Pontsteiger's Innovative use of openBIM® Sets a New Standard for Construction

buildingSMART International

About Project Pontsteiger

Residential building "Pontsteiger" is the tallest of its kind in Amsterdam, Netherlands, rising 90 meters out of water in the IJ canal. This unique location is northwest of the city center in a large-scale redevelopment area. This project hosts 366 apartments, 1400m² commercial real estate, 500 underground parking places, and a marina for 40 yachts. The building is surrounded by water but lifted on pillars to allow for retail and public use. The planning, development and construction was done by De Nijs and Dura Vermeer and an extensive list of architects, designers, engineers, co-makers, sub-contractors and suppliers.

The project made extensive use of openBIM processes and collaboration and set a new standard for construction engineering by developing a strategy for the use of Industry Foundation Classes (IFC). The design started in April 2014, with construction starting in October 2015, and the first residents moving in in May 2018.

Mandating IFC

It was important from the outset that data would be made open and available throughout the various phases of the project. One of the driving factors behind this project was the use of IFC as an open standard approach to delivering data to the various teams. This helped data fidelity and collaboration among the team members and helped ensured data models were developed before construction, ensuring better planning, design and clash detection. Due to a lack of material support however, De Nijs and Dura Vermeer needed to develop their own IFC strategic plan for the successful delivery of this project.

Managing BIM Agreements

Management across the project parties was achieved by defining mandatory conditions and developing supporting documentation, educating parties during kick-off meetings, as well as performing entry inspections to ensure the models delivered conformed to the BIM agreements. For many parties, this meant an adjustment of their existing workflows and ICT infrastructure. The BIM agreements created the right conditions for real openBIM collaboration between the different parties which enhanced the design team to make an integrated design and enhanced the suppliers and producers to optimize the process from BIM to production and assembly.

Concurrent Engineering

During the initial design phase, and due to the time limit on filing for a building permit, models were exported to IFC and checked by the contractor every two weeks with results shared and discussed. During the next phase of design, BIM directors oversaw clashes between the architecture, structural engineering and building services. Additional "co-makers" were added to the project. Weekly meetings were held to resolve clashes and other model related issues. Subsequently, during the construction phase, an openBIM approach was also applied. Modelers from every subcontractor were required to come to the building site to work together as in the design or technical phase.

Model Coordination

One of the project challenges was that all building information needed to be available before production. No cutting and drilling on site would occur. For building speed, the project had to make use of prefabricated materials as much as possible. Demand models were developed to look at all disciplines to a level at which production could participate in making their own supply models. For each discipline within the demand models, a production partner was brought in. BIM coordinators were appointed onsite, coordinating and checking all models and working together with the site engineering team who were responsible for the program, 2D output and contracts.

Working with Solibri Model Checker and IFC models, several coordination models were built to allow for coordination and checks. Because

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Project Overview
Project Pontsteiger

Location:
Amsterdam, Netherlands

Objectives:
Inspire design collaboration, integration and alignment; reuse information throughout the whole supply chain and stimulate forward integration of knowledge from suppliers and producers.

Software used:
Allplan, ARCHICAD, BIMcollab, Docstream, Solibri Model Checker, Tekla Structures, Vectorworks

buildingSMART tools:
IFC 2x3
BCF

Bouwcombinatie Pontsteiger is the tallest residential building in Amsterdam, Netherlands. This unique location is northwest of the city center in a large-scale redevelopment area. This project hosts 366 apartments, 1400m² commercial real estate, 500 underground parking places, and a marina for 40 yachts.

Highlights:

- 85 project participants worldwide
- 75% of all concrete and 100% of all steel structures produced off-site
- 3000+ versions of IFC models
- 6000+ BCF issues to be managed

the building was so large, it was split into four parts, every part had his own life coordination model. BIM coordinators kept these models up-to-date and added new supply aspect models as they came in. In the coordination models, the demand models were completely classified with the project's classifications in order to have a good overview and make automatic and visual checks between aspect models easier. All clashes and issues where kept digitally, using BCF zip files. Finalized aspect models were frozen in the document management system so production could start. Final models formed a base for other partners to confirm their aspect models to.

Due to the openBIM workflow, the status of engineering was always clear and 90% of the building was modeled in 3D and free of clashes. IFC allowed everyone involved to be on the same page and the total collection of IFC models formed the SMC coordination model.

Issue Management Workflow
A major challenge was the scale of models during the process of designing and engineering. Managing remarks on hundreds of dynamic models with many project members was very difficult. An issue management workflow was developed to resolve this. First, all models were combined in one coordination file. These IFC files were checked on both data and geometry. When errors were found, issues were logged and exported to a BCF file. The BCF files were uploaded to BIMcollab and the issue owner received a notification. The owner could then use the BCF file to locate the error and adjust the model and mark the issue resolved.

The renewed models and the resolved issues were loaded into the coordination file, checked, and reactivated or closed if resolved. All closed issues were archived but remained accessible for review. The issue management workflow made it possible to manage, engineer and coordinate this very difficult project, resulting in a coordinated model within time and budget. Complete issue management of over 6000 issues was achieved with BCF and BIMcollab.

Prefabrication and Assembly
The production time onsite had to be minimized to reduce costs. Most building materials were produced offsite in elements as large as possible to speed construction. 75% of all concrete from ground floor to the roof was produced offsite. 100% of all steel structures produced offsite and nothing was welded at the construction site. The designers and suppliers of these elements engineering everything in 3D BIM models and ensured the prefabricated elements were complete with everything required. These stakeholders shared BIM information via IFC and managed issues with BCF.

The IFC demand models of the architect, structural engineer and building services engineer were shared on the document management system with the suppliers who used them as a reference model to engineer their products, ensuring they would fit with the building and were able to be assembled onsite. The suppliers used their own software and exported provision and voids to separate models to make it easy to import the supply models. IFC was used for information sharing and this provision and voids were integrated into the supply model. Workplans for the assembly of the large prefabricated elements simulated with the models including the cranes and other temporary equipment.

By using only IFC and BCF, the use of paper was minimized, and a highly integrated BIM coordinated model was created. The demand and supply models substantially reduced costs.

Safely Bringing it All Together at the Site
The general contractor managed the site facilities, props and scaffolding, safety equipment, cranes and scaffolding. Demand and supply models were shared with the engineers for all temporary services at the site. They were required to make models of their equipment in the right position in and around the virtual building in order to make workplans and coordinate the anchoring to record prefabricated elements. Interfaces with related elements were also coordinated. Models of site facilities with unloading docks and crane positions were made. Construction site managers had large screens in their offices and onsite meeting rooms for access to up-to-date model information.
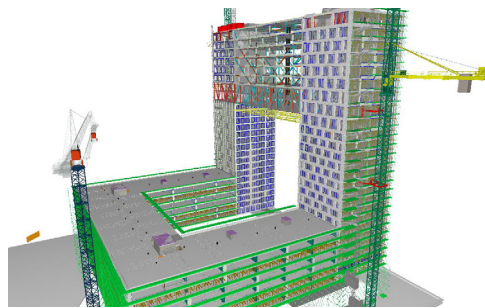
The Results
This project proved that highly complex multi-disciplinary design and production coordination through IFC is possible. It entailed more than 50 disciplines delivering IFC, over 350 unique IFC's, and over 3500 different versions of IFC. By effectively managing a strategy for the use of IFC information, all teams benefited from having access to the right data to manage change throughout design and construction.

The project was realized through the use of open standards, working together and sharing knowledge, being process oriented and focusing on information delivery. It established a new standard for digital construction in the Netherlands, known as 'BIM Basic IDM'. This project was delivered on time and on budget.

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