Son of Ultrathin Slabs

Innovative thin slabs get good report cards after one New England winter.

by Harris Hyman, P.E.

A year and a half ago [*NEB*, July 1985], I described the installation of ultrathin slabs for use in one- and two-story frame buildings. These are fiber-reinforced concrete slabs less than 3 1/2 inches thick, with little or no steel and no thickening at the edges.

There are a number of advantages to the ultrathin design: the slabs are easy to form up, and easy to insulate well. There is no need to use steel reinforcing, and less material is used.

On paper, ultrathin slabs look like a good idea. Out in the real world, after seeing five projects through a winter, they still look like a good idea.

Five for Five

Four of the projects involved enclosed buildings, but the fifth building was open through the winter. There was no evidence of cracking or spalling on any of them. Each was carefully examined for hairline cracks at the edges and at anchor-bolt locations; none were detected.

One of the sites had fiber-reinforced foundation walls as well as slabs, and these appeared to be intact—with no cracks-despite a couple of severe freeze-thaw cycles, Another site had a fiber-reinforced retaining wall between two thin slabs at different levels. Here, also, neither the slabs nor the wall showed any sign of cracking or spalling.

Besides the fiber-reinforced concrete [see sidebar], each of the projects had two features in common: good drainage, and careful workmanship and inspection,

Good drainage is critical to any foundation system. In some manner, water must be carried away from the foundation if a building is to survive northern winters. Also, on buildings with full foundations, water must be routed somewhere else—anywhere else—if the basement is to remain dry; it is virtually impossible to stop water with barrier coatings. With good drainage, most any kind of foundation will remain level, plumb, solid, and dry. Fiber-reinforced concrete is no exception.

There is no evidence as to how fiber reinforcing works under poor drainage conditions. I suspect that in wet situations—or ones with freezing and thawing—the fiber reinforcing would inhibit cracking far better than sparse rebar. [See "Rethinking Rebar."]

The fiber reinforcing is *not* a substitute for *structural* steel reinforcing, and the manufacturer makes no claims that it is. When steel is required to handle tension loading, it must be used. But the manufacturer of the fiber reinforcing that I use *does* make a strong claim for increased impact resistance.

Neatness Counts

The other common factor of the five jobs was careful craftsmanship and inspection in forming and finishing. All of these jobs were handled in a fussy manner, with a preliminary discussion with the contractor and a site checkout prior to placing the concrete. The work was done carefully and well—to the correct size, and level and true.

I don't know how well either fiber-reinforced concrete or ultrathin slabs would work with hack craftsmanship and finishing. I suspect that the finishes would take on a "hairy" quality, with bunches of fiber sticking out at the surface. Also, I don't know how much vibrating or rodding must be done to properly fill the forms, and I don't know whether the water content of the mix should be adjusted to make finishing a little easier.

By the third job, we had worked out a detail that looked good for a while. (This is shown in the sketch.) We became enamored of the detail: it was clean, strong, and easy to install, But this year we received some heavy warnings about the toxic quality of pressure-treated plywood. The warnings applied to the craftsmen as well as the end users, and suggested they wear gloves and respirators for handling and cutting pressure-treated wood. After hearing these warnings, we're not sure what to do. Any ideas out there?

The Novelty Factor

Last season, I specified a project with a fiber-reinforced, full foundation. I believe that the foundation contractor charged a premium, more than he would have charged for a steel-reinforced foundation. This may be the "novelty factor," an extra charge for requesting something a little different. Actually, the labor cost is a lot less since there is no bar or mesh to place. And the material cost is about the same: the $10 a yard for the fibers is paid for by the savings on steel.

Afterward, I talked to the crew, and they were quite in favor of the stuff. They described their experience and told me about whaling away with a sledge on some of the spillover, and how tough it was.

Finishing concrete with fiber reinforcement *does* take care. Finishing the top of a wall is also fussy, and requires a wait, followed by careful work. This year's full basement had an extremely ragged top edge that may have been caused by an impatient crew who wanted to wrap up the pour and go home.

Incidentally, careful finishing does have lasting effects. All of last season's projects still have extremely smooth floors and hardly any sign of hairiness.

Yet everyone remains skeptical. Architects aren't sure about it, and contractors are extremely cautious. I've had at least two foundation contractors change their minds after verbally agreeing to do a job. A couple of contractors wanted to use both fiber and steel—at a heavy premium, naturally.

The transit plants are skeptical, too, and this skepticism must be real since it goes against their self-interest in selling the fiber reinforcing. Many plants now carry it and will add it on request, but without comment or recommendation.

The skepticism extends equally to the fiber reinforcing and the ultrathin slabs, even though the track record of fibers is well demonstrated, while the ultrathin slabs are highly unconventional and unproven.

By now, I've dirtied my hands on both the fibers and the thin slabs and can see some of the limitations. Without hesitation, I recommend fiber reinforcing for control of cracking in almost any situation. The ultrathin slabs generally look good, too—possibly excellent for light-frame buildings—and there are a couple of good examples out there. At the present time, however, I don't know what problems might show up. ■

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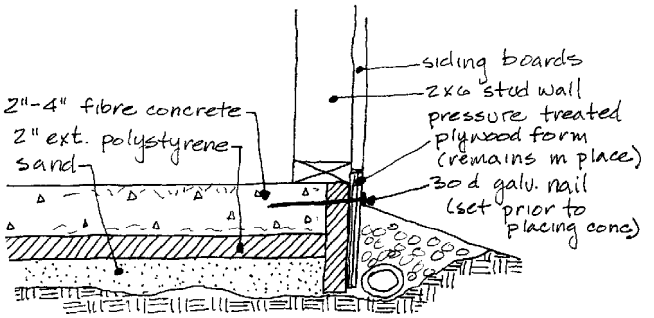

Thin slabs are easy to insulate because the edge is not thickened. Millions of hair-sized fibers keep the concrete from cracking,

FIBERMESH MAGIC

I now specify fiber reinforcing for all frame-building foundations.

In this system, a bag of about a million two-inch, hair-sized fibers is dumped into each yard of the transit mix. The fibers give the concrete quite a bit of extra toughness and impact resistance, and are much more effective than steel at controlling small cracking.

The fibers add approximately $10 per yard to the cost of the concrete, but require no further work by the contractor, and no reinforcing. I particularly like that—it saves an inspection, and avoids heated discussions on the merits of reinforcing (especially when the reinforcing has been omitted and the transit truck has just rolled onto the site).

In Maine, the most generally available product is Fibermesh, distributed by Buckeye Industries of Scituate, Mass. This year, most transit yards will mix it in on request, with no recommendations or attempts to push the product.

There are two problems with the fiber-reinforced system. The first involves finishing, particularly on slabs. The fibers hold water and reduce evaporation, so the surface is somewhat slow to set. I usually suggest that the contractor let the crew off for a long lunch after the slab is placed, and allow two or three hours before the surface is power-troweled. With the extra setting time, the finishing becomes somewhat easier, but even then troweling is a little slow.

The second problem relates to the extreme toughness of the fiber-reinforced concrete. This makes knocking holes in the concrete both difficult and messy, but it can be avoided by careful planning of the sewer, water, and drainage holes. Then again, I know of more than one contractor who skips the knockouts because "the carpenters always move the holes around anyway." ■

—H.H.