



## THE INTEGRATION OF CAD INSTRUMENTS AND DATABASES FOR THE HISTORICAL MONUMENTS RECORDS IN THE AREA OF BIGHI, MALTA

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### ABSTRACT:

Malta is a representative model for recording and preserving archaeological remains and historical monuments. Being a historically and culturally rich location, it requires creating, maintaining and updating a database in order to keep a record of the state of degradation or the actions to restore historical monuments. One way to preserve the image and shape of a historical monument is by creating a three-dimensional model. The advantage of such a model is its visualization and keeping in a form close to the real shape of a monument in a particular moment in time. It can thus highlight the levels of wear and degradation, the eventually necessary rehabilitation works or simply reproduce the impressions that the building would actually leave on a visitor.

### 1. INTRODUCTION

This paper is based on the Royal Naval Hospital building in the town of Kalkara, Bighi area, considered to be a historical monument, for which a database was created and then connected with its plan. Another element that was compiled based on topographic measurements is the three-dimensional model of the building, made to capture its features and elements of design.

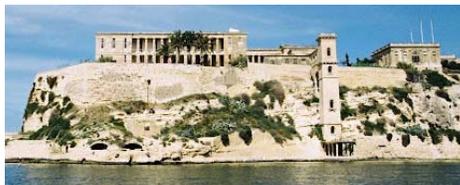


Figure 1. Presentation of Royal Naval Hospital

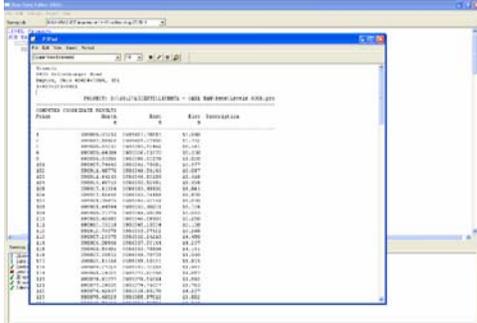
### 2. MATERIALS AND METHODS

Measurements were made with the Trimble 5503 DR Total Station and existing starting point coordinates in the area were provided by the Heritage Malta Institute and are integrated into the national coordinate system, ED50 (European Datum 1950). Measurements were made using the total station to determine the outline of the building and as for surveying, the Leica DISTOTM D3a was used, with the help of which were actually measured the needed sizes of: walls, staircases and windows, height of rooms, size of doors, facades: lengths and widths, as well as their respective heights.

Given the shape of the building, with a terrace type roof, it was possible to reach the top, which made it possible to determine the height using the distomat. The measured heights were used to create the three-dimensional model

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of the building. Processing the measurements was done with the Terramodel software (figure 2) and the situation plan (figure 3) was obtained using AutoCad software, by exporting and processing Terramodel software.



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Figure 2. Coordinate inventory

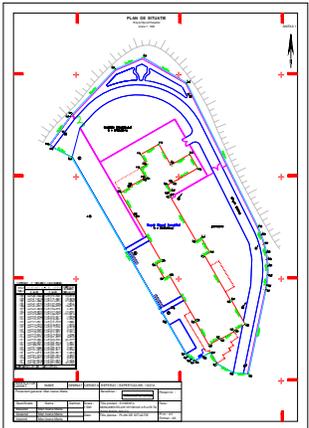


Figure 3. Situation plan

Once the information required for the land surveying was taken from the site (inside and outline measurements) the AutoCAD software was again used for actually drawing the elements of the building (figure 4).

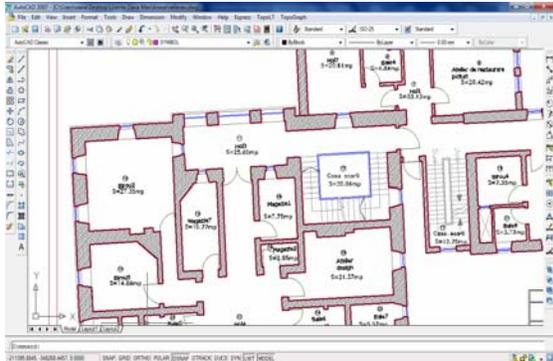


Figure 4. The building survey

Data storage and management was done using the Microsoft Access software, aiming to build an

information database regarding the shape and construction details of the Royal Naval Hospital building. To view the connection between the table and the drawing  is used, and it can be seen that the drawing element name is shown as selected (figure 5).

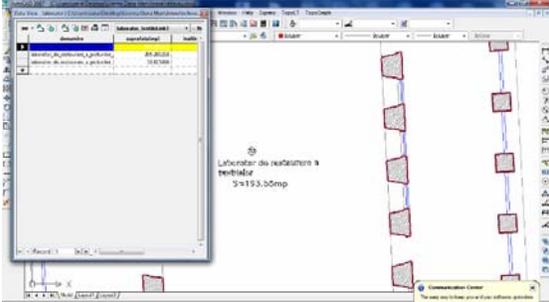


Figure 5. Data View Window

### 3. RESULTS

CAD applications are used for design, starting with sketches and finishing with printing the drawings. The drawings are either in classic form (2D) or first a 3D model of the project is built (used for presentations) from which the software automatically extracts views, sections and quotas for the 2D drawing to print documentation for builders and authorizations.

The ArchiCAD software offers a complete and flexible design solution, the product being in the BIM (Building Information Modeling) category.

One feature offered by ArhiCAD is the possibility of saving the project in various formats, compatible with the most common 3D modeling software.

The software uses ordinary concepts such as: walls, doors, floors, roof. The design process follows the same steps as in traditional design, but instead of 2D design, smart objects are used in three dimensions with complex attributes.

To create the three-dimensional model for the Royal Naval Hospital, the ArhiCAD software is started and after that the objective plan is imported (figure 6), in this case in .dwg format, situation plan.dwg, in order to observe the ground projection. The drawing can also be done without this import. The corresponding AutoCAD layers have been confirmed for better compatibility between the two working software.

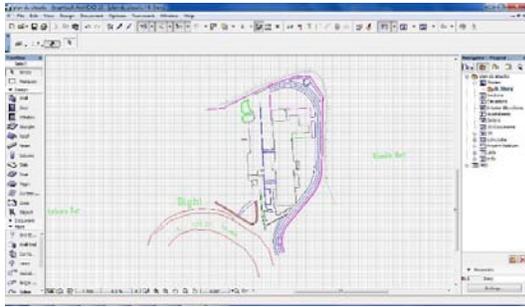


Figure 6. The plan imported from AutoCAD

The Toolbox submenu has drawing options for walls, doors, windows, roof, etc. The building element to be created is selected and then the parameter settings are established.

For building walls, "Wall" is selected and then  is used, after which the desired model and dimensions are set (figure 7).

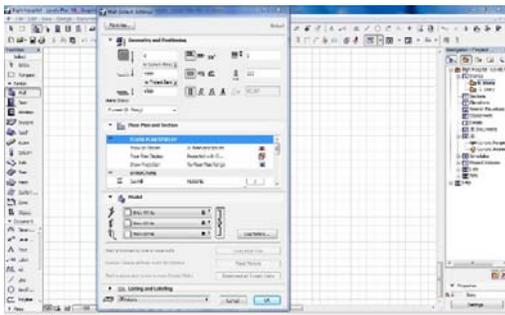


Figure 7. Wall settings

Once the corresponding parameters of the wall have been set (thickness, height, lower level and upper level) for the actual drawing of the wall, in the working window, the starting point and the final point for the desired size are selected (figure 8).

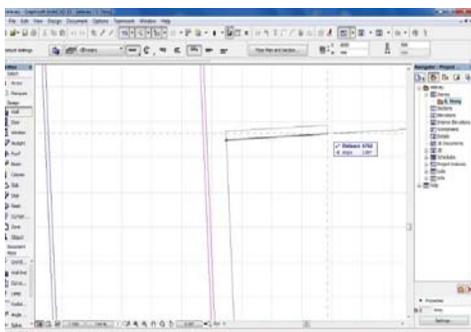


Figure 8. Wall drawing

For building doors, "Door" is selected and then  is used, after which the desired model and dimensions are set (figure 9).

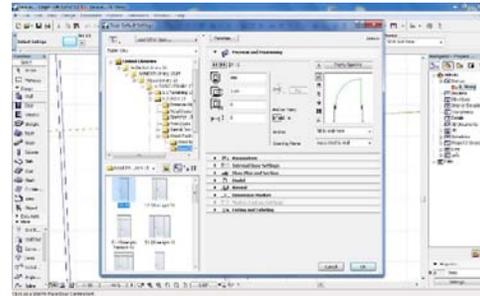


Figure 9. Setting parameters for building doors

For the actual drawing of the door, the working window has to be active, the middle space in the wall where the door is positioned has to be clicked on, and then the outside of the direction that it opens also has to be clicked on. In ArhiCAD, to build the elements of a wall, the wall itself is drawn first, with the desired details to be built on it afterwards (figure 10).

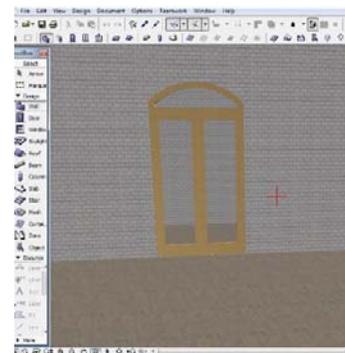


Figure 10. Building a door

For building windows, "Windows" is selected from the Toolbox and then  is used, after which the desired model and dimensions are set (figure 11).

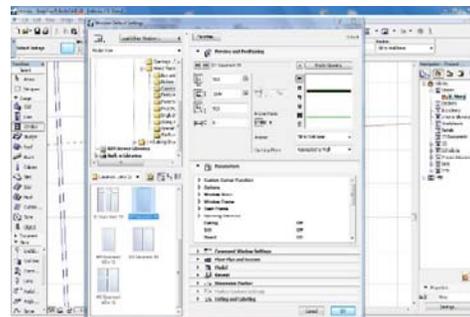


Figure 11. Setting parameters for building windows

For the actual drawing of the window, the working window has to be active, then the space in the middle of the wall where the window is placed has to be clicked on, and then the outside of the direction that is intended for

the opening to be placed also has to be clicked on (figure 12).

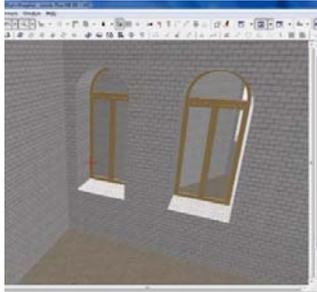


Figure 12. Building windows

For building the slab, the “Slab” command in the Toolbox is selected and then  is used, after which the appropriate parameters are set ( Figure 13).

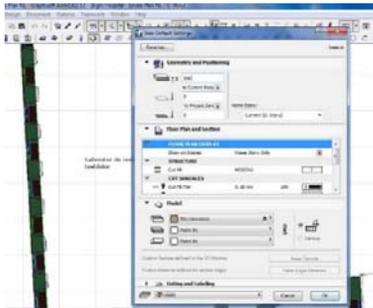


Figure 13. Setting parameters for building the slab

For the actual drawing of the slab, the working window has to be active, and then a closed polygon that will determine its shape will be drawn (figure 14).

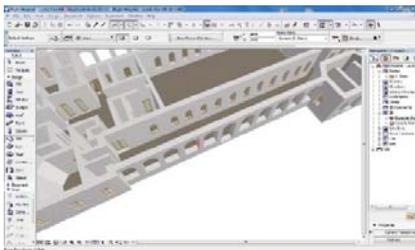


Figure 14. Drawing the slab

By clicking on , from the menu bar it can be chosen how to view the plan: 2D, 3D, sections, heights etc. (figure 15).



Figure 15. Activating the “Go” command

The "Orbit" command in the menu bar provides a dynamic visualization of three-dimensional model (figure 16) and is activated by clicking on .



Figure 16. 3D visualization of the model

Finally, after drawing all building elements, the three-dimensional model is shown in Figure 17.

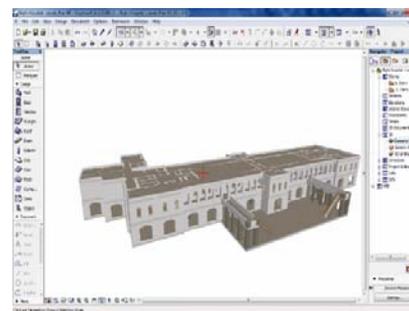


Figure 17. The representation of the completed three-dimensional model

In order to be able to represent the 3D model outside ArhiCAD it is possible to make a Video or QuickTime movie. "Camera Tool" is selected from the Toolbar and is used to place various points around the plan which will then be used to make the recording. From the menu bar the following sequence is selected: Document → Creative Imaging → Create Fly Through (figure 18).

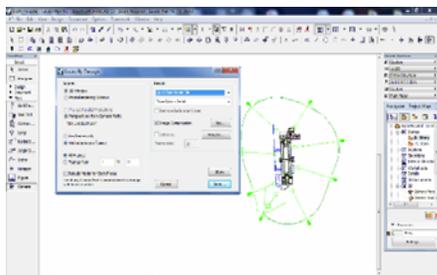


Figure 18. Create Fly-Through window

#### 4. CONCLUSIONS

This paper was based on the Royal Naval Hospital building, considered to be a historical monument, for which a database was created and then connected with its plan. The element that was compiled based on the topographic measurements is the three-dimensional model of the building. The included database can be expanded by adding fields and connections, depending on changes over time.

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