

**RIBA  
REINA SOFIA MUSEUM OF MODERN ART  
MADRID: A CASE STUDY  
4 MARCH 1993**

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## THE PROJECT - SUMMARY

A direct invitation to develop the external animation of the new Reina Sofia Museum of Modern Art by means of three 35m high glass satellite towers for vertical circulation.

The project takes the following guiding principles as its basis:

- Minimalism**      The reduction to basic essential elements in simple form.
- Modernity**      The visible expression of current and forward-looking attitudes to design and technology.
- Performance**    In addition to ensuring effective movement for thousands of visitors a day, the aim is to achieve a degree of transparency that reduces visual impact from outside and allows uninterrupted views from inside, both when waiting and, more spectacularly, when riding in the lifts - a pause to make visual contact and re-orientate yourself with the world outside the museum.
- The Design**      A hierarchical composition from large to small scale of vertical and horizontal planes in concrete, steel, stainless steel and glass. The intention is to articulate clearly the functions of each component in this composition, and to ensure the legibility of the load-carrying system.

The new Reina Sofia Museum of Modern Art was opened in October 1990.

## THE BACKGROUND - WHY EUROPE?

Apart from the current recession, one of the striking differences between British and European values is the commitment to, and investment in culture - and hence cultural buildings - as opposed to the merely material and commercial.

Our practice is fortunate in having been able to build up gradually a recognition in Europe based on a few selected projects - a private house in Fluy (1977), La Villette glass façades (1985), Lintas glass bridge (1985), a pharmacy near Amiens (1989) (and now two further cultural centres in the north and south of France currently being designed).

The fact that many of these projects have been noted for the innovative ways in which they use glass is incidental to their architectural intent, but has of course raised a certain profile with potential clients.

## WHY REINA SOFIA, MADRID?

It was following a visit by the contractor and his client - the Ministry of Culture - to La Villette in Paris that we were approached by the contractor.

The project was at that time well advanced in the conversion of the large 18th century building to enlarge and improve the accommodation for the Museum of Modern Art under the direction Spanish architects Iñiguez and Vazquez. Their proposals included three glazed satellite towers providing public lifts and servicing the building.

The fact that we were approached by the contractor and asked to provide new designs for three satellite towers was a comment on both the state of the original designs, and the relationship between the Spanish contractors and their original architects.

## THE COMMISSION

We were faced with the options of entering a contract to provide design services to the Spanish architects, or the main contractor, or seeking a commission direct from the Ministry of Culture. In choosing to enter a contract with the main contractor, we had in mind the relatively powerful and pro-active position he holds, and the potential sensitivity in the working relationship with the architects. In practice this did not prove problematic, since we took care to ensure that they were fully informed of our proposals, and participated in all our design meetings with contractors.

## HISTORY OF THE PROJECT

Following a couple of preliminary studies of possible approaches to the design of the towers, our commission was confirmed in mid April 1989.

At this point excavation was nearly complete, and the contractor was due to start pouring foundations for the first tower at the beginning of May. Basic frame configuration, services connections and loadings had to be determined within a few days.

## WORKING METHOD

With basic configuration determined, drawings were produced for primary structure, many of these freehand, and including full size details, covering all generic and special conditions. On the basis of these, the steelwork fabricators produced shop drawings for checking by us and our engineers, OAP. Designs were developed and work proceeded in parallel on glazing, environmental design, lifts, maintenance access systems and lighting.

As steelwork fabrication proceeded, working progressively up from the base of the first tower, the details of top glazing suspension and the basic strategy of the proposed spring prestressing method remained in abeyance while the main contractor's engineers were being convinced of the viability of our proposed design.

Details, such as internal finishes, were discussed with the architects for the main building, to ensure coordination and design consistency.

## GLAZING

The glazing contract, including the supply of all fittings and erection, was negotiated with Pilkington, following their acceptance in principle of the design. The basic design intention of glass support is to separate clearly the external system carrying the weight of glazing and the internal system which restrains the glazing against horizontal wind loads.

The entire glass envelope to each tower is suspended by stainless steel rods from roof level. Each panel of glass is individually supported, so that differences in thermal expansion between steel and glass can be spread evenly across all joints between panels.

Wind loads are transmitted through connectors to adjoining panels and back to the main structural frame. Secondary vertical structural members resist wind loads between floors of the link to the building. The size of each panel is determined by wind load, economic glass thickness, structural module and heights between floors.

Given the demands of a rapid programme, the glazing method uses an established and tested system of glass fixing. The method of suspension is more innovative, but uses simple components designed to allow easy monitoring of quality and rapid manufacture in the quantities required.

We entered a separate contract with Pilkingtons to provide a detailed analysis of the system, detailed drawings of all components (again, many full size freehand dimensioned drawings) from which Pilkingtons prepared shop drawings for checking. All laser-cut plate profiles were provided full size on film for digitizing, and booklets were provided describing the functioning (thermal, structural performance, etc., and behaviour under accident scenarios) and a recommended method of erection of the system.

The quality of machining and finishes was monitored by Ian Ritchie Architects with submission of samples by Pilkington at appropriate stages in prototyping and production. Key components were load tested to check the engineering of ties and support arms.

## CONCLUSION

The project may be untypical in its origins and working relationships, but represents for us a satisfactory way of achieving the delivery of a finished construction, with a reasonable degree of control over the quality of the end product.