

# SYNCHRO SOFTWARE 2017 DIGITAL CONSTRUCTION AWARDS



**Project:** Santiago International Airport - CHILE  
**Company:** Vinci Construction Grands Projets

**Categories of Entry:** Speciality Project

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## 1. INTRODUCTION

VINCI Construction Grands Projets together with Astaldi oversees the conception and construction of the extension of the Santiago de Chili International Airport. The conception phase started in 2015 and the construction phase which started in June 2016 must be completed for the end of 2020.

In the EPC contract, BIM together with 4D construction simulation are contractual requirements that need to be fulfilled throughout all the design and construction process. Therefore, the client performs a particular check to the 4D simulation which is delivered to him and the Chilean Ministry of Public Works every two month.

The particularity of the Santiago International Airport project resides in its size and the complexity of the phasing of the works. Indeed, it includes the refurbishment of 30.000 m2 of the existing terminal as well as the construction of a new terminal of 200.000 m2. On top of this, it embraces the construction of two covered parking's of 90.000 m2 and 14.000 m2 of ancillary's buildings (police stations, energy centers...). Moreover, the scope of works covers important works of airports platforms (500.000 m2), roads and buried networks (400.000 m2).

The planning department of the project which consists of four persons, are working since the beginning of the project with SYNCHRO PRO for the creation of 4D simulations and progress reports. This team is working closely with the BIM Management team whose mission is to ensure that the BIM uses defined at the beginning of the project can be correctly implemented. All the trades have been modelled and integrated inside the BIM process of the project which includes design review, coordination and 2D drawings production. Therefore, the 4D simulation is always updated with the latest BIM models reflecting the design and construction information.

A year before the beginning of the works, a bench mark was elaborated by the BIM Manager and the Program Manager to identify the 4D solution that was able reply to the project need in term of construction simulation. Per the project specificities in term of planning complexity (over 7000 tasks) and amount of information coming from BIM (over of 200 BIM models), SYNCHRO PRO has been logically selected as the only tool that could fulfil all the requirements. To facilitate the development of the construction simulation, a 4D Implementation Plan was elaborated in collaboration with SYNCHRO PRO's expert Greg DEMCHAK who helped to define the process to be deployed in order to reply to the project and clients' needs.

## 2. USAGE OF SYNCHRO PRO ON THE PROJECT

During the elaboration of the program of the works, a general simulation was developed by a 4D coordinator working inside the planning department of the project. He used the Revit and Civil 3D models developed in the Design phase together with the project base line developed in Primavera to produce the general project construction simulation that covers the 4 years of works. SYNCHRO PRO allowed to export a high-quality construction animation that was delivered to the client together with the program of the work. This deliverable has been useful for communication with the various project's stakeholder as it was showcasing all the project phases.

The progress of the work is integrated every month inside this construction simulation using the SYNCHRO PRO interoperability with the planning developed in Primavera. Thanks to that, a Planed vs Actual animation can be exported to show the progress of the work against the initial based line. This video is delivered to the client together with the detailed monthly report of the works. It allows him to clearly visualize the progress and help him to forecast his site inspection depending of the status of the construction.

Thanks to the successful outcomes from the general project construction simulation, the planning department decided to develop a detailed day by day construction simulation for the concrete trades. The 4D coordinator has used the tools of SYNCHRO PRO to cut down the 3D models according to the construction methodology in order to build from scratch the day to day sequence. Having the possibility to instantly simulate the sequence of the works allowed to optimize and validate the work methodology. With the support of SYNCHRO's team, an in-house program was created to export from SYNCHRO PRO a PDF for each day of construction that compile the list of elements to be built with related quantities and graphical presentation. This development allowed to provide the foremen and supervisors on site a set of documents which is clearly explaining the day to day sequence of the works.

### 3. CHALLENGES FACED ON THE PROJECT

The Santiago International Airport project is by many aspects a coordination challenge. The number of stakeholders, the public using the existing facilities, the numerous works areas being built simultaneously, the number of engineers, workers and sub-contractors intervening on site, require a specific understandable and useful communication tool. The Program of the works developed in Primavera is not adapted for this general comprehension of the project and requires some previous knowledge of the project to be understood. By displaying geographically, the different phases of the works, the 4D makes this communication much easier and reactive. Indeed, updating a classic video is far more time-consuming than the 4D directly link with the last information available on-site. It allows the construction company to have an updated presentation of the forecasted works through time quickly when the need is expressed by the ministry or the client.

The general simulation in 4D has also being use by the trades' managers to anticipate immediately and visually the number of works area in which they will have to intervene simultaneously. It allows checking that the equipment and resources anticipated or adapted to the challenge.

Apart from the general simulation, the use of the detail day-by-day tool developed to study the works' methodology of construction, was a great help both for planning and construction departments. On a project of this scale, a challenge is to ensure the proper transmission of the information between services (design, planning, construction, management etc.) and the SYNCHRO helps avoiding discoordination.

### 4. HOW SYNCHRO CHANGED THE PLANNING PROCESS

The implementation of a 4D process integrated between the design and the planning department allowed to optimize the design for a better and safer execution of the work. Indeed, it facilitates communication and give more power to the planning teams to convince the client or the project team of construction process or phasing options. Moreover, it allows a visual control to make sure that no tasks are missing from the program and that all elements of the project are connected to a task.

On a larger scale, the implementation of the 4D on the Santiago Airport Project really brought closer the stakeholders of the project around an interface that was understood by all. The 4D simulation became the common approach for sharing and coordinate all the planning aspects. Thanks to that, the daily work on planning is a lot safer and more efficient as it takes in consideration consistent feedbacks coming from the different actors.

Moreover, the day to day work is different for the planning team who is working with a 4D tool that centralize the planning and design information. This changes the approach of the planning as it requires more reflection to ensure it is developed as per the design and construction specification. As the BIM model integrates all the detail from the design, it helps the planning team to ensure that all the parameter from the design are apprehended in the sequence. A key element brought by the 4D is the principle of one element one task or better said that every element it to be linked to a task. It is a powerful tool to ensure that no aspect of the structure is left behind in the sequence of construction. It is also ensuring the planning team that the general sequence is consistent with the object to be built. As the general planning is developed before the construction engineers develop the detailed sequence of the works, it gives a greater level of confidence in the anticipated sequence of the works. Indeed, with the quantities from the BIM model, it can be checked that the ratios (quantities divided by the duration of the task) is within the common rank managed by the company and adapted to the resources of the site. The planning process is also benefiting from the easier and immediate comprehension of the structure to be built without having to open all the drawing. It is well adapted to the necessity of a quick and clear comprehension of the project.

In addition, it allows for the construction engineers to enter into the program of the works and the intention of the planner ensuring a more integrated workflow. Since the program of the works is made of thousands of tasks making its revision a difficult exercise, the graphic representation helps detecting the errors and thus the planning being more reliable. Merging the planning and the BIM model allows the model to be manipulated and used earlier in the elaboration of the methodologies of the works by the construction engineers.

The 4D coordinator who is mainly involved in the process must have both knowledge of the design process and planning requirements. On top of that the power of SYNCHRO PRO and the macro developed for this project allow to automatize many tedious tasks that required more staff on a project were 4D was not implemented.

## 5. BROAD USE OF 4D THROUGHOUT THE PROJECT LIFE CYCLE

If we organize the use of the 4D from the larger scale to the detail, we can organize its use as following:

Communication for project stakeholder:

- Used for the project's sequence of the works presentation to the ministry and the concessionaire company,
- Used by the concessionaire company to introduce the works to the actors on the platform (airline companies, public entities, airside traffic regulators etc.),
- Communication tool for the company and the stakeholders

Pre-Construction Phase :

- Early integration of the design in the planning,
- Used to develop the level 5 of the planning from the level 3 of the tender phase,
- Explanation and feedback with the construction department,
- Quantities control: planning for manpower, equipment
- Coherence of ratio of production
- Control of access of engines and works areas

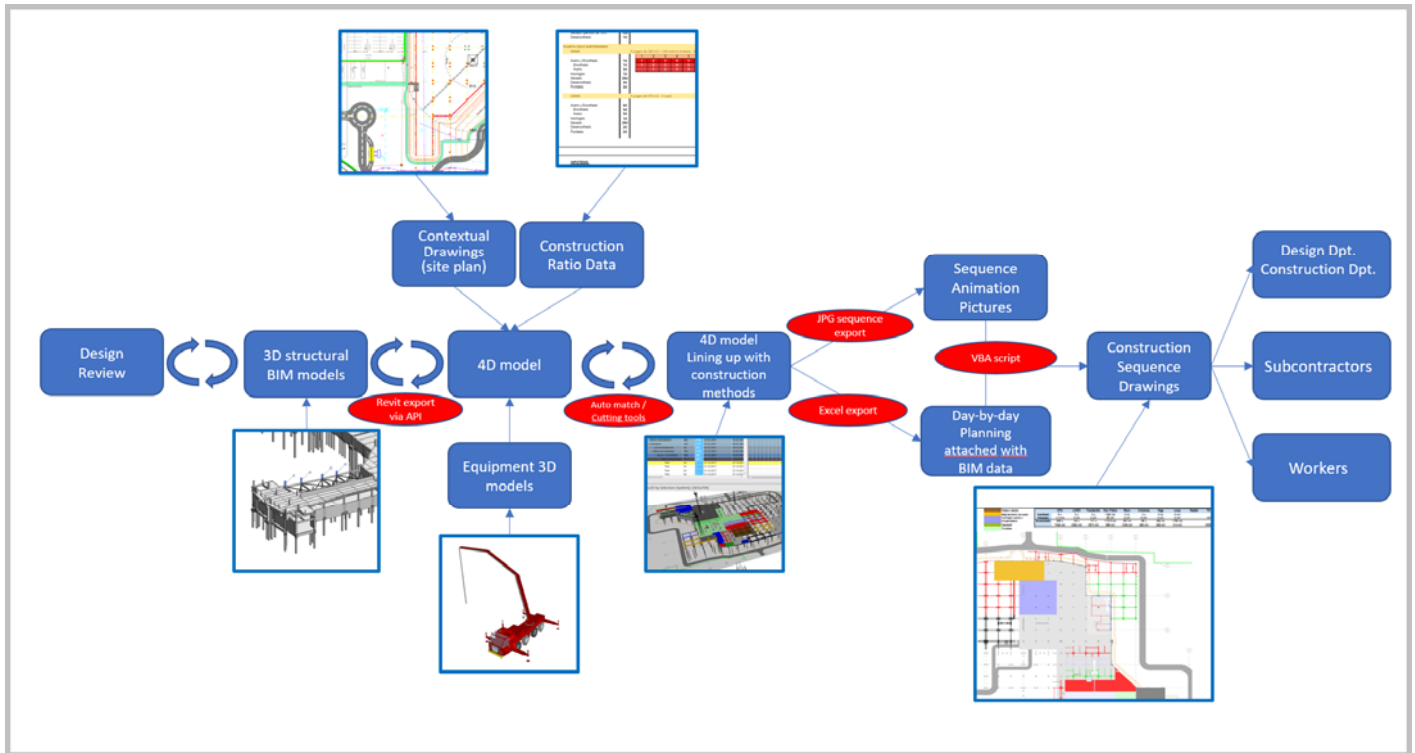
Construction Phase:

- Used to develop and check the coherence of the sequence of the works,
- Use to produce the day to day sequence of the works drawings,
- Communication of the construction department to other department,
- Presentation to foremen and workers,
- Revision of the project progress at a "higher scale", understandable graphic executive summary of the progress,
- Helps organizing the control on site,

Driving Sub Contractors:

- Sequence of work day to day
- Actualization of sequence depending of the development of the works

## 6. SYSTEM AND PROCESS WORKFLOW DIAGRAMS



## 7. PERFORMANCE METRICS AS A RESULT OF USING SYNCHRO

It is a difficult exercise to quantify the benefits from using SYNCHRO with numbers but in term of human resources the 4D coordinator:

- Replaces the need for an external/internal general presentation of the project (generally made by the communication of the project)
- The production of the sequence booklet is made by the engineer in charge instead of a requiring a full-time draftsman to draw and update the sequence,
- Quicker revision of the sequence of the works developed by the engineers by the construction manager saving useful hours in the process