Statistical Summary

Purpose: To facilitate the exchange of culture and information

Design Features: 2 auditoriums, numerous conference rooms, 6,000 Sq. M of exhibition space, restaurants, shops and other support facilities.

Architect: Rafael Vinoly

Structural coordinators: Structural Design Group Co. Ltd.

Plot Area: 21,000 Sq.M

Building Area: 7360 Sq.M

Total floor Area: 40,400 Sq.M

Length: 208 M

Width: 31.7M

Height: 57.5M

Total Steel Weight: 6,600T
The main element of structure are a 190 ft. high hull shaped glass and steel atrium on the west end of the site and a cluster of block like buildings which run along the east end of the site.
There is a profusion of steel structure. The Semi circular steel girders suspended from the ceiling mimics the wooden frame of a ship.

Features:
- Glazing Finish,
- Big Inner Space and unique Structure made up of two massive pylons and the roof structure associated with huge canoe.

Ribbed roof truss

Self supporting Curtain wall.

Steel Pylon supporting the Roof Structure.
Structural Elements

Ribbed roof truss comprising of longitudinal Steel Hollow pipes and transverse Steel Plate Girders

Self supporting steel-framed Curtain wall.

Outer Insulated Glass Skin.

Connecting Bridges at mid-height.

2 no’s Steel Pylons supporting the Roof Structure.
Glass curtain wall supporting itself with opposing tension and compression members

Vertical forces resulting from roof loads and bending stress are carried by the tube structure, lateral roof loads are resisted by the curved plate girders

Two steel columns carry the load of the entire roof structure

The widest section of the column is where the column resists its largest buckling load
The tube structure ties the entire roof together to make it act like one big truss and is the only resistance to loads along the long axis of the roof such as lateral loads and the bending stresses caused by the weight of the roof and beam along the roof's long axis.

The streamlined shape of the long axis of the roof minimizes wind loads on the tube structure which is the only resistance against such forces along the long axis of the roof.
Tension rods keep pressure on compression members to create self-standing curtain walls.

Tube structure carries the weight of the entire roof truss to the two supporting columns.

Lateral loads i.e. wind.

Curved plate girders resist lateral loading by pushing outward on the tube elements.

The thin section of the curved plate girders center indicates that there is not much of a moment here.

Moment couple occurs at the rigid connection between the tube structure and the short span trusses.

Lateral loads i.e. wind.

Load Resisting forces.

Tension rods keep pressure on compression members to create self-standing curtain walls.

Roof loads.

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Peripheral Roof loads

Inverted tripod arrangement

Cable suspended from peripheral edge beam

Edge beam held by semi circular arched ribs.

Individual rib stabilized by top chord

Resultant free standing system

Arch tendency to move out of plane.

Arch held by top chord.

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Condition near Column support: 
Cantilevered rib sees greater moment- 
hence greater web depth at the center(s).

Mid-span condition: 
Lesser moment at center of ribs between pylons, 
here the web plate acts like a pin connection.

The streamlined arched roof truss with ribs 
is more effective. The rib sizes here can be 
adjusted as per the existing moments and 
spans.

The pylon is sized wider at center to resist moments from 
additional floor decks and also 
to resist lateral buckling.

The box truss on the other hand is less effective for 
smaller spans, increasing the dead weight unnecessarily.
First, Piles are Driven into the site and the first floor slab is set.

The Structure is built upward as the excavation continues below.

The Structural Pylons are erected on site in stages.

The main roof structure is assembled at ground level and lifted using cranes.

The Glass wall structure is constructed downwards from top.

Stages of roof construction
Glass wall - analogy

Vertical plain paper - unstable by itself.

Slight curve can make it free standing.
References

University of Arizona research project:
Case study of Tokyo forum.

Tokyo Architectour

UIA- Latest News, 1997

Glass Hall of TIF files

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