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Title: BIM 4D with Navisworks

1 – Aims

The objectives of this Navisworks tutorial are as follows.

Learning about the fourth dimension of BIM.

Knowing a widely used software for 4D BIM tasks.

Using Navisworks to detect collisions and perform 4D planning.

2 - Learning methodology

The teacher will give an explanation about Navisworks of 10 minutes.

Students will read this tutorial and will watch the video.

Students will follow the steps shown in the video:

Introduction to the software

Using the Clash Detective module

Making a schedule using TimeLiner.

Visualise the construction of the project according to the schedule

Exporting the model to KML format (Gogle Earth)

To assess the achievement of the practice, each student will write a report.

3 – Tutorial duration

The practice described in this tutorial will be carried out in a computer classroom.

It will last 4 teaching hours.



4 – Necessary teaching recourses

Computer room with PCs with internet access.

Required software: Navisworks, Google Earth

Hardware required: Pcs

5 – Contents & tutorial

5.1 – Introduction

The fourth dimension of BIM focuses on planning. Therefore, the aim is to establish that the execution deadlines are carried out according to the previous schedule.

The usefulness of BIM 4D is the ability to anticipate conflicts that may arise during the execution of the project. In this way, it creates a connection between the 3D model with the project's programming and planning data, generating realistic simulations of the construction activities of the work.

In summary, BIM 4D allows:

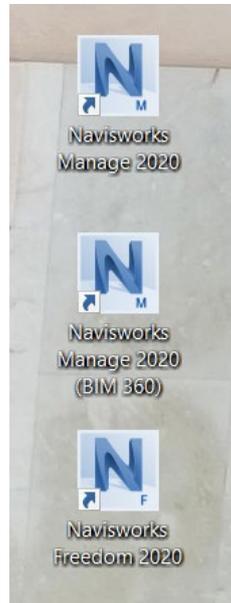
- Optimize and control the execution time of a project
- Coordinate and plan your activities
- Evaluate different situations and scenarios

In order to carry out a correct implementation of BIM 4D, the following steps must be taken into account:

- **Define the activities.** Here the actions necessary to elaborate the deliverables of the project are identified.
- **Sequencing the activities.** The relationship between the different activities involved in the project must be established. In this step, the software to carry out the planning is chosen.
- **Calculate the duration of the activities.** The necessary resources are estimated in order to calculate the work periods.
- **Make a chronogram.** A schedule of the different activities is obtained. Having the schedule, we can analyze it to check if the total and partial deadlines and critical activities are met.

5.2 – Navisworks

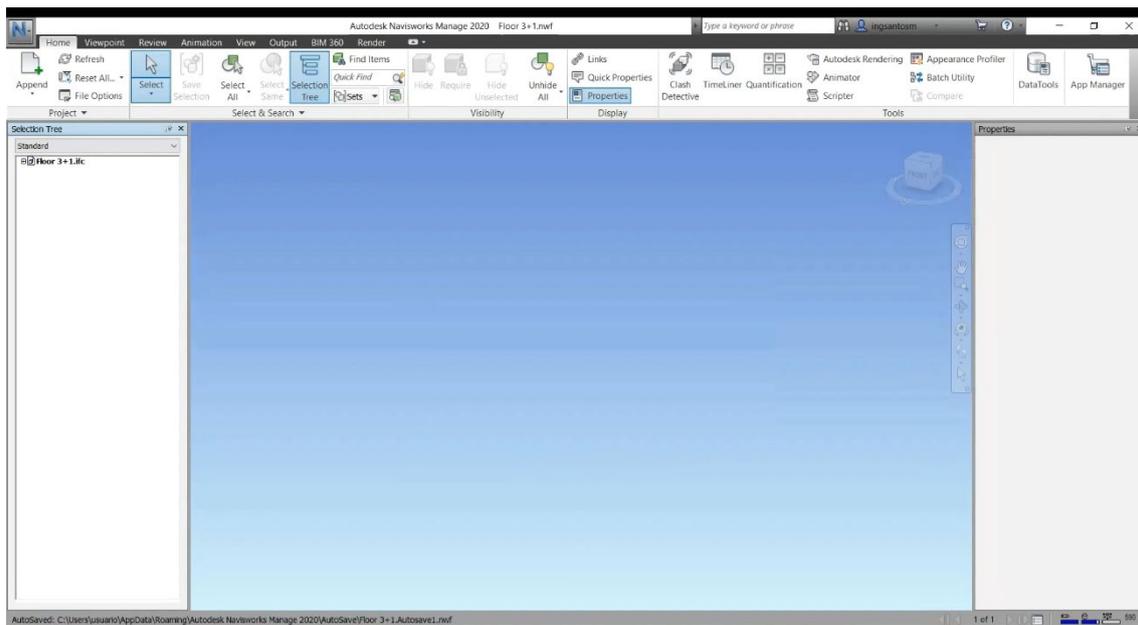
When you install Navisworks, three versions are downloaded:



Navisworks versions

- **Navisworks Freedom:** is a free viewer that can be used to view models published in Navisworks. We can use this tool to analyze, question and communicate provisional designs at various stages of the design process.
- **Navisworks Simulate:** this version is more advanced than the previous one because it incorporates several different functionalities.
- **Navisworks Manage:** this is the version that we will use. It is the highest level Navisworks product and includes all the functionalities of the two previous two, plus a module that has the greatest impact. This module is Clash Detective.

Its interface is similar to that of AutoCAD, therefore, you will feel familiar with it.



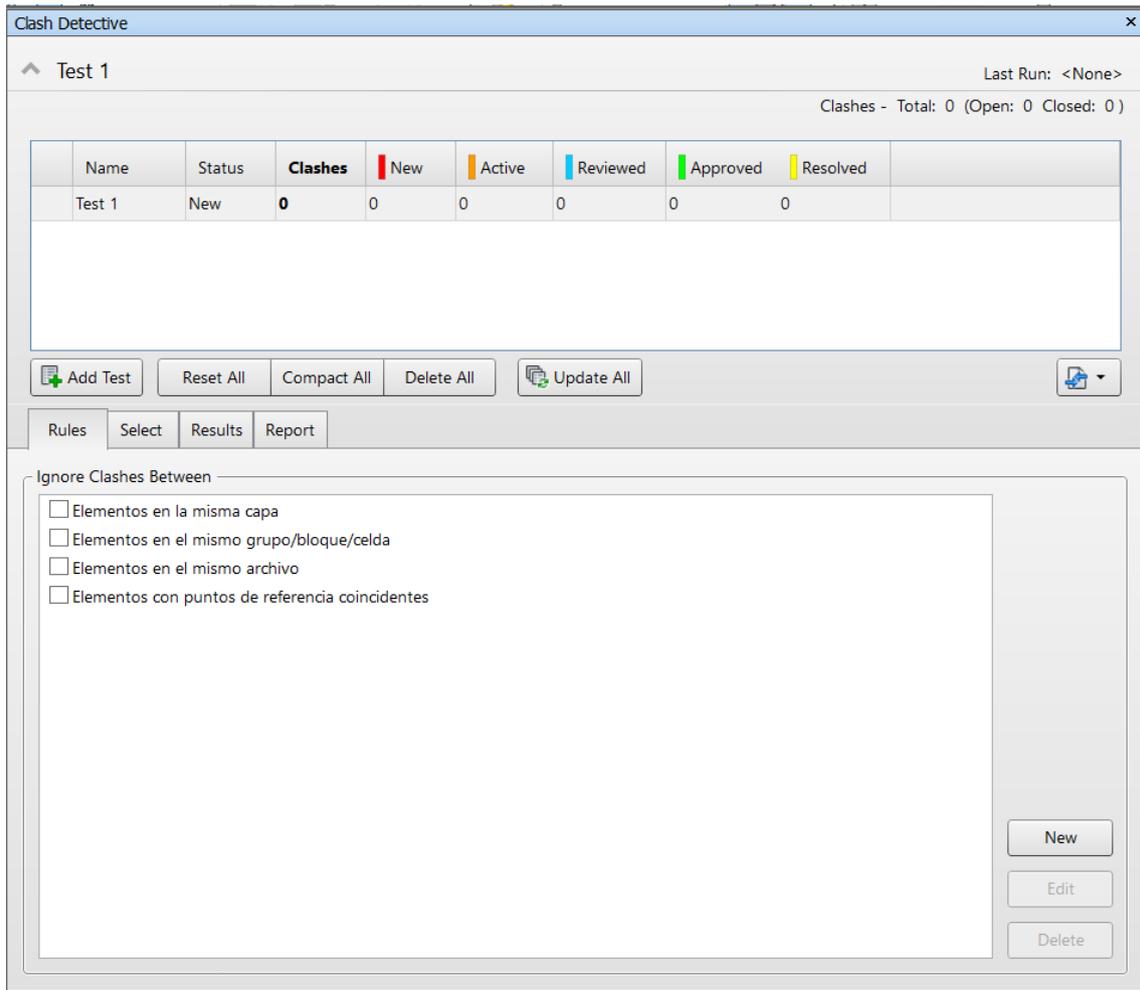
Navisworks interface

With Navisworks you can:

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

5.2.1 – Clash Detective

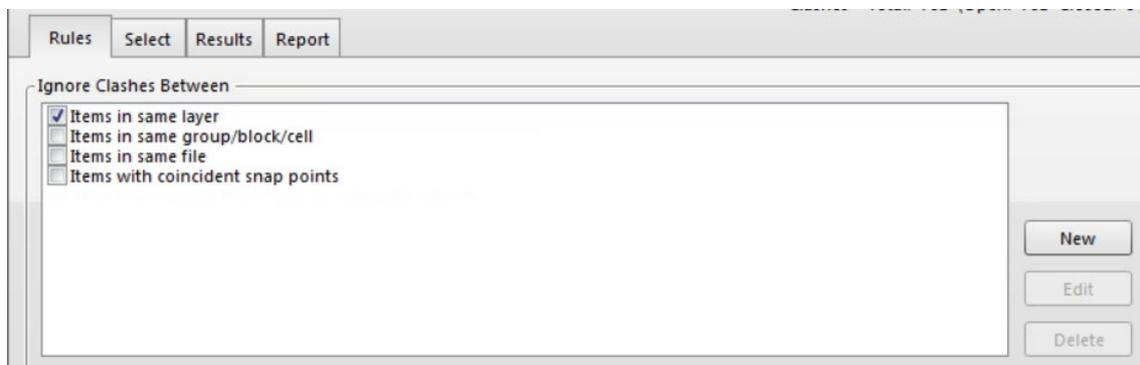
Clash Detective allows to effectively identify, inspect, and record clashes (conflicts) of a 3D project model, between two groups of elements ("A" vs "B").



Clash Detective module

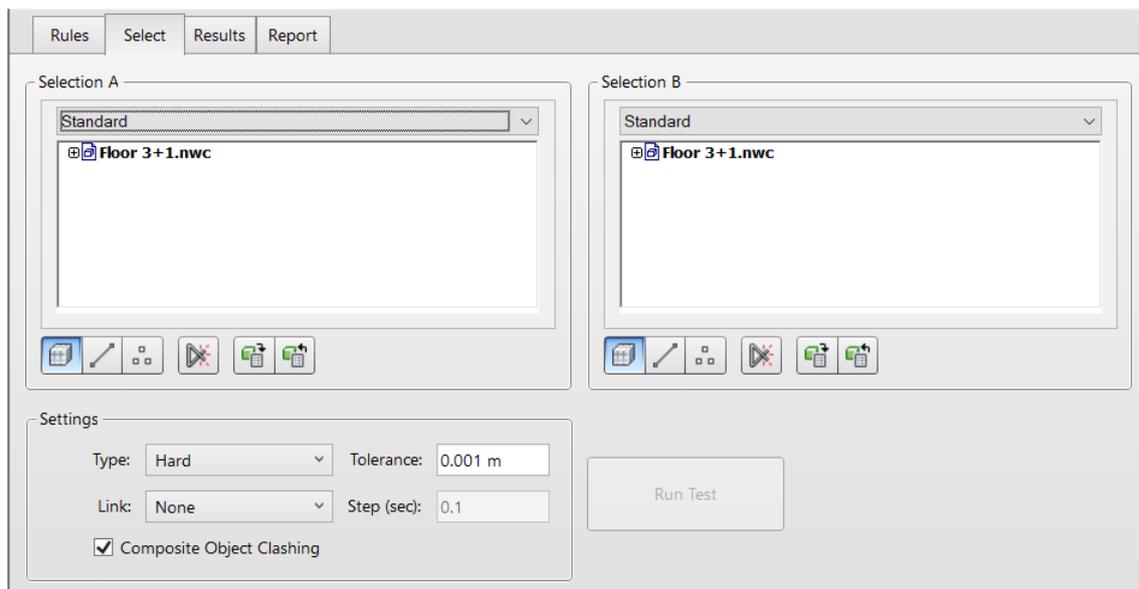
The Navisworks Clash Detective module is divided into four action tabs:

- **Rules:** allows you to define and customize the rules to be followed that will be applied to clash tests.



Rules tab

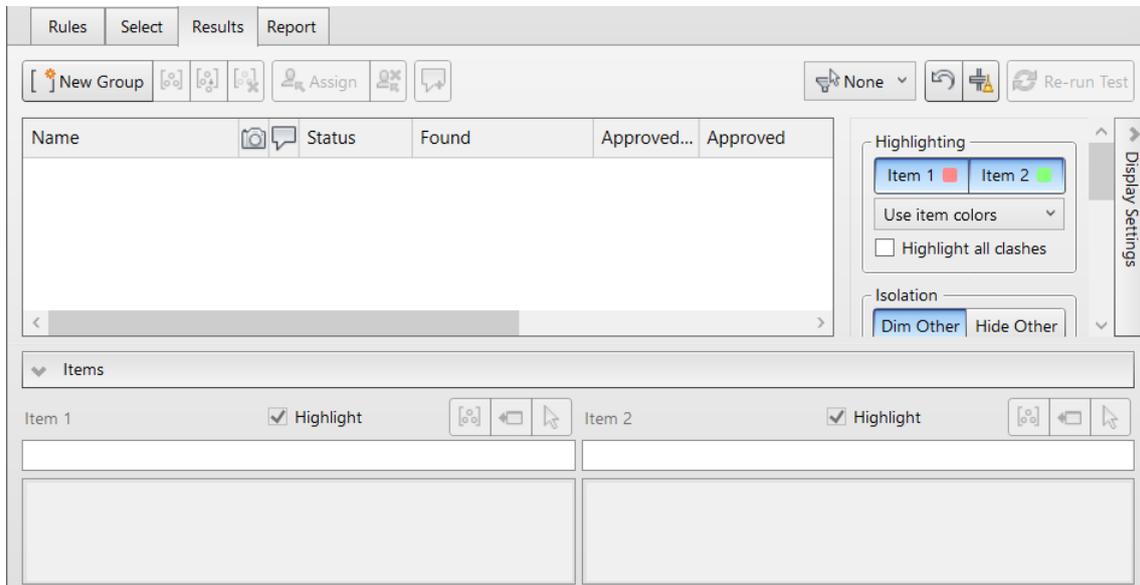
- **Selection:** this is where selection A and selection B are chosen to perform the A vs B test. The types of clash detections available are:
 - *Static (hard):* only objects that are physically inserted will be considered as clashes.
 - *Static (conservative):* two objects are treated as intersecting even though the geometry triangles do not.
 - *Clearance:* objects will be considered as clashes if they are within the specified distance of the other object. You might use this type of clash when pipes need to have space for insulation around them, for example.
 - *Duplicates:* this is done to make sure that there are no duplicate overlapping objects in the model. This type of clash testing may be used to clash the entire model against itself. This enables you to detect any items in the scene that may have been duplicated by mistake.



Select tab

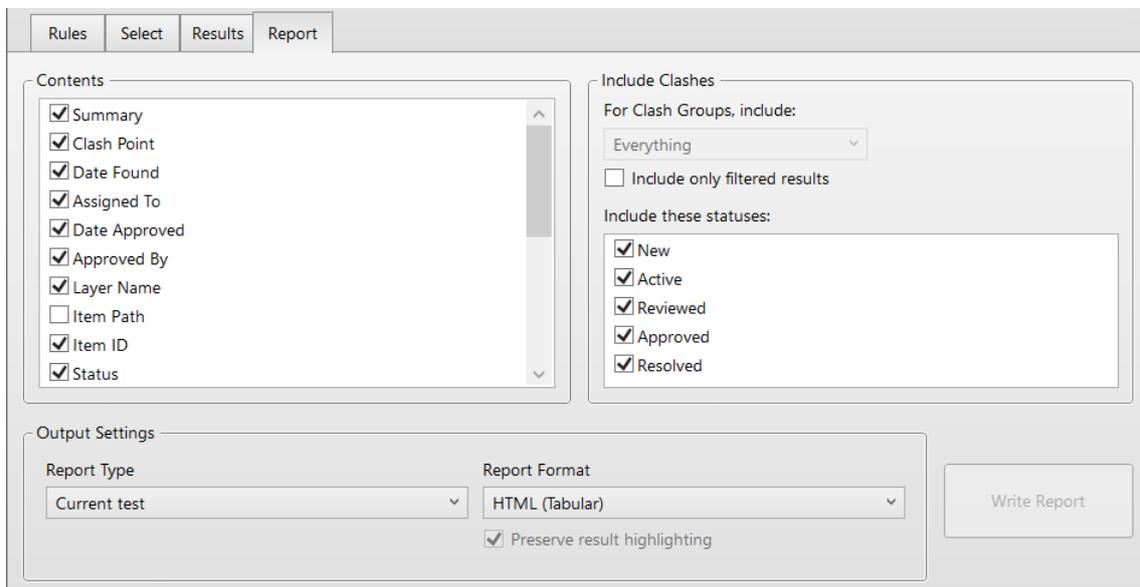
- **Results:** allows you to interactively review the conflicts found. It contains the list of conflicts and a series of controls to manage them. The options offered by this tab are:
 - *Display options:* allows you to modify the way of displaying the colliding objects of selection A and selection B.
 - *Create groups:* allows you to group different clashes that have some kind of relationship so that they appear together in the final report or simply, to make it easier to solve them.
 - *Assignment of responsibilities and introduction of comments:* allows you to assign a specific clash to a person, who will be responsible for solving it.

- *List of collisions:* we can see the different parameters associated with each clash and associate a new status to it.



Results tab

- **Report:** allows various types of reports to be generated with the results of Clash Detective.



Report tab

5.3 - Video

A step-by-step example video will be shown, focusing mainly on Clash Detective and TimeLiner.

For the planning, the estimated project execution tasks are as follows:

Phases	Taks	Duration (days)
Foundation	00_Excavation	5
	01_Foundation	6
	02_Wall_F	7
	03_Columns_F	4
Ground Floor	05_Beams_GF y 06_Ceilings_GF	7
	07_Columns_GF	4
First Floor	09_Beams_FF y 10_Ceilings_FF	7
	11_Columns_FF	4
Second Floor	13_Beams_SF y 14_Ceilings_SF	7
	15_Columns_SF	4
Attic floor	17_Beams_AF y 18_Ceilings_AF	7
	19_Columns_AF	3
Ceiling floor	20_Beams_C y 21_Ceilings_C	6
Stairs	4_Stairs_F	3
	08_Stairs_GF	3
	12_Stairs_FF	3
	16_Stairs_SF	3

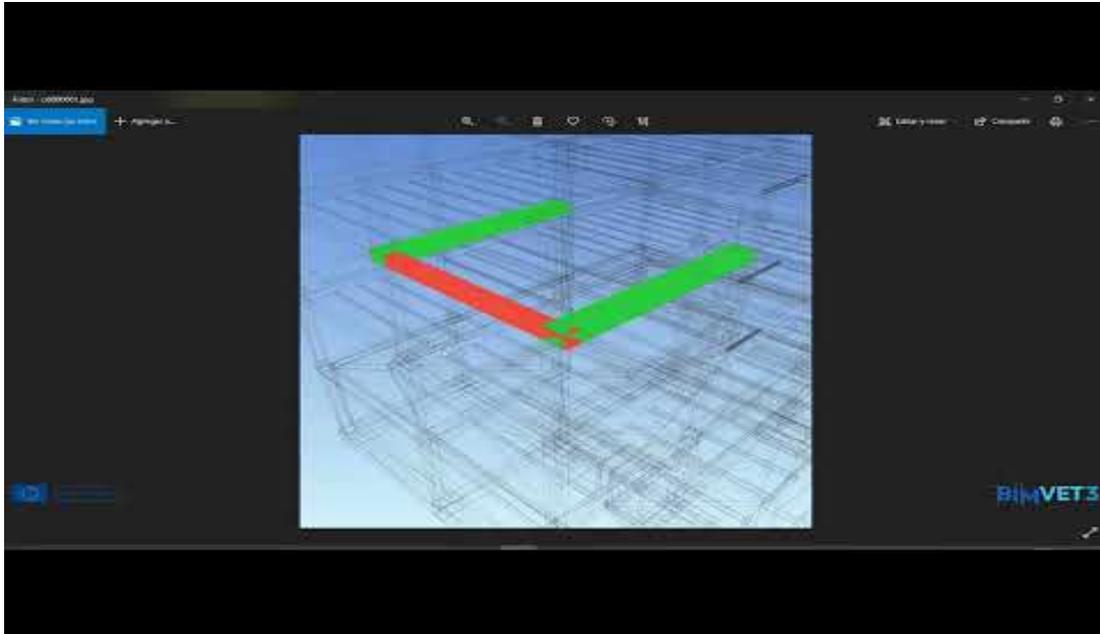
* Working days from Monday to Friday.

** Holidays have not been considered.

*** Start expected on 01/01/2022

Video

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



6 - Deliverables

To assess the achievement of the practice, students will write a report of 3 pages maximum.

In this report, the student will explain the steps taken in practice, the difficulties encountered and the decisions taken.

7- What we have learned

Know the keys to the BIM philosophy in terms of project planning and monitoring.

Carrying out clash tests and report extraction.

4D planning of works with Navisworks.

Export to Microsoft Project and import to Navisworks.

Execution of 4D planning and monitoring.



8– Files to use in this tutorial

Model in IFC format

Model in NWF format