Mott MacDonald BIM Award 2013

NHS Dumfries and Galloway Royal Infirmary Hospital
Reference Design – Viola Valentine
Synopsis

The Structural Reference Design (RIBA Stage C) for the NHS Scotland Dumfries and Galloway Royal Infirmary Hospital project was accomplished and delivered through the efficient use of integrated analysis and BIM software and therefore, should be considered a strong contender for the Mott MacDonal BIM Award 2013.

Mott MacDonal was appointed Lead Technical Advisor by NHS Scotland for the delivery of the 50,000m² healthcare development with a construction value of £200m. The group was responsible for the NPD procurement, all engineering consultancy services, facility management, cost consultancy and construction related services. Architectural and planning services were appointed to Keppie Design, recognized as key competitors in various sectors in the Scotland region and healthcare Architect in national NHS guidance with an unrivalled global track record in significant projects, including acute hospital design.

Faced with a challenging programme for deliverables of four months in total, compared to the more traditional minimum programme period of six months for this size and type of project, the structural team made competent and effective use of BIM software and processes to significantly reduce calculation and modelling time to not only meet deadlines but to do so with an impressive completion gross profit of 35%. By adopting a resourceful BIM approach, also in line with the company’s BIM Implementation Strategy, the team was also able to successfully promote our business and technical capabilities in the eyes of key clients and architects in the region, raising the group profile and developing and strengthening our relationships to encourage future project work together and ultimately become their first choice of Technical Advisors for repeat opportunities.
The Team

The winning team provided a wealth of advantages to the project and ultimately the Client, bringing a dedicated and experienced team with current NPD experience, as well as tailored technical advice specific to the Acute Services Redevelopment Project. The project would also prove a significant opportunity to build and improve our relationships with a key Client and Architect for the region, also in line with the company’s BIM Targets for the Heath Sector.

Sunita MacKillop - PM
Viola Valentine – Civil and Structural Engineer
John Dunn - Technician
Collaboration

Collaboration with the Architect was enabled from the onset of the Reference Design stage, with the original architectural BIM model acting as a starting point. It was agreed that we would adopt the exact software as the Architect and arrangements were made for installation of updated versions of Revit to also ensure compatibility. The process became consistently more streamlined as the project evolved and more detail was added to the design.

Once validated, updates to the central model would be shared with the other individual disciplines concerned (foundation layouts to the geotechnical team etc.) to ensure consistency of information used and to avoid any abortive work.

Significant additional architectural changes issued a few days before the draft preliminary P1 issue, were easily identified and clashes captured through clash detection tools enabled by BIM software (Navisworks). This proved extremely useful for deadlines and costs to still remain manageable.
From the earliest stage it was agreed that an effective and efficient BIM approach should be adopted, also in line with company’s Global BIM Strategy and BIM Implementation Strategy. This was primarily to reduce timescales and therefore increase profits whilst enhancing the quality of our deliverables, but also to take full advantage of the opportunity given to work for a key Client and with a key Architect, by demonstrating our technical capabilities.

It must be noted that at the very beginning, some resistance was encountered by various members of the team to progress with the ‘safe’ and traditional process of delivering a project. However, by informal and honest discussions and a presentation of relevant experience obtained from previous projects from my part, eventually everyone in the team embraced the learning curve, recognizing all the benefits that a BIM approach would provide to not only the team but also the unit as a whole.
The original architectural model was built in Autodesk Revit 2013 and it was agreed that Mott MacDonald would adopt the same software for modelling and drawing production, as well as exploit its integrator tool with the analysis software Autodesk Robot Structural Analysis. The latter was deemed an optimum analysis software, given the significant experience the design Engineer had in using it, as well as Revit Structure. At first, the Architect’s Revit model was optimised for export to Robot Structural Analysis, but due to the presence of circular slabs and walls, which historically have been problematic to export correctly, and other issues, the entire process proved quite inefficient. Therefore, the four parts making up the entire structure of the hospital were individually modelled and analysed in Robot. Modelling timescales were significantly reduced by rationalising grids following co-ordination and agreement with the Architect. The Robot models were then exported to Revit and updated, accordingly. Revit models were saved as central models, allowing work sharing between the engineer and the technician. A site co-ordination model was created with each individual model linked to it, to further enhance worksharing capabilities.

Architectural changes to the Revit model days prior to the draft preliminary P1 issue were detected through the use of the clash detection tool in Navisworks. This proved crucial for a quick turnaround and maintaining costs to a bare minimum. Re-iterative Robot analyses were also undertaken using updated Revit models for critical areas exceeding rationalised assumptions previously adopted, e.g. vibration sensitive slabs over theatre areas etc.

Experience gained and lessons learnt throughout the process were captured in a presentation from myself to the SNI group in late March 2013.
Interoperability

Consistency of shared information between interoperable software is paramount in order to achieve maximum benefit of the actual software used.

Clashes between the updated Architectural model and the work in progress structural model were identified using the clash detection tool in Navisworks. Approved changes to the structural model were carried out in the Revit model, accordingly. Areas of concern in terms of structural design were revisited using exports from Revit into Robot and undertaking similar analyses. Any necessary changes, that would also affect the work of other disciplines, e.g. greater foundation loads in areas of slab spans greater than those previously assumed, were duly shared.

Issues with exporting capabilities from Revit to Robot and vice-versa were discussed in regular working group meetings e.g. Robot User Group, now developed further to the BIM User Group to enable knowledge sharing within the entire group.

Experience gained and lessons learnt throughout the process were also presented to the SNI group by myself in late March 2013.
A common data environment was set up and managed by the Client, in accordance with BS1192. Data exchanges by all the designing teams involved were enabled using Asite.

More specifically to the structural team, a shared data folder in the P-Drive was created and managed by Mott MacDonald to act as the repository system for the BIM model.

The internal BIM execution plan outlined the structure of folders and their content, as well as naming conventions, also in agreement with the Architect.
By embracing an efficient BIM approach, we were able to significantly reduce our timescales in terms of structural analysis, modelling and drawing production and therefore maximise our profits to a staggering 35% gross profit.

Ultimately, our team was able to provide the client with a co-ordinated and high quality BIM Model, which can be used in the further detailed stages of the design, all the while demonstrating to the Client as well as the Architect our technical capabilities to enhance potential of future repeat work.
The Scottish based Architect company Keppie Design is considered a key competitor in the region. They hold an unrivalled global track record of projects in various sectors, but most importantly to this project in acute hospital design.

Through the effective and successful BIM approach adopted, the team was able to raise the company’s profile and demonstrate to both the Client and the Architect our technical capabilities to enhance potential of future repeat work.