St James University Hospital

Leeds

The Project

Faber Maunsell have been working with Graitec UK's SuperSTRESS software to come up with the winning submission for the St. James Hospital Leeds Oncology Wing for the Catalyst Healthcare Private Finance Initiative consortium.

With a structural Project Team lead by Project Director Steve Gunning with Project Engineer Matthew Palmer they have used Graitec UK's SuperSUITE to achieve the design solution.

Design of the 66,500m2 new Cancer Centre of Excellence started in 2001 comprising diagnostic, treatment and research facilities, including ward and hotel accommodation. Work on site started with contractor Bovis Lend Lease, which is a co-founder of Catalyst Healthcare, in October 2004 and construction is planned for completion in 2007. On completion, the facility will contain one of Europe's largest cancer centres with 15MV and 25MV linear accelerators in 12 treatment rooms.

Faber Maunsell's design solution addressed the many engineering challenges necessary for the new 12 storey building on a sloping city centre site adjacent to a working hospital. The structural solution comprises a concrete frame with flat slab construction and a raft foundation bearing onto a combination of sandstone and mudstone. The building is divided into three independent structures to accommodate lateral movement and the structural stability is provided through shear walls located within the circulation cores.

The Solution

The use of Graitec UK's software was integral to achieving a cost effective structural solution that is now demanded from the high-pressure healthcare PFI environment.

SuperSTRESS was selected to analyse the raft foundation. The software provided the facility to model the interaction between the reinforced concrete and variable ground conditions whilst taking into account the iterative process required to balance the output between the structural analysis and the more flexible nature of the ground conditions. Palmer says, "it is easy to fall into a trap of producing complex design models that over-analyse a structure when an iterative process is more appropriate". SuperSTRESS provided the right balance in this respect.

Large rafts can require a notoriously complex iterative design process due to the linear spring stiffness of the reinforced concrete elements and the non-linear behaviour of the ground. Faber Maunsell created the design model using SuperSTRESS to represent the raft using spring supports. The results were transferred to the geotechnical model and re-evaluated before being

transferred back into the SuperSTRESS model for further analysis and re-evaluation. Following a number of iterations the models converged and a final design was achieved. The final result from SuperSTRESS provided the design moments and shear forces used for the reinforcement requirements.

SuperSTRESS was also used to analyse the building for stability and provided the lateral displacements of the structural elements. The flat slabs are repeated over 11 floors and it was important to achieve a cost efficient design solution. Palmer says, "One of the most useful functions of the software is its ability to clearly display areas of inadequate reinforcement".

Within the PFI environment there is constant pressure to achieve the most efficient design solution. A coordinated design solution is required, taking into account the structural elements, medical planning, specialist equipment and engineering services. This requires a constant review of design solutions to check developing needs in the Healthcare environment thus providing adaptability for the Client. Therefore it is highly important that software is flexible enough to cope with frequent design changes; in the case of this project it meant that structural calculations were revised to take account of the need to accommodate a 15 tonne MRI scanner. The design solution provided by the software embodied the permanent location and its temporary tracking route.