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11. Stafford District General Hospital (England)

Owner: West Midlands Regional Health Authority
Engineer: Building Design Partnership
Contractor: Fairclough Building Ltd.
Specialist Sub-Contractor: CCL Systems Ltd.
Works Duration: 3 years 8 months
Service date: 1983
Imposed Load (Including finishes): 5 kN/sq.m

Introduction

The fourth phase of the development of this hospital site at Stafford is a 300 bed district general hospital. Phases 1 and 2 which represented the clearance and preparation of the site were completed in 1977. Major landscaping work has already been carried out and will be extended as part of the fourth phase. The first phase of the residential accommodation, Phase 3A was completed in 1978.

Phase 4 provides the basic functions of the hospital with a scope for further expansion.

On the ground floor, the accommodation comprises accident and emergency, fracture clinic, out-patients, x-ray, pharmacy, children wards, mortuary, group works, non-residential staff changing, boiler house, sub-station, telephone exchange and external storage for medical gases and fuel.

On the first floor, the accommodation comprises five operating theatres and associated facilities, the extensive care unit, two adult acute ward units totalling 133 beds, physiotherapy, administrative offices, hospital sterilizing supply unit and kitchen and dining-rooms.

On the second floor, the accommodation comprises maternity wards totalling 79 obstetric beds and 40 gynaecological beds, maternity delivery and a special care baby unit containing 30 cots.

The structural frame and upper floors of the hospital are partially prestressed, post-tensioned, in situ concrete slab on in situ columns. The building will be clad in brickwork with stained hardwood window frames.

The structure

Structural work on the Stafford District General Hospital was completed in August 1980. The structure was developed as a standard modular structure with floors constructed on a 15 m sq.module. The £12 m. hospital when completed will offer 28,000 sq.m of floor area 16,500 of which is partially prestressed, and is for completion in mid 1982. The present structure is 3-storeys high with a roof construction similar to the suspended floor construction.

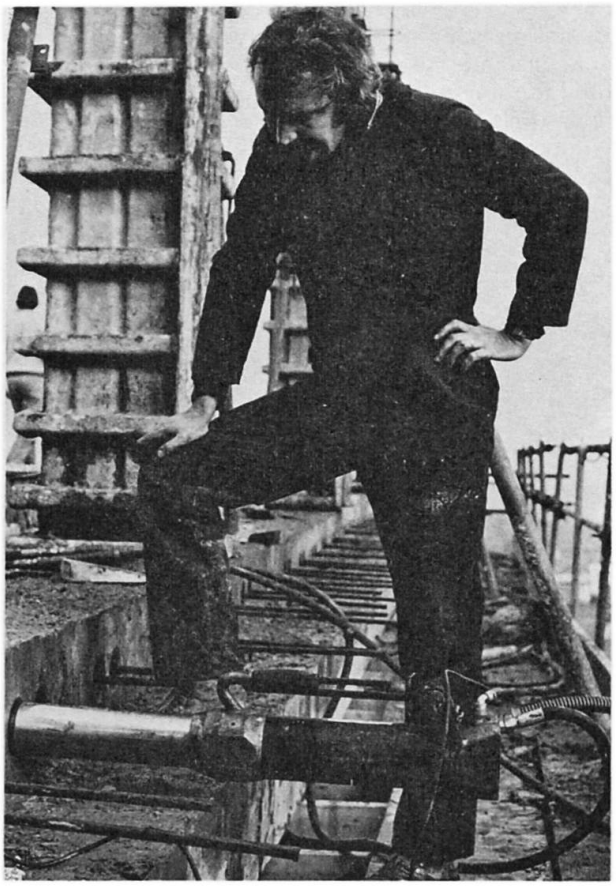
The structural solution adopted is of rib and slab construction with an overall structural depth of 400 mm. This gives the advantage of a completely free area between the floor soffit and the ceiling below in which to house services. The floor is partially prestressed, the prestress incorporated in such a way that the deflection of the floor under self weight plus part of the permanent imposed load is balanced, thus overcoming creep deflections and resulting in a close to horizontal floor.

The prestress is imparted to the floor using 2.

No. 15.2 mm drawn strands greased and sleeved in polypropylene per rib and these are laid to profile and stressed from one end only, the unstressed end utilizing a plate and compression type fitting to ensure a positive anchorage.

The concrete strength of 40 N/sq.mm at 28 days attains a transfer strength within 7 days thus allowing a rapid turn round in formwork usage. The formwork consisted of a proprietary trough mould made of fibre glass. Each floor had a total of 52 strands to be stressed and stressing time took in the region of 1½ hours per slab. Careful planning of the secondary reinforcement allowed prepared strands to be dropped into the troughs thus ensuring the correct catenary profile. The strands were wired in place and the stressed end anchorages fixed to the formwork using standard plastic accessories supplied by the specialist sub-contractor. The tendons were stressed to 240 kN each which represents 80% of their ultimate capacity.

The choice of floor was dictated by the accommodation of services and at 400 mm depth gave a span to



Stressing using the CCL 30 t "Stressomatic" jack

depth ratio of 38.3. From this it was obvious that a prestress solution had to be adopted in some form. Partial prestressing was found to be the best solution as it avoided unacceptable upward deflections. Additional bonded reinforcement was supplied to ensure that the limit state was complied with.

It was also found that the upward deflection introduced by the prestressing force substantially reduced the torsion moment at the beam/column connection.

Wind forces are taken by the edge frames, the different wind directions being catered for by adjacent modules being orientated at 90° to each other.

The method of construction was new to the contractor but, when familiar, a rapid turn round of formwork was attained. At the height of construction, floors were being stressed at the rate of 5 in every two weeks. The specialist sub-contractor prepared the tendons and these were installed during the steel fixing.

Stressing was carried out 4 to 7 days after concreting when the concrete attained the strength of 25 N/sq.mm. Quick formwork release lowered the costs and this advantage was not lost by complicated steel fixing owing to the light reinforcement and its specially detailed links.

The number of standardized 15 m modules required for hospital design becomes dependent only on the space required to house departments and therefore theoretically can cut down design time by 80% compared with the time required to produce a "one off" design. This basic module of 15 m utilizes columns down two sides at the one third point. This absence of columns gives large unobstructed areas, thus offering the advantage of maximum planning capability and flexibility for future additions. The design is claimed to present the cheapest solution consistent with architectural flexibility and engineering intuition.

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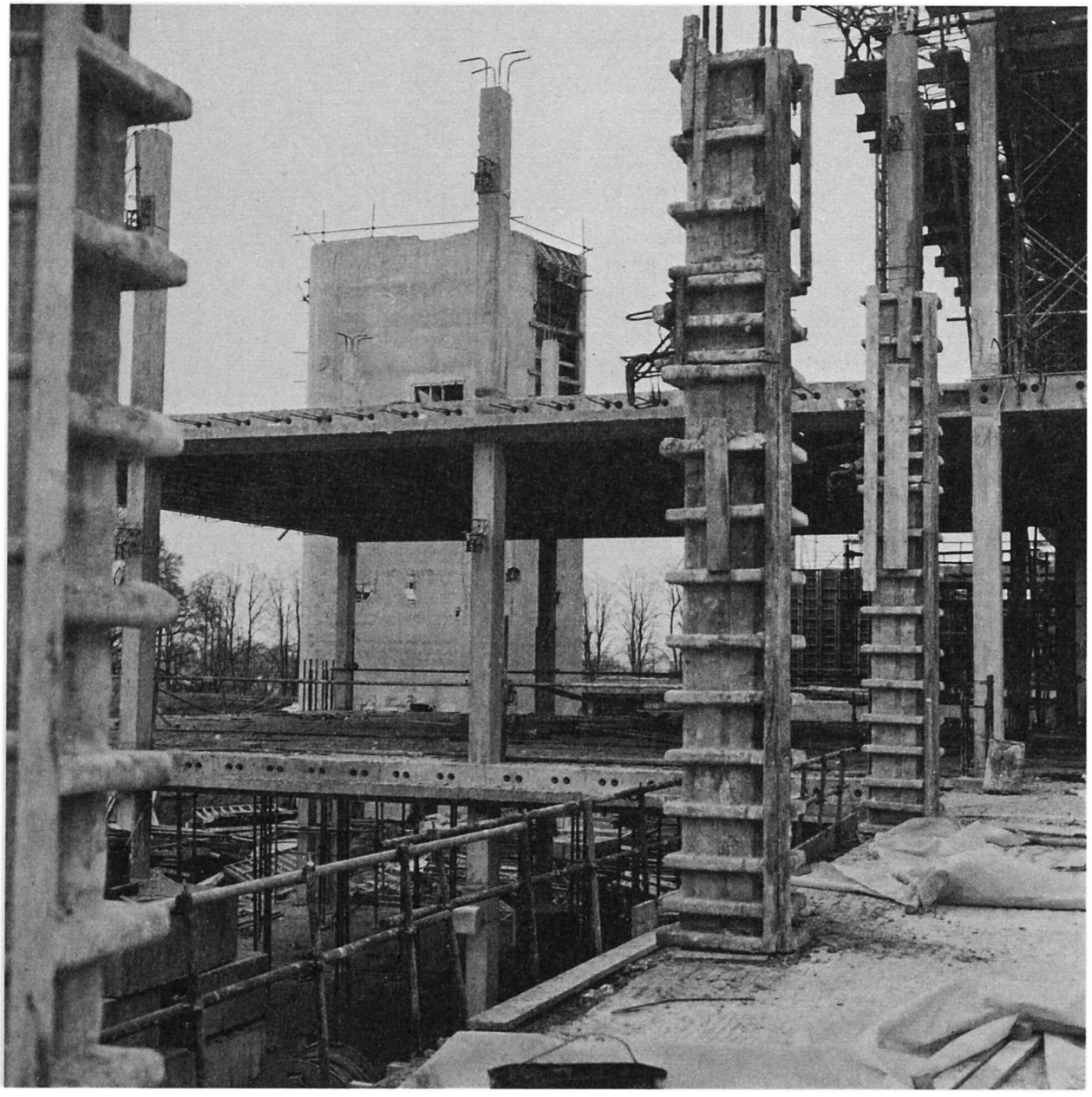

Section of works showing typical floor arrangement