

# Fabric Formwork Applications

The previous article covered but several of the examples where a flexible fabric formwork has been put to practical use forming architectural applications. Fabric forming applications include:

- Foundations
  - Continuous and spread footing systems.
  - Piers
- Walls
  - Cast-in-place
  - Precast
    - Shotcrete thin-shell curtain wall systems.
- Beam and floor systems
  - Trusses
- Columns
- Vaults
  - Prefabrication of thin-shell funicular compression vaults.
  - Molds for stay-in-place concrete formwork pans.
- Civil engineering works
  - Revetments, underwater pile jackets and pond liners.
  - Coastal and river structures

While it's true that a flexible fabric formwork may be used nearly anywhere a rigid formwork is used, a significant amount of research remains to be done to bring these systems into everyday practical use by the construction industry. ACI (American Concrete Institute) Committee 347 has addressed rigid formwork since 1963 but it was only recently (2005) that ACI Committee 334 introduced the construction of shells using inflated forms even though several methods of construction using inflated forms have been available since the early 1940's. It is hoped standards and guidelines for using flexible fabric formworks will be developed in a timelier manner for the design community to take full advantage of this method of forming concrete members.

## Foundations

It's been said "*The beautiful rests on the foundation of the necessary.*" – Ralph Waldo Emerson". This quote aptly applies to fabric-formed structures as well beginning with the foundations.



Fig. 1. Spread/Continuous Footing Application



Fig. 2. Spread/Continuous Footing Application



Fig. 3. Spread Footing Application



Fig. 4. Spread Footing Application



Fig. 5. Column Application



Fig. 6. Column Application

Foundations, continuous and spread footings and piers (or columns), have also benefitted by the use of flexible fabric systems. Since 1993 Richard Fearn, owner and founder of Fab-Form Industries, Ltd., has developed and marketed several fabric forming products including; Fastfoot® for continuous and spread footings (Figures 1 and 2); Fastbag® for spread footings (Figures 3 and 4) and Fast-Tube™ for piers and columns (Figures 5 and 6). See Fab-Form Industries' website listed under External Links for additional information.



## Walls

### Kenzo Unno



Fig. 1. Frame Form Method

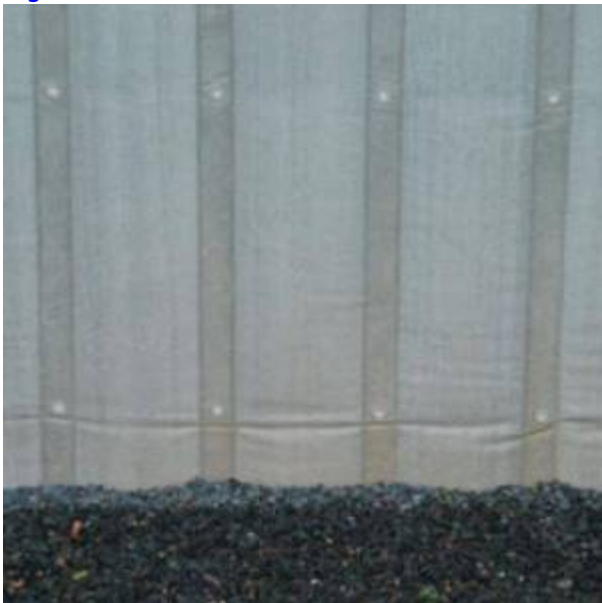


Fig. 2. Frame Form Method



Fig. 3. Quilt-Point Form Method

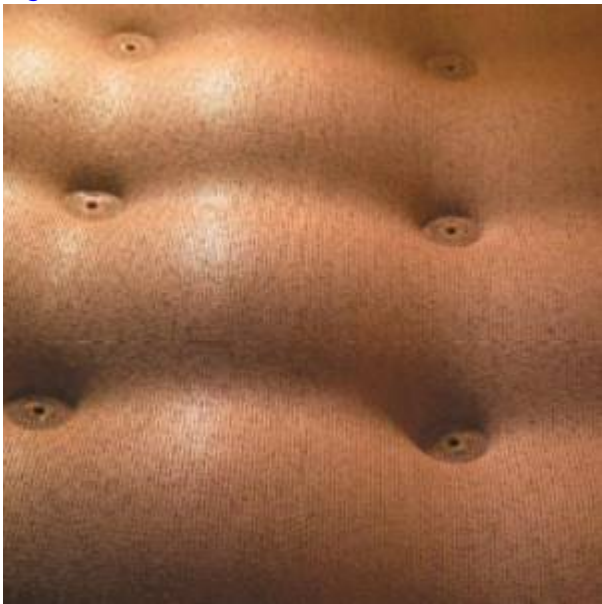


Fig. 4. Quilt-Point Form Method

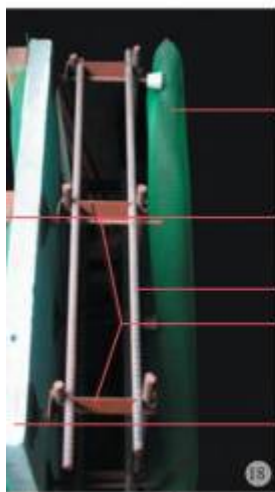


Fig. 18 illustrates Unno's Zero-Waste Formwork Membrane (in this case scaffold membrane could also be a re-usable polycarbonate tile. This Membrane would be restrained by "frame" or "quilt-point" methods (not shown in image) as described earlier. Removal of the membrane leaves a beautiful exposed concrete surface with thermal mass to the interior.

- Studs/Furring: used to support rigid insulation during placing concrete, and remaining in place in finished walls
- Reinforcing Steel
- Form-Ties
- Rigid Polystyrene Insulation

The diagram shows a back-up layer of netting placed outside of the rigid insulation. Unno initially used this location as a kind of structural back-up insurance in case the rigid insulation failed during placement. As he has never had a failure of the insulation he no longer uses this layer of netting.

Fig. 5. Zero-Waste Formwork

Kenzo Unno has developed two basic fabric formwork methods, the Frame method (Figures 1 and 2) and the Quilt-Point method (Figures 3 and 4). With the frame method the net fabric is stretched over the inside surface of a braced stud wall and secured with standard form ties. The wall is vibrated externally, here by poking it with a stick. With the Quilt-Point the net fabric is secured around the perimeter and standard form ties with washers are used to tie the two layers of fabric together assuming this quilt-like wall finish is desired on both sides. Again the wall is vibrated externally.

Kenzo Unno had also gone "green" even before green was "in". With his latest formwork development, the Zero-Waste form system, his hope is to contribute to sustainable construction and a reduction in construction waste, see Figure 5.

For more information on Kenzo Unno's formwork methods please see this article: [Kenzo Unno Article](#)

### Sandy Lawton



Fig. 1. Black Residence "treehouse"



Fig. 2. Black Residence "treehouse"



Fig. 3. Black Residence "treehouse"



Fig. 4. Black Residence "treehouse"



Fig. 5. Black Residence "treehouse"



Fig. 6. Black Residence "treehouse"

Figures 1-6 above show the wall formwork Sandy Lawton used for the "Treehouse" for Chuck and Wendy Black's residence. Here Lawton used a geotextile fabric held in place by standard form ties and wood studs space vertically.

## 2009 Fabric-formed Concrete Workshop



Fig. 1. Wall Form Assembly



Fig. 2. Wall Form Assembly



Fig. 3. Wall Form Assembly



Fig. 4. Wall Form Placement



Fig. 5. Wall Form Placement



Fig. 6. Adding Carbon Fiber Grid



Fig. 7. Wall Form Placement



Fig. 7. Wall Form Placement



Fig. 8. Wall Form Placement



Fig. 10. Concrete Pour



Fig. 11. "Vibrating" Concrete



Fig. 12. Concrete Pour



Fig. 13. Concrete Pour



Fig. 15. Completed Concrete Pour



Completed Concrete Pour



Fig. 16. Completed Concrete Pour



Fig. 17. Completed Concrete Pour



Fig. 18. Completed Concrete Pour

At a 2009 Fabric Formwork Workshop held at Yestermorrow Design/Build School in Warren, Vermont students and instructors constructed two walls of a student “cabin”. This workshop gave students and instructors alike the opportunity to experiment with and have a “hands on” opportunity to work with fabric-formed concrete.

Figures 1-3 above show students and instructors assembling the 2×6 wood frames to which a translucent geotextile fabric was fixed. Figures 4-5 show the outside wall sections being placed on the continuous strip footing. Figure 6 shows the carbon fiber grid, used as the main reinforcing, being installed.

Figures 7-9 show the inside wall formwork and fabric from each wall section being sown together to form pilasters. The inside and outside wall sections were tied together primarily using threaded nylon rods and metal nuts and washers. Figures 10-13 show the concrete being placed. As can be seen in Figure 13 the translucent fabric allowed one to see exactly what level the concrete had been poured to.

Figures 14-18 show the walls after all the concrete has been placed and before the formwork has been stripped.



## Beam and Floor Systems

**Sandy Lawton**



Fig. 1. Black Residence "treehouse"



Fig. 2. Black Residence "treehouse"



Fig. 3. Black Residence "treehouse"



Fig. 4. Black Residence "treehouse"



Fig. 5. Black Residence "treehouse"



Fig. 6. Black Residence "treehouse"

Figures 1-6 above show how Sandy Lawton used fabric formwork to form the beams for the "Treehouse" for Chuck and Wendy Black's residence. Here once again a geotextile fabric is employed by Lawton to create the tight curves required by the design.



## Columns

### Fu Tung Cheng



Fig. 1. Casa Dent



Fig. 2. Casa Dent

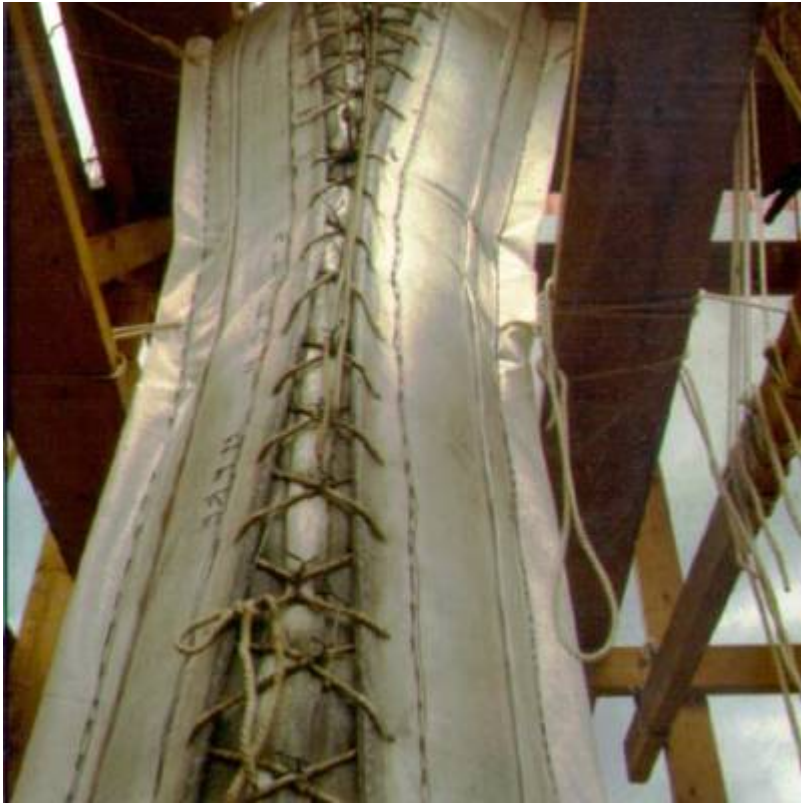


Fig. 3. Casa Dent



Fig. 4. Casa Dent



Fig. 5. Casa Dent

Figures 1-5 above show the fabric forming Mark West used for the columns of this private villa in Culebra, Puerto Rico designed by Fu Tung Cheng of Cheng Design .

## Sandy Lawton



Fig. 1. Black Residence "treehouse"



Fig. 2. Black Residence "treehouse"



Fig. 3. Black Residence "treehouse"

Figures 1 and 2 show the fabric formwork, supplied by Fab-Form Industries, used for the columns in this "Treehouse" for the Chuck and Wendy Black residence. Figure 3 shows the column after the formwork has

been stripped.



## Vaults

See [C.A.S.T.](#) research.



## Civil Engineering Works

*Place text and photos here.*



## See Also

*Place text here.*



## References

[1] *Place text here.*

[2] *Place text here.*



## External Links

[Fabriform](#)

[Fab-Form Industries, Ltd.](#)

[The Centre for Architectural Structures and Technology \(C.A.S.T.\)](#)



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