



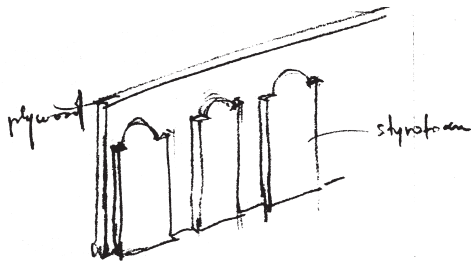
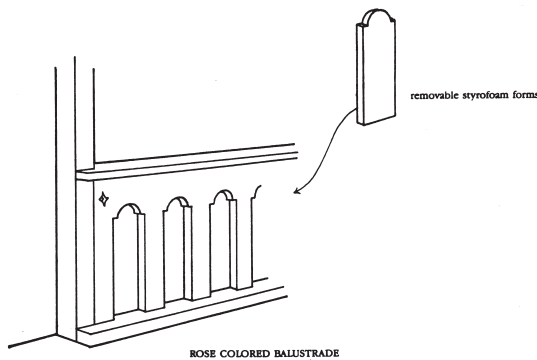
5 / CHEAP AND BEAUTIFUL WAYS
OF FORMING CONCRETE

One example of a very simple way of making beautiful and complex shapes in concrete by hand and rather cheaply relies on the use of styrofoam. Large blocks of styrofoam and polystyrene can be bought very cheaply. They can be carved far more cheaply than wood, and the form of a very complex object can be built up rather fast. The styrofoam is then placed, as a liner, into a plywood box which is built around it and the concrete is poured into the styrofoam mould.

I have used this technique to make brackets, arches, balustrade shapes, windows with beautiful shapes; it has enabled me to make things which could never have been done by conventional techniques without great increases in cost.

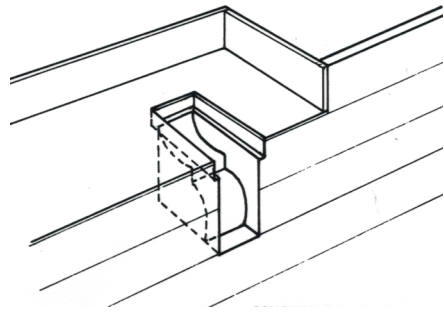
The technique has two important side effects: first, it does not easily create the machine-perfect finish which we have become accustomed to in the 20th century. It produces the form and the beauty of form, but with a certain roughness which is more typical of the objects made in more ancient societies. In my eyes, this is positive because it is an automatic side-effect of life anyway, and is to be expected. But for people who are used to smoothly finished things, the roughness is slightly unusual and takes getting used to.

For that reason, some craftsmen and construction workers may turn up their noses at it. In the construction of the giant capitals in the Great Hall in Eishin, the carpenters wouldn't do



Left: Diagram of formwork. Right: Concrete balustrade made from this kind of form by pouring concrete into low-budget assembly of two sheets of sheetrock, braced, and with hand-cut styrofoam fillers.

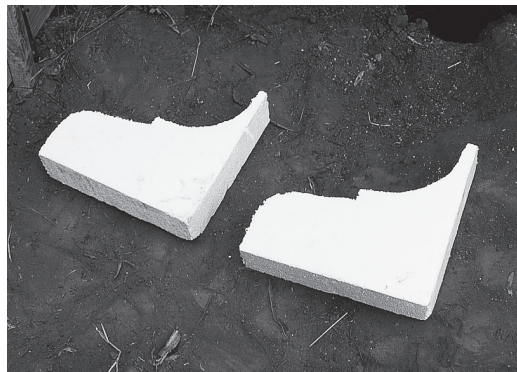
it. For them it was a matter of pride to make the complicated shape of the capitals I had drawn out of wood. What they did made the beautifully-shaped capitals uneconomical—and to me, therefore, uninteresting. They were built anyway, in spite of the cost, because the client found the money for it. But the carpenters' attitude was unnecessary and, if perpetuated, would simply rule out the making of such beautiful shapes in concrete. As a practical matter, it is just the cheapness of the styrofoam technique which makes the



The formwork for the bracket



Checking the shape in styrofoam mockup



Fillers for the forms: the negative shape



The filler in position before the pour



Finished concrete bracket



Light weight, low-cost guidework before shooting the Martinez house in gunite. Note the extreme lightness of the guidework, as it is first put up, which allows easy creation of beautiful shape and proportion.



Guidework not long before it is ready to shoot



Guidework with mesh and window opening in place

difference between being able to bring life to the field of centers and not being able to.

A larger and more general version of the styrofoam-forming technique involves the use of

gunite. Gunite is a high-strength concrete made of sharp sand and cement, carried in air under high pressure, shot dry from a hose, with water added through fine holes pierced in a brass ring



*Shooting gunite over forms to make the ceiling vault and roof of the workshop.
I spent hours on that bridge shooting a fine stream of material to shape the outer vault surfaces.*



*Left: After the gunite shoot. Right: Ceiling detail, in a ceiling formed by gunite
shot over cheap styrofoam fillers on a plywood form.*

within the hose, just at the mouth of the hose, at the last minute before the material leaves the hose. The concrete which comes out of the hose in this technique is immensely stiff and strong. It has no tendency to slump. One can shoot walls, columns, vaults, ceilings. It stays where you put it.

Ordinary poured concrete is controlled (in shape) by its formwork. Because the formwork must withstand huge hydrostatic pressures of the wet concrete, formwork is usually massive, crude, and not easily susceptible to subtle modification

of the kind which the field of centers needs. Formwork for intricate shapes is almost impossibly expensive.

The formwork also makes the shapes hard to “see.” One sees the reverse of what is being made, and it is therefore difficult to modify and adjust to get the proportions right and thus very hard to make the field of centers come out right.

Gunite, which doesn’t require formwork, is different. It is often used for construction of dams, warehouses, and tunnels where the form



The Martinez gunite house, finished and painted. Christopher Alexander and others, 1978–84.



Martinez house from the side, after the shoot, and after roof surface and windows have been installed

is uncomplicated. Experiments were also made in the 50's and 60's to use it for making houses. It was often shot over inflated balloons and then produced an amorphous architecture of ice-cream-like shapes. These kinds of shapes cannot produce positive space easily and rarely produce a living field of centers.

However, I realized that the technique of gunite would make it possible to produce complex, beautiful guide-work easily and cheaply. It is possible to form beautiful and complex shapes with cheap, lightweight guide-work made of foam, masonite, and light-weight cheap wood, one-by-twos, one-by-fours, and so on.



*Two of the series of lacework concrete trusses we shot in the San Jose Homeless Shelter.
Christopher Alexander, Gary Black, Carl Lindberg, 1988.*

This guide-work is also easy to see, so that it can be modified as one sees the shape emerge. This is perfect for the construction of the field of centers since it allows one to maintain a continuous process of judging and changing, judging and changing.

We began experiments using gunite in late 1977. It took almost seven years of experiments to make it work smoothly. Now we know how to do it, simply, cheaply, and effectively. Illustrated above is a large concrete truss, shot in place against guidework in the air.



5A / WOOD AND CONCRETE COMBINATIONS

Conventional wisdom of the construction industry says wood structures and concrete structures should not be mixed in a single structure.

But in many cases, the centers you need to make on the outside of the building, and the centers you need to make on the inside are rather different, in scale, pace, and emotional quality. For this reason, my colleagues and I have often used combinations of concrete and wood.

In one technique we make centers, flexibly, by forming and pouring concrete: shapes, beams, columns, capitals, edges, bases. On the inside, at the finer scale which you want near your skin, wood and plaster — carved, shaped, finely molded, smoother — are more suitable.

So in order to have a single way of building which allows the cruder more massive centers on the outside and the finer centers on the inside,