2016
BIM INNOVATION AWARDS

Design Category
Henry J Lyons Architects

Central Bank of Ireland
North Wall Quay
Dublin 1
The Central Bank of Ireland was established in 1942, and has been located in its Dame Street head office since 1979. The proposed new head office of the Bank at No1 North Wall Quay represents an opportunity for the Bank to consolidate its city centre operations into a single, efficient, fit for purpose building with a unified and integrated design approach to assist in fulfilling its statutory objectives. The project incorporates, an existing concrete shell standing at 8 floors over 2 basement levels, completion of an external podium to the east and north, internal structural amendments, new façade and full fitout works.

Challenges

Working with an existing structure brings a number of challenges to both the design and construction phases of a project. The client procured a design team in 2012 to deliver the project at 1 North Wall Quay, at that time BIM in Ireland was very much in its infancy. CITA & the RIAI were running workshops to disseminate information to the construction industry. The client set an aspirational requirement for the project to be delivered in BIM however no clear definitions or protocol documents formed part of the design team procurement. Once appointed the design team developed a BIM execution plan and agreed the level of BIM integration on the project. The construction phase of the project would be procured under a GCCC Government form of contract and as such BIM would not form part of any contractual obligations of a construction team. Tender documentation for the main contract works incorporated a number of BIM protocols and aspirational requirements for its use at construction stage. BIM usage at construction stage was taken on board by the main contractor and key subcontractors to coordinate and construct complex sections of the project.

Collaboration and Communication

The initial stages of the project produced a number of feasibility studies which were carried out in a BIM environment, the 3D aspect informed design decisions and helped communicate the concept to the client. During the detailed design phase of the project, the design team utilised Autodesk 360 as an online collaboration portal. This allowed team members to view BIM models in the cloud. BIM coordination workshops were held on a regular basis to coordinate complex elements of the project including the external facade and service integration.

As the project moved into the construction phase, the project team used Asite as a cloud based collaboration portal, the project team are using the cBIM and workflow manager modules. Models are uploaded to Asite and go through a gateway system as they develop into “suitable for coordination” models.
A number of Innovative uses of BIM have been employed on the project.

**Point Cloud Survey:**
A "Scan to BIM" survey of the existing 10 storey structure was commissioned in 2012. The surveyors used a Faro Focus 3D laser scanner to create a sub-10mm scan of the existing structure. A point cloud survey was used to develop a Revit model which was then used throughout the project phases. The existing structural model was also used to interrogate the various structural modifications required to the existing structural frame. This was one of the first large scale scan to BIM projects undertaken in Ireland at that time.

**Structural Alterations:**
The final design required a number of structural alterations to the existing concrete frame. These alterations required some remodelling of the main building cores rising throughout the building along with the structural formation of new stair openings. Analysis on the impact of these structural alterations on the existing structure was carried out with the aid of the existing structure model. New structural elements including stairs, infill structural decks and bridges were modelled and coordinated with the existing structure to reduce the impact of the alterations.

- Point cloud survey of the existing structure.
- Revit model of the existing structure.
- Structural analysis of alterations to existing cores.
- Structural slab removal in the existing structure.
- Steelwork trimming around new structural openings cut out of the existing structure.
Facade

The project's façade is innovative and unique in its design. The façade incorporates strong and dynamic sculptural forms expressing a unique identity. A mesh 'veil' outer skin solution is used to control shading and glare. The veil offers a high level of mesh transparency ensuring good daylight transmission and undistorted views of the docklands setting. The use of BIM during the concept design and beyond into the detailed design was fundamental to achieving the desired aesthetic and performance criteria. The façade was procured a full year ahead of the main contract. This enabled a detailed design to be developed with a specialist façade contractor to compliment the exemplar design.

The design team mandated in the façade tender that all aspects of the façade be delivered in BIM. Tender documentation included, a task information delivery plan and a BIM execution plan. The successful façade contractor was required to deliver a level of model definition of 4 as outlined in PAS 1192-2 2013. This was a challenging requirement considering BIM was in its infancy in Ireland and Irish contractors in particular were emerging from the downturn in the construction industry. Once the façade contractor was appointed, detailed design progressed with regular design / BIM workshops being held between the design team and façade contractor.
Highly detailed models of key interfaces were developed by the project team, these informed design decisions and ensured all aspects of the performance criteria of the façade were being adhered to. A detailed model of the veil including mullions, frames and panels was developed by the specialist contractor and used to cut and manufacture the complex elements in a state of the art cutting edge 5 axis 3D CAM machining centre.
The project will act as a benchmark for sustainable design in Ireland. It has achieved a BREEAM Outstanding rating for design stage, this is the first time in Ireland that an Office block has achieved this rating. The building has been designed to be a low energy or a Nearly Zero Energy Building (NZEB) and will achieve an energy rating of A2, again this will be the first time in Ireland that a commercial building will achieve such a high energy rating.

Delivering a holistically sustainable building requires a “cradle to grave” approach. Designing a low energy building ensures that the building has the potential to provide comfortable environmental conditions while using minimal energy.

The design approach to energy efficiency was “Be Mean – Use less Resources” “Be Lean – Use Resources Efficiently” & “Be Green – Use Renewable Resources”. The key approach in this philosophy was to first limit the energy required for space heating and cooling through the design of a highly efficient façade and second to utilise energy in a more efficient way.

The creative design of the façade system has allowed for an innovative mixed mode ventilation system as a sustainable energy solution to provide both energy cost savings and an exceptional ambient environment for the future occupants. The extensive energy modelling and façade analysis undertaken by the design team at early design stage have allowed for the inclusion of innovative and cost effective energy systems to reduce the energy consumption of the building.
The Architect’s aspiration was to maximise the glazing area to allow natural light to penetrate the floor plates. In order to achieve this, while still optimising the Building Energy Rating, external shading and high performance glazing were required. To ensure the optimised design, the MEP consultants analysed thirteen different façade types to ensure excellent levels of daylight were still being provided to the occupied spaces.

Whilst maximising daylight was key, care had to be taken to ensure summertime solar gain was minimised, the optimum situation was established through the extensive external shading mesh. To reach this optimum solution numerous computer based models and scaled models were undertaken in order to evaluate the hole size within the mesh to allow sufficient daylight through while blocking out the summer sun.
Fitout and Interior

The architectural team used BIM for the interior fitout to develop the concept and detailed designs. Communicating concepts in 3D to the project team and the client enabled the fitout design development progress efficiently. Coordination between the MEP and Architectural models was critical to ensure both designs integrated seamlessly. Hardline tender and construction information was produced directly from the coordinated models.
The design team used Revit as the main authoring tool throughout the design phases however the architectural model was developed in ArchiCAD during the early design stages. Model validation and conversion of the ArchiCAD model to IFC formats were used to coordinate all disciplines models. The validation process via IFC was proving problematic and time consuming. A decision was made to move the architectural team to Revit in order to improve the information flow between the design team.

During the detail design stage of the façade, the specialist contractors used a number of Authoring tools, these included, Solidworks for the veil design, Revit for the glazing elements and StruCAD & Tekla for the steelwork design. The native file formats were converted to Revit via IFC and also into Navisworks to allow for clash detection and online viewing through the Autodesk 360 portal.

The projects protocol documents have been developed in accordance with both National and International standards, these include:

- RIAI BIM Execution Plan
- PAS1192-2:2012
- BS 1192:2007
- CPIx Post Contract-Award Building Information Modelling (BIM) Execution Plan (BEP) Revision R1 March 2013
- BIM Overlay to the RIBA Outline Plan of Work
Throughout the design stages of the project, a number of training measures were undertaken to upskill the various project stakeholders. The architectural model was converted from ArchiCAD to Revit, this required the architectural team to undertake an intensive Revit course. Specialist contractors such as the façade contractor undertook additional training for design authoring tools and more advanced skills such as using the façade models for manufacturing.

The façade manufacturing team travelled to Italy to undergo the required training for the BIM to manufacture procedures. Design team members undertook BRE BIM AP training in conjunction with the RIAI to realise the potential for BIM integration at the construction stage. All project stakeholders including the clients team attended training on the use of the cloud based collaboration portal. Autodesk A360 was used for early design stage collaboration while Asite was used during the construction phase to manage all workflows and BIM management.
Clash detection was a common feature of service coordination due to the complexity of the project and design strategies incorporated. The existing structure was designed based on a servicing concept developed over 10 years ago. Building standards and technologies have developed in the interim and as such clash detection was instrumental in coordinating the new layouts within the existing structure.

All large elements of plant are located at roof level, these items of “kit”, all associated ducts and cable runs etc. fully populate the roof space. Due to the large volume of ductwork and plant, planning of fire escape routing at roof level was challenging. The project team incorporated spatial coordination giving the fire escape route preference when routing services.

Developing the project in BIM allowed the project team to review the constructability and installation sequencing of major structural elements such as the northern roof canopy. The BIM model was used to sequence the phased installation, steel connection detailing of the canopy. Constructing the canopy steelwork in a virtual model and developing a construction sequence allowed a hazard matrix to be developed, this ensured the canopy was built in a safe manner.
A number of “Lessons Learned” can be taken from the design phases of the project. These include:

- Ensure where possible that Employers Information Requirements (EIR) are clearly defined with regard to BIM.
- Project timelines should be developed to incorporate model development to the required design stages. Project planning should also incorporate adequate time for clash detection and BIM coordination meetings.
- Model standards should be enforced by a designated BIM Manager for each discipline.
- Roles and Responsibilities should be clearly defined for Design Team members.
- Scope of work for each discipline should be agreed within the team along with a defined level of development matrix for each building element being modelled.
- Understanding is necessary within the team on the required level of development of models in order for each discipline to carry out their work. An example of this is energy and light analysis carried out as part of the sustainability strategy. Analysis tools such as Sefaira use early concept models and as such, understanding the workflows required to develop the analysis is key to successful integration.
Key Project Outcomes

A number of key project outcomes can be reported from the design phase. Developing façade models to a high level of detail has enabled the project to achieve the required aesthetic and performance criteria. The use of BIM to model key performance elements such as water and air tightness gaskets within the unitised façade and analyse solar heat gain will help to deliver one of the most energy efficient façades in the country.

Virtually building each component in the outer veil gave a full understanding of the complexity of each veil panel and drove manufacturing of each element. Using BIM on the project has helped raise awareness of the benefits of BIM at construction stage and in particular to members of the supply chain.

It was seen that all areas coordinated via BIM produced the least amount of contractor queries over those not carried out in BIM. While not all subcontractors used BIM there was a willingness by the majority to carry out their works via BIM. It is hoped that this project will have helped to raise awareness across the supply chain, something which can be built upon for the coming number of years.
Roof Space Development – Design Stage Progression

3D section of design team coordinated models.
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