

Variations from True Plane for Granite Building Stone	
Type of Finish	Variations From True Plane on Parts of Face Surfaces Other Than Bed and Joint Arris Lines (in.)
Polished, honed or fine rubbed	$\pm 3/64$
Rubbed or fine stippled sand blasted	$\pm 1/16$
Shot ground, 8- and 6- cut	$\pm 3/32$
4-cut and sawn	$\pm 1/8$
Thermal and coarse stippled sand blasted	$\pm 3/16$

Figure 5-8 Fabrication tolerances for granite building stone. (From Specifications for Architectural Granite, *National Building Granite Quarries Association, Inc.*, West Chelmsford, MA, 1986.)

carbonate crystals predominate, producing a fairly uniform white or light gray stone of smooth texture. It is highest in strength and lowest in absorption of the various types of limestone. *Dolomitic* limestone contains between 10 and 45% magnesium carbonate, is somewhat crystalline in form, and has a greater variety of texture. *Oolitic* limestone consists largely of small, spherical calcium carbonate grains cemented together with calcite from shells, shell fragments, and the skeletons of other marine organisms. It is distinctly non-crystalline in character, has no cleavage planes, and is very uniform in composition and structure.

The compressive strength of limestone varies from 1800 to 28,000 psi, depending on the silica content, and the stone has approximately the same strength in all directions. ASTM C568, *Standard Specification for Limestone Dimension Stone*, classifies limestone in three categories: I (low density), II (medium density), and III (high density), with minimum required compressive strengths of 1800, 4000, and 8000 psi, respectively. Limestone is much softer, more porous, and has a higher absorption capacity than granite, but is a very attractive and widely used building stone. Although soft when first taken from the ground, limestone weathers hard upon exposure. Its durability is greatest in drier climates, as evidenced by the remains of Egyptian and Mayan monuments.

Impurities affect the color of limestone. Iron oxides produce reddish or yellowish tones while organic materials such as peat give a gray tint. Limestone textures are graded as A, statuary; B, select; C, standard; D, rustic; E, variegated; and F, old Gothic. Grades A, B, C, and D come in buff or gray, and vary in grain from fine to coarse. Grade E is a mixture of buff and gray, and is of unselected grain size. Grade F is a mixture of D and E and includes stone with seams and markings.

When quarried, limestone contains groundwater (commonly called quarry sap) that includes varying amounts of organic and chemical matter. Gray stone generally contains more natural moisture than buff-colored stone. As the quarry sap dries and stabilizes, the stone lightens in color and is said to "season." Buff stone does not normally require seasoning beyond the 60 to 90 days it takes to quarry, saw, and fabricate the material. Gray stone, however, may require seasoning for as long as 6 months. If unseasoned stone is placed in the wall, it may be very uneven in color for several months, or even as long

as a year. No specific action or cleaning procedure will notably improve the appearance during this period, nor can it reduce the seasoning time. Left alone to weather, the stone eventually attains its characteristic light neutral color. No water repellents or other surface treatments should be applied until after the stone is seasoned.

Limestone is used as cut stone for veneer, caps, lintels, copings, sills, and moldings, and as ashlar with either rough or finished faces. Naturally weathered or fractured fieldstone is often used as a rustic veneer on residential and low-rise commercial buildings. Veneer panels may be sliced in thicknesses ranging from 2 to 6 in. and face sizes from 3 × 5 ft to 5 × 14 ft. When the stone is set or laid with the grain running horizontally, it is said to be on its natural bed. When the grain is oriented vertically, it is said to be on edge. Fabrication tolerances for limestone are shown in *Fig. 5-9*.

Travertine is a porous limestone formed at the earth's surface through the evaporation of water from hot springs. It is characterized by small pockets or voids formed by trapped gases. This natural and unusual texturing presents an attractive decorative surface highly suited to facing materials and veneer slabs.

The denser varieties of limestone, including travertine, can be polished and for that reason are sometimes classed as marble in the trade. Indeed, the dividing line between limestone and marble is often difficult to determine.

5.4.3 Marble

Marble is a crystallized, metamorphosed form of noncrystalline limestone or dolomite. Its texture is naturally fine, permitting a highly polished surface. The great color range found in marbles is due to the presence of oxides of iron, silica, mica, graphite, serpentine, and carbonaceous matter in grains, streaks, or blotches throughout the stone. The crystalline structure of marble adds depth and luster to the colors as light penetrates a short distance and is reflected back to the surface by the deeper-lying crystals. Pure marbles are white, without the pigmentation caused by mineral oxides. Brecciated marbles are made up of angular and rounded fragments embedded in a colored paste or cementing medium.

Dimensional Tolerances for Indiana Limestone						
Type of Stone	Length (in.)	Height (in.)	Deviation From Flat Surface, Exposed Face (in.)	Critical Depth (in.)	Non-Critical Depth (in.)	Deviation From Square (in.)
Smooth machine finish	±1/16	±1/16	±1/16	±1/16	±1/2	±1/16
Diamond gang finish	±1/16	±1/16	±1/4	±1/8	±1/2	±1/16
Chat sawed finish	±1/16	±1/16	±1/4	±1/8	±1/2	±1/16
Shot sawed finish	±1/16	±1/16	±1/2	±1/4	±1/2	±1/16
Pre-assembled units	±1/8	±1/8	±1/8	±1/8	±1/2	±1/8
Panels over 50 sq.ft.	±1/8	±1/8	±1/8	±1/8	±1/2	±1/8

Note: Tolerances for deviation from flat surface, exposed face and dimension from square are measured within the length of a standard 4'-0" straightedge applied at any angle on the face of the stone.

Figure 5-9 Fabrication tolerances for Indiana limestone. (*From Indiana Limestone Handbook, 17th ed., Indiana Limestone Institute, Bedford, IN.*)