



# Building in the Bathroom

Photos courtesy Schluter-Systems

## A new way to build in wet areas with building panels

By Dale Kempster, CSC, CTC, TTMAC

For most assemblies receiving a tile installation, the structures and their surfaces are built with variations of wood, cement, and gypsum. Whether the area is exposed to moisture varies from project to project, but the structural elements tend to be the same. Walls, benches, tub surrounds, and counters are constructed with common building materials, such as plywood, drywall, water-resistant gypsum board, cementitious backer units (CBUs), and other similar materials.

Many of the materials used in wet environments are not 100 per cent waterproof, so their properties change when exposed to moisture. Wood products, for example, are susceptible to warping when exposed to moisture over time; they can also be dimensionally unstable due to thermal changes creating expansion and contraction. A CBU is often used in areas requiring waterproofing, but that material is not actually waterproof itself. It is not sensitive to moisture in the same way as wood or drywall, so it remains dimensionally stable, but it will wick water—it is not uncommon for the grout joints on the wall to turn

dark and eventually mould can spread 600 to 900 mm (24 to 36 in.) up from the floor.

In the case of stone, especially marble, the water that has wicked into the CBU may discolour the stone. The alternative and common solution is to use a topical waterproofing membrane that is trowel- or sheet-applied and meets American National Standards Institute (ANSI) A118.10, *American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-set Ceramic Tile and Dimension Stone Installation*, for all wet areas (except continuous commercial steam rooms, which have other specific requirements—see “Designing for Steam Rooms.”).

The Tile, Terrazzo, Marble Association of Canada’s (TTMAC’s) *09 30 00 Tile Installation Manual* calls out in detail 319 SR -2012-2014 for shower receptors that CBU needs to be preceded and installed on the metal or wood studs by a vapour retarder typically made of polyethylene with a perm rating of less than 1.0 per ASTM E96, *Standard Test Methods for Water Vapour Transmission of Materials*

and which conforms to Canadian General Standards Board (CAN/CGSB) 51.34-M86, *Vapour Barrier, Polyethylene Sheet for Use in Building Construction*.

Another challenge in a wet environment is the existence of potential food sources for mould and bacteria. Materials such as drywall and water-resistant gypsum board are excellent sources of food for mould and bacteria when water penetrates into their surface. If these materials are being used, they should always be covered with a waterproofing membrane meeting ANSI A118.10 specifications.

### Evolution of products and practices

Construction methods are often the result of past practice. Traditional division of labour on jobsites means the solid backing for walls, tub surrounds, benches, and other structural elements is usually built by the carpenter or framer. These trades may not fully appreciate the surface that is to receive the tile or stone needs to be perfectly plumb, true, and even for the tile contractor to install the tile or stone and achieve a perfectly flat, square, and level installation.

In the past, when the tile contractor was confronted with surfaces that were not perfectly prepped, they were routinely solved by using what was commonly called ‘mud,’ ‘dry-pack,’ or ‘mortar bed.’ Typically, this mud would be made by using four- or five-parts sand to one-part portland cement.

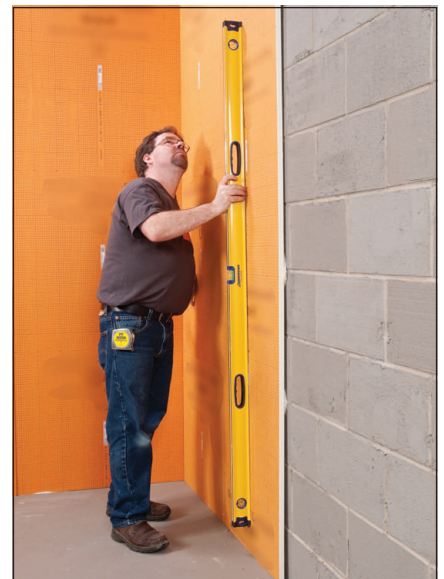
Before the advent of dry-set mortar in the late 1970s, all formally trained and apprenticed tile contractors were trained using mud. It was common practice to build up on



*Water that has wicked into building materials behind a tile wall can leach out into the grout and even into stone tiles to cause serious stain issues.*

the solid backing materials to eliminate any anomalies in the surface. Using mud in this way has fallen out of common practice because it not only takes a lot of time to install, but it also adds a weight of 80 to 105 kg/m<sup>2</sup> (18 to 25 lb/sf) for 38 to 50 mm (1 ½ to 2 in.) in thickness. Few tile contractors employ anyone who knows how to work with mud or can do it proficiently. With today’s fast-track construction schedules, it is important to be able to deliver a finished room in wet environments that is not only functional and durable, but also esthetically pleasing. Meeting these demands requires new materials and methods.

Approximately 10 years ago a new product family—called element boards or building panels—was introduced



*Building panels can be spot bonded to a block wall and easily plumbed in order to remove any imperfections in the original wall. The end result is the creation of a tile-ready surface, making the construction process efficient.*



*Building panels for tub surrounds were cut at the factory and sent in kit form for assembly at the resort in Grand Cayman Islands.*



*The combination of R-value and workability makes building panels suitable for holding hydronic tubing in tiled walls.*

to North America from Europe. These panels are made out of high-density expanded or extruded polystyrene (EPS or XPS), typically with some type of cementitious or waterproof facer on both sides of the board. With thicknesses ranging from 4.5 mm to 50 mm (0.17 to 2 in.), these boards are extremely light, weighing only about 0.48 to 3.4 kg/m<sup>2</sup> (0.1 to 0.7 lb/sf), depending on the panel thickness. They are strong enough to be used as the solid backing and supporting structure for applications, such as walls, benches, shower curbs, and countertops.

Since the boards are made of polystyrene, they have the additional benefits of having R-value of approximately R-4

per 25 mm (1 in.), and they provide some positive sound attenuation. Another big benefit is the ease of use as the boards can be easily handled by one individual. They can be cut into any configuration with a utility knife, or straight cuts can be made with a table-saw.

These board products are low in volatile organic components (VOCs) and have a lifecycle that allows them to last as long as the tile and stone, which is estimated by the Canada Green Building Council (CaGBC) to be a minimum of 50 years. Building panels are not sensitive to moisture or changes in temperature so they are ideal for wet areas and even areas with high temperatures, such as in a steam room.

### **An education in shower design**

One of the most suitable areas for using building panels is in applications where the walls are uneven and have a disparity from one side of the wall to the other. As an example, one of the larger universities in Southern Ontario was in the process of renovating all the communal showers in its dormitories on campus. Dorm renovations must be completed during the summer months when school is out, which makes a quick construction schedule essential.

In this particular case, very costly fines were risked if the late August deadline was not met. The tile contractor awarded this project was provided only a narrow window of time to get the job done, but when renovation on the first building began, a potential disaster was quickly discovered—the walls in the shower were critically uneven. Suddenly, the project was determined to be a lot bigger than originally calculated. The walls had to be made plumb, even, and 100 per cent waterproof before tiles could be installed.

It was estimated it would take two workers a full week to tear out and parge/float the walls in each communal shower. This additional work would mean the deadline would be missed, and the contractor would be handed hefty financial penalties. It was decided to try using a building panel as an alternative method of construction. After a trial installation, it was determined using the building panel reduced the installation time from one week per shower to a single day. The result was a perfectly flat, even, waterproof, and load-bearing installation that could receive the tile within 24 hours after the walls were renovated.

To even out the variations in the wall, the building panels were installed using spot bonding. Mortar was applied in various thicknesses in spots approximately 450 mm (18

in.) apart, allowing the boards to be positioned plumb and even. After allowing the mortar to set overnight, mechanical fasteners were applied through the boards to ensure the panels were permanently secure to the original concrete masonry unit (CMU) walls. The panels completely covered the leftover residue, such as mastic from the original finishing materials, eliminating the painstaking process of having these removed.

Deadlines were met, no fines or penalties were levied, and all parties were satisfied with the end result. The success of this project has since led to other post-secondary residences using building panels in shower renovations with similar quality and time requirements.

### International examples

Building panels can also simplify some very unique and challenging projects, such as one application where a series of tub-surrounds were needed to encase oval bathtubs for a resort project in Grand Cayman Islands. This particular project was a turnkey installation where all material and labour were being



Photo © Sweet Scene Photography

*University dorm showers are often renovated on a tight schedule with very specific moisture management requirements. Waterproof building panels can help meet both the tight deadline and moisture management needs.*

## Designing for Steam Rooms

Steam rooms have been a real challenge in the tile industry as vapour is very difficult to contain in an enclosed room, especially in continuous use steam rooms commonly found in commercial environments such as in fitness centers or spas. In the most recent revision (*i.e.* 2012/2014) of the Tile, Terrazzo, Marble Association of Canada's (TTMAC's) *09 30 00 Tile Installation Manual* (2012-2014), the detail for continuous use steam rooms was modified, providing two options to meet the vapour retarder requirements. Where the waterproof membrane acts as the waterproofing membrane and the vapour retarder, the waterproof membrane must have a perm rating of 0.5 or less using procedure E of ASTM E96 with 90 per cent humidity.

Alternatively, if the waterproof membrane has a perm rating higher than 0.5, then a vapour retarder should be used that has a perm rating 1.0 or less when tested with ASTM E96 procedure A, which is typically located behind the solid backing such as cementitious backer unit (CBU). In the case of building panels, depending on the thickness of the board, the perm rating can be met simply by using the boards. If the thickness of board used does not have a perm rating less than 0.5, a waterproofing membrane can be applied over the board, which will lower the perm rating almost to zero. 📌

supplied by a tile contractor based out of Toronto. It was essential to have a system that was easy to assemble, and capable of handling the heavy weight of the stone being applied on the tub surround.

The building panel chosen for this project was cut and shaped using basic computer numerical control (CNC) equipment and the pieces for each tub surround were packaged as a kit and sent to Grand Cayman for assembly onsite. Once at the resort, each tub surround was assembled within one day by an installer and a helper. It would have been much more challenging and the shipping much less economical if the kits had been made with another solid backing such as CBU.

Another unique application was at a corporate headquarters based in Reno, Nev., where the proposed design called for several faucets to empty into a single long communal sink in each washroom. One linear drain was used per sink, essentially creating a long trough drain. The entire sink was built using building panels.

The combination of their light weight and strength allowed the sinks to be cantilevered from the wall using a ledger made of a stainless steel profile made specifically to work with the building panel. A supporting leg was built on one end, constructed with 50-mm (2-in.) thick building panels and no lumber. Building these sinks with traditional materials would have been extremely time-consuming and challenging.

At the same Reno facility, the building panel was used in the walls in the warehouse where a 37.5-mm (1 ½-in.) thick panel with an R-value of approximately 6.5 was used to insulate all the 2.4-m (8-ft) high walls around the warehouse. The board was not only used for its R-value, but it was also routed out to hold the hydronic pipe, which

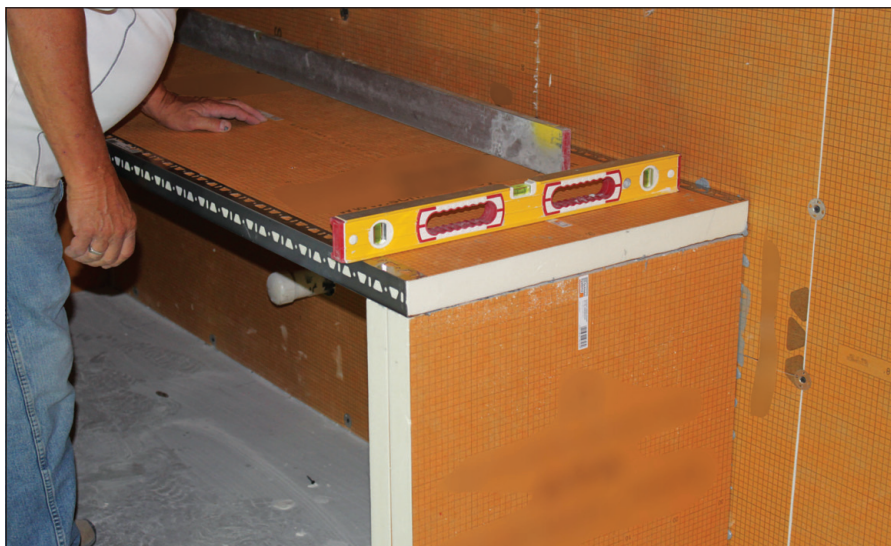
was heated by a geothermal system, making the warehouse exceptionally energy efficient and quick in reaction time.

Traditional office and distribution buildings in the Tahoe Reno Industrial Center (similar to this facility in size and use) typically have total energy consumption costs ranging between \$13.45 and \$16.14 U.S. per square metre (\$1.25 to \$1.50 U.S. per square foot) per meter squared. Over the past two years, this building has been running at a cost of \$4.62 U.S./m<sup>2</sup> (\$0.43 U.S./sf), or an overall cost saving of approximately 65 per cent. The board was tiled with a porcelain tile which has a much longer lifecycle than finishes such as drywall and paint.

### Conclusion

Waterproof building panels, like many other relatively new construction materials, change the way structures are built in two dramatic ways. The first is they help to provide better results more quickly in relatively standard applications like residential showers and university dormitory showers. The second is the role they play in expanding the affordable possibilities in construction.

Wall-mounted sinks with trough drains, hydronic heating in walls, and oval tub surrounds that are prefabricated at the factory and installed in Grand Cayman—these are all creative solutions that are made much more attainable through the use of lightweight, waterproof building panels. 🐶



*Functional and attractive vanity and sink combinations can be built entirely with building panels so they will remain stable and never rot or warp.*



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