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## 6. New Central Hospital, Coimbra (Portugal)

**Owner:** Ministry of Health, Portugal  
**Architect:** Fernando Flores, Madrid  
**Engineers:** GAPRES, Lisbon and HUARTE, Madrid  
**Contractors:** TOHC – TEIXEIRA DUARTE, OPCA and HUARTE Co  
**Works duration:** 36 months  
**Service date:** 1986  
**Quantities:**

Excavation:	300 000 m <sup>3</sup>
Concrete:	45 000 m <sup>3</sup>
Steel:	2300 tons

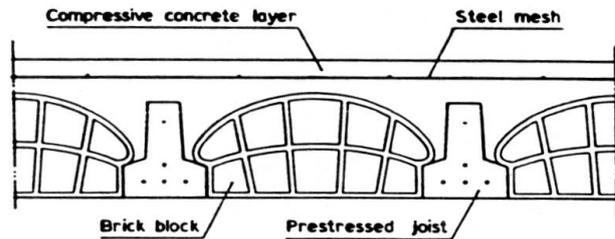


Fig. 2 Prefabricated slabs

### General

The New Central Hospital in the city of Coimbra, with 1200 beds completed in 1986, is located in a ground area of about 120 000 m<sup>2</sup> and has a total floor area of 115 000 m<sup>2</sup>. It is basically formed by nine main blocks having various numbers of floors ranging up to 16, with a shape in plan shown in Fig. 1.

Expansion joints 3 cm wide separate the different blocks. Maximum distance between joints is 40 m.

### Type of structure

A reinforced concrete framed structure was adopted in most of the blocks. Steel structure was used only in some roofs where large spans were required.

Floor slabs are in most cases prefabricated using prestressed joists, brick blocks and a compressive concrete layer, duly connected to the main structure. This type of prefabricated slabs has been largely used in Portugal for more than 30 years with excellent results.

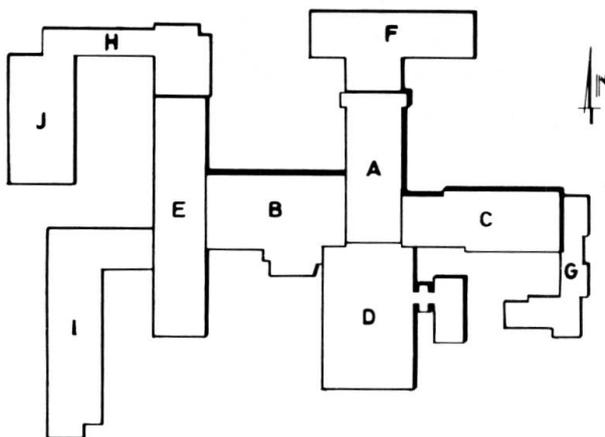


Fig. 1 Schematic zoning of the structure

Fig. 2 illustrates typical structural lay-out and the characteristics of the prefabricated slabs.

It was possible to adopt direct foundations, the soil being in general a hard clay enabling a contact design stress of about 0.5 MPa. Maximum absolute settlements of 2-3 cm were allowed in the design. Resulting differential settlements were less than 1 cm.

### Structural analysis and design

A detailed dynamic analysis for seismic actions was carried out according to the new Portuguese Code on Actions. Although Coimbra is located in zone B, pertaining according to the code a uniform seismic coefficient of 0.05, the importance of the building fully justified the dynamic analysis.

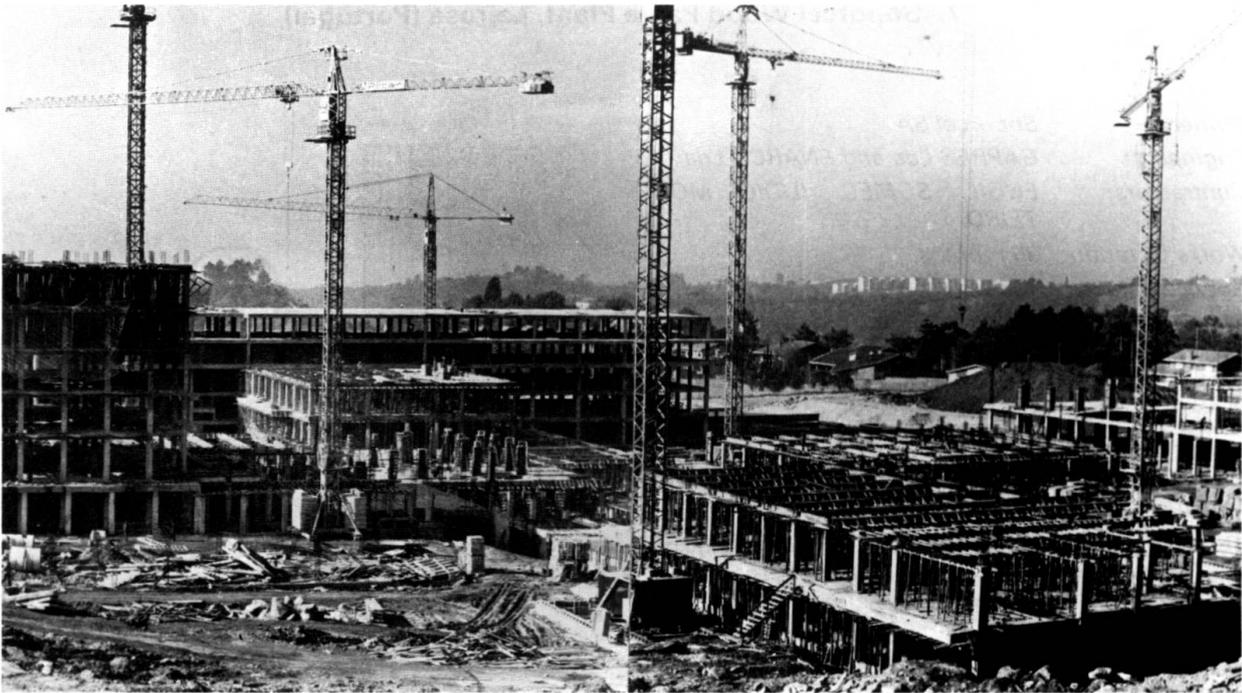
The main structure was idealized as a set of plane frames connected by rigid links to compatibilize the floor displacements.

Natural frequencies and maximum floor displacements for the higher blocks were calculated. An overall behaviour coefficient of  $k = 2.0$  was adopted to compute the seismic interstorey shear forces.

The complete structural analysis was carried out in a DEC-10 (Digital) computer (LNEC, Lisbon) and in a NOVA-3 (Data General) computer (HUARTE, Madrid) using CAD software for the analysis and member design.

Fig. 3 and 4 show views of the buildings during construction and after completion.

(Artur Ravara)



*Fig. 3 View of buildings during construction*



*Fig. 4 View of the completed building*