CS 22013

BIM Implementation for Design, Construction and Hand-Over on Airport Project

Hugues DESCLAUX - BIM Manager on the Santiago Airport Project
VINCI Construction Grands Projets (VCGP)

Pascale COMMUN – BIM Corporate Director
VINCI Construction Grands Projets (VCGP)

Riccardo COCCOLUTO – Lead BIM Coordinator on the Santiago Airport Project
ASTALDI

Laura ASIS - BIM Manager within VINCI Construction Grands Projets (VCGP) Head Office

Learning Objectives

- Identify the challenges of deploying BIM on a large scale construction project
- Best practice to educate and involve project stakeholders into BIM Process
- BIM deliverables best practice
- Interface between As-Built Model and Operation & Maintenance Solution

Description

This class covers the implementation of an integrated BIM system inside the Design and Construction Joint Venture (CJV) of the Santiago de Chile Airport (SCL).
On this project, BIM data life cycle starts with model authoring creation using Autodesk Revit and Civil 3D for 354.000 m2 on buildings and 880.000 m2 on infrastructures. Design Review and Constructability Analysis are performed with the support of Autodesk Revit, Civil 3D, Recap, and Navisworks.
A particular attention will be brought to the challenges of implementing such process on a large scale project as well as best practices for BIM deliverables to final clients.
One particular and new BIM Use, link between BIM and FM, will be also developed during the presentation

Your AU Expert(s)

Hugues DESCLAUX

After a Civil Engineering master degree in Paris, Hugues integrated in 2012 the BIM team of Singapore Sports Hub project. On this first job he was in charge of defining and controlling the project BIM standards for the production and coordination of Architectural shopdrawings using Autodesk Revit.
Since 2015, he is managing the BIM team of the Construction Joint Venture (VCGP-ASTALDI INGENIERA Y CONSTRUCCION LTDA) for the Santiago de Chile Airport (SCL) where full BIM is a contractual requirement.

Riccardo COCCOLUTO

After the M.Sc Degree in Building Engineering at "Sapienza" University of Rome in Italy, Riccardo took part of the Technical Department Urban Policies of the 5th City Hall of Rome as a intern providing BIM service and Urban analysis and investigation.
While he was working as Revit technician freelance for some international contest, in 2015 he was employed as BIM Engineer in BIM Department of ASTALDI.
Since June 2015 he is joining the BIM Team of the Construction Joint Venture (VCGP - ASTALDI INGENIERIA Y CONSTRUCCION LTDA) for Santiago de Chile Airport.

Pascale COMMUN

After a Civil Engineering master degree in Ecole Nationale des Ponts & Chaussées in Paris and a 25-year experience in Engineering, particularly in large scale projects, Pascale is the Director of the BIM Department of VINCI Construction Grands Projets, department created in March 2015 in order to organize and support the implementation of the BIM on all major projects of the Company, all over the world.

Laura ASIS

After an architectural degree in Cordoba, Argentina; Laura integrated several BIM Teams working in dozens of international projects since 2009. Activities included: BIM on-site support (Brazil, U.S., Qatar), internal trainings and standards application, implementing different platforms) Revit and Bentley software's).
Since 2016 she has joined the VINCI Construction Grands Projets BIM Department, adding Management skills to her technical knowledge and adding a technical point of view to in-progress BIM projects.

Identify the BIM objectives and requirements

As a general contractor, the Construction Joint Venture (CJV) made of VINCI Construction Grands Projets and Astaldi are controlling the entire BIM process throughout design, construction and project handover. For a successful implementation they have started by defining BIM rules and procedures.

First step was to identify the BIM requirements of the contract with the Chilean Ministry of Public Works. Because these requirements were quite general and that Chile didn't have any BIM national standards, the CJV decided to implement on this project the BS 1192 (British Standards) for the BIM delivery regulation as well as a AIA (American Institute of Architect) BIM standards for the LOD definition. Using these national regulations helped them to define strong rules in order to have BIM models that could fulfill the contractual BIM uses, particularly the production of 4D and of as-built BIM Models interfaced to the Airport's Owner FM software (MAXIMO).

On top of these BIM uses, the CJV implemented additional ones that were useful for the project which include among other things: design review, coordination, 2D production and constructability studies. Considering the evolution of the BIM maturity of the different stakeholders, new BIM uses have been added as the project was moving forward such as quantity take off and construction methods.

In order to fulfil these objectives, the CJV has developed a BIM Execution Plan which is a contractual document that contains all the requirements to be fulfilled by the designers and sub-contractors in charge of authoring BIM models. This document defines the modeling requirements, lists of objects to be modeled with related modeling rules and parameters to be contained.

Organize the project collaboration

Definition of rules and standards are essential to ensure model collaboration in a shared coordinated system. The division of BIM models need to be compliant with the organization of the design and project work breakdown structure. On this project the CJV implemented a Unique Reference System model which consists of a shared Revit file with all the project grids, levels and origins of the buildings.

For an efficient model sharing, a strong collaboration system must be implemented via a cloud sharing product which allows to control the model workflow and the different revision of the models. The possibility to access, view and comment directly the models via a Web browser solution is a real plus to master BIM workflows. To success on this, model sharing process, naming convention and folder structure were implemented and followed by model authors.
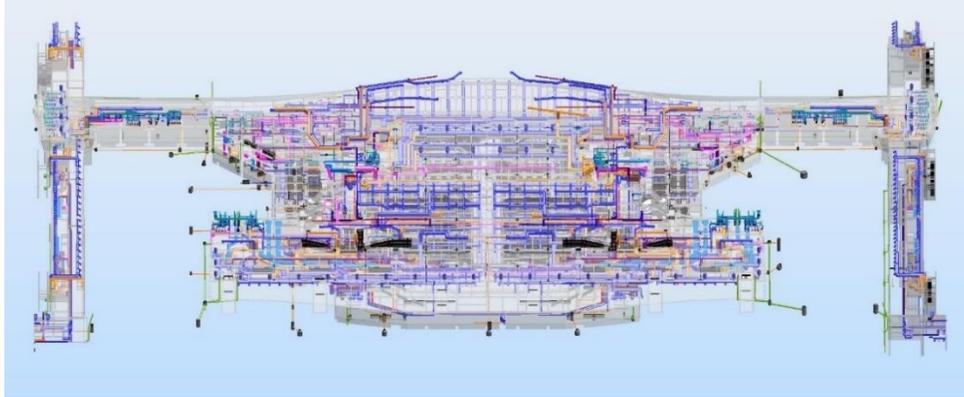
AIRPORT MAIN TERMINAL - MULTIDISCIPLINARY MODEL

Best practices to educate and involve project stakeholders into BIM Process

Setting up a BIM team

The success of the implementation of BIM relies on the people involved in the project. On a large scale project such as the Santiago Airport, a strong internal BIM Management team ensures the control of the BIM model and the deployment of the BIM uses of the project.
This BIM team consists of one BIM manager shouldered by a team of five BIM coordinators. The BIM manager defines the modeling standards and process according to the BIM uses of the project and the team of coordinators monitors the respect of the BIM standards as well as the evolution of the design inside the models.

The recruitment strategy of this BIM team is a key step in the implementation of BIM inside a project. Job descriptions and profiles must be defined with the Human Resources and BIM department of your company. Depending of the country where the project is located, it is always recommended to hire local BIM staff. Universities of many countries now include inside their curriculum various courses of BIM modeling and coordination. Getting in contact with the universities (especially when doing a project for the first time in a country) helps to understand the level of BIM of potential candidates.

Train the project to BIM

On top of building a strong BIM team, engineers of a project must be trained in order to understand how the traditional design and engineering process are impacted with the implementation of BIM.

Having a maximum of stakeholders trained to BIM process and software is a key factor for a successful BIM implementation on a project. On the Santiago Airport, this training includes a tuition to Navisworks Freedom which allow non BIM users to navigate inside the models.
As the project advance, the BIM maturity of the project will evolve; this means that software and training plans have to be adjusted.

For instance, after a year working with Navisworks Freedom, engineers of the CJV are requesting to be trained on Navisworks Simulate in order to make some comments and save viewpoints inside BIM models which is really efficient.

BIM delivery best practices

BIM Quality Checking

In most of the construction project using BIM, the official delivery for the design and construction are the 2D drawings coming out of the models. To guarantee a good quality of these drawings, the BIM team of the CJV has defined with the site engineers the standards of 2D representation and transcript them into the BIM Execution Plan and model templates.

To ensure the stability of their BIM workflow, the BIM Management team of the CJV controls the quality of the BIM models according to the standards defined in the BIM Execution Plan.
For this check, the CJV uses native tools from the Revit model such as schedule and view filters to check the quality of the parameters inside the BIM models.
Moreover, the BIM models are reviewed by the Design Management Team via Navisworks which allow a control taking in consideration the design and engineering aspects.

The CJV requests to the model authors to integrate in their Revit model a set of 2D and 3D views into a particular folder of the project browser. This helps to have a quick review of the models and is particularly appreciated by the client who wants to have a fast understanding and visualization of the project while reviewing the models.

Managing BIM model authors

In the process of selection of the designers or sub-contractors, their BIM skills should always be considered as a criteria of selection.
However, it appears that the BIM level is not homogenous in all companies. For this reason, the BIM team of the CJV has weekly meeting with the BIM managers of the different companies in order to clarify the processes and to adjust that the models requirement throughout the project.

Depending of the BIM maturity of these companies, the CJV had either to accompany them in the modeling process or on other hand to capitalize on their knowledge and experience in BIM.

Manage client requirements in term of BIM

On the Santiago Project, the version of Revit for the delivery wasn't clearly specified inside the contract. This lead to misunderstanding as the client was requesting for a delivery in a Revit version more recent than the one being used by the model authors. In order to avoid this, version of Revit as well as the frequency of its updates (every year, two years…) must be agreed with the client and reflected inside the BIM Execution Plan.

In a large scale project, there is always the possibility that model authors use software other than Revit such as Civil 3D. Working on interoperability between software is always a headache and it can be complicate to transfer models from a software to another.

As the client of the Santiago Airport was only accepting Revit deliveries, the CJV had to define the best integration of Civil 3D models into Revit. Two different workflow were proposed by the CJV, one option was to extract the Civil 3D models in 3D Autocad solids which were then inserted in Revit and the other one to extract from the Civil 3D files, the top surface in LandXML and insert it back to Revit with the Site Designer plugin.

The 3D solid importation in Revit as a generic model created a good geometry representation but it wasn't possible to do spot elevation, on the other hand working in Revit with the surface from XML file allowed to use spot elevation although the geometry was not as precise as the 3D solids. In the end, both options were presented to the client who understood the pros and cons of each one and agreed to have both as official delivery.
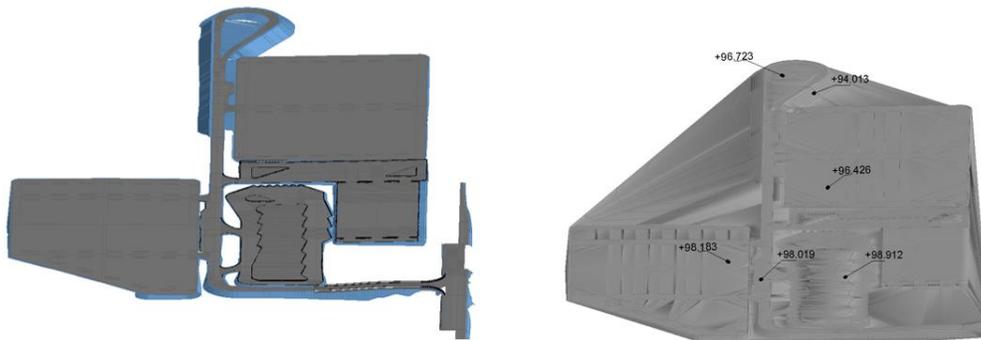
CIVIL 3D FILES EXPORTED TO REVIT USING AUTOCAD SOLID EXPORT (LEFT) AND LANDXML FORMAT (RIGHT)

Working your client to make him understand the challenges behind the BIM process will allow to reinforce your relation with him.

Interface between As-Built BIM Models and Operation & Maintenance Solution

Deployment of a pilot with IBM MAXIMO

In order to ensure a smooth transition at the construction handover, the CJV started a pilot project with IBM, in order to ensure that the BIM Models, as authored in the Santiago Airport Project, will be interfaced with IBM/MAXIMO, and consequently to ensure that all assets that need to be tracked, are well included into the BIM Models with the correct and clear information.

Defining the BIM to FM process

All related documents necessary for maintenance plan and operation will be included and implemented since the beginning of operational stage, what represents an easy transition with no delays.

By implementing COBie standards, and defining the basic enquires (What data is required, when data will be checked, who will provide data and who checks and validates) BIM models will be fully interfaced to MAXIMO.

Thanks to this, the CJV has now the capacity to deliver to its Client, Santiago Airport's Owner, accurate As-Built BIM Models, with all useful data coming from the Construction, immediately available at the Hand-Over, and linked to its FM software, MAXIMO.