

MATERIALS AND COMPONENTS OF

INTERIOR ARCHITECTURE

FIFTH EDITION



J. ROSEMARY RIGGS

Fifth Edition

**Materials and Components
of
Interior Architecture**

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Foreword

Interior design and architecture are an extraordinary combination of science and art. Few other professions require both areas of expertise.

With the tremendous advances in today's materials and technologies it can be a daunting task to achieve successful results within the limitations of time, financial resources, and material constraints. At best, design can be an outstandingly uplifting process, a reward within itself.

To maximize the opportunity for "besting" the design result, knowledge of the product and material resources as well as synergistic thinking are essential. The most innovative solutions are sabotaged by the details.

I think back to my firm's CEO Buckminster Fuller—how he challenged designers to think "outside the box"; to think of the interior systematically instead of as a random arbitrary compilation of products and materials. He would say, "If the invention, the materials, the object doesn't work, then it isn't beautiful; and if it isn't beautiful, then it doesn't work!"

Many of us are familiar with Leonardo da Vinci's sketch design of a man or a proposed flying machine that looked somewhat like a bicycle with wings. Though brilliantly conceived, the design did not work because the materials were too heavy and not strong

enough to perform as envisioned. Three hundred years later, high-grade carbon filament (mylar) was invented and could withstand pressure greater than 100,000 pounds per square inch (psi). Mylar is extremely light and is often used to make sails. As a result, in 1980, Paul MacAlready crossed the English Channel on the *Gossamer Albatros*, a light plane covered with a high-carbon mylar filament. Suddenly, da Vinci's idea had become a reality.

We all know how new materials have changed our world in recent history (for example, plastic and fiberglass). J. Rosemary Riggs's book, *Materials and Components of Interior Architecture*, takes into account the dramatic advances made available to the design professional.

Those who use this book must seek connections among the individual elements discussed herein and relate them, by ecological, operational, and aesthetic reasoning, to the design and goals of those who will use the final facilities. What a wonderful time to be in the design profession

Joyce Burke-Jones, FASID
1997–1998 National President of ASID and
Principal in the firm of Buckminster Fuller,
Sadao & Zung Architects



Figure 1-1

TOPsiders Panel Mount Planters provide proper scale and proportion for open plan systems and are easily installed and taken down. The TOPsiders shown fit on top of the partitions. (Photo courtesy of TOPsiders.)

The following information from Interface, a member of Envirosense, shows what a responsible company can do in setting standards for other manufacturers to follow:

Interface is dedicated to offering alternatives which ensure that we do not contribute to the environmental problem, but that we contribute to the solution. Interface's environmental efforts are focused on three critical areas:

Materials, Processes, and Programs

Interface Flooring Systems (IFS) is committed to conforming to the spirit and to the letter of sound environmental practices. Prior to any process or material change, we undertake an evaluation of the environmental impact the change may have on any area of our business, including product quality, commercial use, or Mother Earth.

Our commitment to this environmental effort is evidenced by the investment in a state of the art testing laboratory at our Interface Research Corporation facility. We are able to test for VOCs and **off-gassing** as well as other critical factors related to the environment. An example of our commitment is the development of Gridset® adhesive

which is manufactured by our subsidiary Rockland React Rite. Gridset establishes new industry standards for VOC and off-gassing emissions of adhesives which have historically been a major source of VOCs. Gridset produces less than half the VOCs in proposed EPA standard for VOC emissions.

In addition to Gridset, all of the recommended chemicals used in the Interface Service Management (ISM) maintenance program have been thoroughly tested and certified as environmentally responsible. Interface invites and welcomes comparison of its environmental efforts (and investment therein) with those of any other companies in the field.

Proactive Solutions to Indoor Air Quality Problems Through the Envirosense Consortium

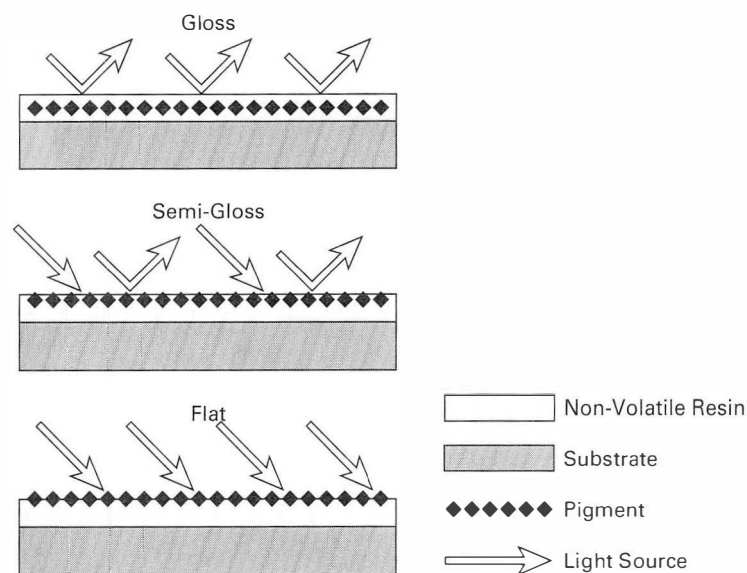
Indoor Air Quality, Sick Building Syndrome, and Building Related Illness are all real issues of growing concern and importance in today's work place. Interface offers real solutions today through its Envirosense Consortium.

The Interface led, Envirosense Consortium delivers a family of products, ranging from interior fabrics, plastic components, wall coverings, upholstery fabric, paints, coatings, and laminates, to flooring, ceiling tile, and HVAC components, which, collectively, demonstrably inhibit the growth of microorganisms, and thereby offer an enhanced interior environment for today's commercial building.

Intersept®, an EPA-registered antimicrobial, the active agent incorporated into all Envirosense products, is a durable, environmentally friendly, broad spectrum antimicrobial which inhibits the growth of microorganisms and controls bacteria and fungi—major sources of indoor air quality contamination.

Recycle/Reuse—A Continuing Process

Interface has created a worldwide multi-disciplinary task force which is dedicated to identifying and implementing programs and processes to reduce waste generation, increase the percentage of materials recycled, and increase the proportion reused in the manufacture of products and other

**Figure 2-2**

An illustration of how pigment volume concentration affects light reflectance. (Drawings courtesy of Builders Guide to Paints and Coatings, NAHB Research Center.)

2-1). The ratings in Table 2-1 measure the light reflectance of the surface only. Table 2-2 shows the percentage of light reflected by different hues and their different values.

Enamel is a term whose meaning has become increasingly imprecise over time. It originally designated a hard, durable, high-gloss interior paint. However, some flat paints are now called “flat enamels.” While enamel formulations run toward gloss or semi-gloss, a flat appearance can be produced through the use of appropriate additives. Enamels include both alkyd and latex paints.

TABLE 2-1
Standard Gloss Range for Architectural
and Special Coatings

NAME	GLOSS RANGE	TEST METHOD (ASTM D-523)
Flat	Below 15	85° meter*
Eggshell	5–20	60° meter
Satin	15–35	60° meter
Semi-Gloss	30–65	60° meter
Gloss	Over 65	60° meter

*Angle at which light is reflected.

Source: Consumerism Subcommittee of the NPCA Scientific Committee acting with the Subcommittee D01.13 of the American Society for Testing and Materials (ASTM).

TABLE 2-2
Percentage of Light Reflected by Colors

COLOR	PERCENTAGE OF LIGHT REFLECTED
White	89
Ivory	77
Canary yellow	77
Cream	77
Orchid	67
Cream gray	66
Sky blue	65
Buff	63
Pale green	59
Shell pink	55
Olive tan	43
Forest green	22
Coconut brown	16
Black	2

Today, manufacturers generally use the term “enamel” to indicate a higher quality paint with greater durability and smoother finish.⁸

Enamels and other paints should be applied to a properly prepared surface. A glossy surface will not have **tooth** and should be sanded with sandpaper or a liquid sanding material before application of another coat of paint.

TABLE 2-3
Wood Classification According
to Openness of Pores

NAME	SOFT	HARD	OPEN PORE	CLOSED PORE	NOTES
Ash		X	X		Needs filler
Alder	X			X	Stains well
Aspen		X		X	Paints well
Basswood		X		X	Paints well
Beech		X		X	Varnishes well, paints poorly
Birch		X		X	Paints and varnishes well
Cedar	X			X	Paints and varnishes well
Cherry		X		X	Varnishes well
Chestnut		X	X		Requires filler, paints poorly
Cottonwood		X		X	Paints well
Cypress		X		X	Paints well and varnishes well
Elm		X	X		Requires filler, paints poorly
Fir	X			X	Paints poorly
Gum		X		X	Varnishes well
Hemlock	X			X	Paints fairly well
Hickory		X	X		Needs filler
Mahogany		X	X		Needs filler
Maple		X		X	Varnishes well
Oak		X	X		Needs filler
Pine	X			X	Variable
Redwood	X			X	Paints well
Teak		X	X		Needs filler
Walnut		X	X		Needs filler

Source: Abel Banov, *Paintings and Coatings Handbook*. Torstar Corporation, 1973, p. 127.

in the product description that it is a short-, medium-, or long-oil coating. A long-oil paint has a longer drying period and is usually more expensive. One property of a long-oil product is that it coats the surface better than a short-oil product because of its wetting ability.

The volume of solids is expressed as a percentage per gallon of paint. This percentage can vary from as much as 90 percent in some industrial coatings and from 40 percent to the high teens in architectural paints. If, for the sake of comparison, a uniform thickness of 1 1/2 **mils** is used, the higher percentage volume paint would cover 453 square feet and the lower percentage only 199 square feet. This, of course, means that more than twice as much paint of the lower volume would have to be purchased when compared with the higher volume. Thus, the paint that may be a bargain may turn out to cost more if the same result is to be achieved.

Painting specifications are a way of legally covering both parties in the contract between the client and the painting contractor. There will be no misunderstanding of responsibility if the scope of the paint job

is clearly spelled out, and most major paint companies include in their catalogs sample painting specifications covering terms of the contract. Some of these are more detailed than others. Tables 2-4 and 2-5 will aid the designer in calculating the approximate time required to complete the painting contract.

A time limit and a penalty clause should be written into the contract. This time requirement is most important, because painting is the first finishing step in a project and, if it is delayed, the completion date is in jeopardy. The penalty clause provides for a deduction of a specific amount of money or a percentage for every day the contract is over the time limit.

TABLE 2-4
Coverage According to Method of Application

METHOD	COVERAGE PER HOUR
Brush	50–200 sq ft
Roller	100–300 sq ft
Spray	300–500 sq ft

TABLE 2-5
Average Coat Requirements for Interior Surfaces

SURFACE	VEHICLE	NUMBER OF COATS
Woodwork	Oil gloss paint	2-3 coats
	Semi-gloss paint	2-3 coats
Plaster	Alkyd flat	2-3 coats
Drywall	Alkyd flat	2-3 coats
	Vinyl latex	3 coats
Masonry	Vinyl latex	3 coats
Wood floor	Enamel	3 coats

Information on surface preparation may be obtained from the individual paint companies. The problems created by incorrect surface treatment, priming, and finishing are *never* corrected by simply applying another coat of paint.

High-performance paints should be selected if budget restrictions permit, because high-performance paints last several times longer than regular paints. This longer durability means that business or commercial operations will not have to be shut down as frequently. Therefore, the increase in cost will more than offset the loss of business. The words *high performance* should be included in the product description.

The method of application should be specified: brush, roller, or spray. The method must suit the material to be covered and the type of paint to be used. Moreover, primers or base coats must be compatible with both the surface to be covered and the final or top-coat. When writing painting specifications, items to be excluded are just as important as items to be included. If other contractors are present at the site, their work and materials must be protected from damage. One area should be designated as a storage for all paint and equipment, and this area should have a temperature at or near 70°F, the ideal temperature for application of paints. The painting subcontractor should remove daily all combustible material from the premises.

The specifier should make certain that inspections are made before the application of each coat, because these inspections will properly cover both client and contractor. If some revisions or corrections are to be made, they should also be put in writing and an inspection should be made before proceeding.

Cleanup is the responsibility of the painting contractor. All windows and glass areas must be free of paint streaks or spatters. The area should be left ready for the succeeding contractor to begin work without any further cleaning.

Some states do not permit interior designers to sign a contract for clients, whereas other states do

allow this. The designer should check state laws to see whether he or she or the client must be the contractual party.

USING THE MANUFACTURER'S PAINTING SPECIFICATION INFORMATION

All paint companies have different methods of presenting their descriptive literature, but a designer with the background material this chapter provides will soon be able to find the information needed. For example, first the material to be covered is listed, then the use of that material, and then the finish desired. Let us use wood as an example: The material is wood, but is it going to be used for exterior or interior work? If interior, is it to be used on walls, ceilings, or floors? Each different use will require a product suitable for that purpose. Floors will obviously need a more durable finish than walls or ceilings.

Another category will be the final finish or luster—flat, semi-gloss, or gloss? Will you need an alkyd, a latex, or, for floor use, a urethane? This category is sometimes classified as the vehicle or generic type. The schedule then explains which primer or sealer is to be used for compatibility with the final coat. After the primer, the first coat is applied. This coat may also be used for the final coat, or another product may be suggested. Drying time for the different methods of application may also be found in the descriptive literature. Two different times may be mentioned, one "dust free" or "tack free," meaning the length of time it takes before dust will not adhere to the freshly painted surface. Sometimes a quick-drying paint will have to be specified because of possible contaminants in the air. The second is recoat time; this is important so that the application of the following coat can be scheduled.

The spreading rate per gallon will enable a specifier to calculate approximately how many gallons are needed for the job, thereby estimating material costs. Sometimes, in the more technical specifications, an analysis of the contents of the paint is included both by weight and by volume. The most important percentage, however, is the volume amount, because weight of solids can be manipulated whereas volume cannot. This is the only way to compare one paint with another. The type and percentage of these ingredients make paints differ in durability, application, and coverage. Some paint companies now have these percentages printed on the label of paint cans, similar to the manner in which percentages of the daily re-

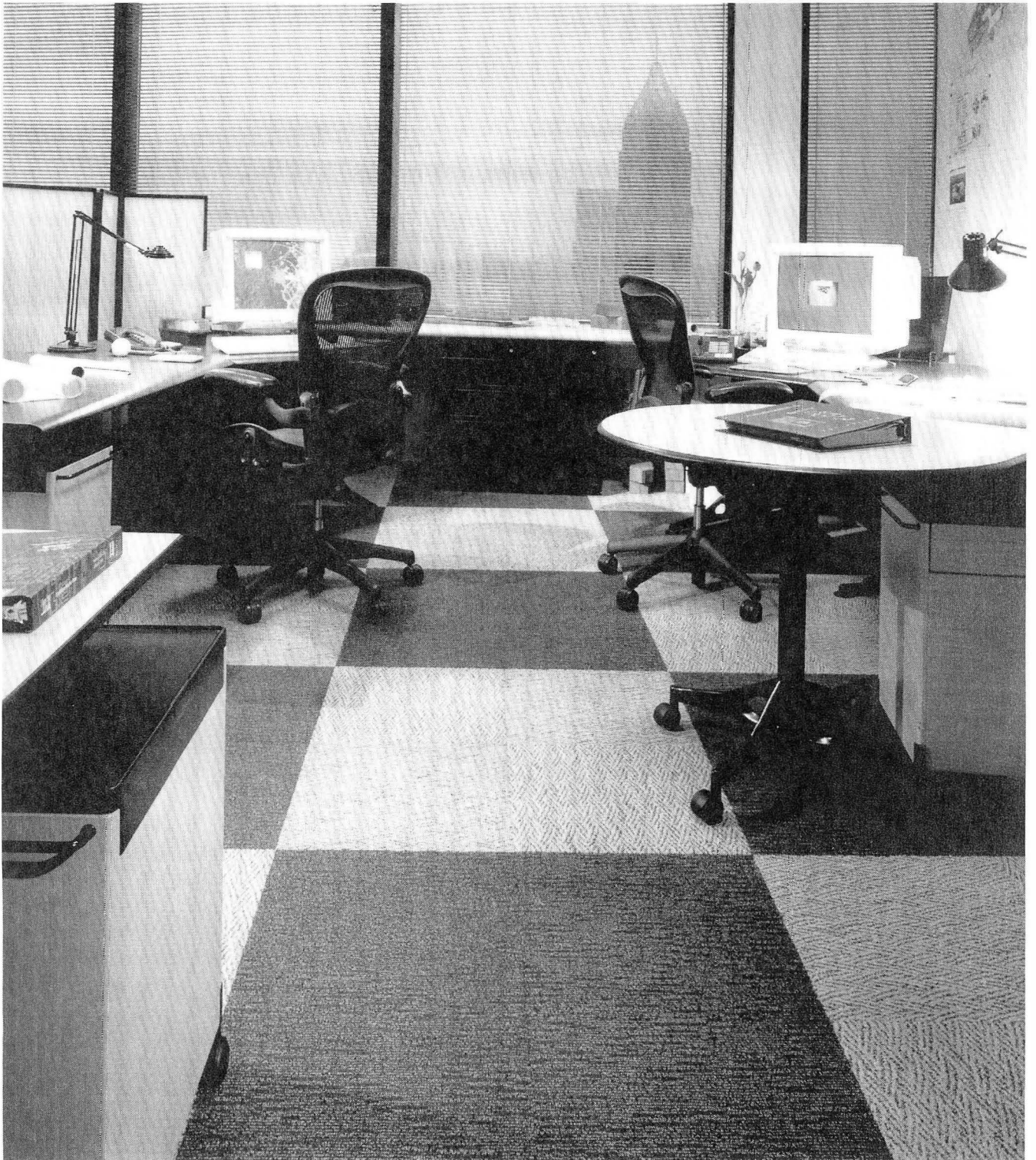


Figure 3-2
Tatami Tile in gray and tan were used in this office. The texture of the tiles simulates the texture of a Tatami mat. (Photo © Jonathan Hillyer Photography Inc.; photo courtesy of Interface Flooring Systems, Inc.)

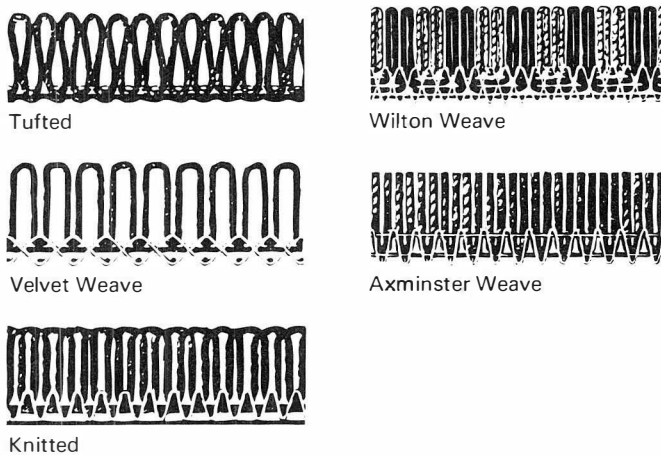


Figure 3-3
Construction methods.

the traditional weaving method and has greatly reduced the cost of carpet, thereby making it available to more buyers. The technique is fast, efficient, and simple. More than 90 percent of all carpet sold in the United States is tufted.

Weaving

Weaving is a fabric formation process used for manufacturing carpet in which **yarns** are interlaced to form cloth. The weaving loom interlaces lengthwise (warp) and widthwise (filling) yarns. **Pitch** is measured by the number of lengthwise warp yarns; in a 27-inch width, the higher the number, the finer the weave. Carpet weaves are complex, often involving several sets of warps and filling yarns. The back and the face are produced simultaneously and as one unit. When describing an area rug, the term *tapestry weave* is sometimes used. Coir and sisal are always woven.

According to the DuPont company, "When a woven carpet backing is used, specify 100% moisture-resistant warp, filling and stuffer yarns for this construction to eliminate shrinkage during wet cleaning or where installation is on or below grade."⁸

Velvet carpets are the simplest of carpets to weave. They are made on a velvet loom that is not unlike the Wilton loom without the Jacquard unit. The rich appearance of velvets is due to their high pile density. Velvets can be cut or looped pile.

Knitted

Knitted carpets were not made by machine until 1940. Their quality is generally high, depending on the

yarns used and their density. Knitting a carpet involves at least three different facing yarns and perhaps a fourth for backing. Face yarns are knitted in with warp chains and weft-forming yarns in a simple knitting process. Variations of colors, yarns, and pile treatment (cut or looped, high or low) create design choices for knitted carpets. Knitting today is a speedy process that produces fine-quality carpet:

Most knitted carpet is solid colored or tweed, although some machines have pattern devices. Both loop and cut pile surfaces are available.

Needle Punching

Needle-punched carpet is a durable, felt-like product manufactured by entangling a fiber fleece with barbed needles. . . . A latex coating or attached padding is applied to the back. . . . Technological advances in machinery now allow a diverse range of designs, including ribs, sculptured designs, and patterns. Needle punched carpet is almost always glued down when installed.⁹

Aubusson

Aubussons are flatly woven tapestries and carpets in silk or wool, named for the French town where they originated (circa 1500). Tapestries bear narratives or portraits, whereas carpets feature architectural designs in rich colors or flowers in muted pastels.

Axminster and Wilton

Although the appearance of Axminster and Wilton carpets may be similar, the construction is very different. In an Axminster, pile tufts are individually inserted from colored yarns arranged on spools, making possible an enormous variety of colors and patterns (Figure 3-4). The Wilton looms have Jacquard pattern mechanisms that use punched cards to select pile height and yarn color. In a Wilton, unwanted yarn colors are buried under the surface of the carpet, limiting the color selection to five or six colors. The carpets are often patterned or have multilevel surfaces. The traditional fiber in Axminster and Wilton construction is wool, but a blend of 80 percent wool and 20 percent nylon is sometimes used. One way to distinguish between the two types is to roll them across the warp and weft. A Wilton will fold in both directions, an Axminster only in one (see Figure 3-4).

TABLE 3-1
Minimum Recommended Criteria for Satisfactory Carpet Cushion Performance in Contract Installations

TYPES OF CUSHION	CLASS I MODERATE TRAFFIC			
<i>Commercial Application</i>				
Minimum recommended criteria for satisfactory carpet cushion performance in contract installations	Office Buildings: Executive or private offices, conference rooms			
	Health Care: Executive, administrative			
	Schools: Administration			
	Airports: Administration			
	Retail: Windows and display areas			
	Banks: Executive areas			
	Hotels/Motels: Sleeping rooms			
	Libraries/Museums: Administration			
<i>Fiber</i>				
Rubberized Hair	Wt. 40 oz.	Th: .27"	D = 12.3	
Rubberized Jute	Wt. 32 oz.	Th: .25"	D = 12.3	
Synthetic Fibers	Wt. 22 oz.	Th: .25"	D = 7.3	
Resinated Recycled Textile Fiber	Wt. 24 oz.	Th: .25"	D = 7.3	
<i>Rubber</i>				
Flat Rubber	Wt. 62 oz.	Th: .150"	CR @ 25% = 3.0 psi min.	D = 21
Rippled Waffle	Wt. 56 oz.	Th: .270"	CR @ 25% = 0.7 psi min.	D = 15
Textured Flat Rubber	Wt. 56 oz.	Th: .220"	CR @ 25% = 1.0 psi min.	D = 18
Reinforced Rubber	Wt. 64 oz.	Th: .235"	CR @ 25% = 2.0 psi min.	D = 22
			CR @ 65% = 50.0 psi min.	
<i>Polyurethane Foam</i>				
Grafted Prime Polyurethane*	D = 2.7	Th: .25"	CFD @ 65% = 2.5 psi min.	
Densified Polyurethane*	D = 2.7	Th: .25"	CFD @ 65% = 2.4 psi min.	
Bonded Polyurethane**	D = 5.0	Th: .375"	CFD @ 65% = 5.0 psi min.	
Mechanically Frothed Polyurethane***	D = 13.0	Th: .30"	CFD @ 65% = 9.7 psi min.	

CLASS II HEAVY TRAFFIC

Office Buildings: Clerical areas, corridors (moderate traffic)
Health Care: Patients' rooms, lounges
Schools: Dormitories and classrooms
Retail: Minor aisles, boutiques, specialty
Banks: Lobbies, corridors (moderate traffic)
Hotels/Motels: Corridors
Libraries/Museums: Public areas (moderate traffic)
Convention Centers: Auditoriums

CLASS III EXTRA HEAVY TRAFFIC

Office Buildings: Corridors (heavy traffic), cafeterias
Health Care: Lobbies, corridors, nurses' stations
Schools: Corridors, cafeterias
Airports: Corridors, public areas, ticketing areas
Retail: Major aisles, check outs, supermarkets
Banks: Corridors (heavy traffic), teller windows
Hotels/Motels: Lobbies and public areas
Libraries/Museums: Public areas
Country Clubs: Locker rooms, pro shops, dining areas
Convention Centers: Corridors and lobbies
Restaurants: Dining areas and lobbies

Wt. 40 oz. Th: .3125" D = 12.3
Wt. 40 oz. Th: .25" D = 12.3
Wt. 28 oz. Th: .3125" D = 7.3
Wt. 30 oz. Th: .30" D = 7.3

Wt. 50 oz. Th: .375" D = 11.1
Wt. 40 oz. Th: .34" D = 11.1
Wt. 36 oz. Th: .35" D = 8.0
Wt. 38 oz. Th: .375" D = 8.0

Wt. 62 oz. Th: .150" CR @ 25% = 3.0 psi min. D = 21
NOT RECOMMENDED FOR USE IN THIS CLASS
Wt. 64 oz. Th: .235" CR @ 25% = 1.5 psi min. D = 22
Wt. 64 oz. Th: .235" CR @ 25% = 2.0 psi min. D = 22
CR @ 65% = 50.0 psi min.

Wt. 62 oz. Th: .150" CR @ 25% = 4.0 psi min. D = 26
NOT RECOMMENDED FOR USE IN THIS CLASS
Wt. 80 oz. Th: .250" CR @ 25% = 1.75 psi min. D = 26
Wt. 54 oz. Th: .200" CR @ 25% = 2.0 psi min. D = 22
CR @ 65% = 50.0 psi min.

D = 3.2 Th: .25" CFD @ 65% = 3.5 psi min.
D = 3.5 Th: .25" CFD @ 65% = 3.3 psi min.
D = 6.5 Th: .25" CFD @ 65% = 10.0 psi min.
D = 15.0 Th: .223" CFD @ 65% = 49.9 psi min.

D = 4.0 Th: .25" CFD @ 65% = 5.0 psi min.
D = 4.5 Th: .25" CFD @ 65% = 4.8 psi min.
D = 8.0 Th: .25" CFD @ 65% = 8.0 psi min.
D = 19.0 Th: .183" CFD @ 65% = 30.5 psi min.

Maximum thickness for any product is 3/8"

D—Denotes Density in lbs./cu.ft.

Oz.—Denotes weight in ounces/sq. yd.

CR—Denotes Compression Resistance in lbs./sq. in. as measured by ASTM D-3676

CFD—Denotes Compression Force Deflection as measured by ASTM D-3574

All thicknesses, weights and densities allow a -5% manufacturing tolerance

* = Polymer densities

** = Particle size not to exceed 1/2"

There are many parquet patterns, as shown in Figure 4–5, and most manufacturers make a similar variety of patterns, but the names may vary. One company will name a pattern Jeffersonian, another Monticello or Mt. Vernon, but they are variations of the same pattern. This particular design is made with a central block surrounded by **pickets** on all four sides. The center may be made of solid wood, a laminated block, five or six strips all in the same direction, or a standard unit of four **sets**.

Designers need a word of warning about using some parquet patterns. Some parquets have direction (for example, the herringbone pattern). Depending on whether the pieces are laid parallel to the wall or at an angle, a client may see L's, zigzags, or arrows. The important thing is the client's expectations.

To reduce expansion problems caused by moisture, the oak flooring industry has developed several types of parquets. The laminated or engineered block is a product that displays far less expansion and contraction with moisture changes and, therefore, can be successfully installed below grade in basements and in humid climates. It can even fit tight to vertical obstructions. Blocks can be glued directly to the concrete

with several types of adhesive, which the industry is making VOC compliant. One concern in the past has been the ability of a laminated block to be sanded and refinished. Because the face layer is oak, with proper maintenance the initial service life can be 20 to 30 years. Any of the laminated products on the market today can be sanded and refinished (at least twice) using proper techniques and equipment, so the expected life of a laminated block floor is 60 to 90 years.

The PermaGrain Series has acrylic impregnated parquet tiles in 12" × 12" parquet, or 12" × 12" or 6" × 12" one-directional 5/16" tile, which may be combined with pickets and bands for even greater design freedom. This product exceeds all current ADA requirements and is UL listed for slip resistance.

Special custom-designed borders are available for use in a Victorian setting or for a contemporary custom look. These borders are made of contrasting woods and vary in width from 4 to 20 inches. Thin strips of semiprecious stones or metals, such as brass or aluminum, may also be incorporated in the design. Custom Borders from Kentucky Wood Floors are pre-assembled modules that can be glued down flush with 5/16 inch thick flooring or on top of underlay-

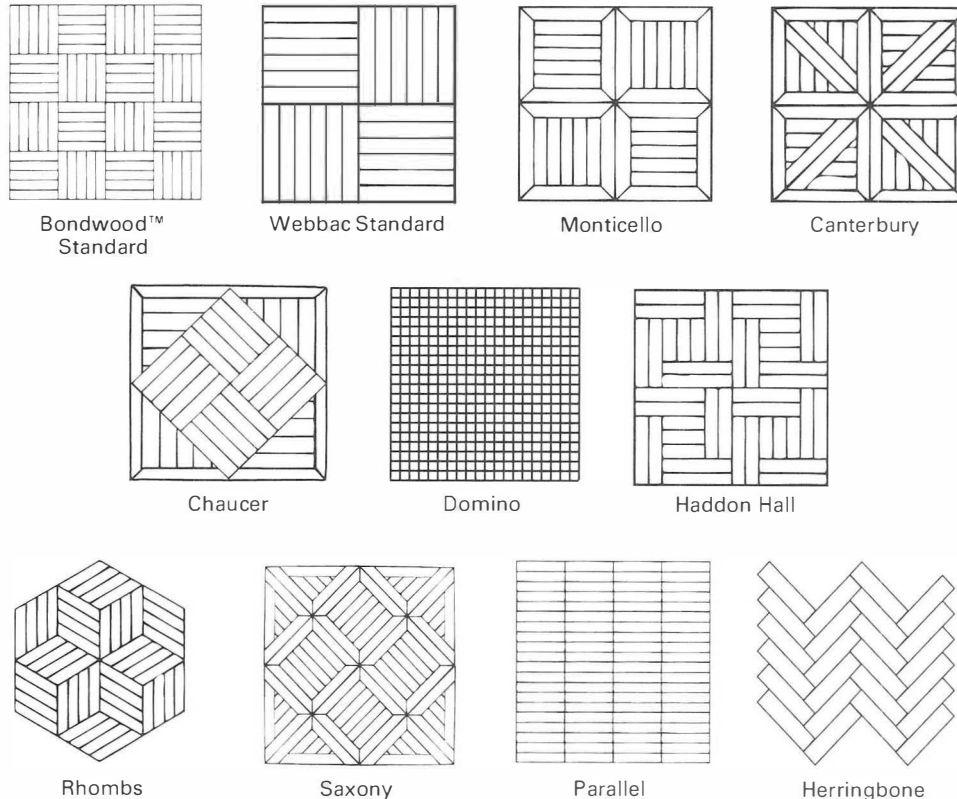
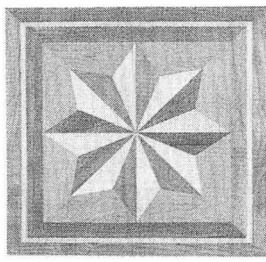
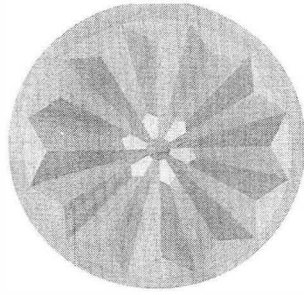
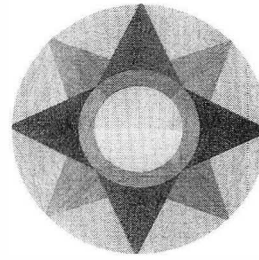
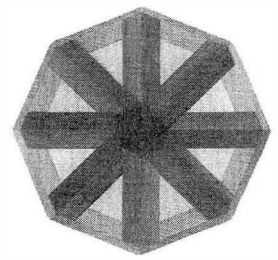
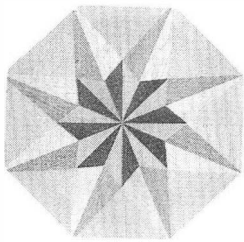
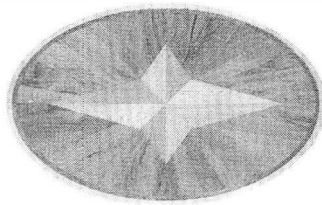
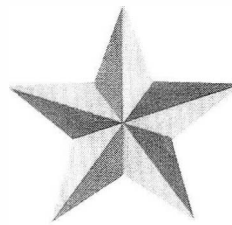
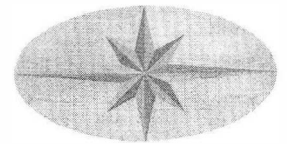


Figure 4–5

Parquet patterns from Harris-Tarkett. (Reproduced by permission of Harris-Tarkett.)

**Square Rose****Round Rose****Compass Rose****Wheel****Carousel****Elliptical Star****North Star****Nautical****Figure 4-6**

Custom Accents are available in the designs shown or in a custom design, such as a family crest or a corporate logo. The combination of species (from Ash to Zebrawood), when used with Kentucky Wood Floors, will match the adjacent hardwood flooring in grain and color. (Photo courtesy of Kentucky Wood Floors.)

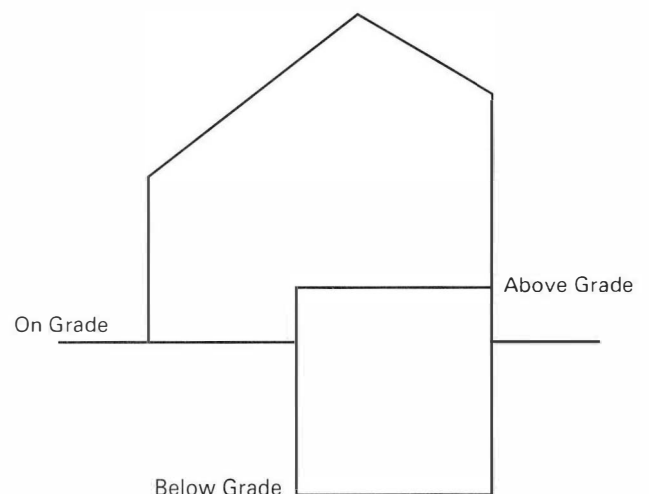
ment with 3/4 inch thick flooring. Corner blocks are also available. Matching architectural millwork is available, such as quarter round, baseboard, nosing, and **reducer strips**. Custom Accents are medallion-style designs to accent any wood floor (Figure 4-6).

Parquet flooring comes packed in cartons with a specific number of square feet. When ordering parquet flooring, only whole cartons are shipped, so the allowance for cutting may be taken care of with the balance of the carton.

All the parquet woods mentioned in this subsection are quarter sawn or plain sawn, but some species are cut across the growth rings (end grained). End-grain patterns are formed by small cross-cut pieces attached into blocks or strips with the end grain exposed. The thickness may vary from 1 inch to 4 inches, depending on the manufacturer. One and a half inches of end-grain block have insulating qualities equal to 23 inches of concrete. Some end-grain block floors are still in place after more than 40 years of heavy industrial use. These blocks absorb noise and vibration and have been installed in museums and libraries.

Grade Levels

Figure 4-7 illustrates the differences among on, above, and below grade. Above grade is not a problem for installation of wood floors, because no moisture is pre-

**Figure 4-7**

Grade levels.

TABLE 4-1
Grout Guide

These guidelines cannot address every installation. The type and size of tile, service level, climatic conditions, tile spacing and individual manufacturer's recommendations are all factors that should be considered when selecting the proper grout.

Printed through the courtesy of the Materials & Methods Standards Association (rev. 1996) W = wall use F = floor use	GROUTS CONTAINING PORTLAND CEMENT					OTHERS			
	Commercial (Sanded) A118.6 H-2.1 (4)	Jobsite Mix (Sanded) A118.6 (4)	Dry-Set (Unsanded) A118.6 H-2.3 (4)	Commercial or Dry-Set with Latex (Polymer) A/118.6 H-2.4 (4, 9)	Mod. Epoxy Emulsion A118.8 (4)	100% Solid Epoxy A118.3 (1, 3, 4, 6)	Furan A118.5 (1, 3, 4, 6)	Silicone or Urethane (2, 4)	Mastic Grout (3, 4)
TILE TYPE									
Glazed Wall Tile (7)	W		W	W		W		W	W
Glazed Floor Tile (7)	W, F	W, F	W, F	W, F	W, F	W, F			W, F
Ceramic Mosaics	W, F	W, F	W, F	W, F	W, F	W, F		W	W, F
Quarry, Paver, and Packing House Tile (8)	W, F	W, F		W, F	W, F	W, F	W, F		
Large Unit Porcelain or Vitreous Tile (8)	W, F	W, F	W, F	W, F	W, F	W, F	F	W	W, F
Dimension Stone (7, 8) (Including Agglomerates)	W, F	W, F	W, F	W, F	W, F				
USE									
Dry/Limited Water Exposure	W, F	W, F	W, F	W, F	W, F	W, F	W, F	W, F	W, F
Wet Areas (10)	W, F	W, F	W, F	W, F	W, F	W, F	W, F	W, F	
Exteriors (8, 9, 10)	W, F	W, F	W, F	W, F	W, F	W, F (4)	W, F (4)	W, F	
PERFORMANCE	Note: There are 5 performance ratings, from Best (A) to Minimal (E)								
Suggested Joint Widths (5)	1/8 to 5/8"	1/8 to 5/8"	1/16 to 1/8"	1/16 to 5/8"	1/16 to 5/8"	1/16 to 5/8"	3/8 to 5/8"	1/16 to 1/4"	1/16 to 1/4"
Stain Resistance	D	E	D	C	C	A	A	A	B
Crack Resistance	D	E	D	C	C	B	C	A	C
Color Availability	B	D	B	B	B	B	Black only	B	B

Notes:

- (1) Mainly used for chemical resistant properties.
- (2) Special tools needed for proper application. Silicone, urethane and modified polyvinylchloride used in pregrouted ceramic tile sheets. Silicone grout should not be used on kitchen countertops or other food preparation surfaces unless it meets the requirements of FDA Regulation 21, CFE 177.2600.
- (3) Special cleaning procedures and materials recommended.
- (4) Follow manufacturer's directions.
- (5) Joint widths are only guidelines. Individual grout manufacturers products may vary. Consult manufacturer's instructions.
- (6) Epoxies are recommended for prolonged temperatures up to 140°F, high temperature resistant epoxies and furans up to 350°F.
- (7) Some types of glazed ceramic tiles, polished marble, marble agglomerates and granite can be permanently scratched or damaged when grouted with sanded grout formulas. DO NOT use sanded grout or add sand to grout when grouting polished marble, marbled agglomerates and ceramic wall tiles with soft glazes. Check the tile or marble manufacturer's literature and test grout on a separate sample area prior to grouting.
- (8) Some types of ceramic tiles and dimension stone may be permanently stained when grouted with pigmented grout of a contrasting color. WHITE GROUT IS BEST SUITED FOR GROUTING WHITE OR LIGHT COLORED MARBLE OR GRANITE.
- (9) Latex modification may be required in areas subject to freezing temperatures. Consult grout manufacturer for recommended products and methods.
- (10) Colored cementitious grouts may darken when wet.

Source: 1994 Handbook for Ceramic Tile Installation. Copyright © Tile Council of America, Inc. Reprinted with permission.

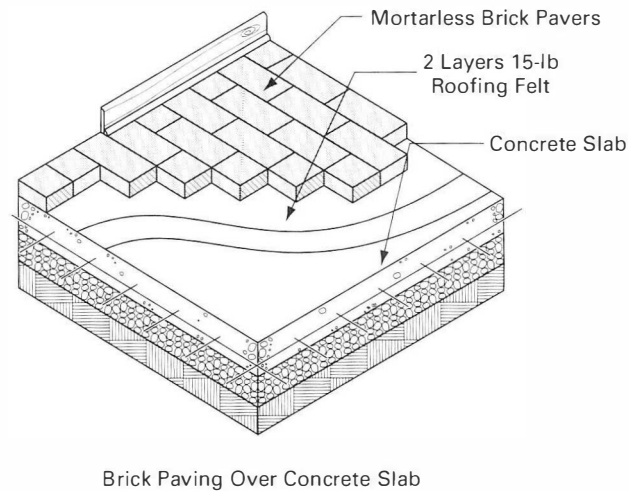
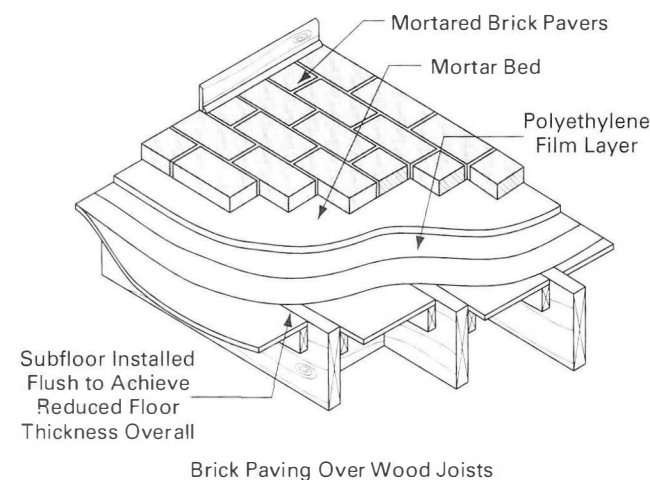
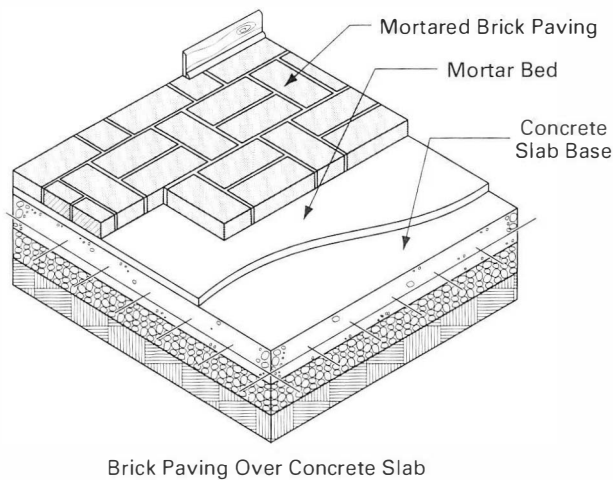
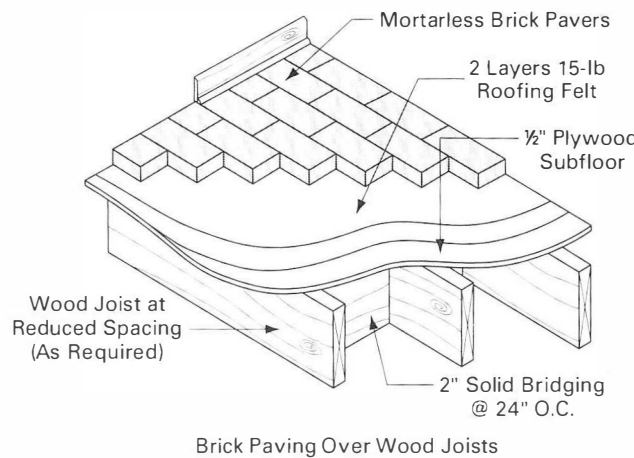
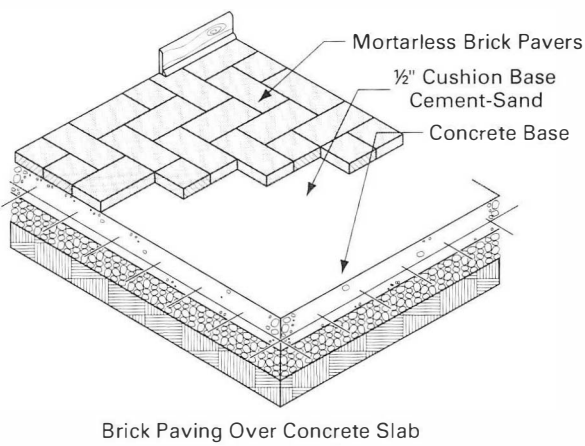
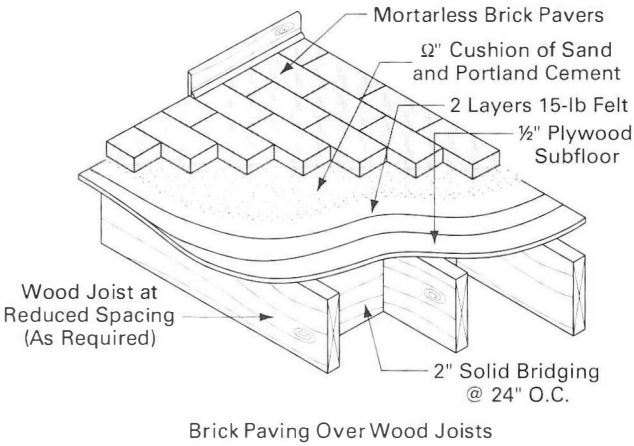


Figure 4-17
Methods of installing brick. (Note: O.C. means "on center.")

5

Walls

In floors, the weight of flooring material is spread over a large area; however, when these same materials are used on walls, they create a heavy dead load. Thus walls, whether constructed or veneered with granite, stone, or brick, must have a foundation prepared to withstand this additional weight. **Compressive strength** is also important for wall installation materials.

There are two types of walls: load bearing and nonbearing. Interior designers need to know the difference between the two. Load-bearing walls are those that support an imposed load in addition to their own weight; a nonbearing wall is just for utilitarian or aesthetic purposes. The architect deals with both, but the interior designer probably deals more with nonbearing walls. A load-bearing wall should never be removed or altered without consulting an architect or engineer.

STONE

A stone wall is usually a veneer and may be constructed of any type of stone. **Rubble** is uncut stone or stone that has not been cut into a rectangular shape. **Ashlar** is stone that is precut to provide enough uniformity to allow some regularity in assembly. The rubble masonry is less formal, requires the use of

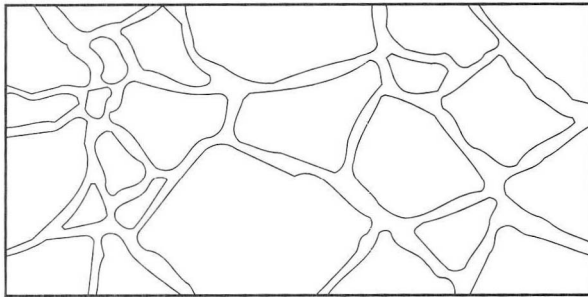
more mortar, and is not as strong as the other types of bonds because of the irregularly shaped bonds. Uniform mortar joints are a mark of a skilled worker. **Fieldstone** or **cobble** has a more rounded feeling than does ashlar or rubble (Figure 5-1).

Maintenance. Stonework should be cleaned with a stiff brush and clean water. If stains are difficult to remove, soapy water may be used, followed by a clean-water rinse. Stonework should be cleaned by sponging during construction, which facilitates final cleaning. The acids used to clean brick should never be used on stone walls.

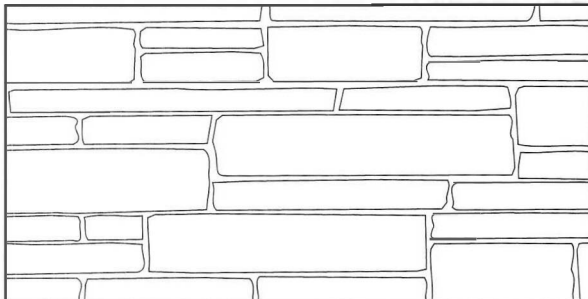
Regular maintenance consists of brushing or vacuuming to remove dust. It is important to remember that, generally, igneous types are impervious, but sedimentary and metamorphic stones are more susceptible to stains. Stone walls should not be installed where grease or any substance that may stain the stone is present.

GRANITE

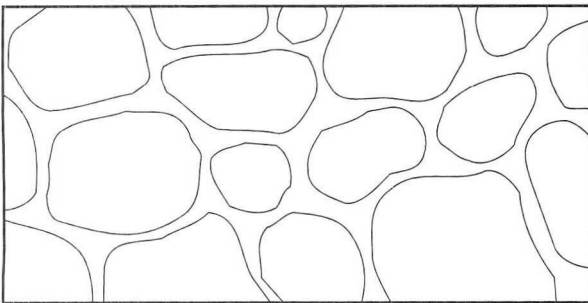
Granite is used wherever a feeling of stability and permanence is desired, which is probably why one sees so much granite in banks and similar institutions. The properties of granite were mentioned in Chapter 4.



Rubble



Ashlar



Fieldstone

Figure 5-1
Types of stonework.

Granite for walls may be polished or honed because abrasion is not a problem with walls.

Durastone produces 48" × 96" granite that is 1/16-inch thick, installs like wallpaper, and is strictly for wall use. This product has a rough stone finish.

Installation. Anchors, **cramps**, dowels, and other anchoring devices should be type 304 stainless steel or suitable **nonferrous** metal. A portland cement sand mortar is used and, where applicable, a sealant is used for pointing the joints.

Maintenance. If required, granite walls may be washed with a weak detergent solution and rinsed with clear water. The walls should be buffed with a lamb's wool pad to restore shine.

MARBLE

Marble has the same elegant and formal properties whether used for walls or for floors. According to the Marble Institute of America, interior marble wall facing may be installed by mechanical fastening devices utilizing nonstaining anchors, angles, dowels, pins, cramps, and plaster spots, or in a mortar setting bed to secure smaller units to interior vertical surfaces. The overall dimensions of the marble determine the setting method. Resilient cushions are used to maintain joint widths, which are then pointed with white cement or other approved material.

In addition to the traditional sizes, new thin marble veneers that are backed with lighter-weight materials have less weight per square foot and, depending on job conditions, may be set in either a conventional full mortar bed or by any of the several newer thin-bed systems.

Maintenance. Maintenance is the same as that for marble floors.

TRAVERTINE

When travertine is used in wall applications, it is not necessary to fill the voids. Unfilled travertine gives an interesting texture to the wall surface, but for a perfectly smooth installation, filling is required. Like flooring, wall applications of travertine may be filled with a clear, translucent epoxy or an opaque epoxy matching the color of the travertine. Filled travertine does tend to have less sheen on the opaque filled area than on the solid area. The surface of the travertine may be left in its rough state, providing texture, or it may be cut and sanded or ground smooth.

Installation. Installation methods of travertine are the same as for marble.

BRICK

Brick is used for both exterior and interior walls, and the surface of the brick may be smooth, rough, or grooved. Bricks with these surface textures create interesting wall designs with interesting shadows. Bricks are available in whites, yellows, grays, reds, and browns and may be ordered in special sizes or shapes. Firebrick is used for lining boilers and fireplaces and is made of special fire-resistant clays.

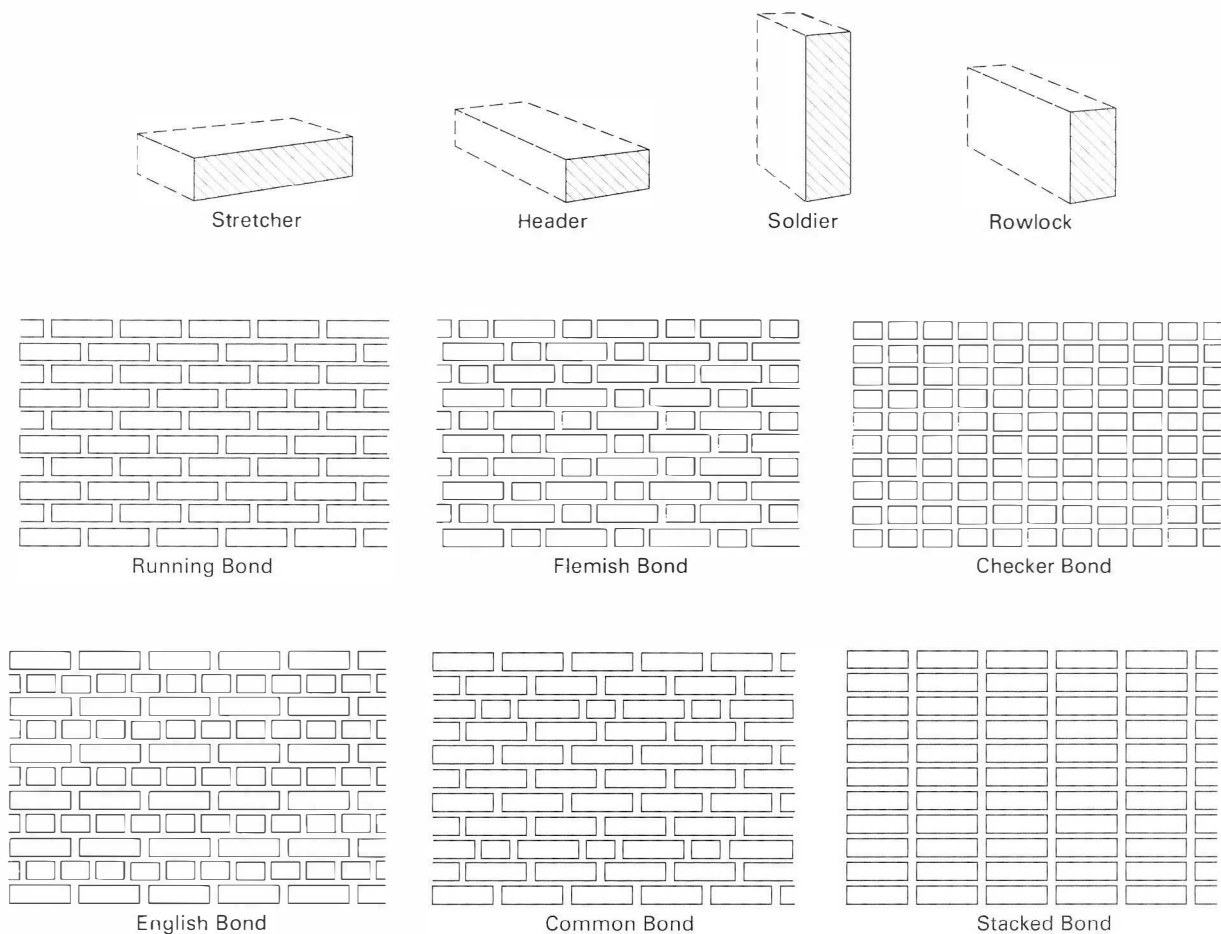


Figure 5-2
Stretches, headers, and brick bonds.

The standard brick size is 3 3/4 inches wide by 8 inches long and 2 1/4 inches high. Bricks laid to expose the long side in a horizontal position are called **stretchers**; vertically they are called soldiers. When the ends of the bricks show horizontally, the bricks are called **headers**, but vertically they are called rowlocks (Figure 5-2). A bond is the arrangement of bricks in rows or courses. A common bond is defined as bricks placed end to end in a stretcher course with vertical joints of one course centered on the bricks in the next course. Every sixth or seventh course is made up of headers and stretchers. These headers provide structural bonding as well as pattern. A bond without headers is called a running bond. It is interesting to note that in some historical digs of buildings dating from the 1880s, it is possible to discover the nationality of the builders of brick walls (e.g., English and Flemish), as well as several other European nationalities) by the type of bond used (see Figure 5-2 for types of brick bonds).

Masonry walls may be hollow masonry, where both sides of the wall are visible, or they may be ve-

neered. When both sides are visible, the **header course** ties the two sides together. A veneered wall is attached to the backing by means of metal ties (Figure 5-3).

The joints in a wall installation are extremely important because they create shadows and special design effects. The joints of a brick wall are normally 3/8-inch thick. The mortar for these joints consists of a mixture of portland cement, hydrated lime, and sand. The mortar serves four functions:

1. It bonds the brick units together and seals the spaces between them.
2. It compensates for dimensional variations in the units.
3. It bonds to reinforcing steel and therefore causes the steel to act as an integral part of the wall.
4. It provides a decorative effect on the wall surface by creating shadow or color lines.

Mortar joint finishes fall into two classes: troweled and tooled joints. In the troweled joint, the excess

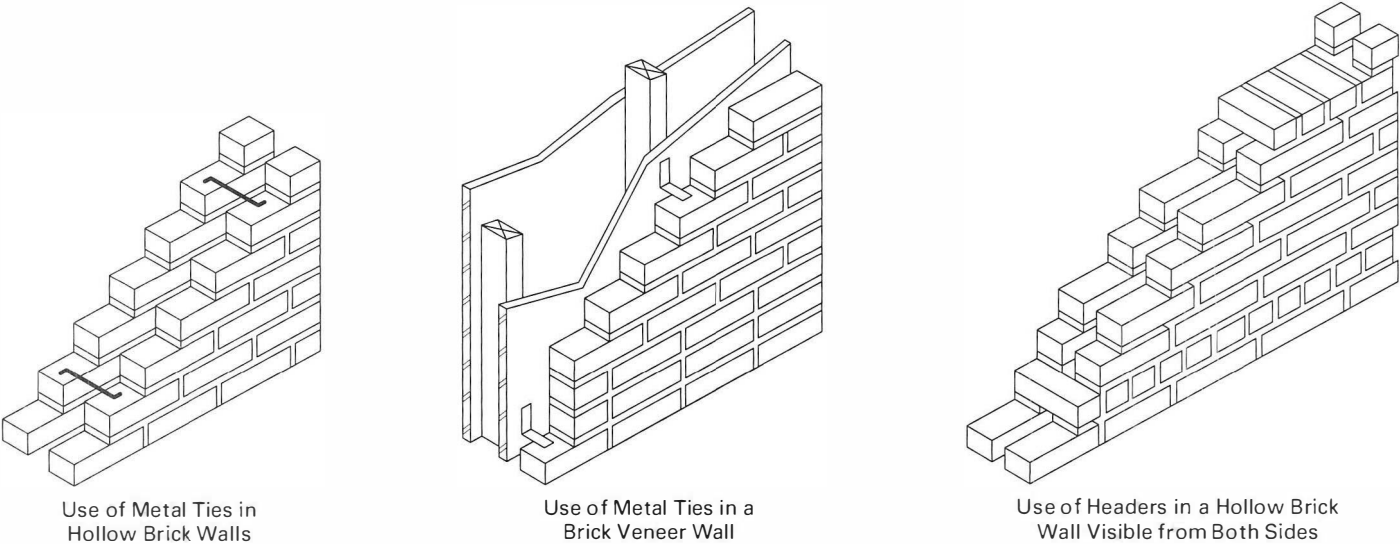


Figure 5-3
Brick wall construction.

mortar is simply cut off (**struck**) with a trowel and finished with the trowel. For the tooled joint, a special tool other than the trowel is used to compress and shape the mortar in the joint (Figure 5-4).

Installation. Brick and concrete blocks are both installed by masons. Bricks are placed in a bed of mortar and mortar is laid on the top surface of the previous course, or row, to cover all edges. The mortar joints may be any of the types shown in Figure 5-4.

Maintenance. The major problem with finishing brick walls is the **mortar stain**, which occurs even if the mason is skilled and careful. To remove mortar stain, the walls are cleaned of surplus mortar and dirt; then scrubbed with a solution of trisodium phosphate, household detergent, and water; and then rinsed with water under pressure. If stains are not removed with this treatment, a solution of muriatic acid and water is used. The acid should be poured into the water, and not vice versa, to avoid a dangerous reaction. Just the bricks themselves should be scrubbed. The solution should not be allowed to dry but should be rinsed immediately with clean water. For cleaning light-colored bricks, a more diluted solution of muriatic acid and water should be used to prevent burning.

Regular maintenance for bricks includes brushing and vacuuming to remove dust that may have adhered to the rough surface. Masonry walls that may come in contact with grease, such as in kitchens, should be either impervious or sealed to prevent penetration of the grease.

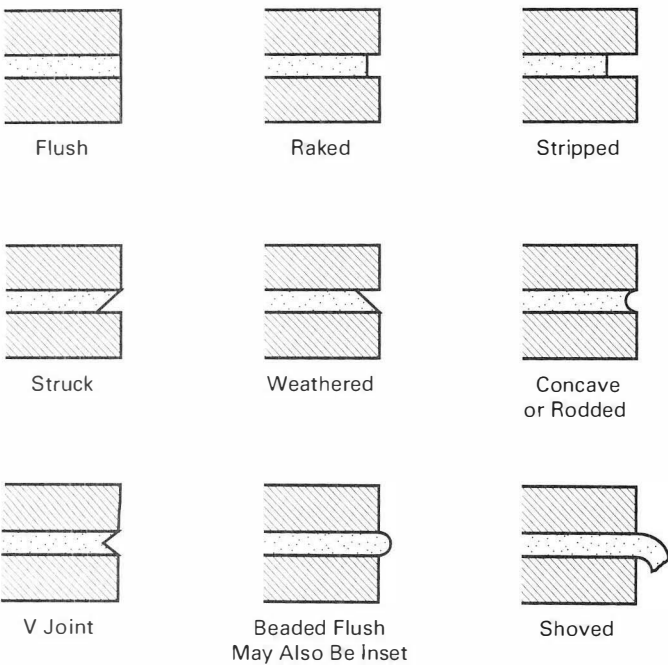


Figure 5-4
Mortar joints for brick walls.

CONCRETE

Currently, many architects of contemporary buildings, particularly in the commercial, industrial, and educational fields, are leaving poured concrete walls exposed on the interior. The forms used for these walls may be patterned or smooth, and this texture is reflected on the interior surface. The ties that hold the forms together may leave holes that, if properly placed, may provide a grid design.

From the interior designer's point of view, a poured concrete wall is a fait accompli. The surface



Figure 6-2

Rotunda is a domed, luminous ceiling system available in any module size or custom design (typical sizes are 8- to 24-inch radials). (Photo courtesy of USG Interiors.)

between the suspended ceiling and the joists is used as a plenum area, with the conditioned air entering the room through orifices in the individual tiles.

One word of warning: If you are replacing a ceiling that may contain asbestos, OSHA has some very

stringent regulations and safety precautions that must be strictly adhered to.

For areas in which mold, mildew, or microorganisms may be present, an inorganic ceiling, such as Eurostone from Chicago Metallic®, is recommended.

Eurostone won a 1997 Builder Show award for Technology Solutions.

METAL

Metal ceilings were originally introduced in the 1860s as a replacement for the ornamental plasterwork that decorated the walls and ceilings of the most fashionable rooms of the day. Once in place, it was discovered that metal ceilings offered two important benefits: (1) Unlike plaster, the metal could withstand rough use, and (2) it could be more easily maintained than plaster, which would flake, crack, and peel. Many of today's metal ceilings are actually steel, which can be pre-painted or plated with copper, brass, or chrome.

Stamped metal ceilings now come in 1 foot squares, 1' × 2', 2' × 4', or 2' × 8', and are installed by attaching the units to furring strips with nails 12 inches apart. These stamped metal ceilings are suitable for Victorian restorations and may be ordered with cornice mouldings.

One contemporary metal ceiling is made of 3- to 7-inch-wide strips of painted or polished aluminum, which clip to special carriers. The polished metals also

include bronze and brass finishes and can provide an almost mirrored effect. These ceilings may be used in renovations over existing sound ceilings or for new construction. The metal strips may be installed as separate strips, with the area between the strips left open to the plenum, or the open space may be covered with an acoustical pad. The metal strips may also be covered with a joining strip on the face to form a flush surface, or on the back for a board-on-batten effect. Metal strip ceilings may be installed as a flat, curved, or wavy surface (Figure 6-3).

For a special metal ceiling, the Gage Corporation International offers 24-inch square modules in a large collection of standard designs. Also available are custom designs, constructed of 50 percent recycled aluminum. One of Gage's custom designs is shown in Figure 6-4 and Color Plate 11.

OTHER CEILING MATERIALS

A vinyl-coated, embossed aluminum, bonded to a mineral fiber substrate, results in an easily maintained, corrosion-resistant, and durable ceiling product. Grease vapor concentrations may be wiped clean



Figure 6-3
Brooks Army Medical Center, San Antonio, Texas, features PLANAR®, an Interfinish™ brand product from Chicago Metallic. (Photo courtesy of Interfinish brand products of Chicago Metallic.)

7

Other Components

MOULDINGS

To an interior designer, trim and mouldings are what icing is to a cake: They cover, enhance, and decorate a plain surface. Basically, heavily carved or ornate trim is used in a traditional setting, whereas simpler trim is used where a contemporary ambience is desired.

The AWI lists four types of trim, all custom manufactured: **Standing trim** is fixed-length trim such as door and window **casings**, stops, **stools** or sills, and **aprons**. Such trim can usually be produced with single lengths of wood (depending on the species). **Running trim** is continuing lengths of trim (depending on species), such as **cornices**, **fascias**, **soffits**, **chair rails**, baseboards, and **shoe moulding**. **Rail moulding** is used on corridor walls of hospitals and nursing homes and for guard rails at glass openings. **Board paneling** is applied in the form of multiple boards (Figure 7-1).

Materials for trim and mouldings should be constructed from easily shaped stock. Both pine and oak are used when wood trim is desired, and both provide details that are easily discernible and smooth. Trim should always be **mitered** at the corners; that is, the joint should be cut at a 45° angle. Also available are Medium Density Fiberboard (MDF) mouldings for painted interior trims. Other trim materials include solid surface materials, such as Corian® and Gibraltar®, which are also used for counters. Depending on

thickness, these materials are fairly easy to shape, and they are used most often in commercial and medical installations.

Bases are a type of moulding universally used to finish the area where the wall and floor meet. There are several reasons for using a base or skirting: It covers any discrepancy or expansion space between the wall and the floor; it forms a protection for the wall from cleaning equipment; and it may also be a decorative feature. The word *base* is used to describe all types of materials, including those mentioned earlier as well as vinyl or rubber.

Baseboard is the term used for wood bases only. When a plain baseboard is used, the wood should be sanded smoothly on the face and particularly on the top edge to facilitate cleaning. The exposed edge should be slightly beveled to prevent breaking or chipping. Traditional baseboards have a shaped top edge with a flat lower part. This design may be achieved with one piece of wood 3 1/2 to 7 inches wide or may consist of separate parts, with a base moulding on top of a square-edged piece of lumber. A **base shoe** may be added to either type. Traditional one-piece baseboards are available as stock mouldings from the better woodworking manufacturers (see, for example, Figure 7-1).

For residential use, windows come prefabricated with the **brickmould** or exterior trim attached. The interior casing (the exposed trim) may be flat or

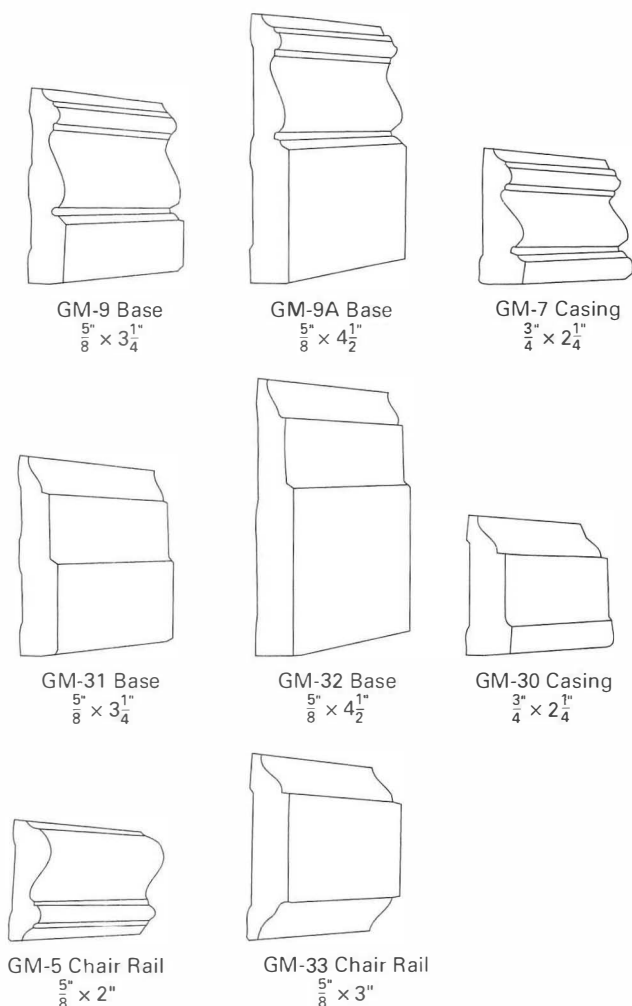


Figure 7-1
Wood bases, chair rails, and casings. (Courtesy of Granite Mill.)

moulded and is applied after the window and walls have been installed and the windows **caulked**, a crucial step in these days of energy conservation. The interior casing usually matches the baseboard design, although the size may vary (see Figure 7-1).

Doors, particularly for residential use, often come **prehung**. After installation of the door frame, the space between the jamb and the wall is covered by a casing. This casing matches the profile of the one used around the windows, with the width of the casing determined by the size, scale, and style of the room.

Crown and bed mouldings are used to soften the sharp line where ceiling and walls meet. Cove mouldings also serve the same purpose; the difference is that crown mouldings are intricately shaped and cove mouldings have a simple curved face. Cove mouldings may be painted the same color as the ceiling, thus giving a lowered appearance to the ceiling. Cornice

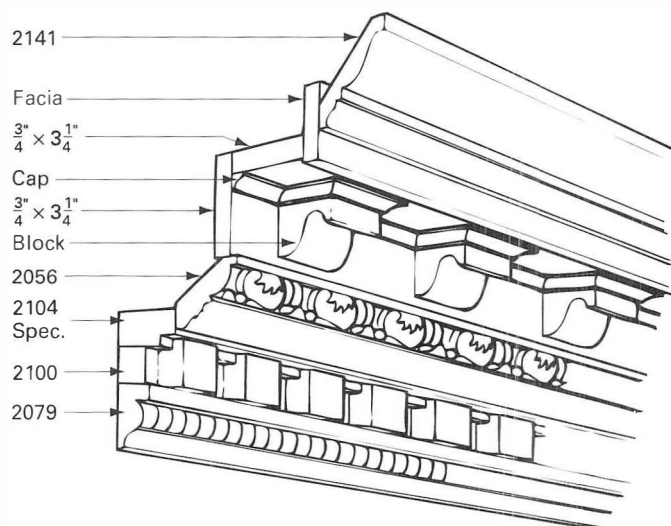


Figure 7-2
Ten-piece wooden ceiling cornice. (Drawing courtesy of Driwood Period Moulding.)

mouldings may be ornate and made up of as many as 10 separate pieces of wood (Figure 7-2).

Chair rails are used in traditional homes to protect the surface of walls from damage caused by the backs of chairs. These rails may be simple strips of wood with rounded edges, or they may have shaped top and bottom edges, depending on the style of the room (see Figure 7-1). The installed height of chair rails should be between 30 and 36 inches. When chair rails are to be painted, they should be made of a hard, close-grained wood. If they are to be left natural, they should be of the same material and should be finished in the same manner as the rest of the woodwork.

When plywood panels are used on walls, the edges are sometimes covered with a square-edge batten. In more traditional surroundings, a moulded batten is used.

Picture mouldings, as the name implies, were used to create a continuous projecting support around the walls of a room for picture hooks. Picture moulding has a curved top to receive the picture hook. Of course, when pictures are hung by this method, the wires used for hanging will be visible, but this

Figure 7-3
This room, as seen in *House Beautiful* magazine, is a fine example of the use of stock mouldings to achieve a period appearance. Shown are a cove moulding in the coffered ceiling; fluted moulding for the cornice; Osborne Shell niche cap; cornice moulding for the broken pediment of the overmantel; cornice moulding for the mantel; and Linden frieze for the frame under the pediment. (Photo courtesy of Focal Point Architectural Products Inc.)



Color Plate 13

Chatham's white beaded inset cabinets with mullion glass doors and simple trim help to create an open feeling that is at the same time intimate and reminiscent of turn-of-the-century bungalows. Note the glass shelves where ornaments and glassware are stored. The upper cabinets, however, have wood shelves that are almost hidden by the cross mullions of the glass doors. (Design: The Kitchen Works, Julie Vagts, ASID; photo courtesy of Wood-Mode.)

Color Plate 14

This colorful bathroom from American Standard features the compact fixtures Hamilton toilet, Seychelle pedestal lavatory, and an Ellisse built-in whirlpool. (Photo courtesy of American Standard.)



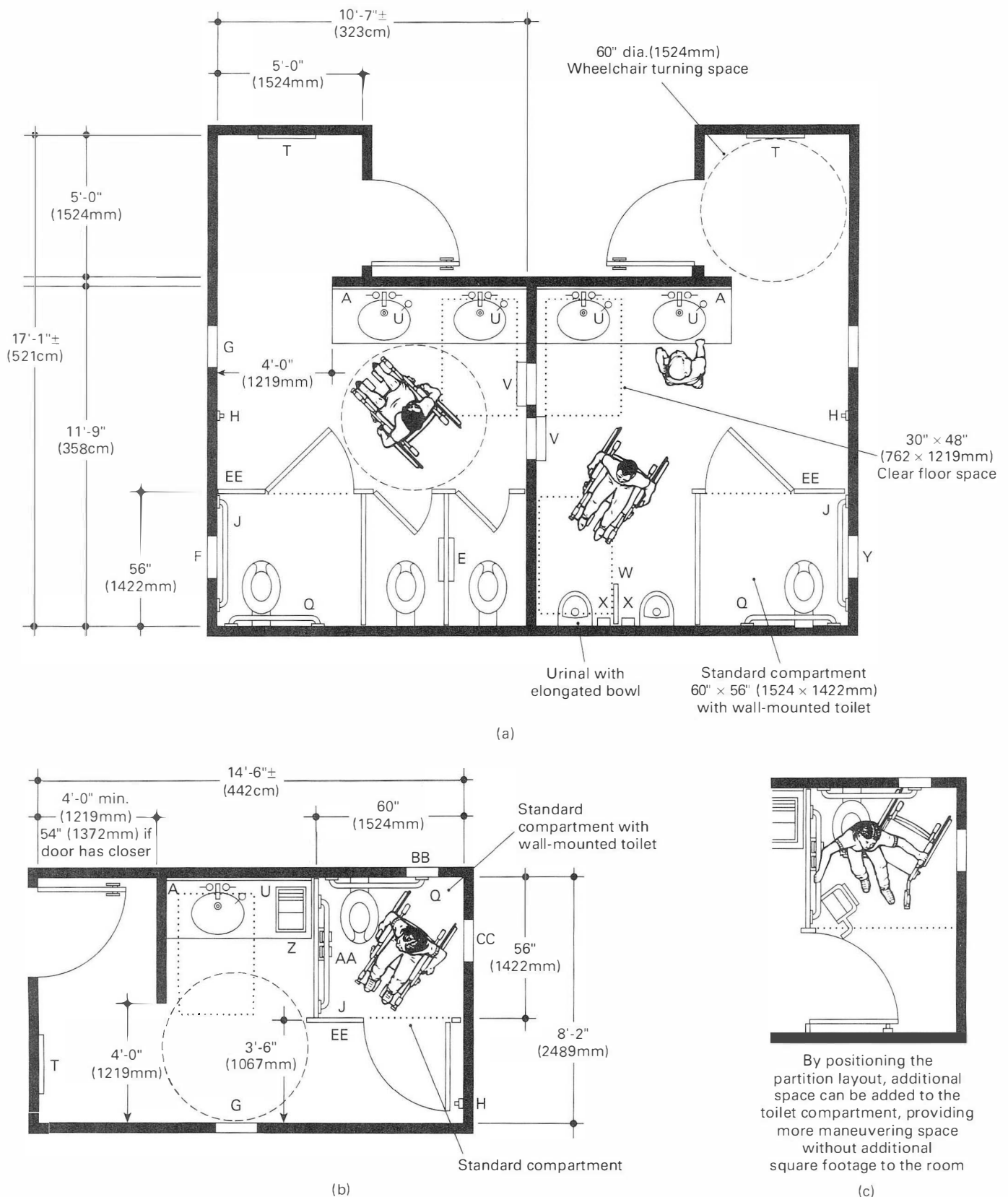
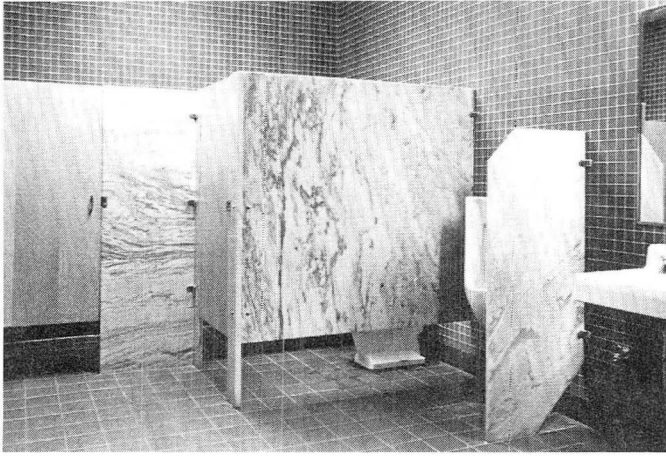


Figure 10-10
 Small barrier-free public washrooms. (a) Small public washroom with single compartment. (b) Standard compartment meeting minimum ADAAG requirement. (c) Standard alcove compartment provides greater accessibility. By positioning the partition layout, space can be added to the toilet compartment, providing more maneuvering space without adding square footage to the room. (Courtesy Bobrick Washroom Equipment Inc.)

**Figure 10–11**

Marblstal®, made of Georgia Marble®, is perfect for toilet compartments and urinal screens, as shown in this photograph. Marblstal is prefabricated and ready to install, with rugged chrome-plated hardware included. (Photo courtesy of the Georgia Marble Co.)

Each toilet compartment requires a toilet tissue dispenser; an optional accessory is a toilet seat cover dispenser. A feminine product disposal is necessary in each stall in a ladies' room. A napkin and tampon vending machine should be placed outside, near the toilet stalls. A hook for hanging pocketbooks and jackets is optional in toilet stalls. The preferred location for a hook is on the handle side of the door so no personal items are left behind. Another optional accessory in ladies' toilet stalls is a flip-down shelf that holds packages off the floor area.

In stalls for use by disabled individuals, stainless steel grab bars are required by law to be mounted on the wall nearest the toilet. They are 1 1/2 inches in diameter and 1 1/2 inches from the wall and 33 inches from the floor. Local building codes vary, so it is important to consult the codes for exact measurements.

There are two methods of transfer for wheelchair-bound people, depending on their abilities. Those who are able to stand with support can pull themselves upright by means of the grab bars. Others have to use the side transfer method, in which the arm of the wheelchair is removed and the individuals lean across the toilet and pull themselves onto the seat. The side transfer method requires a larger stall, because the chair must be placed alongside the toilet; front transfer requires only the depth of the chair plus standing room in front of the toilet.

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GLOSSARY

Bidet. A sanitary fixture for cleansing the genito-urinary area of the body.

CBD. Certified bathroom designer.

Center fit. Two handles and one spout mounted on a single plate.

Centers. Another way of saying "on centers"; in other words, the measurement is from the center of one hole to the center of the second hole.

Compartmented. Bathroom divided into separate areas according to function and fixtures.

Diverter. Changes flow of water from one area to another.

Feed-in. Where the rough plumbing is attached to the fittings.

Fittings. Another word for the faucet assembly; a term used by the plumbing industry.

Flush valve. Designed to supply a fixed quantity of water for flushing purposes.

Gel coat. A thin, outer layer of resin, sometimes containing pigment, applied to a reinforced plastic moulding to improve its appearance.

GFI. Ground fault interrupter. A special electrical outlet for areas where water is present.

Lavatory. The plumbing industry's name for a bathroom sink.

Low profile. A one-piece toilet with almost silent flushing action. There are almost no dry surfaces on the bowl interior.

Metering device. A preset measured amount of water is released when the metering device is activated.

Overflow. A pipe in bathtubs and lavatories used to prevent flooding. The pipe is located just below the rim or top edge of these fixtures.

Pedestal. A lavatory on a base attached to the floor rather than set into a counter surface. The base hides all the waste pipes that are usually visible.

Pilaster. Vertical support member, varying in width.

Pop-up rod. The rod that controls the raising and lowering of the drain in the bottom of the lavatory.

Preformed base. Shower pan or base of terrazzo or acrylic.

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