Installing Glass Block

Privacy and light in the same package

by Michael Byrne

As a tilesetter, many of the jobs I've worked on over the years have included walls of glass block that were installed by others. Unlike bricks, masonry block and stone, which have rough textures and seem to suck up mortar and stay put, glass block slips and slides during installation, and refuses to behave unless treated correctly. Fed up with hours of making my tile fit around the lousy glass-block work I found, I began to learn that trade myself about eight years ago.

My first attempts to build a glass-block panel (a panel is a "window" of block surrounded by wall) seemed awkward and confounding, and before long, I began to sympathize with those whose work I had criticized. But I've done a number of glass-block jobs since and am finally confident in my skills. What follows are some tips that will help you to avoid the painful learning process I went through.

Characteristics of glass blocks—Glass blocks were originally made by hand (sidebar, facing page), but today's blocks are machine-made by pressing two molded halves of semi-molten glass together. The edges of the inner and outer faces create a flange that allows the block to key into the mortar joints, and allows space for metal reinforcing rods or wire. The raised bump formed at the point where the two halves are fused together is an additional mortar key. To reduce the slipperiness of glass when mortar is buttered on, the hidden edges of blocks are spray-coated with a plastic-like polyvinyl butyral coating while they are still hot from fusing.

The most common sizes of hollow glass block are 6x6, 8x8 and 12x12. Other sizes and shapes are available, including 4x8 and 6x8 rectangular blocks, and hexagonal corner blocks. Blocks manufactured in the U. S. are modular; that is, the nominal size includes an allowance for a ¼-in. mortar joint. The actual dimension of a modular block is ¼ in. less than the nominal size (a 6-in. block, for example, is actually 5¾ in. square). Though you can find a few glass artisans who will provide custom-made solid glass block, there's only one company in the U. S. that manufactures glass block—Pittsburgh-Corning Corporation (800 Presque Isle Dr., Pittsburgh, Pa. 15239). Imported glass blocks are available (see the list on p. 49), but direct technical information and assistance may be limited.

In addition to the different sizes, Pittsburgh-Corning makes hollow block in two thicknesses. The standard block is 3⅞ in. thick and has an insulating value of R-1.96. It can be used for both interior and exterior applications. An 8x8 block weighs 6 lb. For light commercial and residential jobs, Pittsburgh-Corning makes a "Thinline" block that's 3⅛ in. thick, with an insulating value of R-1.75. Because Thinlines aren't as strong as the thicker blocks, their use is limited to exterior panels of 85 sq. ft. and interior panels of 150 sq. ft. But they are about 20% lighter than standard blocks, so they're ideal for situations where weight would be a problem. An 8x8 Thinline weighs 5 lb. Another kind of glass block is solid, instead of hollow. Called VISTABRIK, it's a solid chunk of glass that's suitable for translucent pavers between two levels of a structure, or as a nearly vandalproof panel. An 8x8 VISTABRIK weighs 15 lb., and can withstand a 30.06 rifle shot from 25 ft.

Standard glass blocks have a compressive strength of 400 psi to 600 psi, and solid glass VISTABRIK blocks are rated at 80,000 psi. Glass blocks, however, should not be used in load-bearing situations, regardless of the application or panel size. Provision must be made to channel loads around the block panels with properly sized lintels or headers.

Most of Pittsburgh-Coming's line can be specially ordered with inserts of translucent fiberglass that improve the R-value by about 5%. You can also get solar reflective block that cuts down on solar heat gain. In combination with these characteristics, various patterns can be pressed into the inside surfaces during manufacture, while the two halves are still semi-molten. These patterns change the way light passes through the block, and also change the amount of privacy blocks offer. Some blocks are clear, while others admit light but not the view. Putting the pattern on the inside of the block leaves the outside of the block smooth, making the blocks easier to clean once they're in place.

Mortar and admixes—Glass blocks are stacked one upon the other, and mortar joints are usually aligned both horizontally and vertically. You can stagger the joints if you wish, but this makes the blocks more expensive to install. Laying up glass block is like laying up concrete block or brick, except for one crucial difference: the consistency of the mortar.

Masons work with a rather moist mortar mix to compensate for the absorbent nature of brick and concrete block. When either one is laid up, moisture is wicked from the fresh mortar, which then stiffens and supports the weight of the masonry. Glass blocks, however, aren't absorbent, so standard mortar won't stiffen as quickly. Instead, it will ooze out of bed joints and head joints after a few blocks are in place—a sight greeted with considerable dismay by novices.

Mix your mortar on the dry side. Pittsburgh-Corning recommends a mix of 1 part portland cement, 4 parts clean sharp sand and ½ part lime (measure by volume). Add just enough water to change the mix from crumbly to spreadable—roughly five gallons of water to a 94-lb. sack of cement. The mix should just barely wet the edges of the blocks. (I prefer a mortar mix of 3 parts sand and 1 part cement, no lime, with a liquid additive in place of water. I'll discuss additives more below.)

You won't have a lot of working time with the drier mortar, so in moderate temperatures mix only what you'll need in about a half-hour; mix even smaller batches in very dry or hot weather. Don't add more water to mortar that begins to set up because this prevents it from curing properly. It also increases the likelihood of mortar cracking when it sets up.

You can use a pre-packaged mortar mix to which you add only water, though I prefer to mix my own. These mixes usually set up faster than a standard mortar, which can sometimes be an advantage. Pre-packaged mortar mixes have a disadvantage, too. They often contain a finer grade of sand than you get from a building-supply yard, so the mortar will shrink more as it sets. On small panels this won't present a problem, but on larger jobs you should use some sort of liquid mortar additive to control shrinkage.

The additive should also provide some waterproofing. As one side effect of waterproofing, the mortar gets stickier and so gets a better grip on the slippery blocks. An additive also increases the flexibility of the cured mortar joint, reducing cracking. The additive I use (which does all this) is Laticrete 8510 (Laticrete International Inc., #1 Laticrete Park North, Bethany, Conn. 06525). If you're making mortar from scratch in an area where special additives are hard to come by, you can get a sticky mix by using waterproof portland cement instead of standard portland.

A third kind of additive, called a mortar fortifier or lattice, can increase the compressive strength of the mortar. It will also make the mortar stickier and more flexible, and increase its water resistance after cure.

Panel design—The overall size of a panel and whether it's to be built on the interior or exterior of your House will determine the thickness of

In this shower surround, glass block was used as an interior partition and as a divider between the shower and the adjacent sunroom. The pattern inside each block obscures views yet admits light.

block to use and the method of installation. Though the design of glass-block walls can get complicated on large commercial installations, most residential jobs are pretty straightforward. For design purposes, these fall into two categories: small panels (under about 25 sq. ft. in area) and large panels (up to 144 sq. ft. in area).

Small panels, like a slender sidelite alongside an entry door or a glass-block divider in a shower room, add a touch of elegance and style to a house. From a technical standpoint, a small interior panel, like a block window between two rooms, is the easiest to build. Jobs this small can be mortared in tight at jambs and headers. For interior panels, no reinforcing is necessary, and you needn't waterproof the surrounding framework. But make sure that even a small job is adequately supported. Glass blocks may look light and airy, but a small panel of standard 12x12 blocks can weigh as much as 400 lb., not including the mortar. Put in extra cripples beneath the sill, or build up a heavyweight sill with an extra 2x to keep deflection to a minimum.

For a small exterior panel (and any other panel frequently exposed to water), the sills should be waterproofed before the block is installed. Pittsburgh-Corning doesn't call for waterproofing the jambs, but I often do it anyway. Tar paper embedded in asphalt emulsion is a suitable waterproofer for many situations. But I prefer to use a waterproof membrane (like Nobleseal, made by The Noble Co., 614 Monroe St., Grand Haven, Mich. 49417). Membranes are fairly easy to install, too; just wrap a sheet 2 in. or 3 in. over the framing and staple the edges in place; lap the seams and seal them with Noble adhesive. Even though Pittsburgh-Corning requires no reinforcing for a small exterior panel, I feel more comfortable about the job if it is reinforced. I'll talk more about reinforcing below.

For large interior panels, like a full-height partition between two rooms, the design gets a bit

Substance and shadow

The history of plate glass and glass block is linked with the history of modern architecture. Early in this century, the classic precepts that underpinned much of architectural thinking were being challenged, and a fresh new vision was emerging in all the arts. This vision was due, in part, to the technical advances In construction materials and techniques that allowed architects more flexibility with structural design. Cast-iron columns could be spaced widely apart, and because of advances in glass technology, ever wider and longer sheets of plate glass began to fill the spaces between.

Glass block was another product whose invention depended largely on manufacturing advances. The "glass brick" walls in early modern architecture were actually single thicknesses of pressed glass squares set in large reinforced-concrete panels. These panels were either formed on site or precast before being installed as infill between structural elements. Auguste Ferret's Notre Dame de le Raincy (1922) and Le Corbusier's Immeuble Porte Molitor (1933) provide examples of this technique.

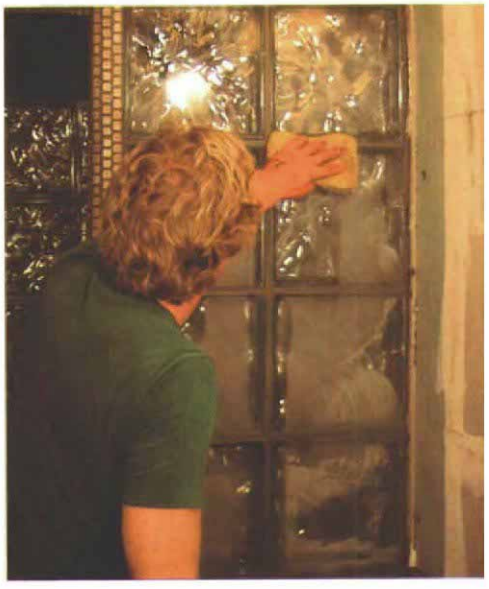
In 1902, the Corning-Steuben Company invented the hollow, modular glass units that became known as glass block. The blocks were made by pressing molten glass into identical molds. The square "dishes" thus formed were sealed together at high temperatures, with a partial vacuum forming in the space between dishes as hot air cooled and contracted. Earlier attempts to form glass blocks using traditional glass-blowing techniques had proven unsatisfactory, because moist air from the lungs of the glass-blowers would condense on the inside of the blocks, clouding them. Owens-Illinois made glass block at one time, but with architectural preference for materials nearly as changeable as Paris fashions, they dropped out of the market years ago.

The directions for installing glass block offered to builders in 1902 were amazingly similar to the specifications offered today by Pittsburgh-Corning (formed by the merger of the Corning Glass Works and Pittsburgh Plate Glass Company), which is the sole U. S. producer of glass block. Back in 1902, Corning-Steuben said "The [glass] bricks are laid in a similar way to ordinary bricks, with a mortar consisting of one part portland cement, two or three parts fine sharp sand and one-fifth lime mixed not too thin with water." Contemporary Pittsburgh-Corning instructions go on to suggest the addition of a waterproofing admixture if waterproof portland cement mortar is not used.

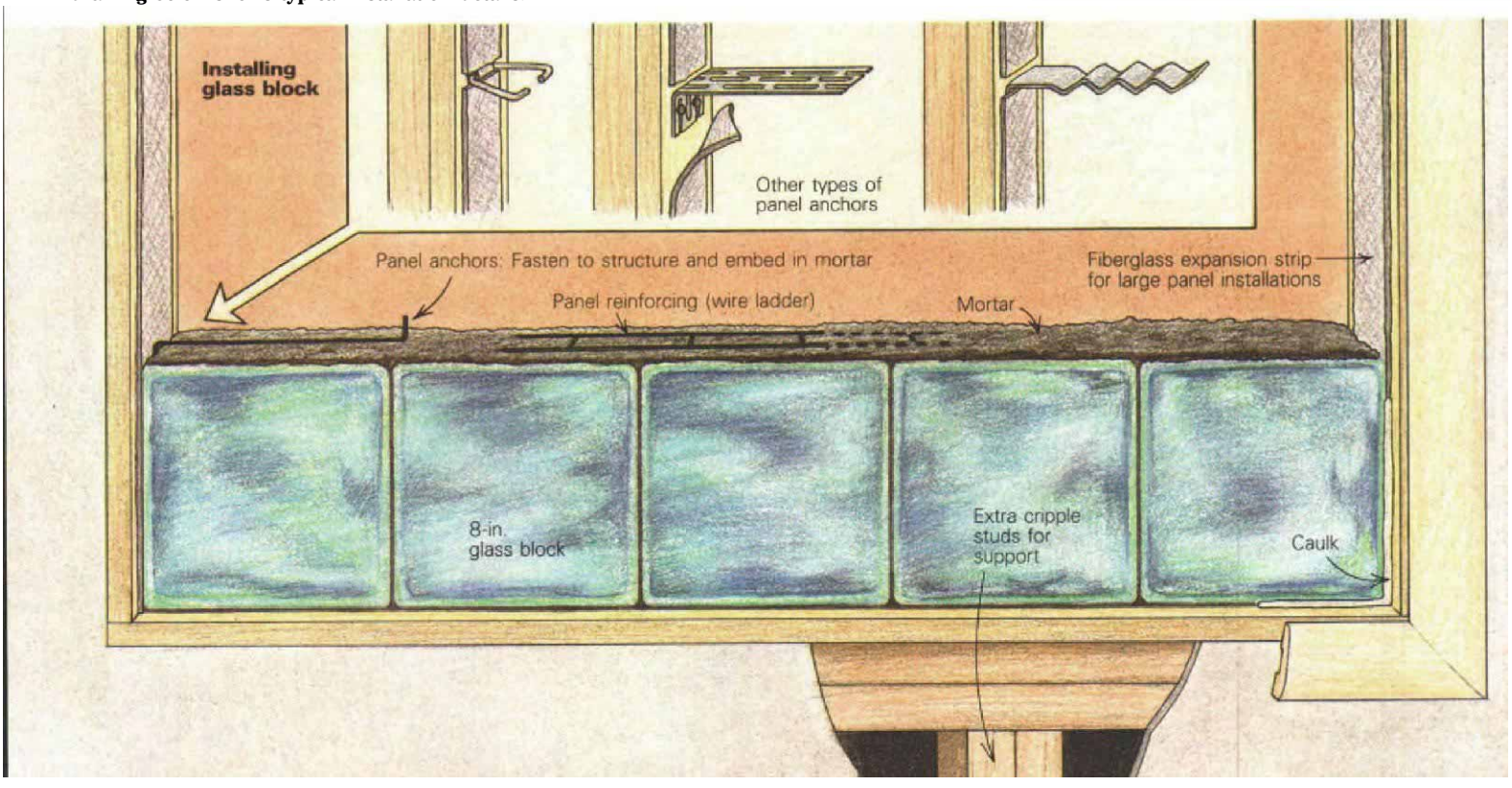
The revival of interest in daylighting is one reason for the current wave of interest in glass block. Another factor, ironically, is a revived taste for historic allusion in architecture. European and Japanese manufacturers are now scrambling to catch a share of expanding sales in glass block.

Arthur Korn, in his 1926 book *Glass in Modern Architecture,* spoke for all the pioneers of modern architecture when he identified glass and glass block as altogether exceptional materials, "at once reality and illusion, substance and shadow."

—Ronald W. Haase



Any glass-block panel exposed to water, such as this divider between a tub and a shower stall, should be treated like an exterior job. Jambs and sills should be waterproofed. In this case, tile fills that role. Top left: A block, with one edge already buttered with mortar, is being set onto the mortar bed. The wood strip on the wall acts as a guide to keep the blocks plumb. Top right: Additional rows of glass block are buttered on one edge and pressed into a layer of fresh mortar. In this case white thinset was smeared on the wall to increase the bond between the mortar and the wall. Once the blocks are in place and the joints have been tooled, any mortar haze should be removed with a sponge and plenty of clean water, as shown at right. Ceramic tile caps the edges of the blocks. The drawing below shows typical installation details.



trickier. The panel must be isolated from the surrounding framing to allow for expansion, contraction or deflection of the framing members. But at the same time, it must be anchored securely to the building. To satisfy both conditions, various kinds of expansion strips and special metal panel anchors can be used to anchor panels to a building (drawing, facing page). One is nailed into the wall and the other is embedded in the mortar.

The use of expansion strips at jambs and headers is essential because they allow the surrounding framing to expand and contract without destroying the panel. The block itself won't move much unless the panel is very large; glass block's thermal expansion rate is .0000047 in. per degree Fahrenheit. Expansion strips are usually 4⅛ in. wide, ⅜ in. thick and 2 ft. long, and are made of dense fiberglass or polyethylene. They can be stapled, nailed or glued in place.

Where the edges of the expansion strips are exposed, fill the gap between wall and panel with packing. A common type of packing, called backer rod, looks something like a rope of stiff foam, and is just pushed into the joint. I prefer to use packing material that's square or rectangular in cross section, like POLY-VOID (Stegmeier Corp., 750 Garcia Ave., Pittsburg, Calif. 94565). Remember to take the thickness of expansion strips into consideration when sizing openings. A bead of caulk covers the packing.

Large exterior panels should be installed like large interior panels, but with the additional precaution of waterproofing. Because there are a number of variables to consider in the design of any large panel, I'd suggest that you consult with your local distributor, who may in turn contact a technical representative at Pittsburgh-Corning.

Reinforcing—Like masonry walls, walls of glass block require a certain amount of metal reinforcing to resist bending stresses. Pittsburgh-Corning offers panel reinforcing "ladders" that consist of two parallel runs of stiff wire that are separated by cross wires. The reinforcing should be placed in continuous rows every third course in standard block walls, and every other course in Thinline and VISTABRIK walls.

Proper reinforcing in the mortar joint is essential on larger jobs and useful on smaller ones, but not every glass-block outlet carries the full line of accessories. When scheduling problems won't allow time for tracking them down, I rely on an old standby to fortify small installations. In a pinch, 9-ga. galvanized wire can serve as both reinforcing and anchoring on small panels. For large panels, I'd definitely stick with the standard Pittsburgh-Corning reinforcing.

Installing a panel—Not long ago, I did a project that involved several different panels of glass block. The block I used for all three panels was 12x12 VUE, by Pittsburgh-Corning. I'll show you how I did the smallest one, a divider between the shower and the tub, because it illustrates the versatility of glass block (photos facing page). As you can see, a block panel doesn't always have to be entirely enclosed by wall.

Earlier I had installed ceramic tile on a wood framework that wrapped around the shower, along with two vertical lengths of rebar to stabilize the "open" side of the panel. Later the rebar would be covered with more ceramic tile. Because the sill was already waterproof, I dispensed with what is normally the first step in such a job: giving the sill a thick coating of asphalt emulsion (normally, this should be allowed to dry before any mortar is applied) or flashing it with a suitable waterproof membrane.

I glued expansion strips to the wall jambs with asphalt emulsion, and set a wood guide strip along the wall to keep the blocks running true. Such a guide speeds the work by giving me a constant reference to plumb. Panels should be anchored to the wall just above the first course, just below the last course, and at some intermediate courses (every 24 in. for standard block, and every 16 in. for Thinline). For this panel, L-shaped lengths of 9-ga. wire, fastened to the wall with 10d nails, were sufficient to serve both as panel reinforcing and anchoring.

When I was ready to lay the block, I mixed up a batch of mortar on a mudboard, scooped up a trowelful of mortar and slid it onto the sill, using a sweeping motion to spread it. All layers of mortar (the mortar bed) should be a full thickness, not furrowed. The slick edges of glass block need 100% support on this first course, so they must be bedded completely in the mortar. The first block went against the expansion strip and, as with all the remaining blocks, I gave it a couple of raps on the top with my fist or a rubber mallet to seat it securely. The block should butt up tight against the expansion strip, but should not be mortared here. The next block was buttered with mortar on one edge, then slid against the first and tapped in place. If you were doing a longer row of blocks you'd just continue this routine of butter, tap, butter until you reached the end of the first row. After every few blocks I carefully check for plumb and level, using a small level, and cut away any excess mortar from the blocks with the edge of a trowel.

Reinforcing should be centered in the mortar bed and run the full width of the panel. When I have to use more than one length of reinforcing to reach the end of the row, I overlap the pieces at least 6 in. or so. The panel anchors should be placed directly over the reinforcing, but they don't need to be fastened together; mortar provides the connection between them. I bend the anchors so that 6 in. to 8 in. contacts the jamb.

While stacking the rows of block, be sure to maintain plumb and level. Strings tacked to matching layouts above and below the panel are especially helpful when laying up curved or serpentine panels. The important thing to remember about glass-block walls is that light will be passing through the finished panels to highlight any inconsistencies in the mortar joints. Very slight variations in joint thickness are acceptable, but goofs or sloppy work practically scream for attention.

It's sometimes hard to maintain a consistent mortar-joint thickness, particularly if the installation is a tricky one, or if you're a novice. One trick is to use wood spacers cut from scrap stock. Wiggle them into the mortar bed just before setting a course of block, and they'll support the blocks while the mortar sets up. Soak the spacers before you put them in so they don't suck moisture from the mortar, and stuff the holes that remain with mortar.

Finishing the job—When the mortar has stiffened a bit, the joints should be tooled. On a large project you can't wait until all the block is up before tooling the joints, but usually you can on a small panel like this one. When the last row is in place, I step back and look at the joints. I usually find voids that need a little extra mortar, so I fill them in. When the voids are filled, each joint can be smoothed with a striking tool, a metal bar with a C-shaped cross section (available from masonry-supply outlets). This forces the mortar into any voids between the blocks, and also it compacts it to make it harder and more waterproof. If you can't get a striking tool, you can use a length of smooth copper pipe.

After tooling the joints on both sides of the panel, I clean up each block with a wet brush or a sponge, rinsing it frequently. If you have ever grouted tile, you will recognize this step (see *FHB* #17, p. 75). Any lingering light haze can be removed with a piece of cheesecloth.

On some jobs, to add a little color to the transparent wall, I'll rake out the joints to a depth of ¼ in. to ⅜ in. and fill the resulting channel with colored grout, which I then finish smooth with a striking tool and clean as above.

Glass blocks can be tricky to install properly, but they can also be loads of fun. Just wait for a winter's day when the snow is piled up around the house and the sun is low in the sky. That's the time to pull out the old lawn chair, stretch out and close your eyes—you're as good as on the beach in Jamaica. □

Michael Byrne is a tilesetter in South Hero, Vt. Photos by the author, except where noted. His book, Setting Ceramic Tile, *will by published by The Taunton Press in the fall of 1987.*

Sources of glass block

Only one company In the U. S. manufactures glass block on a commercial scale;

Pittsburgh-Corning Corporation
800 Presqae Isle Dr.
Pittsburgh, Pa. 15239.

Other sources of glass-block:

Forms & Surfaces
Box 5215
Santa Barbara, Calif. 93108
(Japanese glass-block)

Earoglass Corp.
123 Main St., Suite 920
White Plains, N. Y. 10601
(French glass-block).

Two companies import glass block from West German manufacturers:

Solaris U. S. A.
Division of Sholton Associates
6915 S. W. 57th Ave.
Coral Gables, Fla. 33143

Glasshaus, Inc.
P.O. Box 517
Elk Grove Village, Fla. 60007.

Drawing: Chuck Lockhart