

KENZO UNNO

fabric-formed walls



Photo © Tsunenori Yamashita (Tokyo, Japan)

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The principle architect of Umi Architectural Atelier in Tokyo Japan runs a very unusual architectural practice. In a building culture that tends to reject the very idea of a design-build practice, he serves his clients as both designer and contractor. His designs, to date mostly single-family houses, are original, sensitive, and adventurous. Although the larger subject of his architectural works as a whole certainly deserves attention, this article will concentrate solely on his extraordinary inventions in the field of cast-in-place fabric-formed concrete walls. Unno is the undisputed master of the design and construction of such walls. He has invented and developed several elegant methods of using thin flexible textile sheets to cast walls of great beauty and economy. These methods are collectively known as URC (“Unno Reinforced Concrete”).

Unno is deeply concerned with providing simple methods of construction that people can use to build houses for themselves. These concerns originate in the events of the Kobe earthquake of January 17, 1995, and in his profound spirit of generosity. He has developed several different yet related URC methods of forming cast-in-place walls. All of these methods provide large reductions in the materials consumed in construction. Most noteworthy perhaps is his method of using sheets of rigid insulation in place of plywood on the flat side of a fabric-cast wall, while using a plastic netting as a formwork membrane on the ‘finished’ side¹. The insulation, which is captured by the concrete cast against it, provides an insulated structural wall with essentially zero construction waste as no plywood or other disposable rigid mold materials are required.

It is perhaps stating the obvious that his walls are also extraordinarily beautiful. They have an essential and sensual beauty that is unlike any concrete wall you have ever seen or felt. This is all achieved with the utmost simplicity of method and detail. This article provides a general technical introduction to URC wall forms while at the same time, I hope, bringing some well deserved attention to the buildings being produced by this very talented and dedicated architect.

TWO BASIC METHODS OF FORMING URC WALLS

Because a fabric membrane can only resist tension forces, it will automatically deflect into a repertoire of efficient tension curves when loaded with wet concrete. Any cast-in-place fabric-formed wall will require a field of supports to distribute these naturally occurring tension curves across the wall surface (otherwise the “wall” would form one huge deflection). Unno uses two basic methods to restrain the formwork membrane, as described in the pages below. In one, the flexible membrane is restrained by linear frame elements, such as wood studs or steel pipes, held in place either by external bracing or by standard form-ties. This “Frame” method is illustrated directly below. The second basic method uses closely spaced form-ties with washers, producing a quilt-like pattern (figs. 3, 4 and figs. 11-16).

1. Frame Method



Fig. 1 shows Unno’s first fabric-formed wall construction. This is the Mitsushi Turu residence in Kawasaki City, Kanagawa, 1997 (see fig. 4 below). Here he uses a “frame” method where the netting is stretched along the inside surface of a braced stud wall. The concrete is vibrated externally by poking the wet concrete with a stick as shown. (Fabric formworks in general lend themselves to simple and very effective methods of external vibration.)



Fig. 2 shows the surface of concrete wall (from a later construction) produced by the “frame” restraint method. Here can be seen the vertical indentations given by the restraining frame members as well as the impressions left by the standard form-ties that were used in this application.

2. Quilt-Point Method



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Fig. 3 shows a wall formwork supported in a pattern of individual ‘quilt’ points provided by standard form-ties equipped with washers on the outside of the form. Again, because of the flexibility of the formwork membrane, external vibration can be used to consolidate the concrete.

It can be appreciated from this photograph that the state of the concrete inside of the wall forms is made much more evident when a flexible form is used. Voids or other inconsistencies can literally be felt through the formwork membrane and consolidation of the concrete can be accomplished precisely where it is required. Excellent concrete finishes are easy to produce in permeable forms.

Note here how the net fabric used by Unno allows cement paste to escape. Properly selected geotextile fabrics will not do this. By choosing the right fabric, a suitable permeability will allow only air bubbles and excess mix-water to escape through the formwork membrane without bleeding any cement paste.

Note also in fig. 3 the solid panel portion of the formwork seen at the bottom right of the photo: conventional rigid formwork can be integrated into a fabric formwork wall at any point simply by placing rigid panels over the fabric membrane. The fabric in that portion of the wall then acts as a conventional form-liner would.

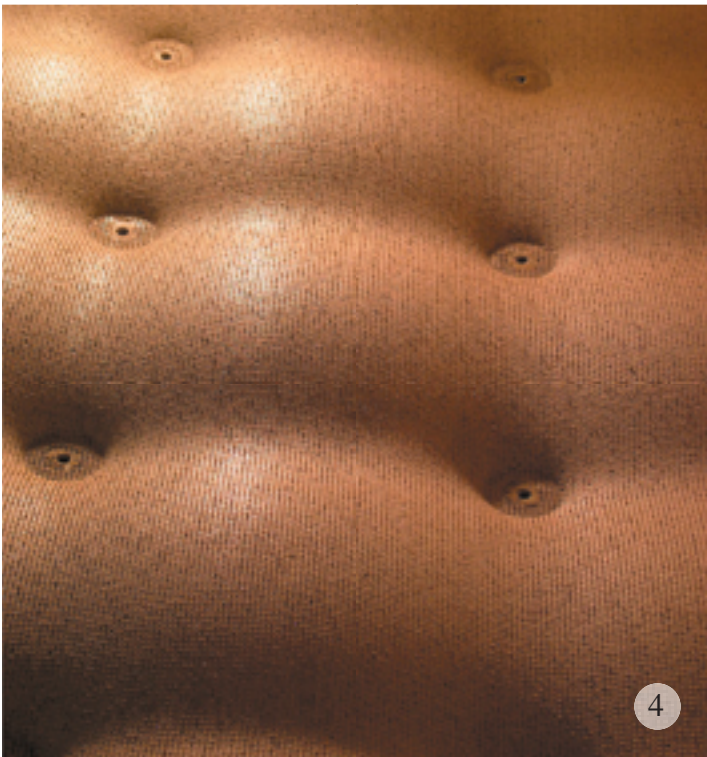


Fig. 4 shows the typical, and sensual, quilt-like surface produced by this method