circulation. Interior Installations are to comply with ANSIA108.19.

- Mix the chosen mortar to the manufacturers recommended consistency
- Use the appropriate trowel to apply the mortar to the countertop and to the back of the tile panel.
- Be sure to scratch/key the mortar into the substrate and panel or slab with the flat side of the trowel before combing.
- Ensure the mortar is spread edge to edge on the slab. This will ensure full support of mortar along the edges.
- Mortar ridges on both the tile panel back and substrate must be parallel to each other, combing at right angles to the long side of the tile panel. Use the appropriate trowels and troweling technique (hold at least a constant 45° angle) and take care to keep the ridges straight and of consistent height. This is crucial to achieving maximum coverage.
- The resulting mortar layer, using the double coat approach, will be approximately 5 mm

Joint & Seam Fillers
Seams in natural stone, engineered or manufactured slab countertops are should be filled level to the top surface. The most common filler materials are polyester resin, epoxy resin and elastomeric sealant. Elastomeric sealants can be of silicone, polyurethane, or acrylic bases. The table below identifies several advantages and disadvantages of each product.

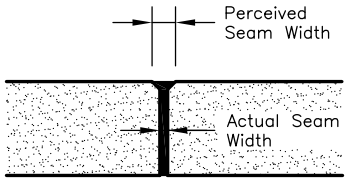
Product	Advantages	Disadvantages
Polyester resin	• Accepts dyes readily, allowing a pleasing color match to stone. • Leaves joint neatly flush with counter-top surface. • Can be buffed to a glossy finish that complements the polished stone surface. • Relatively quick cure time.	• Cures to a high durometer hardness which offers little or no forgiveness for movement. • Limited pot life.
Epoxy Resin	• Leaves joint neatly flush with countertop surface. • Can be buffed to a glossy finish that complements the polished stone surface. • Provides stronger bond than polyester resin. • Long pot life.	• Cures to a high durometer hardness which offers little or no forgiveness for movement. • More difficult to achieve accurate color match than polyester resin. • Long cure time. • The stone fabric will fail before the seam, which is more difficult to repair.
Grout	• Simple to use. • Long pot life. • Relatively easy to dye for color matching.	• Color may not be consistent between batches. • Cracks easily due to movement. • Coarse texture contrasts with polished stone. • High porosity can be a sanitation concern.
Elastomeric Sealant (Silicone, polyurethane, or acrylic)	• Relatively low durometer hardness provides significant extension and compression capability, hence the greatest accommodation for movement of any filler material. • Cures to a glossy surface that compliments the polished stone surface	• Limited to available colors. • Some sealant products contain plasticizers that can migrate into and stain the stone.

TOLERANCES

The tolerances listed in this section are achieved using skilled tradesmen following standard industry workmanship practices. Due to variations in fabrication equipment and stock availability, these tolerances may not be achievable, or in some cases, closer tolerances may be achievable. Therefore, for any particular project, the supplier and customer may agree to hold tolerances that are more or less stringent than those listed herein. Such agreements must be documented in writing. Unless otherwise agreed, the tolerances listed in this document shall govern.

Joint Widths

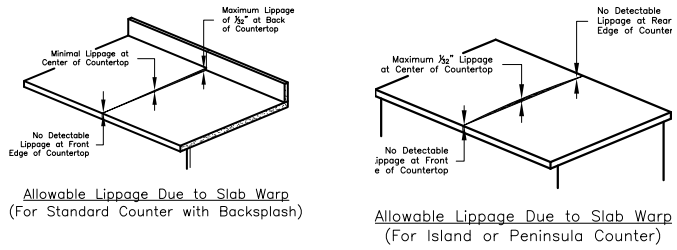
Unless otherwise agreed to at the onset of the project, joint widths for stone or tile countertops must conform to the following: Slab-to-wall joints must be 3 mm in width. Slab-to-slab joints must be 1.5 mm minimum, 2 mm maximum, and uniform from slab to slab. Slab-to-cabinetry joints must be 3 mm in width.



Visual Accentuation of Seam Width due to Arris at stone edges

Graphic courtesy of the Natural Stone Institute

Lippage
The term “lippage,” as used in the tile & stone industry, is the planar offset of the finished surfaces of two adjacent stone units. Due to the relatively tight seams used in countertop installations, even minor amounts of lippage are noticeable. There should be no detectable lippage at the front edge of the countertop. See sketch below for clarification.



Graphics courtesy of the Natural Stone Institute

Vein Trend
When using slabs or panels with obvious vein trend, all tiles shall be installed with vein trend running in the same direction unless otherwise specified.

Shading Variation
Manufactured Slabs are subject to manufacturing processes different from natural stone. There is generally more acceptability in variation between natural stones then manufactured tile. Installers are cautioned to lay out the stone or tile or for inspection and obtain written approval from the owner or specifying authority prior to installation if variation occurs.

Overhangs
As a general guideline, support is required for overhangs. As each type of countertop material, material thickness and material manufacture may have different guidelines for overhangs, it is important to check first to determine when support is required.

REPAIRS

General Information
As we continue to employ better and faster building techniques the opportunity to incorporate changes or corrections has greatly been diminished. Lead-times to incorporate any changes have almost become non-existent. Repairing or patching material that has been damaged may become necessity in order not to impede the progress of the project. Repair of the slab is permitted when the repaired region is not in a structurally significant area of the countertop, and when it can be accomplished skillfully so that the repair is consistent in color and texture with unrepaired regions of the slab. Only skilled and qualified technicians should perform this type of work. Repairs must not distract from the aesthetic and strength of the completed installation

Fissures
Occur naturally in many stone types and are therefore not considered flaws. A fissure is defined by the American Geological Institute as, “An extensive crack, break, or fracture in the rock, which may contain mineral-bearing material.” The term “fissure” is used commercially in the stone industry to describe a visible separation along intercrystalline boundaries. This separation may start and stop within the field of the stone or extend through an edge. A fissure differs from a crack in that it is a naturally occurring feature in the stone that may be found in other areas of the same slab or other slabs of the same material.

Cracks
Occurring as a result of man made mechanically induced stresses during handling, fabrication, transport, or installation. When cracks are detected in slab material prior to fabrication, the best method is to simply avoid including them in the installation and removing them during the layout process. This option may not be practical, or possible. In these circumstances, with written approval, cracks may be repaired by bonding them together with epoxy or polyester resin, either with or without dowel reinforcement. Cracks that occur as a result of handling-induced stresses are often more difficult to repair, as they commonly include chipping in addition to the crack. Repair is frequently performed by injection of a penetrating resin adhesive, which may be dyed to match the stone, and then rebuffing the area after curing of the resin. In many cases with natural stone, the entire slab must be repolished to make the repair unnoticeable. If the repair is attempted but unsuccessful, the slab is to be replaced with a new piece.

Chips
Chips can occur in slabs either as a result of sawing operations or handling and restraint devices. Particularly in the natural stone varieties, the exiting portion of the diamond blade will create many small chips. A small chamfer, called an “arris,” of approximately 1.5 x 1.5 mm can be used to eliminate most of these small chips. The use of an arris will make the seam appear wider than its actual dimension when filled (see image above). Larger chips may be repaired with epoxy or polyester resin if the completed repair is consistent in color and texture with unrepaired areas of the slab. In many materials, the resin used in the repair will appear more natural if it is not dyed. Written approval on acceptance of the repair from the owner or specifying authority should always be sought. If the repair is attempted but unsuccessful, the slab is to be replaced with a new piece.

Pitting
Pitting of natural stone countertop surfaces, particularly in granite or basalt materials, is a commonly seen characteristic. These stones are made up of several different minerals, each mineral having a different hardness. Biotite (small, black minerals throughout the slab) is very soft (2.5) and flakes easily. All true granites have biotite in their composition. Because biotite is relatively soft and flaky, the first few layers are often removed during the polishing process, causing pits throughout the slab. Some stones have more biotite throughout their composition than others. The higher the biotite content of the stone, the more pits it will have. Most polished igneous rocks will have varying degrees of pits, depending on the amount of biotite in their composition.

The pits do not make the slabs less durable or otherwise inferior, and do not in themselves qualify the slab for replacement. Pits are common in all granites and should be expected when dealing with a natural, polished stone. It is usually best to not attempt repair of pits, as most repair techniques will not cosmetically improve the countertop.

CARE AND MAINTENANCE

General Information
Care and Cleaning Practices of a natural stone or manufactured countertops are to be thoroughly discussed with the client upon completion of the installation. Carry out a first cleaning upon the installation of the countertop in order to remove traces or residues of mastics and silicones possibly used during installation. When any surface protection or cleaning product is used, care must be taken to read and follow the manufacturer’s written instructions accurately. This will provide the greatest benefit from the application and will guarantee safe handling of the product.

Sealing

Manufactured Slabs
Porcelain, sintered, or quartz slabs have a hard and very nonporous surface making them simple to clean. In most cases, there is no requirement to seal these slabs. Always check with the manufacture to be certain.

Natural Stone
Stone products are porous by nature. To ensure your natural stone products will provide you with a lifetime of aesthetics and performance, proper maintenance is crucial. The application of a topical sealer or impregnator is a common step in decreasing the vulnerability of the stone to stains. Sealers may be applied during fabrication but also benefit from an additional application after installation. If in question check with supplier or manufacture of the slab. All surface treatments must be used in accordance with manufacturer’s specifications.

- Impregnators will penetrate the stone and cure a few millimeters below the surface, residing in the intercrystalline boundary areas and pores of the stone. These products do not actually “seal” the stone and are more correctly referred to as a repellent rather than a sealer. As such, they are formulated to prevent transmission of liquids, while allowing transmission of vapor. Since they reside below the actual surface of the stone, the change to the appearance of the stone surface is minimal. Impregnators will be either hydrophobic, in that they repel water-based fluids only, or oleophobic, repelling both oil and water-based fluids. The manufacturer of the impregnator product will recommend a reapplication interval.
- Topical sealers cure as a film on the stone surface. Since the material is actually covering the stone, the appearance of the stone surface may be altered by the application of this type of product. This material will provide somewhat of a sacrificial layer over the stone and will absorb most of the wear on the countertop. Since the sealer is softer than the stone, normal use of the countertop will result in abrasion of the sealer surface and dictate reapplication to maintain the original luster of the surface. A properly applied topical sealer will normally reduce, although not eliminate, the vulnerability of calcareous stones to attack from mildly acidic solutions.

Cleaning

Manufactured Slab Cleaning

For daily care, use neutral detergents diluted with plenty of hot water. Detergents should not contain wax or leave glossy stains. Dry with a good quality microfibre cloth. Rinse with water once cleaned and clean off the water using another dry microfibre cloth.

Natural Stone Cleaning

Use neutral cleaners specifically designed for cleaning stone. Stone cleaners should never contain acid or bleach. Acids, even a light solution of vinegar and water, will etch and eventually damage natural stone.

Staining & Types of Stains

Manufactured Slabs

Should a spill occur, wipe off the stained area with a neutral cleaner or household detergent and then rinse area with ordinary water immediately. For more stubborn spills and stains, repeat the procedure several times and use a soft, non-metallic scouring pad to remove the stain.

Natural Stone

Stains can often be removed, Identifying the type of stain is the key to removing it. Look for color, shape and environmental factors that could be causing the staining.

- Oil Based: Include grease, tar, cooking oil, milk and cosmetics. An oil-based stain will darken the stone and normally must be chemically dissolved, so the source of the stain can be flushed or rinsed away. Clean gently with a soft liquid cleanser with bleach or household detergent, ammonia, mineral spirits or acetone

- Organic: Includes coffee, tea, fruit, and tobacco, paper, and food, urine, leaves, bark and bird droppings. May cause a pinkish brown stain and may disappear after the source of the stain has been removed. Outdoors, with the sources removed, normal sun and rain action will generally bleach out the stains. Indoors, clean with a 12% hydrogen peroxide and a few drops of ammonia.

- Metal: Includes iron, rust, copper and bronze. Iron or rust stains are orange to brown in color and follow the shape of the staining objects such as nails, bolts, screws, cans, flower pots, and metal furniture. Copper and bronze stains appear as green or muddy brown and result from the action of moisture on nearby or embedded bronze, copper or brass items. Metal stains must be removed by making a poultice. Deep seated, rusty stains are extremely difficult to remove, and the stone may be permanently stained.

- Biological: Includes algae, mildew, lichens, moss and fungi. To clean, dilute with 1/2 cup in 3.78 litres of water with only one of the following: ammonia, bleach, or hydrogen peroxide.
  DO NOT MIX BLEACH AND AMMONIA! THIS COMBINATION CREATES A LETHAL AND TOXIC GAS!

- Ink: Includes magic marker, pen and ink. Clean with bleach or hydrogen peroxide for light colored stones. Use lacquer thinner or acetone for dark colored stones.

- Paint: Small amounts can be removed with lacquer thinner or scraped off carefully with a razor blade. Heavy paint coverage should be removed with a commercial “heavy liquid” stripper. Paint strippers can etch the surface of the stone; re-polishing may be necessary. Do not use acids or flame tools to strip paint from the stone.

- Water: Water spots and rings that include surface accumulation of hard water. Buff with dry 0000 steel wool.

- Fire and Smoke Damage: Older stones and smoke or fire-stained fireplaces may require a thorough cleaning to restore their original appearance. Commercially available “smoke removers” may save time and effort.

- Etch Marks: Usually caused by acids left on the stone. Some materials will etch the finish but not leave a stain; others will both etch and stain. Once the stain has been removed, wet the surface with clear water and sprinkle with marble polishing powder. Rub the powder into the stone with a damp cloth or by using a buffing pad with a low-speed power drill. Continue buffing until the etch mark disappears and the stone surface shines. Honing may be required for deep etching.

Stain Removal

Poultice

A poultice is a fine, non-acid, absorptive clay cleaning powder that may remove deep-set oil stains, grease and light cementitious grout haze from polished and unpolished natural stone and manufactured slabs

Poultice Stain Removing Options:

- Oil Based Stains: Poultice with baking soda and water OR one of the powder-based poultice materials and mineral spirits.
- Organic Stains: Poultice with one of the powdered poultice materials and 12% hydrogen peroxide solution OR use acetone instead of hydrogen peroxide.
- Iron Stains: Poultice with diatomaceous earth and commercially available rust. Rust stains are particularly difficult to remove. Professional assistance may be required.
- Copper Stains: Poultice with one of the powdered poultice materials and ammonia. These stains are difficult to remove, professional assistance may be required.
- Biological Stains: Poultice with one of the poultice materials and diluted ammonia OR bleach OR hydrogen peroxide. DO NOT MIX AMMONIA AND BLEACH! THIS COMBINATION CREATES A TOXIC AND LETHAL GAS!

Application of Poultice

Prepare the poultice. If using powder, mix with the cleaning agent or chemical to a paste with a thick creamy consistency. If using paper, soak the chemical and let drain. Do not let the liquid drip.

Wet the stained area with distilled water. Apply the poultice to the stained area, approximately 6 mm to 12 mm thick and extend the poultice beyond the stained area by approximately 2.5 cm. Use a wood or plastic scraper to spread the poultice evenly. Cover the poultice with plastic and seal the edges with tape.

Allow to dry thoroughly, usually 24 to 48 hours. The drying process pulls the stain out of the stone and into the poultice material. After approximately 24 hours, remove the plastic and allow the poultice to dry. Remove the poultice from the stain, rinse with distilled water and buff dry with a soft cloth. Use a wood or plastic scraper if necessary.

Repeat the poultice application if the stain is not removed. It may take up to five (5) applications for difficult stains.

If the surface is etched by the chemical, apply polishing powder and buff with a polishing pad recommended by the polishing powder manufacturer.

OUTDOOR KITCHENS

General Information

An increasingly popular area for stone countertops is in outdoor kitchens. The installation of natural stone countertops in these areas creates additional challenges from the installation of indoor countertops for suppliers and installers. Due to extreme temperature changes, possible freeze/thaw cycling, UV exposure and varying moisture levels, typical installation methods along with certain materials cannot be used.

Customer Communication

In addition to the prescriptions state earlier in this chapter, customers should be made aware that due to the use of resins in the finishing process of natural stone, they will most likely experience some fading in their countertops. Nearly all resins used in the fabrication process are subject to color change and surface degradation when exposed to UV light See section 14.2.4.

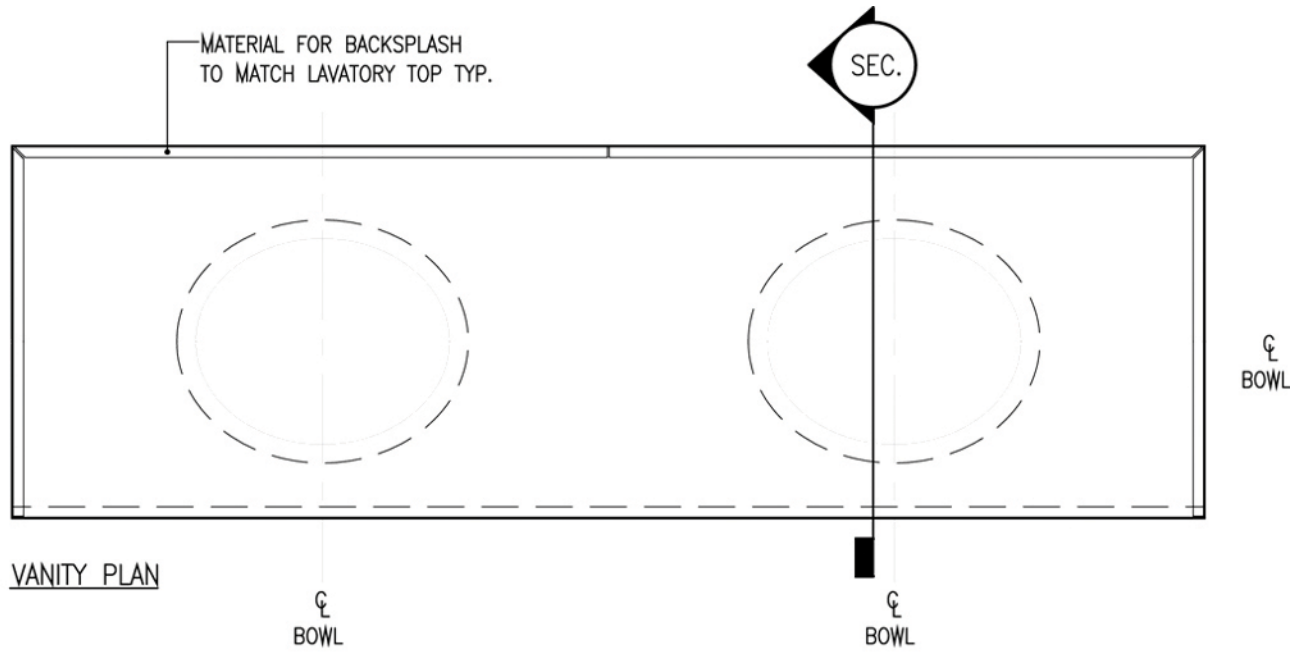
Materials

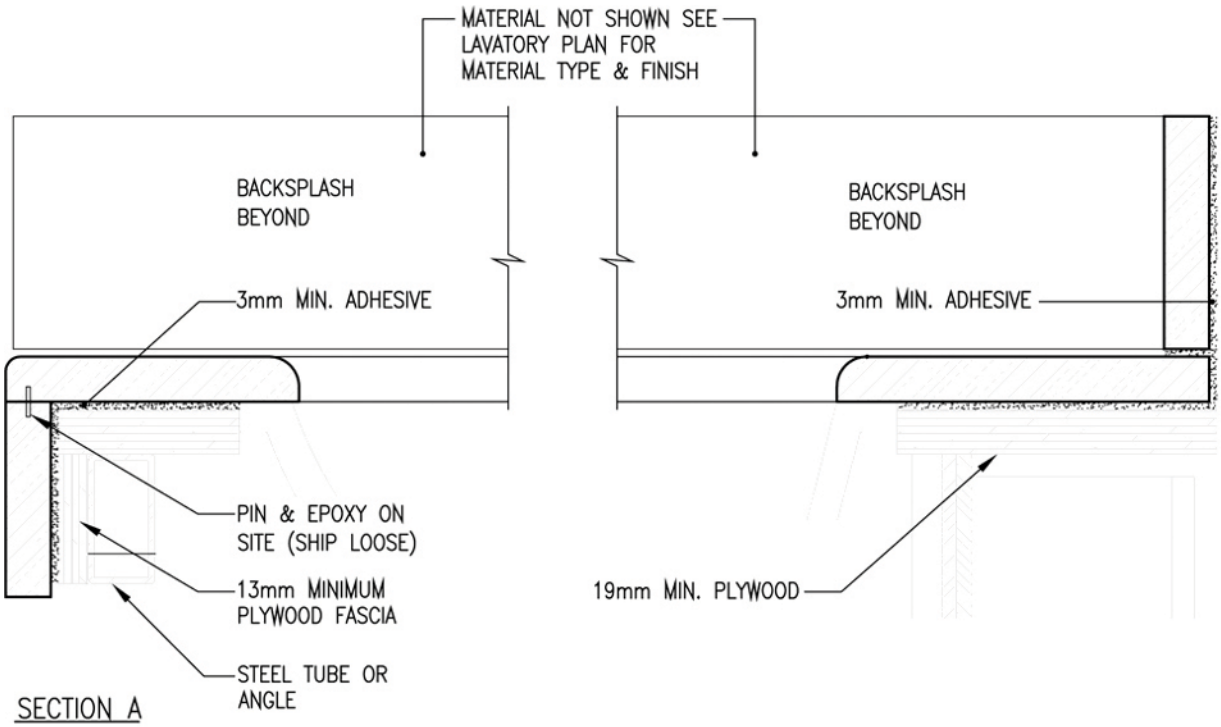
It is recommended that only sound stones with minimal geological flaws or voids be used for these areas. Stones that contain these voids or fissures may harbor contaminants which allow the growth of mold and mildew . Additionally , the loosening of filler materials and in some cases, cracking and separating due to thermal and/or freeze/thaw cycling .

Subtops
All areas that are to receive stone countertops should have a sub top or auxiliary frame made of cement board or mortar bed. The subtop or auxiliary framing should include only materials which are rated for exterior exposure.

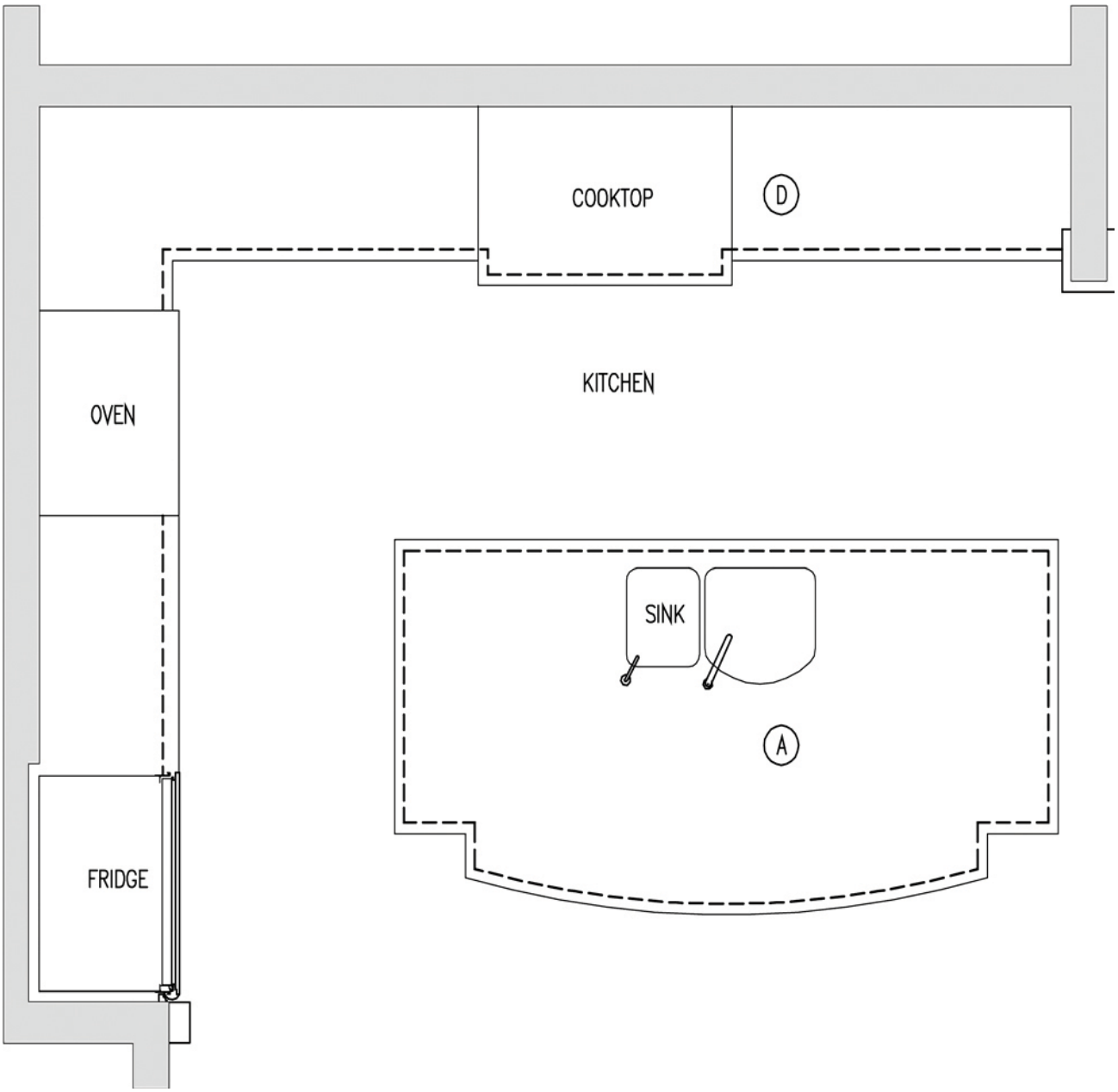
Adhesives
All adhesives to be used must be suitable for exterior installations. Since silicone is frequently used on outdoor kitchens, care must be taken to ensure that staining does not result from plasticizer migration of some silicone products. Polyester adhesives should be avoided in an exterior environment.

Seam Filler Materials
All materials that are to be used for seam filler must be suitable for exterior installations and allow for some movement. Joint widths between adjacent stone units may be as small as nominal 1/16”, but ample accommodation for differential movement due to thermal expansion and contraction must be made at the perimeter of the stone installation.

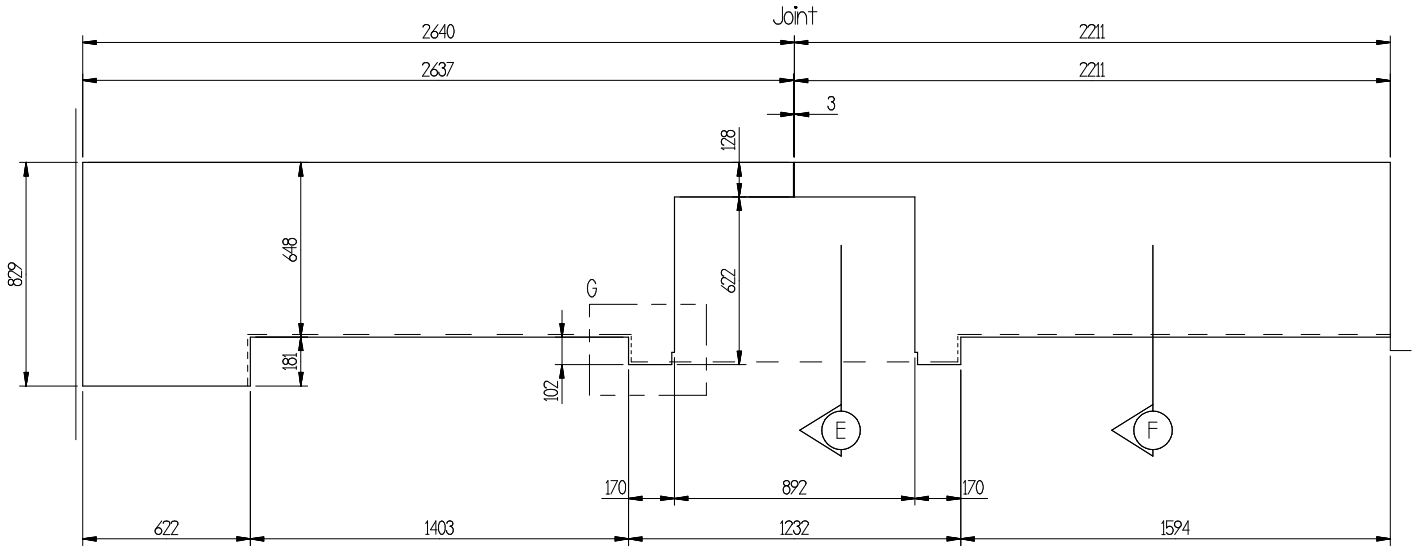

MATERIAL FOR BACKSPLASH
TO MATCH LAVATORY TOP TYP.
SEC.
℄
BOWL
VANITY PLAN
℄
BOWL
℄
BOWL


MATERIAL NOT SHOWN SEE
LAVATORY PLAN FOR
MATERIAL TYPE & FINISH
BACKSPLASH
BEYOND
3mm MIN. ADHESIVE
BACKSPLASH
BEYOND
3mm MIN. ADHESIVE
PIN & EPOXY ON
SITE (SHIP LOOSE)
13mm MINIMUM
PLYWOOD FASCIA
STEEL TUBE OR
ANGLE
19mm MIN. PLYWOOD
SECTION A

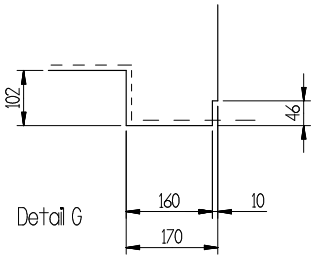
SAMPLE KITCHEN PLAN

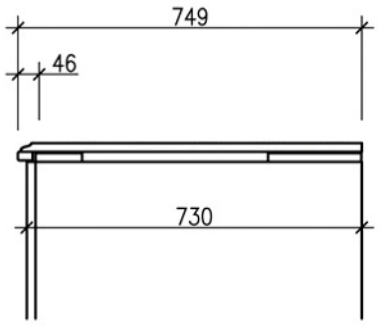


COUNTER DETAILS

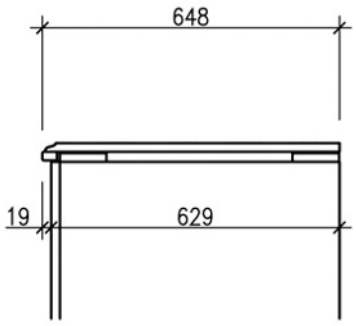


Plan D – Finished Granite Dimensons



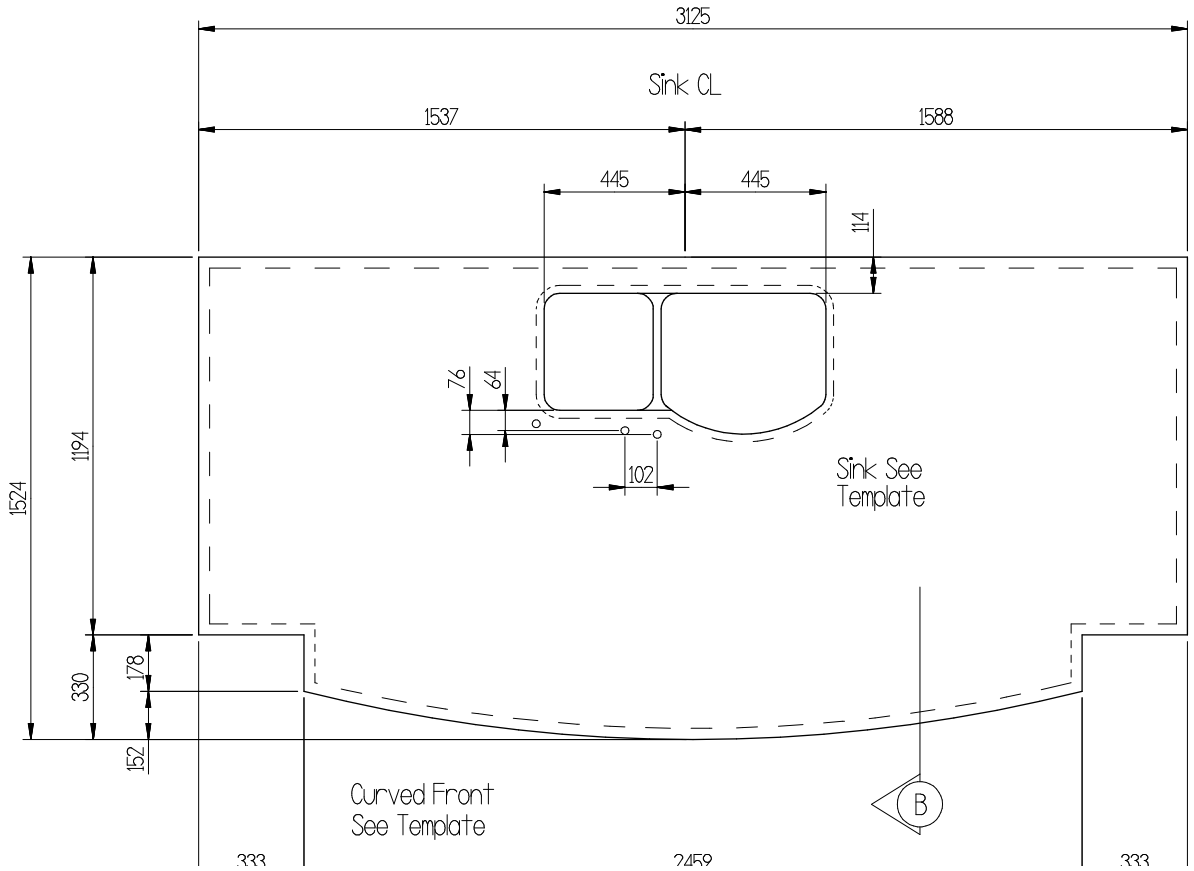


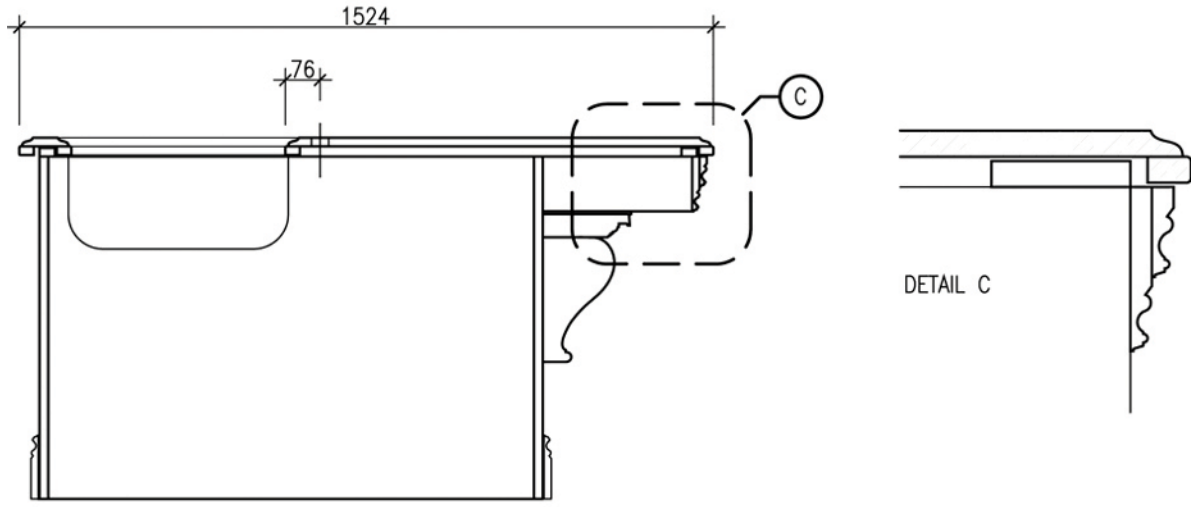
SECTION E – COOKTOP



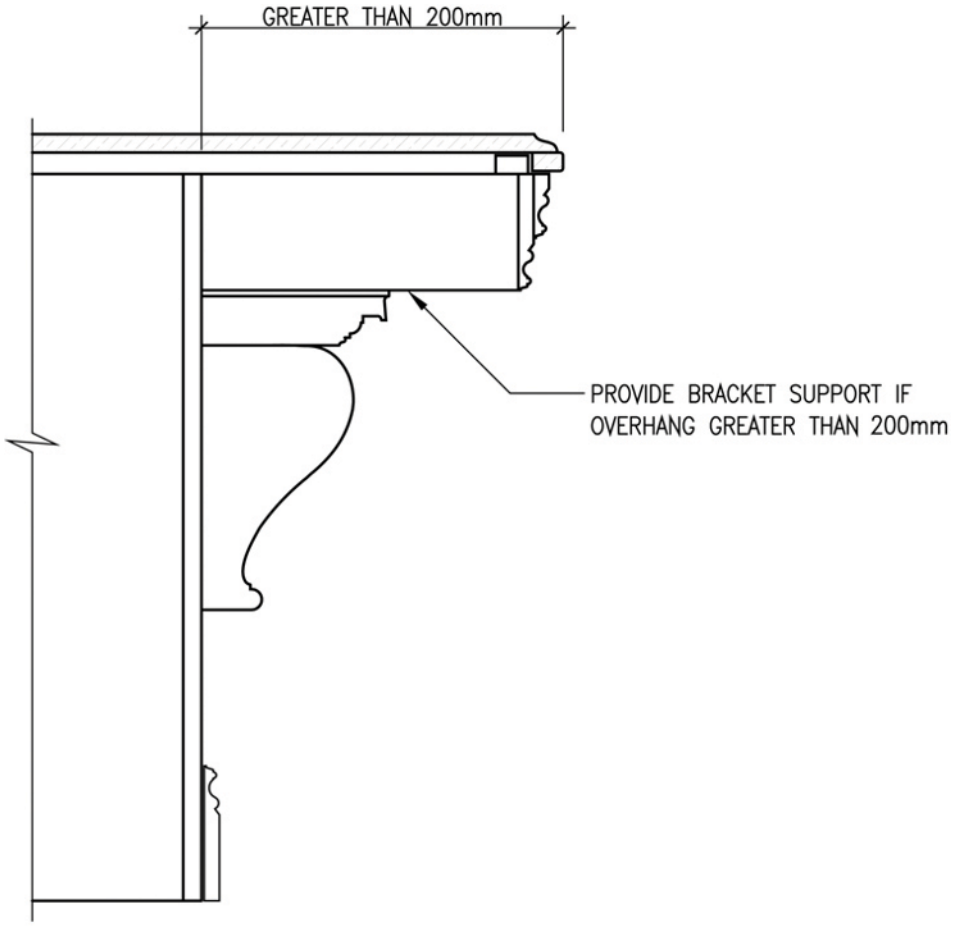
SECTION F – COUNTER

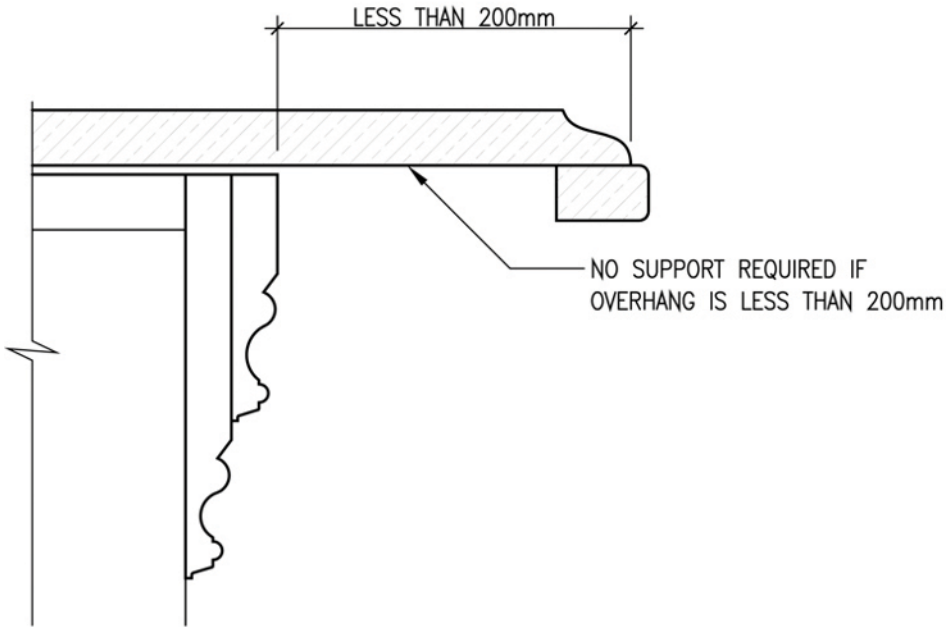
ISLAND DETAILS





SECTION B – ISLAND


GREATER THAN 200mm
PROVIDE BRACKET SUPPORT IF
OVERHANG GREATER THAN 200mm


LESS THAN 200mm
NO SUPPORT REQUIRED IF
OVERHANG IS LESS THAN 200mm

A

Abrasive Finish
A flat, non-reflective surface finish.

Abrasive Hardness (Ha)
Refers to the wearing qualities of stone for floors, stair treads, and other areas subjected to abrasion by foot traffic.

Absorption
Percentage of moisture absorption by weight; (see ASTM C97)

Acid Cleaning
Solution of inhibited acid and water used for cleaning unglazed surfaces.

Adhered
Stone veneer secured and supported by adhesion of an approved bonding material over an approved backing.

Adoquin
A volcanic quartz-based stone containing a variety of colored aggregates and pumice in a quartz matrix. Quarried in Mexico. Available in several colors.

Agglomerated "Stone"
A product made from quarry waste.

Alabaster
Fine-grained, translucent variety of gypsum, generally white in color. May be cut and carved easily with a knife or saw. Term is often incorrectly applied to fine-grained marble.

Alkali Carbonate Reaction (ACR)
The reaction of alkalis within certain limestone aggregates which can cause expansion and cracking in concrete.

Alkali-Silica Reaction (ASR)
The reaction of alkalis with aggregate (sand/rocks) with poorly crystalline and reactive silica. May cause distress to concrete.

Anchor
Metal device for securing dimension stone to a structure.

Anchorage
The means by which slabs are attached to a self-supporting structure.

Anchors
Mechanical devices for securing marble units to structural members or back-up walls.

Apron
A trim piece under a projecting stone top, stool, etc.

Arris
Edge of an external angle.

Ashlar
Stone having a square or rectangular shape.

B

Backbuttering
Placing mortar on the backside of the stone with a trowel before setting into place.

Backing
Wall surface on which stone will be applied.

Backing Rod
A flexible and compressible type of closed-cell foam polyethylene, butyl rubber, or open cell and closed cell polyurethane, rounded at surface to contact sealant. It is installed at the bottom or rear of joint. Often described as a "filler strip".

Back-up Wall
That part of masonry wall behind the exterior veneer or facing.

Banker
Bench of timber or stone (may be a single block) on which stone is worked.

Basalt
A dark-colored, igneous rock commercially known as granite when fabricated as dimension stone.

Base
The bottom course of a stone wall, or the vertical first member above grade of a finished floor.

Bearing Check
A slot cut into the back of dimension stone to allow entry of a supporting angle or chip.

Bed
1. Stone set with grain running horizontally is said to set on "natural bed". Stone set with the grain running vertically is on "edge".
2. The top or bottom horizontal surface of a piece of stone, which is covered when the piece is set in place.
3. A filled or open space extending horizontally between adjacent pieces set in place.

Bedding Plane
Horizontal plane of sedimentary stone in position of its original formation.

Bevel
A sloped surface contiguous with a vertical or horizontal surface.

Bleed
Staining action on marble of various oil- based putties, mastics and other caulking.

Bond Coat
The cement, epoxy or adhesive coat applied over prepared surface or to individual slabs during setting operations.

Breccia
Rocks made up of angular fragments of still older rocks, which have been melded together over time.

Brushed Finish
Textured surface obtained by brushing a stone with a coarse rotary type wire brush. (Sometimes referred to as broom finish)

Building Stone
Natural rock of adequate quality to be quarried and cut as dimension stone as it exists in nature.

Buttering
Placing mortar or other jointing materials on masonry unit before laying it in place.

C

Calcarenite
A limestone composed predominantly of clastic sand-size grains of calcite, or rarely aragonite, commonly as tiny fossils, shell fragments, or other fossil debris.

Calcite
One of the most common minerals - calcium carbonate. It occurs in crystalline forms and is a major constituent of limestone, marble and chalk. Marble containing no more than 5% magnesium carbonate (dolomite) is sometimes called calcite marble.

Capillary Action
Saturation of the substrate caused by the rise and fall of liquid and may travel from lower to higher elevations.

Carbonation
The neutralization of the protective alkalinity of concrete caused by the absorption of dioxide and water resulting in the formation of carbonic water. May lead to corrosion issues later.

Cementitious Backer Unit (CBU)
A backer board designed for use with stone. It can be used in place of metal lath, Portland cement scratch coat and mortar bed over frame construction. Should be used in place of plywood or drywall in wet areas or for exterior use.

Clearance
Space allowed facilitating erection of units and providing for thermal and other estimated movements in structure.

Cleavage Plane
An asphalt coated paper or polyethylene film installed over the structural slab providing a slip sheet to prevent transmission of structural cracks through to the flooring surface.

Coated Glass Mat Backer Board
A backer board designed for use with stone. It can also be used in non-tile applications. Should be used in place of plywood or drywall in wet areas. Not for exterior use.

Conglomerate (Agglomerate)
Tile or slabs made up of stone chips in a cement or resin binder.

Conglomerate
A sedimentary rock consisting of rounded pebbles and cobbles in a sandstone matrix, typically strongly cemented.

Control Joint
A joint cut, formed or tooled into the concrete surface to control the location of cracks due to shrinkage and other dimensional changes in the concrete structure.

Coquina
A limestone composed predominantly of unaltered shells or shell fragments loosely cemented by calcite.

Cramp
U-shaped metal device for holding two adjacent pieces of marble together.

Cultured Stone
Artificial stone.

Curtain Wall
Exterior wall which is non-load bearing, and which is supported by structural framework of building.

Cushions
Resilient pad intended to absorb or counteract severe stresses between adjoining marble slabs or marble slabs and other adjoining materials.

D

Dado
Marble treatment on walls which does not extend to the ceiling.

Dimension Stone
Stone that has been trimmed or cut to specified shapes and sizes.

Dolomite
A sedimentary carbonate rock (a variety of limestone) that consists largely or entirely of the mineral dolomite.

Dowel
Cylindrical metal pin used in aligning and strengthening joints of adjacent pieces of marble.

Drip
A recess cut into the underside of projecting stone to divert water and prevent it from running down the face of a wall or other surface of which it is a part.

Dry Seam
Unhealed fracture which may be a plane of weakness.

Dry-set or thin-set cement
A modified Portland cement bond coat setting material with self-curing properties, which when mixed, as per manufacturer's instructions, is used for stone installation.

Durability
The measure of the ability of natural building stone to endure and to maintain its essential and distinctive characteristics of strength, resistance to decay and appearance. Durability is based on the length of time that a stone can maintain its innate characteristics in use. This time will vary depending on the environment and use of the stone in question (for example, outdoor versus indoor use).

E

Efflorescence
A whitish powder, sometimes found on surfaces, caused by the deposition of soluble salts carried through or onto the surface by moisture.

Entasis
The curve resulting from the gradual diminishing of the diameter of the upper two- thirds of a column.

Epoxy Resin
A flexible, usually thermal setting resin made by the polymerization of an epoxide and used as an adhesive.

Epoxy
Resin which forms strong, tough resilient polymers with low shrinkage during cure and good physical properties for structural applications.

Erection
The process of setting vertical dimension stone into place.

Expansion Anchor or Bolt
A socket that grips a drilled hole in stone by expanding as the bolt is screwed into it.

Expansion Joint
A joint that extends through the stone, bonding material and substrate. They are designed to allow for continuous movement in the building structure caused by expansion and/or contraction due to thermal change or other influences.

F

Fabricated
Dimension stone manufactured and ready for installation.

Face
Refers to the exposed surface of stone on a structure.

Filler Strip
See “Backing Rod”.

Filling
The filling of natural voids in stone units with cements or synthetic resins and similar materials.

Fines
The powder, dust, silt-sized or sand-sized material resulting from stone processing.

Finish
Final surface applied to the face of dimension stone during fabrication.

Flagstone
Thin slabs of stone used for paving walks, driveways, patios, etc. They are generally fine-grained, bluestone, other quartz- based stone or slate. Thin slabs of other stones may also be used.

Flamed Finish
See “Thermal Finish”.

Flamed (Thermal) Surface Finish
A flamed, or thermal surface finish is achieved by passing a 2,800 ºF torch flame over the surface of the stone. This process heats the various minerals and crystals and expands them until they explode or break from the body of the stone. The result of this thermal process is a coarse, irregular surface finish with an exposed port structure. The flamed finish creates a look and texture which is desirable in certain applications. However, this open porosity also exposes the stone to weathering and other moisture-bearing contaminants. Generally, only granites and a few other stones can be successfully flamed due to the amounts of dissimilar minerals present with different coefficients of thermal expansion.

Flashing
Protection preventing infiltration of moisture.

Fleuri Cut
The “mottled” effect obtained when certain stone varieties are cut parallel to their natural bedding plane.

G

Gang Saw
A mechanical device, also known as a “frame saw”, used to reduce stone blocks to slabs of predetermined thickness.

Gauged or Gauging
A grinding process to make all pieces of material to be used together the same thickness.

Gauged and ungauged slate
1. Gauged slate is machined on underside for constant thickness – for adhesive, thin-set or mortar bed installations.
2. Ungauged slate a natural cleft of nominal thickness.

Glass Seam
Vein fillings of coarsely crystalline calcite that do not necessarily decrease the strength of stone.

Grain
The easiest cleavage direction in a stone “with the grain”, same as “natural bed”; also, particles (crystals, sand grains, etc.) of a stone.

Granite
A hard, crystalline, igneous rock. A granular igneous rock composed principally of feldspar and quartz, with lesser amounts of dark ferrous-magnesium materials.

Greenstone (commercial definition)
A metamorphic rock, typically with poorly defined granularity, ranging in color from medium green or yellowish green to black.

Grout
Mortar used to fill joints.

Guide Specification
Recommended specification for the finishing and installation of dimension stone.

H

Hand or Machine Pitch-Faced (Rock-Faced) Ashlar
A finish given to veneer stone. This is created by establishing a straight line back from the irregular face of the stone. Proper tools are then used to cut along the line, leaving a straight arris and the intended rustic finish on the face.

Hat
Specialized bracket used to fasten steel strut to substrate.

Head
The exposed surface of the jointed end of any given piece of stone whose gauged dimension is not more than the minimum thickness of the material specified.

Hone Finish (or honed)
A satin smooth surface finish with little or no gloss. This finish is recommended for commercial floors.

Hydrostatic Pressure
Water pressure beneath a below grate slab driven by the forces of gravity resulting in transmission through the slab in the absence of waterproofing techniques.

Igneous
One of the three great classes of rock (igneous, sedimentary and metamorphic), solidified from molten state as granite.

I

Importer
One who imports marble and maintains a storage yard for stocking and distributing blocks and rough sawn slabs of marble from foreign countries to marble trade in this country in substantial quantities and reliable quality.

Incise
To cut inwardly or engrave, as in an inscription.

Indiana Limestone Institute (ILI)
A trade organization established for the dissemination of information on limestone standards, recommended practices, grades, colors, finishes, and all technical data required for specifying, detailing, fabricating and erecting Indiana Limestone. Publishers of the “Indiana Limestone Handbook” and other technical papers.

Installation
See “Erection”.

K

Kerf
Slot cut into the edge of stone with a saw blade for the insertion of anchors.

L

Leakage
The moisture migration traveling from a higher to a lower elevation due to the force of gravity.

Leveling or straightening coat
A cement mortar applied to the surface of backing or structural slab to bring surface to a true even plane. Differs from mortar bed as the leveling coat or straightening coat is usually allowed to set up prior to installation of slate.

Limestone
Any stone consisting wholly or principally of calcite (calcium carbonate). Marble is a limestone which has been transformed (metamorphosed) over time. The variety of limestone used as a building stone is hard and lasting; it can be cut easily and shaped with saws, planes and lathes, and has a minimum of graining.

Limestone Marble
Compact, dense limestone that will take a polish is classified as marble in trade practice. Limestone marble may be sold as limestone or as marble.

Liners
Structurally sound sections of marble which are cemented and dowelled to back of marble veneer slabs with polyester, epoxy or German cement. Their purpose is to give greater strength, additional bearing surface or to increase joint depth.

Lippage
The edge of an aperture at the seam or joint of two parallel surfaces resulting in an exposed edge.

M

Marble
Carbonate rock that has acquired a distinctive crystalline texture by recrystallization, most commonly by heat and pressure during metamorphism, and is composed principally of the carbonate minerals calcite and dolomite, singly or in combination.

Matching
Selecting, cutting and placing finished marble slabs to obtain a uniform and symmetrical pattern of natural veining and color.

Microcrystalline Limestone
A limestone that consists largely or wholly of crystals that are so small as to be recognizable only under magnification.

Mortar bed
The bed installed to receive stone.

Mullion
Upright division member between windows or doors of closed series.

N

Natural Cleft Surface Finish
A natural cleft finish is a natural surface texture that is produced by splitting or separating stones which possess natural cleaved planes such as slate. The true color of the stone is maintained during the splitting process and the natural cleft surface creates a unique look for a variety of applications.

Non-Ferrous
Of non-iron nature.

Notched trowel
A special trowel with notched edges on two adjacent sides to facilitate the application of organic adhesive or thin-set cement to the proper thickness.

O

Onyx Marble
Translucent, generally layered, cryptocrystalline calcite with colors in pastel shades, particularly yellow, brown and green.

Oolitic Limestone
A limestone composed largely of the spherical or sub-spherical particles called oolites or ooliths.

Oxidization
A reaction to the loss of electrons in the metal often resulting in corrosion where the corroded metal forms an oxide, elevated temperatures increase the rate of oxidation.

P

Panel Wall
Non-load bearing wall consisting of panels of various materials, each panel being separately held in frame. Frame may be structural itself or be fastened to structural frame work of building.

Parging
Plastering of face of back-up wall or back of facing material with cement mortar to fill chance voids.

Pilaster
Engaged pier of shallow depth, in classical architecture it follows height and width of related columns with similar base and cap.

Plinths
Lower square part of base column. Square base or lower block of pedestal. Base block and juncture of baseboards and trim around opening.

Pointing
Final filling and finishing of mortar joints that have been raked out.

Polished Surface Finish
A glossy surface which brings out the full color and character of the stone. The higher the sheen or polish, the more resistant the stone will be to damaging conditions such as moisture, acidic solutions, and air pollutants.

Unfortunately, the higher the sheen or polish, the lower the slip resistance or coefficient of friction (COF) of the stone. Harder stones, such as granite will hold their polish longer under traffic than softer stones.

Polyethylene Film
Plastic film sheet used for curing or cleavage membrane.

Porphyry
Igneous rock characterized by distinct and contrasting sizes of course and fine-grained crystals. Used as a decorative building stone.

Poultice
A moist mass of chemicals spread on a cloth and applied to remove dirt and stains.

Predella
Platform surrounding alter.

Privacy Partition
A thin stone panel between urinals; see “Urinal Screen”.

Q

Quarrier
One who extracts natural stone from a quarry.

Quarry
Stone quarry is pit, open to air or underground from which is obtained by cutting, drilling or wire-sawing stone.

Quarry Block
Generally, a rectangular piece of rough stone as it comes from a quarry, frequently dressed (scabbed) or wire-sawed for shipment.

Quartz-Based Stone
This stone may be either sedimentary in formation (as in sandstone) or metamorphic (as in Quartzite).

Note: Definitions of three classes of stone which form a Quartz-Based Stone Group are explained in ASTM C119.

Quartzite
Classified as metamorphic sandstone, it is 95% free silica with hardness close to granite. A metamorphic quartz-based stone formed in exceedingly hard layers. In some deposits, intrusion of minerals during the formation process created unusual coloration.

Quartzite Sandstone
Sandstone containing at least 90% free silica (quartz grains plus siliceous cement), which may fracture around or through the constituent grains.

Quirk Mitre
System used where two pieces of marble from external angle constructed of beveled edge which does not extend to outside angle.

R

Rabbet
Type of joint used at intersection of two pieces of marble where one-piece fits into a recess. The groove cut into the surface along an edge so as to receive another piece similarly cut.

Rake
An angular cut on the face of stone.

Receptor
Combined floor and curb used as base for shower.

Rebated Kerf
An additional cut that countersinks a kerf from the back edge of the kerf to the back edge of another piece of stone for the purpose of additional anchor clearance. It is not a gauged cut. If used for a bearing surface, must be shimmed to allow for tolerance in the cut.

Recrystallized Limestone
A limestone in which a new pattern of crystallinity has pervasively replaced the crystal orientation in the original clastic particles, fossils or fossil fragments and interstitial cement. The new generation of crystals, encompassing both fragmental and matrix materials, extends across boundaries between former crystals. The new crystals generally are larger than those of the original rock. Evidence of original textures may or may not be retained.

Reglet
A narrow, flat recessed molding of rectangular profile.

Reinforcing Mesh
A wire mesh installed in flooring to increase tensile strength, usually 50 mm x 50 mm x 1.6 mm (2" x 2" x 1/16") gauge square mesh.

Reinforcement
A fabrication technique often called “rodding”; refers to the strengthening of unsound marble and limestone by cementing rods into grooves or channels cut into the back of a stone unit. Another method of “reinforcement” is the lamination of fiberglass to the back of the stone.

Reliquary
Receptacle for relics set in marble alters.

Residual Moisture
Excessive moisture in the slab from the original concrete mixing water.

Return
See “Head”.

Reveal
The exposed portion of a stone between its outer face and a window or door set into an opening.

Rift
the most pronounced direction of splitting or cleavage of a stone (see grain). Rift and grain may be obscure, as in some granite, but are important in both quarrying and processing stone.

Rock
A naturally occurring consolidated aggregation of one or more minerals constituting the crust of the earth.

Rodding
Reinforcement of structural unsound marble by cementing reinforcing rods into grooves or channels cut into the back of slab.

Rough Sawn
A surface finish resulting from the gang sawing process.

Rubble
A term applied to dimension stone used chiefly for walls and foundations, consisting of irregularly squared pieces, partly trimmed or squared, generally with one split or finished face, and selected and specified with a size range.

Rustication
Chamfers or square sinkings around the face edges of individual stones to create shadows and to give an appearance of weight to a lower part of a building. When only horizontal joints are sunk, the device is known as banded rustication.

S

Saddle
Flat or shaped strip of marble projecting above finished floor surface between jambs of door threshold.

Sample
A piece of dimension stone, usually 305 mm (12”) x 305 mm (12") showing the general range of color, markings and finish of a given variety.

Sand Blasted
A dull non-glossy finish applied to stone; usually accomplished by blasting air blended with sand across the surface.

Sand Finished
A matte textured surface finish with no gloss; finished by application of a steady flow of sand and water under pressure.

Sandstone
See “Quartz-Based Stone”. Scabbling: See “Dressing”.

Sandstone
Composed of medium to course grains of sand - mainly of quartz - with iron oxide, minerals and secondary silica comprising the cementing materials.

Scarifying
Process utilizing star shaped steel or carbide tipped cutters to impact the surface, chipping or tearing away particles of the floor, resulting in a rough profile. Scarifying will remove almost any material – hard or soft. A disadvantage of using the scarifying method is strong vibrations and noise. It is recommended that shot blasting or water pressure cleaning be used as a secondary process to remove micro cracked particles.

Scratch Coat
The initial cement mortar coat installed over backing usually preceding the mortar bed.

Sculpture
The work of a sculptor cutting a three-dimensional form from a block of stone.

Sealant
An elastic adhesive compound used to seal stone veneer joints.

Sealing
1. To make a veneer joint water-tight or leak-proof with an elastic adhesive compound;
2. Application of a surface treatment to retard staining. Sedimentary Rocks: Rocks formed by sedimentary deposits (mineral or organic matter deposited by water, air or ice). Marble is one example.

Serpentine Marble
A rock consisting mostly or entirely of serpentine (hydrated magnesium silicate), green to greenish-black in color, commonly veined with calcite and dolomite or magnesite, or both (magnesium carbonate).

Setter
An experienced journeyman who installed dimension stone.

Setting
The trade of installing dimension stone.

Setting Compound
A chemical resistant setting compound sometimes used for installing slate.

Setting Space
Term used to indicate distance from finished face of piece of marble to face of back-up material.

Shear
Type of stress; body is in shear when it is subject to pair of equal forces which are opposite in direction and which act along parallel planes.

Shims
Thin pieces of metal used to adjust to exact plane. Wood lead and aluminum not permitted.

Shot Blasting
Method that cleans and profiles concrete surfaces by removing dirt, laitance, curing compounds, sealers or other contaminants in preparation for the application of protective materials.

Sill
Horizontal marble member immediately supported by foundation wall or piers and which in turn bears upright members of frame for opening in wall.

Siltstone
A fine-grained, noncarbonated clastic rock composed mostly of detrital quartz and clay minerals in which the particles have an approximate size range of 0.06 to 0.005 mm. Siltstone may be designated fine-grained sandstone and is texturally transitional between sandstone and shale.

Slate
A natural quarried fine-grained metamorphic rock or material, available in multiple shapes and sized, thicknesses and colors, (Gauged or ungauged), natural cleft finish, non-slip wet or dry, other finishes available to special order. Frost proof, acid resistant, noncombustible, low absorption, sanitary and easy to clean maintain.

Slurry Bond Coat
Usually a Portland cement and water mixture applied to surface of a structural slab to insure a positive bond for mortar bed.

Soffit
The underside
Soundness
Describes the degree to which untreated stone is free from cracks, faults and similar imperfections. It is of concern at the time of fabrication and installation.

Spall
A chip or splinter separated from the main mass of stone.

Spandrel
Panel of wall between adjacent structural columns and between window sill and window head next below it.

Split
Division of a rock by cleavage.

Split Face (Sawed Bed)
Usually sawed on the stone bed and split by hand or machine so that the face of the stone exhibits the natural quarry texture.

Split Face Stone
Stone on which the face has been broken to an approximate plane.

Split Stone Finish
Obtained by sawing to accurate heights then breaking by machine to required bed widths. (Normal bed widths are 3-1/2" (90 mm))

Spots or Spotting
Adhesive contact, usually of plaster of paris, applied between back of marble veneer and face of back-up wall to plumb or secure standing marble.

Sticking
Process of cementing together broken slabs or pieces of marble.

Stool
Inside sill of window.

Stringer
Defines treatment at edge of stairs, inside and outside.

Structural Slab
The flooring surface on which stone will be installed.

Struts
Supporting brace.

Styolite
Longitudinally streaked, columnar structure occurring in some marbles and of same material as marble in which it occurs.

Sulfate Attack
Salts derived from the soil and foreign to concrete via moisture intrusion that adversely affect the concrete and the covering material.

T

Telegraphing
A common industry term to describe cracking conditions that originate from within the assembly and/or substrate and migrate to the surface.

Template
Pattern.

Texture
The size, degree of uniformity and arrangement of the minerals contained in a piece of marble. Grains of calcite, the principal constituent of most marbles, are crystalline and have definite cleavages, showing bright reflecting faces on a broken surface. Most marble have elongated grains going in one direction.

Thermal Finish
A rough surface finish that tends to subdue the color and markings of marble and granite.

Translucence:
Translucence is one of marbles most intriguing attributes. It is dependent on four factors:

1. Crystal structure
2. Color - white and other lighter colored marbles are generally more translucent
3. Thickness - the thicker the panel, the less light is transmitted
4. Surface finish - smooth finishes heighten translucency, rough ones decrease it.

Travertine Marble
A porous or cellular layered partly crystalline calcite of chemical origin. Pores and cavities commonly are concentrated in some of the layers, giving rise to an open texture.

Tolerance
Dimensional allowance made for inability of men and machines to fabricate product of exact dimension.

U

Uncoupling Membrane
Minimizes the transfer of thermal movement, shrinkage of Portland cement, subfloor deflection, minor crack transference caused by substrate movement, etc. to the stone floor. Eliminates the need for crack isolation and anti-fracture membranes. Recommended for installation over problematic substrates.

V

Vapor Transmission
Process of moisture emitting through a concrete surface driven by nature through the capillaries within the concrete.

Vein
A streak or marking in marble - the result of mineral deposits. Iron oxides make the pinks, reds, yellows and browns. Most grays, blue greens and blacks are of bituminous origin. Micas, chlorite and silicates cause greens.

Veneer
Decorative facing material which is not meant to be load-bearing.

W

Water Vapor
Permeability – Water vapor permeability of a homogeneous material is a property of substance. This property may vary with conditions of exposure. Average permeability of specimen is product of its permeance and thickness.

Wear
The removal of material or impairment of surface finish through friction or impact.

Weathering
Natural alteration by either chemical or mechanical processes due to the action of constituents of the atmosphere, surface water or ground water, or to temperature change.

Metric Conversion Guide

To convert inches to millimetres, multiply the number of inches by 25.4 to obtain millimetres. To convert feet to millimetres, multiply the number of feet by 304.88 to obtain millimetres. To convert millimetres to feet multiply the number of millimetres by .00328 to obtain feet.

For a reference only, some common (rounded nominal) industry metric conversions to the imperial equivalents follow:

mm to inch conversion			
1 mm = 1/32 inch	19 mm = 3/4 inch	150 mm = 6 inches	600 mm = 24 inches
1.5 mm = 1/16 inch	22 mm = 7/8 inch	180 mm = 7 inches	1000 mm = 40 inches
3 mm = 1/8 inch	25 mm = 1 inch	200 mm = 8 inches	1200 mm = 4 feet
5 mm = 3/16 inch	30 mm = 1-1/8 inches	280 mm = 11 inches	2400 mm = 7.8 feet
6 mm = 1/4 inch	32 mm = 1-1/4 inches	300 mm = 12 inches	2440 mm = 8 feet
8 mm = 5/16 inch	38 mm = 1-1/2 inches	356 mm = 14 inches	3000 mm = 10 feet
10 mm = 3/8 inch	51 mm = 2 inches	380 mm = 15 inches	3600 mm = 12 feet
11 mm = 7/16 inch	75 mm = 3 inches	406 mm = 16 inches	4600 mm = 15 feet
13 mm = 1/2 inch	92 mm = 3.62 inches	480 mm = 19 inches	4900 mm = 16 feet
14 mm = 9/16 inch	100 mm = 4 inches	488 mm = 19.2 inches	6100 mm = 20 feet
16 mm = 5/8 inch	125 mm = 5 inches	500 mm = 20 inches	9000 mm = 30 feet

kg to lbs conversion		
1 kg = 3 lbs	5.4 kg = 12 lbs	135 kg = 298 lbs
2,27 kg = 5 lbs	40 kg = 90 lbs	136 kg = 300 lbs
4.5 kg = 10 lbs	45 kg = 99 lbs	727 kg = 1,600 lbs

MPa to PSI conversion			
.27 MPa = 40 PSI	4.8 MPa = 700 PSI	17 MPa = 2,500 PSI	69 MPa = 10,000 PSI
1.3 MPa = 200 PSI	5.5 MPa = 800 PSI	21 MPa = 3,000 PSI	48 MPa = 7,000 PSI
2.75 MPa = 400 PSI	6.8 MPa = 1,000 PSI	24 MPa = 3,500 PSI	
3.1 MPa = 450 PSI	10 MPa = 1,500 PSI	34 MPa = 5,000 PSI	
4.1 MPa = 600 PSI	14 MPa = 2,000 PSI	62 MPa = 9,000 PSI	

kPa to psf conversion	
.48 kPa = 10 psf	1.92 kPa = 40 psf

kg/m^3 to lb/ft^3 conversion
1681 kg/m^3 = 105 lb/ft^3

kg/m^3 to cu. ft conversion
1842.12 kg/m^3 = 115 per cu. ft.

kg of force to lbs of force conversion
907 Kilograms of force = 2,000 pounds of force

m^2 to ft^2 conversion
93 m^2 = 1,000 ft^2

N/mm^2 to PSI conversion
13.78 N/mm^2 = 2,000 PSI

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Head Office
163 Buttermill Avenue
Unit 8
Concord, Ontario
L4K 3X8
T: 905.660.9640
800.201.8599
F: 905.660.0513

Western Office
T: 604.294.6885
F: 604.294.2406

E-mail: association@ttmac.com
technicalinfo@ttmac.com

Web site: ttmac.com