AUTODESK UNIVERSITY

CS500683

How Forge makes life easier leveraging your 4D project data

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Learning Objectives

- Realize the benefits of uploading your current data into the cloud
- Understand the benefits of displaying 4D data in 3D models: the time analysis is a key factor of success
- Know how Forge can help attain more productivity and reduce project risk by implementing custom high standard workflows
- How to manage model views in a personalized way and for collaborative purposes

Description

In the construction market, MS Project is a strong scheduling and management tool, widely spread all over the world.

We have implemented an innovative workflow that uploads MS Project data directly into a Custom Web Cloud Environment shared between stakeholders with security permissions based on project, schedule option and user role, leveraging our current tools and easily bringing their users into a Cloud BIM environment.

The developed Custom Web Site implements an Autodesk Forge platform that connects uploaded data in the cloud with 3D modelling, boosting the information into a new visual format.

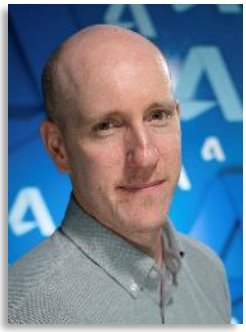
This workflow has greatly improved the time it takes to get updates to the 4D dimension of a BIM project and the benefits of its implementation.

Speakers

António Hipólito
Mota-Engil Global Technical Services
Structures & Civil Construction Director

Civil Engineer, 22 years at Mota-Engil Group, giving worldwide support from concept design to construction field and maintenance in the fields of Engineering, Architecture, Quantity Survey, BIM Process

36 years of experience in app development



Sebastian Zaje
Autodesk
Technical Solutions Executive

Supports corporate accounts (Construction, Engineering, and Energy) to provide value through technology and help transform their organization on the path to success.

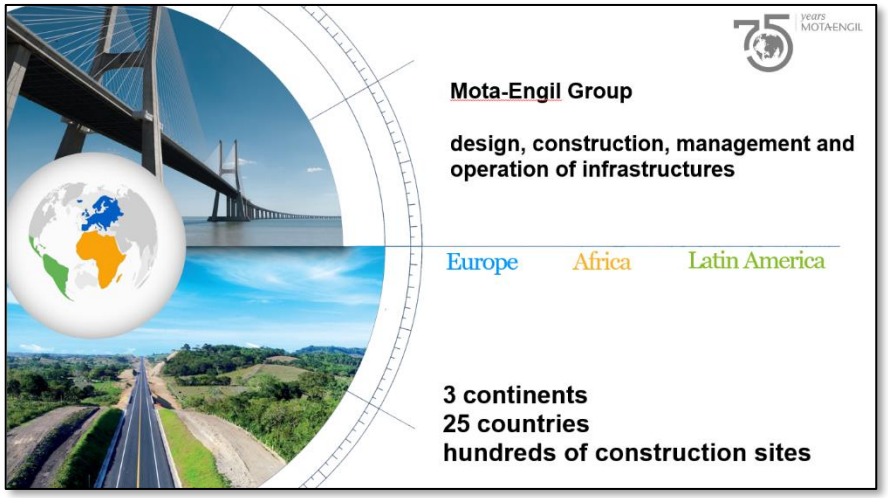
14.5 years at Autodesk *(between Latin America and Iberia)*

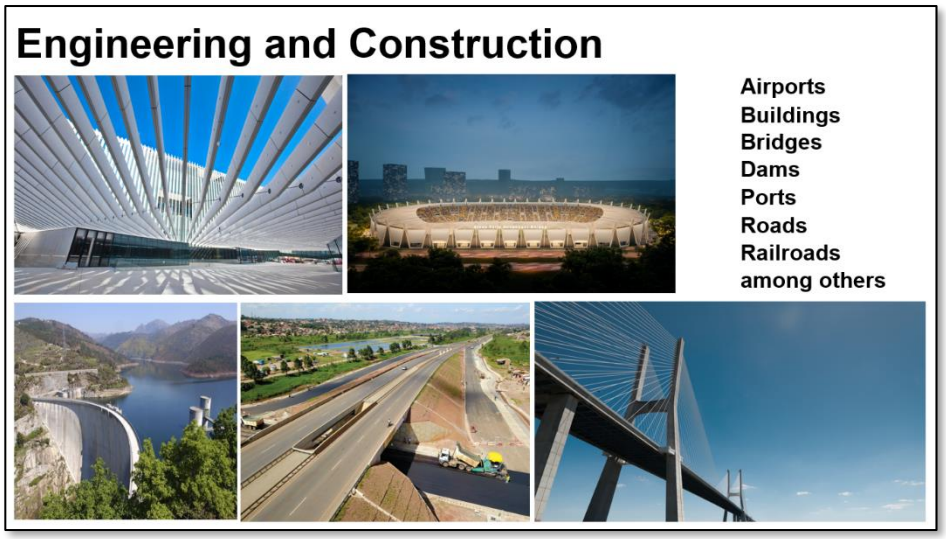
Context

Mota-Engil Construction Group

Mota-Engil Construction Group has a business record of more than 75 years, marked by a culture of entrepreneurship and innovation in a constant search for new horizons.

Mota-Engil is the biggest construction group in Portugal, with a consolidated position in the ranks of the 25 largest European construction groups and one reference company across the globe, with operating activities in three distinct geographical areas: Europe, Africa and Latin America. Mota-Engil assumes a position in the market according to the values and cultural identity of the organisation, grounded in a unique and integrated strategic vision for the Mota-Engil of the future: a more international, innovative, and competitive Group on the global scale.





Mota-Engil Group Overview

Relationship with Autodesk

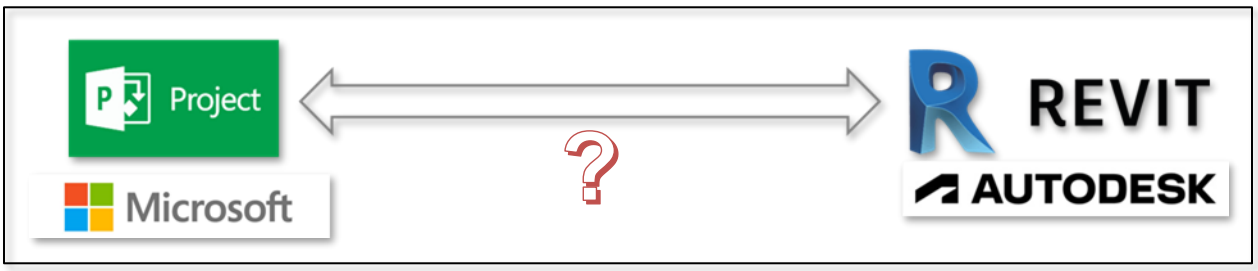
With a history of using Autodesk products for over 20 years, Mota-Engil got closer to Autodesk in recent years. This proximity led to an Enterprise Business Agreement (EBA) signed in 2021 that allowed Mota-Engil to benefit not only from the complete portfolio of Autodesk applications, but also from Autodesk Technical Support and Advise to Mota-Engil Construction Group.

In that relationship, while mutual knowledge was raising, Forge solution was presented and analysed, planting the seed for this project.

The challenge

At Mota-Engil as within many other construction groups, MS Project is a strong scheduling and management tool, widely spread all over the world. At Mota-Engil, most of our construction sites use MS Project as the main planning tool.

To leverage the 4th dimension of BIM (schedule), we wanted to deploy a new workflow that connect this widely used tool to our 3D BIM models in the most seamless way.



The Challenge

We wanted a tool that would give us:

- Improved coordination and communication among all stakeholders
- Ability to visualize each construction stage from any angle point, sectioning, etc.
- Ability to easily study different scenarios and easily implement adjustments in the construction sequence, reducing the time needed to make updates and iterations in the planning and its connection within the BIM environment
- The need for a minimum number of different used platforms
- Short development time & fast learning curve
- Ability to scale to multiple projects, after a first initial pilot

To trace our path towards these goals, we define a slogan that guided us throughout our development process

Make it simple and significant

Development slogan

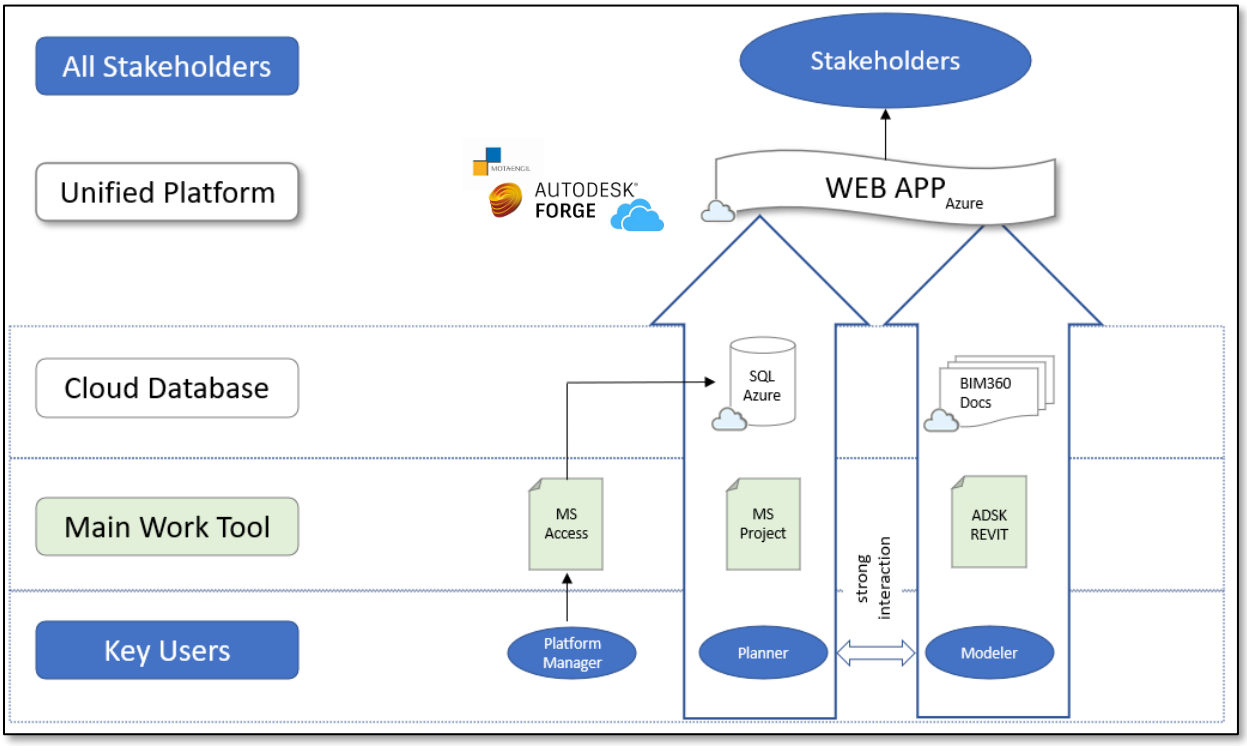
The idea

1. Keep the main users working the same way they were working, as much as possible: the modeler working in Revit, the planner working in MS Project

2. Upload the data to the cloud, to better process, cross analyse, share and communicate the information: Revit files to be uploaded to BIM360/ACC and MS Project data to SQL database

3. Add a single new user role to manage the cloud platform (create and configure projects, user permission and roles)

4. Develop a web application to share and communicate the 4th dimension of BIM to all project stakeholders, in a secure environment ruled by specific user permissions

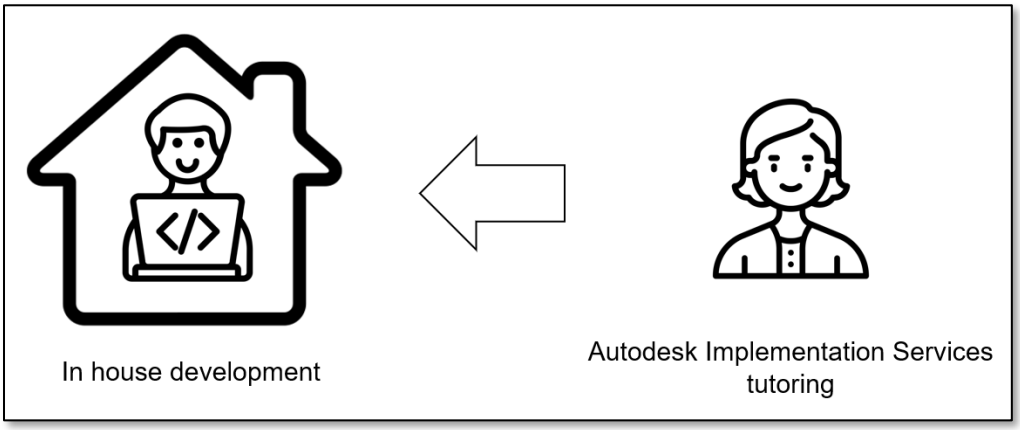


Main workflow

The implementation processes

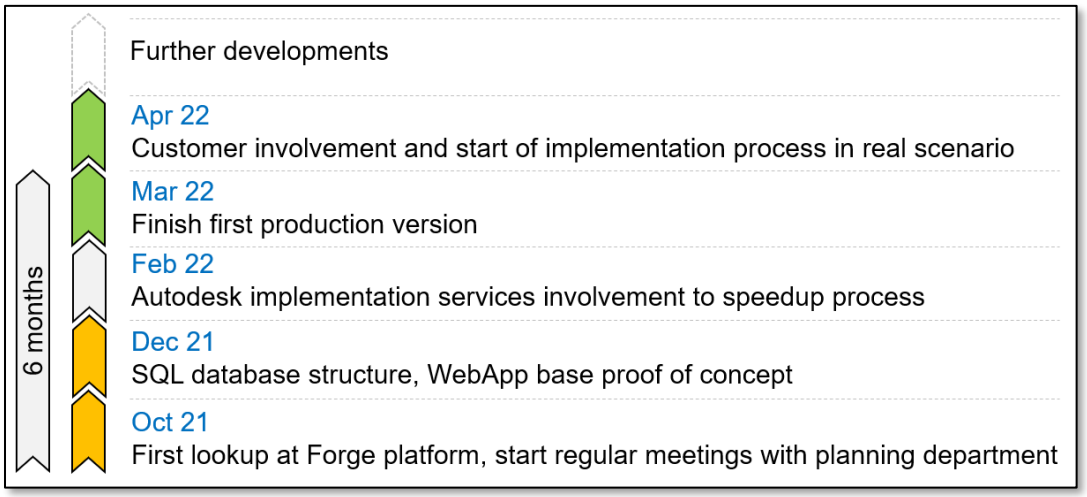
Mota-Engil Global Technical Services started to look for the solution in October 2021, with regular meetings to the internal planning department and with the first Cloud development tests. A couple of months later we have developed a skeleton and a working proof of concept.

Afterwards, we identified a working on project to test the solution. To speed up developing times, we got Autodesk Implementation Services involvement. While maintaining code development internally at Mota-Engil, Autodesk would be tutoring our team in online sessions.



Implementation model

Six months after project's kick-off, we got a first production version of the tool and the ability to involve our client and the remaining stakeholders.



Implementation timeline

For this model to succeed, some development knowledge must be ensured inhouse, as stated on the following figure.

Inhouse knowledge for code development

The pilot

Project name: Lisbon General Drainage Plan

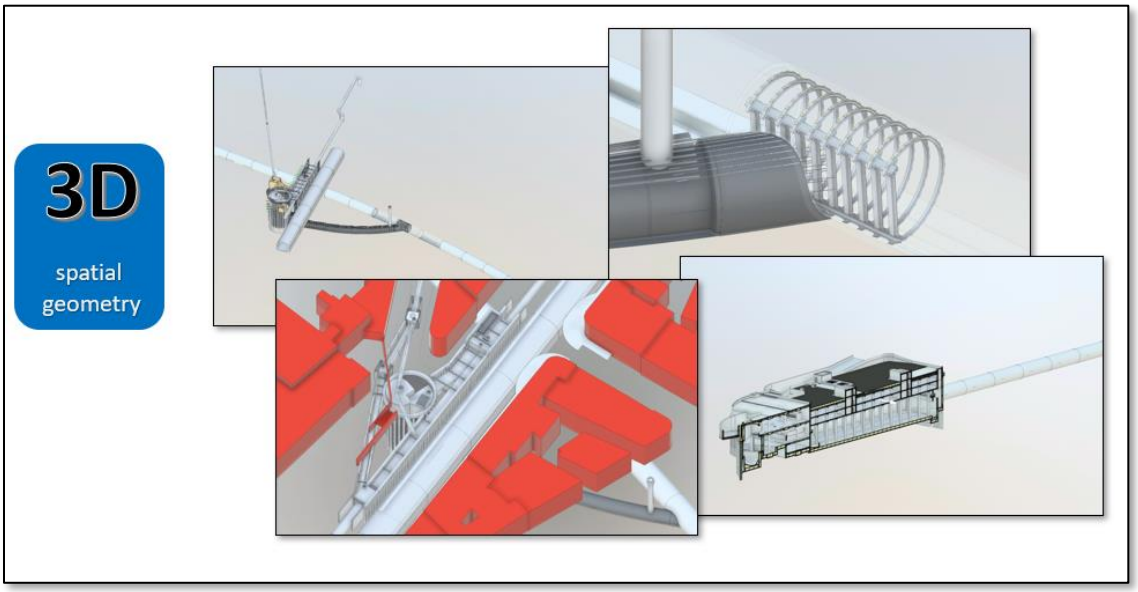
Location: Lisbon – Portugal – Europe

Scope: 2 drainage tunnels crossing ancient Lisbon: 5.5m diameter, 5km + 1km length
5 intersection works
2 discharge works

Budget: 133 M EUR

Client: Municipality of Lisbon
Lisbon General Drainage Plan Project Team

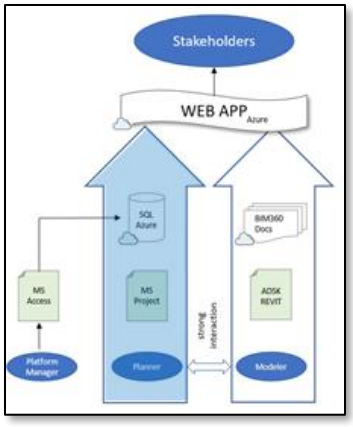
Pilot project layout



Images of the pilot project 3D models taken from the Forge viewer (snapshot extension)

The solution

Planner side

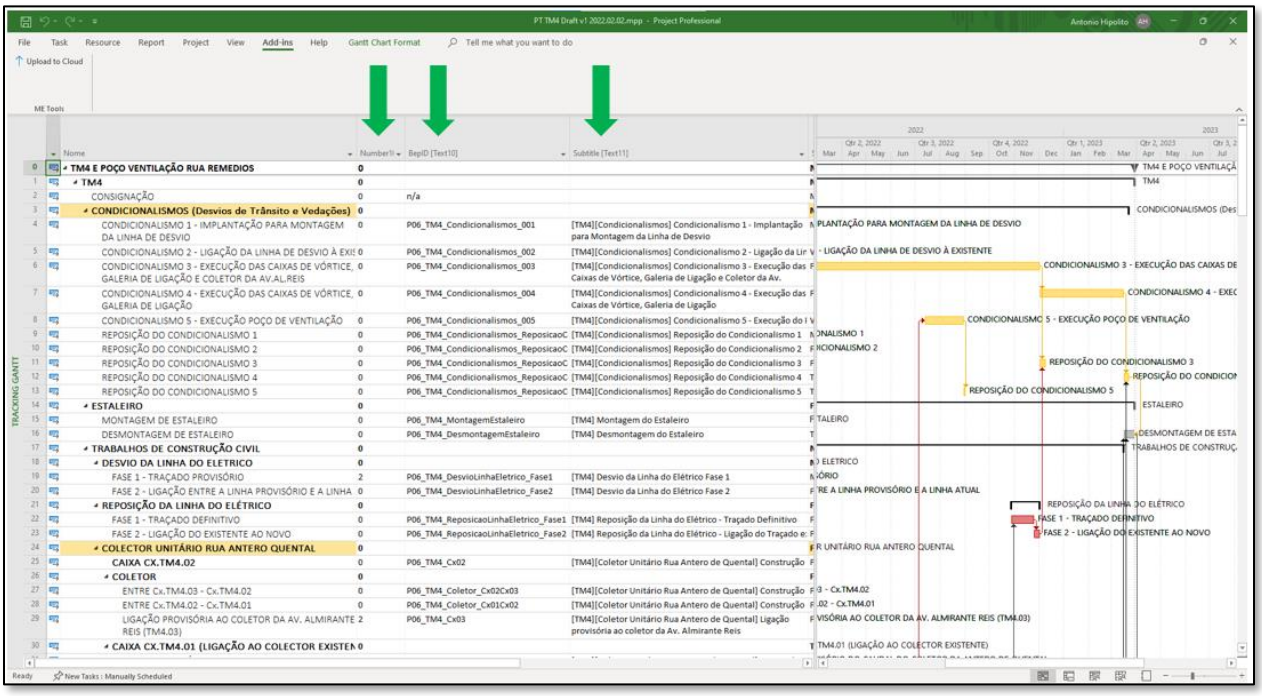


The planner keeps working on the usual tool (MS Project) the same way he/she was doing, but adding 3 additional columns of data:

- kind of task (construction, demolition, other kind)
- task code according to BEP specifications, that will connect that specific task with a group of Revit objects
- task description, a free text to help realize what will be done in that task

The upload of MS Project data to the cloud is done through an add-in specially developed by Mota-Engil Global Technical Services for that purpose. For security reasons, the add-in was developed in C#. The solution allows for a specific project to have multiple scheduling options, with different user restrictions to each option (some might be under development, other for internal discussions, others shared among the stakeholders).

In this workflow, the planner takes only a few seconds to share the last update with all stakeholders that have permission to see that specific planning option.



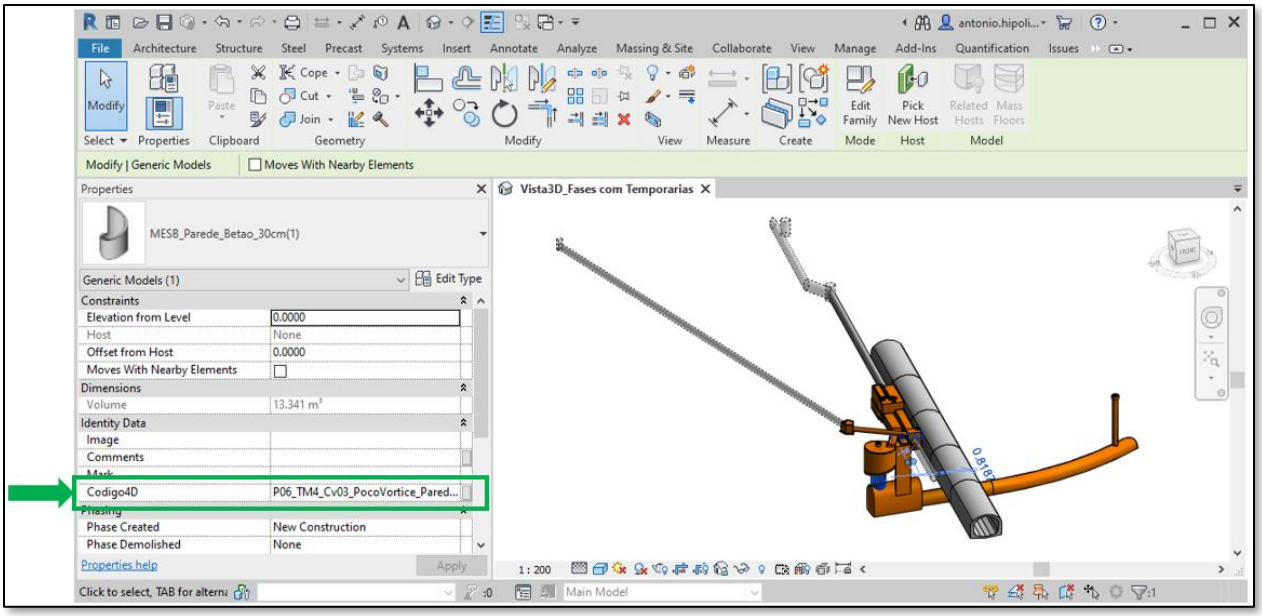
MS Project with only 3 additional columns

Modeller side

The modeller keeps working on the usual tool (ADSK Revit) the same way he/she was doing but filling one additional parameter.

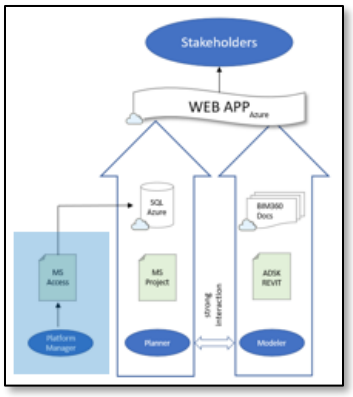
That parameter can be named on a project wise base, according to BEP requirements.

The upload of the Revit models to the cloud is done the usual way, throughout BIM360 or ACC interface.



Autodesk Revit with only 1 additional parameter

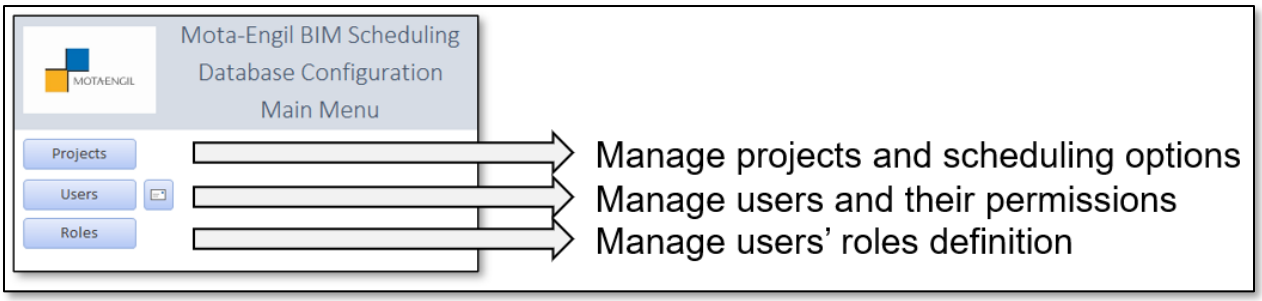
Platform Manager side



The platform manager is the only new role and has the responsibility of configure the projects in the platform, users' credentials and permissions.

This task is performed using a MS Access front end, connected directly to SQL database.

The front end was developed by Mota-Engil Global Technical Services.



Platform Manager main form

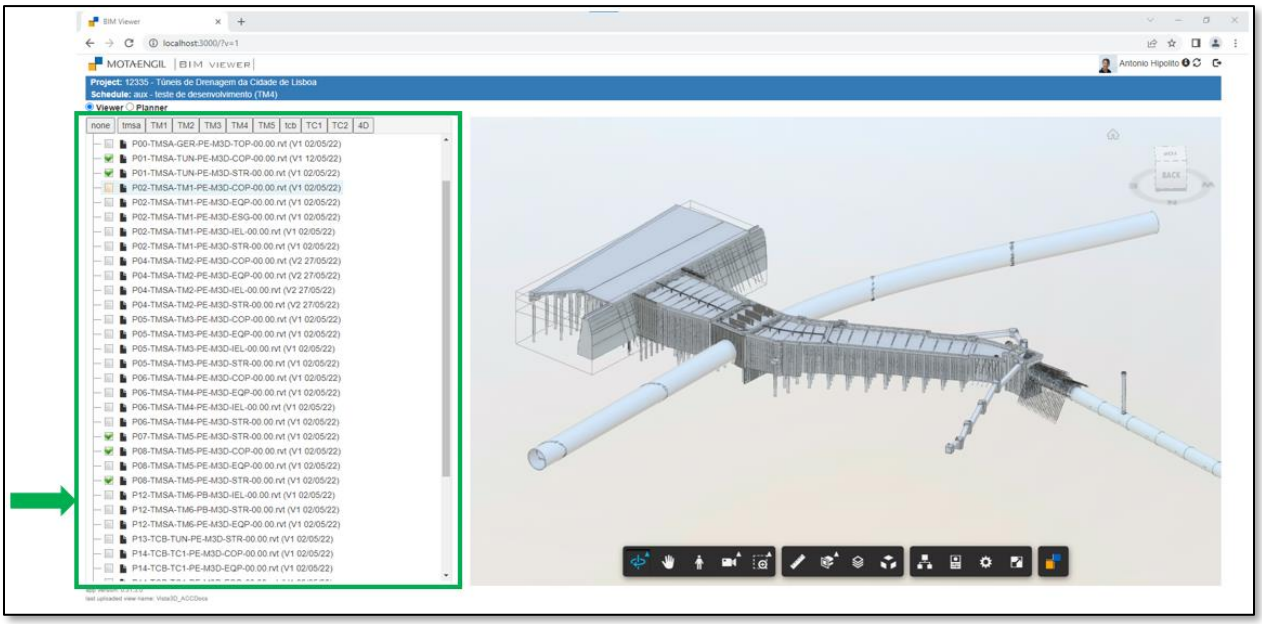
Stakeholders side

The main development of this project was the totally new BIM Viewer made by Mota-Engil. It runs on a web browser environment with no need for local installations.

The login is done with Autodesk credentials. Mota-Engil BIM Viewer recognizes the user and the specific permissions that this specific login has on a specific project / scheduling option.

After login to a specific scheduling option, Mota-Engil BIM Viewer automatically connects to the correct BIM360/ACC hub, project and folder and shows to the user what Revit files can be activated. The latest version of the models is always retrieved keeping data updated to the latest version.

If multiple models are activated, the shared coordinate system defined in Revit is recognized and the models are accurately positioned. No need for local positioning adjustments.



Mota-Engil BIM Viewer - Left panel showing the available Revit models

Custom action buttons

To further keep it simple for the user, we added a toolbar with custom action buttons, defined on a project wise base (meaning that one project can have one set of buttons while other project may have other set of buttons), that further manipulate the interface. For this project we added Action Buttons for automatically selecting the correct Revit models for a specific subpart of the construction, without the need to scroll the Revit files list or knowing the Revit files naming standard.

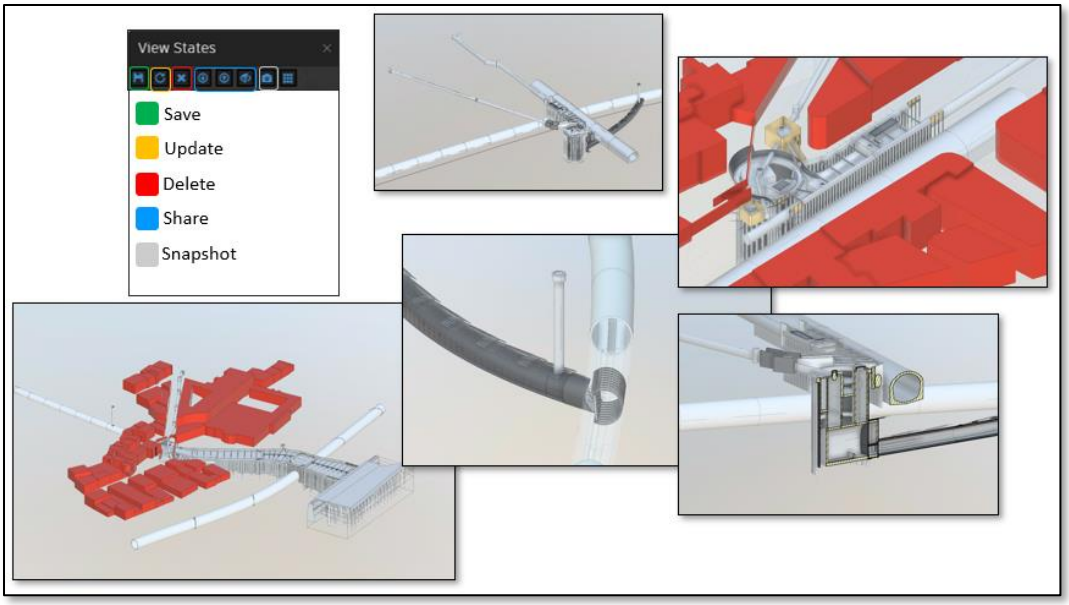
Custom action buttons for the pilot project

The *tmsa*, *TMx, tcb* and *TCx* are specific sub works inside the contract. The 4D button was inserted only for test purposes during the development phase.

View states extension

Additionally, and following our slogan “Make it simple and significant” we developed a custom extension to the standard Forge Viewer, that allows each user to save a particular view, make it private or public to all stakeholders with a single mouse click, share it by email with a specific user, or take fast snapshots by hiding all the buttons on the viewer and copying the clean view into a new web browser page.

This extension greatly improved the user experience by navigating much faster on the model and raising up the communication capabilities of the platform



Mota-Engil BIM Viewer - View states extension samples

Planner mode

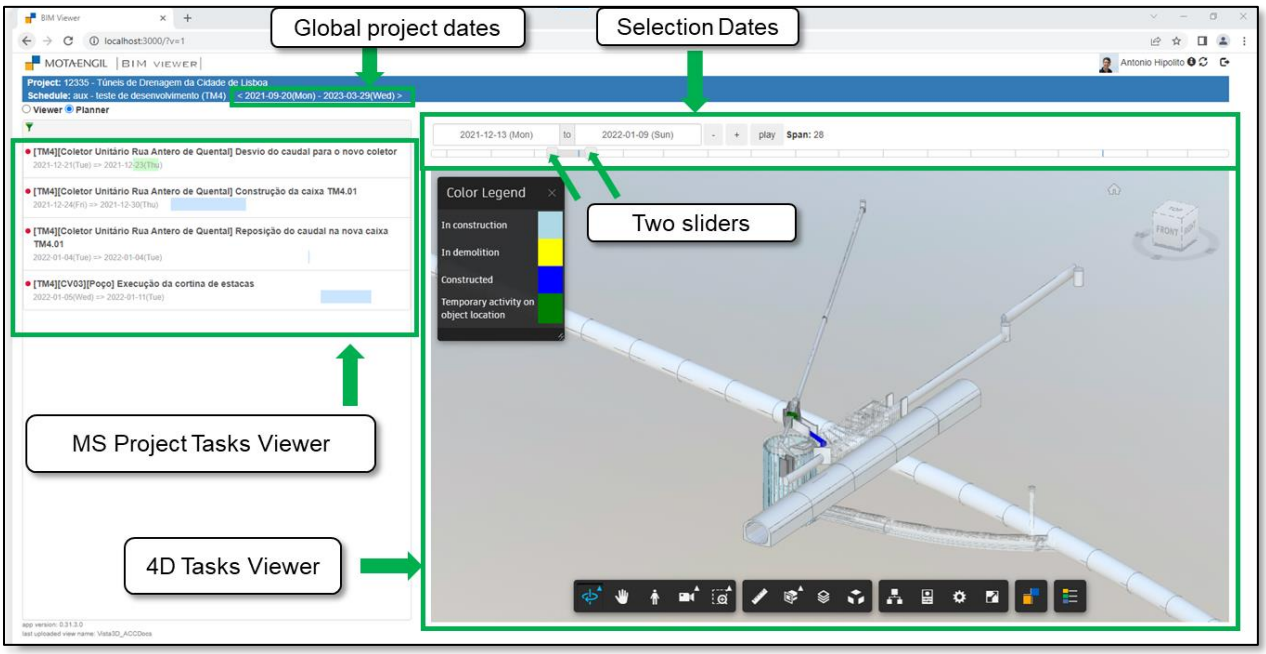
Once the user gets into planner mode, Mota-Engil BIM Viewer shows the project start and finish dates, a toolbar for date period selection and the MS Project tasks for that period.

The cards on the left panel show specific information for each MS Project Task. Those cards have for now the following information:

- Task description
- Task start and finish dates
- A red marker for critical path tasks
- A Gantt bar representation

On the Forge viewer side, the Revit objects are automatically hidden or shown based or their construction state, and painted according to the kind of activity being developed (construction / demolition / other kind). If the construction of a certain object is finished, the object is marked as so.

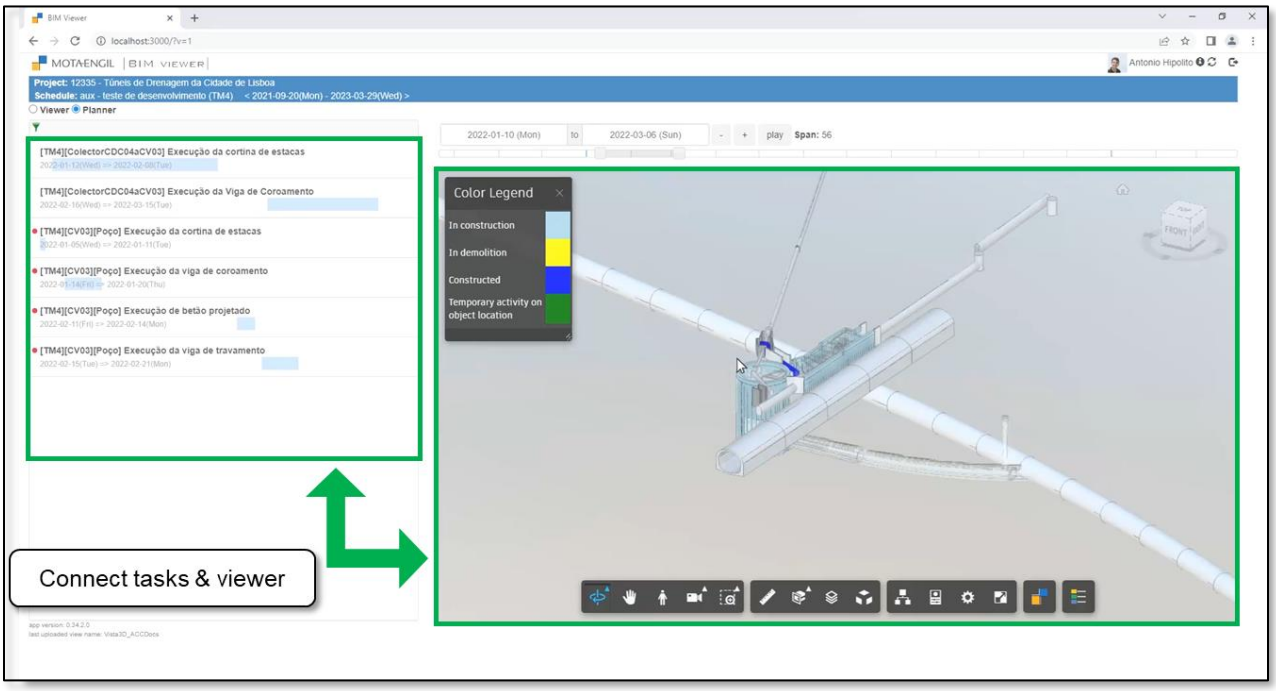
One nice feature that we decided to add was the ability to peek two dates to define the time span that we want to analyse. Most of the times it is more important to know what is planned to do on a specific week, month (or other period) than on a specific day. A day specification is also possible by defining a time span of 1 day.



Mota-Engil BIM Viewer - Planner mode layout

Note that the MS Project Tasks Viewer and the 4D Tasks Viewer are interconnected. So, when someone pick a specific task on the left panel the Mota-Engil BIM Viewer

automatically highlights and zooms the objects that are linked to those tasks, making a useful clarification of that task meaning.



Mota-Engil BIM Viewer – Task list and viewer interconnection

Final words

In this case study, we were able to test and deploy a unique innovative custom workflow for implementing the 4th dimension of BIM in a construction site environment. The workflow is based on custom applications developed internally by Mota-Engil Global Technical Services, that allow the upload of MS Project data directly into a Custom Web Cloud Environment shared between stakeholders with security permissions based on project, schedule option and user role, leveraging our current tools and easily bringing their users into a Cloud BIM environment.

The developed Custom Web Site implements an Autodesk Forge platform that connects uploaded data in the cloud with 3D modelling, boosting the information into a new visual format.

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