INTERFACE BETWEEN MEMBRANE AND SUPPORT STRUCTURE

or

"A plea for more thought"

David Oliver, A.R.A.I.A.
B.Sc. (Arch), B. Arch. (Hons.)

Managing Director, Hannaford Architects (Qld) Pty Ltd
30 King Street, Buderim, Qld. 4556. Australia.

This Paper is somewhat lightweight (pun intended) by comparison with other topics being discussed at this conference. None the less, to my simple way of thinking it is of paramount importance and all too often is only briefly dealt with by membrane designers. Perhaps it is because, like myself, we (designers) are just coming to grips with the problems of converting structural membranes (capable of the most elegant of free form shapes) into useful building enclosures. We tend to spend such considerable time surmounting these difficulties that little if any time is spent in detailing the connections to the support structure. Mostly it gets left to others with the results being the most elegant structures with some of the ugliest connections ... perhaps forgivable if concealed from view, but all too often in "full frontal" for all to see.

I have no dispute with the Modernists[1] dictum "form follows function", however even the Brutalists abhorred that which was plain ugly. What I'd like to do in this Paper is quickly examine a random selection of structures to analyse the membrane/structure interface.

You may be wondering about the "armidillo" structure (plate 1). It is only to provide intrigue ... we're interested in what is above (plate 2).

The canopy shelter

These are obviously the simplest structures to support, generally elegant, free form shapes, tensioned at the edges with the forces drawn together at nodes, strutted over pylons and restrained at buttresses. These structures are very simple, very elegant, use a minimum of structure and utilize almost exclusively the structural capabilities of the membrane.

Needless to say, building designers have become enchanted with the potential of such structures and inevitably began dreaming of membrane structures as building enclosures.

The translucent roof

A natural progression was the translucent structural membrane roof (plates 3 and 4).

At once you could provide natural daylight within while providing shelter from the elements and becuase of the amazing absence of dead load, all with the minimum of structure. Intriguingly for such elegant, seemingly gossamer thin roofs, the restraints required to secure these canopies were considerable. The result in many cases has been considerable ugliness with all the hall-marks of an afterthought (plate 4).

The detailing of the membrane/structure interface is no small problem and if to be left visible, consumes considerable thought and in a lot of instances is still, for one reason or another, not adequately resolved.

Another option is to completely hide the structure, a not unreasonable option given the expense that may be incurred (both designing and fabricating) a visually appealing membrane/ structure interface.

The membrane novelty

One abrogation, at which I cringe every time I notice one, is the membrane structure as novelty. I insert this here for while not quite being within the scope of this Paper, they are almost universally characterised by clumsy detailing and inappropriatness.

The unwritten rule of current designers must be: "If you haven't got a fabric structure in it somewhere, you are definitely not HIP". How many utterly boring buildings do we see with a dinky little fabric canopy over the entrance ... or in our case (plates 5 and 6) two totally extravagant skylights where the support structure, superbly detailed in this case and at many times the cost of the membrane makes one wonder ... why use membranes at all?

The complete membrane building

This is the ultimate outcome of structural membrane technology meeting totally the requirements of building enclosure. Zenith I (plates 7 and 8) had to tackle all the problems of such an enterprise; the problems of rectilinear door inserts in the membrane, the membrane to ground detail, the membrane to structure detail. While the solutions here are relatively successful, the sophistication of the designers' ability can be clearly seen in the evolution of Zenith II.

Thus, in summary, some of the simplest ideas are the most memorable and if all I have done today is provoke a little more thought from designers, then any small contribution to this conference has been worthwhile. As a continual reminder to myself of the enormous potential of membrane structures for the future I still wait for a commission to design an earth shelter membrane structure (plates 9 and 10).

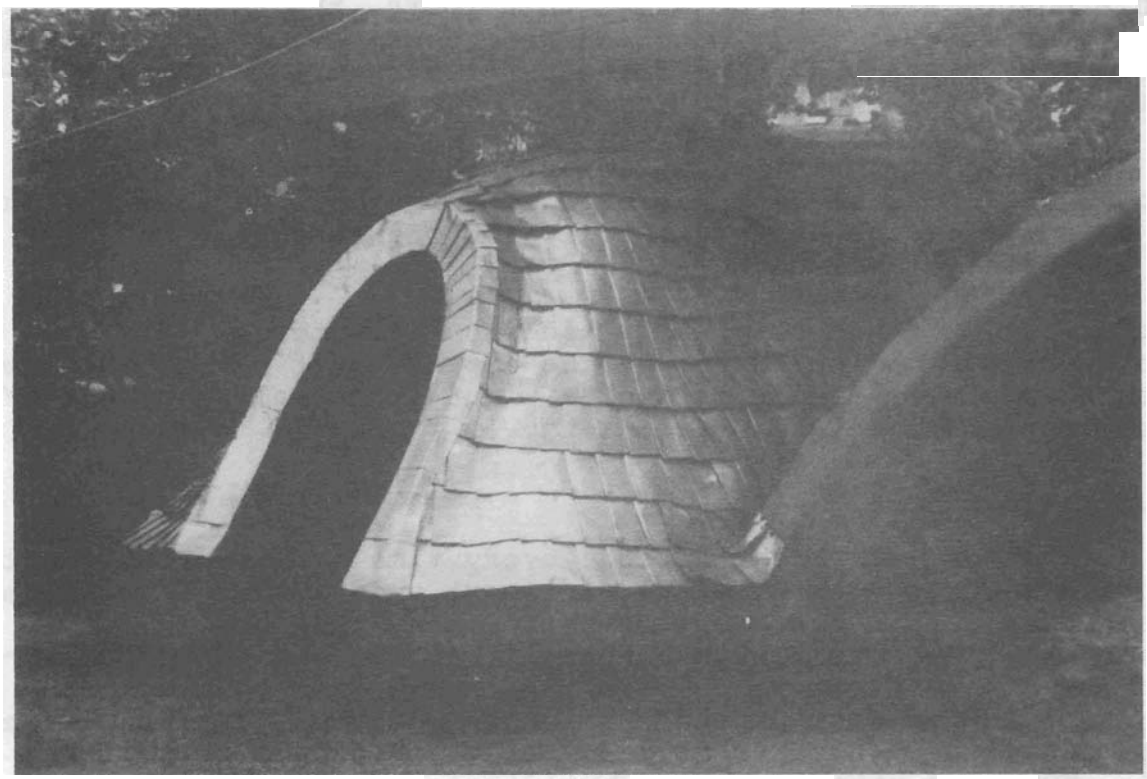

PLATE 1.

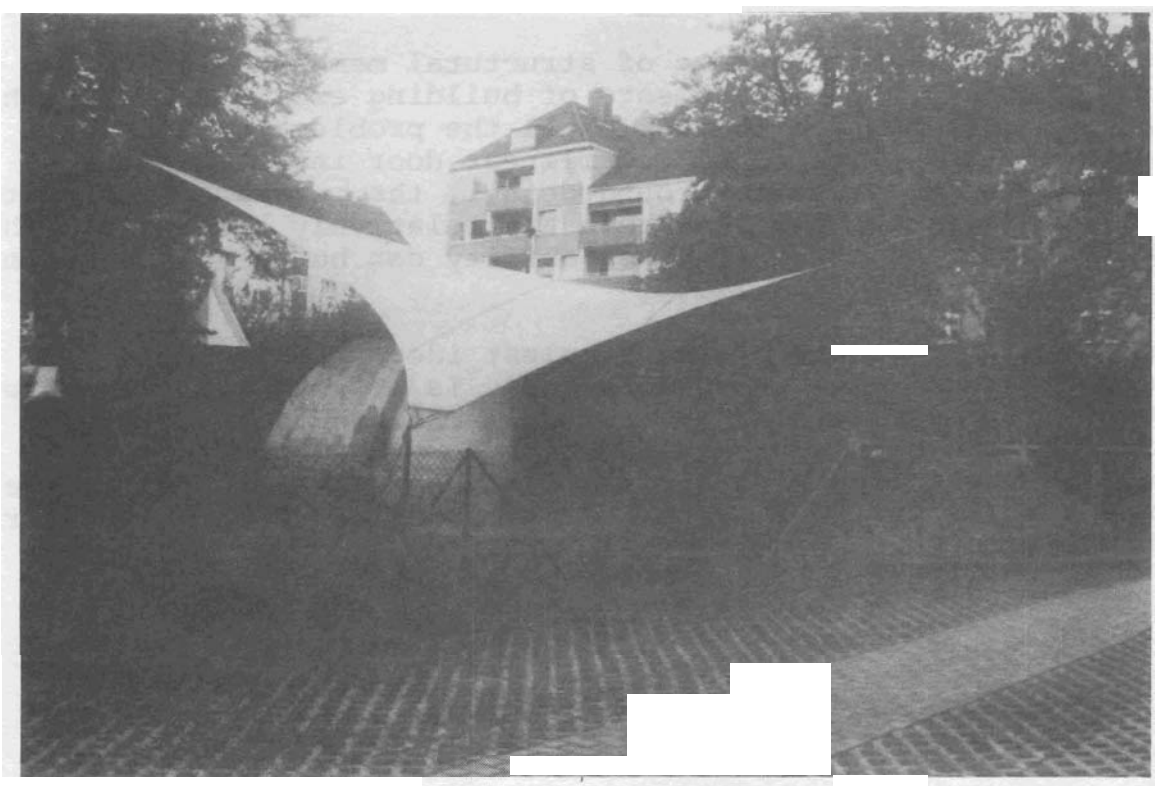

PLATE 2.

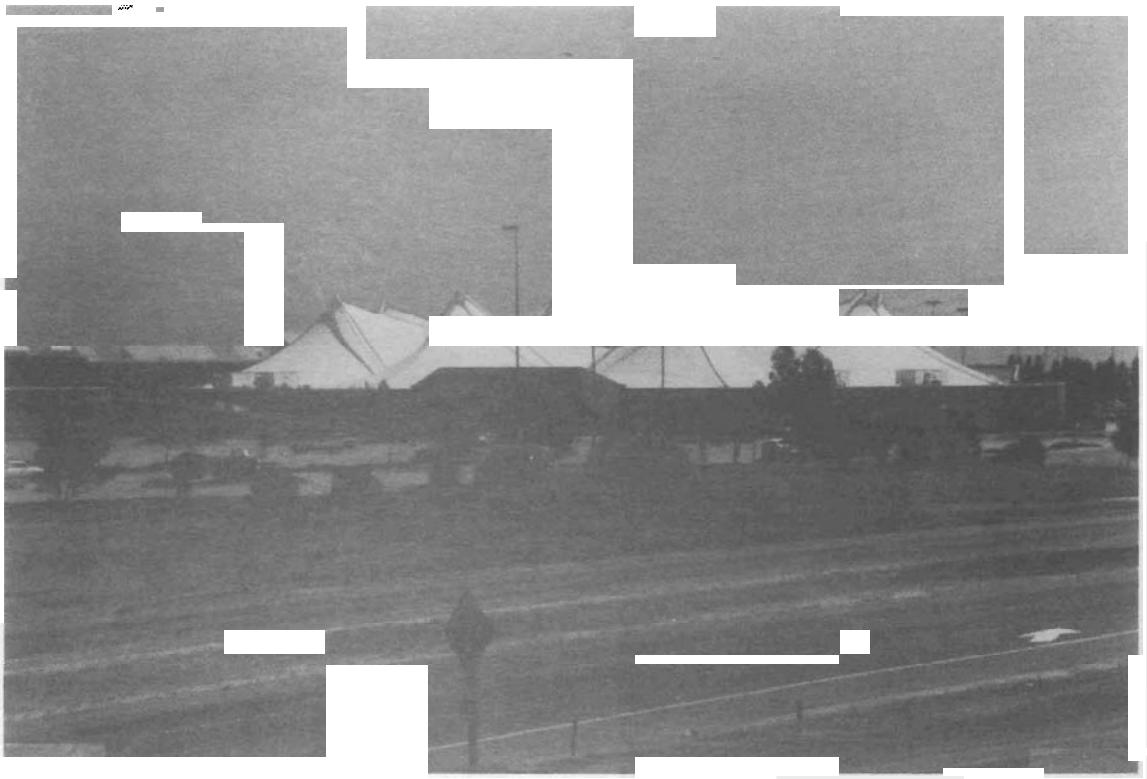

PLATE *3.*

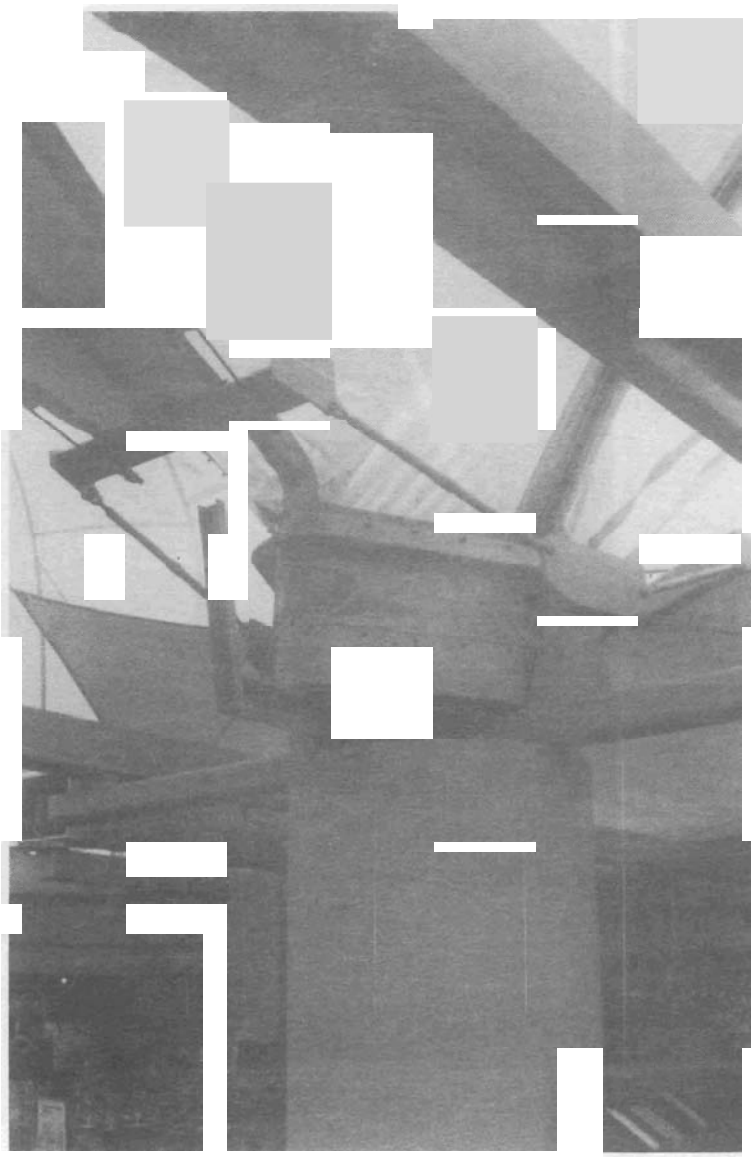

PLATE *4*

PLATE 5.

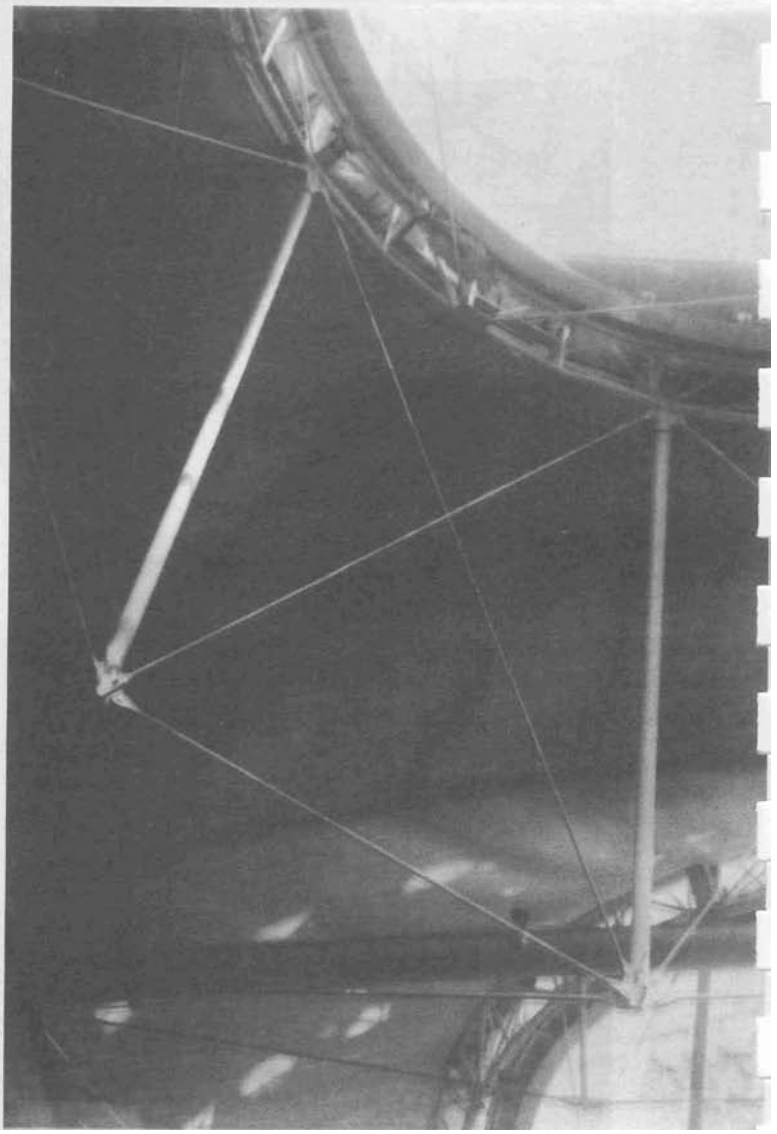

PLATE 6.

PLATE 7.

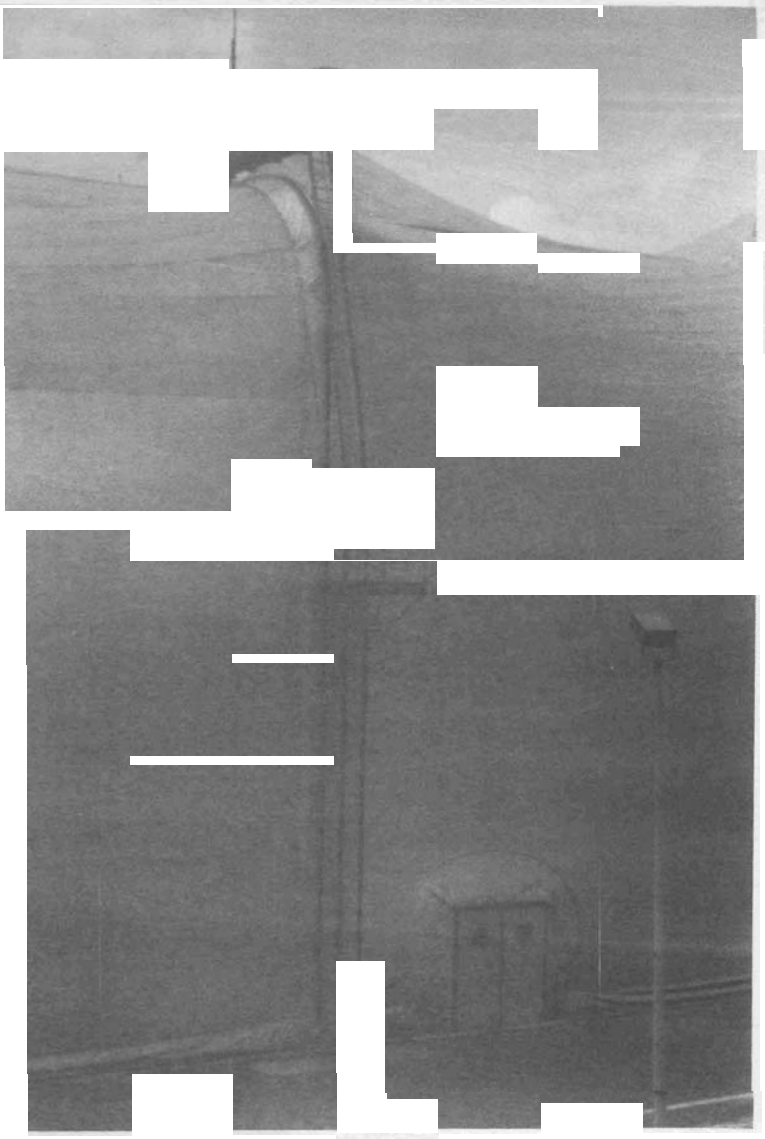

PLATE 8.

PLATE 9.

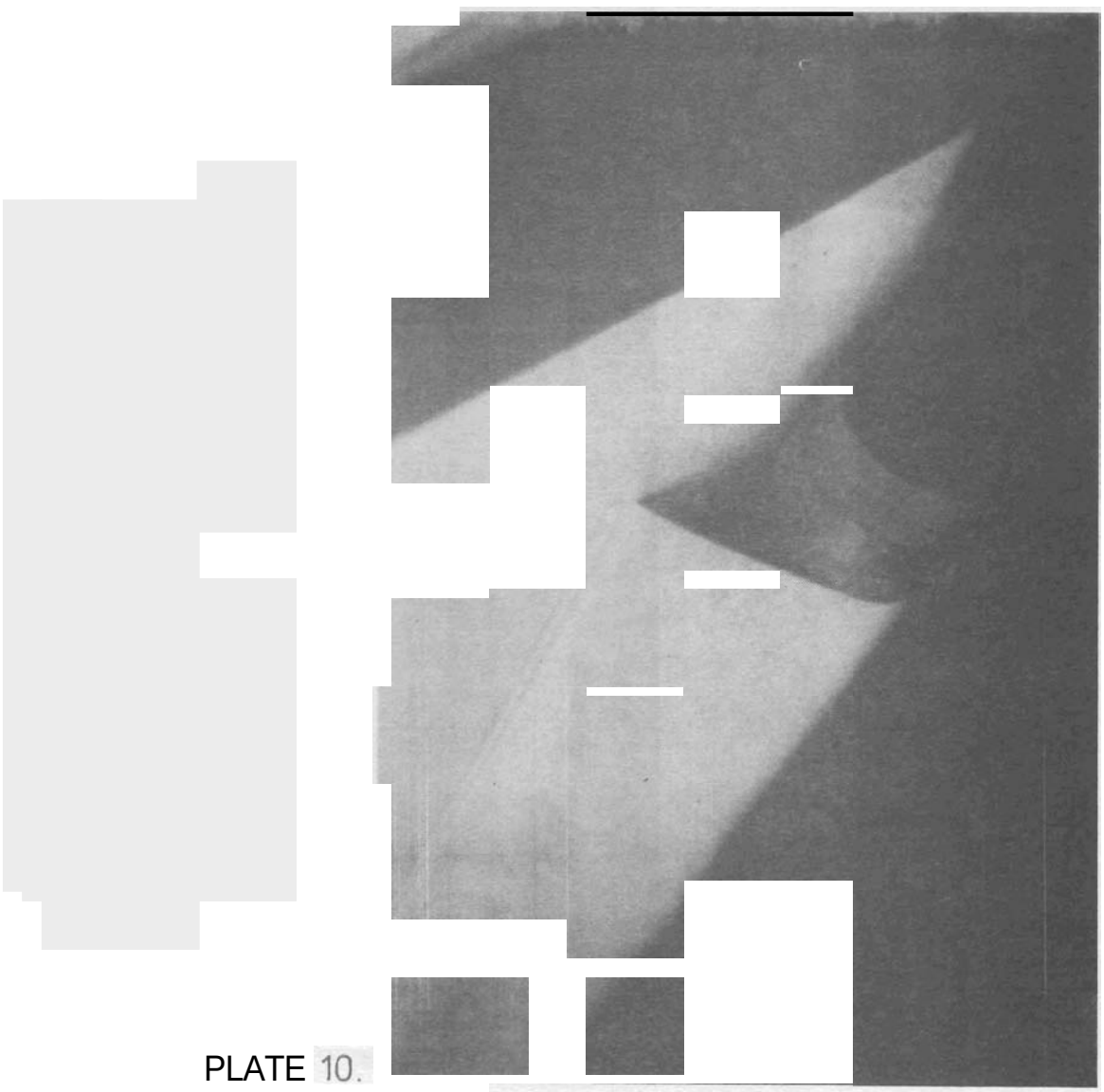

PLATE 10.

David Oliver

Trained as an architect, David has spent the last seven years involved with the design and construction of some of the country's more unusual building projects. A passionate activist for alternative building techniques, David has produced various membrane projects and, when not fully committed with his innovative earth building company is continually investigating further uses for membrane structures.