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## 1. La Beaujoire Stadium, Nantes

### Introduction

In the summer of 1982 the city of Nantes decided to build a large capacity stadium, to replace the existing Marcel-Saupin Stadium which had become too small, capable of being used, as early as June 1984, for certain matches of the European Football Championships.

The project chosen from a number of competitive submissions, was that presented by an architect B. Agopyan (in association with the CERA Design Office) and by a group of companies which included Les Chantiers Modernes : Moisant-Laurent-Savey ; l'Entreprise Industrielle and Compagnie Française d'Entreprises Métalliques. This team was led by Chantiers Modernes, who managed the site works.

Freyssinet International was subcontractor for the Group of Companies for the following works :

1. Installation of all prestressing
2. Precasting of segments
3. Placing of segments with temporary tie-rods and subsequent permanent prestressing
4. Fixing of roof trusses by prestressed bars.

### Stadium characteristics

The stadium is situated on the Eastern side of the city of Nantes, in the heart of a vast landscaped area extending from La Beaujoire Floral Park.

In order to fit perfectly into its setting, the layout of the structure consisted of curved lines and was designed to comply with the functional requirements for which it was intended, i.e. good visibility from any position, easy access and evacuation. At the same time economy of construction was sought by reducing to a minimum the areas allotted to stairs and floors.

Several arrangements are possible for accommodating the spectators :

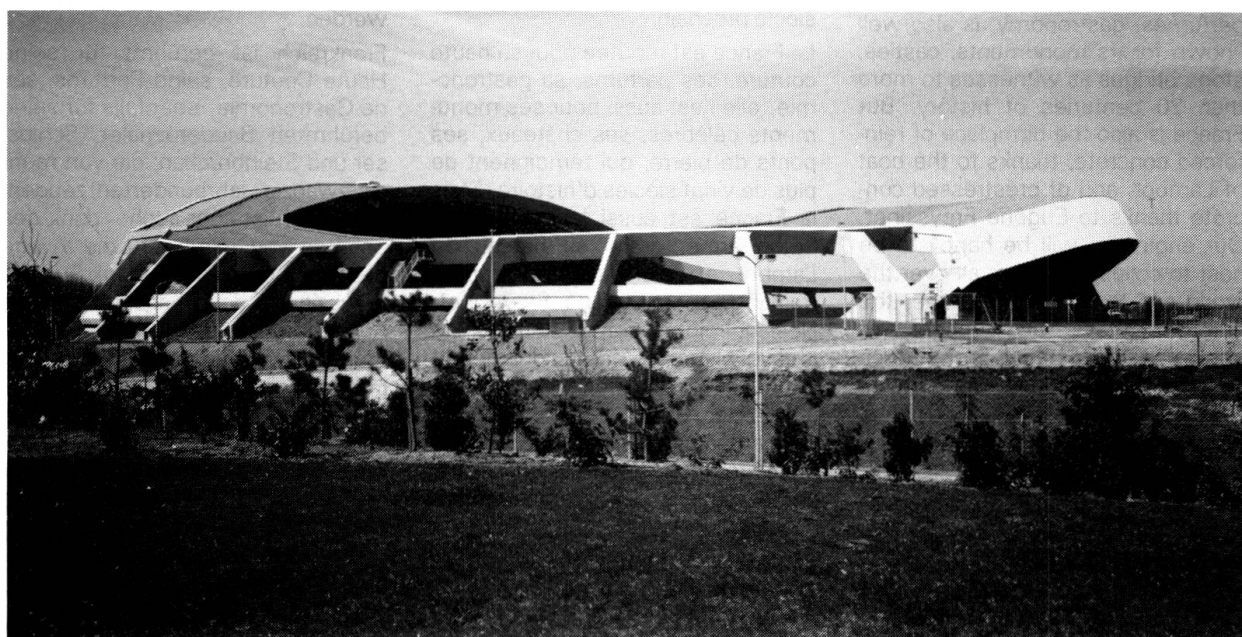
1. 32000 seats
2. 46000 seats – of which 18000 are situated in the side stands
3. 52000 places – by adding to the preceding case 6000 standing places on the sides of the Northern and Southern terraces.

The plan dimensions for the structure are 240 m long by 200 m wide. The roof height of the stand is 35 m above ground level on the west side and 25 m on the east side.

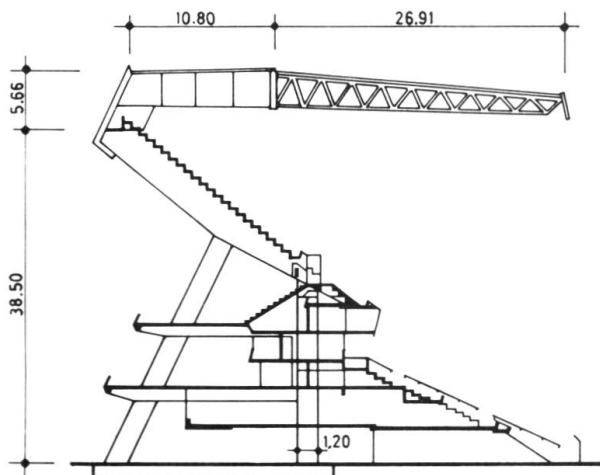
### Special contractual conditions

These are due, essentially, to the very short period allowed for the completion of the structure. Earthworks were commenced in November 1982 and, even allowing for stoppages due to inclement weather, the structure was handed over at the end of April 1984. Furthermore, as the football pitch was to be used as soon as the stadium was handed over, the grass was planted in 1982 thus prohibiting the use of this central one of the site by the contractors for the whole duration of the site works. The construction methods made extensive use of prefabricated concrete and steel units, thus helping to adhere to the delivery time, while ensuring a quality of construction recognized by all concerned.

It is to be noted that the prefabrication of the segments was made on a long bed.



(Photo Y. Blond)



Typical cross section trough stand portal

### Structural arrangement

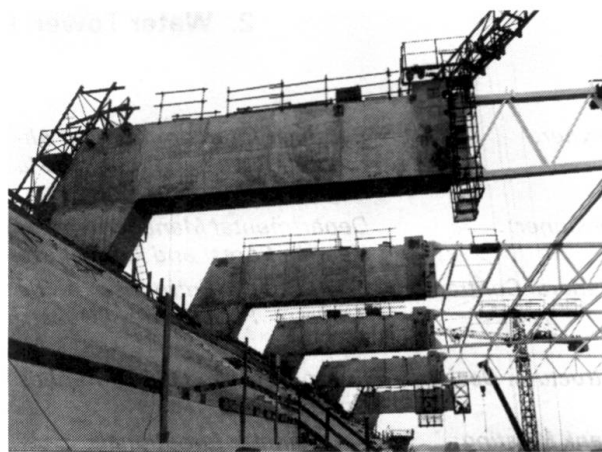
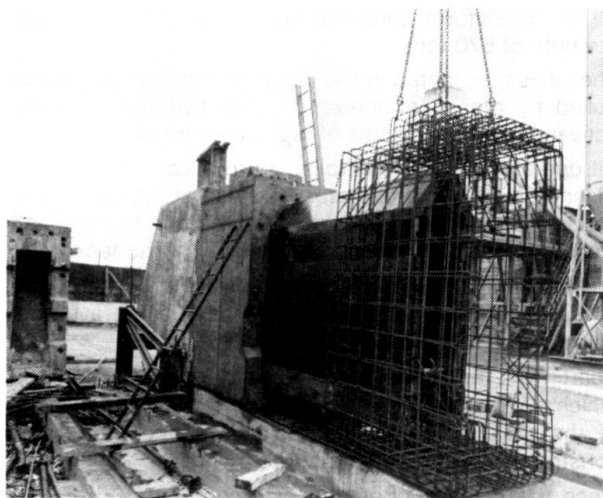
The structure is founded on piles of three different diameters : 600 mm, 800 mm and 1000 mm and on square caissons 800 mm x 800 mm.

Reinforced concrete was used for the stairs, terracing, walls and various structural elements.

Prestressed concrete was adopted for buried tie-beams, precast floors (prestressed with bonded wires) and for the portal frames and cantilevered supports of the terracing.

The portal frames incorporate at the top a console extending outwards over the terraces and built of precast segments placed by successive cantilevering. This console and the cast-in-situ crossbeam on which it is fixed (see sketch) are prestressed with 12 T 13 and 6 T 13 Freyssinet tendons.

A cantilevered steel truss is fixed by steel prestressing bars to the end of the concrete console.



### Quantities of materials

In-situ concrete:	10'000 m <sup>3</sup>
High grip rebar (excluding terraces):	1'100 t
High grip rebar for terraces:	250 t
Formwork:	39'000 m <sup>2</sup>
Concrete for precast segments:	750 m <sup>3</sup>
Concrete for precast terraces (off site):	3'000 m <sup>3</sup>
Precast floor slabs:	5'500 m <sup>2</sup>
Backfill around structure:	80'000 m <sup>3</sup>

### Prestressing:

* Prestressing cables: dia. 13 mm. strand, grade III, very low relaxation	71 t
* Anchorages:	
12 V 13	530 u
B 12 V 13 E	122 u
6 V 13	315 u

* Sheath :	
for 6 and 12 strand cables:	10'500 m

* Precast segments:				
	Skew	Angle	Standard	End
East stand	12	12	30	12
West stand	14	14	52	14

i.e. a total of 160 segments involving the use of 750 m<sup>3</sup> of concrete.

### Segment weights:

minimum:	7 tonnes
maximum:	25 tonnes

Official opening:	8th May, 1984
Total cost:	147 MF

(P. Jartoux)