FIG WORKING WEEK 2017

Helsinki Finland

29 May - 2 June 2017

REALIZATION OF A FUNCTIONAL PHOTOREALISTIC 3D CITY GEOGRAPHIC INFORMATION SYSTEM (3D GIS), THE PLACE OF GOOGLE EARTH & Arc SCENE

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From digitalisation to augmented reality

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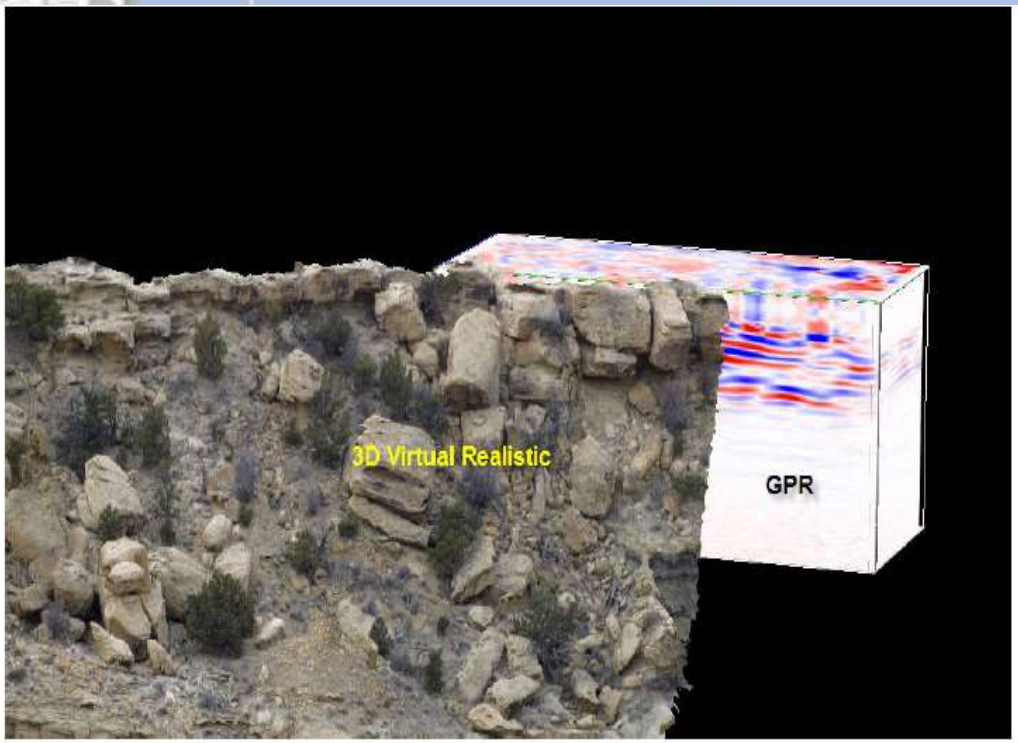
INTRODUCTION 1

3D city (3D GIS) is swiftly evolving, efforts have been on how to create 3D City Models that do not only present real-world visualization but also allow for different kinds of spatial analysis and measurements.

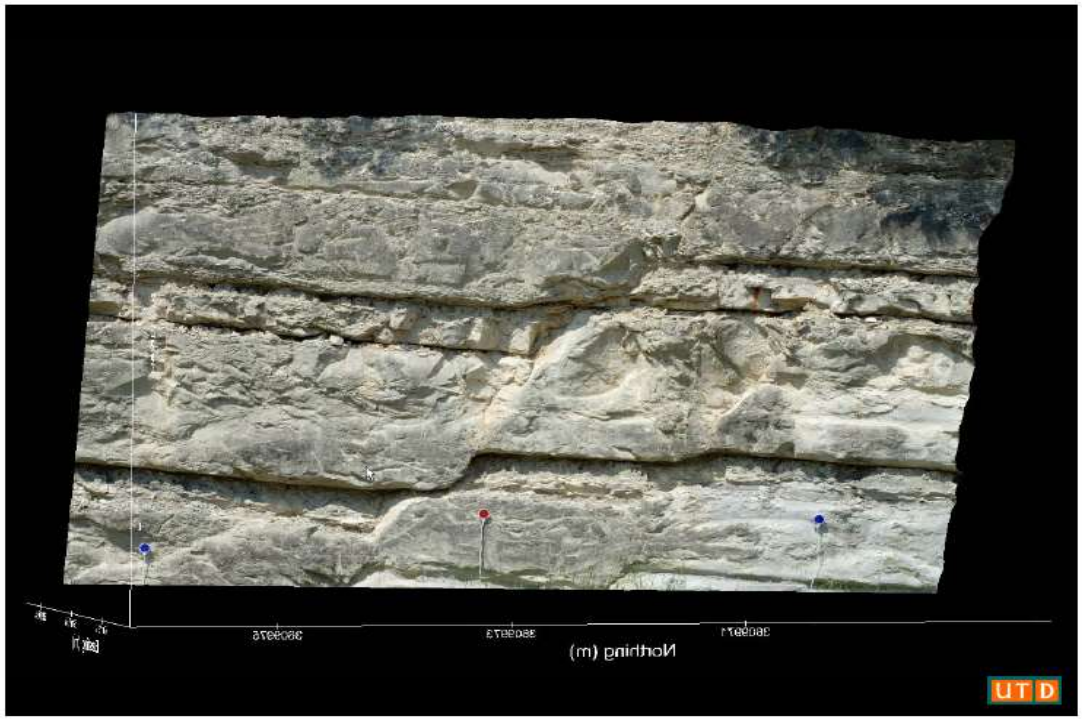


INTRODUCTION 2

Linking 3D photo-realistic models and 3D GIS opens up for a new paradigm for greater understanding, communication and analysis on the real world

INTRODUCTION 3

In this paper, we present a quality realization of a functional photo-realistic 3D City Geographical Information System(GIS) of a University Campus using Google Sketchup and Arc-scene technologies.



INTRODUCTION 4

The realized 3D photorealistic model does not only present the photo-realistic visualization of the objects but also incorporates the objects, semantics, spatial, thematic and a spatial attributes.

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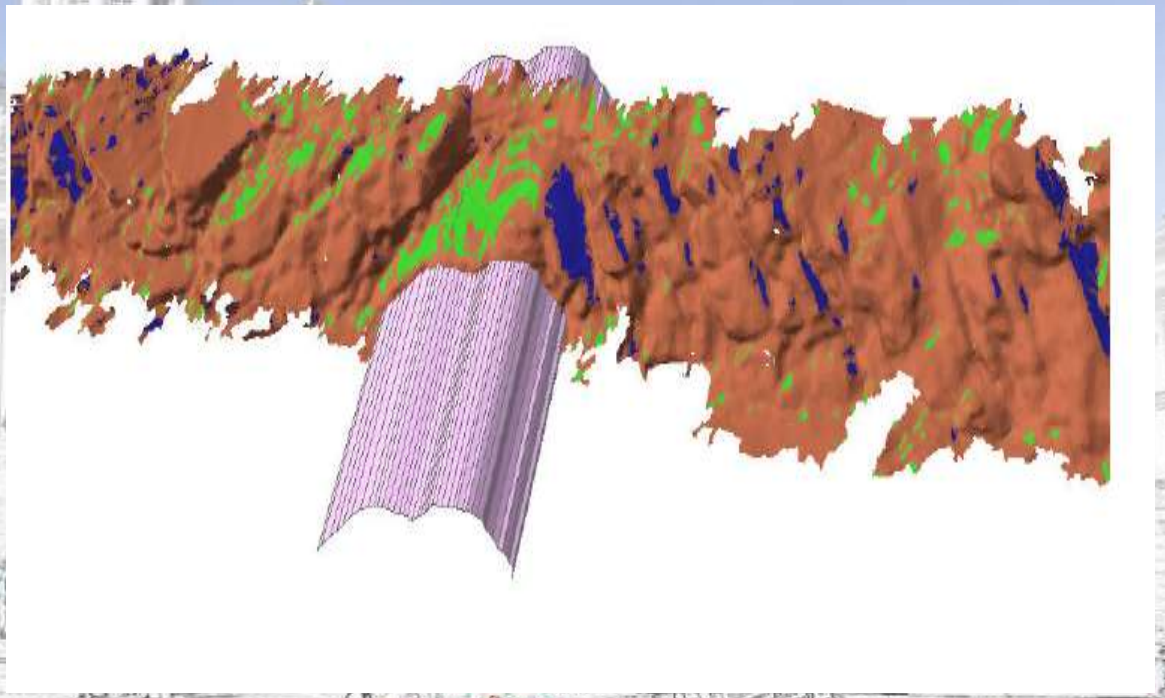
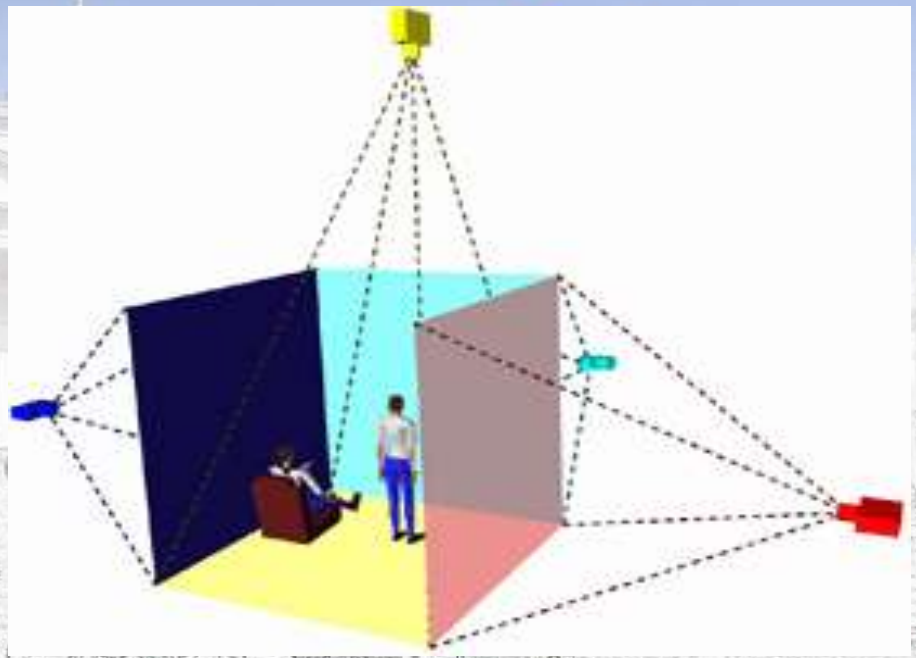


AIM & OBJECTIVES

- The aim of this study is to create 3D GIS as well as 3D Photo Realistic models of a built environment, using University of Nigeria Enugu Campus as a case study.
- OBJECTIVES
- Making reasonable and rational comparisons of the real Earth with a virtual Earth.

WHY 3D MODELS ?

- When Maps are presented in two dimensional form(2D), it is clear that, we see only the x and y axis, and we cannot appreciate it much when we relate it with the real Earth. The third Dimension(Z) and realistic representation are often left out in visualization and presentation



WHY 3D MODELS ?

- **Thus, an effective and efficient means, is required to reconstruct the realistic built/urban environment, so as to appreciate, make good decisions, and visualize in three Dimensions(3D).**

STUDY AREA

- **The study area is the University Of Nigeria Enugu Campus (UNEC). It is an extension campus of the University of Nigeria Nsukka. It is located at approximately 7’27’.42 E of Longitude and 6’58’.95 N of Latitude.**

- **UNEC is landlocked to the North, by Ogui new layout, to the South Maryland layout, to the East by Independence layout and to the West Uwani Layout. UNEC has a total of 1,319,195.515 Square Meters. UNEC has about 15,000 students.**

- UNEC is made up of five (5) different Faculties which include: Faculty of Law, Faculty of Environmental Studies, Faculty of Business Administration, College of Medicine and Faculty of Health Sciences.
- It also has an administrative block, security Department, works Department, Eight (8)Students Hostels and Staff quarters

APPLICATION AREAS 3D MODELS

- INACCESSIBLE AREAS (Highly built-up area)
- DANGEROUS ENVIRONMENT(Railway cut)
- (NON GEOSCIENCES APPLICATIONS)

APPROACHES TO 3D MODELING

1

Building 3D Photorealistic Models

Photogrammetry Approach

2

Creating 3D Models Using Ground Laser Scanning

Scanners Capturing the data

Cameras Taking high resolution photos

GPS Global coordinate system

3

SiroVision – Construct 3D Model

Next is a 3D Model = Two 100% overlapping photos

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METHODOLOGY

- HARDWWARE
- GPS LEICA RTK
- TRIMBLE GeoXT
- LEICA TOTAL STATION
- Riegl LPM Scanner
- 2HP LAPTOPS
- ONE HP DESIGN JET(AO)PLOTTER
- ONE HP (AO) SCANNER

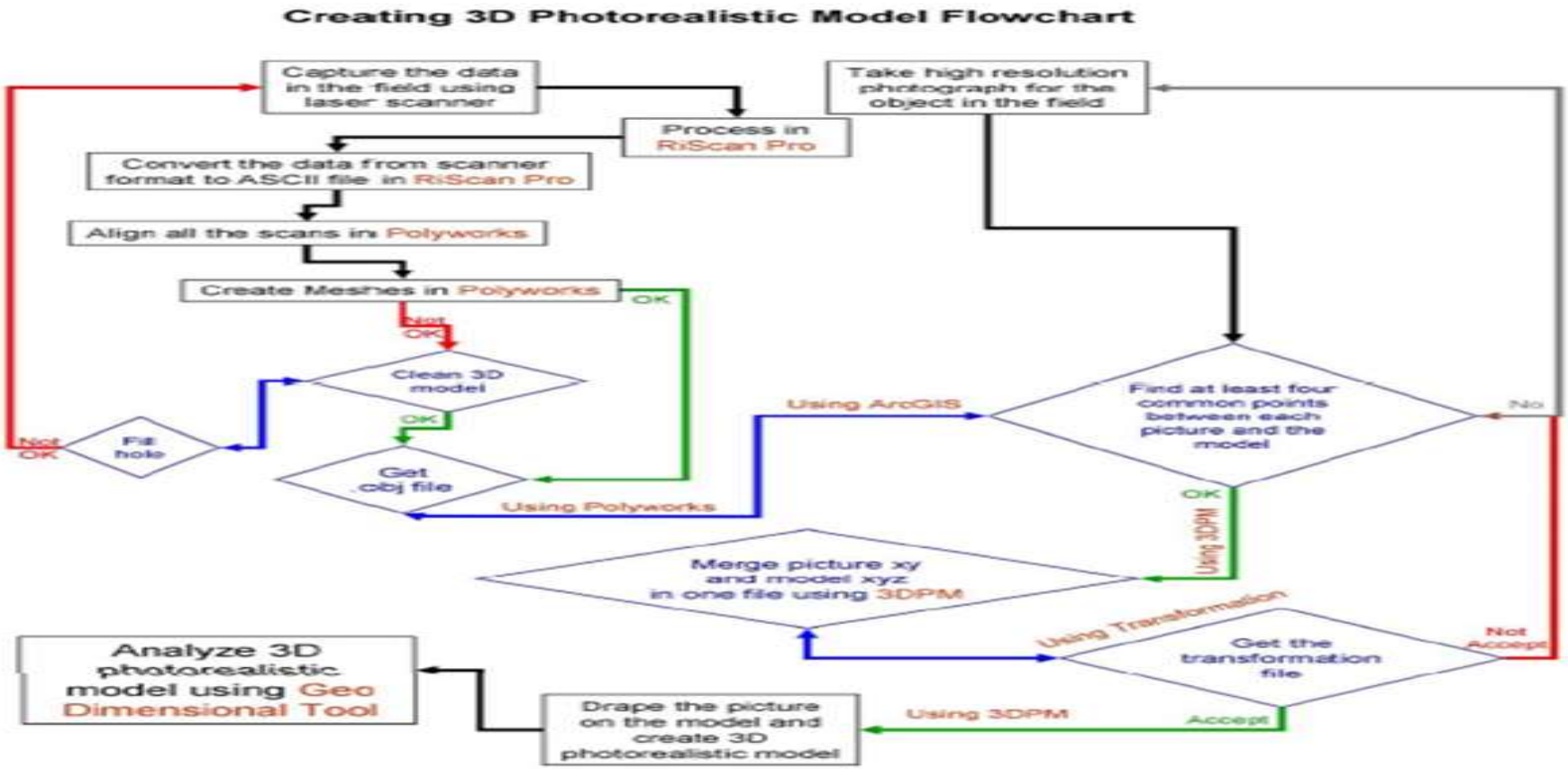
METHODOLOGY

- **DATASETS**
- IKONOS raster Imagery covering UNEC
- Already existing Base Map of the study area
- Snapshots of all the buildings found within the study area with a digital camera.
- Ground Control Point (GCP) for Geo-referencing the Image with Differential GPS Receiver.

METHODOLOGY

- SOFTWARE
- POLYWORKS
- Arc GIS . AutoCAD . MicroStation
- Riscan .3D Studio Max . Photo modeler
- OpenScene Graph
- MathLab
- ERDAS/ENVI

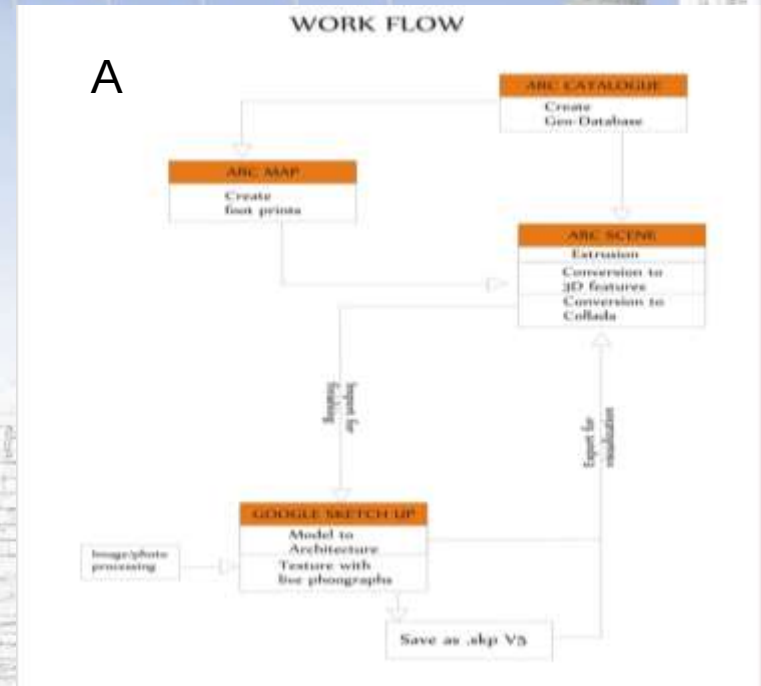
CREATING 3D PHOTO MODEL



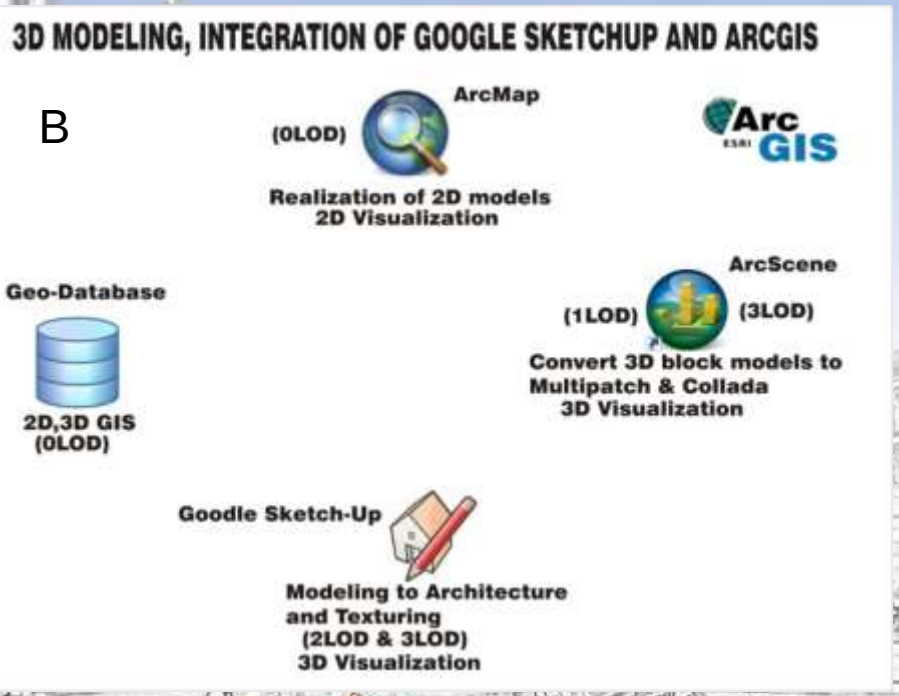
GENERALIZED WORK FLOW

THE WORKFLOW OF THE PROCEDURE USED

A



B



SPECIFIC WORKFLOW

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REALIZATION OF THE FOOTPRINTS OF UNEC IN ArcMap

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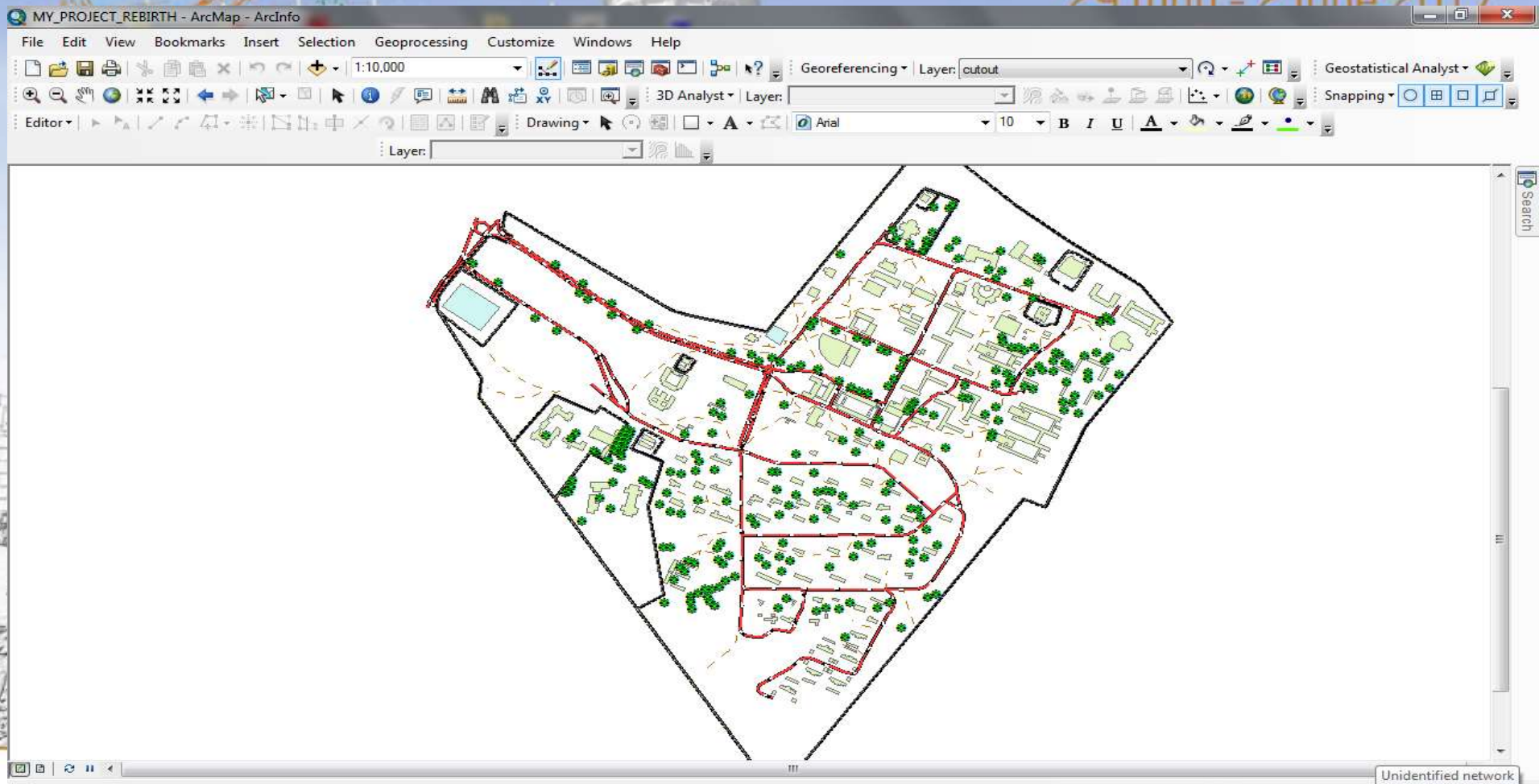
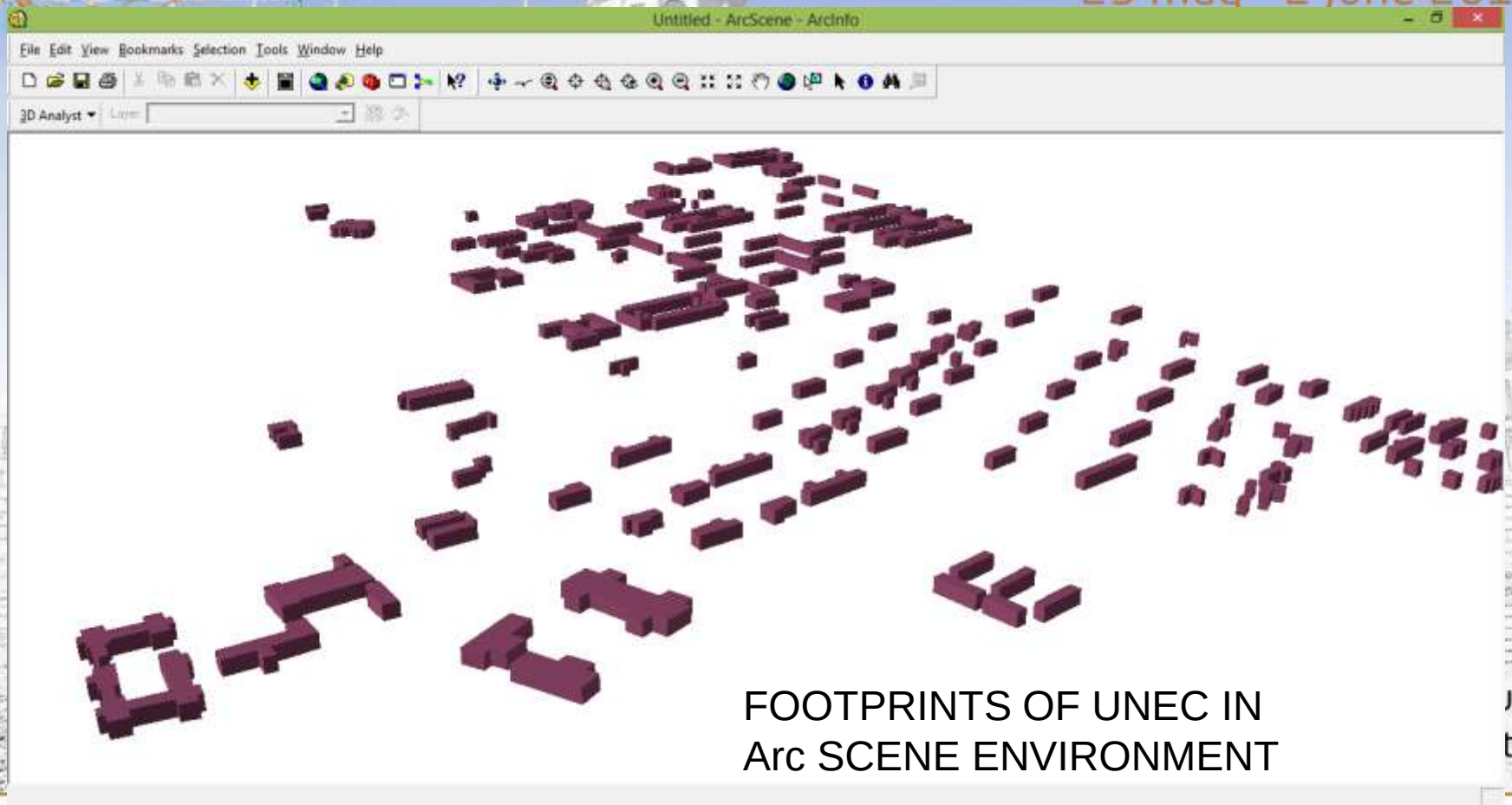
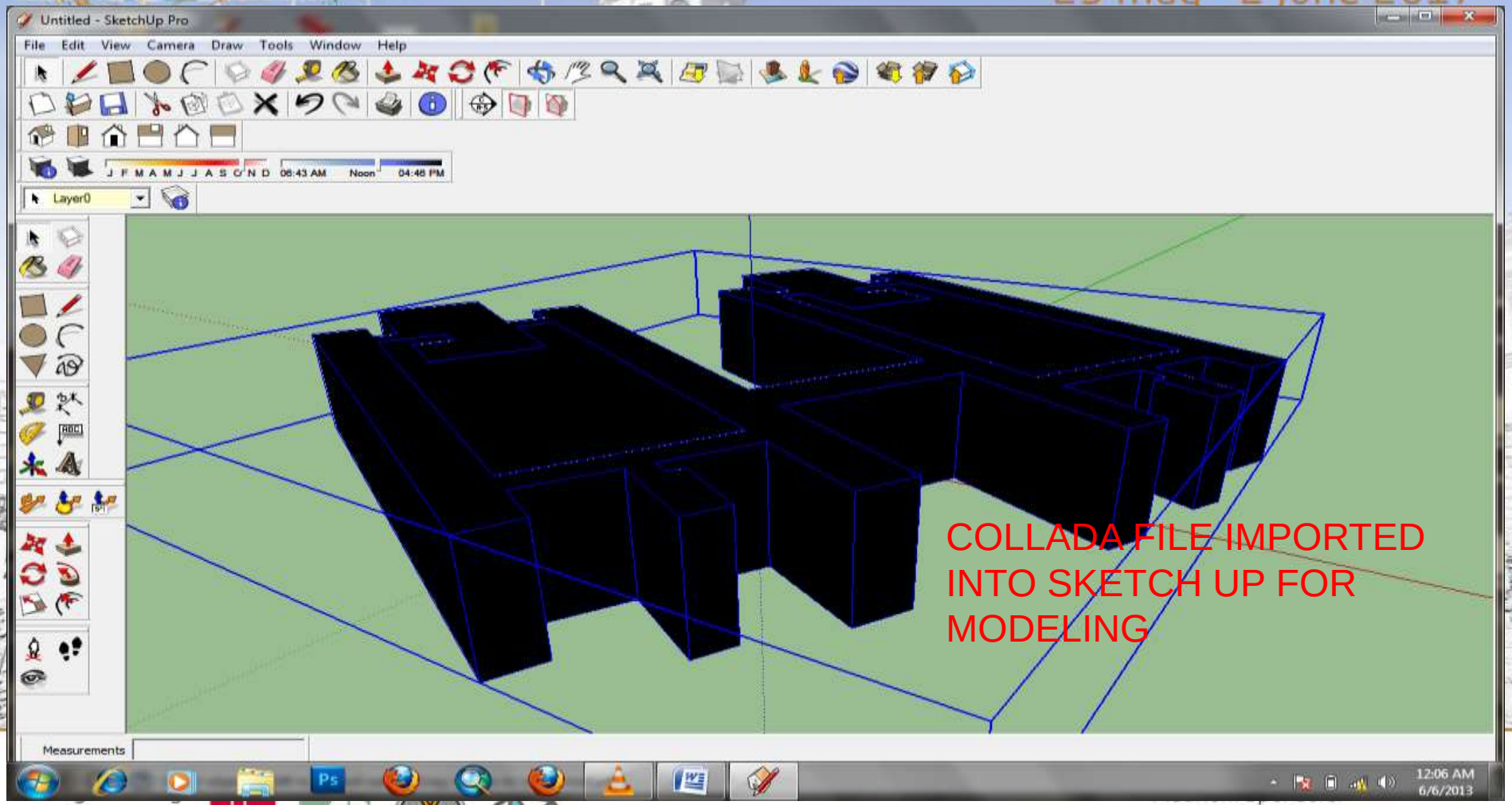


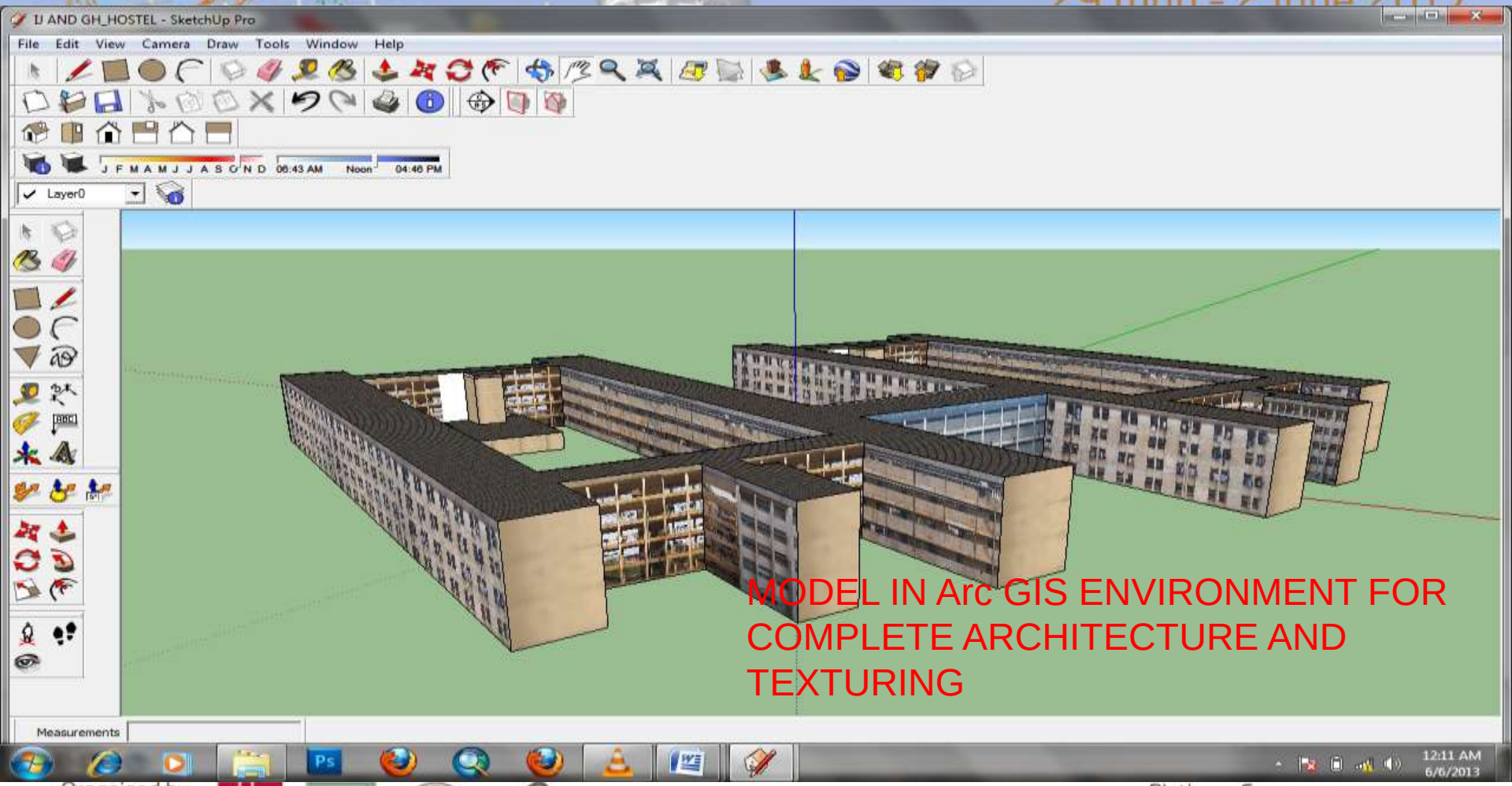


FOOTPRINTS OF UNEC IN
Arc SCENE ENVIRONMENT

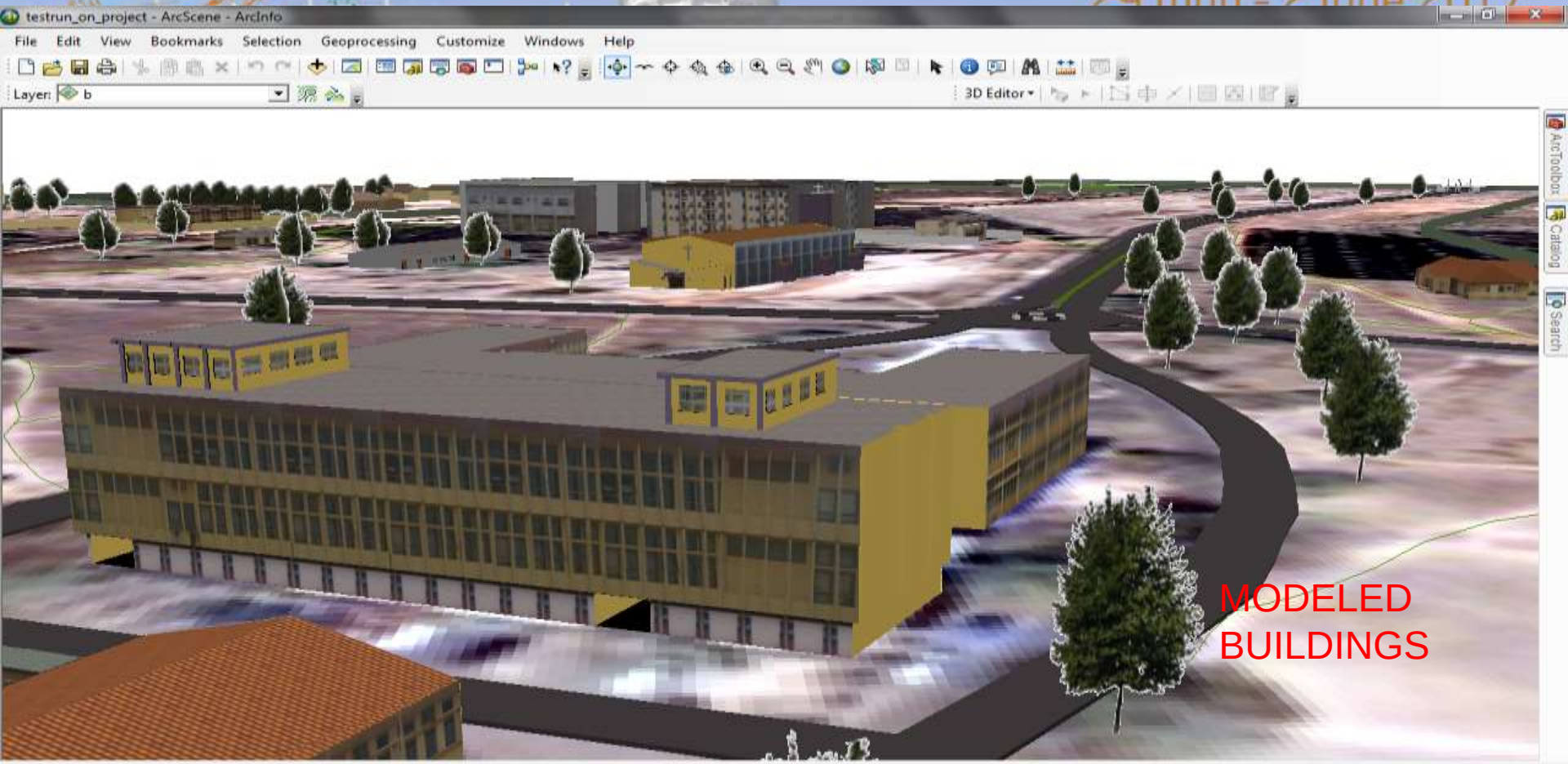
IMPORTING THE COLLADA FILE INTO GOOGLE SKETCH UP FOR MODELING



MODEL TO ARCHITECTURE AND APPLY TEXTURE

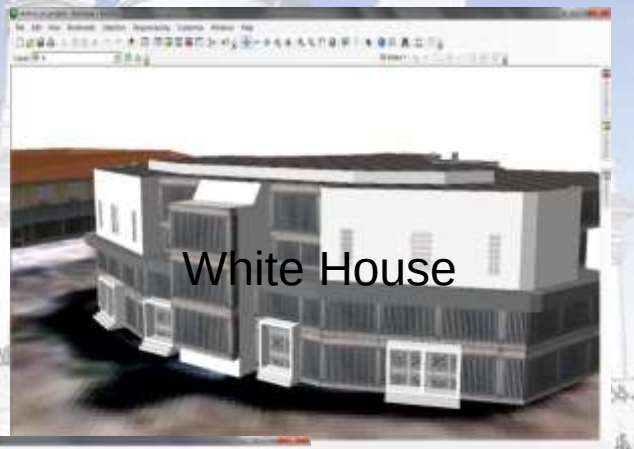


RESULTS: MODELS OF SOME BUILDINGS IN UNEC.



UNEC LIBRARY

Moot Court and Coscharis Building



White House

Faculty of Environmental Studies

The University Library

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VIEW FROM THE UNIVERSITY GATE

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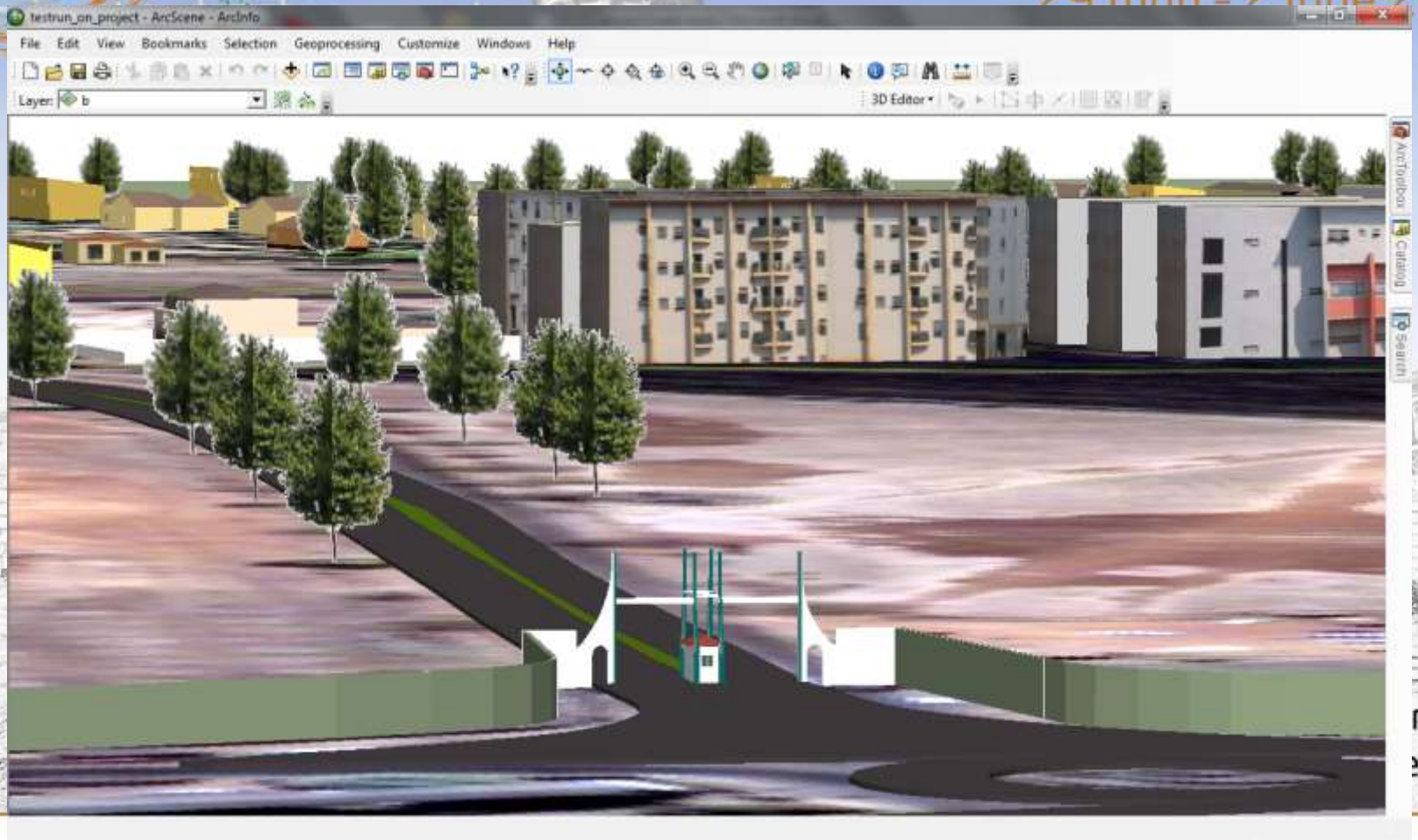

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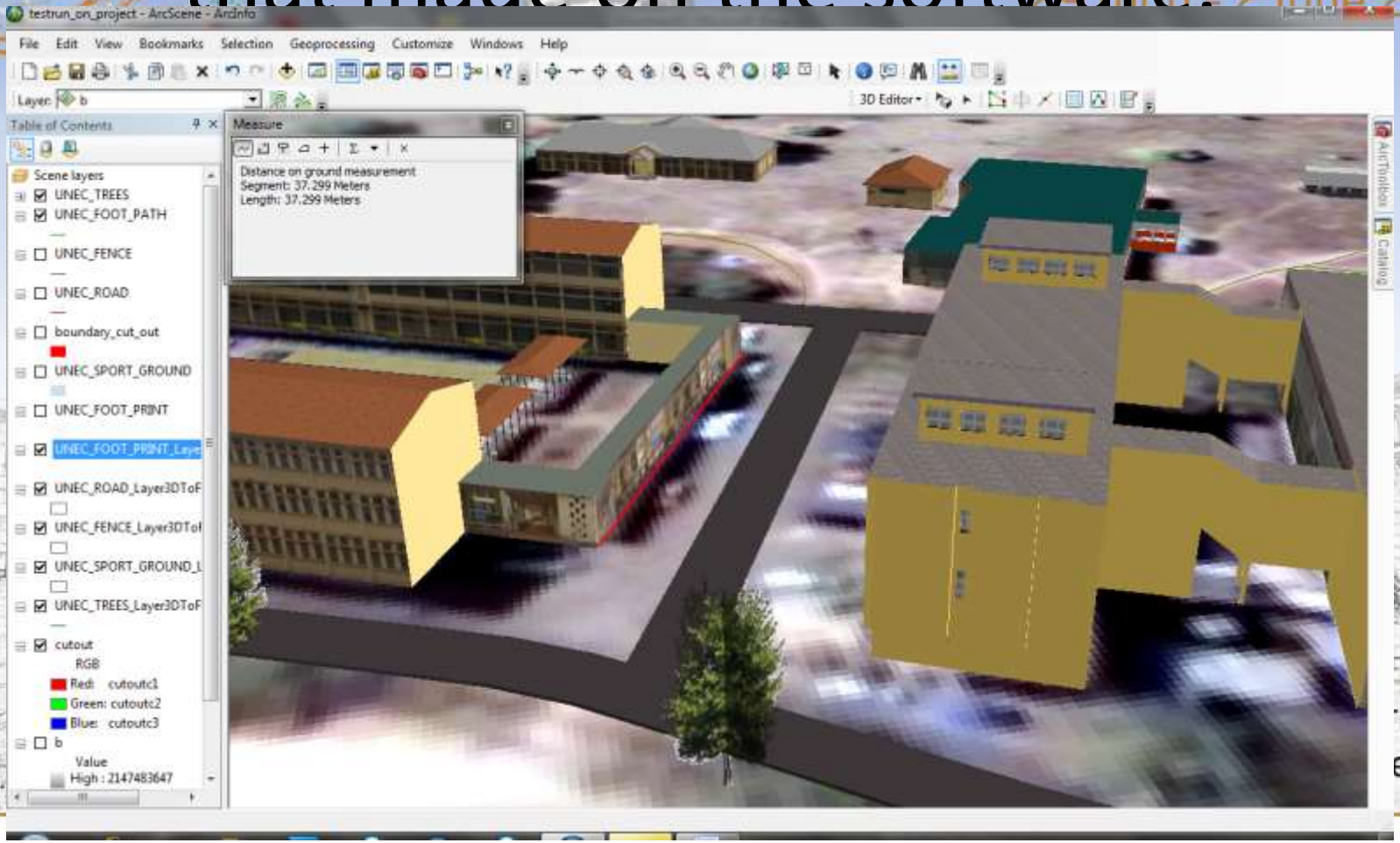
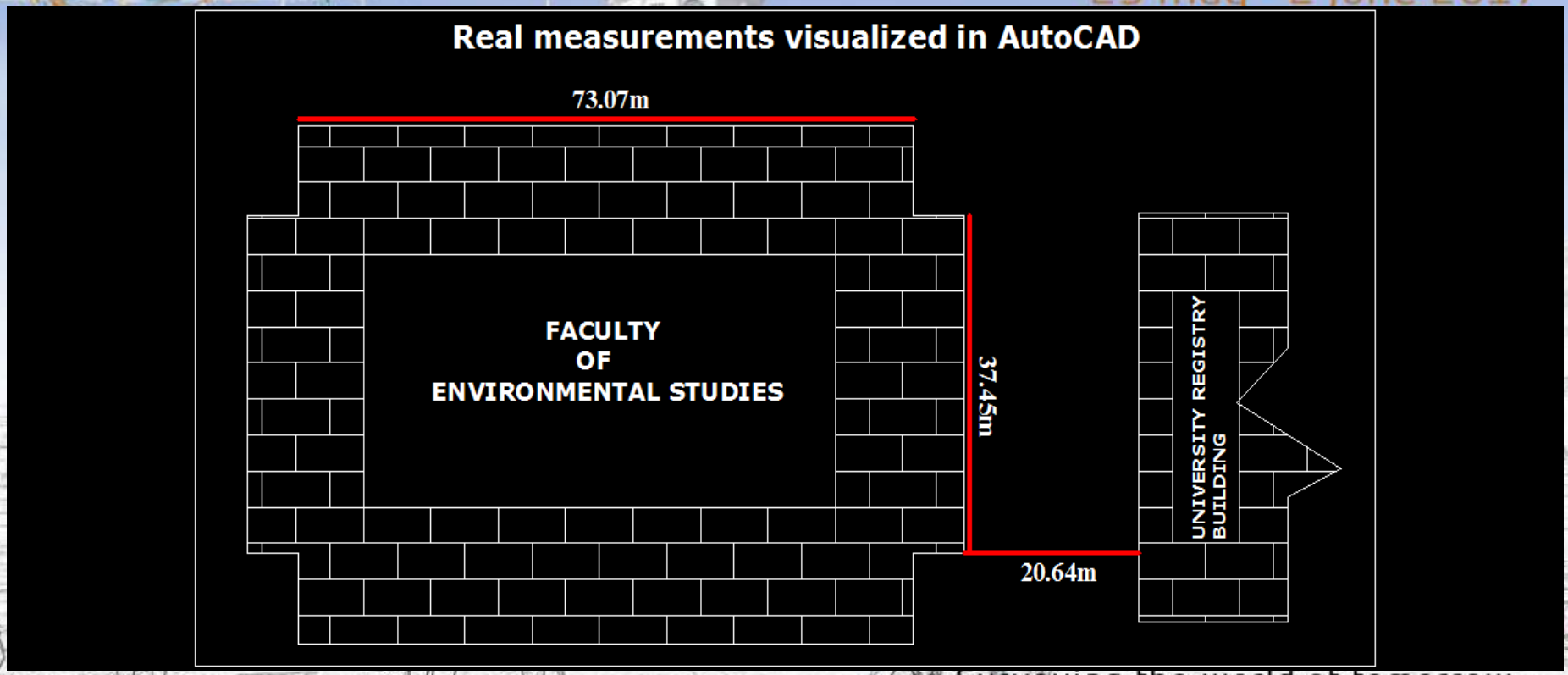
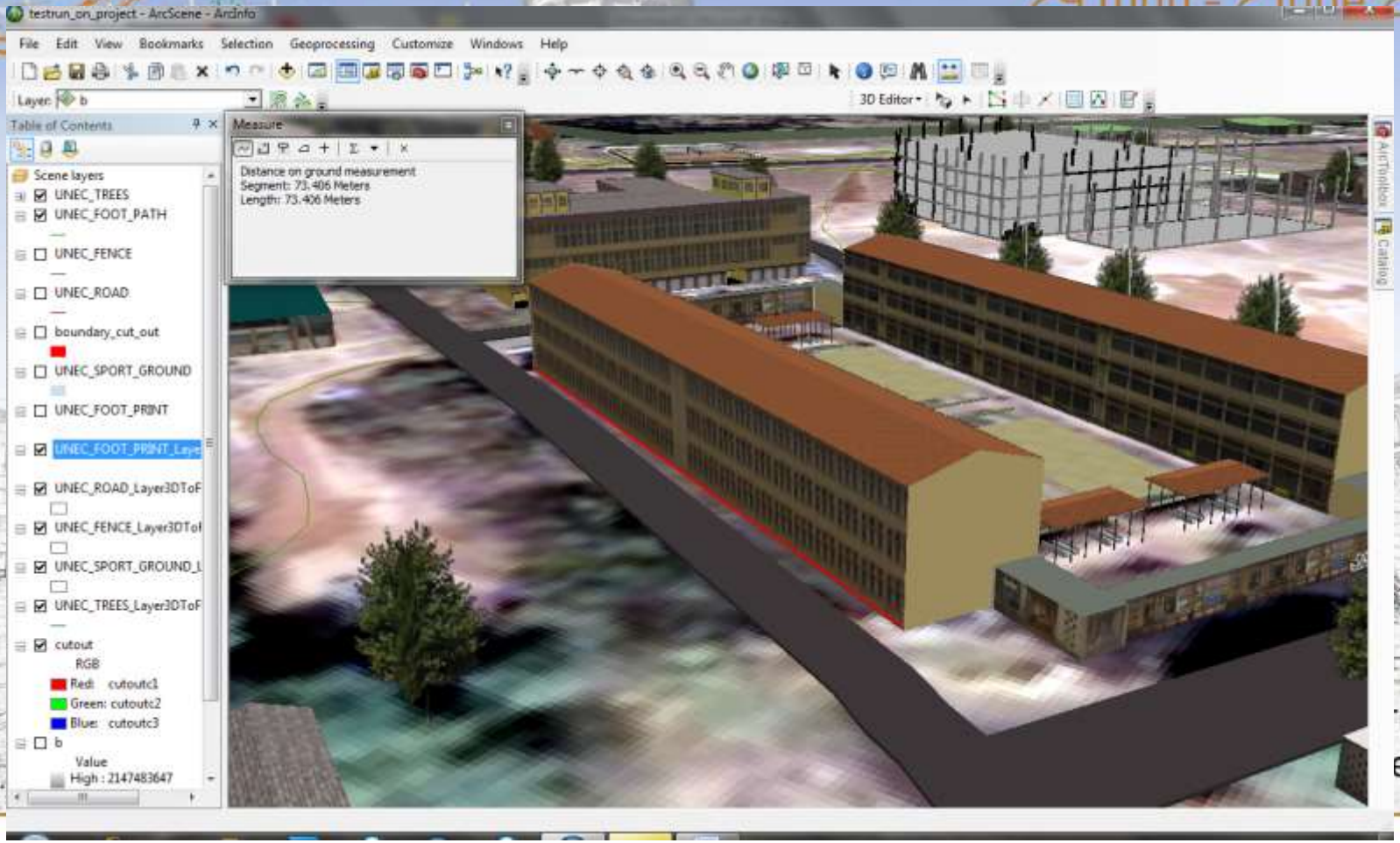
Bellow shows the analysis of measurements made on ground and that made on the software.



Sketch of Faculty of Environmental Studies drawn to scale.



Corresponding (2) Measurement on Arc Scene



RESULTS AND ANALYSIS

- The result of this work has shown the effectiveness of 3D GIS.
- The Photo-Realistic models represented the reality of the environment.
- The models are accurately placed and this shows that the spatial attributes of the model depicted exactly what is on ground.

- **Having the Models textured with Photo-Realistic Texturing, further advancement can be made to improve the properties, use and relevance of the 3D map, but this is not within the scope of this study.**
- **Furthermore, modifications which can be made on the map may include but not limited to update, Building Information Model (BIM).**

CONCLUSION:

- **3D modeling/3D GIS have been shown in this study to be a reliable approach of representing the real environment using 3D software applications such as those listed in the course of this work.**
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- **The combined technology of ArcGIS and Google Sketch up to produce 3D GIS and 3D modeling of a built environment have been shown in this study to be a reliable approach of representing the real environment where analysis, real measurements and visualization can be made without fear of blown errors.**

- Visualization methods successfully facilitate analysis in many science fields and have played a central role in communication of dependencies in spatial datasets.
- The approach used in this work presents a simple strategy that is suitable for required spatial applications.

- **The procedure followed is economic based on available databases and can be implemented easily to deliver quick and sufficient results.**
- **An Estate developer needs this same technique in his profession.**

- **In situations where the client cannot go to the site due to some reasons, or that the site is very far away, this technique can be used to depict exactly what the client wants to buy.**

RECOMMENDATIONS

- **The advantages of 3D GIS (Modeling) cannot be over emphasized because of its applications in several disciplines. With respect to this work, an Urban Planner can use 3D GIS (Modeling) to present the prototype of what he has conceptualized.**

- **RECOMMENDATIONS**
- **An urban Planner can as well produce a virtual city because if this technique was used in an environment like UNEC therefore, the technique can be used to create a virtual City e.g. Enugu City.**

RECOMMENDATIONS CONTINUE

- **Having an integrated system of Photo realistic Models and Building Information Management, an Estate valuer can as well make use of this technique, since the positions of a the feature maintained, He can carry His valuation without necessarily getting to the field.**

- **RECOMMENDATIONS**

- **City GML is an advanced form of this work. In some developed countries, the effective use of City GML is being made use of.**

RECOMMENDATIONS

- **City GML actually has many applications : Visualizing the City for various purposes (e.g. tourism, virtual tours)**
- **For urban Planning, in Navigation Systems, it is also used in intelligent Transportation Systems.**

- **It can be applied for noise modeling of Large areas especially industrial sites / buildings.**

REFERENCES:

- Dubrauka, B., Sudan, P. Miro, G. (2009) Site View Reconstruction Using 3D Modeling Techniques. http://elib.mi.sanu.ac.rs/files/journals/ncd/14/ncd14001.pdf (accessed February 2013)
- Faust, N.L. 1995. "The virtual reality of GIS." Environment and Planning B, vol. 22 pp. 257-268.

- Jiang B. and Li, Editorial (2005). Geovisualization: Design, Enhanced Visual Tools and Application. The Cartographic Journal Vol. Z
- Nedal A., Iyad F., Bashaar A., Mohannad, D. (2006). Building 3D GIS Model of A University Campus For Planning Purposes: Methodology And Implementation Aspects. http//www.gisdevelopment.net/proceedings/mapmiddleeast/2006/320D20mapping2020visualiztion/pdf/7.pdf (accessed February 2013)

- Pilouk M. (1996). Integrated modelling for 3D GIS, Wageningen Agricultural University, The Netherlands. 200 pp. ISBN 90-6164-122-5.
- Sengula. A. (2008) 3D GIS Example in Historical Peninsula Of Istanbul. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Vol. XXXVII. Part B2. Beijing http//isprs.org/proceeding/XXXVII/congress/2_pdf/5_WG_11_5/09.pdf (accessed September 2010)

- **Iwaszczuk, D., Stilla U., 2010. Quality measure for textures extracted from airborne IR image sequences. International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences, vol. XXXVIII (part 3A), Saint-Mandé, France, pp. 79-84**.

- Niem, W., Broszio, H., 1995. Mapping texture from multiple camera views onto 3D-object models for computer animation. Proceedings of the International Workshop on Stereoscopic and Three Dimensional Imaging, Santorini, Greece.
- Poulin, P., Ouimet M., Frasson M. C., 1998. Interactively modelling with photogrammetry. Eurographics Workshop on Rendering, Springer-Verlag, pp. 93-104.

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