

New Software Interoperability in the A.E.C. field

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Nowadays, around the world, there is a new huge buzzword in AEC (Architecture Engineering Construction) field: “interoperability”. Interoperability means interaction between different software. Why is so important? Because the collaboration represents an important added value in the work (and in the life). How can software be collaborative? Importing and exporting file but it is not so easy. In fact it depends by the complexity of the data we are using. Generally speaking in the construction world actors of the process-product are using a very large number of different software: architectural, structural, MEP, accounting, financial and the whole system become every day more complex. In addition, there are a lot of professionalism, skills, knowledge, cognitions, responsibilities that work on the same project using different cultural and technical background and these to have an interaction in this situation is difficult because is like people using different languages while they are speaking each other. We can affirm that it is necessary an “Esperanto language” for the software to reduce this level of entropy (Figure 1a,b).

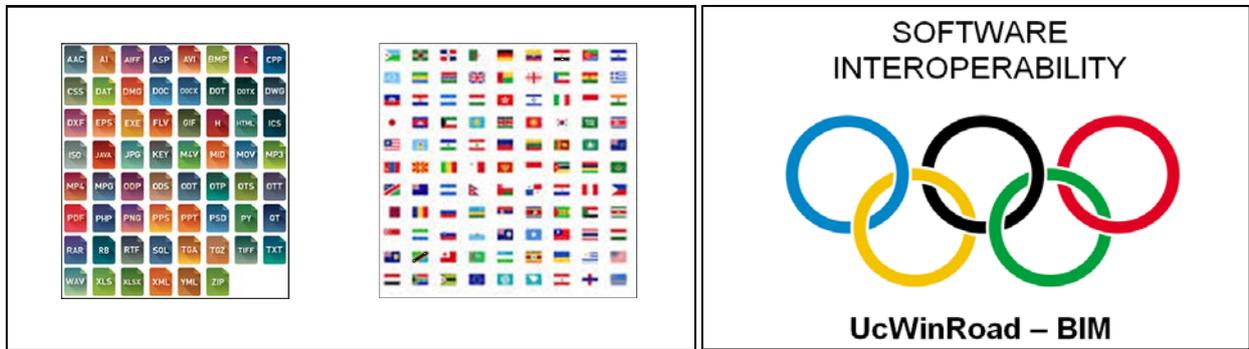


Figure 1a,b – A conceptual icona of software languages and interoperability

IFC is the magic word. IFC is a platform neutral, open file format specification that is not controlled by a single vendor or group of vendors. It is an object-based file format with a DATA MODEL developed by the International Alliance for Interoperability (IAI) to facilitate the interoperability in AEC. Industry used collaboration format in (BIM) based projects. The IFC model specification is open and available. It is an official International Standard ISO 16739:2013. What does it mean “object based file format”? These words are very important because introduce the concept of the “object”. An object is an ontology, something described by specific attributes. In the IFC format is described the whole identity of an object. Different objects are related, i.e., to different knowledge. The Building Information Modeling approach is another important innovation in the AEC field. The BIM method is based on an object oriented system of knowledge.

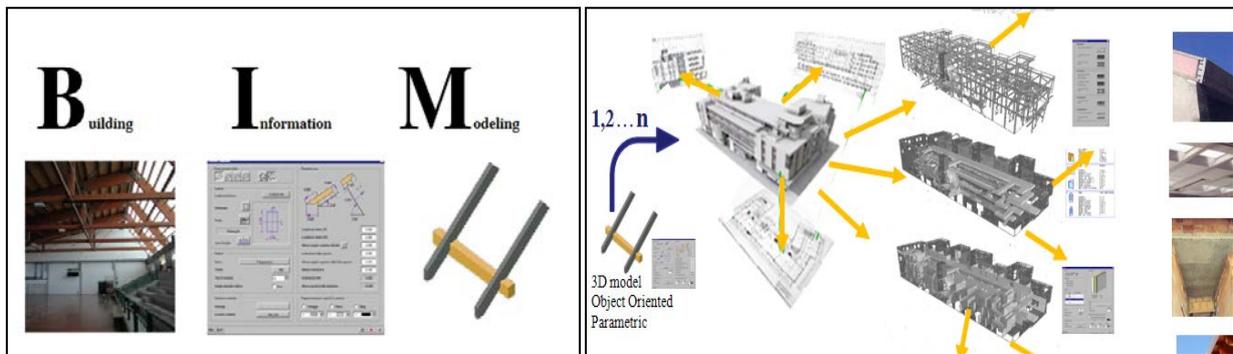
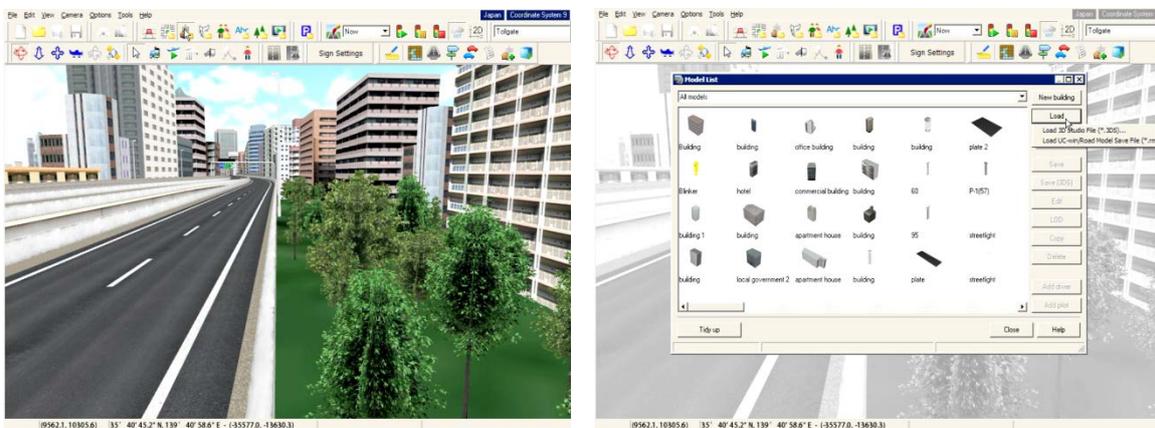


Figure 2 a,b – The BIM cparadigm: every part of the model is an object oriented ontology

BIM means a logical-functional model of the future construction “unicum” not only the possibility to study the different phases of construction, to simulate the thermo-physical properties, the cost, but allows to generate everything in a combined manner. It is not just a procedural method change (to build directly a constructive object-oriented model from which documents: views, sections are derived afterwards instead of the opposite) but a cognitive change. The BIM is an olistich method that involves all the actors in all the phases of the whole process-product: from thr firs idea to the end of the building life cycle.

In a object orientd BIM file there are stored all the features of an object like beam, pillars, flor, wall: this is noy just a geometrical file but a file where the geometrical object is related with all its data (material, cost, procedure of installaton, durability, maintenance..). We want explore the level of interoperability between UC-win/Roadand some of the must knowledge BIM around the world.

Please note that we are speaking not just about a file exchange but about a protocol that allows to transport 3D model and its data togheter. For this reason we don’t use the command “load models” because this way is only for 3D grapich objects. In fact, when I have imported a file I can change only the texture, the position and the geometry of the file object.



The right key is in a different position: in the UC-win/Roadversion 10.0 go on the “tools menu” and find command *import IFC file* (or export IFC file). For the latest version of the software it is possible another way. Forum8 offers a software named 3D Cad linked with UcWinRoad. From a logical point of view the 2 software are the same virtual environment. Thanks this opportunity the user can optimize the IFC file before to import the model in the UC-win/Roadenvironment. Please note what is a IFC file: is a huge text file where every single aspect of the onthology is, specifically, described.

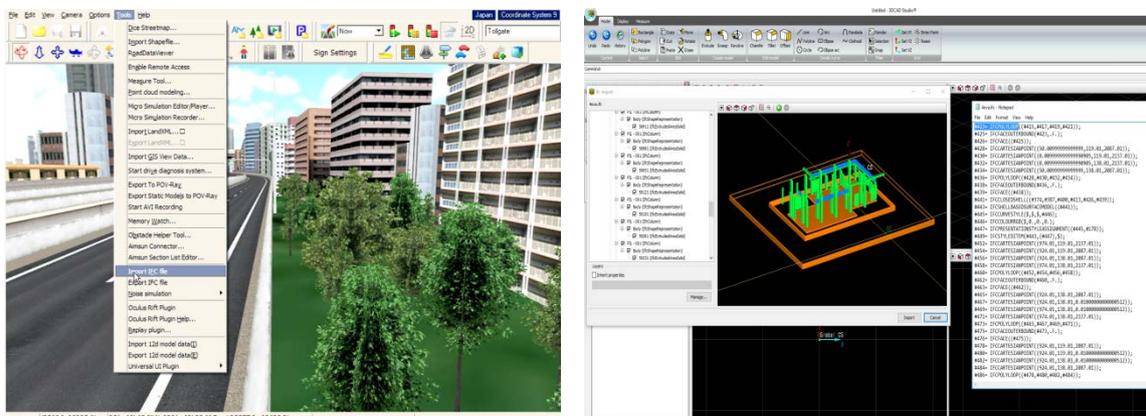


Figure 4a,b – Import/export IFC menu; an IFC file opened in 3D Cad

Using 3D Cad, designers can check the whole data and, if it is necessary, specify or fix some features of the files (figure 3b). Thanks this facility UC-win/Roadcan import single building into a complex scenario: I would underline how that is very usefull for designers. We are going to an integrated approach to the virtual reality modeling where the project is checked before the beginning of the construction: i.e. architecture design, traffic flows and safety condition for people, in case of accident, are parts of an only one concept. To sum up, we are moving beyond vision to "experience" the design before it is built: we design the constructive ontology according our experience of the "artifact". Modeling the interaction means representing the process throught the time. If every actor of the all phases of the process-product have the opportunity to have only one virtual environment, where verify their design, the quality level of the final result can be deeply improved. We know as the process design is fragmentary owing to the numerous "actors", phases, environmental contexts and cultural backgrounds. Therefore, generally speaking, people consider design activity as a set of isolated and sequential compartment: this habit introduces an inefficiency of costs, timing and quality level of the result. To have the opportunity to use BIM model in a virtual environment like UC-win/Road means combine the architectural scale with the urban scale. In addition designers of buildings have a powerful tool to check their model, using UC-win/Road facilities. This is the goal. Please note the difference between a usual import/export file with respect to the import7export of IFC file. In the Figure 5a,b a regular 3d model imported in UC-win/Road using the "load model" function. If we check "texture", we immediately understand that the object is made of five surfaces: therefore, is an empty envelope. We can assign a texture for each one surface.

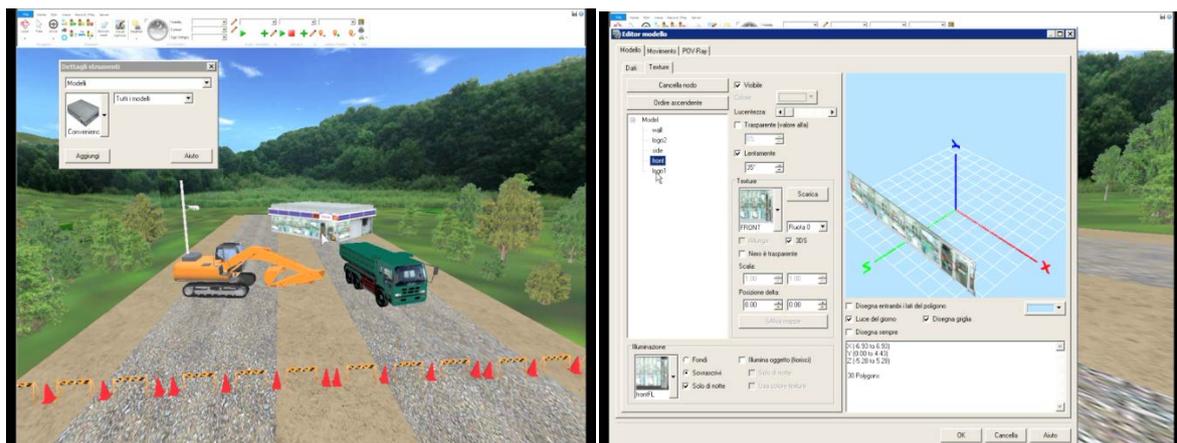


Figure 5a,b - A regular 3d model

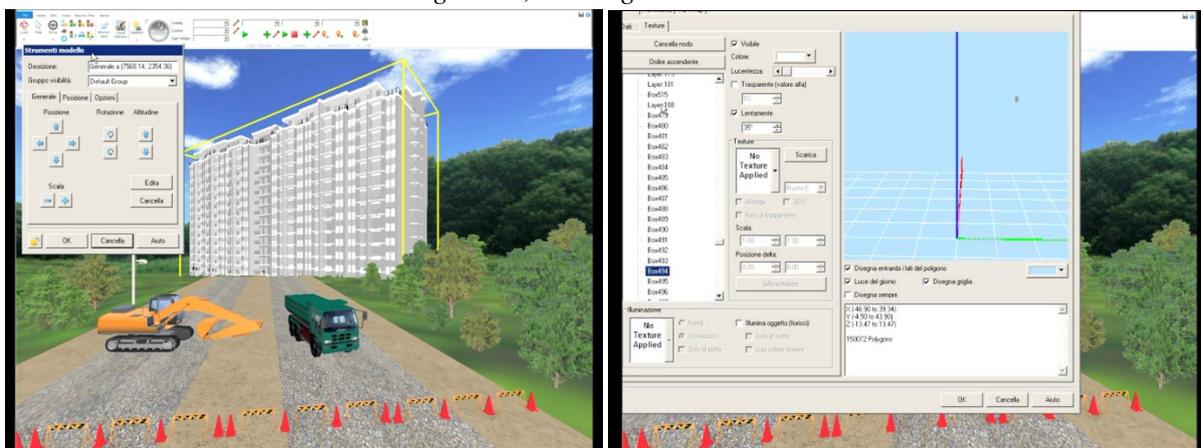


Figure 6a,b – An IFC model imported in the UC-win/Road virtual environment.

In the Figure 6a,b we have an IFC model imported in the UC-win/Road virtual environment. In this case the import-export protocol between the two software, allows importing every single object that is part of the

building: wall, pillar, floor, roof...the building model is not just an envelope. Using IFC model we can have a real building made as in the reality according with the mode of the real construction. In fact, if we fly to an apartment (figure 7a,b) we can have the opportunity to understand the executive detail of the building. In the figure 6b, in fact, there are hundreds of components of the building that the software can understand coming from the BIM configuration.

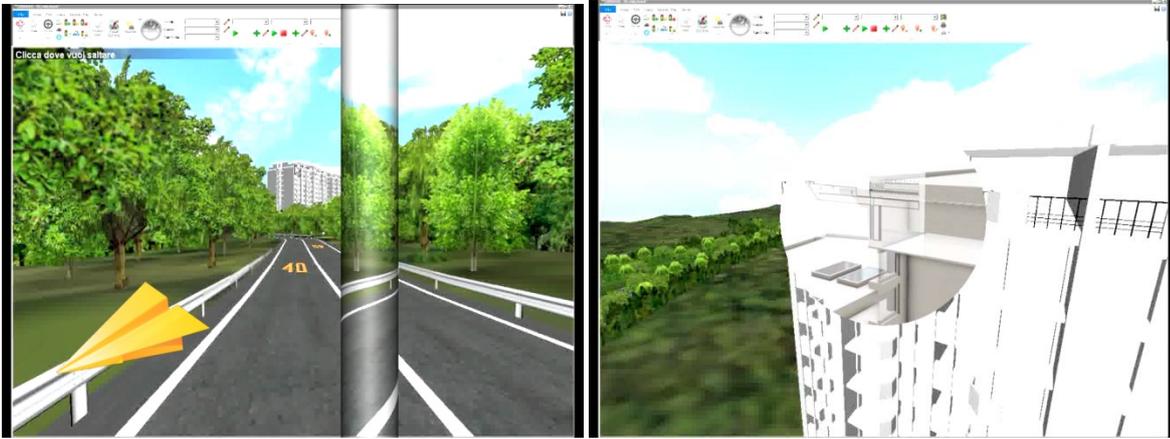


Figure 7a,b - Fly to an apartment: what a surprise: is buildable!

I would underline that every part of an IFC model is an ontology, therefore in the IFC file we have, also, all the details related to every single object. In addition, the ontology of every single object It doesn't depend from the scale. Please rebar that. The detail in al BIM/IFC mental approach can be a room, or a building, or a part of the town (figure 8 a,b,c).

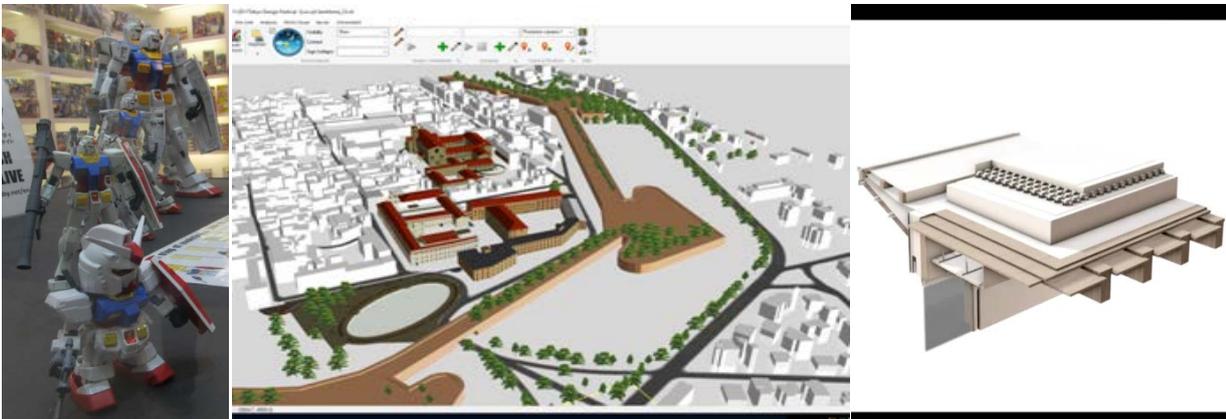


Figure 8a,b,c – The scale of the design is not important. The onthology is important.

The digital design turns a new “environment”, accessible through a new IFC door, where it is born and grows a new concept of an unusual form of interaction between the designers (subject) and the design (object). I would underline how it is important for a whole project tha phase of the control of the connections between the different knowledge of different acotrs of the process involved in the whole project activity. At the current state of the art in the digital tools for AEC some new research and technical spaces are born. To sum up, we can adfirm that the object of this dimension is an overlap between the different scales of the parts of the same project. And it is not so easy to find tools that allow professionals to investigate this dimension. Ther are two main aspects. On the theoretical side the current needs of design push actors to overcome a specific cognition towards an integration of competences, on the technical side this interaction is not so easy, becasue tools are designed for different goal. Who design the tool of the interaction? Or, may be, it is possible to have tool that can develop this interaction becoming open virtual environment? One of the

most important needs is to navigate the BIM model; another one is to generate flows of people, or means of transportation, or things in order to mix the static dimension of architecture with the dynamic dimension of the environment around the building. In addition it is a large record of situation where the dimension of the project is between the architectural and the urban scale, or where the object of study is the integration of different aspects. What is important in the design activity is the continuing iterative process between the concept and its verification and into this dynamics there are a lot of disciplines involved in an integrated manner. Therefore, the new environment where obtain new results and benefits are the overlap between different knowledge. Designing a very large building, or planning a development of a new part of the town (figure 8a), both are situations where we have mixed together dynamic flows of people, building and blocks. That increases the complexity in terms of quantity but we can think to a quality approach too. A restoration of an ancient building, (figure 8b), i.e., means a significant link with the environment. Usually speaking, we must have two different approaches coming for different tools we use: one for the building and one for the environment.

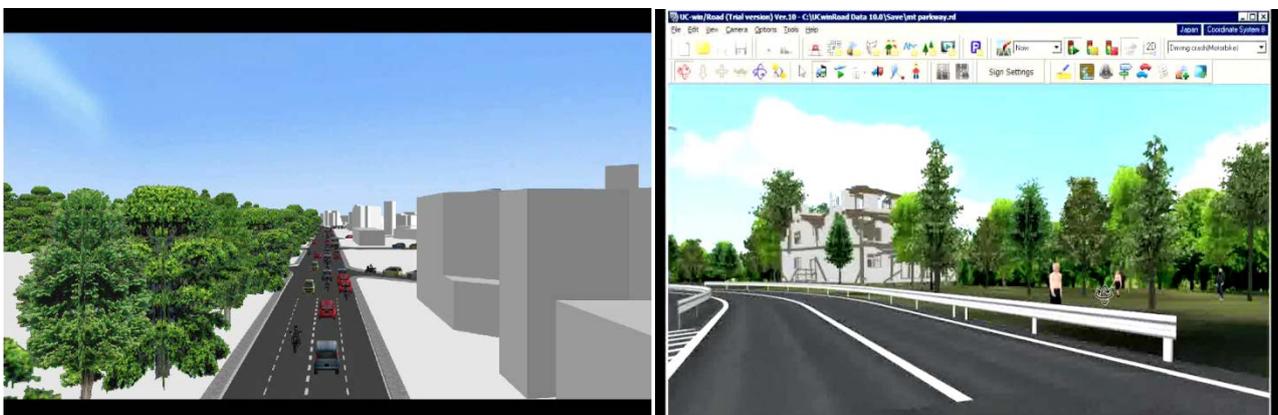


Figure 9 a,b – The scale of the design is not important. The ontology is important.

Generally speaking digital tool working on the building have not powerful resources to manage the virtual environment. Therefore the attention is on the building and not on the building as part of a context. But if we can manage a parametric approach, i.e., both for the building and for the environment, we can use the same digital context to explore the dimension between the house and the park. Our vision is a common virtual environment developed to collect data together from different knowledge of the process, where different actors can share, control and verify the common design. The AEC field needs resources for this effort. Virtual reality design studio tools as UC-win/Road are already a very important answer for the needs of a huge number of professionals.

Questions

- 1 What does AEC - BIM - IFC mean?
- 2 Explain the object oriented approach.
- 3 It is possible to import IFC in UC-win/Road?
- 4 How the procedure to connect BIM and UC-win/Road works?
- 5 Why to connect BIM and UC-win/Road give to designers an important added value?
- 6 What is a new technical and research field where is possible obtain new results and benefits?
- 7 Describe your vision of virtual environment for the next years.

Homework

Make a BIM model and import it in UC-win/Road urban scenario. Try to point out the benefit of the virtual environment for the BIM model. Show the model to some actors of the process-product in the AEC field (architects, engineers, fabricators, public administrations, ...) and write to us the comment of these people.