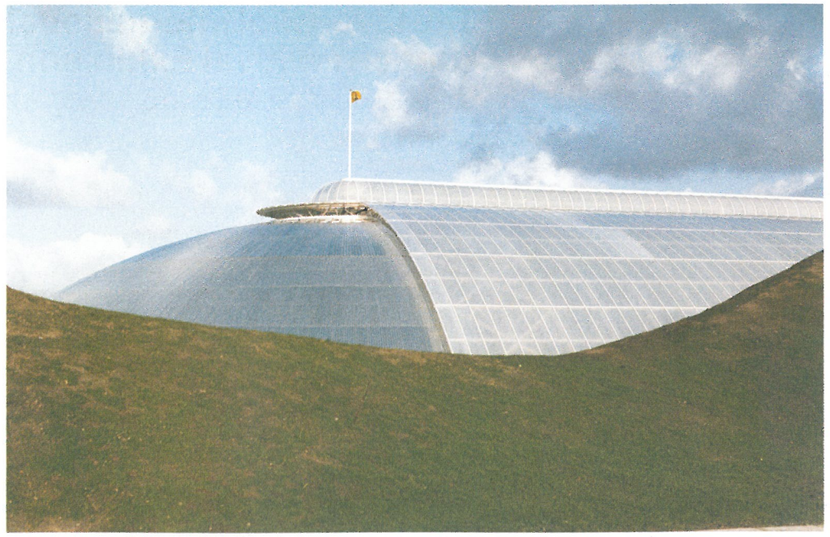

AWARD

The Liverpool International Garden Festival Exhibition Building

For The Merseyside Development Corporation

The building was the centrepiece of the Liverpool Garden Festival, the first of its kind to be held in the United Kingdom. The Festival was conceived as the focal point for urgently needed urban rejuvenation of this once great city. From this principal idea stemmed the brief for the building which was required to perform two distinct and separate functions. These were firstly to form a 7500 square metres covered but column free exhibition hall and secondly to provide the shell within which on completion of the exhibition a sports centre could be erected. This sports hall was to accommodate 3 separate types of functions – (a) a swimming pool, (b) a sports hall and 3000 spectators (c) club facilities

In addition to these it was essential that the building should be economic to build and to adapt for its eventual use as a sports centre. It was also considered important that the building should have a shape which was sympathetic to the contours of the newly landscaped gardens. The shape adopted is that of a 90° dome halved and joined with a linear barrel vault. This gives the space requirements with the structural efficiency of the curvi-linear form resulting in minimum material content and favourable ratio between external surface area and plan area.

The structural frame is made up from two primary elements.

1) A two layer barrel vault structure of 60m span and 78m long, comprising braced arched frames of 3 pin configuration at 3m centres. The upper and lower booms are connected by longitudinal members. The lower longitudinal member connects through to the domes providing the path for the axial forces, and also supports services and acoustic panels in selected areas. The upper longitudinal member acts as a purlin for the polycarbonate sheet cladding. The intermediate arch frames are connected by braced frames which, with the on grid frame, transfer their reactions to bipod frames at 6m centres.

2) Half domes of span 62m at each end of the vault. These are of segmental ribbed single layer construction with circumferential rings at 3m centres connected through via the longitudinal lower vault members.

The out of plane forces at the junction of the dome and vault are resisted by the end three arched frames which are braced together with both in and out of plane bracing. In order to minimise member sizes at the top of the dome use is made of an architectural feature, the occulus, which is a continuation of the ventilation structure. This is framed to give a semi-circular in plan, triangular in section braced girder which, cantilevered from the last three braced vault frames, picks up the braced in plane ends of the dome ribs. The steel sections used are a combination of joists, universal beams and tubes.

The vault frames are fully welded with full strength site butt welds at the quarter span points and the dome ribs also have a full strength site butt weld at their mid span point. Bracing connections are made using the fork ends of the 'Nodus' system.

The main vault frames are supported on simple bipod frames made up from large diameter welded tube, arch thrusts being dealt with by 75mm diameter tie bars (type 16M). Longitudinal ties are also provided to cater for the resulting horizontal thrust from the dome ribs, pretensioned to give a positive factor of safety against sliding.

The height to the underside of the dome is 13.8m giving a total enclosed volume of 72,200 cubic metres. The designers were appointed in June 1982, work started on site in January 1983 and the building was handed over to the client in February 1984.

Architects: Arup Associates
Structural Engineers: Arup Associates
Steelwork Contractors: Tubeworkers Ltd

Judges' Comments:

A simple and elegant building making straightforward use of structural steel with careful modelling of connections to provide a light, airy festival hall and subsequently a major leisure centre at reasonable cost and within a short time scale facilitated by extensive offsite fabrication.