OSAKA MARITIME MUSEUM

BASIC DESIGN PHASE 1

FINAL REPORT MARCH 1995

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1.1 Basic Design

GENERAL CONCEPT

This Basic Design phqse 1 report has been made by the design team headed by Paul Andreu Architect and assisted by consultants Ove Arup International, Tohata Architects and Engineers and the MTN Cooperation.

The Osaka Maritime Museum is a focal point at the entrance to the Port of Osaka on the Sakishima reclaimed island. The Sea Sphere museum is contained in a 70m diameter glass and steel dome sited in an inlet sea basin. The dome forms one part of an entire landscaping composition consisting of the dome, set in the basin and framed by a garden of trees and landscaping. Integrated into the garden design is the entrance building and a parking lot facility both of which are located under a landscaped slab. The slab and parking lot are not part of the current phase of studies but are however a critical part of the finished coherent design.The site is defined by a future highway which will serve the new Umeshima island currently under construction.

The sphere itself is designed to allow the visiting public to experience the full panorama of the Osaka Bay sensing the sea, the sky and the maritime horizon whilst remaining protected from the wind and rain. The public, as well as the exibits are also protected from the sun with a huge kinetic sun screen covering half the dome, revolving constantly around it's base in 24hr revolutions. This screen becomes an important element in the architectural composition providing a dynamic element relating to the celestial movements themselves. The glass sphere also permits a view from the outside in allowing a view of the principle exibit which is a full scale 200t Edo period wooden ship located in the middle of the museum.

For the public, entering the sea sphere is a process beginning in the entrance building on the shore then descending below the sea and being able to percieve the water during their passage through roof windows. Then they arrive underneath the hull with a dramatic view upwards to the dome shell and the sky beyond. The museum planning itself is organised around the ship. The public then move upwards to the same level as it's theoretical waterline. Then they may continue upwards in the panoramic lifts which give a full view of the ship and the sail. The upper floors form rings around the ship allowing the public further panoramic view of the Osaka bay. Suppporting these floors are a series of cylinders which provide technical services as well as escape facilities in the event of emergency. Contained within the larger cylinders are also special exibition spaces with completely controllable light and climate conditions.

The space formed by the cylinders and ring floors contained within the hemispherical dome and it's revolving screen is also designed to be used for audio and visual projections where the surfaces will become a support for cinematic scenography.

PROJECT 6 C/1 D

The Basic Design Phase 1 follows the Basic Planning Phase 2 submitted at the end of December 1994. The initial part of the studies were based on the comparative evaluation of a different basement, tunnel and sea window configurations. This analysis was presented, along with an historical analysis of previous projects, in book No.5, Project No.6 on 31 January 1995. This analysis led to the adoption of project entitled 6 C/1 D as the safest and most economical one. A summary of the configurations analysed is presented on the chart.

The 6 C/1 D project has two tunnels, one for general public acces with a service, goods acces and firman's corridor alongside it as well as a second escape tunnel with three independant corridors. An optional 'sea window' viewing room is located on the side of the main public entrance corridor. A series of top−light transparent windows are located in the corridor itself with safety shutters, destined to give the visiting public the feeling of passing under the sea upon entering the dome.

The technical Plant rooms are located on top the main public entrance tunnel so as to economise foundation costs.

The dome foundation structure is based on a ring concept where escape corridors are located in a ring around the perimeter of the dome. The foundations themselves are a particularly important aspect of the design and will require special attention in the later design phases because of three principle particularities of the site: Firstly,the ground is sedimentary and composed of layers of aluvial and diluvial deposits such as sof clay, sand and gravel. Secondly, the reclaimed land will settle over a long period of time causing negative loading on the the foundations exposing them at the tops of the piles. Thirdly, the seismic charactristics of the site will amplify the difficulties mentioned above. These issues are not insurmountable given that many other constructions have been made on the same site conditions. The current design is indeed inspired by foundations of neighbouring constructions and consists of deep piling to approx. 55m where good bearing soils exist. The current understanding of soil conditions is based on surveys and designs for neighbouring projects. Detailed surveys specific to the Sea Sphere, as well as it's adjoining entrance building and tunnels will be nescessary for a complete understanding for the final design.

The entrance building is located under a garden slab, the roof structure for the building forming support for the future garden.

The dome floors and superstructure consist of three large services and controlled exibit cylinders, three smaller escape stair cylinders as well as small columns which support the floor rings of exibition space. This superstructure is made of structural steel and clad in lightweight steel cladding. The floors all contain the nescessary air conditioning, electrical and lighting services. Thes services will be designed for maximum flexiblity. Toilet and cafeteria or refreshment services are also provided in the cylinders. All floors are served by panoramic lifts as well as by services lifts in one of the cylinders. Lifts are also provided for handicapped public allowing them acces to all levels.

The dome structure itself is designed to be as transparent and lightweight as possible. It consists of a tubular grid−shell frame with diagonal bracing forming cable truss supports for the glass skin. This glass skin is composed of laminated toughened glass with a perforated stainless mesh safety layer which also provides solar protection. The glass is screened using this technique with varying density going from fully transparent at the equator up to 80% opaque around the polar crown.

The revolving sun screen is supported on the dome steel shell by meams of small stub supports. The support rails and traction systems are located on the screen itself so as not to conflict with the pure spherical geometry of the dome and it's lamella grid shell structure.

The polar summit of the dome is crowned with a transparent two way cable truss ring approx 20m in diameter allowing a maximum of zenithal daylight to fall on the ship and the museum exibits. The steel ring around the top−light also contains nescessary smoke venting, lighting and maintenance facilities.

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