



Module 8

BIM and Collaboration

Digitalisation in Construction



24
partners

12
countries

Date of Event

*Author/ **Institute***

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To equip the learner with the relevant knowledge and skills required to understand and know how to use data in a collaborative digital workflow between all construction team members.



1. Outline the importance of BIM collaboration at each stage of construction.
2. Outline the benefits of a digital collaborative workflow between all construction team members.
3. Outline the principles and use of the Common Data Environment, CDE for storing digital data to support collaboration in construction
4. List and outline how digital tools can support the principles of *system thinking* between teams on site.
5. Demonstrate how communication between the construction team members is carried out on site using digital tools to create a problem-solving workflow.
6. Outline how to access and evaluate a BIM model using digital design review tools to support collaboration between the design, construction, operation and maintenance teams
7. Demonstrate simply how to access and evaluate a BIM model using digital design review tools for the construction and maintenance phases using case studies





Topic 1 – Accessing info through the cloud

Topic 2 – Accessing info with mobile devices

Topic 3 – BIM review and problem solving

Topic 4 – Quantification and clash detection





1. Accessing info through the cloud



What is the cloud?



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Click on
the video

<https://www.youtube.com/watch?v=i9x0UO8MY0g>



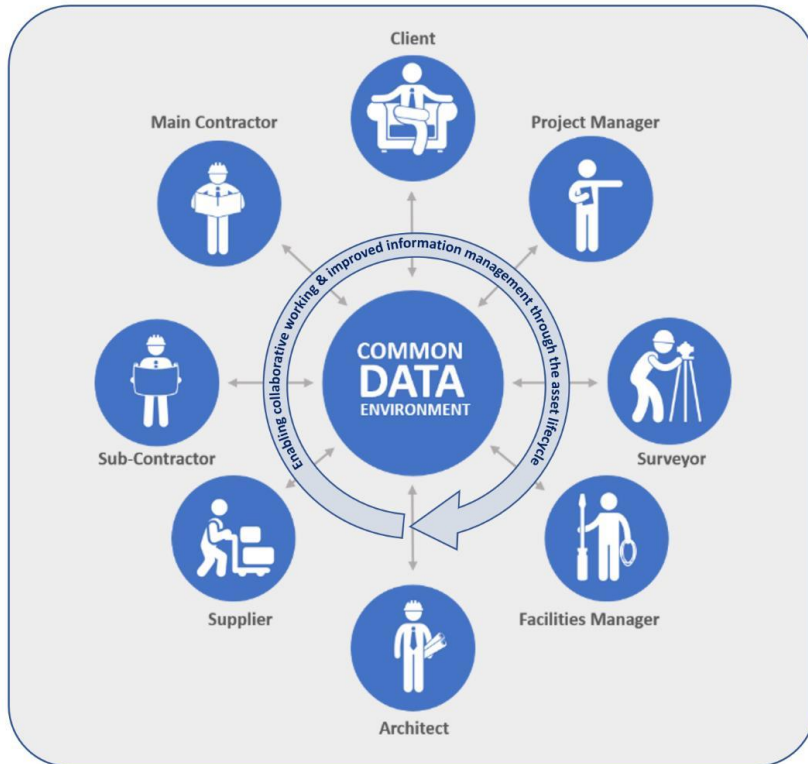
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Common Data Environment

The Common Data Environment (CDE) is a central repository where construction project information is stored.

This allows every participant in the project to access a single shared source of all the project information enabling effective collaboration

To enable effective collaboration and use all the project data various software tools are available.



How does a CDE work?

Access Protocols

CDE enables every participant access to the platform in order to share their documents and models.

CDE is facilitated by an online server or, more frequently, it is cloud based.

Data security is guaranteed by operating an account based system.

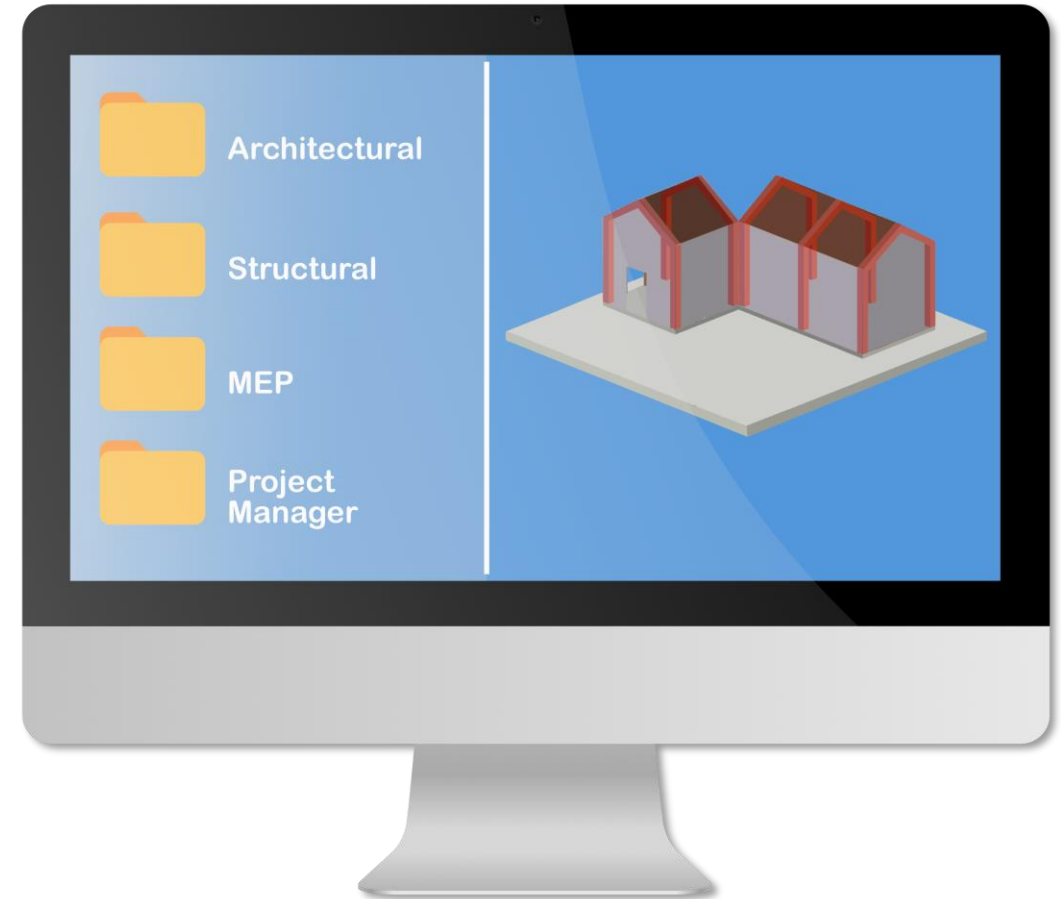


What does it look like?

CDE interface

A Common Data Environment works more or less like a system of shared folders that are freely organised by the team.

This platform also enables viewing of more than one model at a time, so users can identify if any inconsistencies occur.



Account based access

This access method enables allocating different levels of access to different users. The Information Manager controls the kind of operations that any particular user can do to any of the folder's content.

For example : an Architect can see and download elements in the «Structural» folder, but cannot edit the content!

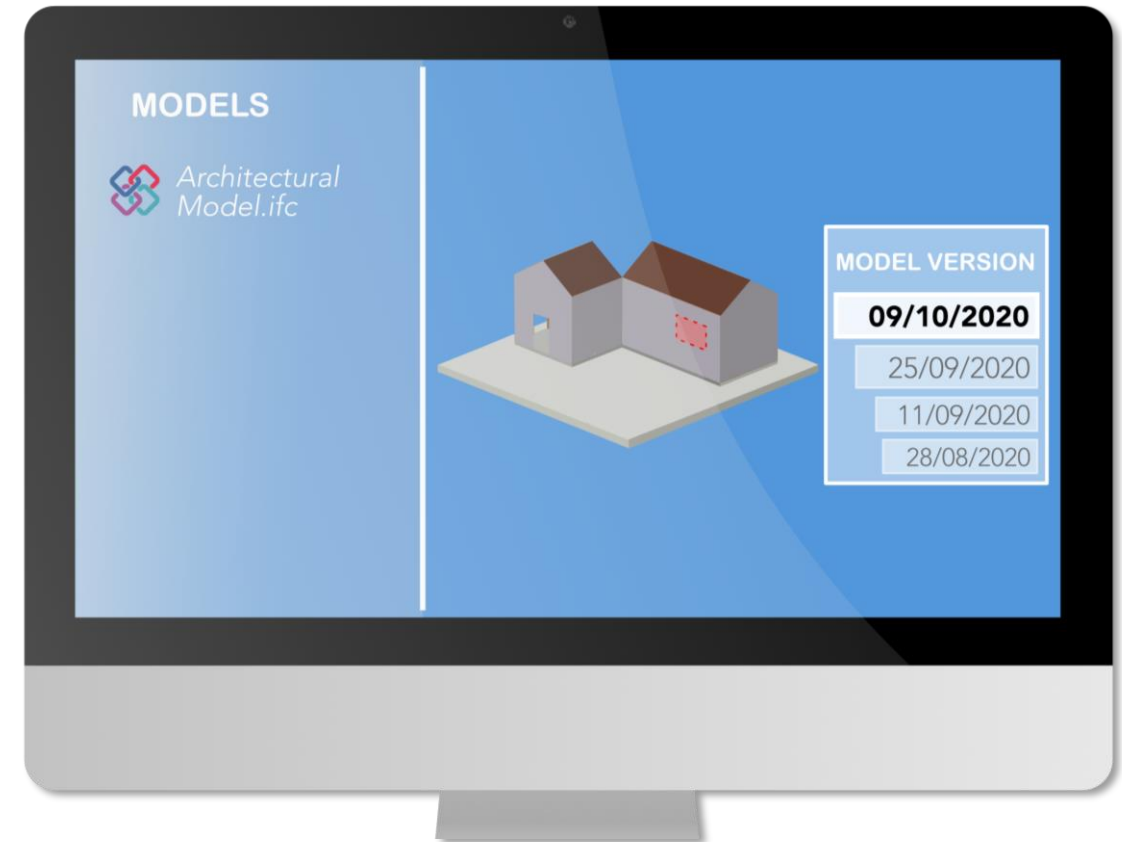


Model version

Whilst work is in progress project files in CDE are updated frequently.

Old versions of the same file are not deleted.

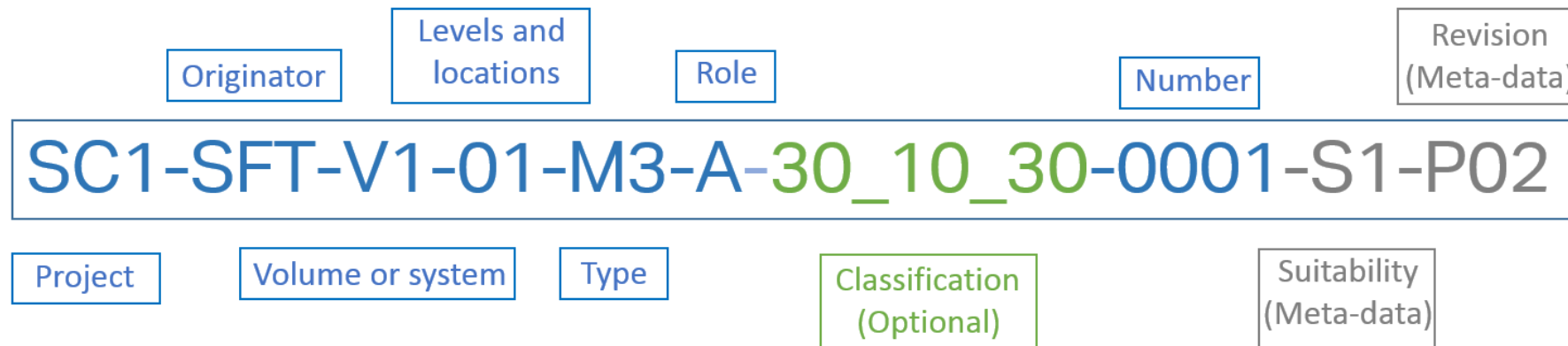
In fact the CDE maintains all the copies of a model, to enable users to identify file changes.



File naming convention

EN ISO 19650

As more and more information is shared digitally, the use of structured, consistent and understandable naming conventions for information becomes vital. An example is:



Smart Connectivity

Notification system

CDE also provides a multi-platform system that can be used in the browser on a desktop computer, tablet, or on the Apps on a smartphone. Authorised users are usually notified of any updates to the model.





2. Accessing info with mobile devices



BIM Collaboration



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NZEB and circular buildings require:

- innovative design processes
- mixtures of technologies
- based on an integrated design approach
- constructed by work teams

BIM Collaboration is essential between architects, engineers, technical experts, building managers, site supervisors, construction workers and building clients to achieve NZEB compliance and Quality of works.



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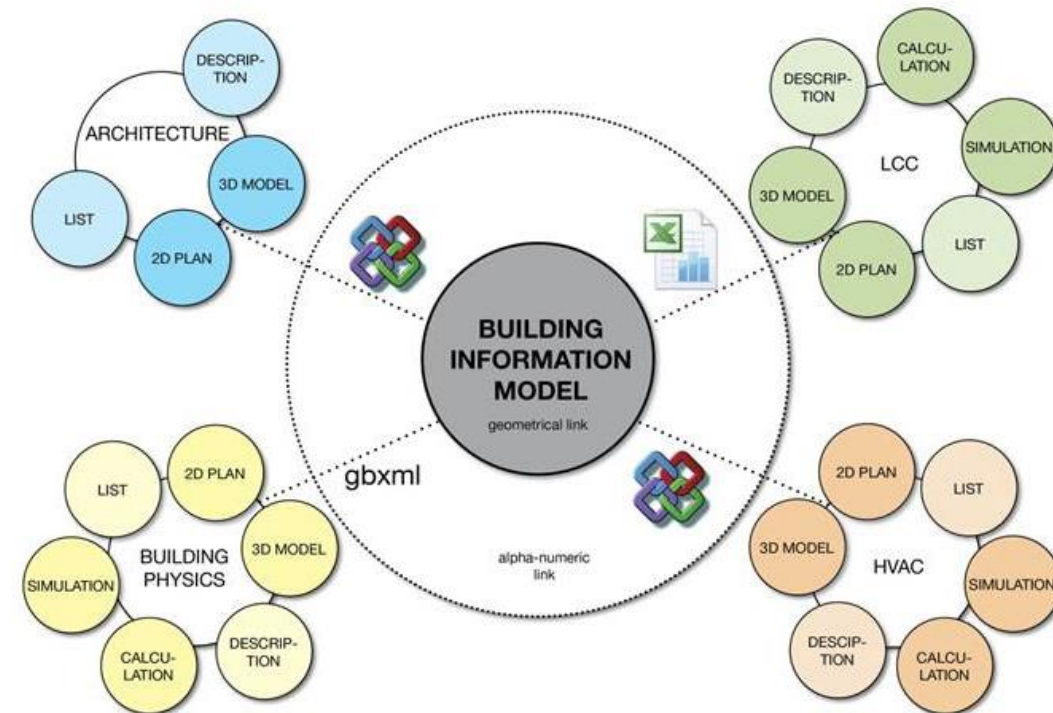
BIM provides a platform for collaboration throughout the project's design and construction

BIM can combine in one **database/cloud** :

1. Design Information for all disciplines,
2. Product and Material Information,
3. Installation Instructions,
4. Project Management Logistics.

BIM model and database can exist for the life of a building,

- the owner may use BIM to manage the facility well beyond completion of construction



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Source: Iva Kovacic, TU Wien, BIM_SUSTAIN

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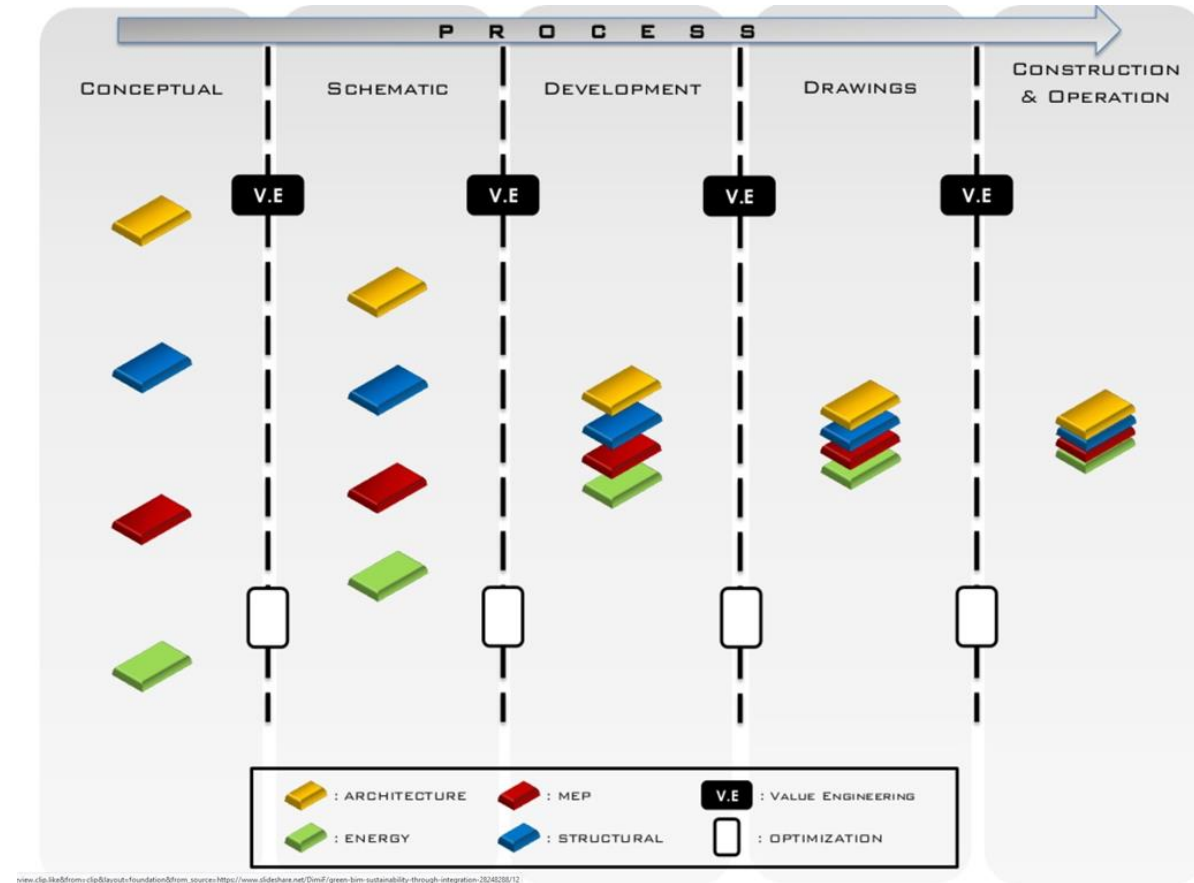
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If the key team are involved from the earliest practical moment:

- Decision making at early stages by ALL key players will improve Quality and time frame of the build
- Combined knowledge and expertise by ALL key players during the project's early stages will set out roles and responsibilities to improve production.



How to use BIM to solve some of the issues

A number of videos have been developed to show how BIM can assist with a number of issues.

Federated Model and Navigate

(What is a Federated Model and how important is it in modern construction on-site?)

Different professionals work on their own model, but can also work on a combined model known as a “Federated Model”.

“A Federated Model is a combined building information model that combines a number of BIM models from different disciplines into one”.

The main fields include models produced as Architectural + Structural+ Electrical+ Mechanical+ Civil and Sprinkler

Combining these individual models allow the BIM user to visualize, share, review, and validate BIM projects using 3D/2D information from a single file.

Using a Federated Model is so important in construction as it assembles all the elements of the building into one model, and can be viewed layer by layer or zoom into a specific area of the building.

Previously on site, numerous drawings were used (or still is) and changes had to be marked up by hand, causing errors, confusion and delays.



BIM: Collaboration using Models



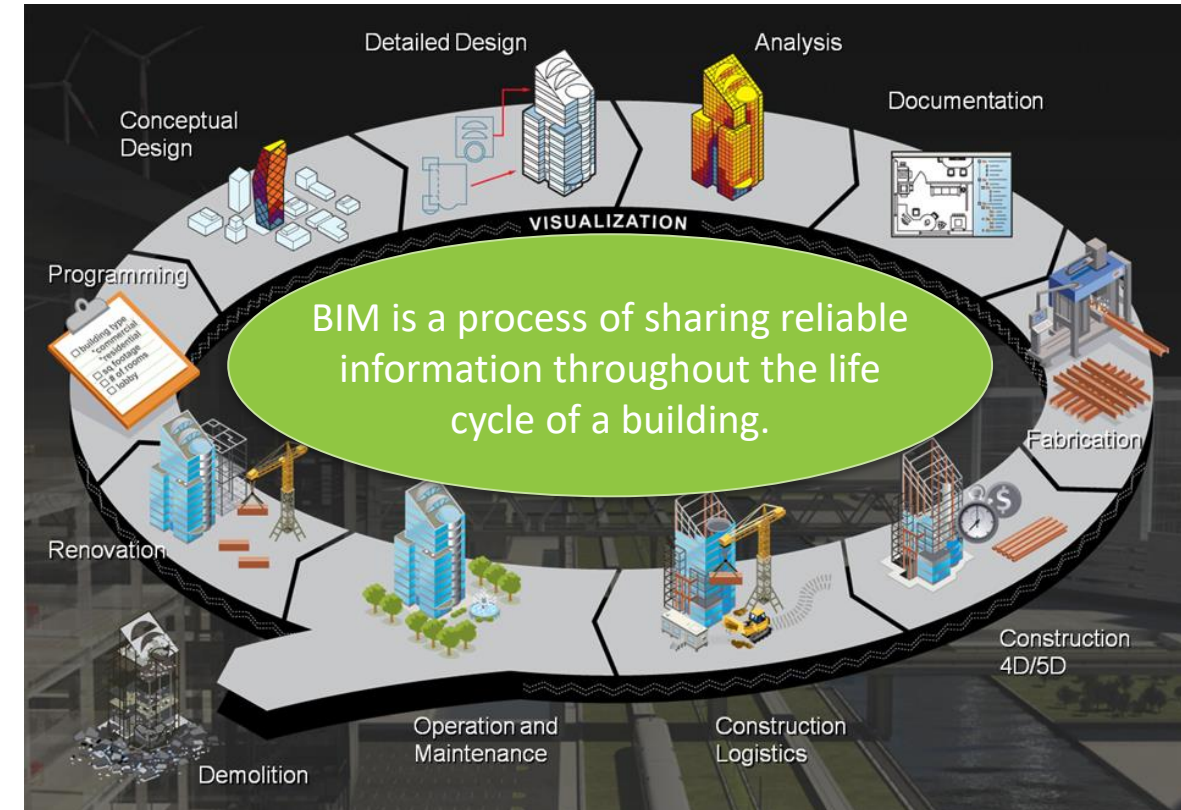
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BIM is...

A collaborative working method that makes use of **3D digital models** that contain **technical and structured data**, which improves the traditional approach

There are different types of models, which are distinguished along professional disciplines or technical aspects; main models:

- Coordinated (Federated) model
- Architectural model
- Bearing structure model
- Building services model



Source : <http://buildipedia.com/aec-pros/design-news/the-daily-life-of-building-information-modeling-bim>



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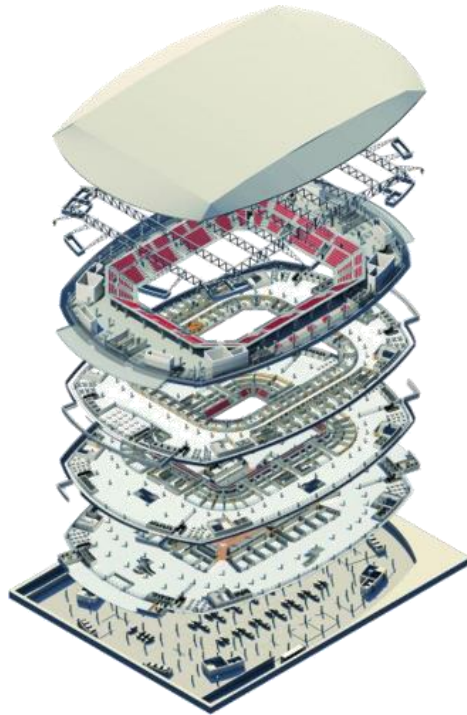
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Coordinated (Federated) model

All relevant project. Information of all disciplines and elements.

This is e.g. to be used as Documentation at the End of the project



Architectural model

Digital depiction of the architectural design.
Generally the first model and the base for integration of other models



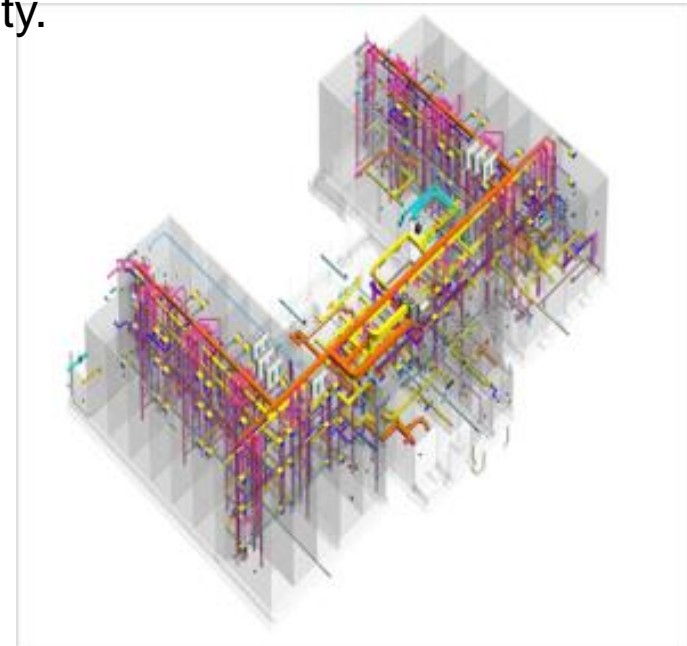
Structural model

Structural design solution and analysis of building structural integrity and performance



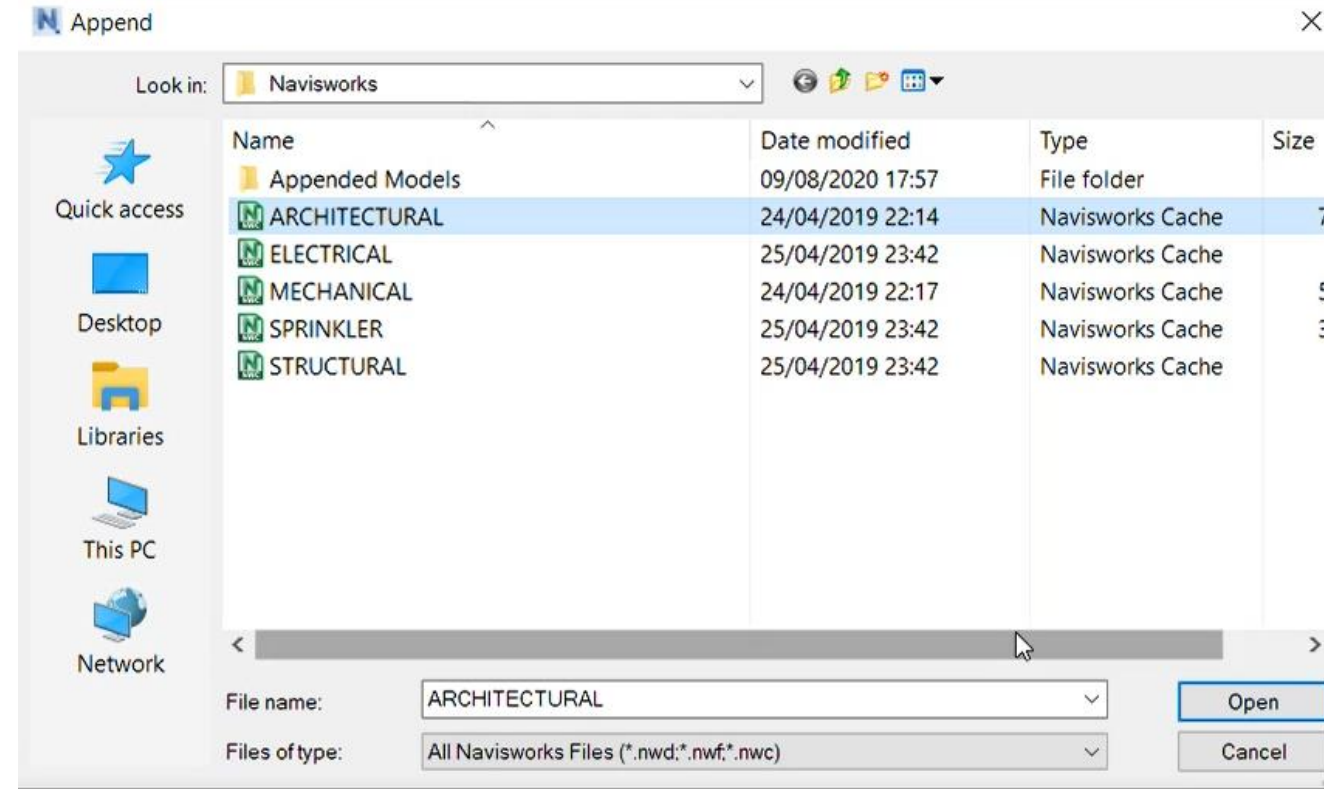
Building services model

A mechanical, electrical and plumbing model, detailing the services required for optimal building functionality.



What is a Federated Model? And how does it work?

- Different professionals work on their own model but can also work on a combined model known as a “Federated Model”.
- “A Federated Model is a combined building information model that combines a number of BIM models from different disciplines into one”.
- Architectural + Structural+ Electrical+ Mechanical+ Civil + Sprinkler...
- BIM users can use federated models to visualize, share, review, and validate BIM projects using 3D/2D information from a single file





3. BIM review and problem solving



Review the BIM-Viewer



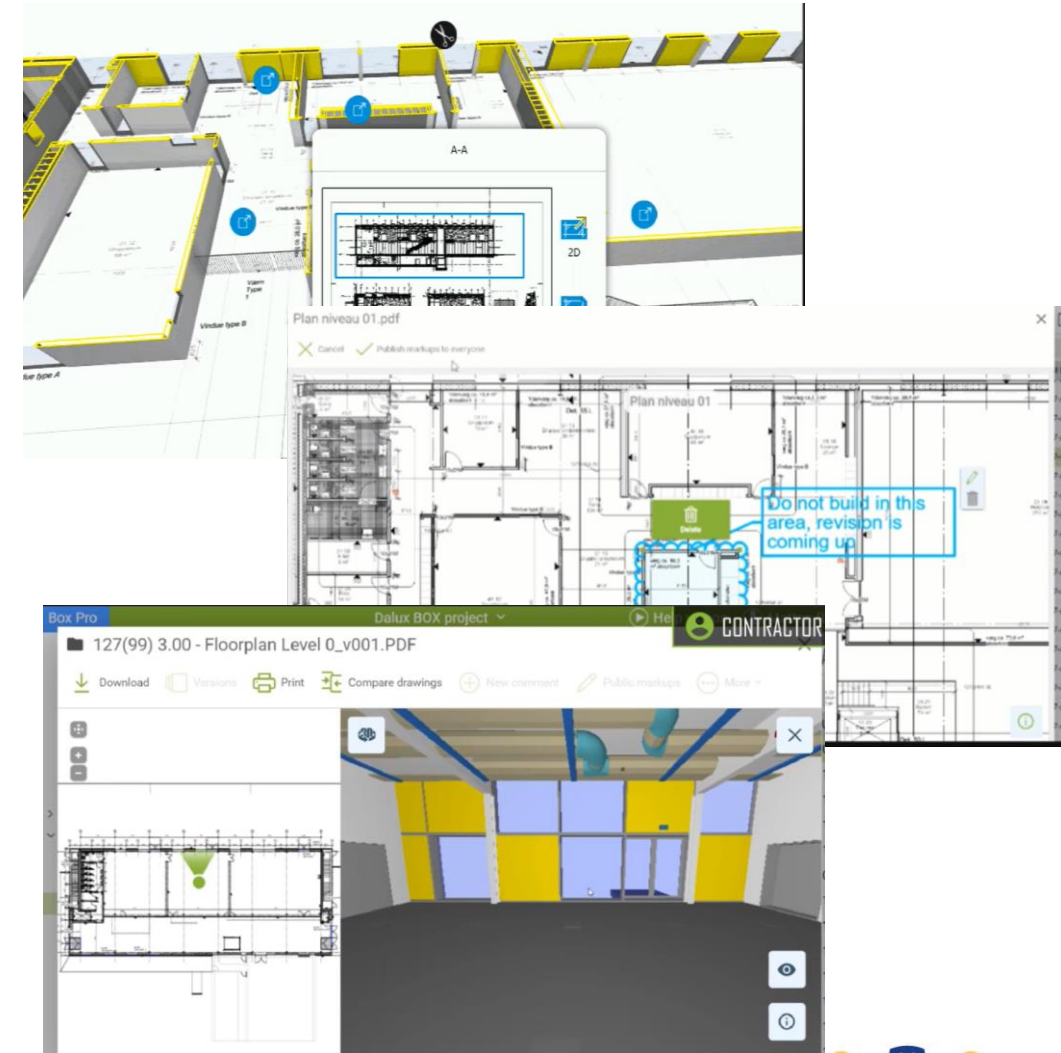
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What is a BIM-Viewer?

An App/Tool that allows the easy sharing/viewing of drawings and BIM models.

This is to help workers to:-

- Visualise the building by viewing, [location of columns]
- Compare sheets to see changes in real-time [reviews and log activity]
- Confirm what information is needed, [floor finishes, size of window opening].
- Report a problem in the viewer, [marking and highlighting service clashes]
- Check the delivery of materials on site, [time of arrival and quantity of concrete]



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Source: Dalux BIM Viewer and Box

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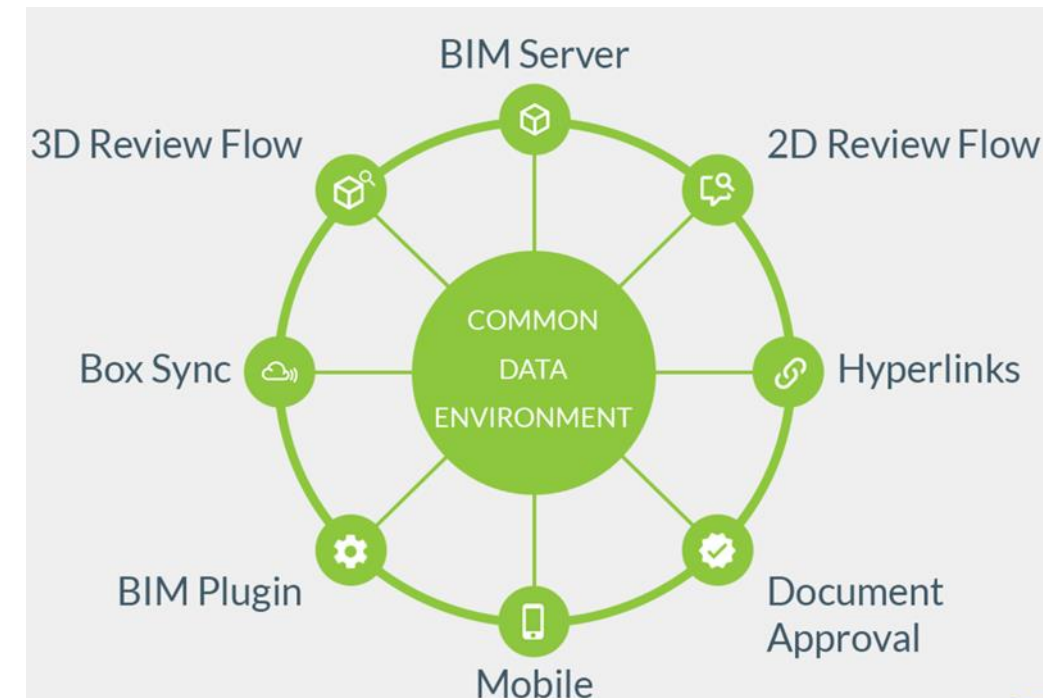
Review the BIM-Viewer



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Benefits to the Contractor

- Minimise the risk associated with high investments
- Better coordination and control over the task
- Automation of the quantities and costings process
- Streamlining the workflow and management process
- Highlight early clash detection
- Schedule of work linked to the BIM model
- Consistently work on the most up to date information (real-time)



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Source: Dalux BIM Viewer and Box

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Review the BIM-Viewer



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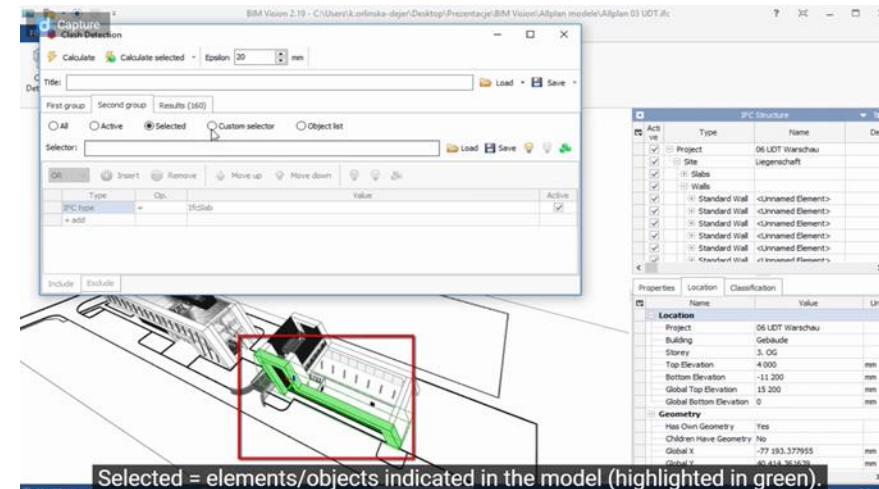
There are several free BIM Viewers available in the market:

<https://bimvision.eu/en/>

<https://www.dalux.com/daluxbimviewer/>

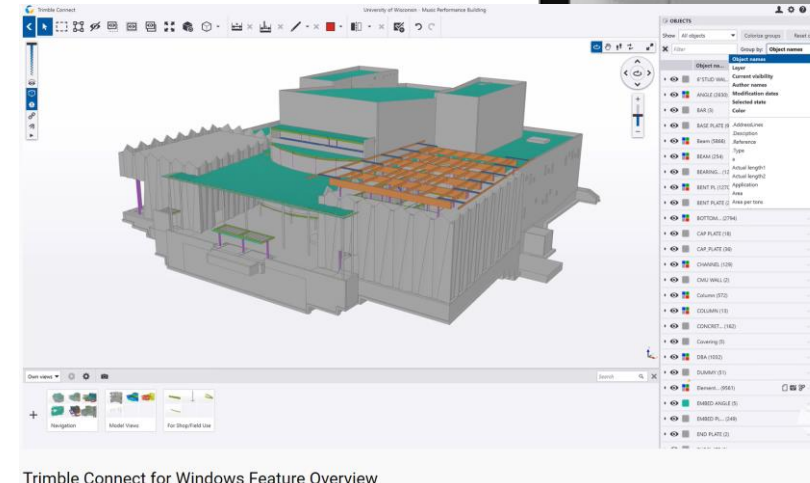
<https://teklastructures.support.tekla.com/2019/en/rel2019/TeklaBIMsightandWebViewerreplacedbyTrimbleConnectforDesktop>

<https://solution.solibri.com/application/#!/ProductsView>



Source: BIM vision

Source: Dalux BIM Viewer and



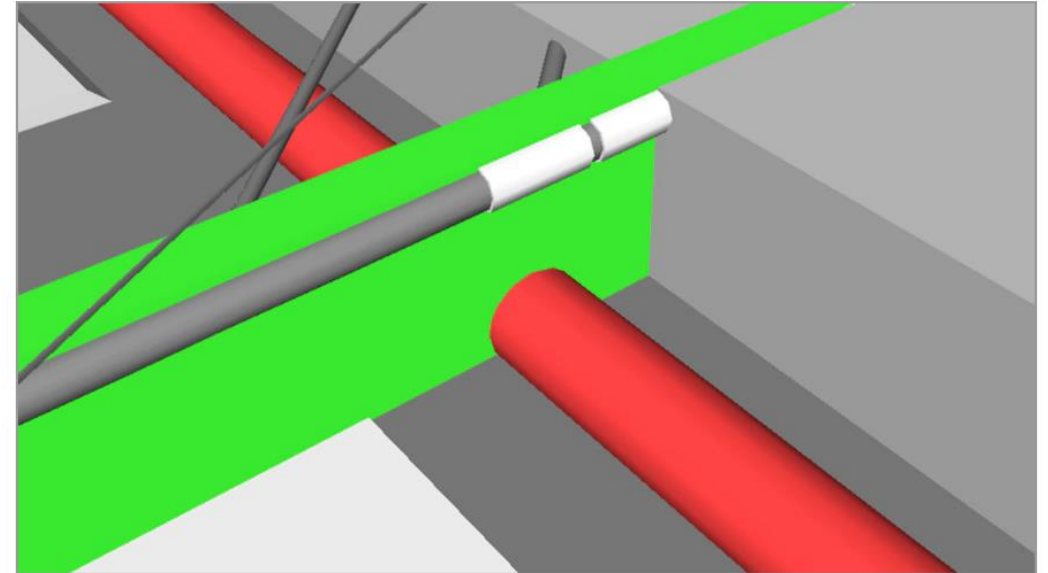
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With tools like these you can perform tasks such as:

- Combine design and construction data into a single model.
- Identify and resolve clash and interference problems before construction.
- Aggregate data from multiple trades to better control outcomes.
- Work within a cloud-based Common Data Environment (CDE) for the purposes of construction site and office activity.



Combine data from multiple sources to prevent problems.



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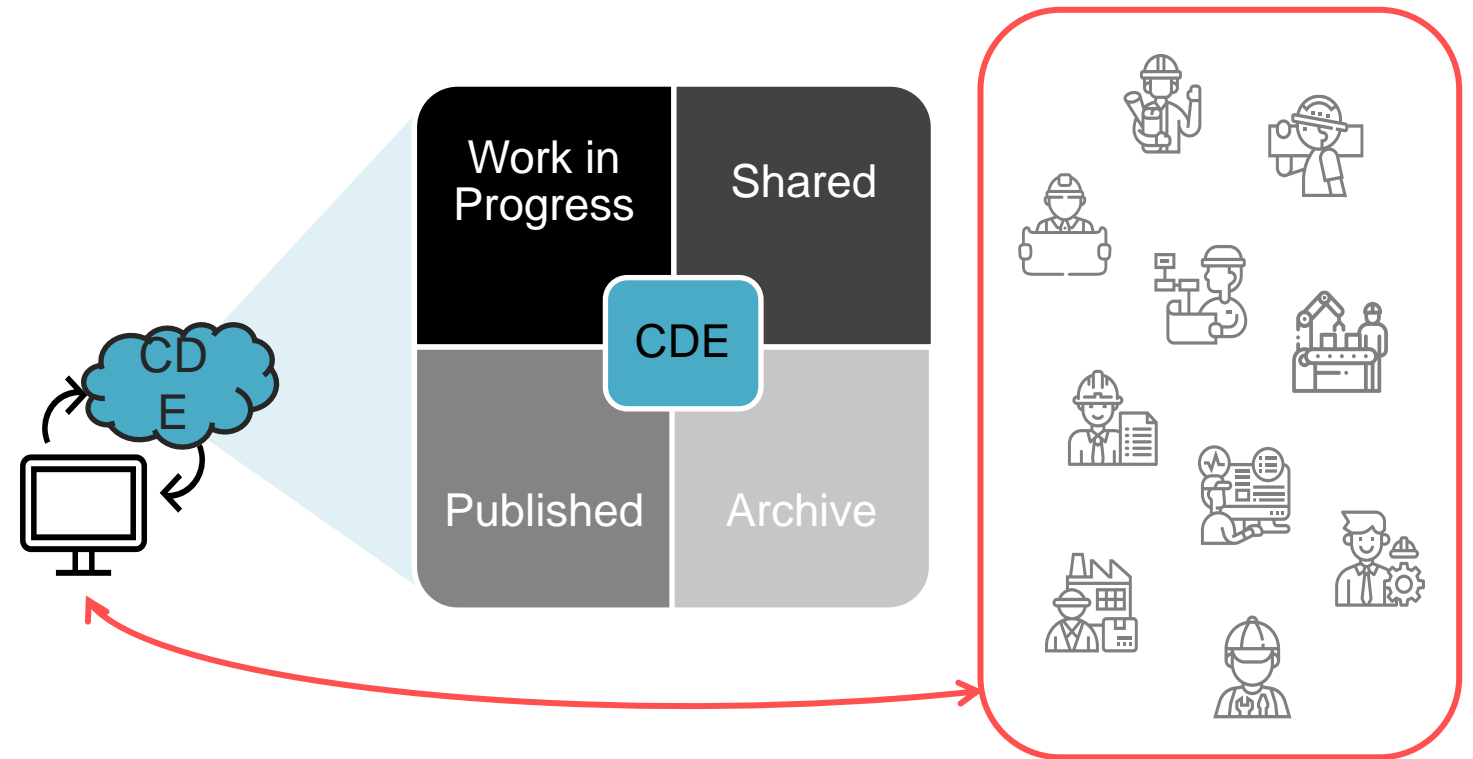


Common Data Environment



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If you recall, the Common Data Environment (CDE) supports BIM and is usually available in the cloud to allow everyone to access the Information they require, when they require it in real time.



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Access and Navigate Data



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Two Videos developed with Navisworks Manage have been created to assist with understanding how to export between BIM models and use Navisworks Model.

Review these videos and then you will have the opportunity to carry these tasks out in directed Tutorials

Part 1a Navisworks refresh house

Part 1b Navisworks and Revit

Activities and self-study are to be completed using videos as support during the learning.



Videos



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4. Quantification and Clash Detection



Clash Detection

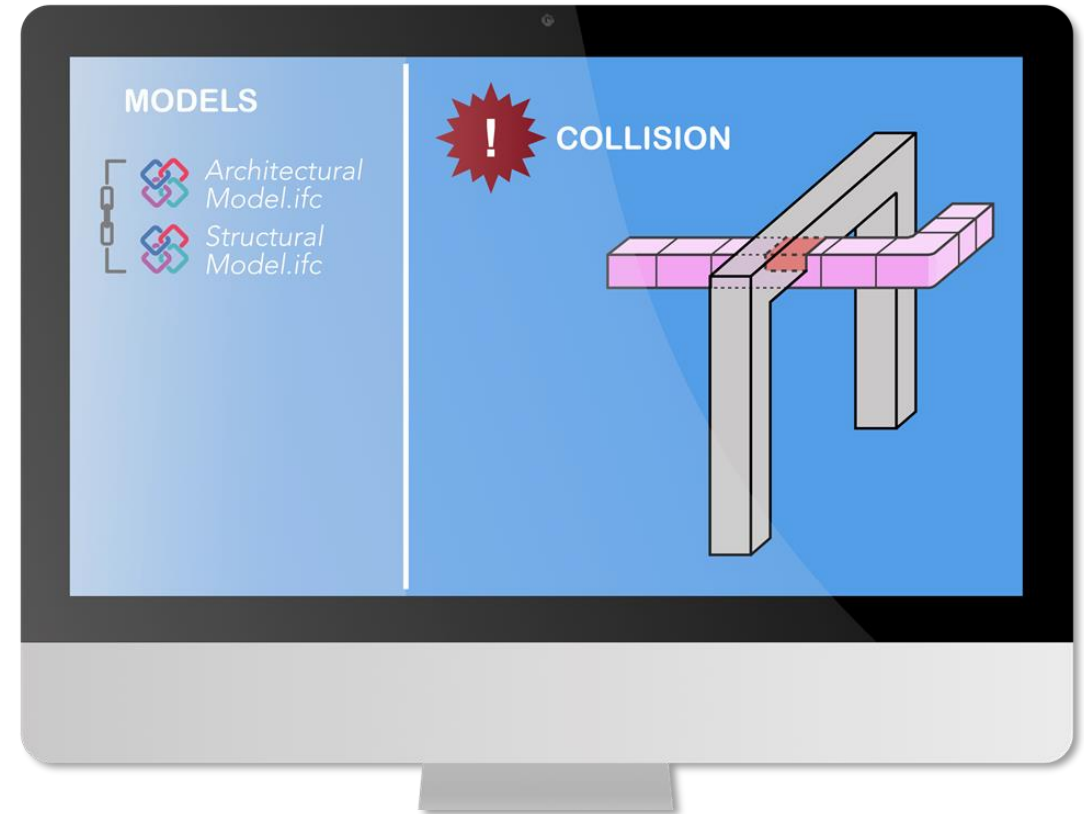


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Clash Detection

This is a critical part of the integrated BIM process. Clash detection identifies where the different disciplines' models clash with each other – finding where elements from one model overlap the elements of others.

Clash detection ensures every aspect, works hand-in-hand and nothing is incompatible or causes delays during construction.



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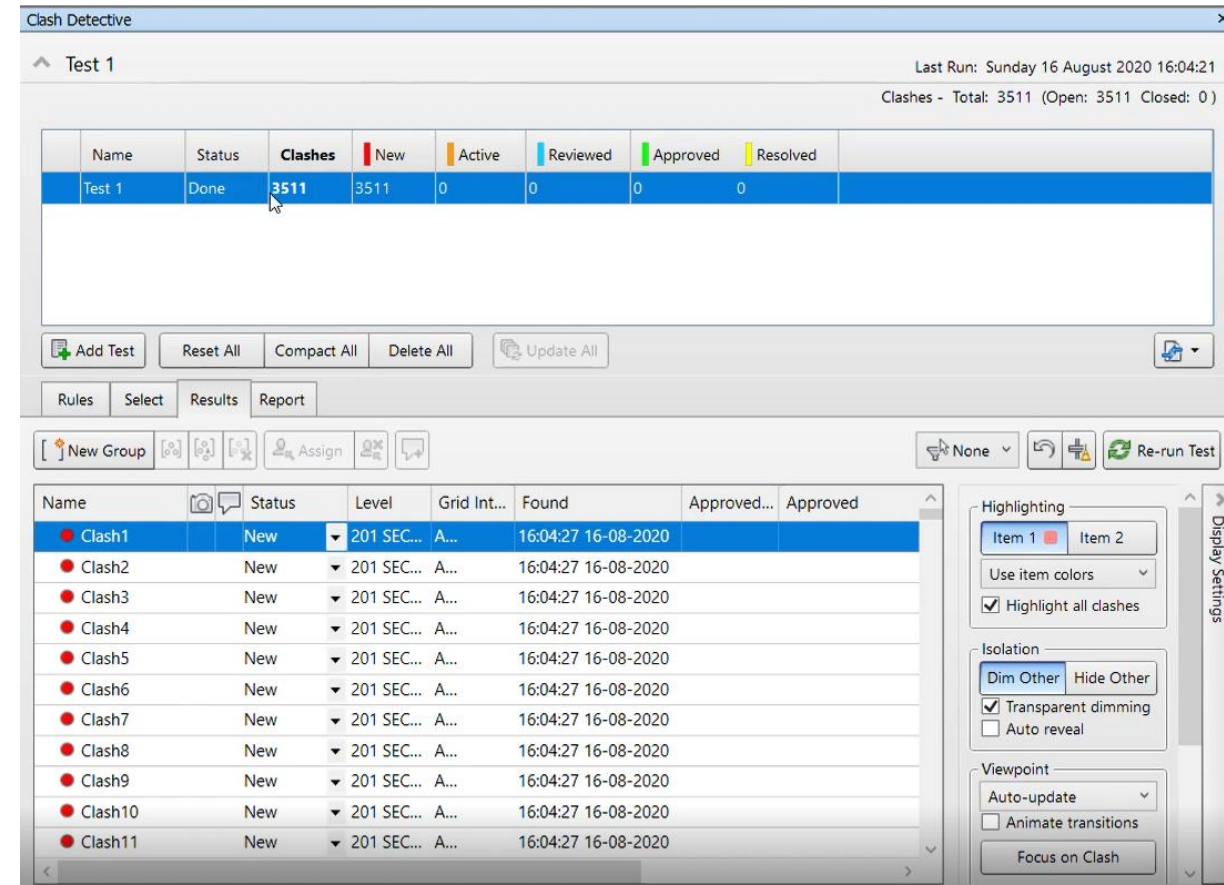
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Clash Detection

- Knowing what is possible with these software helps to inform site workers of the potential of such tools in avoiding problems on site. Engagement between site workers and Navisworks experts is the key to using the tool successfully.
- Clash detection should mainly be completed during the design phase. However, it can be very useful in checking the set-up of works or with renovation works, as information missed at design stage can be sent directly to the rest of team highlighting any issues, clashes or comments.
- Ideally , clash detections are run before a project starts on site, otherwise much of the cost/time saving potential will have been missed.



The screenshot shows the 'Clash Detective' software interface. At the top, it displays 'Test 1' and 'Last Run: Sunday 16 August 2020 16:04:21'. Below this, a summary table shows the total number of clashes (3511) and their status (New, Active, Reviewed, Approved, Resolved). The main table lists individual clashes, including their names, status, level, grid intersection, and found date. The interface also includes various toolbars for adding tests, resetting, compacting, deleting, and updating, as well as tabs for Rules, Select, Results, and Report. On the right side, there are settings for highlighting, isolation, and viewpoint.

| Name | Status | Clashes | New | Active | Reviewed | Approved | Resolved |
|--------|--------|---------|------|--------|----------|----------|----------|
| Test 1 | Done | 3511 | 3511 | 0 | 0 | 0 | 0 |

| Name | Status | Level | Grid Int... | Found | Approved... | Approved |
|---------|--------|------------|-------------|---------------------|-------------|----------|
| Clash1 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |
| Clash2 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |
| Clash3 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |
| Clash4 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |
| Clash5 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |
| Clash6 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |
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| Clash9 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |
| Clash10 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |
| Clash11 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |



Navisworks Features

Video lessons related to NavisWorks have been developed using the BIM tool **NavisWorks Manage**

Features

- Easy opening of NWD and 3D DWF files
- Enables viewing of model hierarchy, object properties, and embedded review data, including viewpoints, animations, redlines, and comments
- Includes full set of navigation tools, including Walk, Look Around, Zoom, Zoom Box, Pan, Orbit, Examine, Fly, and Turntable
- Supports real-time display of materials and lighting

These Videos are demonstrated in Module 11 – Quality Checks on Site .

They enable you to view, measure, mark up and manage projects using a BIM tool.



Access and Navigate Data

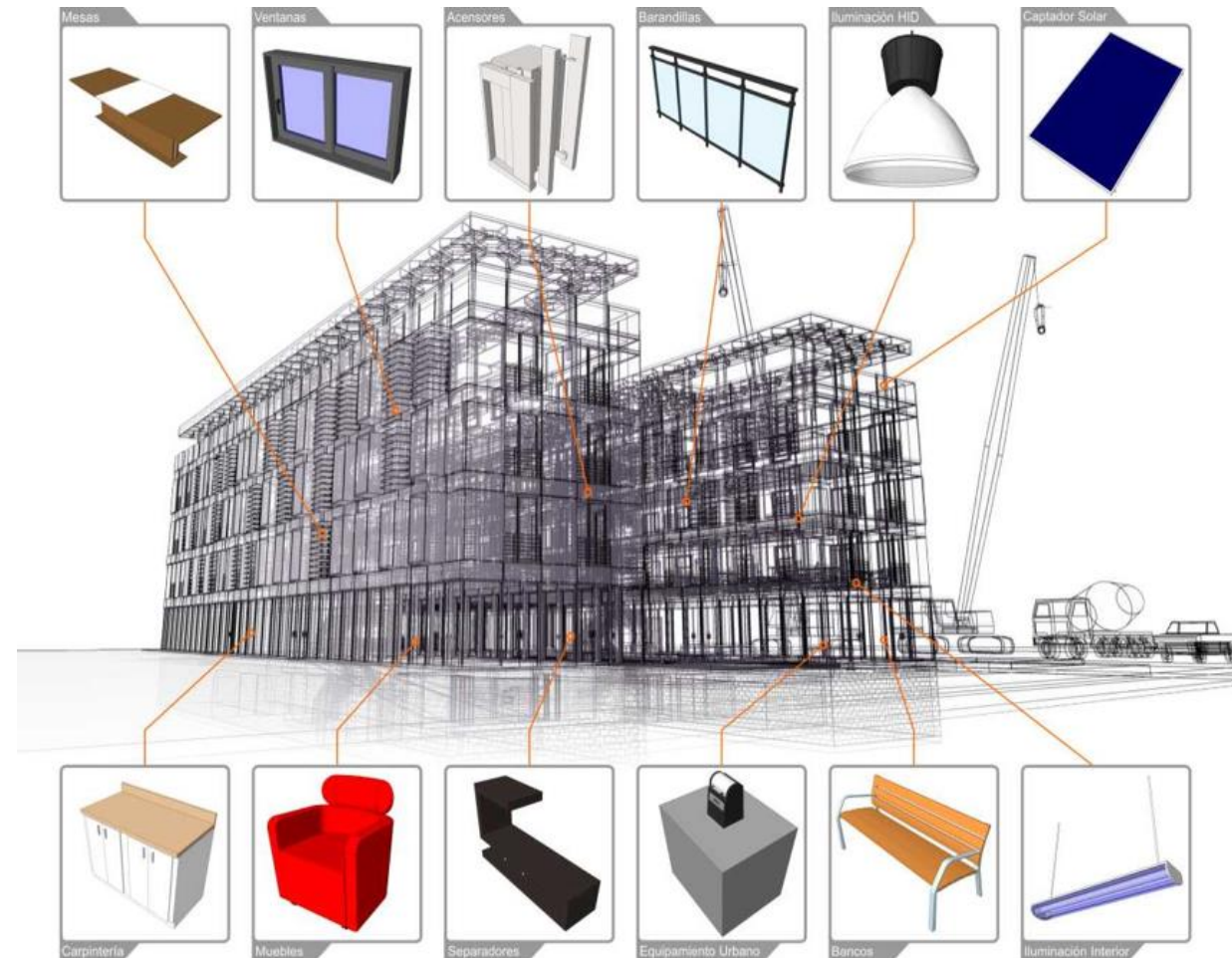


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How can BIM assist with NZEB compliance relevant to your trade and improve your trade on-site activities?

- Details and on-site implementation
- Tender stage inputs and quantification
- Time and Cost Management
- Communication and System Thinking
- Knowledge Transfer
- Quality and NZEB compliance

Using Navisworks Manage and other digital tools we will cover each topic, specific to construction workers and on-site works.



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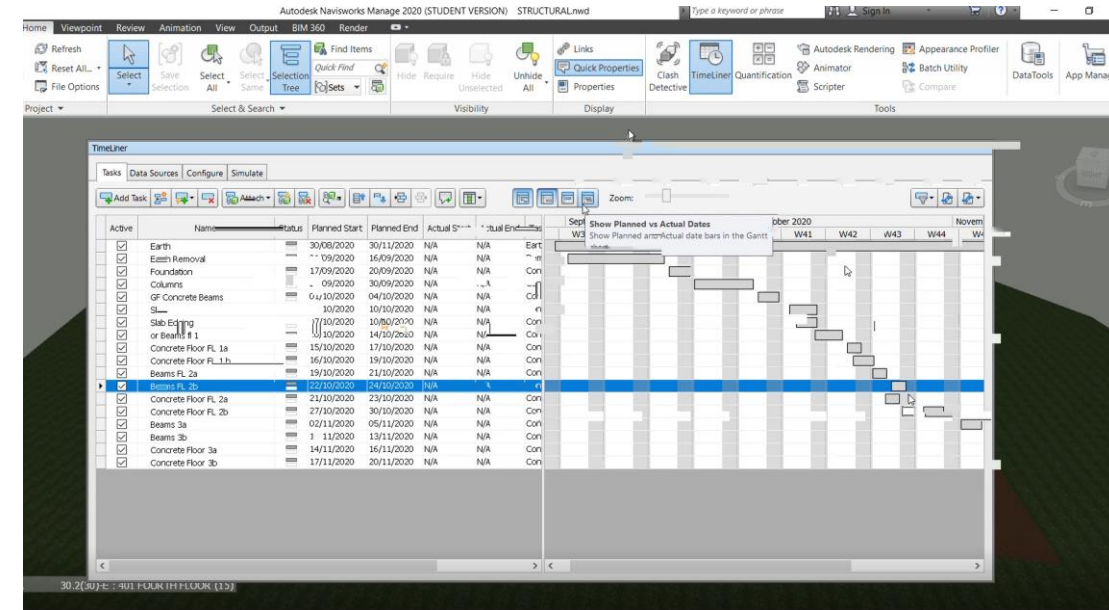
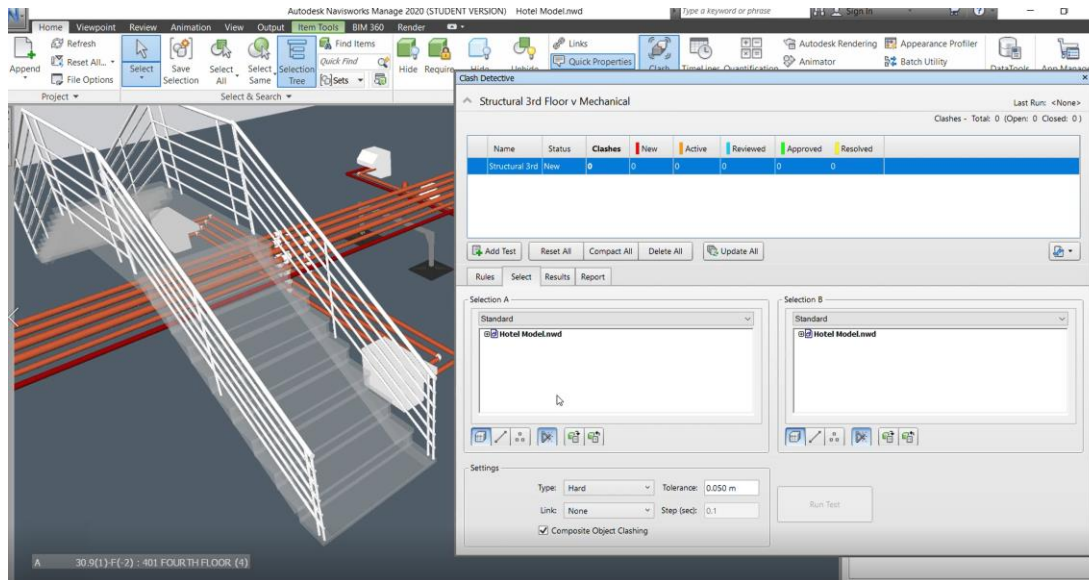
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Access and Navigate Data

In general, the construction-phase of the BIM model provides information used for:

- coordination amongst trades,
- clash detection,
- quantification
- installation and maintenance procedures.



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Quantification

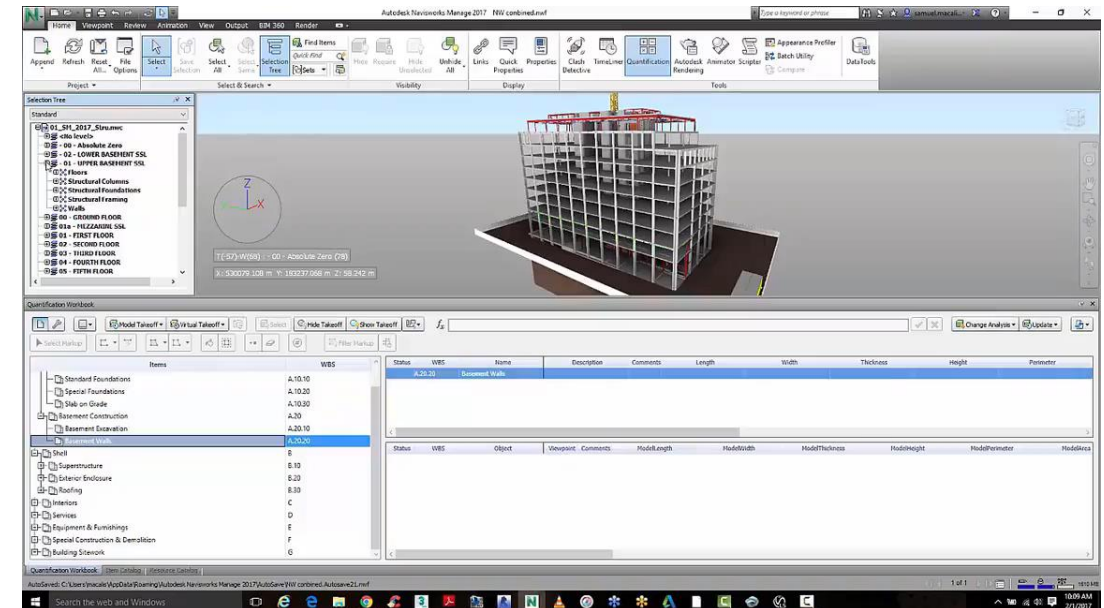


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Navisworks on Site

Capture material quantities from 2D or 3D designs

- Measure lines, areas, and counts from 2D sheets or 3D models.
- Create synchronized project views that combine Revit and AutoCAD files, including geometry, images, and data.
- Export take off data to Excel for analysis



Analyse the whole project during preconstruction

Click on
the Video



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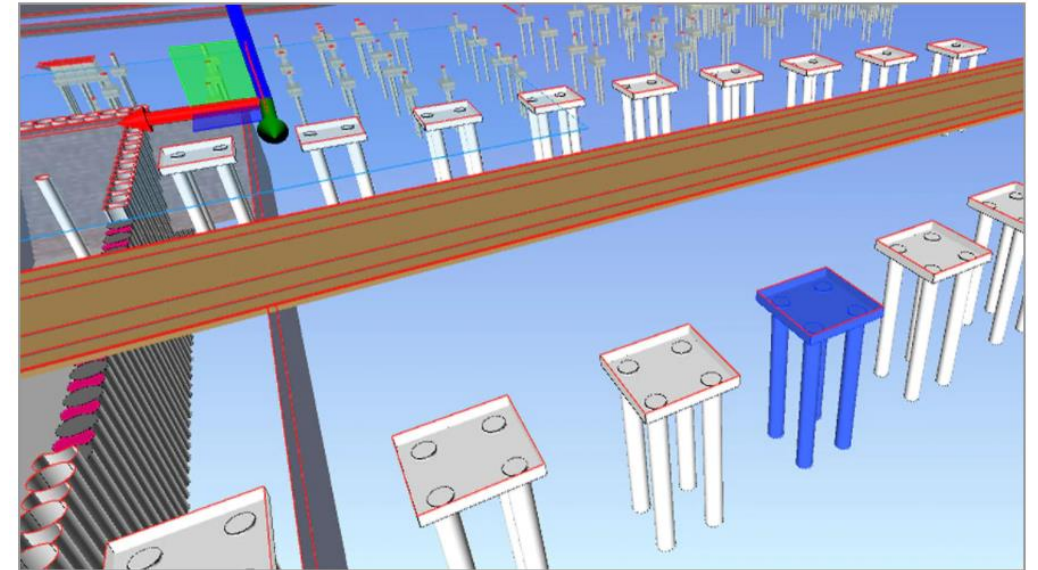
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Navisworks on Site

Control schedules and costs using 4D and 5D simulation

- Animate and interact with model objects for simulation.
- Create schedules directly from project models.
- Import schedules and cost items from external project management applications.



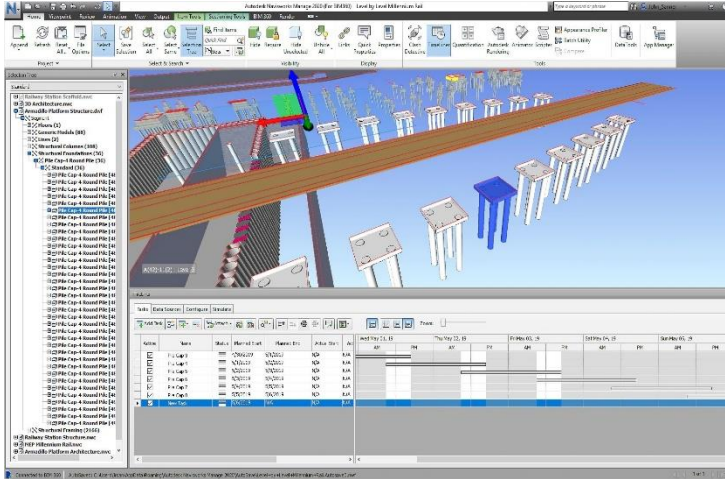
TimeLiner 4D simulation tool streamlines BIM coordination.



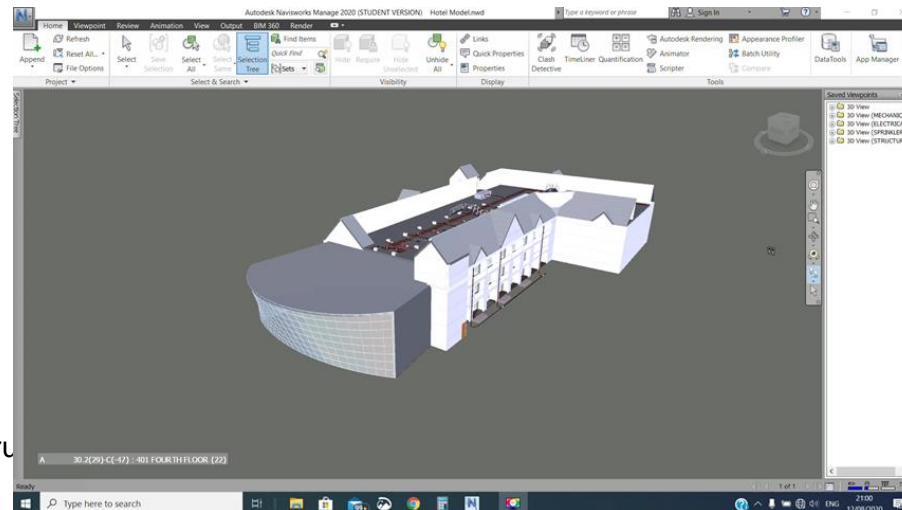


How to use BIM to solve some of the issues

Part 2 Viewpoint and Review (Duration 9:06)



Part 3 Item Selection (Duration 4:26)



Part 4 Clash Detection (Duration 16:18)

Clash Detective

Test 1 Last Run: Sunday 16 August 2020 16:04:21
Clashes - Total: 3511 (Open: 3511 Closed: 0)

| Name | Status | Clashes | New | Active | Reviewed | Approved | Resolved |
|--------|--------|---------|------|--------|----------|----------|----------|
| Test 1 | Done | 3511 | 3511 | 0 | 0 | 0 | 0 |

Add Test Reset All Compact All Delete All Update All

Rules Select Results Report

New Group Assign Re-run Test

| Name | Status | Level | Grid Int... | Found | Approved... | Approved |
|---------|--------|------------|-------------|---------------------|-------------|----------|
| Clash1 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |
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| Clash10 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |
| Clash11 | New | 201 SEC... | A... | 16:04:27 16-08-2020 | | |

Highlighting
Item 1 Item 2
Use item colors
☒ Highlight all clashes

Isolation
Dim Other Hide Other
☒ Transparent dimming
☐ Auto reveal

Viewpoint
Auto-update
☐ Animate transitions
Focus on Clash



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Part 5. Timeliner

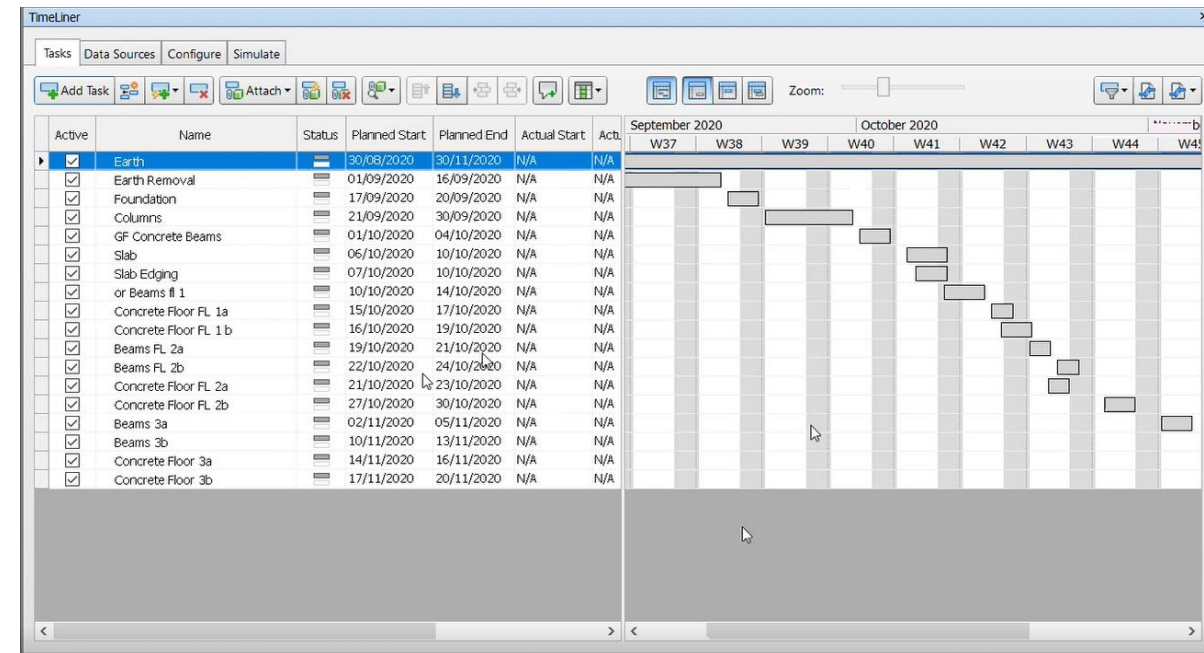
BIM tools are not just for design or graphical purposes, but can assist with management sequencing.

Timeliner is available on Manage and Simulate

It is an ideal tool for project managers or the main contractor.

It enables time and cost planning management by setting out timeframes, tasks and costs associated to these tasks.

It is ideal for site supervisors to check for any gaps or deviations from the planned schedules or budgets and how many workers are needed to get the job completed on time and in budget.



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How to use BIM to solve some of the issues



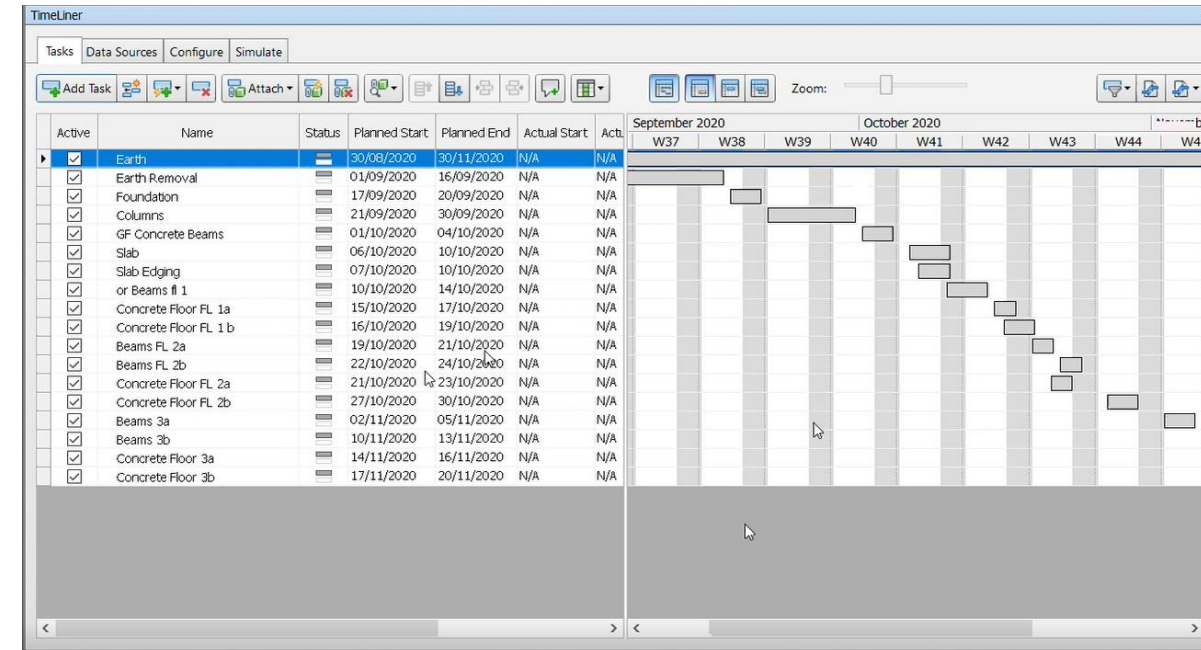
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Part 6. Quantifications

This is one of the core functional features of Navisworks, creating a highly accurate quantity takeoff linked to the model.

It allows you to see items that have been accounted for—and those that have not—and make sure you produce accurate material estimates and quantities.

This is important as it allows for the extraction of key information from the model and project, to assess materials costs, quantities and order items when required.



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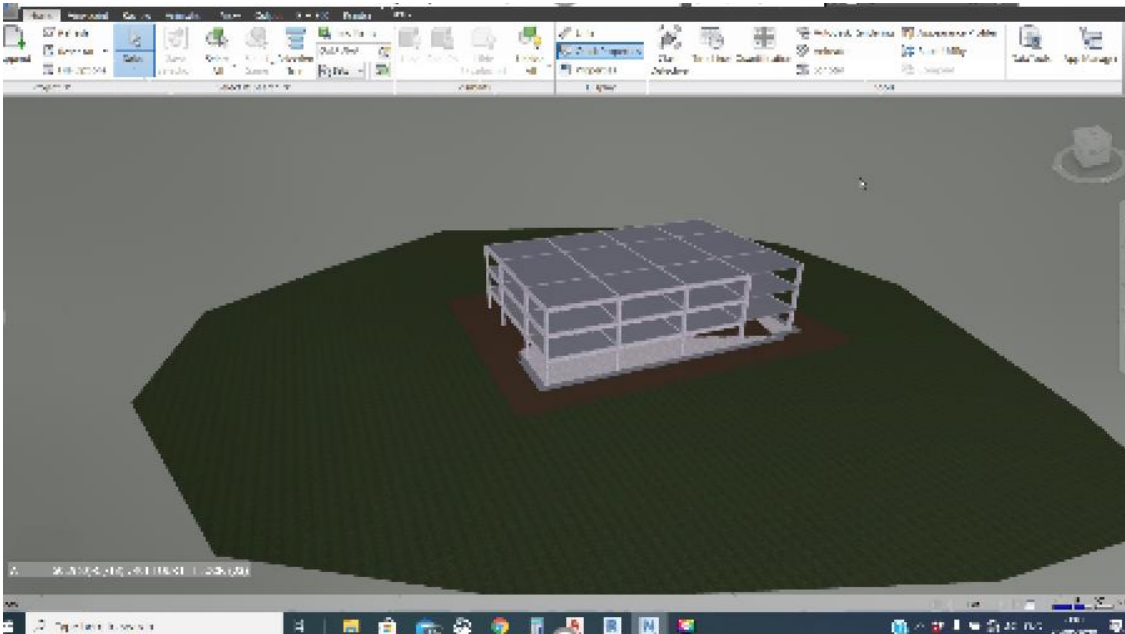


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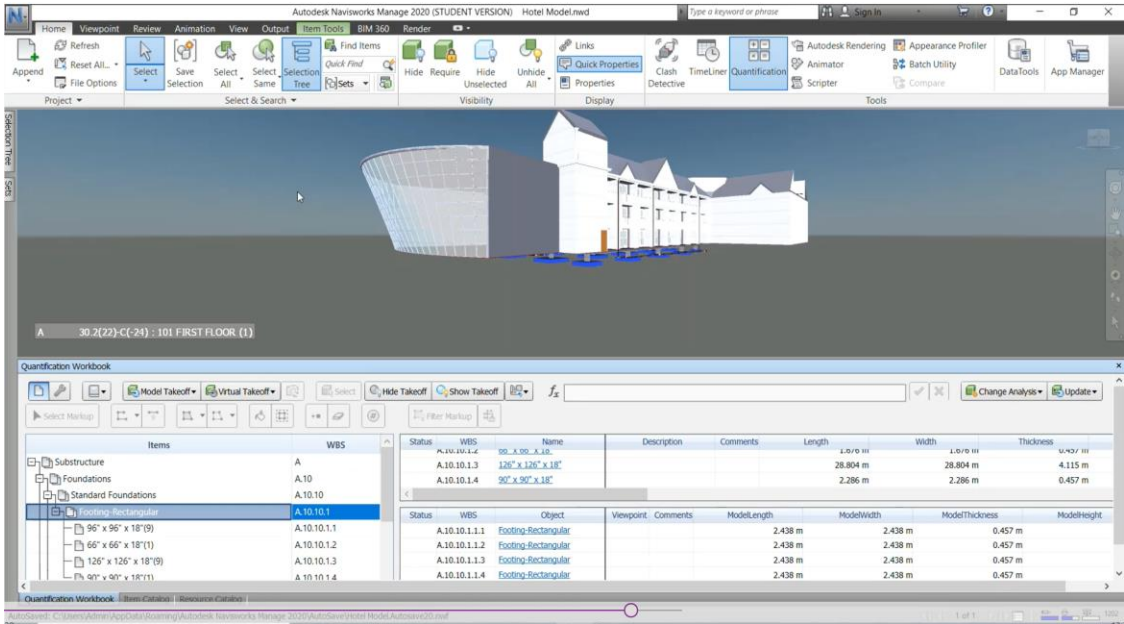


How to use BIM to solve some of the issues

Part 5 Timeliner (Duration 15:14)



Part 6 Quantification (Duration 13.27)

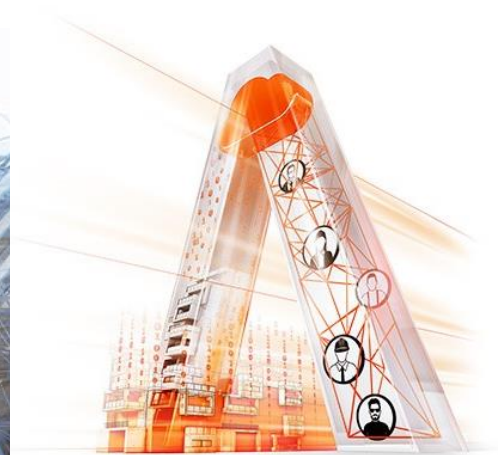


BIM RELATED EXERCISES CAN BE PERFORMED IN VARIOUS BIM TOOLS

Revit <https://www.autodesk.eu/free-trials>

Allplan <https://www.allplan.com/en/products/allplan-architecture/>

Solibri <https://www.solibri.com/construction>



The principles remain unchanged regardless of the tools used.



Accessing BIM information in the cloud through mobile technologies



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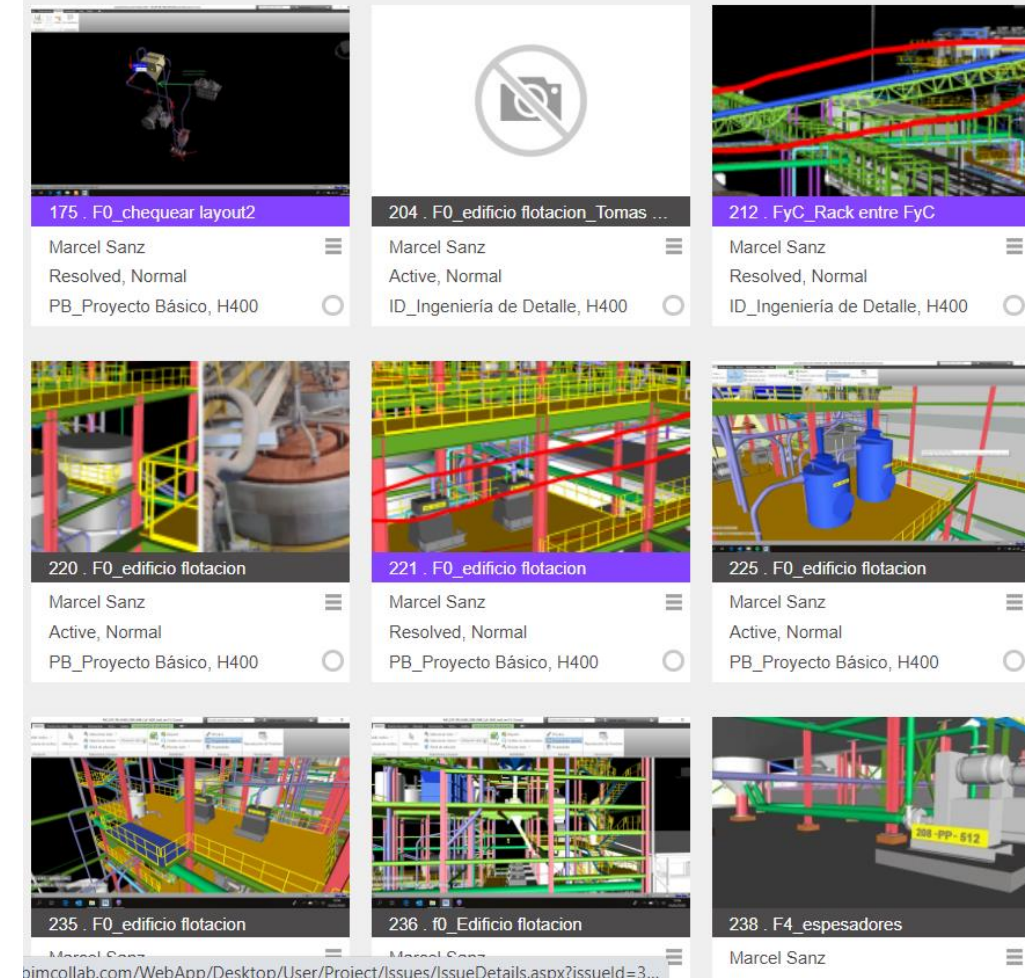
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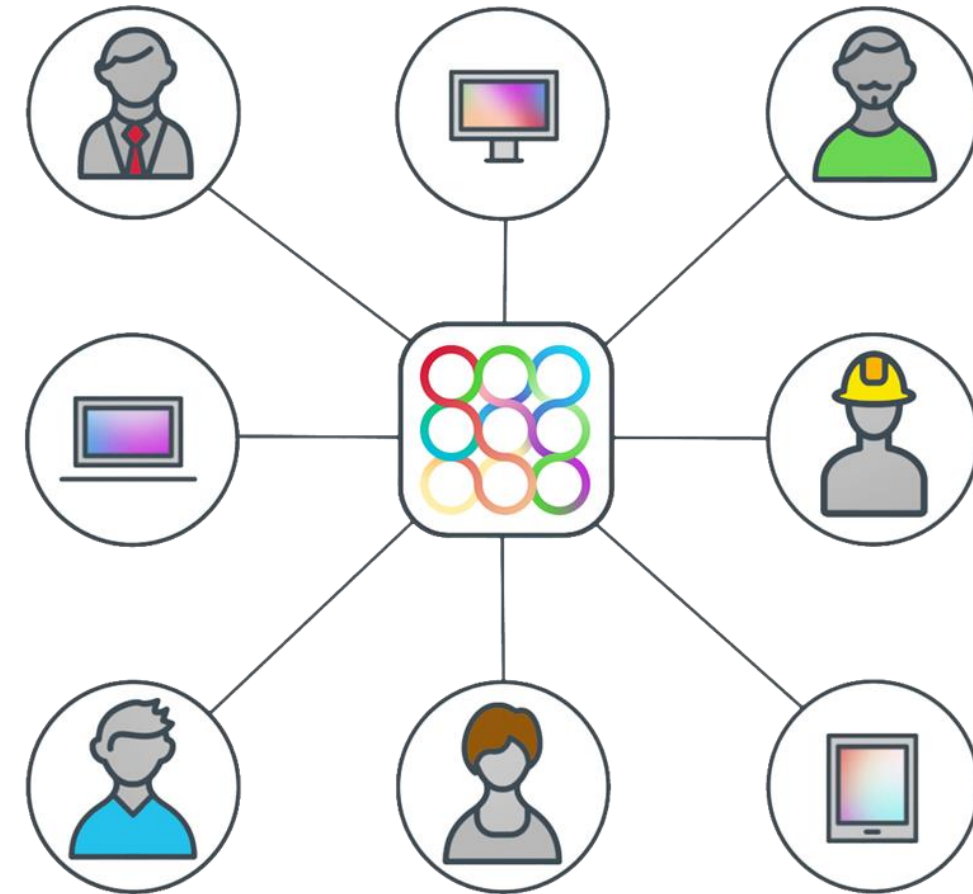


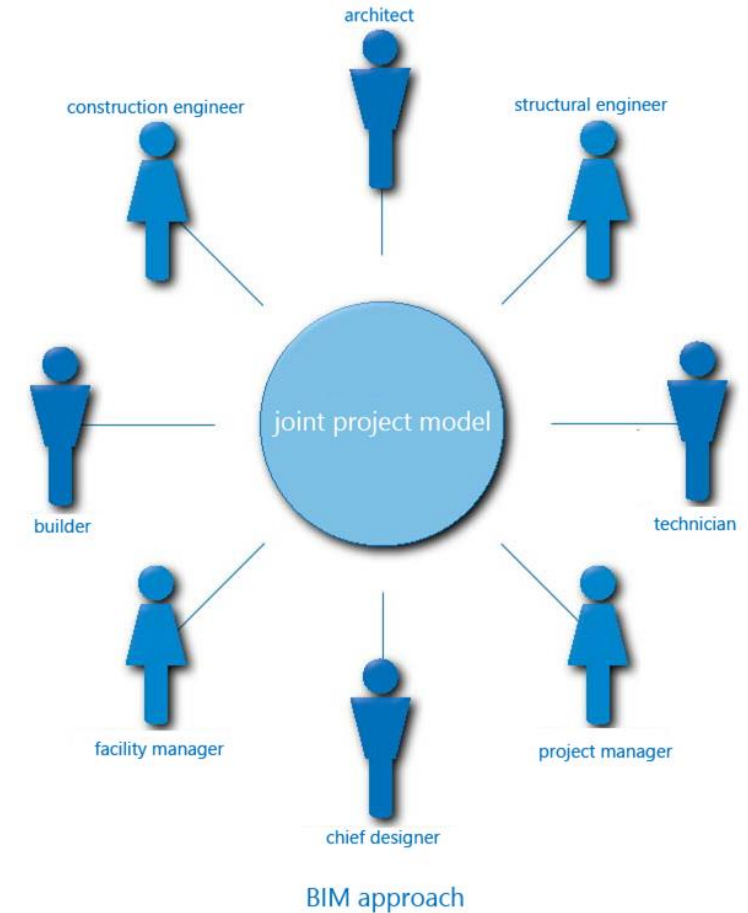
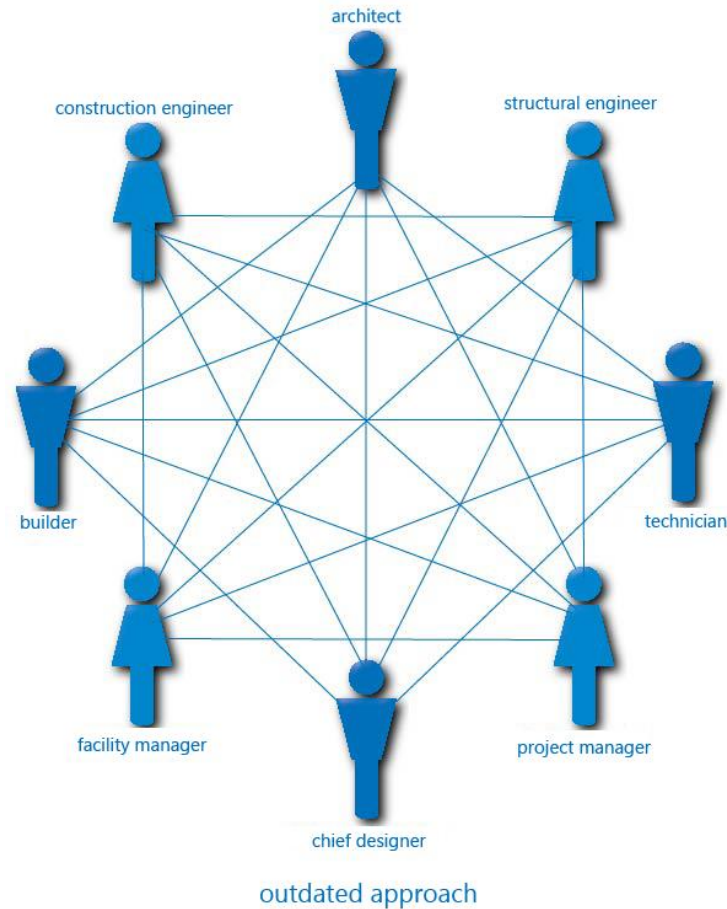


- **KEEP TRACEABILITY OF:**
- Clash Management
- Technical Discussions Management
- RFI (Request For Information)
- General Communications
- Internal Tasks Management



“...an easy-to-use and powerful **issue tracker** in the **cloud** dedicated to BIM. Issues in BIMcollab are directly **linked to positions and objects** in your model, accessible via **web browsers** or directly from your **BIM application**.”

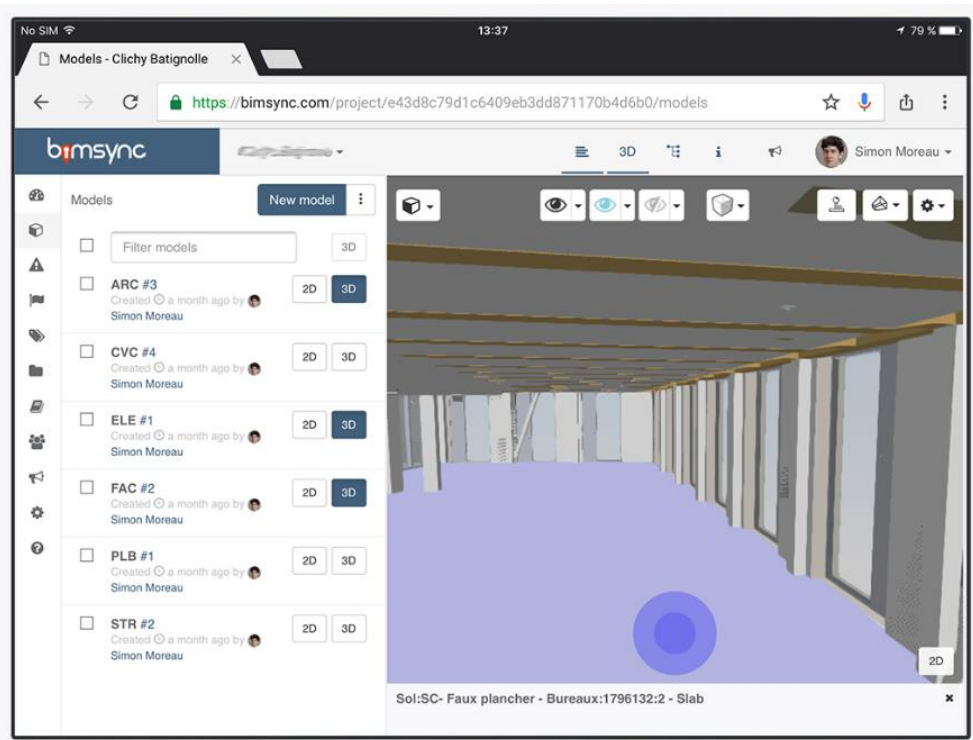
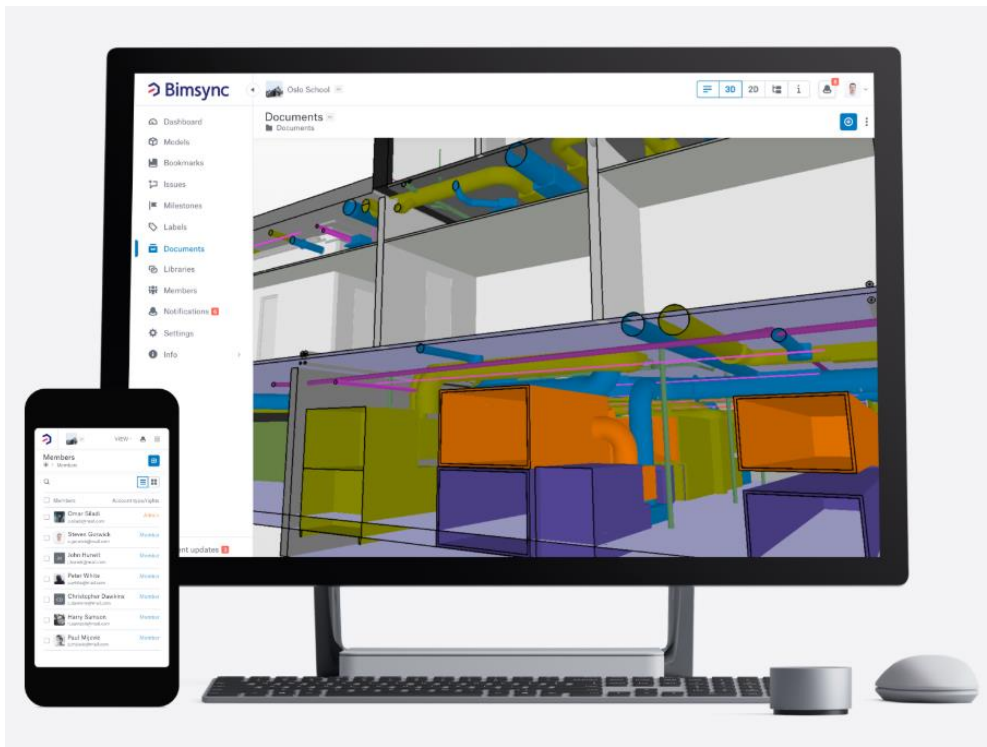




VISUALIZATION PLATFORMS_Issue Management_BIMSynch



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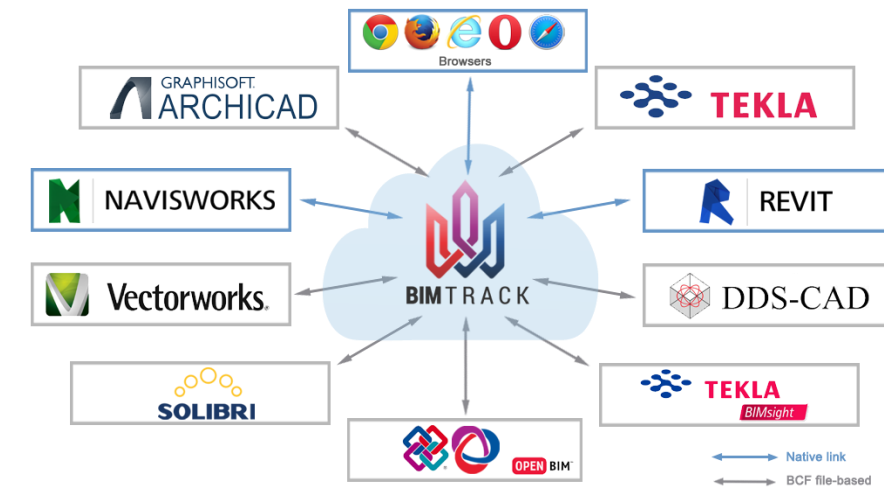
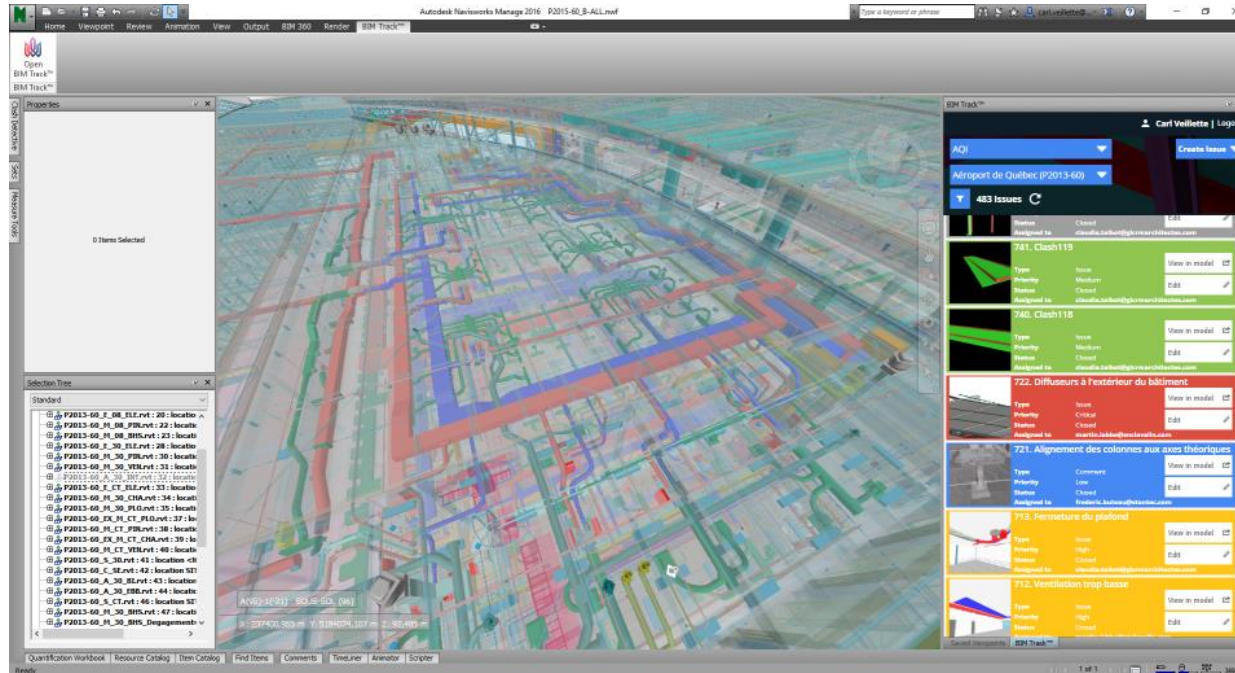
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VISUALIZATION PLATFORMS_Issue Management_BIMTrack



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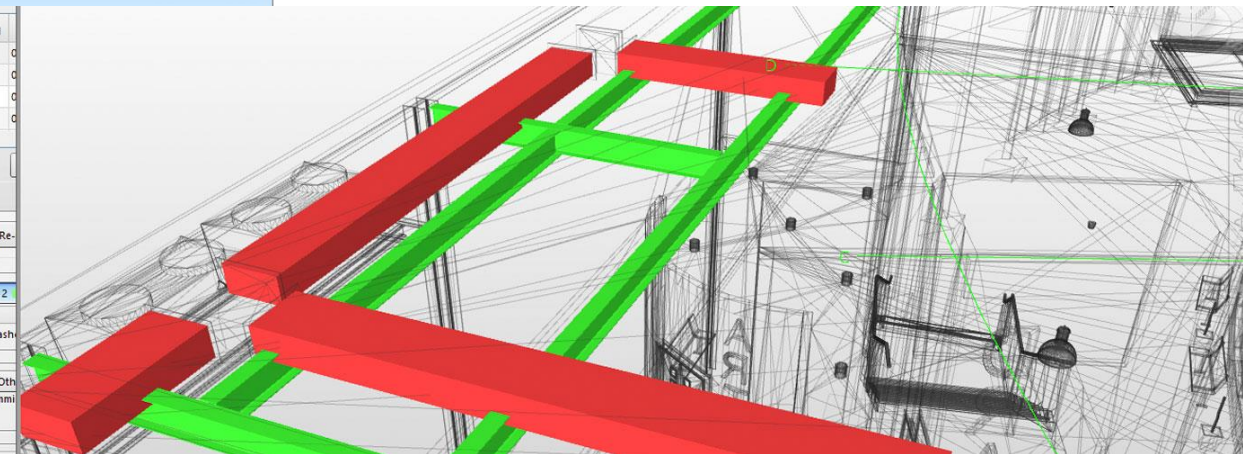
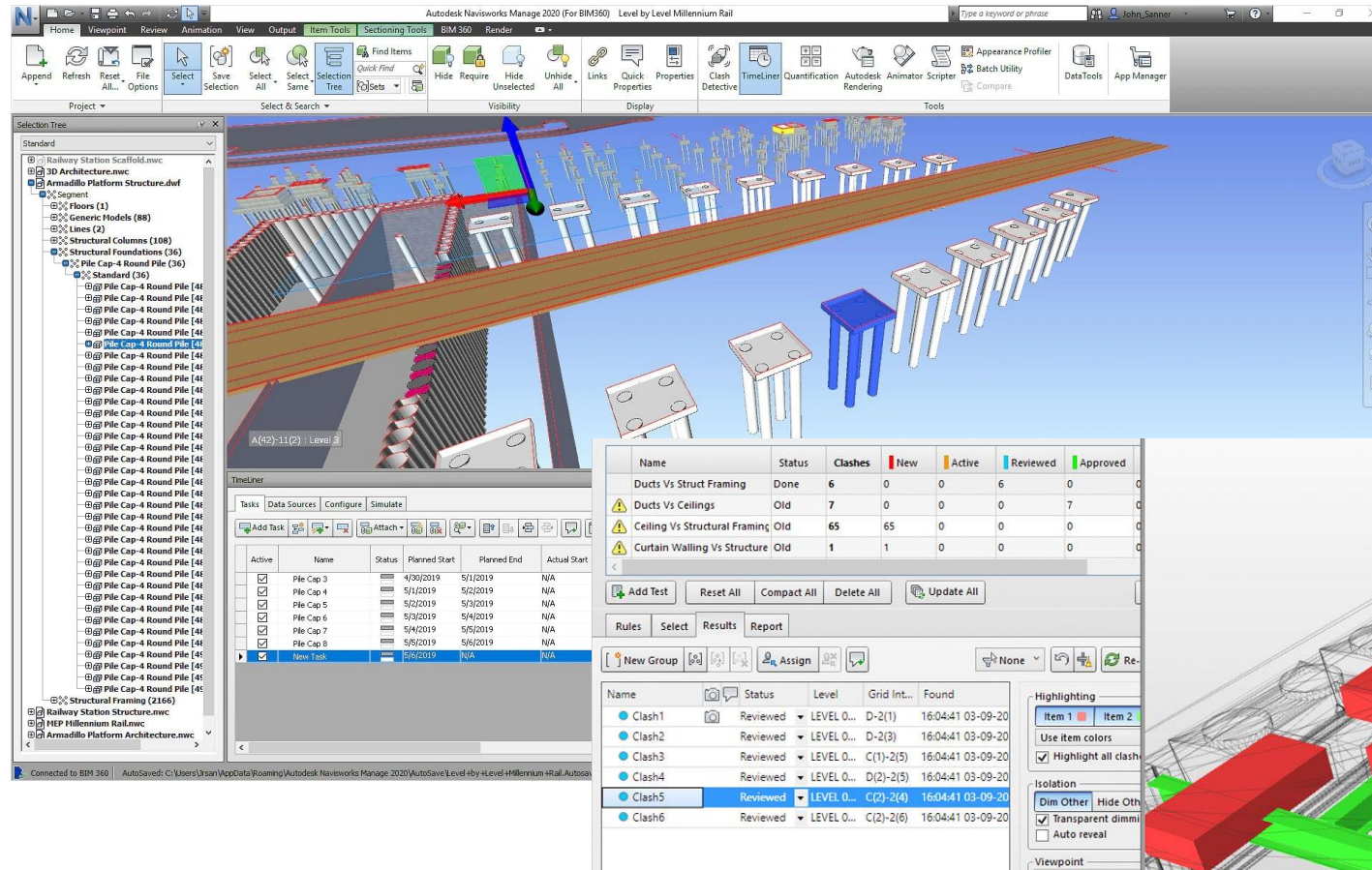
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■ THEORY TO DEVELOP THE TASK

- 1- User Interface (Selection Tree, Properties, Sets, Find Items, Saved Viewpoints)
- 2- Units of Navisworks File
- 3- Types of Navisworks Files
 - NWF: Navisworks File
 - NWD: Navisworks Document
 - NWC: Navisworks Caché

4- Gridlines

5- Navigation

6- Viewpoints

7- Comments





DEVELOPMENT OF THE TASK 1.4

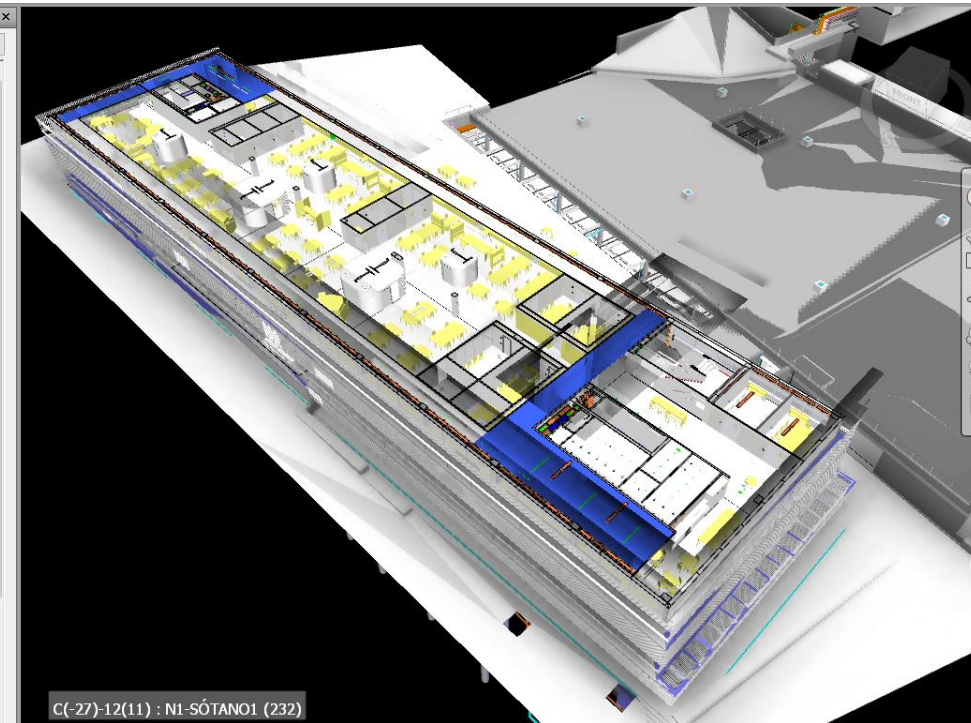
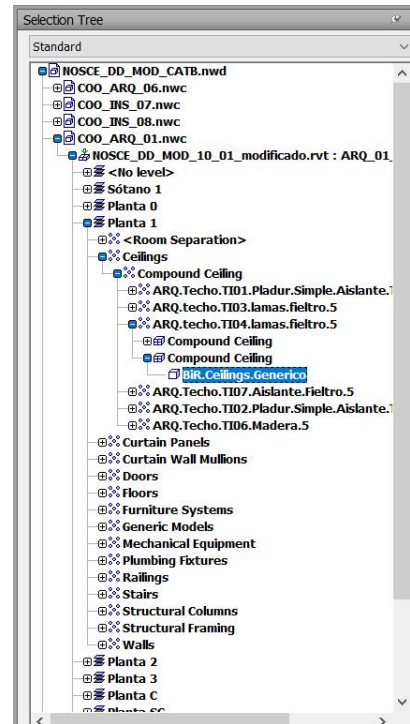
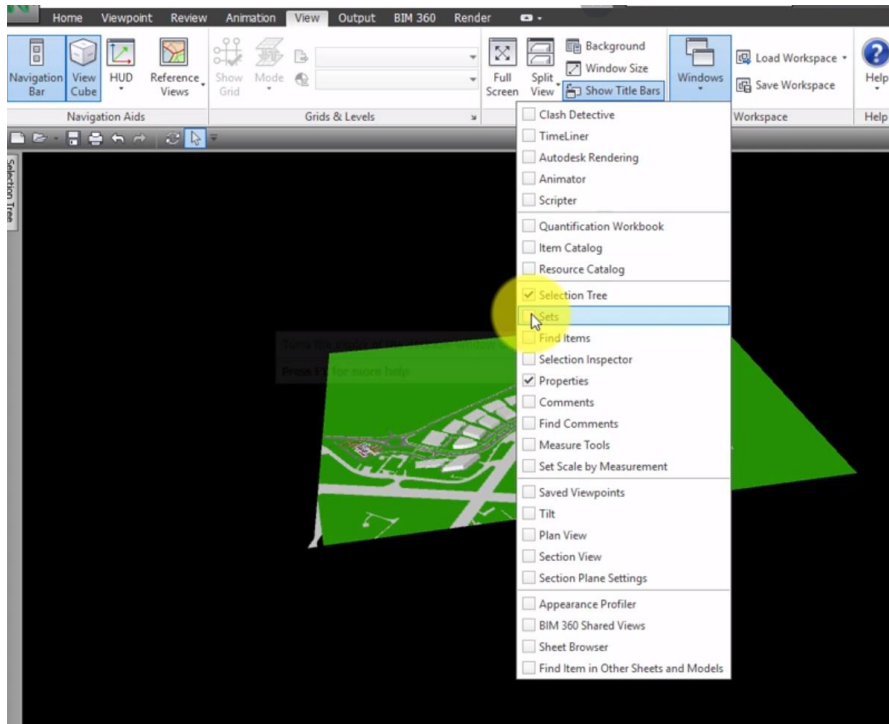
- Open Screencast from Autodesk to record your screen developing the following steps:
- Open a blank Navisworks file.
- Organize your User Interface as you desire to show Selection Tree, Properties, Saved Viewpoints.
- Append all the files of the folder provided.
- Show Gridlines.
- Navigate through the Project and save relevant Viewpoints. Include Sections of the Model.
- Organize the views in Navisworks folders.
- Show Properties of a particular Element.



VISUALIZATION PLATFORMS_Task 1.4_Navisworks_User Interface



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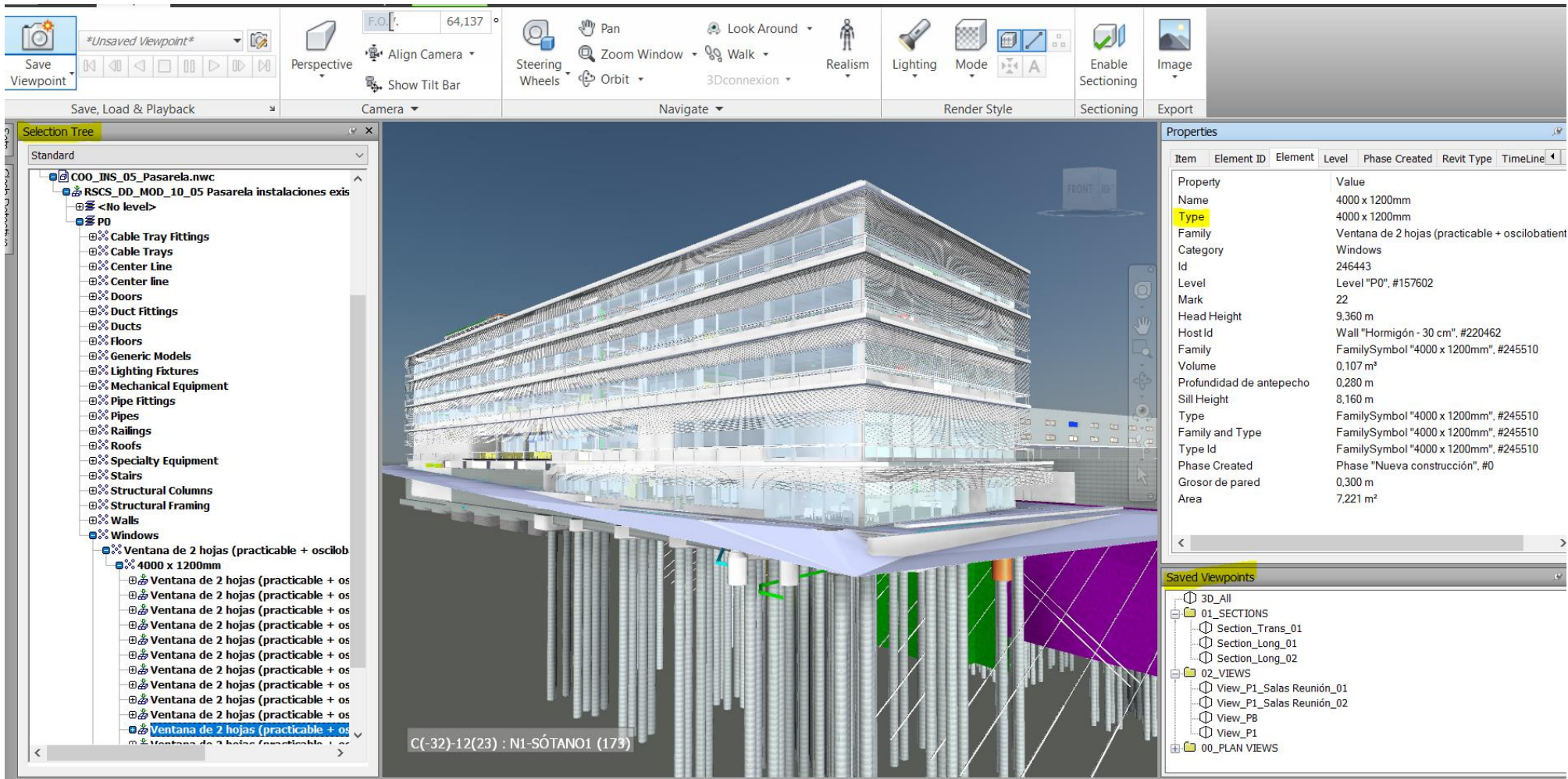
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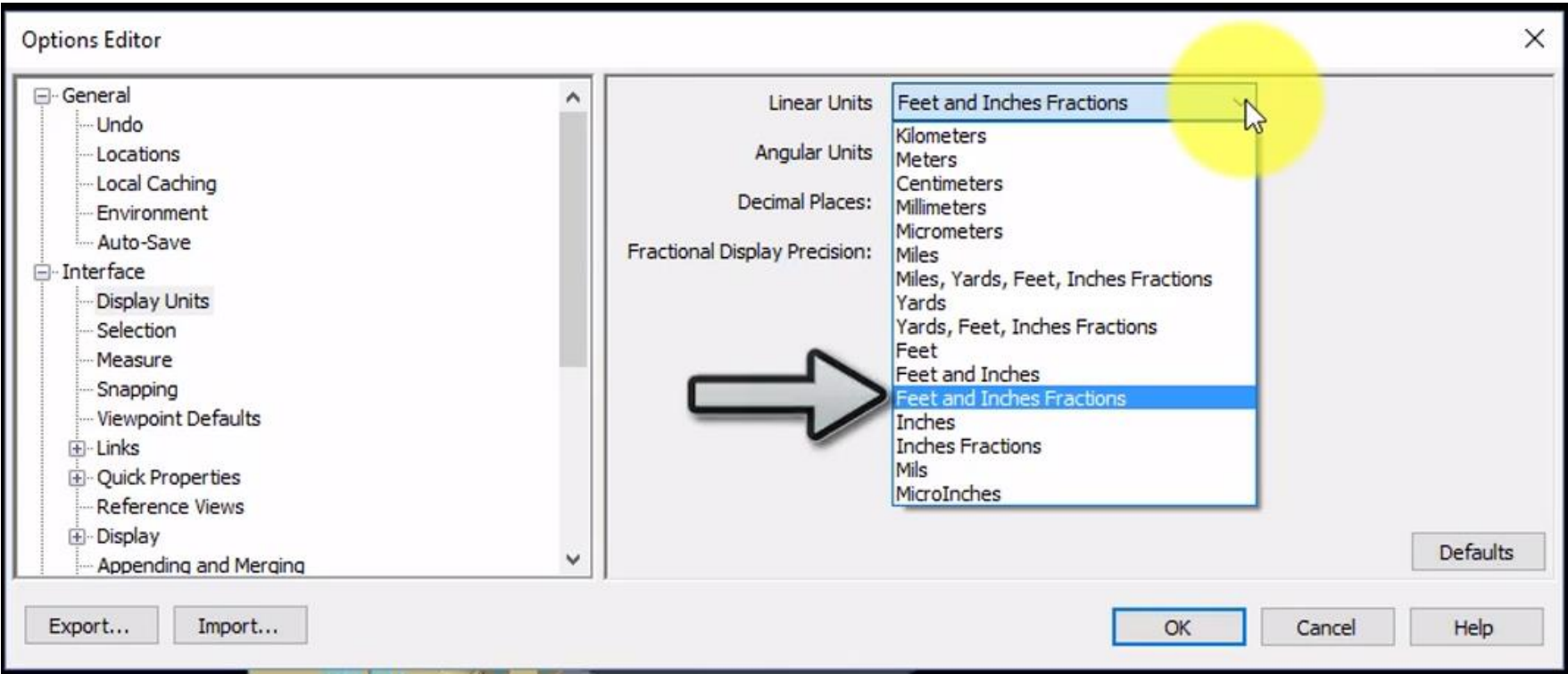


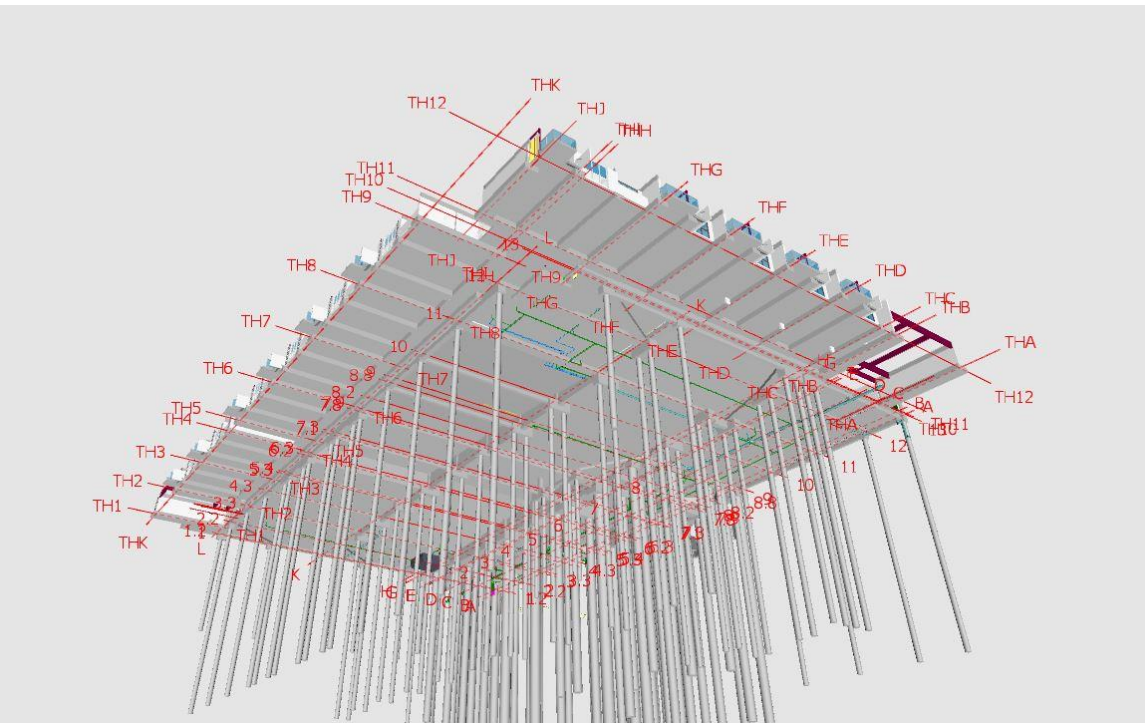
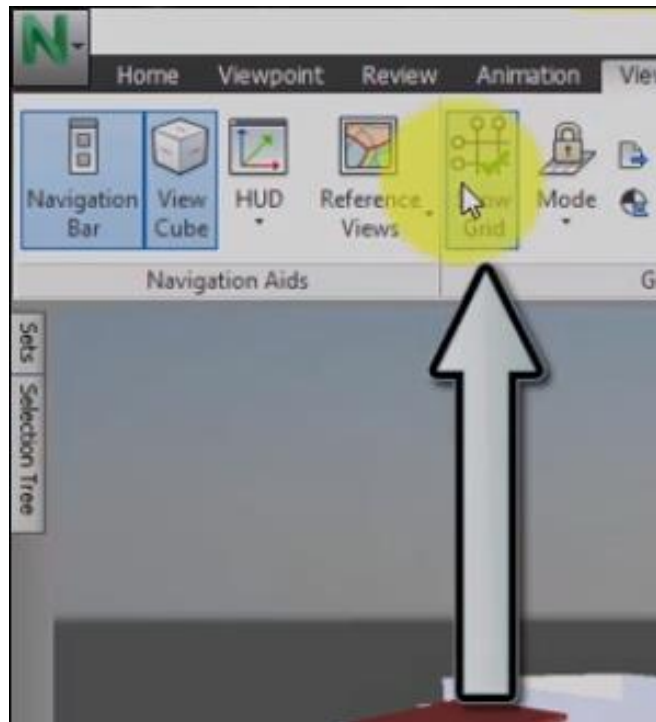
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VISUALIZATION PLATFORMS_Task 1.4_Navisworks_User Interface



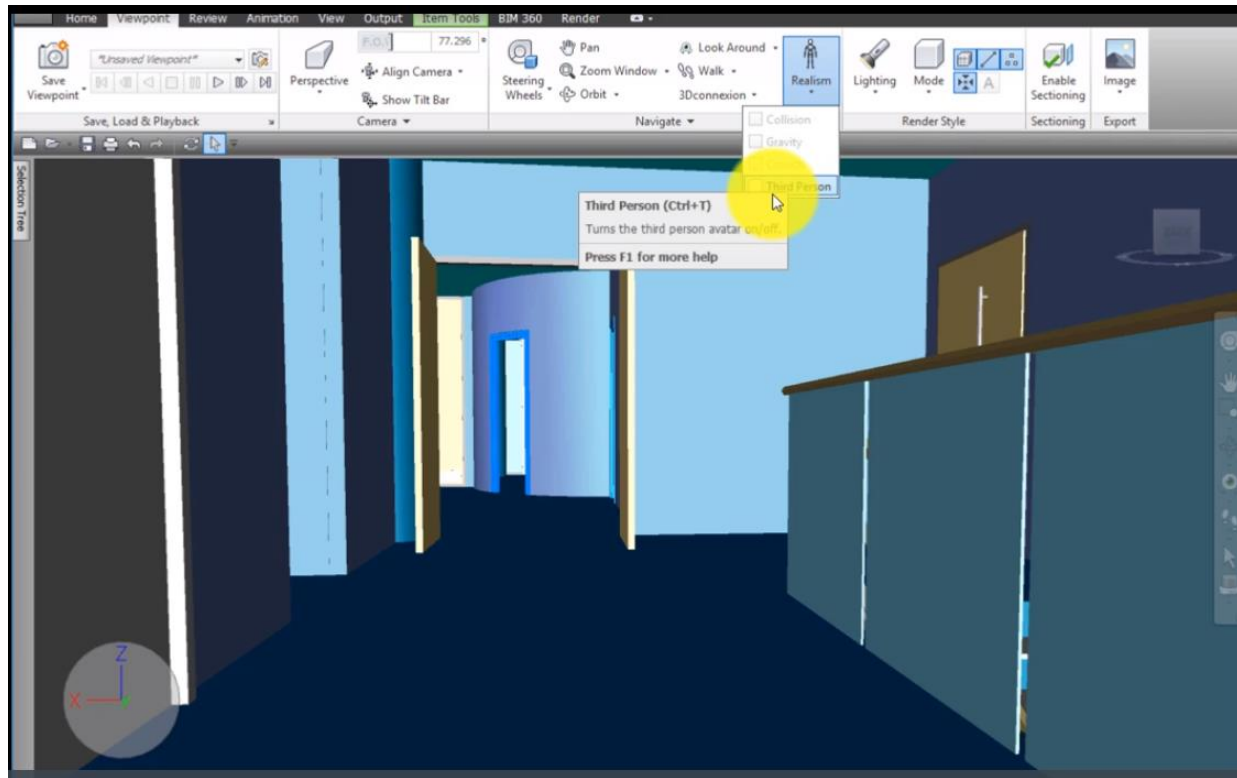




VISUALIZATION PLATFORMS_Task 1.4_Navisworks_Navigation



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- Walk Mode (Shift)
- Fly Mode
- Realism
- Collision
- Gravity
- Crouch
- Third Person



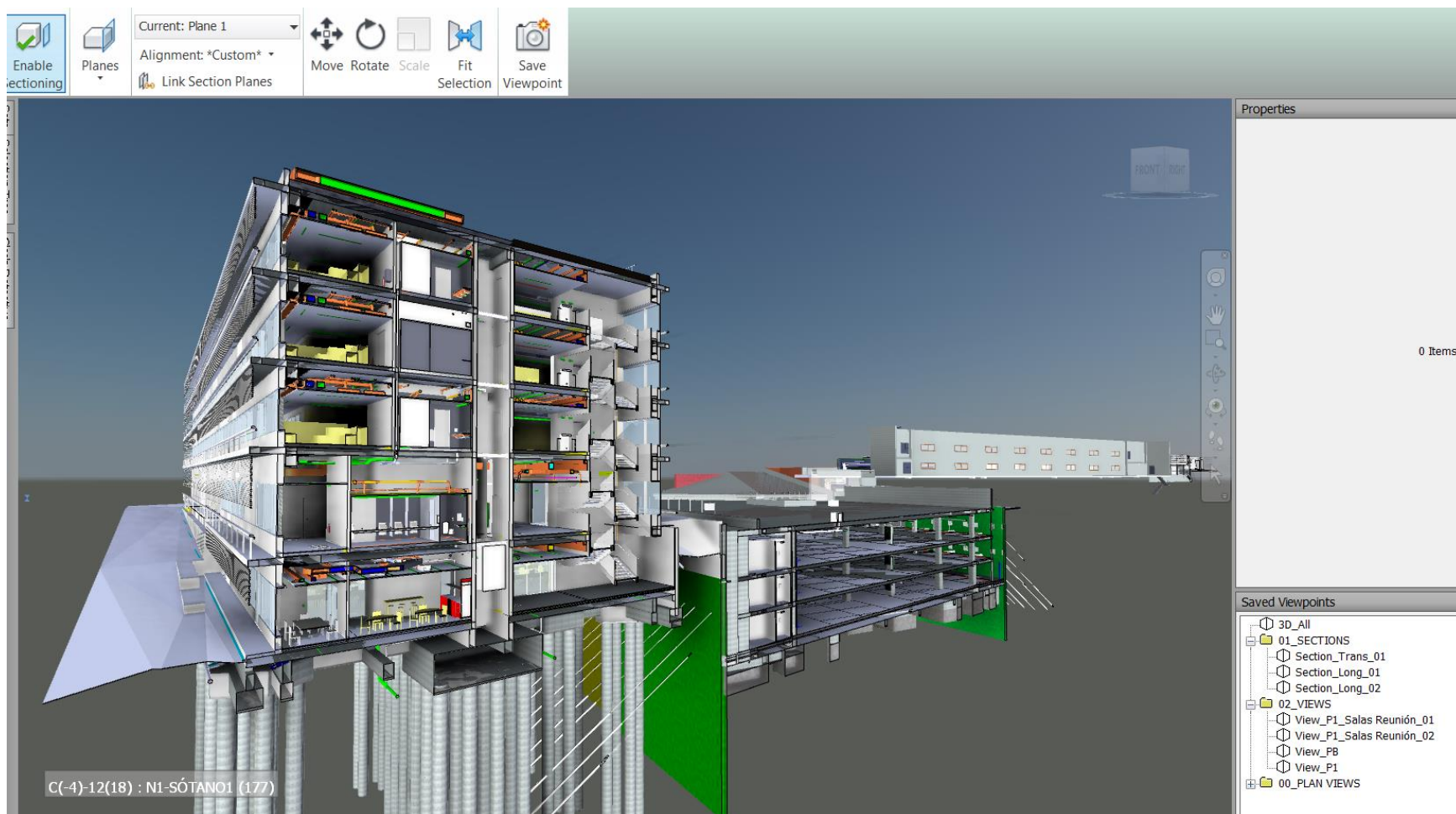
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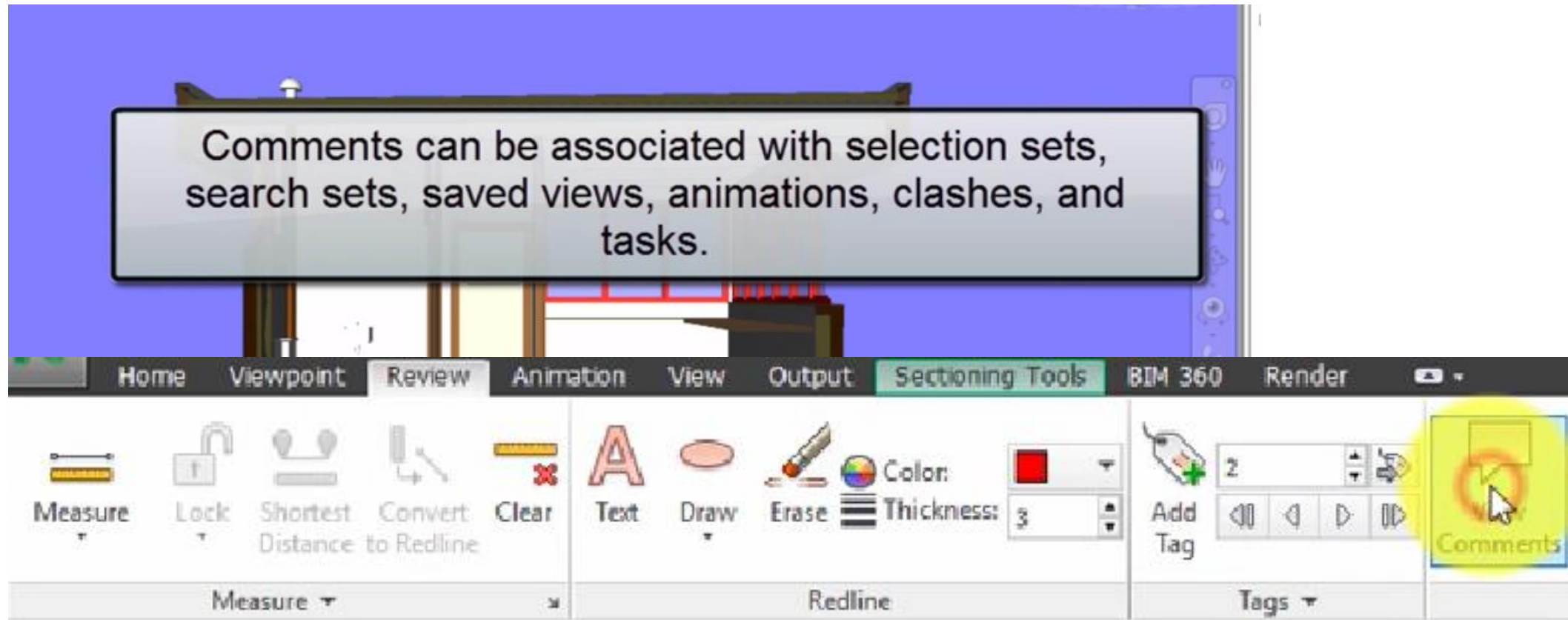
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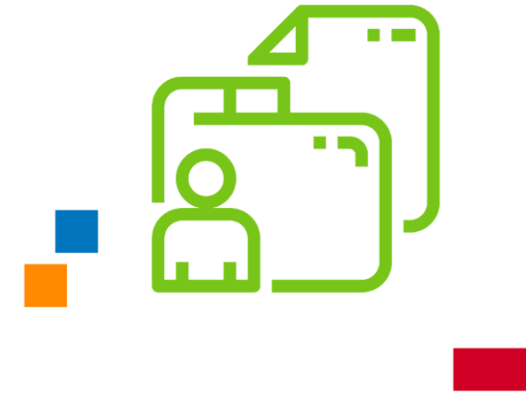


VISUALIZATION PLATFORMS_Task 1.4_Navisworks_Comments





■ START NOW!



Assessment / Exam



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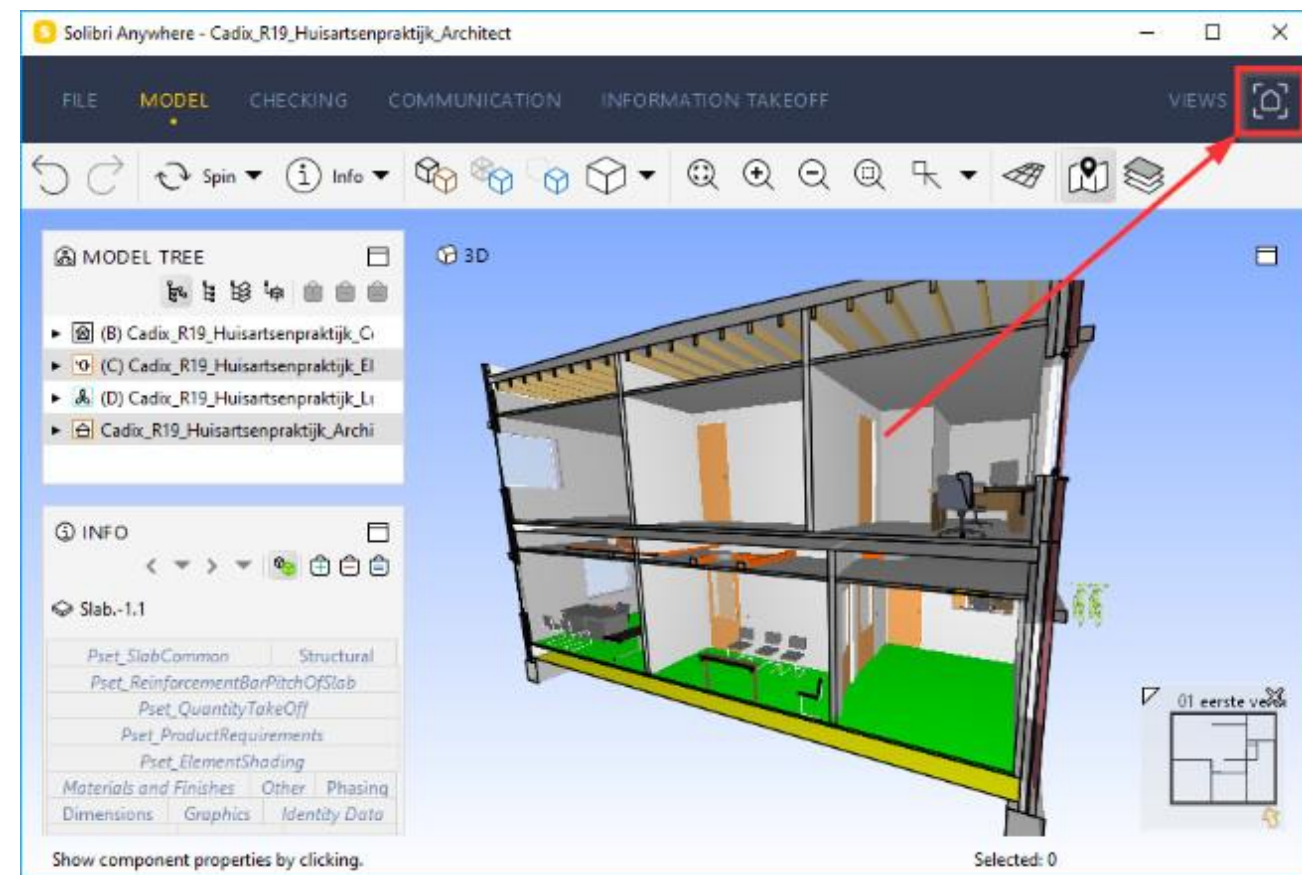
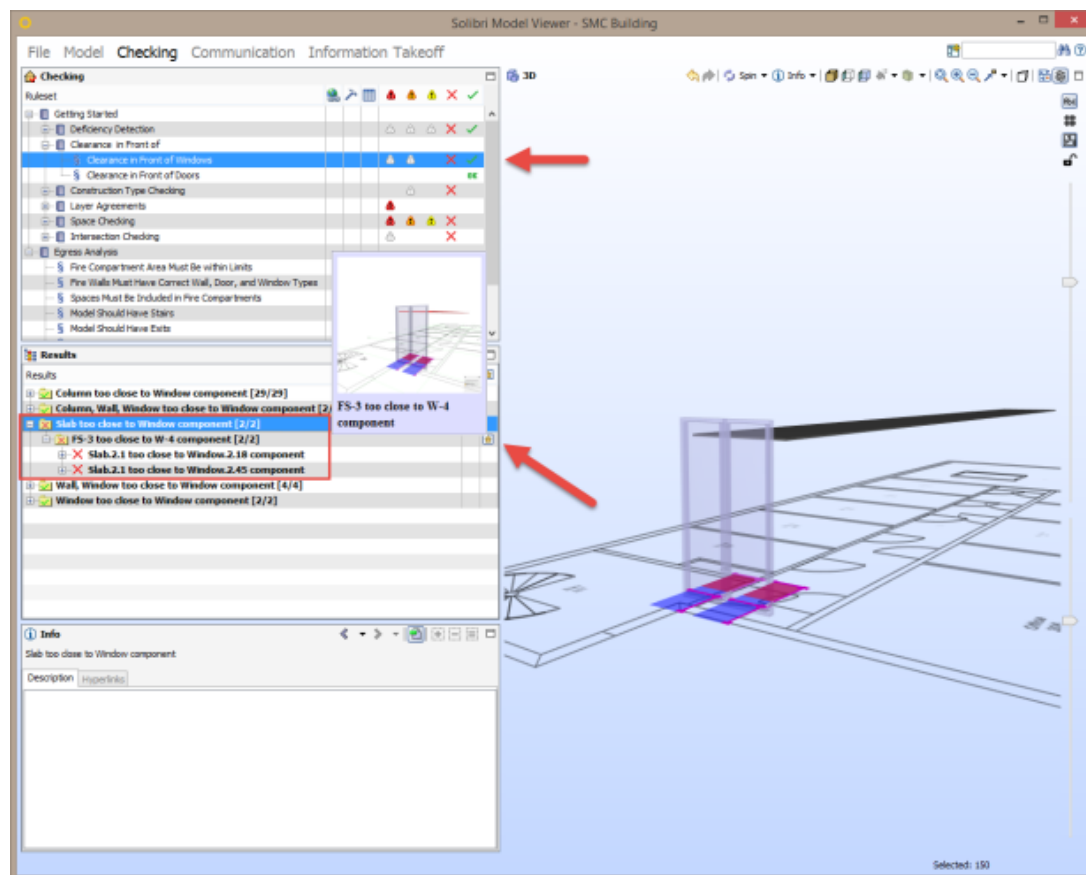
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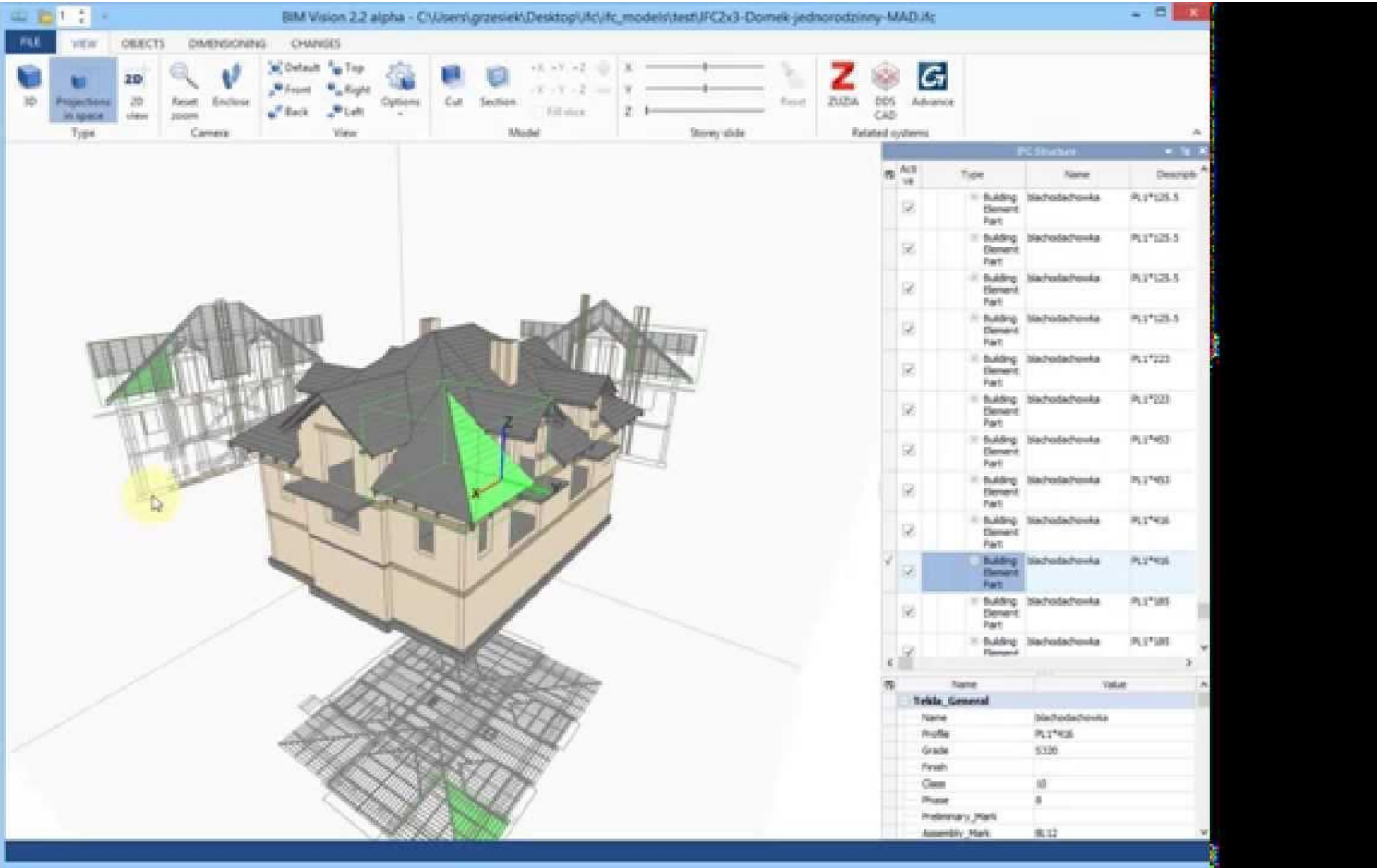
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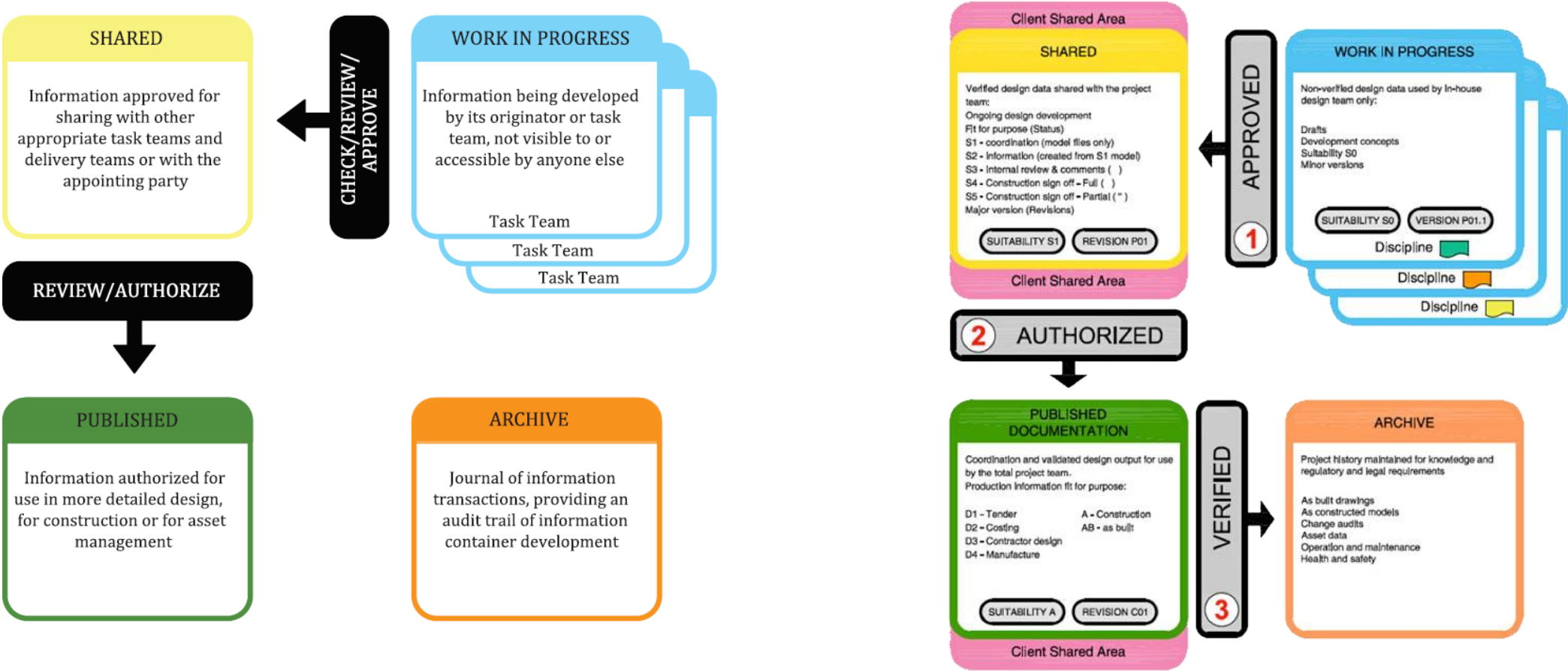
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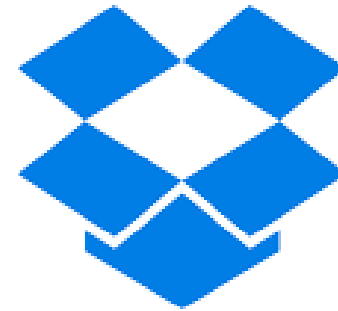




Google Drive



OneDrive



Dropbox





01855_COLONIAL...EMS > ... > FED > 01855_LEV_ARQ_R19_CNT.rvt

V.1

Overview

View

SHEETS (27)

00.01.00 - Superficies Totales

00.01.01 - Superficies Planta Sótano

00.01.02 - Superficies Planta Baja

00.01.03 - Superficies Planta Primera

00.01.04 - Superficies Planta Segunda

00.01.05 - Superficies Planta Tercera

00.01.06 - Superficies Planta Cuarta

00.01.07 - Superficies Planta Quinta

00.01.08 - Superficies Planta Sexta

00.01.09 - Superficies Planta Ático

00.01.10 - Superficies Planta Técnica

REF.00.01 - Ventana Inicio

REF.01.01 - Vistas Navegador de Proyecto

REF.01.02 - Worksets

REF.01.03 - Plantillas de vistas

REF.01.04 - Familias Arquitectura

200_ARQ_Ventana_T-

▼ Constraints

Level

NA+02

Sill Height

0.600000

▼ Dimensions

DesfaseVentana

0 m

Altura Montante ...

1.225 m

Anchura

6.8015 m

Altura

2.45 m

Height

0 m

Width

0 m

Rough Width

0 m

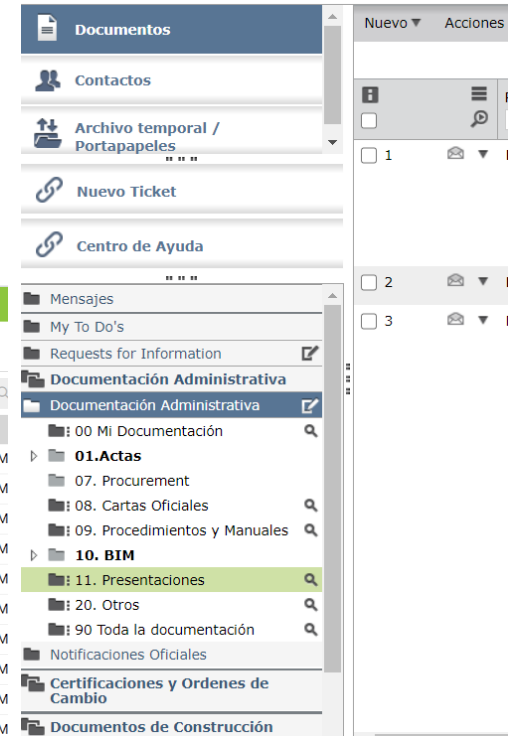
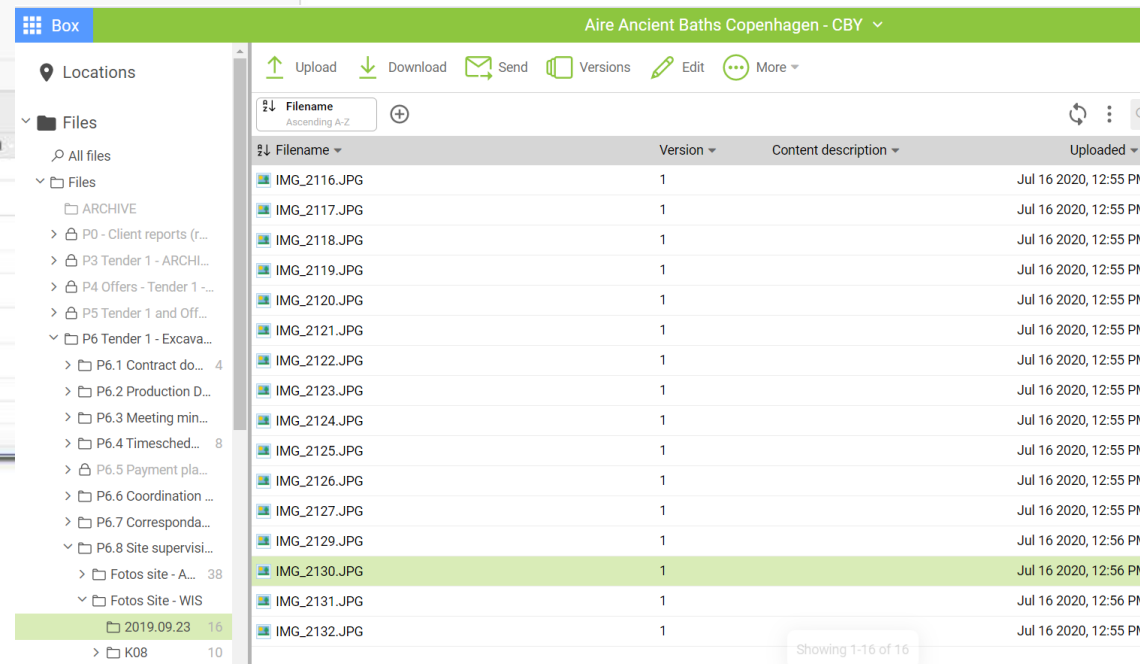
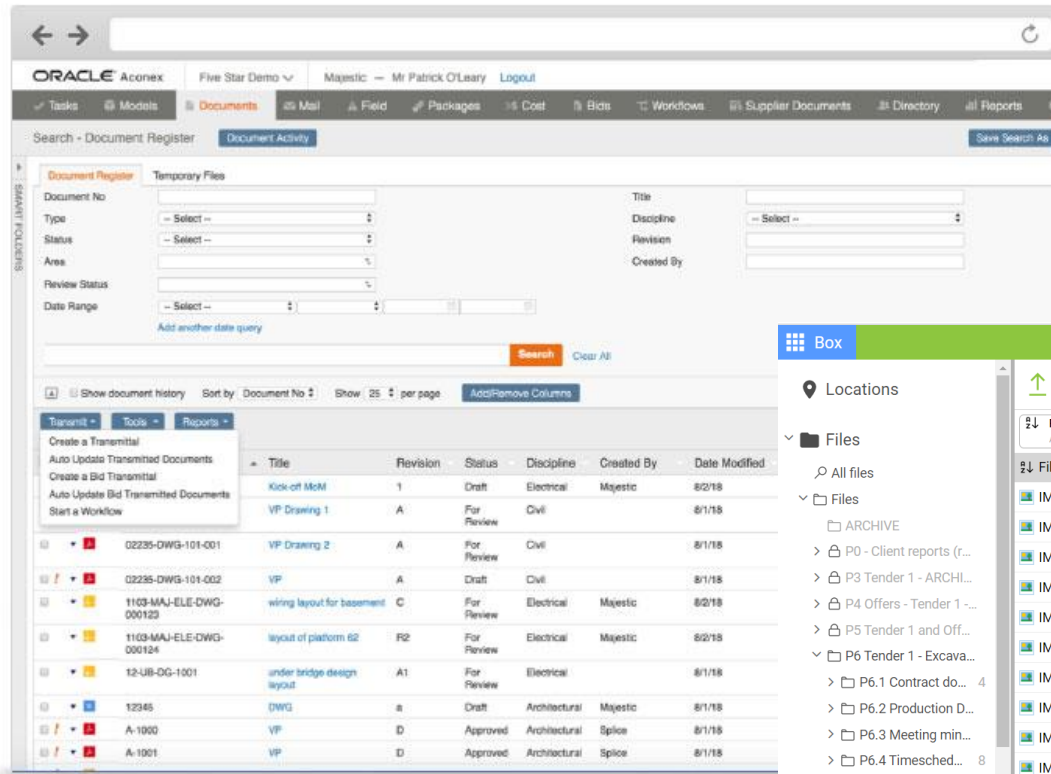
Rough Height

0 m

▼ Identity Data



thinkproject!



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Thank You

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