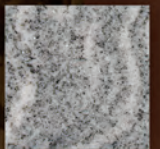


MIA Technical Module

Residential Stone Countertop Installation

NEW for July 2011:
Completely Updated
Countertop Specifications
PLUS
New Outdoor
Kitchen Guidelines



**MARBLE
INSTITUTE**
of America

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Cover Photo

Project Name: Private residence
City: Vienna, VA
Designer: Portfolio Kitchens
Stone Supplier, Fabricator, and Installer: MARBLEX
Photo Credit: Michael Levy
Countertop: 3CM Golden Beach granite
Backsplash and mosaic: 4" x 4" mosaic travertine
Floor: 12" x 12" travertine

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Residential Stone Countertop Installation

1.0 INTRODUCTION

1.1 The beauty and permanence of natural stone countertops are enjoyed by many. The full 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. This document has been prepared and published by the Marble Institute of America to guide the user in the correct means and methods of using natural stone as a countertop surface.

2.0 STONE MATERIALS

2.1 Varieties. All varieties of dimension stone have been used successfully for countertop surfaces. Different types of stone have specific properties that offer advantages or disadvantages in various applications. The following is a brief overview of the common varieties of dimension stone.

2.2 Granites are undoubtedly the most popular stone type used in countertop applications today. This group of stones, in a commercial sense, includes many stone materials that are not true granites by geological definition. For example, gabbro, anorthosite, gneiss, diabase, and diorite would be commercially sold as granite due to similar working and performance properties. These are some of the hardest of the common dimension stones, offering high levels of resistance to abrasion and scratching. The primary minerals in granite materials are resistant to virtually all chemicals commonly found in a residential setting; however, there may be trace minerals present in some granites and granite-like stones that are vulnerable to some acids.

2.3 Marbles are traditionally prized for their aesthetic appeal, accentuated by pronounced veining trends and often bold colors. These stones are calcium carbonate-based, made up principally of the calcite crystal. Due to their mineralogical makeup, all marbles are vulnerable to either abrasion or chemical attack. Abrasive attack occurs most commonly from common kitchen utensils, and can be prevented with the judicious use of protective cutting boards and similar measures. The use of cleaners containing abrasives must be avoided. Chemical attack is most commonly brought about by exposure to acidic solutions, such as lemon juice, tomatoes, vinegar, etc. The use of inappropriate cleaning agents may also trigger acidic attack. Acidic solutions can permanently etch the surface of the material. The application of an impregnating sealer may reduce the vulnerability to acidic attack, but it will not eliminate it.

2.4 Serpentes are 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 generally have improved abrasion and chemical resistance over true marbles. See Chapter 9, Geological Classification in the *Dimension Stone Design Manual*, for distinguishing characteristics of serpentine.

2.5 Onyx, also prized for its color and veining, is perhaps best known for its translucent properties allowing for stunning effects when backlit in the application. Like several other rock varieties, onyx was traditionally commercialized as marble, despite its notable differences. When compared to true marbles, onyx tends to have lower levels of resistance to both chemical and abrasive exposures due to its cryptocrystalline grain structure. Refer to section 1.2 of the Geological Classification section in Chapter 7 of the *Dimension Stone Design Manual* for further discussion of onyx mineralogy.

2.6 Soapstone is a metamorphic rock that is comprised primarily of talc with varying amounts of dolomite, magnesite, and other minerals. Soapstone generally has a smooth feel to the touch. It is used for countertops and other various building aspects such as sinks and heaters. 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.

2.7 Slates have high resistance to chemicals and have been traditionally used as chemistry laboratory tops. Being of metamorphic origin, slates are of limited hardness and therefore the vulnerability to scratching or other abrasive attack should be noted. The same precautions applying to marbles with regard to abrasive damage should be applied to slates.

2.8 Limestones and travertines used in countertop applications, being of calcium-based makeup, will have the same chemical attack vulnerabilities as marbles. Abrasion damage is also a concern, particularly if the stone is provided with a polished finish. Many varieties of these stone types have high absorption rates, and commonly, a sealer will be applied to retard the rate of water absorption into the stone.

2.9 Stone tiles can be used as a countertop surface material, and the finished surface will carry the same precautions as the particular stone type from which it is made. The joint filler, whether grout, elastomeric sealant, epoxy or polyester resin, may have specific requirements for protection and maintenance. Follow the recommendations of the Manufacturer of the material.

3.0 STONE FINISHES

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

3.1 Polished. A high gloss, mirror like finish with sharp reflections. This finish is achieved using multiple grinding heads and progressively finer abrasives. A polished finish intensifies the color and pattern of natural stone.

3.2 Honed. A non-reflective, satin-like finish. This finish is achieved using multiple grinding heads and progressively finer abrasives stopping short of a polish. A honed finish shows fewer scratches.

3.3 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 finish 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 will also affect the final product.

4.0 CUSTOMER COMMUNICATION

4.1 Documentation. As dictated by standard practices of good business, communications with the customer should be documented in writing.

4.1.1 As all natural stones are unique, with pits, fissures, cracks, corrosive minerals, or other features that the customer may find objectionable, these should be acknowledged when samples and/or slabs are being viewed. The customer must be made aware that some of these features may become more or less noticeable when the position (vertical or horizontal) of the slab is changed, or when the lighting intensity is changed.

4.2 Customer and Subcontractor Responsibilities. Those items that are required to be completed by the customer, or by subcontractors coordinated by the customer, should be specifically addressed (e.g., cabinetry installation, plumbing rough-in and electrical rough-in).

4.3 Shop Drawings (or facsimile) can effectively communicate exact cutting information to the customer. A shop drawing is a highly detailed document that will identify all aspects of the finished product installation. The shop drawing is to be prepared by the fabricator, showing the layout of the stone pieces, location and size of all seams, and details clarifying all corner and edge treatment conditions. This document can be reviewed by the customer prior to commencement of fabrication. Time constraints of some projects, particularly multi-unit projects, may not allow for the formal shop drawing preparation and approval processes. In such cases, a copy of the field measuring technician's sketch and notes may be used in place of the shop drawing. This document shall be signed by the field measurer upon completion of the field measurement.

4.4 Stone Slab Layout. When working with highly variegated materials, it may be necessary to invite the customer to participate in the layout of the actual stone slabs.

5.0 CONTRACTS

5.1 Examples of residential supply contracts can be found in the Introduction of this Manual and *Customer & Sales Forms* in the MIA Management Tool Kit Series.

6.0 CABINET AND SUBSTRATE REQUIREMENTS

Cabinets to receive stone countertops must be permanently affixed in their final position prior to field measuring for countertops.

6.1 Measurement Tolerances. Top surfaces of the cabinets must be within 1/8" (3 mm) of flat and level when measured across a distance of 10'-0" (3 m). Wall surfaces to receive stone backsplashes must be plumb and within 1/8" (3 mm) of a true plane when measured across a distance of 10'-0" (3 m). When cabinets are not within these tolerances, a notice to proceed with the installation shall be obtained from the customer (or authorized representative). Installations done on cabinetry that is outside of these tolerances will have excessive shim spaces and wide regions of filler material. Any required aesthetic improvement to conceal this condition (e.g., additional wood trim) is the responsibility of others.

6.2 Subtops. Fragile stone varieties may require a full subtop to support the stone. Generally, sound varieties of granites and marbles falling within soundness classifications A or B can be used in thicknesses of 20 mm or greater without the use of a subtop. The presence of unsound veins, cracks, or excessive fissuring will mandate the use of a subtop, regardless of thickness. Appropriate materials for subtops are marine-grade plywood, exterior-grade plywood, waterproofed medium-density particle board, or furring

strips. Excessive load-carrying requirements, such as the use of heavy cast-iron sinks, may require the use of either a subtop or auxiliary framing to carry the weight of the sink and its contents.

6.3 Cabinet doors, end panels, and hardware shall be installed when the field measurements are made.

7.0 FIELD MEASUREMENTS

7.1 Cabinet Components. Field measurements are to be taken once all cabinets have been installed in their permanent positions. The following related components must be available to the technician at the time of measurement:

7.1.1 Cabinet Doors

7.1.2 End Panels

7.1.3 Cabinet Hardware

7.1.4 Sinks

(and manufacturer-supplied templates)

7.1.5 Plumbing Fixtures

7.1.6 Cook Tops

7.1.7 Exhaust Vents

(when full-height splash is required)

7.1.8 Electrical Outlets (roughed in)

7.2 MIA Instruction Video. Refer to the MIA video *Basics of Natural Stone Countertop Installation* for additional information and helpful techniques.

8.0 DESIGN CONSIDERATIONS

8.1 Joinery Layout. The layout of the joinery of the countertops is extremely important to the overall appearance upon completion. Being products of nature, slabs of natural stone are limited by the yields of the quarry in addition to the limitations of the equipment used in their processing. Most, but not all materials marketed for use as countertops will be available in lengths up to ± 8 ft (± 2.5 m), and some materials are available in lengths of 10 ft (3 m) or slightly greater. Seam location and frequency is therefore influenced by the available stock for selected species of material. Details on drawings 17-D-1, 17-D-2, and 17-D-3 show a variety of joinery schemes.

8.2 Spans and Cantilevers. In designs where part of the countertop is spanning between supports, the length of the span shall be limited to 2'-0" (600 mm) for $\frac{3}{4}$ " (20 mm) stone thicknesses and 3'-0" (900 mm) for $1\frac{1}{4}$ " (30 mm) stone thicknesses. In designs where the countertop is cantilevered beyond the supports (overhanging), the cantilever shall be limited to 6" (150 mm) for $\frac{3}{4}$ " (20 mm) thick countertops and 10" (250 mm) for $1\frac{1}{4}$ " (30 mm) countertops, but in no case may the cantilevered portion

represent more than $\frac{1}{3}$ of the width of the countertop. Cantilevered countertops exceeding these dimensions will require corbelled supports beneath the stone. The exposed underside of cantilevered portions of countertops will be sawn or otherwise unfinished surfaces. NOTE: Stones of lesser soundness may require corbelled supports for cantilevers that are less than those specified herein.

8.3 Sink Mounts. Sinks are supplied in one of several types: top mount (or self-rimming), undermount and "farm-home." In the case of the top-mounted sinks, the weight of the sink and its contents are transferred to the top surface of the stone counter via the rim of the sink. Undermount sinks can be anchored to the underside of the stone countertop or carried by a subtop or auxiliary frame. A subtop or auxiliary framing may be required for either design when stones of lesser soundness are used, or when the sink (with contents) is excessively heavy. Refer to details on drawings 17-D-8 through 17-D-11 for examples of sink mounting.

8.4 Edge Profiles. Whether shaped by a router or a Computer Numeric Control (CNC) machine, edge profiles add elegance to the finished project. Edge profiles with narrow projections and sharp corners are more susceptible to chipping than those with large radii. Examples of edge profiles commonly used are included on drawing 17-D-16. With machinery and tooling available to modern fabrication shops, many custom profiles can be created which are not shown in this document.

8.5 Corner Embellishments. Corners of stone countertops can be cut square, cut to a radius, or projected. Some hand grinding may be required with projected corner designs.

8.6 Backsplashes. Partial backsplashes usually range from 4" to 8". Full-height backsplashes cover the entire area between the countertop and the upper cabinets. Backsplashes are normally made of the same thickness as the countertop material. The narrow strips will aid in the layout efficiency and allow for better color match. It also provides the fabricator better yield. Mixing materials of two different thicknesses requires using stone slabs sawn from two different blocks, and color variation can be pronounced.

9.0 FABRICATION METHODS

9.1 Safe Work Practices. All technicians involved in the handling and working of stone materials must receive training in the safe work practices (Refer to MIA videos on stone shop and slab handling safety).

9.2 Layout and Sawing. The layout should be marked on the stone slabs using a temporary mark or by laying physical templates on the slab. This will roughly indicate the location and

orientation from which the finished panels will be sawn. The actual finished dimensions of the sawn slabs will be controlled by the sawyer, and depending on the sophistication of the available equipment, may be a digitally controlled process. The slab thickness is to be sawn through its full depth, in single or multiple passes as required by the equipment used. Blade type, rim speed, saw travel rate, and downfeed rates are to be adjusted to provide the smoothest cut with the least amount of chipping possible.

9.3 Finishing Of Edge Profiles. Edge profiles shall be constant in section along the entire length of the countertop. The shaping of the edge is normally done with hand-held routers or with CNC machinery. Some hand grinding is frequently required at inside corner conditions to create a sharp line of reprise. Edges are to be finished to the same type and quality of surface as the top, unless a contrasting edge surface has been specified for accent purposes. In the case of resin treated slabs, some alteration to the color of the edge surface is required to be completed in the fabrication shop. In some cases exact color match between the edge surface and the top surface may not be achievable.

9.4 Cutouts for auxiliary equipment can be made with hand-held or automated tools. 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.

9.5 Crating and Protection for Transport. The stone materials are to be crated or otherwise protected for transport to the project site. Local transportation laws shall be researched to ascertain tie-down and clearance requirements when transporting stones.

10.0 INSTALLATION METHODS

10.1 Safe Handling. All technicians involved in the handling and working of stone materials must receive training in safe work practices.

10.2 Dry Assembly. At the project site, it is recommended that all stone pieces be “dry assembled” in place to verify satisfactory fit prior to the application of adhesive.

10.3 Shims are commonly employed to level the stone countertops. Shim material may be wood or plastic. Shims must be placed over portions of the cabinet that are rigid enough to support it, not over some trim filler portion. Maximum spacing between shims is 2'-0" (600 mm). Alternatively, longer spacing between shims may be used if the stone is supported with a noncompressible filler material (usually epoxy or polyester resin). This practice is often referred to as “hard packing.”

10.4 Adhesive. The stone countertops are to be secured to the substrate with a nonstaining 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 3" (75 mm) of all edges and at 6" (150 mm) maximum center-to-center spacing when installing over a subtop. When installing to the cabinet frame without a subtop, apply adhesive to all frame members that contact the stone slab.

10.5 Final Positioning and Joint Filling. Final positioning of the stone is done either manually or with the aid of commercially available stone-alignment tools. The filling of the seams is normally completed prior to final positioning of the stone units, allowing the filler material to extrude out of the joint as the stones are pulled into alignment. The stone surface may be masked to prevent contact by the filler material (refer to MIA *Basics of Natural Stone Countertop Installation* video).

10.6 Sealer Application. After the countertops are installed and the seams are filled, a sealer or impregnator may be applied. Refer to the Maintenance section of this chapter for further discussion of these applications. Alternatively, some fabricators prefer to apply the sealer or impregnator in the fabrication shop prior to transporting the pieces to the project site.

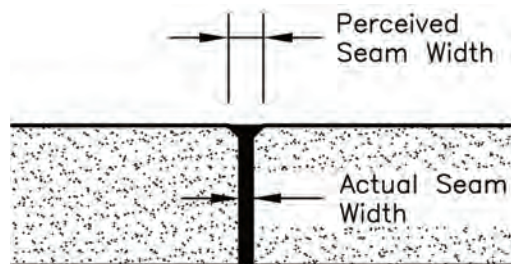
11.0 TOLERANCES

11.1 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.

The tolerances in this section pertain to large stone panel-type countertops only. Tolerances for stone tile countertops are listed in section 13 of this chapter.

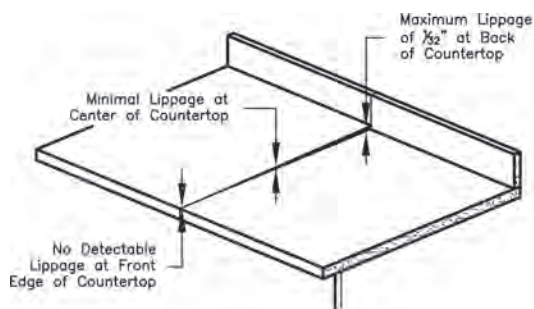
11.2 Joint (seam) Widths. Unless otherwise specified, joint widths between two stone units should be a nominal 1/16" (1.5 mm), with a tolerance of $\pm 1/64"$ (± 0.4 mm). In such cases where a larger joint width has been specified, the tolerance is to be $\pm 25\%$ of the nominal joint width. Joint width does not include the dimension of an arris on the stone edge. When an arris is used, the perceived joint

width may be greater than the actual width due to the seam filler occupying the width of the arris.

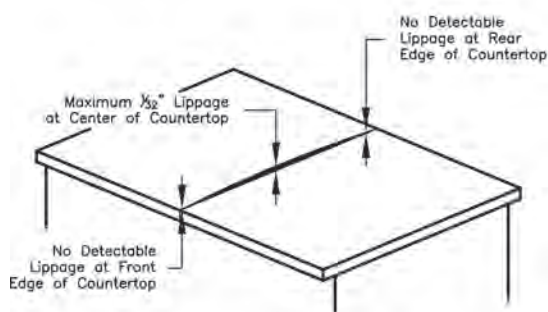


Visual Accentuation of Seam Width due to Arris at stone edges

11.3 Lippage. The term “lippage,” as used in the 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. Lippage may be unavoidable due to permanent warp in the slab stock. There should be no detectable lippage at the front edge of the countertop. Maximum allowable lippage at the back of the countertop is $1/32"$ (0.8 mm). There should be no detectable lippage on the finished edges of islands and peninsulas. Maximum allowable lippage at the center of the island or peninsula is $1/32"$ (0.8mm). See sketch below for clarification.



Allowable Lippage Due to Slab Warp (For Standard Counter with Backsplash)



Allowable Lippage Due to Slab Warp (For Island or Peninsula Counter)

11.4 Slab Thickness. The thickness of the stone slabs used in a given project shall not vary by more than $1/8"$ (3 mm) between the thickest and thinnest slabs.

11.5 Exposed edges of adjacent stone slabs must be matched in thickness and properly installed so that neither the top nor bottom surface exceeds lippage tolerances.

11.6 Joints at Materials Transition. Visible joints between the stone units and other materials (e.g., cabinetry, gypsum wall board) shall be $1/8"$ nominal, with a tolerance of $\pm 1/16"$ (± 1.5 mm), and filled with a low modulus elastomeric material. Exceptions to this would be the joint between a full-height backsplash and the underside of the upper cabinets, which is to be a nominal $1/4"$ with a tolerance of $\pm 1/8"$ (± 3 mm). Concealed joints between the stone and other construction materials (e.g., stone-to-wall joint underneath the backsplash) shall be sized to ensure a minimum of $1/8"$ (3 mm) of cover.

11.7 Slab Flatness and Levelness. Individual stone slabs are to be flat within $1/16"$ (1.5 mm) when measured with a 4'-0" (1.2 m) straight edge. Finished countertop surfaces including multiple stones are to be both flat and level to $1/8"$ (3 mm) across 10'-0" (3 m).

12.0 ADHESIVES AND JOINT FILLERS

12.1 Types. Adhesives used for stone installation can be either standard construction adhesives or elastomeric sealant with strong bonding properties to both the stone and the substrate. Construction adhesives will normally provide greater bond strength, while elastomeric sealants will provide some forgiveness for movement within the substrate cabinet. Excessive movement of the substrate, regardless of the type of adhesive used, will result in cracking of the seams or stone units. Verify that the product used does not stain the stone material.

12.2 Seam Filler Materials. Seams in the stone countertop are usually filled to the level of the top surface. The most common filler materials are polyester resin, epoxy resin and elastomeric sealant. Elastomeric sealants can be of silicon, polyurethane, or acrylic bases. The table below identifies several advantages and disadvantages of each product. (See chart on next page.)

13.0 STONETILE COUNTERTOP INSTALLATION

13.1 Subtops. Stone tile countertops must have a subtop made of minimum $3/4"$ exterior-grade plywood or $1/2"$ cementitious backer board. Subtop must be flat to within $1/8"$ in 10'-0".

Seam Filler Materials Advantages and Disadvantages

Product	Advantages	Disadvantages
Polyester resin	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Cures to a high durometer hardness which offers little or no forgiveness for movement • Limited pot life
Epoxy Resin	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Simple to use • Long pot life • Relatively easy to dye for color matching 	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Limited to available colors • Some sealant products contain plasticizers that can migrate into and stain the stone

13.2 Edge Treatment. Exposed edges of the countertop may be finished by providing an edge profile strip of stone, wood, or metal. Where stone is employed, it is to be used as an apron to the top surface stone, which limits stress on the countertop/apron joint.

13.3 Stone tile tolerances for all stone types must be 1/32" (1 mm) in length, width, and thickness.

13.4 Joint Widths. Unless otherwise agreed, joint widths for stone tile countertops must conform to the following: Stone-to-wall joints must be 1/8" (3 mm) in width. Stone-to-stone joints must be 1/16" (1.5 mm) minimum, 3/32"

(2 mm) maximum, and uniform from stone to stone. Stone-to-cabinetry joints must be 1/8" (3 mm) in width.

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

13.6 Shading Variation. Stone tiles are subject to manufacturing processes different from structural stone. There is great latitude in the acceptability of shaded stones. Installers are cautioned to lay out the stone for inspection and obtain approval from the Owner or Specifying Authority prior to installation.

13.7 Tile Widths. No tile shall be employed that is less than ½ the width of the stone tile, except at the front of cutouts, unless previously discussed with the client.

13.8 Cutouts should be prepared for drop-in appliances and sinks. Avoid undermounted sinks, stove tops, etc.

13.9 Aprons. Where a stone apron is employed and the countertop is designed to have a radial corner, the apron may be staved to fit the radius.

13.10 Flat Installation. Stone tiles must be installed flat, side by side, within 1/32" (0.8 mm) maximum lippage.

13.11 Splashes must be of stone tile, minimum of 4" high. On stones with obvious vein trend, the vein trend of the splash must be identical to the countertop below unless otherwise specified.

13.12 Back buttering of all stone tiles is required. This technique applies a portion of the installation material to the back face of the stone. It requires placement of one-half of the setting material in the case of thin-set mortar, epoxy, or nonwater-soluble adhesive, or a lesser quantity of very rich mortar in the case of portland cement, to the back of the stone, while the balance of the setting material is applied to the bed. Application should be performed so that one pass is completed in a north-south direction, while the second pass is performed in an east-west direction, thus ensuring, as close as possible, 100% contact of the stone to the installation bed.

13.13 Tile Reinforcement. A common re-inforcement for stone tiles of limited soundness is to adhere a fiberglass mesh to the back surface of the tile. The adhesive used in this application is commonly an epoxy or polyester resin. When this type of reinforcement is adhered to the tiles, the Installer must use a thin-set material that will bond to the resin-impregnated backer. Most often this will require an epoxy-based, rather than a portland-based, thin-set compound.

Mohs Scale

In 1812, the Mohs Scale of mineral hardness was devised by the German mineralogist Frederich Mohs (1773-1839), who selected the ten minerals because they were common or readily available. The scale is not a linear scale, but a relative scale.

Source: American Federation of Mineralogical Societies, Inc.

Hardness	Mineral
1	Talc or Mica
2	Gypsum
3	Calcite
4	Fluorite
5	Apatite
6	Orthoclase
7	Quartz
8	Topaz
9	Corundum
10	Diamond

14.0 RESIN-IMPREGNATED SLABS

The application of resin to the surfaces of stone slabs has become an ever-increasing practice. The intent of this procedure is to fill pits, cracks, and fissures of natural stones with a glossy resin to enhance the appearance of the polished slab. When received, the resin treatment is usually easily detected by viewing the raw edges of the slab. Evidence of excess resin is usually visible on the edges of the slab if the stone has been treated.

14.1 Description of Procedure. The process involves screeding the resin on the surface of the cleaned, sawn slab. This is frequently done in an automated process, although some suppliers will do this manually. Depending on the equipment used, the slab may be placed over a large vacuum table to draw the resin deeper into the stone. The resin is allowed to cure, which may or may not be accelerated with heat application. Once the resin has cured, the slab is polished. The polishing grinds most of the resin from the stone surface, so that it remains only in depressions and some intercrystalline regions of the slab. The amount of surface area that remains as resin varies due to the natural features of the material, but it is usually a fraction of one percent.

14.1.1 The resin used in this process is typically an epoxy, but polyester and acrylic-based polymers may be used.

14.2 Design Considerations. While the intent of this process is to provide a cosmetically more attractive surface, these are several characteristics of which the fabricator should be aware:

14.2.1 Color. The resin application normally makes the color of the stone somewhat darker than an untreated slab. This becomes an issue when finishing the edges of the countertop, as the color of the edge will be lighter in appearance than the color of the face surface. Several products are marketed in the industry for the darkening of the edge, but none have been found to be universally successful.

14.2.2 Interaction with Sealers. There have been cases of incompatibility between a given resin and fabricator-applied sealer combination. This usually results in a "cloudy" or "blotchy" appearance after the sealer product has been applied.

14.2.3 Structural Flaws. The resin process can hide cracks or other blemishes which are structurally influential features of the material. Assessment of the structural worthiness of the material can be made more difficult as a result.

14.2.4 UV Light Exposure. Nearly all of the resins currently in use are vulnerable to color change or surface degradation when exposed to ultraviolet light. These materials are therefore not suitable for exterior applications.

15.0 REINFORCEMENT TECHNIQUES

As products of nature, stones have varying strength and behavioral properties. Stones of lesser soundness or stones that have had substantial areas removed from the slab (e.g. sink cutouts) will benefit from reinforcement by a variety of techniques.

15.1 Fiberglass Mesh. A common reinforcement for stone slabs of limited soundness is to adhere a fiberglass mesh to the back surface of the slab. The party doing the sawing of the slabs normally completes this process. The adhesive used in this application is commonly an epoxy or polyester resin.

15.2 Liner Blocks. Although not frequently used in stone countertop construction, a liner block of stone material can be adhered to the underside of the stone slabs (when no subtop is used) to reinforce seams or other vulnerable areas. The liner block need not be of the same type of stone material as the countertop.

15.3 Splines. Seams, particularly those between narrow stone pieces, are often splined together with a steel or stainless steel key. Commonly, a large washer is used as the spline key. The metal is fully encapsulated with polyester or epoxy resin and fitted to closely cut slots in the stone, similar to the “biscuit” joint reinforcements used in woodworking.

15.4 Rodding. A commonly seen method of countertop reinforcement is the technique referred to as “rodding.” Rodding may be beneficial to narrow strips of stone material, such as those in front or behind sink or cook top cutouts. This technique requires a shallow kerf in the underside of the stone slab (See details on drawing 17-D-5). The kerf is then closely fitted with a metal or fiberglass rod, which is then fully embedded in epoxy. The rod, having greater tensile strength than the stone, helps prevent concave flexure of the stone surface. Closely matching the rod size to the kerf size and careful preparation of the rod, including cleaning or abrading the bonding surface, are required to get the maximum benefit from this technique. A strip of fiberglass mesh backing is often adhered over the rodded region for additional reinforcement. See detail on drawing 17-D-5.

16.0 ALLOWABLE REPAIR

Repair of stone countertops must be performed by competent, experienced artisans to achieve the desired results. Repair of the stone 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.

16.1 Fissures occur naturally in many stone types. 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.

16.2 Cracks occur in stones as a result of manmade 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 product through culling during the layout process. In stones with lesser soundness properties, this option may not be practical, or possible. When working with such stones it is common practice to repair cracks by cementing 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, the entire stone must be repolished to make the repair unnoticeable. If the repair is attempted but unsuccessful, the stone is to be replaced with a new piece.

16.3 Chips can occur in stones either as a result of sawing operations or handling and restraint devices. Particularly in the igneous stone varieties, the exiting portion of the diamond blade will create many small chips. A small chamfer, called an “arris,” of approximately 1/16" x 1/16" (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 section 11.2, 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.

16.4 Pitting of the countertop surface, particularly in granite material, is a commonly seen characteristic on natural stone. Granites are made up of several different minerals, each mineral having a different hardness. Granites contain quartz, feldspars, biotite, amphibole, ferrous titanium oxides, and other mineral combinations. On the Mohs Scale (see chart above), diamonds are the hardest mineral, with a rating of 10. Quartz and feldspar have a

hardness of 6.5 to 7 and are very durable. Biotite (small, black minerals throughout the slab) on the other hand 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 granites 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, muscovite, and phlogopite in their composition.

The pits do not make the granite 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 containing several types of minerals with different hardnesses. It is usually best to not attempt repair of pits, as most repair techniques will not cosmetically improve the countertop.

17.0 MAINTENANCE

17.1 Application of Sealers. The application of a topical sealer or impregnator is a common step in decreasing the vulnerability of the stone to stains.

17.2 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.

17.3 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.

17.4 General Precautions. When any surface protection 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.

17.5 Care and cleaning practices of the stone countertop are to be thoroughly discussed with the client upon completion of the installation. Refer to the MIA brochure *Care & Cleaning for Natural Stone Surfaces* for more information.

18.0 OUTDOOR KITCHENS

18.1 General Precautions. 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, UV exposure and varying moisture levels, typical installation methods along with certain materials cannot be used.

18.2 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.

18.3 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 experience the growth of mold and mildew, the loosening of filler materials and in some cases, cracking and separating due to extreme temperature changes.

18.4 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 be rated for exterior use.

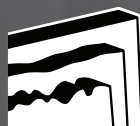
18.5 Adhesives. All adhesives to be used must be suitable for exterior installations. Since silicone is frequently used on outdoor kitchens, care must be taken to insure that staining does not result from plasticizer migration of some silicone products. Polyester adhesives should be avoided in an exterior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

18.6 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 two stone units should be nominal $1/16" \pm 1/16"$. Undermount sinks can be anchored to the underside of the stone countertop or carried by a subtop or auxiliary frame. A subtop or auxiliary framing may be required and should be rated for exterior use.

Timeless Value

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Beautiful
Durable
Hygienic
Safe

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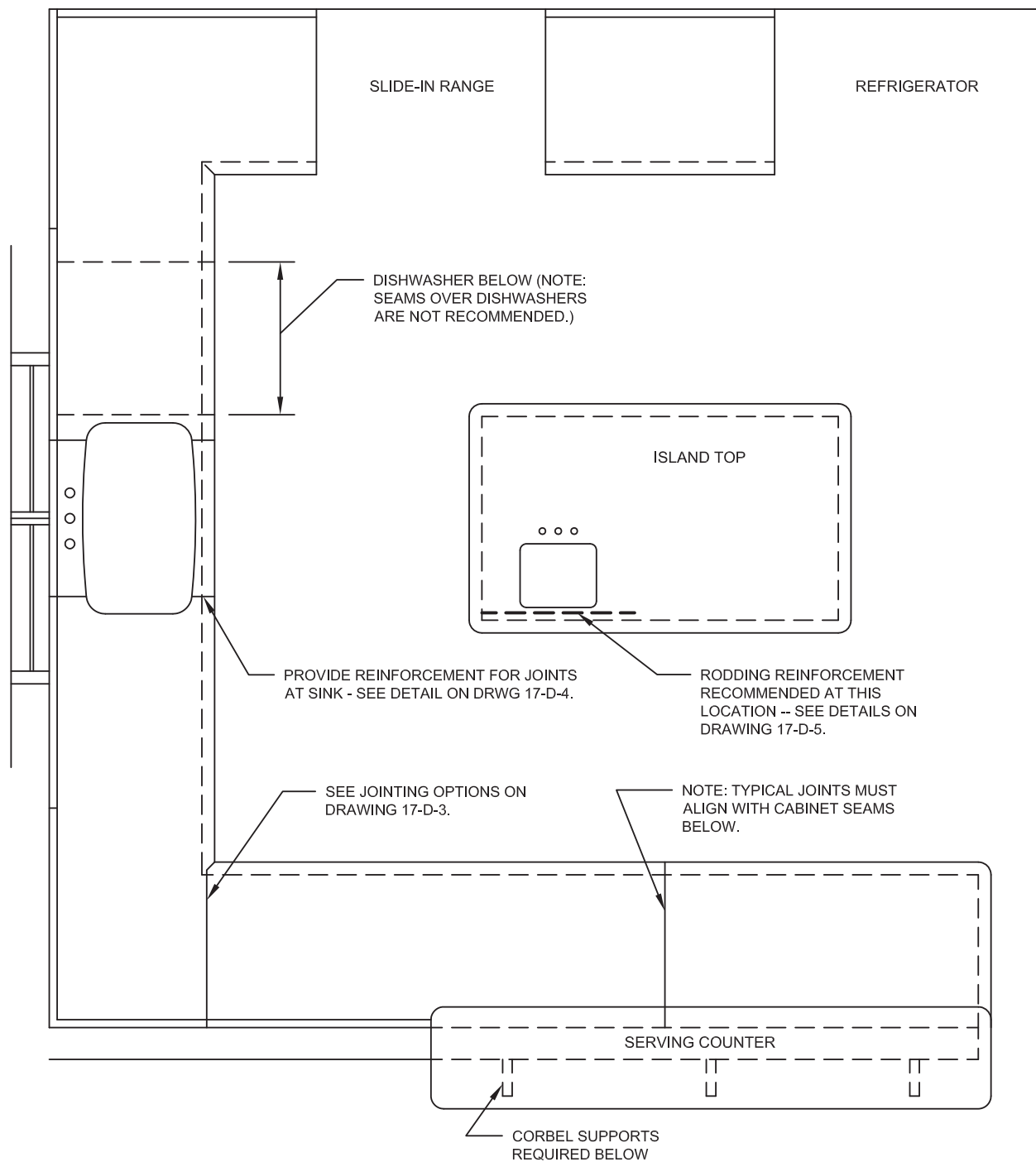
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**TYPICAL KITCHEN LAYOUT
(WITH JOINTS AT SINK)**



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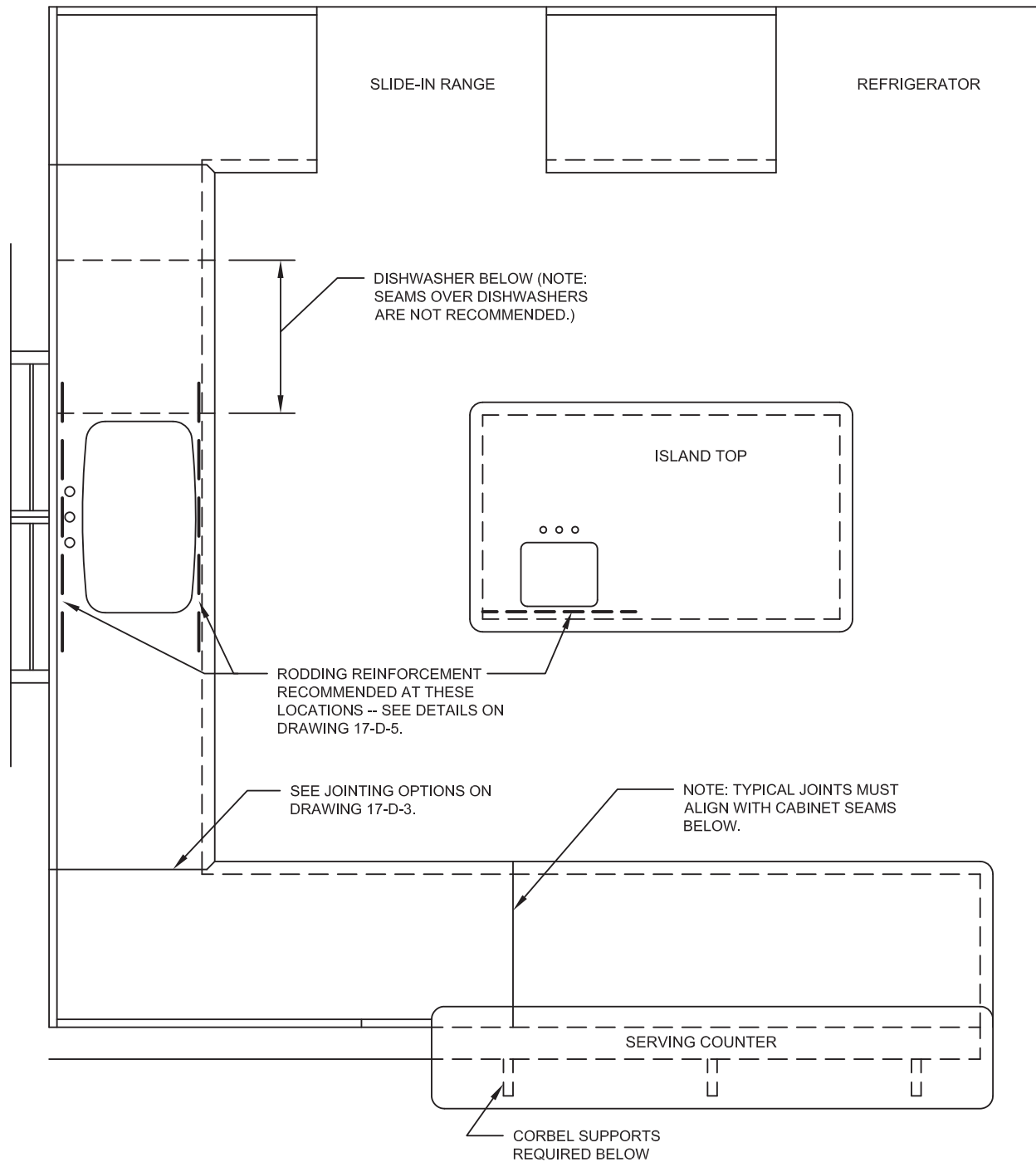
REV	DATE
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1	Oct 2006
2	Apr 2011

TYPICAL KITCHEN LAYOUT

MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-1

SCALE:
1/2" = 1'-0"



**TYPICAL KITCHEN LAYOUT
(WITH JOINTS AT CORNERS
IN LIEU OF SINK)**



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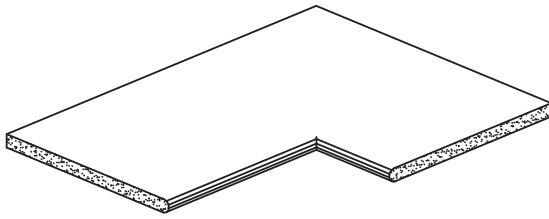
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1	Oct 2006
2	Apr 2011

TYPICAL KITCHEN LAYOUT

MIA DIMENSION STONE DESIGN MANUAL VII

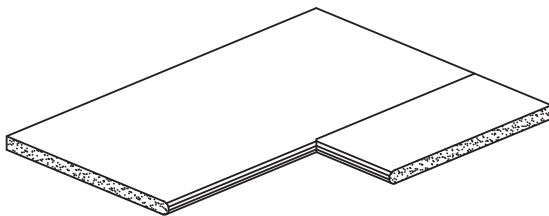
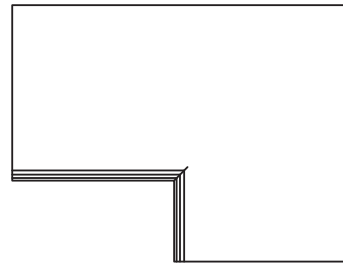
DRWG NO: 17-D-2

SCALE:
1/2" = 1'-0"



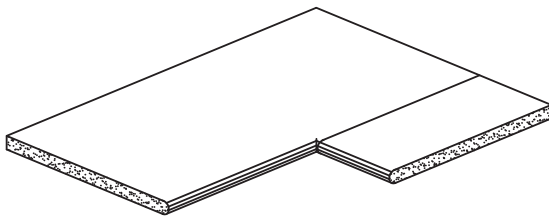
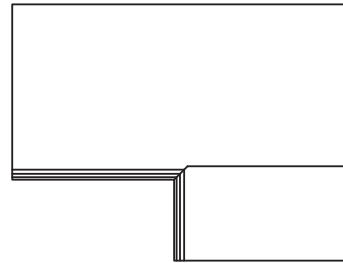
NO JOINT IN CORNER

THIS IS PERHAPS THE MOST PREFERRED DETAIL VISUALLY, AS IT PROVIDES THE CLEANEST-LOOKING RETURN. SOME HAND GRINDING WILL BE REQUIRED AT THE INTERIOR CORNER. THE LOSS OF YIELD IN THE STONE SLAB ADDS TO THE COST OF THE PROJECT. THIS DETAIL IS SOMEWHAT MORE SUSCEPTIBLE TO CRACKING IF THE COUNTERTOP IS NOT SHIMMED UNIFORMLY, OR IF THERE IS MOVEMENT IN THE CABINETS AFTER THE INSTALLATION OF THE COUNTERTOP.



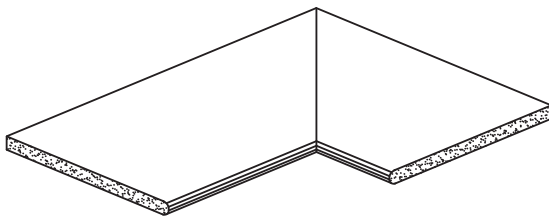
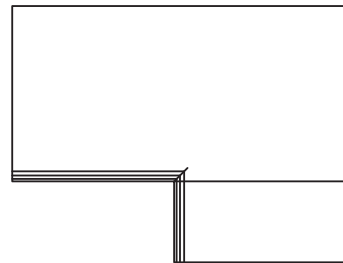
MITER JOINT THROUGH BULLNOSE EDGE DETAIL

THIS DETAIL IS WELL SUITED FOR EDGING MACHINES, AS IT REQUIRES NO HAND GRINDING OF THE BULLNOSE.



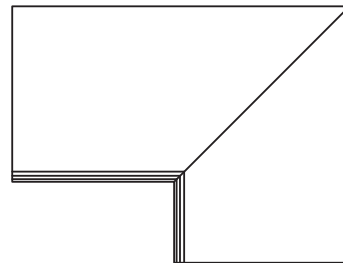
COMMON JOINT WITH BULLNOSE RETURN CORNER

THIS DETAIL WILL REQUIRE SOME HAND GRINDING OF THE BULLNOSE RETURN.



MITER JOINT THROUGH ENTIRE COUNTERTOP SURFACE

THIS DETAIL IS NOT RECOMMENDED. SLAB YIELD IS REDUCED BECAUSE BOTH PIECES NEED TO BE CUT TO FULL LENGTH. THE SHARP CORNERS ARE VERY FRAGILE. LEVELING OF THE COUNTERTOPS IS DIFFICULT DUE TO THE LENGTH OF THE SEAM AND UNACCEPTABLE LIPPAGE OFTEN RESULTS. HOWEVER, THE USE OF A STONE MATERIAL WITH A HEAVY, LINEAR VEINING TREND MAY MAKE THIS DETAIL AESTHETICALLY PREFERABLE TO THE PREVIOUS DETAILS.



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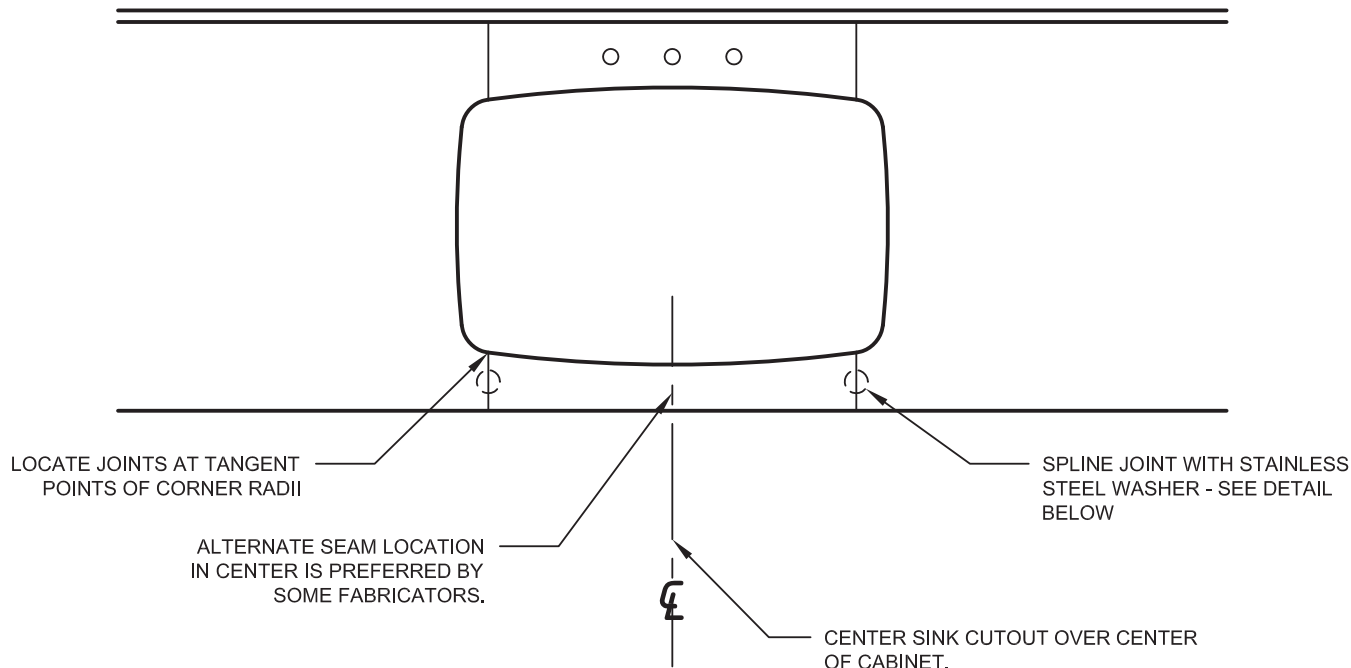
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CORNER JOINERY EXAMPLES

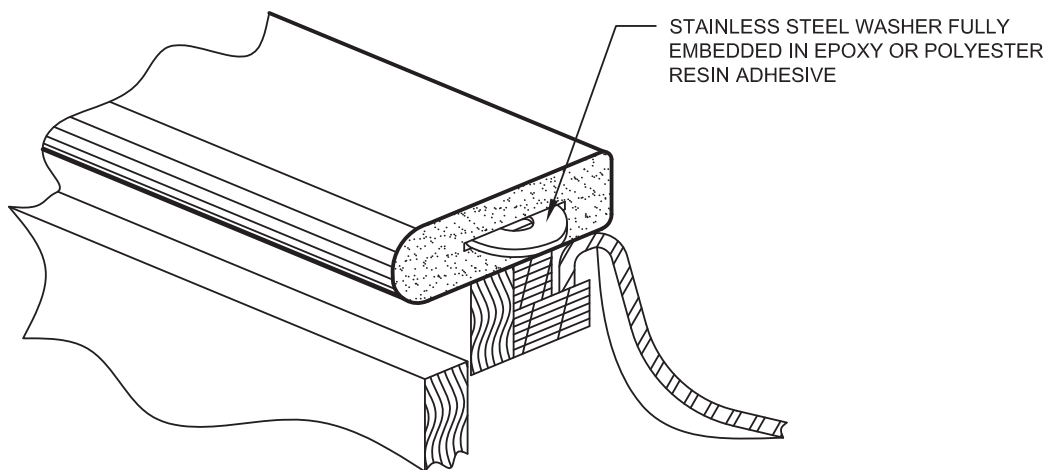
MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-3

SCALE:
1/2" = 1'-0"



PARTIAL PLAN WITH JOINTS LOCATED AT SINK



DETAIL OF SPLINE JOINT REINFORCEMENT



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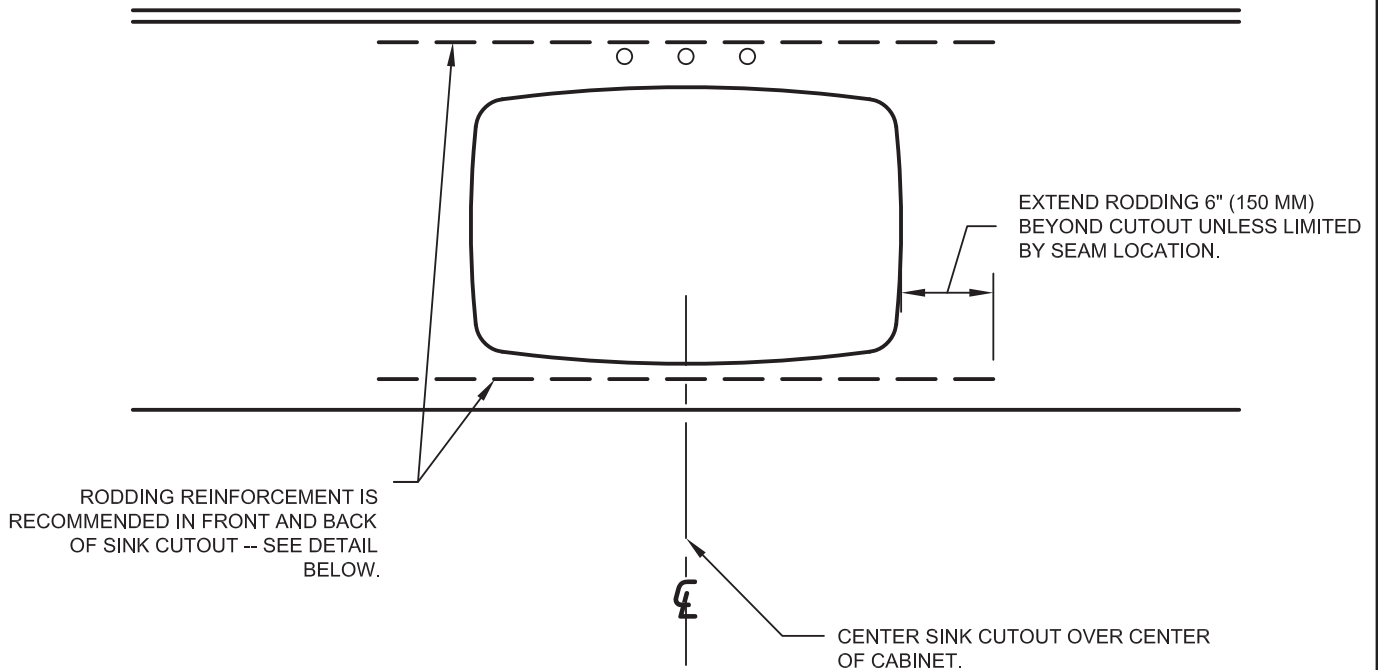
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TYPICAL JOINERY @ KITCHEN SINK

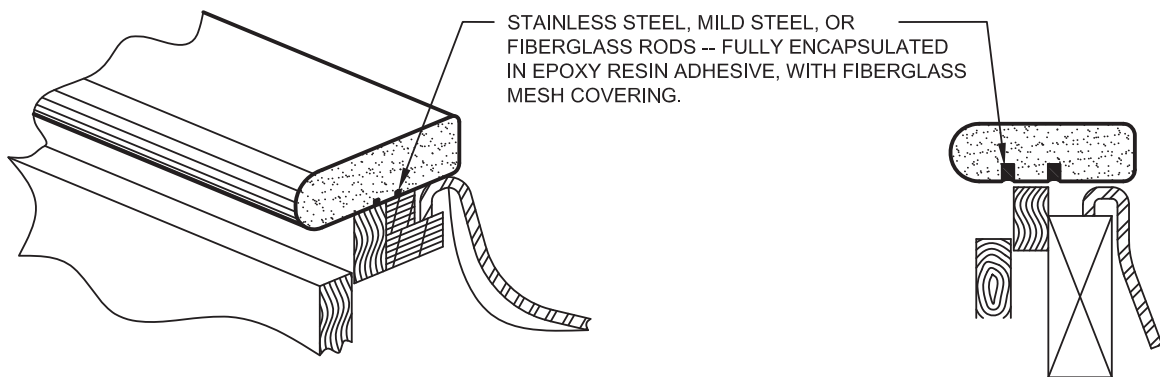
MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-4

SCALE:
1" = 1'-0"



PARTIAL PLAN WITH NO JOINTS AT SINK



DETAIL OF RODDING REINFORCEMENT



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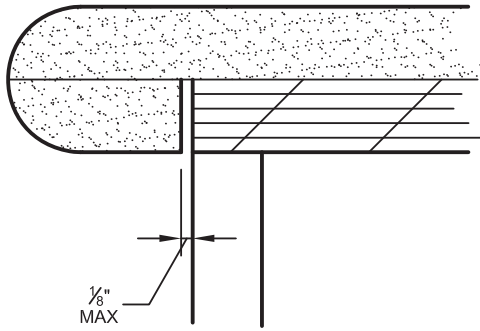
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DETAIL OF RODDING REINFORCEMENT

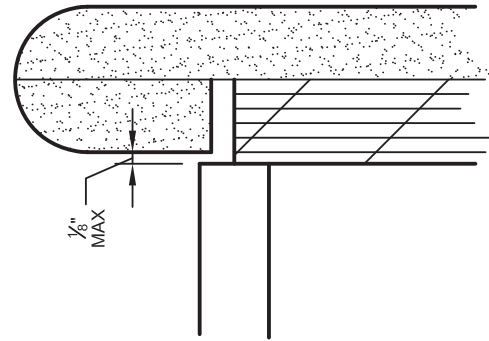
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DRWG NO: 17-D-5

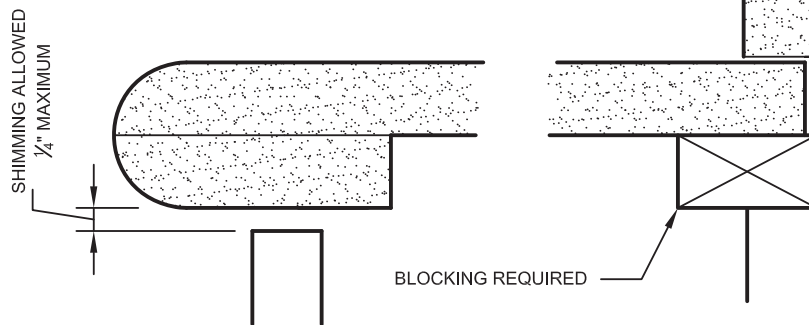
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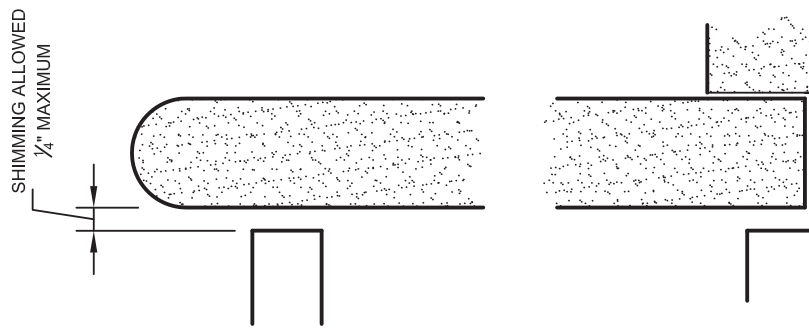
TYPICAL DETAIL AT
FLUSH SUBTOPS



TYPICAL DETAIL AT
SETBACK SUBTOPS



TYPICAL DETAIL WITH NO SUBTOPS
LAMINATED 20 MM STONE



TYPICAL DETAIL WITH NO
SUBTOPS -- 30 MM STONE



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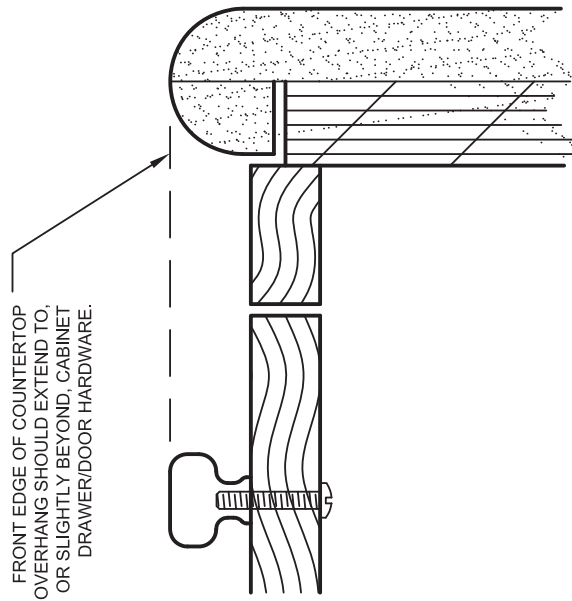
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TYPICAL COUNTERTOP SUPPORT DETAILS

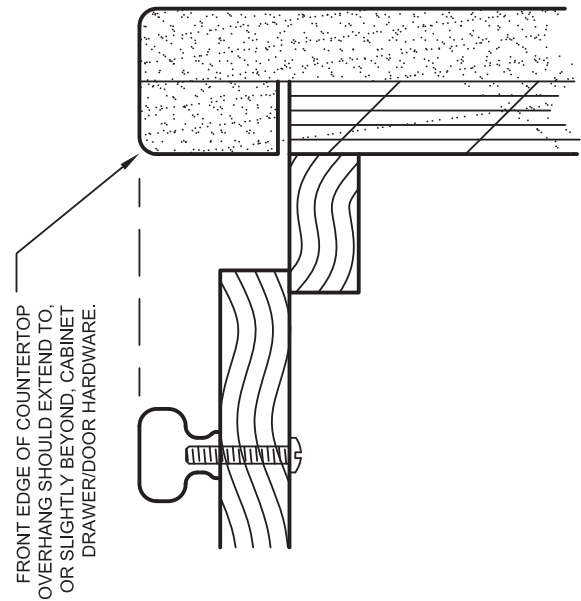
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DRWG NO: 17-D-6

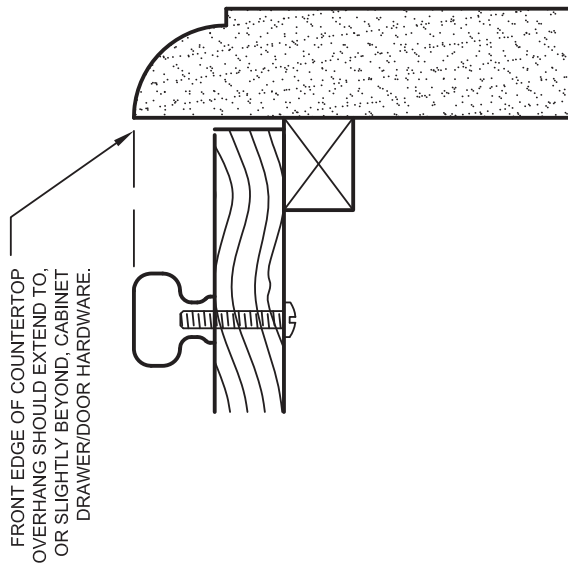
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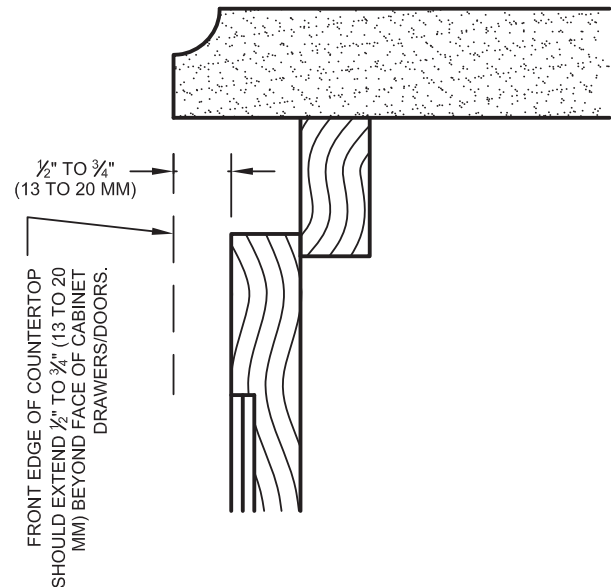
DOORS FLUSH WITH CABINETS



DOORS OVERLAPPING CABINETS



DOORS COVERING CABINETS



RECESSED OR FLUSH HARDWARE



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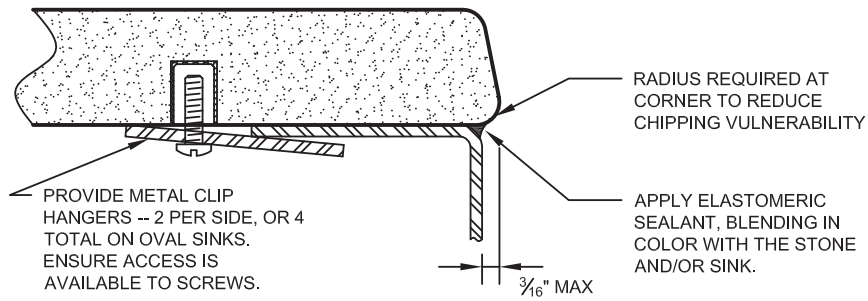
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RECOMMENDED COUNTERTOP OVERHANG

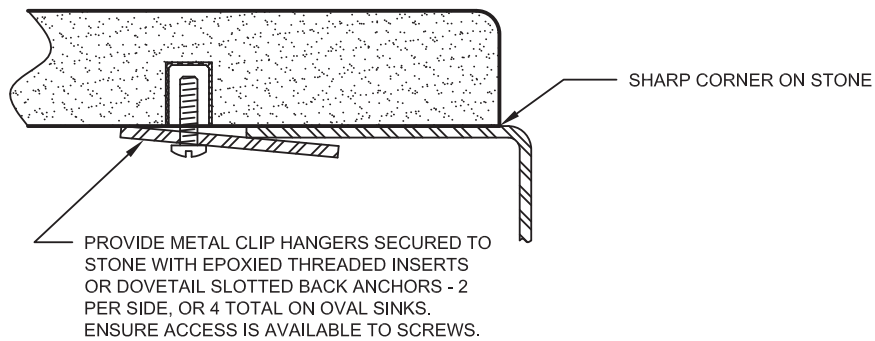
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DRWG NO: 17-D-7

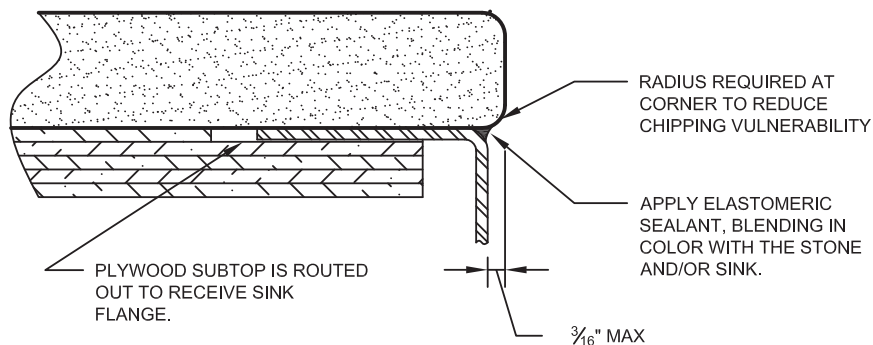
SCALE:
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DETAIL WHEN COUNTERTOP OVERHANGS EDGE OF SINK



DETAIL WHEN COUNTERTOP SETS BACK FROM SINK EDGE



DETAIL OF SUBTOP ROUTED OUT TO RECEIVE SINK FLANGE



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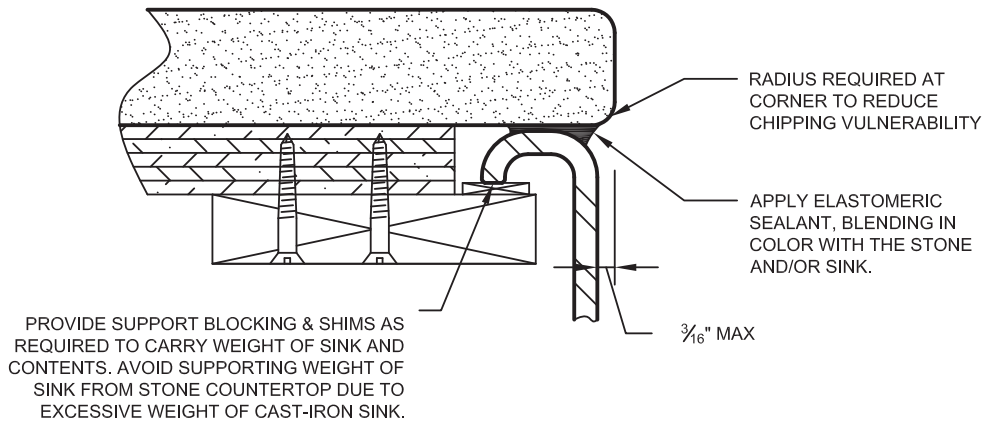
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UNDERMOUNT SINK SUPPORT DETAILS

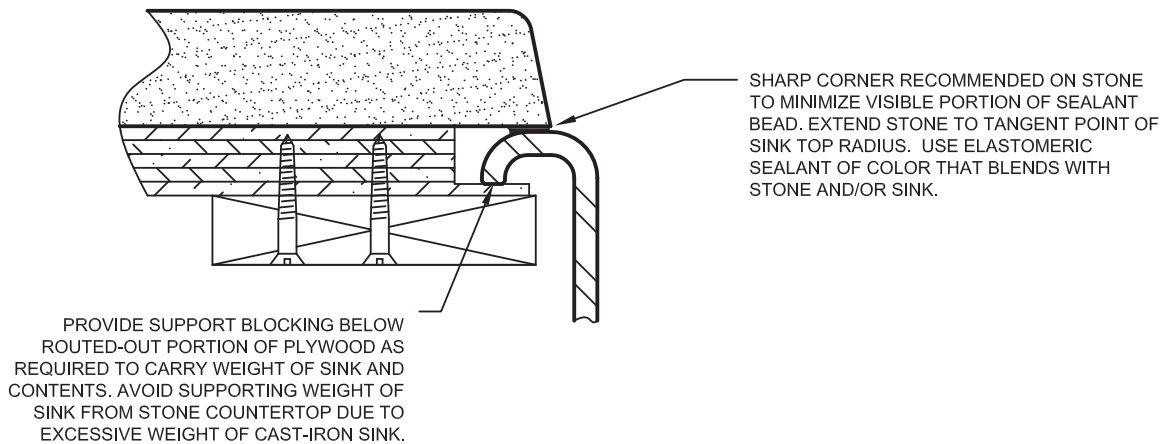
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DRWG NO: 17-D-8

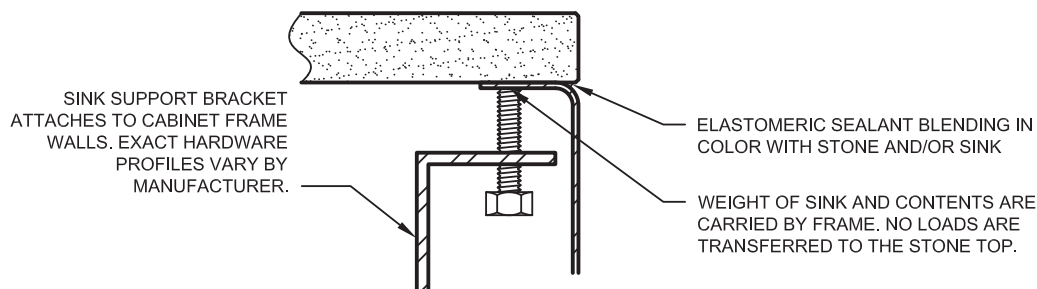
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DETAIL FOR COUNTERTOP OVERHANGING SINK EDGE



DETAIL FOR SINK EXTENDING PAST COUNTERTOP CUTOUT



DETAIL FOR SINK SUPPORTED BY HARDWARE KIT



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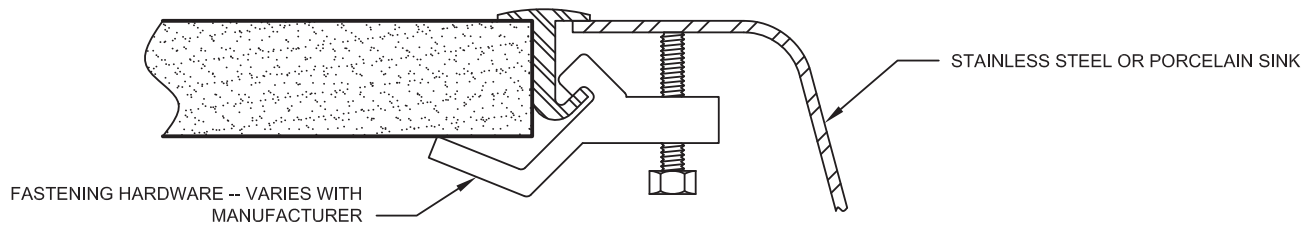
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SUPPORT DETAILS FOR HEAVY (ENAMELED CAST-IRON) SINKS

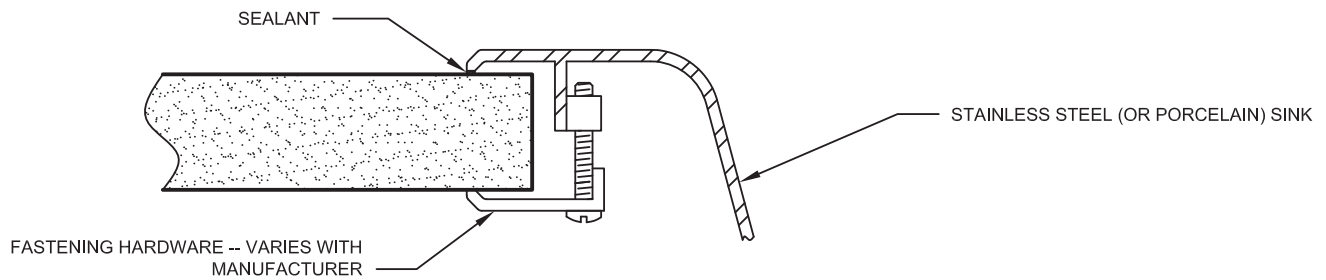
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DRWG NO: 17-D-9

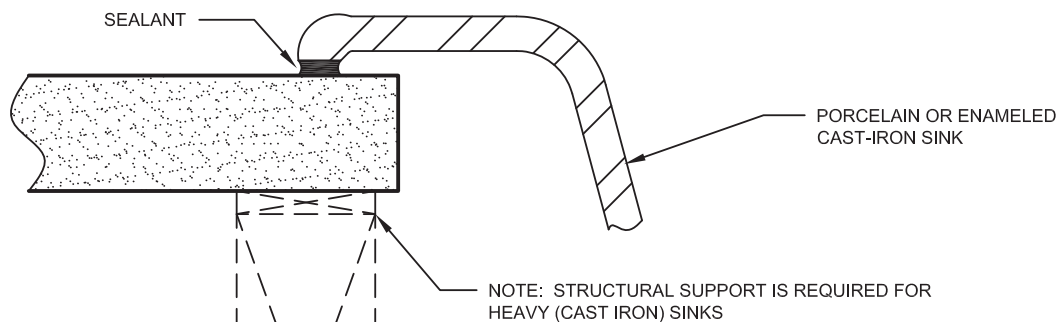
SCALE:
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DETAIL FOR SINK SUPPORTED BY METAL FRAME



TYPICAL DETAIL FOR STAINLESS STEEL SINKS



DETAIL FOR SINK SUPPORTED BY METAL FRAME



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SUPPORT DETAILS FOR RIMMED OR "DROP-IN" SINK STYLES

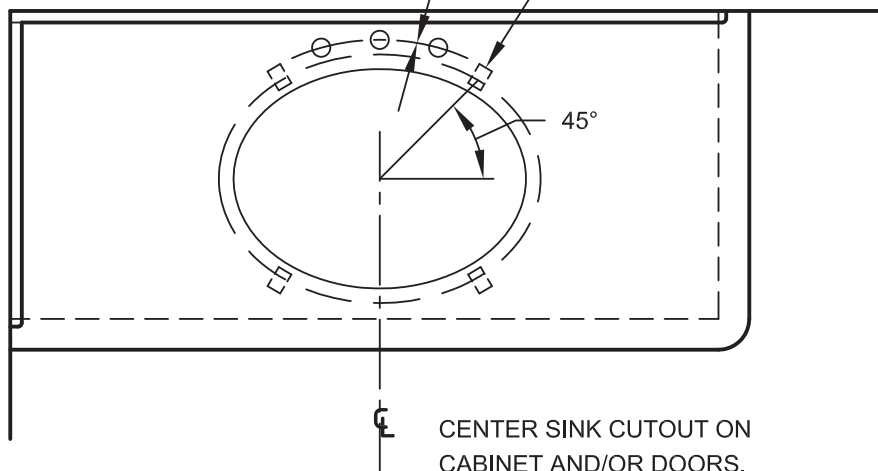
MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-10

SCALE:
6" = 1'-0"

FAUCET HOLES MAY BE
COLLINEAR OR FOLLOW CURVE
OF SINK OPENING.

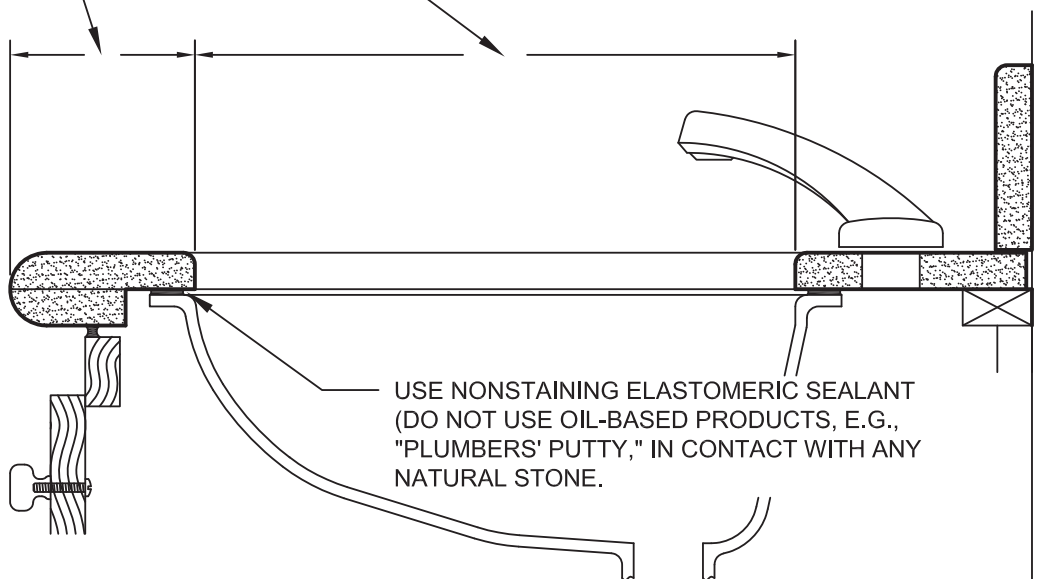
LOCATE SUPPORT CLIPS AT
APPROXIMATE 45° ANGLES.



PLAN VIEW OF TYPICAL VANITY

SINK SETBACK MUST PROVIDE SUFFICIENT
CLEARANCE FOR CABINET FRAME AND SINK LIP.

VERIFY THAT DEPTH AND PLACEMENT OF SINK ALLOWS
ROOM FOR FAUCETS AND BACKSPLASH.



SECTION THROUGH VANITY COUNTER



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VANITY TOP DETAILS

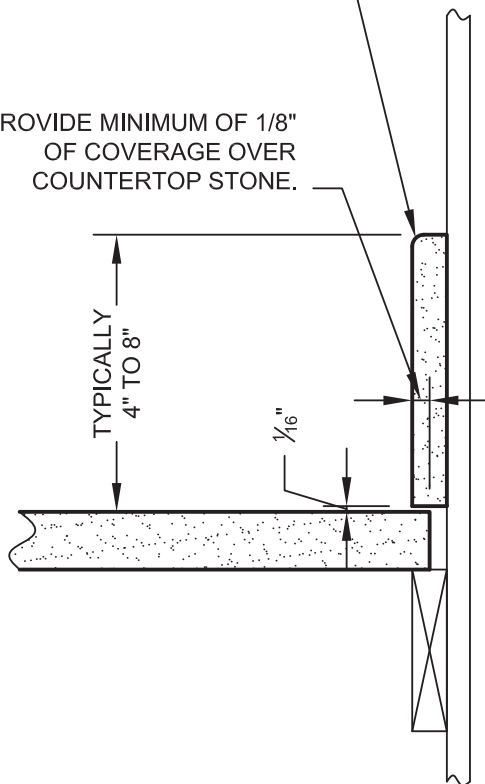
MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-11

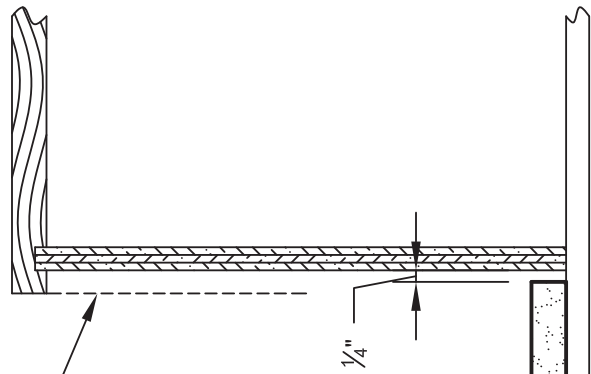
SCALE:
3" = 1'-0"

TOP EDGE OF SPLASH TO
RECEIVE PROFILE THAT
MATCHES OR
COMPLEMENTS THAT OF
COUNTERTOP STONE.

PROVIDE MINIMUM OF 1/8"
OF COVERAGE OVER
COUNTERTOP STONE.

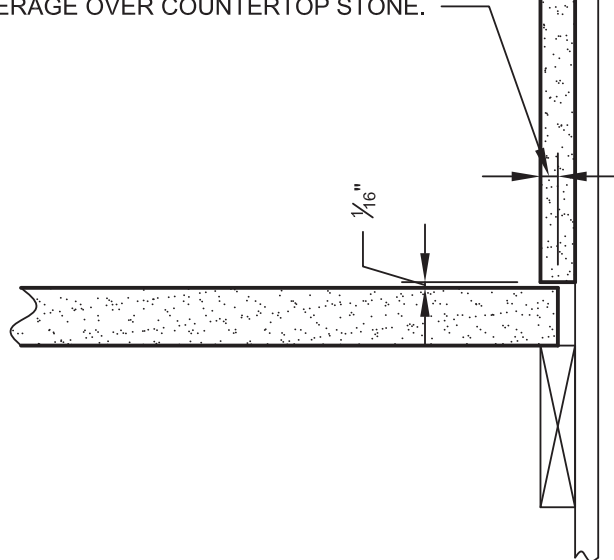


**SECTION THROUGH PARTIAL-
HEIGHT BACKSPLASH**



NOTE: CABINET LIP MAY INTERFERE
WITH STONE SPLASH AT ENDS OF
CABINETS.

PROVIDE MINIMUM OF 1/8" OF
COVERAGE OVER COUNTERTOP STONE.



**SECTION THROUGH FULL-
HEIGHT BACKSPLASH**



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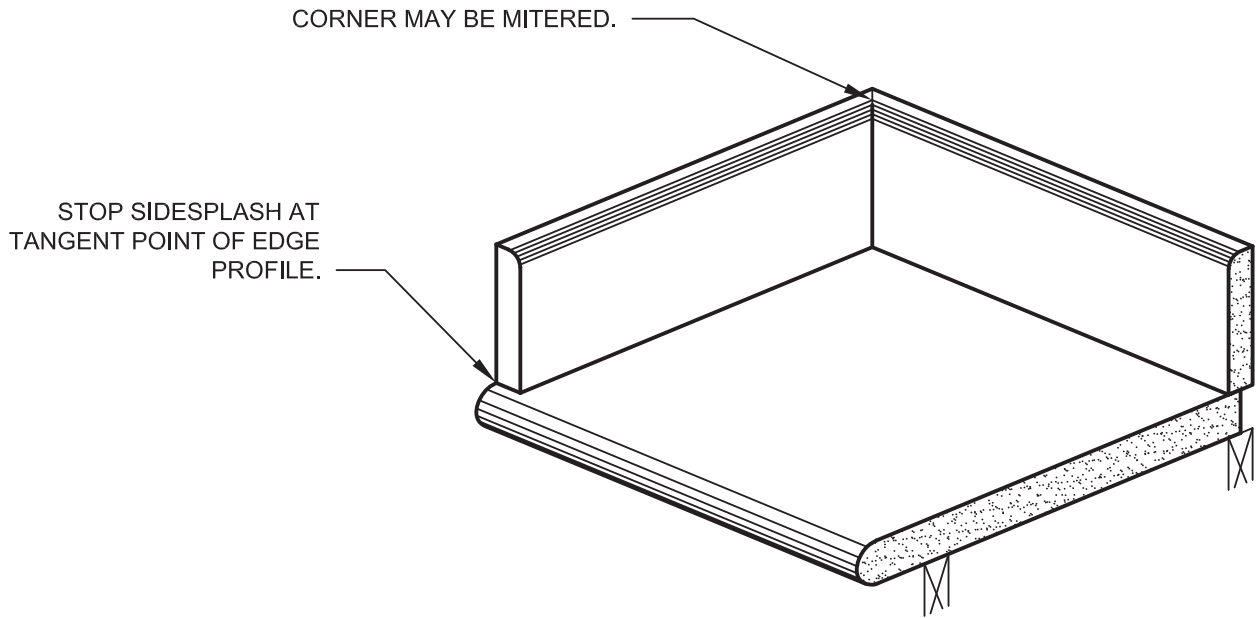
REV	DATE
0	Jan 2005
1	Oct 2006

BACKSPLASH DETAILS

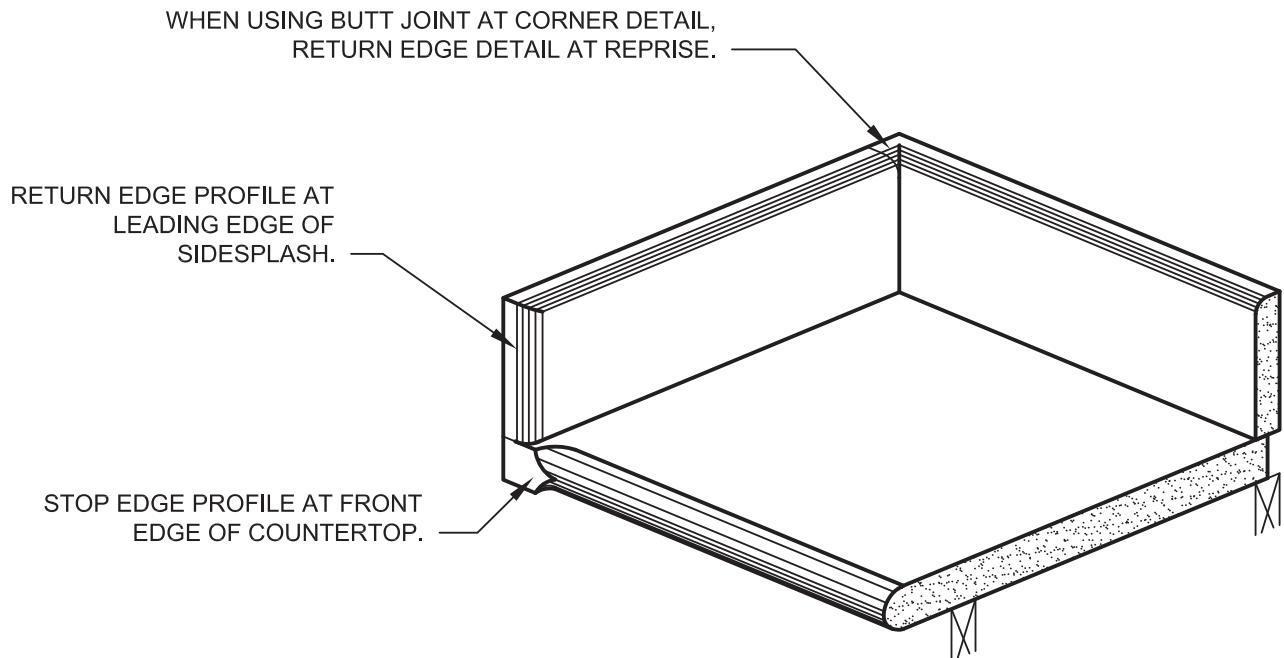
MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-12

SCALE:
3" = 1'-0"



VIEW OF COUNTERTOP WITH FULL- LENGTH NOSING PROFILE



VIEW OF SIDESPLASH CONTINUING TO EDGE OF COUNTERTOP



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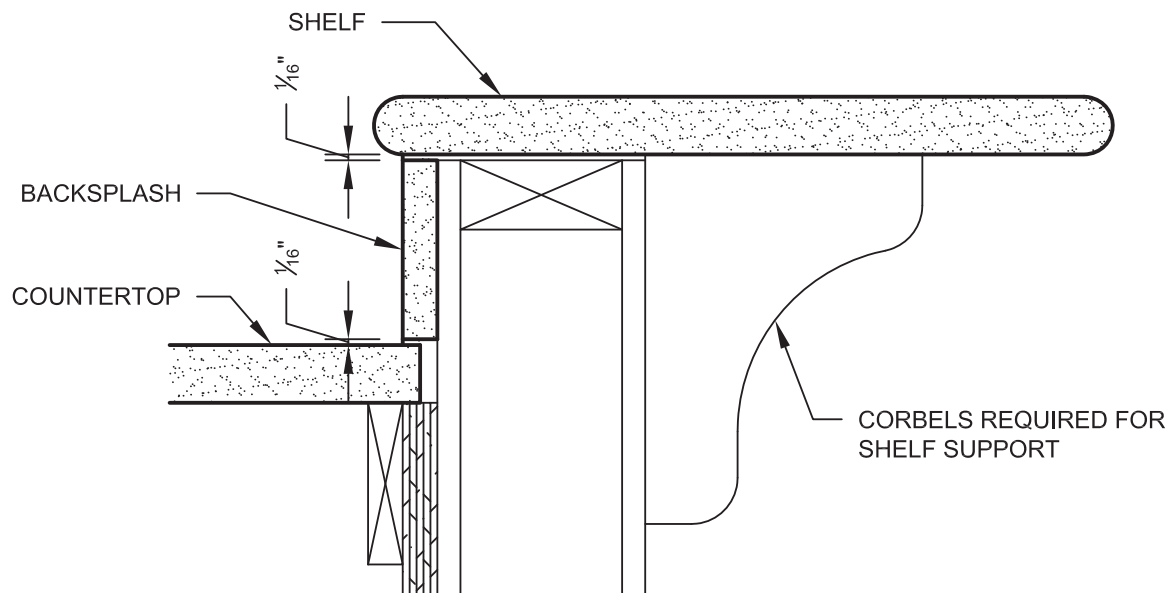
REV	DATE
0	Jan 2005
1	Oct 2006

OPTIONS @ SIDESPLASH

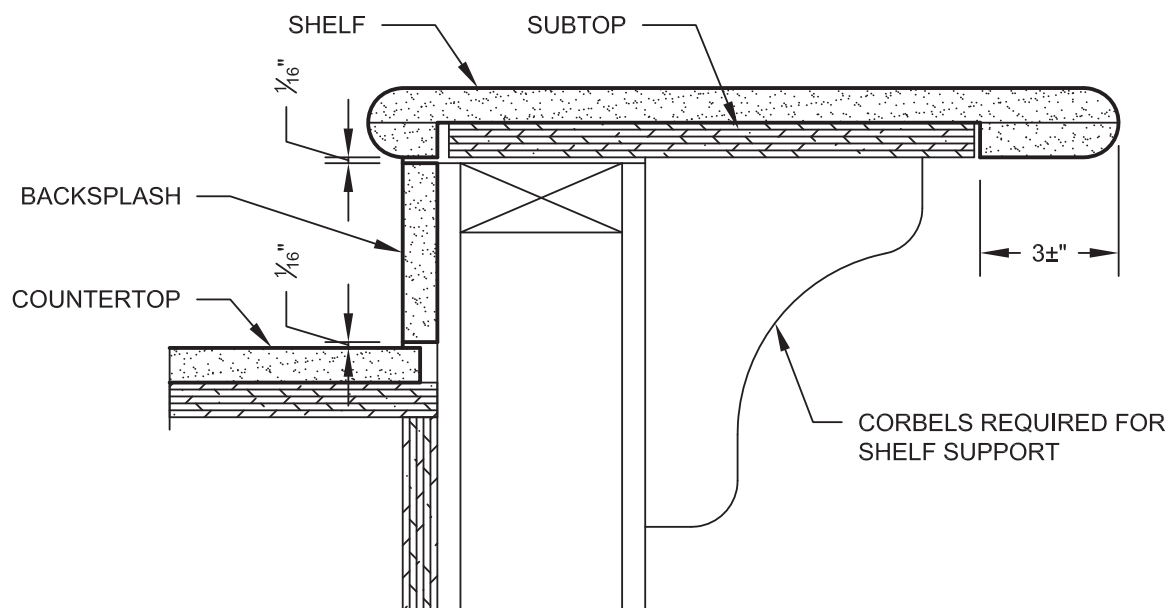
MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-13

SCALE:
N.T.S.



DETAIL OF STONE SHELF WITHOUT SUBTOP



DETAIL OF STONE SHELF WITH SUBTOP



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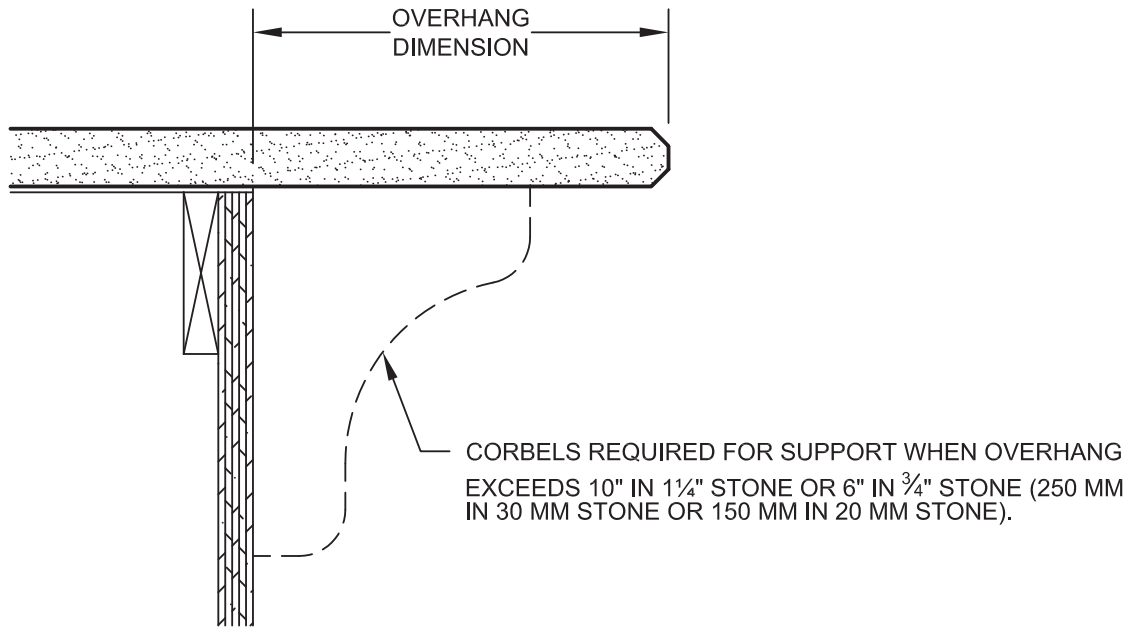
REV	DATE
0	Jan 2005
1	Oct 2006

STONE SHELF DETAILS

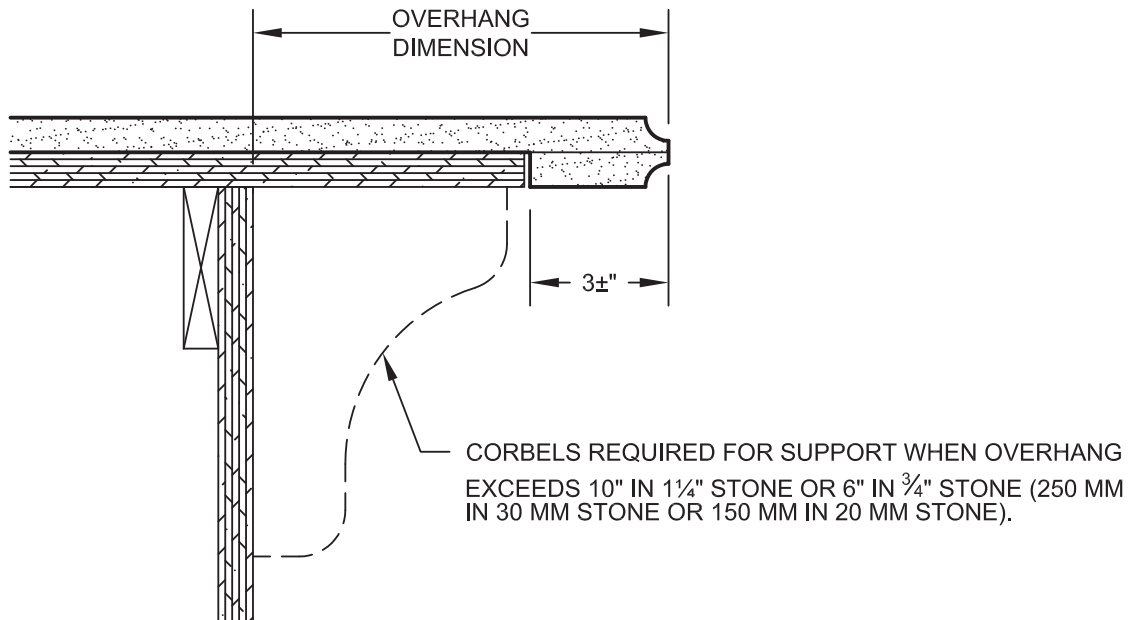
MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-14

SCALE:
 3" = 1'-0"



DETAIL OF COUNTERTOP OVERHANG WITHOUT SUBTOP



DETAIL OF COUNTERTOP OVERHANG WITH SUBTOP



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COUNTERTOP OVERHANG DETAILS

MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-15

SCALE:
3" = 1'-0"

Straight with Radius Eased Edges (1)	Straight with Chamfer Eased Edges (1)	Pencil Round (2)	Double Pencil Round (2)
Radius (3)	Double Radius (3)	Chamfer (3)	Double Chamfer (3)
Full Bullnose	Half Bullnose	Demi Bullnose	Chiseled or "Rocked"
Ogee	Ogee Roundover	Dupont	Normandy
Cove (3)	Double Cove (3)	Cove Ogee	Cove Dupont
Stair Tread	Waterfall (or Triple Waterfall)	Platner (or Knife Edge)	Laminated (4)

Notes:

1. The term "Eased Edge" more commonly refers to a slightly radiused profile than a slightly chamfered profile, although the use of the term varies regionally and/or with specific fabricators. In either case, the edge treatment is slight, and normally does not exceed $\frac{1}{16}$ " (1.5 mm).
2. "Pencil Round" generally refers to a radius near that of a standard pencil, approximately $\frac{3}{8}$ " to $\frac{1}{2}$ " (3 to 4 mm).
3. Radius, Chamfer, or Cove edge profile can be any dimension. The actual dimension should be specified at the time of sale. Chamfers are most commonly 45°, although not necessarily so.
4. Many of the profiles shown on this drawing can be done with laminated edge details.



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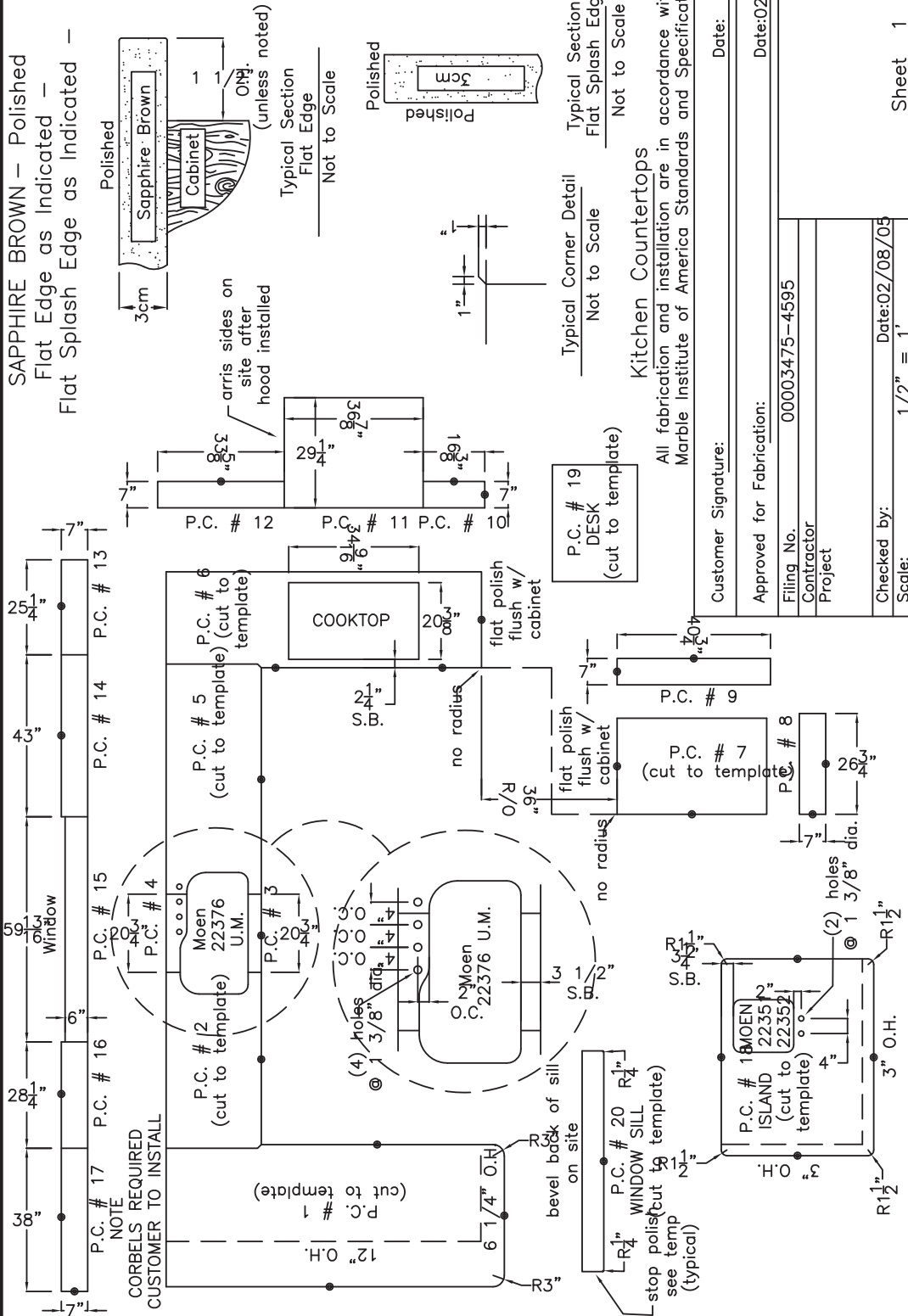
EDGE PROFILE NOMENCLATURE

MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-16

SCALE:
N.T.S.

SAPPHIRE BROWN – Polished
Flat Edge as Indicated –
Flat Splash Edge as Indicated –



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EXAMPLE SHOP DRAWING

MIA DIMENSION STONE DESIGN MANUAL VII

DRWG NO: 17-D-17

SCALE:
1/2" = 1'-0"

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Granite Countertops: #1 in Cleanability!

Butterfly Green Granite

Choose granite for cleaner & safer food preparation!

In a recent study, granite countertops provided the greatest reduction in bacteria counts of all materials tested! Six countertop surfaces were contaminated with E. coli bacteria, then washed and rinsed using dish soap and "normal and reasonable" cleaning practices. In an additional study conducted in 2006, granite, marble and engineered stone were compared. The study showed conclusively that natural stone and engineered stone essentially have the same level of cleanability.

Reduction in Bacteria After Washing & Rinsing:

Granite:	36,000 to 1*
Stainless Steel:	4,000 to 1
Concrete:	2,400 to 1
Tile:	900 to 1
Wood:	500 to 1
Plastic Laminate:	285 to 1



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* Source: "The Reduction of E. Coli on Various Countertop Surfaces," by Dr. O. Peter Snyder, Jr., Ph.D., of the Hospitality Institute of Technology and Management, March 1999.
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For over sixty-five years, the Marble Institute of America has served as the authoritative source of information on standards of natural stone workmanship and practice and the suitable application of natural stone products.

Membership in the association is worldwide and includes natural stone producers, exporters/importers, distributors/wholesalers, fabricators, finishers, installers, and industry suppliers — all committed to the highest standards of workmanship and ethics.

MIA publishes a monthly newsletter for members, markets a range of technical publications and consumer pamphlets on natural stone, sponsors business and technical meetings and seminars on industry-related topics, provides educational programming for architects and construction specification professionals, and conducts the annual Pinnacle Awards competitions recognizing outstanding natural stone projects worldwide. And new in 2009, the MIA Natural Stone Craftsman of the Year award will recognize one craftsman who has physically performed outstanding stone fabrication and/or installation over a period of many years. MIA also sponsors an industry accreditation program for high quality fabricators and commercial installers.

MIA is also a leading promoter of stone usage in the commercial and residential marketplaces. MIA produces a number of consumer education materials on the use of natural stone and its proper care and maintenance and hosts an informative website for consumers at www.usenaturalstone.com.



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