E3. Traceability and group work

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While there are projects where a single engineer will do all the calculations, from start to finish and at all phases, most of the time the work is divided among several people. This requires the implementation of a particular methodology, described below. And even when the engineer is alone, these elements are part of the global quality approach and allow to remember the work done.

E.3.1 Transmission / traceability / archiving

For the project success, it is essential that any model can be passed on to another person with the skills required to operate it without wasting time trying to understand what has been carried out.

To allow the transmission of the FE model, and without redefining the classic notions of quality (files storage in a well-defined folder, explicit filename in relation to the valid version of the model), it is necessary to trace precisely what has been modeled (in a modeling note if possible, but failing that in a simplified text that can easily be found), which will list at least the following data:

- the software used;
- the type of elements used;
- the material properties considered;
- the support modeling principle;
- the representation by sketch of the main principles of geometric modeling (in particular simplifications made);
- the principle for numbering nodes and elements;
- applied loads;
- the calculations performed;
- the combinations made.

If the models are modified as the projects progress, it is necessary to make a point of noting the changes made at each stage so that the effects of this or that modification on the results obtained can be traced and the intermediate models used can be saved. These should be stored and identified. We should be wary of names which at time t seem to mean something and which 6 months later are no longer understandable ("test_support_2_z_flexibility", for example).

In case of software operating by lines of code, see the following paragraph.

E.3.2 Operating and commented code

In the case of a model imported directly in the interface, the user does not have access to the entire process of creation of the model.

On the other hand, in the case of FE programs operating by lines of code, it will be advantageous to take advantage of the options that outline the entire model construction process. This makes it possible to retrieve all the reasoning and to understand how the software created the different parts of the structure and loads step by step.

It is necessary to make maximum use of the commenting options to explain each line of code or group of lines of code, to quickly find the specific data you are looking for in the model, and for a person who is not familiar with the language of the software to at least be able to identify the main modeling principles.

E.3.3 Reflection about BIM

BIM (Building Information Modeling) is currently a new work method applied to the various construction trades. This approach aims to interconnect the different trades to create a single model from multiple files.

The connection of calculation models to geometric models is beginning to be developed by software companies.

Nevertheless, it is important to be vigilant and not to take for granted all the options presented as automatic. Indeed, FE modeling is based on an engineer's approach, to model only what is useful and necessary, whereas geometric modeling aims to provide additional information that is useless for mechanical dimensioning.

The geometric model is created to present 3D plans and views of a structure, as well as the interfaces between the structure and the equipment, and to detect possible volume conflicts. It is not created to ensure that element connections are mechanically correct. It does not distinguish between main structural elements and secondary (non-structural) elements that should not be taken into account. It does not integrate any of the simplifications described above which are important to understand the functioning of the structure (for example the shifting of the neutral axis of successive elements or the reprocessing to obtain the nodes).

Thus, the use of FE models derived automatically from geometric models does not necessarily save time compared to the conventional method, given the need for exhaustive control of the EF model, on the one hand, and the time required to rework the FE model to make it conform to the desired objectives, on the other hand.

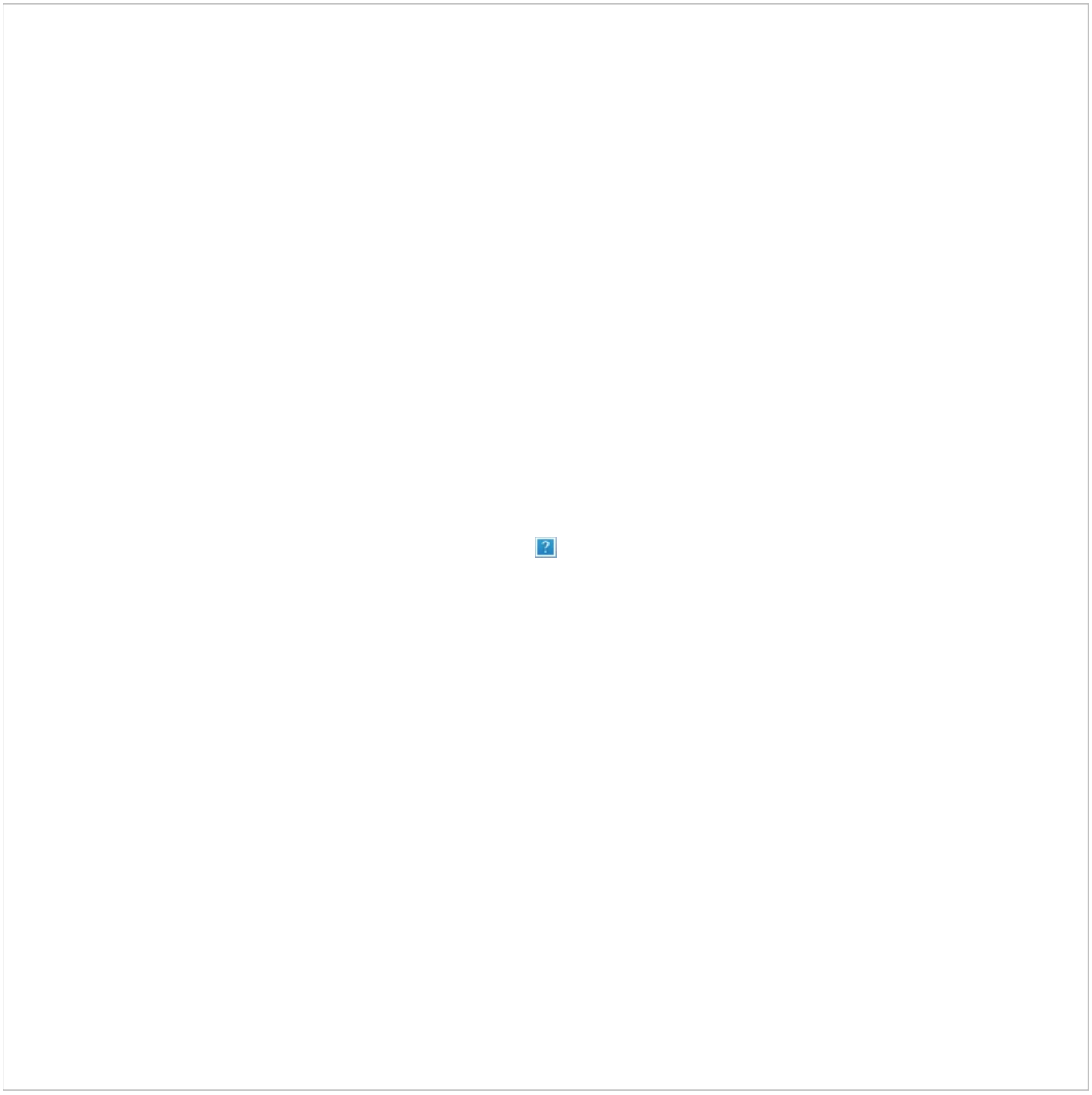
This is true at the time of writing, but companies are making improvements to their products every day, which could render the previous text obsolete.

The BIM implementation, whose objective is to facilitate exchanges with other professions, should in no way cause us to lose sight of the fact that FE modeling is another profession, based on the added value of the engineer's viewpoint.

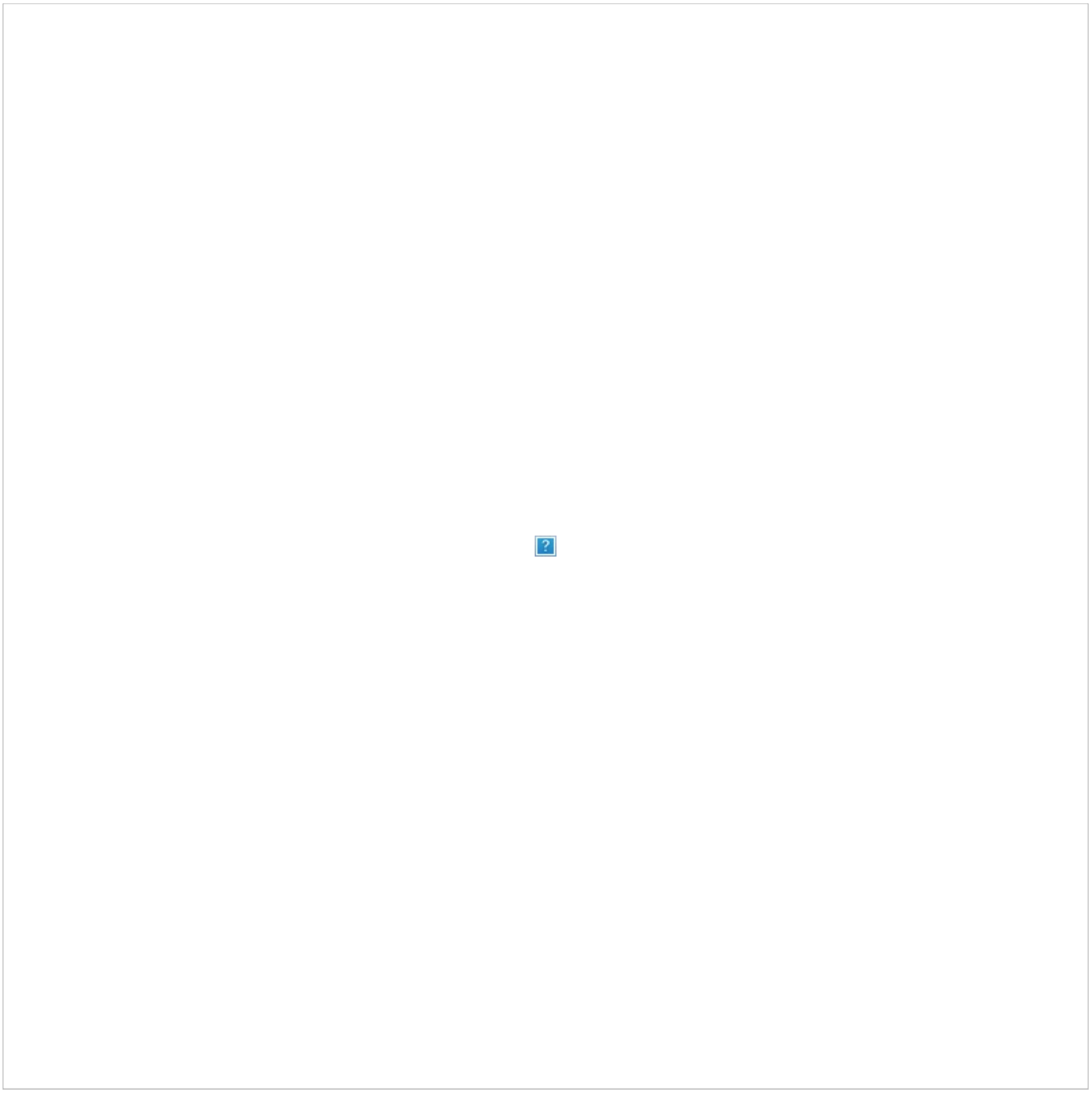
In any case, the use of BIM to obtain a computationally compatible model forces to rethink the traditional modeling sequence (engineer/projector), to redefine the responsibilities towards the information ... which leads to define specific

processes for the project.

Example of a structure whose calculation model comes directly from the BIM model:



BIM model



FE model from the BIM model

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