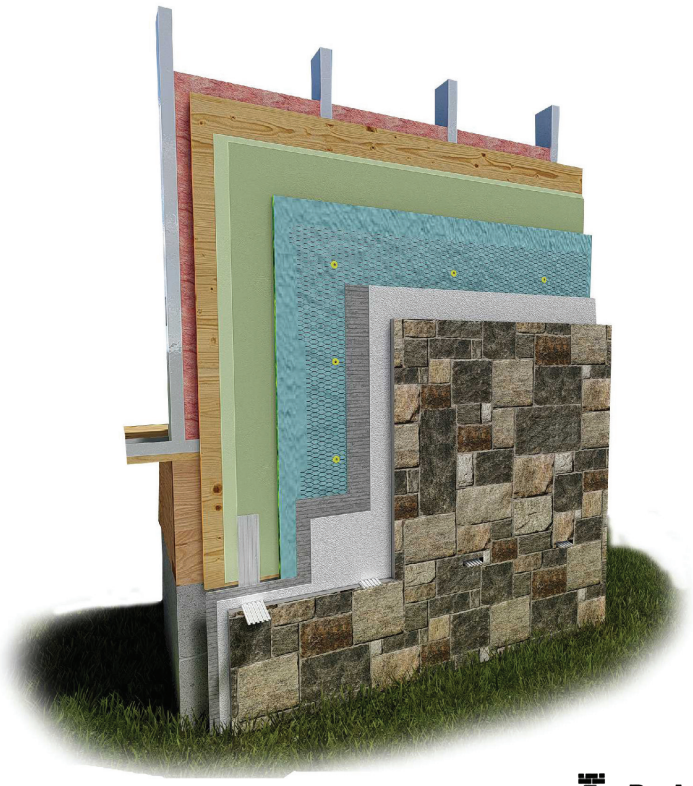
NATURAL FACING

Adhered Natural Stone Veneer Installation Guide



Rocky Mountain MASONRY INSTITUTE

BSI Building Stone Institute

Most natural stone is inherently durable, but there are many types and varieties of natural stone and not all are suggested for exterior use. For best results, use materials that have shown a history of successful resistance to weather conditions in your area. Check with local building codes.

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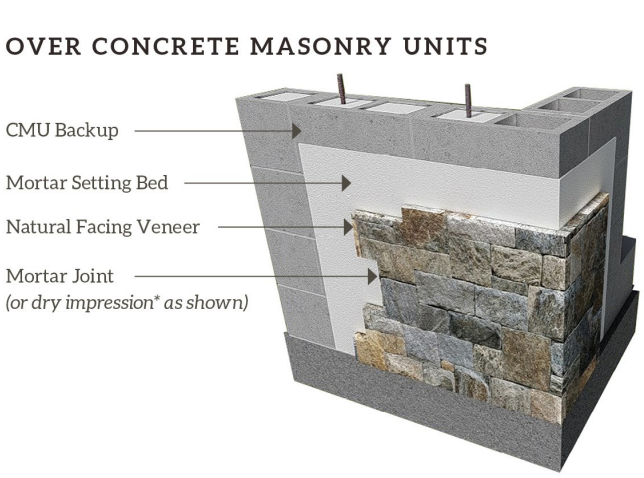


1a. Concrete/Concrete Block/Stucco needs to be clean and in its original, untreated condition. If the surface has been treated, light sandblasting or waterblasting can be used to restore the wall to a smooth, clean surface. Remove all form-release agents, dust, etc., that may inhibit the mortar bond.

1b. Alternately, you can securely attach metal lath to the wall every 6" on center and apply a scratch coat of mortar 3/8"-3/4" thick. Use a toothed scraper, notched trowel or small piece of lath to lightly rake horizontal grooves in the scratch coat. Allow the scratch coat to cure for a minimum of 24 hours before installing adhered veneer.

Fig.1A - Attaching Lath

Fig. 1B - Applying scratch coat of mortar

1. Apply sheathing over the studs. Sheathing can be exterior OSB, plywood, exterior grade drywall, wallboard or cementitious board.

2. Staple the building paper to the sheathing. Attach the building paper in horizontal strips. Start at the bottom and overlap 2" (like shingles). Overlap the vertical joints by at least 6". If using flashing or support brackets (anchors), install them before proceeding to the next step.

3. Screw, staple or nail the metal lath to the studs. Only the screws that attach to the studs are counted to meet code requirements. Overlap the metal lath at least 1/2" for horizontal and 1" for vertical joints. At corners, overlap the vertical joints at least 16" around the corner to avoid corner cracking. Use barbed galvanized nails at 6"o.c. vertically for exterior work or steel wire furring nails at 4"o.c. for interior work. Minimum nail penetration is 1" into the studs. For steel studs, the lath must be anchored with corrosion resistant screws that have a minimum shank diameter of 0.136". (Fig 1A)

4. Apply a scratch coat that is 3/8" to 1/2" thick over and embedded into the metal lath. Use a toothed scraper, notched trowel or small piece of lath to lightly rake horizontal grooves in the scratch coat. Allow the scratch coat to cure for a minimum of 24 hours before installing adhered stone. (Fig 1B)

Mortar Application and Stone Placement

Starting Point

You can start laying stones at the top or the bottom of the wall. Working from the top down may keep mortar droppings from staining stones below, but make sure the mortar is strong enough to hold the suspended stone in place.

If beginning from the bottom, use a straight-edge and start 4” above soil or 2” above concrete to keep moisture from being absorbed from the ground. If your wall requires corner pieces, place these stones first. After your corner pieces are in place you can continue with the field stones.

Mortar Application

At the beginning of the workday, sponge or hose down the entire surface of the wall. This keeps the moisture from the wet mortar from being absorbed by the wall. Remoisten your work area with a fog spray or wet brush every hour. You want your work area to be damp, but not wet.

Using a trowel, apply mortar 3/8” to 3/4” thick to your work area. Push the mortar layer directly onto the backup wall (for concrete/concrete block/stucco) or into the scratch coat (for studs) with firm pressure on the trowel. Keep your work area limited to 10 square feet, so the mortar on the wall will not set before you can place the stones.

Setting Stones

Before setting absorptive stones like sandstone and some limestone, you should mist or brush the back of the stone with water to make it damp, but not wet. Do not pre-wet dense granites or other stones with less than 1% absorption. Natural stones do not absorb much water and a saturated stone will not adhere to the mortar.

Just before placing the stone, cover 100% of the back of the stone with 1/2" of mortar. Place a slight excess of mortar at the edges of the stone. This will allow some mortar to squeeze out the stone edges and fill the joints when pressure is applied. Once the stone has been firmly pressed into the mortar bed, gently tap the stone with a soft mallet to set it in place. Be careful not to tap too hard. Some stud systems may be flexible and setting adjacent stones by tapping may dislodge a stone. Do not disturb or tap the stone after it has been set. The resulting total mortar thickness behind the stone should be between 3/8" and 1 1/4".

Joint Width

Proper joint width depends on the type of stone being used and the desired appearance. For wide joints, more mortar may need to be placed on the back of the stone. For thin joints, less mortar should to be used. Be aware that increasing the amount of mortar on the back of the stone unit increases the possibility of mortar droppings on the stones below it. This also adds extra weight, which may cause the stones to be too heavy and fall off the wall. Make sure to keep your joints uniform in width. If your joints are greater than 1/2" in width, shrinkage cracks may develop within the joint.

Cutting and Trimming Stones

When placing a stone, try to find one that looks like a good fit with its neighbor. Some of these stones will still need to be trimmed to fit neatly and maintain uniform joint widths. To cut the stone, use a handheld grinder with a diamond cutting wheel or a chisel and hammer. If you prefer a rougher cut, score the back of the stone with the grinder and then use the hammer to break the unwanted pieces off. After the stone has been cut and trimmed, use a sponge or brush to assure that all grinding residue and dust have been removed.

Grouting and Finishing Joints

After the stone is in place and has set for 24 hours, come back and fill the joints using a pointing tool or grout bag. The final joint finish helps the wall resist moisture penetration. Tool the joint using a concave joint tool to compress and smooth the joints for maximum water resistance. Rough cut or raked joints will not be as water resistant as tooled joints. Brush away any crumbles or mortar tags after tooling the joint. We do not recommend installing stone veneer with open joints outdoors in climates with freeze/thaw weather cycles. Dry stack installation can be used for interior installations or warm climates where it does not freeze.

Clean up at the End of the Day

At the end of the workday, gently brush mortar smears off the stone. Do not use aggressive high pressure cleaning methods to clean the wall. They might loosen the stone. Natural stone is resistant to many chemicals, but some types of cleaners can damage the stone. Talk to your stone supplier to get specific recommendations for cleaning your stone.

Workmanship

Installation of adhered natural stone veneer is relatively straightforward, but requires an experienced tradesman with a keen eye to fit the stones in an attractive pattern.

Important workmanship issues to consider include:

- Complete mortar bedding at the back of the stone is essential. Even small voids can collect water over time, leading to premature failure.
- Mortar joints need to be full and well-tooled, without voids or cracks that may let water into the wall. Dry-stack patterns are not recommended for exterior use in harsh environments like Colorado, with lots of freeze/thaw cycles.
- Mortar joint width should be fairly uniform. Very wide joints are likely to develop shrinkage cracks. Narrow joints are difficult to fill properly.
- The bond pattern should be "comfortable" – avoid the use of occasional large or very small stones or thin vertical stone pieces. The final product should have the appearance of load-bearing masonry, as shown below for several typical stone patterns.
- Avoid continuous vertical mortar joints that cross more than 4 units.

Roughly Rectangular

European Ledgestone

Ledgestone

Mosaic

Interior Uses

Most interior stone veneer installations are not exposed to moisture so you do not need to take steps to prevent water penetration. For dry interior applications, thin stone can be adhered to the backup wall using mortar or special epoxy adhesives approved for thin stone applications. In these installations, the weather resistive barrier is no longer needed.

The acceptable types of backup walls for interior applications are:
- Concrete
- Concrete Masonry Units (CMU)
- Brick
- Cementitious Board over studs

Apply a thin bed of adhesive over these backup walls using the flat side of the trowel. Then apply an additional coat of adhesive using the notched side of the trowel. You can now place the stone. If needed, cover the back of the stone with adhesive to achieve correct coverage and bedding. Once the stone has been firmly pressed into the adhesive bed, use a soft rubber mallet to set the stone. The resulting total adhesive thickness behind the stone should be a minimum of 1/4".

Mortar/Adhesive Pros and Cons

Type N vs. Type S Mortar

- Type N is a good all-around mortar choice for most applicaions. In hot weather applications, it performs better and overall it is easier to use.
- Type S has a stronger bond, but with this increased bond strength comes an increase in possible shrinkage and cracking. Type S may be required by some building codes, especially in seismic areas.

Portland-Cement-Lime (PCL) vs. Masonry Cement (MC)

- PCL has a stronger bond and should be used whenever possible.
- MC has better workability, which many masons prefer, but it has a weaker bond strength due to its high air content. It also retains less water, which can result in rapid mortar dry-out when used in hot weather.

Mortar Bonding Agents

Bonding agents are added to mortar to increase its bond strength. They are normally not required if correct application procedures are followed. Some installers will use bonding agents for additional "insurance" and to avoid call-backs. Be extra careful to keep the wall clean if you use these high bond mortars. Their droppings are difficult to clean off once they cure. Talk with your stone supplier for recommended bonding agents for your stone.

Adding a bonding agent to your mortar may be advantageous in the following applications:
- Soffits or other overhead uses.
- When placing non-absorptive, high density stones (such as granite or marble) with smooth cut surfaces.

Structural Backup Wall

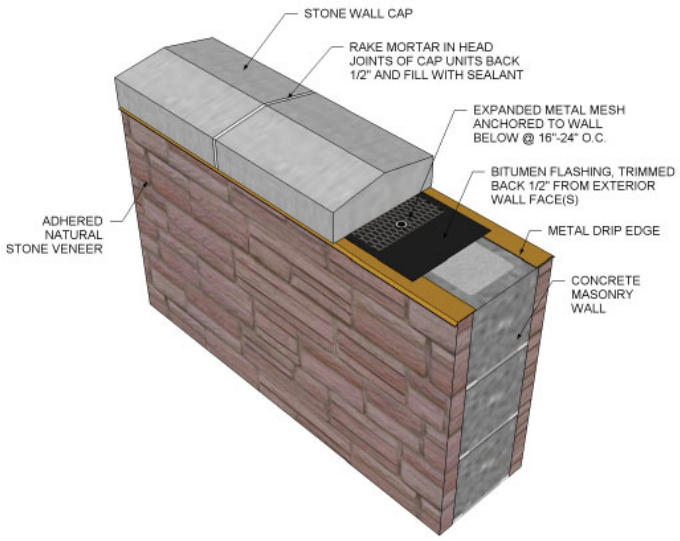
Adhered natural stone veneer is an attractive wall covering, but it is the structural backup behind the stone veneer that does all the work in resisting loads. According to section 6.3.2.3 of the MSJC, the backup wall may be wood framing, steel framing, concrete block, or poured in place concrete.

With adhered applications, the stone veneer will move with the backup wall as the structure responds to loads, temperature variations, and soil settlement. Natural stone veneer is relatively stiff, and is well-matched to a concrete block or poured in place concrete backup system. Wood and steel framing, on the other hand, are relatively flexible. Choosing a stiff backup structure can help to prevent future cracking of the adhered veneer. Wood framing is particularly susceptible to movement as the wood swells during damp periods, and shrinks when it dries.

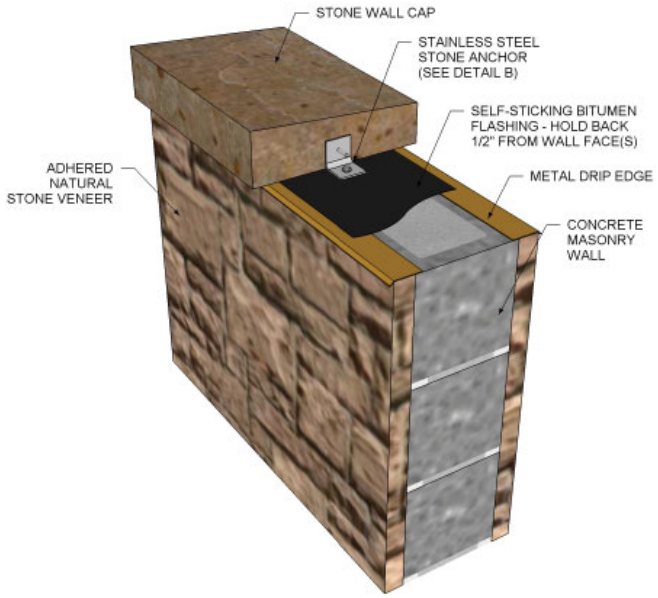
Narrow cracks in the mortar may appear over time as the backup wall moves. Water that gets in these cracks can cause premature failure. Slight cracks that appear due to this movement usually do not threaten the integrity of the stone veneer, but the cracks should be pointed with new mortar to keep moisture out of the wall system.

Special Challenges

Wall Caps



Wall caps require special attention. The many exposed mortar joints at the top of a wall are prone to moisture penetration, hastening deterioration of the cap. To keep water from running down into the wall under the cap, use through-wall flashing with weep holes directly beneath the wall cap. Even better, use a precast concrete or monolithic stone cap.



Deflection Limits

Although adhered natural stone veneer isn't expected to carry structural loads, it is an inherently stiff material. When installed over stud framing, adhered stone veneer can actually be much stiffer than the backing material used for structural support. With adhered applications, the stone veneer will move with the backup wall as the structure responds to loads, temperature variations, and structural movement. Some applications of adhered stone veneer over conventional wood or steel stud frame construction have experienced cracking due to deflection of the stud wall.

The relatively stiff natural stone veneer is well-matched to a concrete block or poured in place concrete backup. Wood and steel framing, however, are relatively flexible. Wood framing is particularly susceptible to movement as the wood swells during damp periods and shrinks when it dries. Designers of steel and wood stud backup systems should consider backup stiffness in their design and use heavier studs or a tighter stud spacing to reduce the potential for veneer cracking.

While the MSJC code does not contain stiffness requirements for the backup wall, there are a number of recommendations from industry groups about how much to limit deflection of the backup to reduce cracking:

- IBC Table 1604.3 asks for L/240 for walls supporting brittle materials like adhered veneer
- The Tile Council of America asks for L/360 in the back-up wall.
- The Metal Lath/Steel Framing Association also asks for a stiffness ratio of L/360.
- The Brick Industry Association recommends a deflection limit of L/600 to L/720 for brick veneer tied to a steel backup.
- NCMA TEK 3-6B references IBC 1405.9.1.1 for interior veneer supported by wood construction: "the wood backup must be designed for a maximum of the backing, which can cause veneer cracking or loss of adhesion."
- The Cast Stone Institute publication titled *The Difference between Cast Stone and Adhered*

Manufactured Stone Masonry Veneer (September 16, 2008) states that "Choosing a stiff backup structure (L/600 to L/1000) is required to prevent future cracking of the adhered veneer."

- The Building Stone Institute Bulletin, *The Art of Deflection* (November 2009) recommends that you limit deflection to L/1000. This advice is based on the fact that adhered veneer is not as thick as anchored veneer. The more conservative deflection limit protects future occupants from the risk of falling stones and eliminates the redundancy of mechanical anchors.

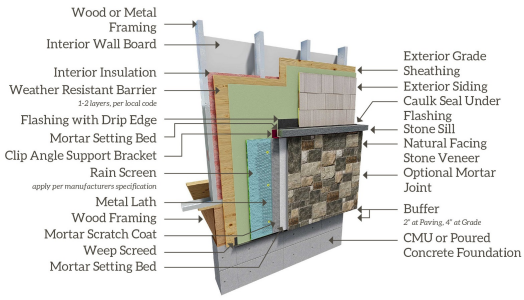
Oversized Window Sills

MSJC 6.3.2.1 limits the thickness of all adhered masonry veneer to 2-5/8" deep, measured horizontally as installed. Any stone that is deeper than this limit exerts an eccentric load on the wall that exceeds the capacity of the bonding mortar to hold it in place. If it is deeper than 2-5/8", it needs to be installed as a piece of anchored veneer.

Window sills are often fashioned from pieces of wall stone, installed horizontally instead of vertically. These sills often measure more than the code-allowed depth. They must have their gravity loads supported by steel angles. These angles do not need to be continuous nor do they need to be particularly hefty. They are not holding up much weight. The clip angles do, however, need to be large enough to support 2/3 of the depth of the sill. A clip angle at each end of each piece of sill stone should suffice.

Have your project engineer design the clip size, spacing, and its anchorage to the backup structure.

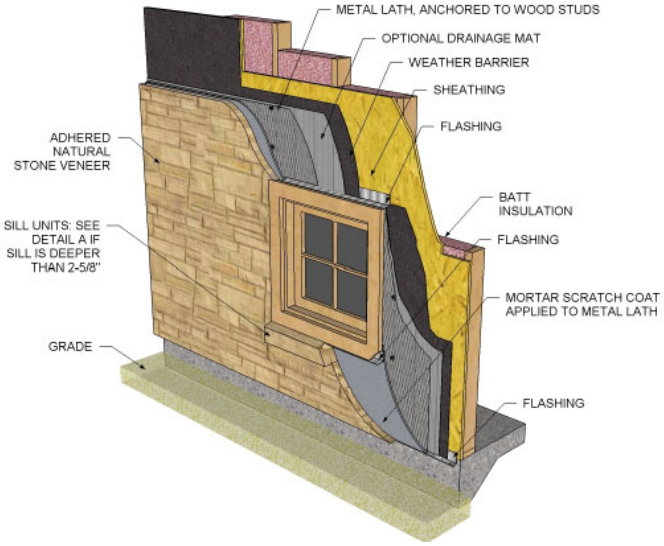
With Stone Sill



Detail A

Flashing/Water Penetration

Masonry veneers are water-resistant, not waterproof, no matter how well they are built. They do a good job of resisting moisture penetration, but require a moisture-resistant covering at the face of the backup wall to prevent water damage. Install building paper as a moisture barrier on top of the sheathing over wood or steel stud walls. Concrete block and poured-in-place concrete are both sufficiently water-resistant. They require no moisture barrier. Use flashing at the base of walls, at sills, and under wall caps to direct any moisture to the exterior face of the wall.



Water Repellents

Most natural stone veneer applications are inherently weather-resistant and do not need treatment over time. There are some instances, however, when water repellent treatments will help the wall resist moisture penetration and staining. It may be wise to apply water repellent at areas that are prone to constant wetting, such as at the base of walls, sills, and caps. Be sure to use a breathable water repellent with a silane or siloxane base. These products penetrate into the surface of the veneer to shed water, while allowing water vapor from within the wall to escape. Avoid elastomeric or acrylic sealers that form a film at the wall surface. Non-breathable films can actually trap water in the wall, leading to long-term damage.

Efflorescence

Efflorescence is a white, powdery deposit that sometimes appears on the face of masonry walls. Natural stone rarely shows this chalky deposit while manufactured stone, which is made using cement, is very absorbent and often shows efflorescence. You may see a slight efflorescence from the mortar joints if the veneer is installed in an area that occasionally gets saturated.

Efflorescence normally is not harmful but serves as an indicator of excessive moisture exposure. Remove powdery deposits by brushing; harder carbonate deposits may require scrubbing with a weak acid dissolved in water. Eliminate the source of the moisture and efflorescence will not recur.

De-icing salts are a common cause of efflorescence, scaling, and corrosion of metal lath. Efflorescence may arise in the splash zone, or at the entry to a building; stone can wick salt-rich moisture from adjacent sidewalks or paving areas.

Durability and Maintenance

Natural stone has very low absorption, high strength, and excellent resistance to weathering, and it will give you long-lasting performance if you follow a few simple guidelines:

- Keep excess moisture from saturating the wall. Adjust landscape sprinklers, downspouts, etc., to prevent water from constantly wetting the wall.
- Periodically remove any vegetation such as ivy or moss.
- Clean with a gentle water spray to remove dust and dirt. If you have stains, graffiti, or other serious cleaning issues, use gentle methods to avoid damaging the mortar and stone. Talk to your local stone supplier for the best recommendations on cleaning solutions. Test any cleaning solution on a small area to check for results.
- Cracks may appear over time as the building shifts and settles. Repoint cracks with new mortar to restore the wall's natural weather resistance.

See Table 1 for natural and manufactured stone property comparisons.

Table 1. Natural and Manufactured Stone Property Comparison

Stone type	Min. Compressive Strength[1], psi	Max. Water Absorption by Weight[2], %	Thermal Expansion[3], in/100°f/10ft	Shrinkage (-) and Expansion (+)[4], in/10ft	Freeze-Thaw Durability
Natural Stone	1,800 to 20,000	0.2 to 12	0.0264 to 0.0804	(+) 0.00048 to 0.012	Good to Excellent
Manufactured Stone	1,500	13 to 29	0.0432 to 0.0744	(-) 0.054 to 0.084	Poor

1 Natural Stone includes Sandstone, Limestone, Marble and Granite

2 ASTM Requirement values for Natural Stone; ICC Acceptance Criteria for Artificial Precast Stone Veneer; Max. weight for adhered veneer is 15 psf per MSJC/IBC

3 Expansion in inches per 10 ft section for a 100° F temperature increase. "Conservation of Historic Stone Buildings and Monuments," National Materials Advisory Board

for Natural Stone; "Reinforced Concrete : Mechanics and Design," James G. MacGregor for Concrete (Manufactured Stone)

4 Shrinkage and Expansion in inches per 10 ft section. Natural stone usually expands over time due to moisture uptake; manufactured stone always shrinks over time due to drying and carbonation.

Installing over Rigid Insulation

In attempting to achieve good thermal performance many designers are calling for a continuous layer of rigid insulation in exterior walls. In fact, some building codes require it. The codes do not specify where you must install this layer of insulation. We suggest that you add the rigid insulation to the inside face of the wall if you are using adhered stone for the exterior veneer. If you install the rigid insulation board between the sheathing and the stone veneer, it can destabilize the structure of the wall. Insulation is not really all that rigid.

Some manufacturers have recommended applying adhered stone veneer to metal lath installed directly over rigid insulation, using rigid insulation in lieu of sheathing. We do not endorse this approach. In our opinion, rigid insulation is too compressible to be a suitable substrate for adhered veneer. If you lean a ladder against the wall, the point load at the top of the ladder can crack the stone veneer if the substrate behind it compresses from the pressure.

Rigid foam board cannot transfer the weight of the adhered stone veneer directly to the stud backup or foundation. It must rely on the fasteners that pass through the insulation and attach to the studs to transfer these loads. The addition of the foam introduces a bending component to the fasteners that is not present when lath is attached directly to the studs. The thicker the layer of foam, the more extreme the bending component will be. If such an installation cannot be avoided, consult an engineer to design appropriate lath anchors in order to avoid sagging or racking that can produce cracks in the veneer.

Scuffing

Since natural stone is a homogenous material, the color is consistent throughout the stone. It is much less prone to scrapes and scuffs than manufactured stone that has a thin, pigmented exterior. For small scrapes and scuffs, first try simple cleaning or scrubbing to hide the scuff. You can also use a hammer and chisel to resurface the stone, restoring the original surface texture.

Retaining Walls

Stone veneers used to face retaining walls, around swimming pools, and in the splash zone near roadways will all need special care in detailing and installation. Provide adequate drainage and damp-proofing.

Movement Joints

Natural stone is relatively stable and will not move of its own accord. All buildings move slightly over time in response to applied loads, foundation settlement, traffic vibrations, and changes in temperature and humidity. This movement can sometimes cause cracks to appear in the veneer unless movement joints are incorporated into the design.

Typical locations for movement joints include:

- near building corners
- at window and door openings (use a movement joint at one side of an opening 6 to 12 feet wide; openings over 12 feet wide need a joint at each jamb)
- where the stone veneer meets another material such as siding or stucco
- about 35 feet on center for large walls without openings

Movement joints should be flexible. Leave a 3/8" gap through the veneer and fill with backer rod and sealant.

Building Code Requirements

Adhered natural stone veneer can be installed using a variety of methods for exterior and interior walls. The installation methods recommended in this Guide have proven to be sound and effective in the severe weathering climate of Colorado.

Shown on the next three pages are examples of common installation methods based on requirements of the 2009 International Building Code (IBC) which references the requirements of the Masonry Standards Joint Committee (MSJC), 2008 edition. This standard includes Building Code Requirements for Masonry Structures, TMS 402-08/ACI 530-08/ASCE 5-08 and Specification for Masonry Structures, TMS 602-08/ACI 530.1-08/ASCE 6-08. Since standards, codes, and conditions vary and are sometimes contradictory, contact your local Masonry Institute or building department to determine which method is best for your climate and your project.

Material Requirements

Weather-Resistive Barrier

(Only required for Steel or Wood Studs with Sheathing for Exterior Uses)

2009 IBC, paragraph 1403.2 – All weather-exposed surfaces need a weather-resistive barrier behind the exterior veneer that will provide a barrier to moisture penetration. According to the Commentary to the Code, this assembly has three parts: "a water-resistive barrier installed over the substrate; flashings at penetrations and terminations of the exterior wall finish and a means of draining moisture that may penetrate the finish back to the exterior". The Commentary states that this drainage plane may be "as complicated as a rain-screen pressure-equalized type of exterior assembly or as simple as providing discontinuities or gaps between the surface of the substrate and the back side of the finish, such as through the use of noncorrodible furring".

TMS 402-08/ACI 530-08/ASCE 5-08 – Exterior Veneer is required to have a backing system that resists water penetration. This means that the exterior sheathing needs to be covered with a water-resistant membrane unless the sheathing is water-resistant and the joints are sealed.

Metal Lath and Fasteners

2009 IBC 2510.4 – Corrosion Resistance – Metal lath and lath attachments shall be of corrosion-resistant material. The type and weight of metal lath, gage and spacing of wire in welded or woven lath, the spacing of supports, and the methods of attachment are given in the ASTM Standards referenced in IBC Tables 2506.2 and 2507.2 (see pp.13 & 14 of this Guide).

1 "Corrosion-resistant" are materials that are inherently rust resistant or materials to which an approved rust-resistive coating has been applied either before or after forming or fabrication.

For galvanizing requirements, see ASTM A 153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

ASTM C 1063 – Lath shall be applied with the long dimension at right angles to the supports, unless otherwise specified. (Section 7.10.1.2)

Metal lath shall be lapped ½ in. at the sides (horizontal joints), or nest the edge ribs. Lap metal lath 1 in. at ends (vertical joints). Wire lath shall be lapped one mesh at sides and ends. Where end laps occur between the framing members, the ends of the sheets of all types of lath shall be laced or wire tied with 0.0475 in. galvanized, annealed steel wire. (Section 7.8.2)

TMS 402-08/ACI 530-08/ASCE 5-08 – Backing shall provide a continuous, moisture-resistant surface to receive the adhered veneer.

Backing is permitted to be concrete block, concrete, or metal lath and Portland cement plaster applied to masonry, concrete, steel framing, or wood framing.

(See p. 13 Table 2 Screws, Nails and Staples for attaching Gypsum Lath to Horizontal and Vertical Wood Supports and p. 14 Table 3 Types and Weights of Metal Plaster Bases and Corresponding Maximum Permissable spacing of Supports)

Mortar

2009 IBC

1405.10– Adhered masonry veneer – Adhered masonry veneer shall comply with the applicable requirements in 1405.10.1 and Sections 6.1 and 6.3 of ACI 530/ASCE 5/ TMS 402.

TMS 402-08/ACI 530-08/ASCE 5-08

6.3.2.4 - Adhesion developed between adhered veneer units and backing shall have shear strength of at least 50 psi based on gross unit surface area when tested in accordance with ASTM C 482, or shall be adhered in compliance with Article 3.3 C of ACI 530.1/ASCE 6/TMS 602.

ACI 530.1/ASCE 6/TMS 602

3.3 C. Placing adhered veneer

1. Brush a paste of neat Portland cement on the backing and on the back of the veneer unit.

2. Apply Type S mortar to the backing and to the veneer unit.

3. Tap the veneer unit into place, completely filling the space between the veneer unit and the backing. Sufficient mortar shall be used to create a slight excess to be forced out between the edges of the veneer units. The resulting thickness of the mortar in back of the veneer unit shall not be less than 3/8" nor more than 1 -1/4".

4. Tool the mortar joint with a round jointer when the mortar is thumbprint hard.

Stone Dimension and Area Restrictions

TMS 402-08/ACI 530-08/ASCE 5-08 (paragraph 6.3.2.1) The maximum thickness of adhered veneer units is 2-5/8" (measured horizontally as installed). No side of the veneer unit can exceed 36 inches in length and the overall face area of the stone unit may not be greater than 5 ft2. Adhered veneer units may not weigh more than 15 pounds per square foot.

TABLE 2 SCREWS, NAILS, AND STAPLES[A,B] FOR ATTACHING GYPSUM LATH TO HORIZONTAL AND VERTICAL WOOD SUPPORTS *(adapted from ASTM C 841)*

MAXIMUM SPACING, *(inches)*					MINIMUM GAGE REQUIREMENTS *(inches)*			
Width of Lath	**Thickness of Lath**	**Distance Between Supports**	**Number of Attachments per Bearing**	**Approximate Spacing *c* to *c* of Attachments**	**Length of Leg**	**Depth of Support Penetration**	**Diameter of Flat Head or Blued Nails or Crown Width of Staples[A]**	**Gage of Shank of Nails or Staples**
16	3/8	16	4	5	1 1/8 1 [A]	3/4 5/8 [A]	19/64 7/16 [A]	13 16 [A]
24	3/8	16	6	4 1/2	1 1/8 1 [A]	3/4 5/8 [A]	19/64 7/16 [A]	13 16 [A]
16	1/2	24	4	5	1 1/4 1 1/8	3/4 5/8 [A]	19/64 7/16 [A]	13 16 [A]
24	1/2	24	6	4 1/2	1 1/4 1 1/8	3/4 5/8 [A]	19/64 7/16 [A]	13 16 [A]
48	3/8 1/2	16 24	8	4 1/2	1 1/8 1 1 1/4 1 1/8	3/4 5/8 [A] 3/4 5/8 [A]		

A Galvanized staples.

B Screws for attaching gypsum lath to wood supports shall be type W as described in Specification C 1002.

TABLE 3 TYPES AND WEIGHTS OF METAL PLASTER BASES AND CORRESPONDING MAXIMUM PERMISSIBLE SPACING OF SUPPORTS *(adapted from ASTM C 1063)*

Type of Metal Plaster Base	Minimum Weight of Metal Plaster Base *(lb/yd²)*	Walls *(inches)*		
		WOOD STUDS OR FURRING	SOLID PARTITIONS[A]	STEEL STUDS OR FURRING
Diamond Mesh[B]	2.5	16[C]	16	16[C]
	3.4	16[C]	16	16[C]
Flat Rib	2.75	16	16	16
	3.4	19	24	19
Flat Rib (large opening) ⅜ in. Rib	1.8	24	24	24
	3.4	24	N/A[D]	24
	4.0	24	N/A	24
¾ in. Rib Welded Wire[B]	5.4	24	N/A	24
	1.4	16	16	16
	1.95	24	24	24
Woven Wire[B]	1.1	24	16	16
	1.4	24	16	16

A Where plywood is used for sheathing, a minimum of ⅛ in. separation shall be provided between adjoining sheets to allow for expansion.

B Metal plaster bases shall be furred away from vertical supports or solid surfaces at least ¼ in. Self-furring lath meets furring requirements; except, furring of metal lath is not required on supports having a bearing surface of 1⅝ in. or less.

C These spacings are based on unsheathed walls. Where self-furring lath is placed over sheathing or a solid surface, the permissible spacing of supports shall be no more than 24 in.

D Not applicable