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FACULTY OF ARCHITECTURE
DEPARTMENT OF DESIGN COMPUTING**

MBL607E / BUILDING INFORMATION MODELS

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**DIGITAL VERSION OF CONSTRUCTION SITE
VERSUS
DIGITAL VERSION OF DRAWING BOARD**

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Digital Version of Construction Site

versus

Digital Version of Drawing Board

1. INTRODUCTION

One of the prominent architectural design offices in Turkey has been chosen for this survey. The office with high awareness in public has several national/international awards and published projects. It changes cyclically but has six architect employees now.

This study explores the implementation of Autodesk Revit Architecture in the office. The researcher of this case study has an insider view as he worked for the firm for three years. This study may give a hint about the potential problem areas during the adaptation process of the software for similar offices. The investigated case is based on a private housing project for high income groups. It was executed with Revit but not constructed yet.

2. PROBLEM

One of the problems encountered during a typical project is that the drafting and documentation phases are undesirably long and they steal valuable time from the design phase. There is also a need for more employees for drafting and revisions purposes. These seem to be the most problematic sides of the traditional project production method.

Some offices try to overcome this problem by outsourcing the construction drawings, others standardize drawing tools and styles in order to minimize the drafting time. The coordination of the technical projects with each other and the architectural project is also not easily managed with the traditional method.

Due to being small sized, these architectural organizations are open to new technological developments in order to reduce the workload mentioned above. They aim to minimize the drawing phase, visualize the complex 3D geometries more quickly and produce more expressive documents for other participants.

3. METHOD

In this case study, open ended, semi structural interviews were conducted with a senior employee working in the office for ten years and another one who led the Autodesk Revit Architecture trial project in the office. She was a 5-year employee in that office at the time of the trial, and she is currently working in another architectural office.

In these interviews the following areas are investigated by open ended questions with probes:

- Understanding the usage of BIM Technologies in design and construction phases.
- Determining the data exchange platforms/formats of the project participants and their roles in the process.
- Defining the issues encountered in a BIM project.
- Understanding the effects of BIM on personnel structure, task allocation and way of working in the office.
- Discovering the innovative ways of BIM usage in design and construction phases.

4.FINDINGS

4.1 Understanding the usage of BIM Technologies in design and construction phases.

Even for the architect who is expected to master the project since he/she creates it considering the user needs, it is impossible to manage every aspect and detail of the project without drawing during design phase. At this point, Revit's enabling to visualize every component as in reality makes it a design tool. 3D visualization can also be managed with several other software, but by Revit construction drawings can be derived from a 3D model and this saves a remarkable amount of time.

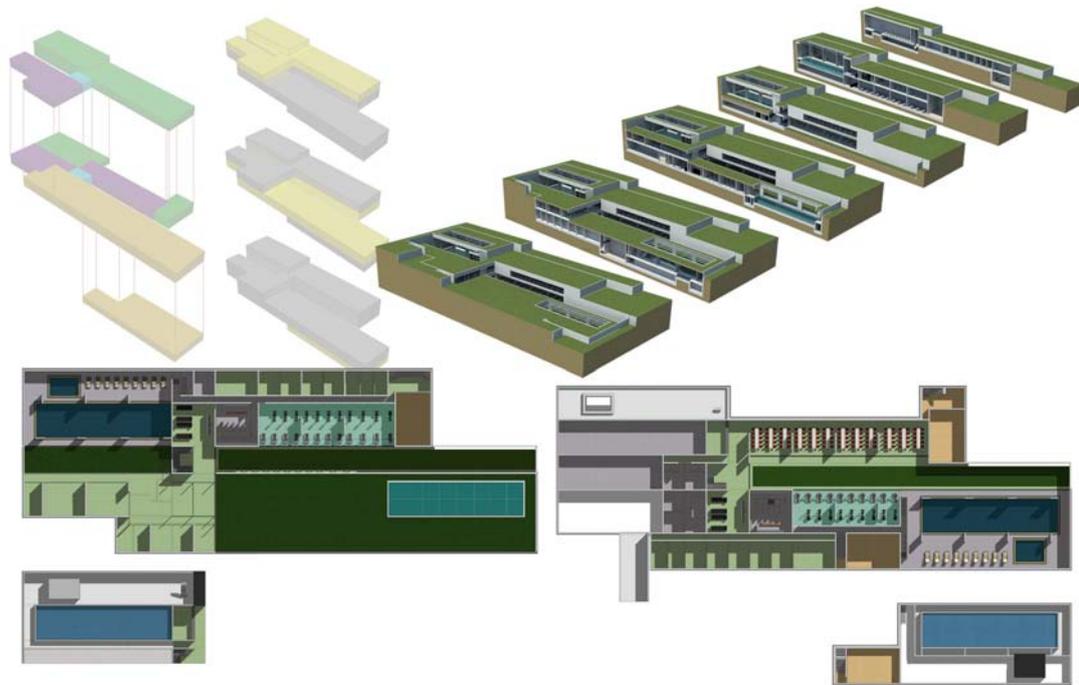


Figure 1: Conceptual representation, easily producing vertical and horizontal sections.

“Mastering the whole project and deriving solutions quickly ; this is the most catchy point.”

Not only deriving vertical and horizontal sections from 3D model easily but also not being obliged to produce new drawings for different scale techniques also save time.

Accessing the quantity survey data easily makes BIM attractive to users. Besides that speed BIM also increases the reliability of data as it is automatically produced without an intervention of users.

4.2 Determining the data exchange platforms-formats of the project participants and their roles in the process

It was mentioned in the interview that presenting the project to other participants with the 3D model became easier. If they do not use Revit, a model enabling them to see the whole construction system with electrical, mechanical etc... subsystems together and to depict the potential problems, could not be formed.

“I wish we could have built a model to see the overlapping areas.”

When drawings are sent in a DWG format, overlapping lines and false hatches makes this process harder. It is also very difficult for technical participants to add 2D drawings to Autodesk Revit Architecture to build up a meaningful system. Transferring 2D drawings using symbolic expression methods instead of parameters, to 3D model makes the process longer.

“Autocad is the digital version of drawing board while Revit is the construction site's.. While working with Autocad, nobody can understand that a box composed of lines symbolizes a column unless you name it.”



Figure 2: Fast 3D models generated during the design phase help architects present their projects easily for other participants.

4.3 Defining the issues encountered in a BIM project

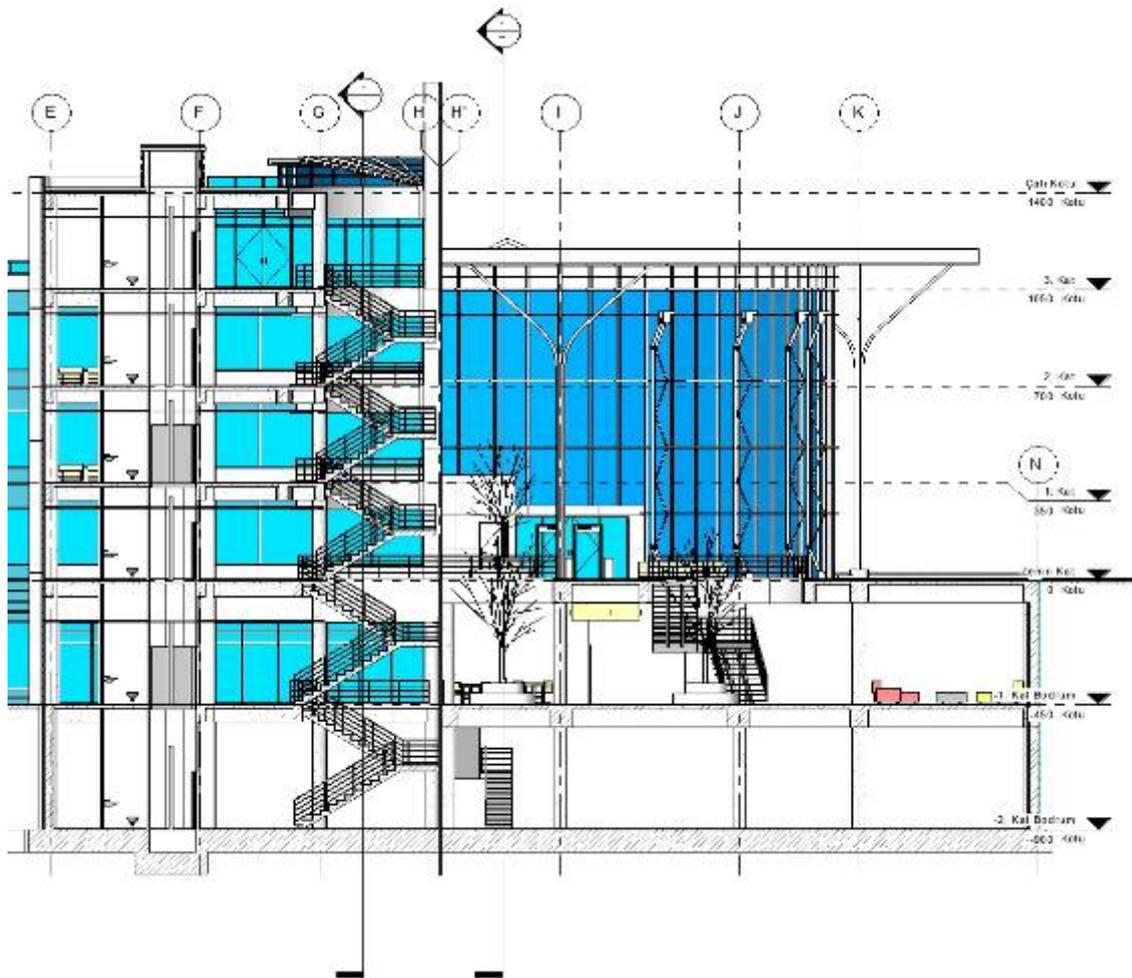


Figure 3: Notation style of Autodesk Revit Architecture

The convenience for providing notations of Autodesk Revit Architecture (axis expressing style ...etc.) had to be adapted to the office's drawing standards. This time consuming process requires patience. Extension of project time due to reorganizing the notation style designed with American standards is one of the reasons against the adaption of Revit; however not the main one.

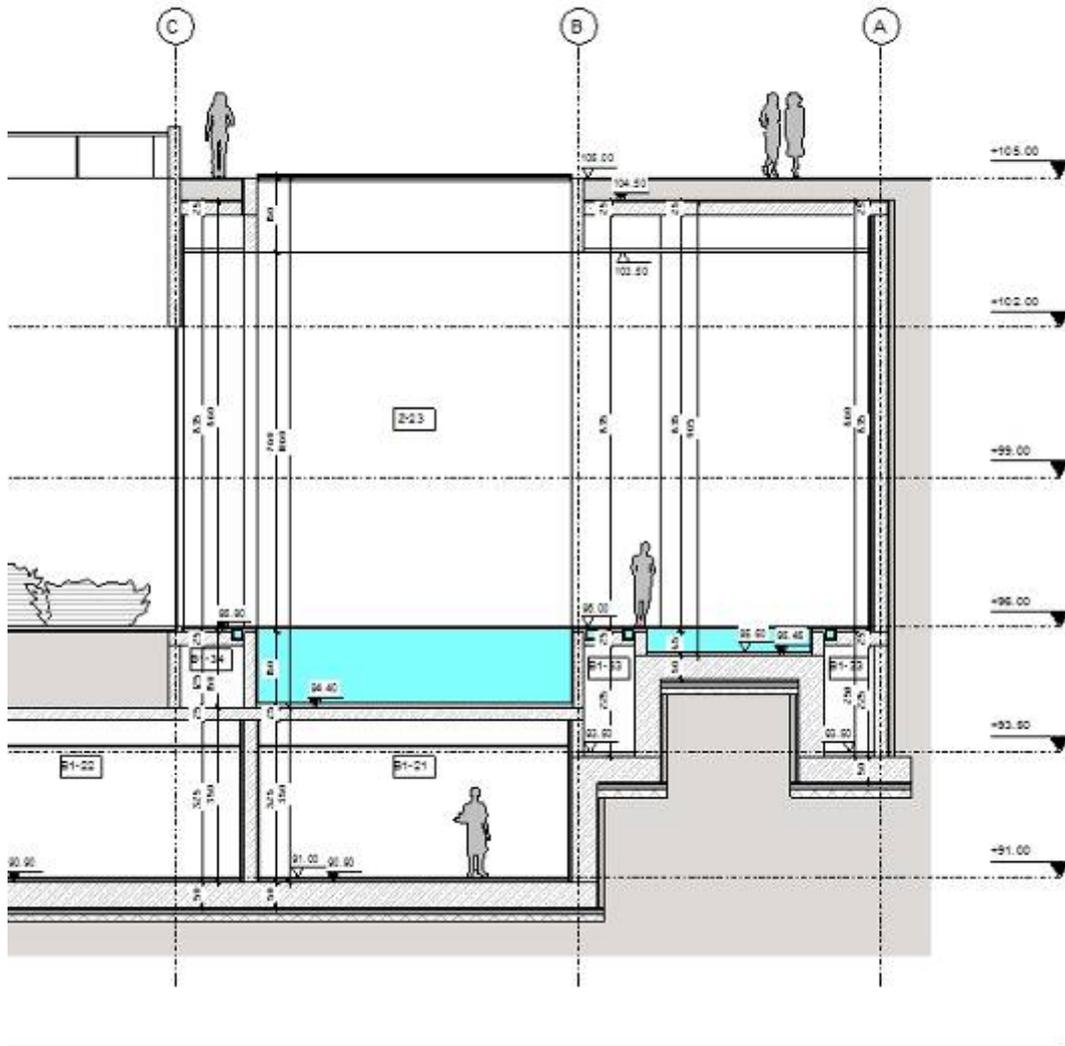


Figure 4: Notation style of the office interviewed

In addition to the need of new notation style, an office library of components/families (doors, windows...etc.) has to be established at the beginning of the implementation period.

“The more you give the more you get from the software.”

There was a lack of qualified user support during the process. The amount of user-generated content about the software on the internet is not at the desired level yet.

As the projects became bigger and the amount of knowledge added to the model increased with more details, the need of new investments on hardware became inevitable owing to the lack of capacity. Due to this hardware insufficiency all details of

the project could not be managed via Revit and detail drawings are produced in 2D format. The interviewee stated that producing 2D details with Autocad is also encouraged by Autodesk. Revit's lack of 2D drawing tools is the main reason why Autocad is selected at this stage.

The biggest problem is the contradiction between the clients in Turkey who are accustomed to start construction before the completion of the construction project and logic of the software which does not let the architect finish the project with open/undefined items. For the offices, which prefer to create totally tailor-made solutions for each problem instead of using previously developed ones, it is impossible to define each component from scratch unless leaving some solutions to construction phase or setting longer project durations . This was stated as the biggest obstacle against the Autodesk Revit Architecture usage in the office.

4.4 Understanding the effects of BIM on personnel structure, task allocation and way of working in the office

An employee who is eager to work with Autodesk Revit Architecture is selected on voluntary basis for the trial and to instruct the others.

The number of employee on the project did not increased since it was easy to produce drawings but no more effects could be observed due to the lack of more trials.

4.5 Discovering the innovative ways of BIM usage in desin and construction phases.

Since the software was used in one single project, innovative ways could not be discovered.

5-CONCLUSION

In spite of the advantages mentioned above the high amount of components to be defined in accordance with the office's style in the implementation period of Autodesk Revit Architecture and intolerance of the office management against that prevented the

usage of Revit in other projects. In the interview with the senior employee it is observed that the necessity to build up an office library of notations and components was accepted.

Even though the office is still eager to use Autodesk Revit Architecture; one of the common properties of the widely-recognized offices like the interviewed one which are producing high quality projects is their way of working to create totally tailor-made solutions for each problem instead of adapting the existing ones to the new design problems, makes the standardization process harder*. This approach which prevents architects who are under time pressure of Turkish construction market, for reducing the time needed to produce construction drawings causes overlaps between design and construction drawing phases which leads to continuous revisions.

Considering that the only way to cope with the time pressure is to leave some of the design problems to the construction phase; the architectural design offices defining “quality” as “not only meeting client expectations but also going beyond them” are in contradiction with the software which does not let the project be finished with unsolved design problems. One of the advantages of using the digital version of the drawing board (ie. Autocad) is letting one to leave some issues to be solved in construction site. On the contrary it is not possible to define something without a parameter even it is true or false in parametric modelling.

One may think that the solution lies in the mindset change required to extend the project duration to European standards. However in any case it will be appropriate for Autodesk to make further research on BIM software Revit Architecture to make it more flexible in terms of symbolic expression tools and building up different drawing styles.

* This information was derived from the interviews conducted in 2008 with ten widely- recognized offices producing high quality projects for my graduate thesis named as “Implementation of Total Quality Management in Architectural Offices”