ter it. All this is hugely positive. But as implemented in its evolved high-tech version, because of earthquake problems, and for various other structural reasons, another way of using straw bales has evolved; this adds an inserted standard timber frame — usually four-by-fours about six feet apart — and ties the frame together with a beam and braces.

In this new form, now widely used throughout the United States, the earthquake problem is solved, but the high-tech straw bale technique has lost nearly all the adaptive qualities of the original straw bales themselves. They have now become merely infill panels in a frame which is drawn, fixed, and built to building department specifications, and is far more rigid than the idea behind the original use of bales as highly flexible building blocks. The straw bales have become cumbersome infill panels that are bigger and more expensive than conventional infill — with some good qualities — but losing altogether the beauty, the ability of a straw-bale wall to be determinative as a structure in its own terms, thus losing altogether the possibility of fine tuning and adjustment which made it so attractive in its original form.

The supposedly "green" attributes of the material are still present. But the essential thing — that the material is able to take its place as part of a living process — has been lost. It has been turned into yet another dead, technically perfected and specifiable system component in a non-living process.

The essential thing about a living architecture is not the greenness of its materials but the capacity of its materials to form living structure in the complex, geometric, life-affirming sense that has been demonstrated in this book. That requires a different kind of thinking, a determination to focus without wavering on this aspect of their adaptive performance.

3 / WHAT MATTERS IS THAT WE HAVE TECHNIQUES OF CONSTRUCTION WHICH HELP US MAKE LIVING CENTERS

The biggest issue is adaptability. Materials and methods of construction must be of such a kind that they can create details freely enough to intensify the field of centers at every point. And the materials must allow builders to have direct human control over every evolving center and thus to make each one, in some sense, "by hand."

In recent years there have been some efforts to find materials which allow all this. Certain architects and builders, inspired by the natural building movement, try to use materials which are plentiful, easy and cheap to get in many parts of the world. Some of these techniques, almost as an extra bonus, tend to create walls which are more profound as centers (rammed earth walls, for example, are thicker, more natural, and create masses that have more feeling), and are able to incorporate more adaptation, naturally, almost without effort. It is important that the growing use of such materials should continue. As the Earth's population grows, and resources dwindle, these techniques will increase in importance.

However, there is a slightly dangerous, nearly archaic aspect to such ideas and experiments which is not consistent with advances in strength, technology, durability and performance. We need to look for those new materials which have superior performance, are truly "modern" as materials, and *yet* have the character needed to support fine-scale adaptation and unfolding.

To this end, there needs to be emphasis on materials and processes which can bring *life* into the building. We need a continuous program of invention, then, aimed at finding new materials and physical techniques which support living character and beauty of buildings. In any case, some kinds of building technique allow the unfolding of living structure, while others do not. Historically, traditional building techniques — wood, brick, stone, plaster — all did it. But most of these techniques are gone. They cannot be resurrected easily, since for the most part the cost of labor has made them impractical today.

But the need for adaptation does not necessarily require a return to hand-craft. For reasons stated earlier, that would often be completely impractical, given modern methods of construction, and changing the ratio of labor cost to materials cost.

What is needed is a range of physical techniques — the most modern methods of fabrication and invention — which allow adaptation and hand fitting of details to individual circumstances *without* the labor-intensive hand-craft methods which were typical in ages gone by.

The processes must allow each center freedom to develop according to its context, in a fashion which cannot be predicted when the construction starts. To achieve this, we have to use methods which allow the gradual formation of centers, one by one, under conditions which allow each center to become whole according to its place within the field.

Not all material systems can do this easily. For example, stud-wall construction and concrete-panel construction make adaptation difficult. In these techniques the builder assumes too readily that he knows what he is going to build, pretty much down to the last detail; and then he goes ahead and does it, without thinking or looking carefully while he is doing it. Concrete panels make adaptation all but impossible. Stud walls allow adaptation, but do not *encourage* the creation of living centers.

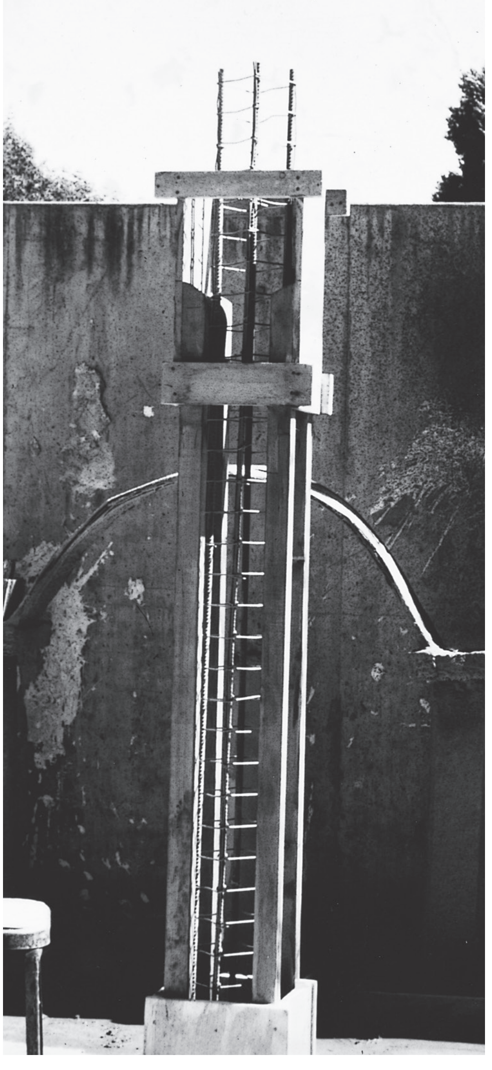
On pages 521-22, I show an example that naturally invites adaptation and special shaping. This is a column made by shooting gunite into a low-cost open form. The form allows elegant shaping; the process of the Reed gun (the first gunite gun) is sophisticated and produces a high-strength concrete very rapidly which stays in position when it is shot. This is capable of producing an infinite variety of forms and shapes by high-strength, high-performance technique, while allowing maximum flexibility in the builder's hands, at relatively low cost.

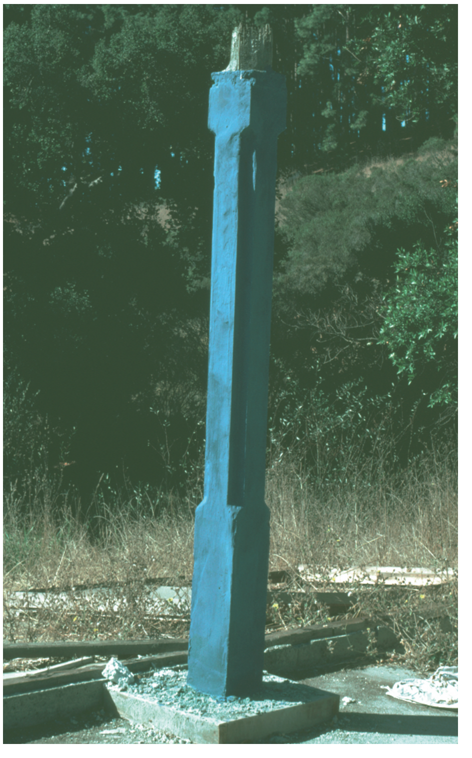
More generally, in order to produce the field of centers in simple, economical, and normal ways which can become everyday for millions of people in today's society, *I would argue, that it will require, primarily, process-based methods — methods which use high technology to give us processes, not components, and processes which can create sophisticated elements and members, fast and cheaply, yet fitting local circumstance and the eye of the person doing the work.* Technology itself is perfectly capable of defining new techniques to help create a living field of centers: fast methods of cutting, shaping, pouring, forming. It is capable of using computer-controlled processes and processes where we investigate and create a far richer array of shapes than could be done in the first machine age.

Creating living structure in the environment, therefore, requires that we actively invent materials, methods, building systems, and ways of building, which have these characteristics — and which make it easy to encourage the creation of living structure.

It may strike you as unusual, that we should be required to invent so much. In the last hundred years, architects have, for the large part, been used to a fairly passive role as far as invention of new construction technology is concerned. Architects in the 20th century were routinely taught to assemble components specified in Sweet's catalogue, to use only available techniques and materials. But existing and available techniques from Sweet's catalogue, in the majority of cases, do not permit — and certainly do not encourage — creation of living structure.

Those few architects and builders who believe that they are somehow helping to make things more human by going back to stone, mud, thatch, and other materials used in primitive cultures, are — I believe — deluding themselves that this could ever enter widespread mainstream building processes. No matter how wonderful a





A recently invented, process-based technique. Left: Guidework for a column that is to be shot in gunite. Upper right: The jig I made so that I could cut compound curves on a two-by-two to build the corners of the form. This curve, cut off the plane of the diagonal, allows a flare to be created, making an elegant (and cheap) transition from the column shaft, to the capital and base (the finished shape that comes out is visible in the lower picture). Lower right: One of the first experimental columns, showing the result of shooting gunite into such an open form. The flare created by the cut two-by-two is visible on the corner of the column, where shaft meets base. In the picture on page 523, you may see columns of this kind in one of our building projects. Christopher Alexander, 1979.

stone wall might once have been, if you cannot afford to build a stone wall now in a house of ordinary price, it is wasteful and foolish to dream too much about stone walls. Stone walls were part of the technology, economic life, and social life of another era. Primitive technologies are unlikely to work for us because, so often, they just don't work economically.

We therefore need to invent altogether new construction techniques which in *new* ways make it possible to unfold a building so that every part becomes just right, and so that every part has its life.

Since we have had, during the last 100 years, almost no modern tradition of such building techniques, architects must now, necessarily, play a major role as inventors of new techniques.

Evening: a view from the porch of the Martinez house. The concrete walls, beams, and columns are all made with ultra-low-cost formwork, shot by the new techniques which are described in the text. We built this house (which later became one of our offices) over a period of time, and various CES staff at different times worked on it with me at different times, including Harissos Tsiringas, David Dacus, Gary Black, Olasheni Agbabiaka, Jonathan Fefferman, Carl Lindberg, Eleni Coromvli, Seth Wachtel.