C3 – International Student Workshop in Nicosia

Enabling data-driven, multi-scale and multi-modal studies of historic urban environments

GEORGIOS ARTOPOULOS
Assistant Professor, The Cyprus Institute

MARISSIA DELIGIORGI
Research Assistant, The Cyprus Institute

Cyprus Workshop, May 2022
Erasmus+ Key Action: Cooperation for innovation and the exchange of good practices
Action Type: Strategic Partnerships for higher education
Enhancing of Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education  I  HERSUS
Project Reference: 2020-1-RS01-KA203-065407
Local heritage assets can play a critical role in successful urban regeneration projects

> socio-economic benefits from the construction and tourism sectors
Erasmus+ Key Action: Cooperation for innovation and the exchange of good practices
Action Type: Strategic Partnerships for higher education

Enhancing of Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education – HERSUS

Project Reference: 2020-1-RS01-KA203-065407
Urgency for safeguarding

Proven socio-economic benefits

Expected need for renovation
THE GAP, AND SUBSEQUENT CHALLENGES

Authorities lack of:
   Data (knowledge of change, in time); and,
   Tools (monitoring, visualization > interpretation).

Professionals lack of:
   Data (interdisciplinary know how, cost, labour).

Owners lack of:
   Incentives, guidance for renovation, cultural value of heritage.
"Historical sense involves a perception, not only of the pastness of the past, but of its presence."

— T.S. Eliot, Tradition and the Individual Talent (1919)
WHAT

This online BIM-enabled platform will allow holistic, integrated research inquiries that range in **scale** (from a macro scale environmental monitoring of clusters of historic buildings to the structural analysis of individual buildings), as well as in **time** (monitoring of the development of cities).

PERIsCOPE aims to produce an innovative online platform for the:
identification, documentation, classification, and renovation of heritage buildings, to be exploited by a variety of stakeholders related to the conservation and retrofit activities.
HOW

PERIsolete’s methodology:

(i) Mapping and parametric management of data of heritage buildings through BIM;
(ii) Restoration and renovation requirements, policies, pool of examples & step-by-step guidelines;
(iii) Structural condition and environmental impact data (LCA of heritage);
(iv) Classification of architectural typology and architectonic features with a 3D precision documentation workflow (UAV, photogrammetry, TLS, etc.);
(v) Monitoring of built env. at neighbourhood scale though a time machine operation of the platform.
Pilot building selection criteria:

- Architectural value;
- Historical value;
- Location;
- Typology;
- Condition;
- Ownership;
- Accessibility;
- Date of construction;
- Construction method;
- Construction material;
- Structural condition as result of climate, time wear and human interventions;
- Proximity to public service or landmark;
- Renovation state;
- Example of best practices.

(a) Reinforced concrete modernist structures;
(b) Rural vernacular buildings of adobe or stone masonry;
(c) Urban vernacular buildings of adobe or stone masonry.
Erasmus+ Key Action: Cooperation for innovation and the exchange of good practices
Action Type: Strategic Partnerships for higher education
Enhancing of Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education I HERSUS
Project Reference: 2020-1-RS01-KA203-065407

Surface temperatures over Limassol and Strovolos pilot areas. NDT at Strovolos pilot building. TLS 3D documentation. Aerial documentation of pilot building block at Strovolos. Surface temperatures over Limassol and Strovolos pilot areas.
Online access to Digital Twins and environmental data at historic cluster scale.
Enhancing Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education  

**HERSUS**

Project Reference: 2020-1-RS01-KA203-065407

**Erasmus+** Key Action: Cooperation for innovation and the exchange of good practices

**Action Type:** Strategic Partnerships for higher education

CYPRUS WORKSHOP

**HERSUS Intro Presentation**

---

**Scan to H-BIM Process**

- **Information Requirements for BIM**
  - Historical Analysis
  - Building phases analysis
  - Literature
  - Observation
  - Conservation state analysis
  - List of non-geometric attributes
  - Exchange Information Requirements for NDT (UP_WP7_D7.1_0007_NDTProcedureUNCTION_140220)
  - Pilot Buildings Excel Information (08/06/2021)

- **Determination of Data Quality**
  - Reality Capture (TLS, photogrammetry, NDT (thermal pulse))
  - Conservation state analysis
  - Other properties

- **Data Acquisition**
  - Existing Conditions Survey
  - Devices (locations, resolutions, other parameters)

- **Data Curation**
  - Point Cloud: *.stl, *.ply
  - Mesh models: *.obj

- **3D Geometrical Reconstruction**
  - 3D scanning and photogrammetric software:
    - Leica Photogrammetry, CloudCompare, Reality Capture

- **3D Modeling**
  - BIM Software: ArchiCAD, Revit

- **BIM Implementation**
  - Scan to BIM
  - Cloud-based Interactive Walkthrough and VR

- **BIM Execution Plan**
  - UP_WP7_D7_1_0001_BIM Execution Plan_Cy5_20210201

- **H-BIM Modeling Strategy**
  - UP_WP7_D7_1_0002_ReportBIMModelDescription_Cy5_2020021

- **XML File**
  - Revit File
  - Cloud Based Interactive Walkthrough and VR

---

*The document under the title Naming Convention and File Structure: UP_WP7_D7.1_0001_NameConvention_Cy5_00020 applies to all phases of the Scan to BIM*
**H-BIM Implementation**

**Observation /Historical analysis**

The purpose of the Building Identity Data Guide is to serve as a requirements guide in the collection of all the available data related to the identity of the case study building.

**Exchange Information Requirements for NDT**

The purpose of these documents is to record the recommended process required for NDT and their derived deliverables. It provides guidelines for the NDT documentation techniques and evaluation criteria to ensure that the specified requirements for the deliverables are met the specifications of Scan to BIM standards.

**List of Required Geometric attributes / Building Elements Required LOD (WIP)**

The document provides a list of required geometric attributes to be captured during the existing condition survey phase as well as the required level of detail that should be captured.
Enhancing Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education  

**HERSUS**

**Project Reference:** 2020-1-RS01-KA203-065407

---

**CYPRUS WORKSHOP**

**HERSUS Intro Presentation**

---

**Scan to H-BIM Process**

---

**Methodologies**

- Observation / FIstistorical analysis
- Reality Capture (TLS-photogrammetry)
- NDT (thermal pulse)
- Conservation state analysis
- List of Requisite Geometric attributes / Building Environments Required LCD

**Activities**

- Historical Analysis
- Building phases
- Literature
- Observation
- Existing Conditions Information
- List of non-geometric attributes
- Exchange Information Requirements for NDT
  - UP_WP7_D7.1_001_NDT_Protocol_ARC_2022
- Pilot Buildings Excel Information_08062021

**Information Requirements for BIM**

- **Determination of Data Quality**
  - Spatial resolution
  - Accuracy
  - Coverage
  - Conservation state analysis
  - List of Required Geometric attributes

- **Existing Conditions Survey**
  - NDT (thermal pulse)
  - TLS-photogrammetry

- **Data Acquisition**
  - Mesh models: *obj
  - BIM Software: Revit
  - Point Cloud: *ply

- **Data Curation**
  - Revit File
  - BIM Execution Plan
  - BIM Modeling Strategy
  - H-BIM File

- **3D Geometrical Reconstruction**
  - Exchange Information Requirements for BIM
    - UP_WP7_D7.1_001_BIM_Execution_Plan_CYL_000000
  - UP_WP7_D7.1_001_BIM_ModelDescription_CYL_200000
  - UPC Manual
  - Technical Specifications for the geometric survey and conservation state visual analysis tender
  - UP_WP8_D1.1_002_SurveyDocument_CYL_170720
  - MetadataSchema
  - Exchange Information Requirements for LCA
  - UPC Manual

**BIM Implementation**

- Scan to - BIM
- Scan to H-BIM Process

---

*The document under the title Naming Convention and File Structure: UP_WP7_D7.1_001_NameConvention_CYL_000720 applies to all phases of the Scan to BIM*
Erasmus+ Key Action: Cooperation for innovation and the exchange of good practices
Action Type: Strategic Partnerships for higher education
Enhancing of Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education
HERSUS
Project Reference: 2020-1-RS01-KA203-065407

H-BIM Implementation

Existing Conditions Survey

This document provides a technical specification for the geometric survey and general conservation state visual analysis of the historical buildings. It is intended to assist all those connected with the documentation survey or the procurement and production of such analyses and in the future shall accompany the tender documents.

The purpose of this document is to record the recommended process required for 3D laser scanner and photogrammetric data and their derived deliverables. It provides guidelines for the Geometric survey documentation techniques and evaluation criteria to ensure that the specified requirements for the deliverables are met the specifications of Scan to BIM standards.

exchange Information Requirements for Geometrical Data Survey

Technical specifications for the geometric survey and general conservation state visual analysis tender

Co-funded by the Erasmus+ Programme of the European Union

CYPRUS WORKSHOP
HERSUS Intro Presentation
H-BIM Implementation

3D Geometrical Reconstruction

The purpose of the EIR for BIM is to provide support and to serve as a requirements guide in the design of the buildings selected, according to the BIM model goals. This document focuses on data optimization, creating a hierarchy of the information (i.e., metadata linked with 3D assets), and explaining BIM with a clear methodology.

The BIM Revit Technical Manual provides all the technical details and design options required for the creation of an h-BIM model. The manual focused on the creation of all the components and materials, the specific component information which defines the various building features such as walls, floors, roofs, doors and windows as well as the generic assemblies to be assigned material properties.

* The document under the title Naming Convention and File Structure: UP_WP7_D7.1_001_NameConvention_Cyprus_Coul00720 applies to all phases of the Scan to BIM
The BIM Execution Plan is a living document that addresses all the requested information founding the EIR and sets out the project goals for collaboration and information modelling and key project milestones and where they fit with the UP h-BIM goal. BEP sets out how the project's information model will be assembled and delivered.

The present document describes the different stages of the H-BIM-based design asset strategy that have been adopted within the UP BIM process based on the data that has been delivered by observation, historical analysis and existing conditions survey stages.

The document provides a standard categorization of building elements used within the UP project and their specifications.

An architectural Revit design template that includes the basic components/families such as walls, floors, ceilings, openings as well as set up views (plan views, sections, etc) have been used within the already modeled case study buildings.
H-BIM Implementation

h-BIM / Digital twin

A document that describes a series of metadata schemas such as bibliographic documentation or geoinformatics, that are required to be added to the BIM model in order to meet the specifications of a CIDOC CRM based on ISO standards ISO 21127:2014.

These checklists are intended to standardize the performance of all the repetitive activities that take place during the h-BIM design phase as well as to verify the correct BIM implementation.

This document is intended to serve as a guide for UP BIM team, handling IFC data and providing a better understanding of the settings that are available within BIM software, discussing the way they can influence the quality and the content of IFC files.

The purpose of these documents is to record the recommended process required for NDT and LCA and their derived deliverables. It provides guidelines for the LCA documentation techniques and evaluation criteria to ensure that the specified requirements for the deliverables are met the specifications of Scan to BIM standards.
H-BIM Modeling Strategy

Existing Conditions Information
h-BIM
LCA
NDT
Interactive visualization
Erasmus+  Key Action: Cooperation for innovation and the exchange of good practices
Action Type: Strategic Partnerships for higher education
Enhancing of Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education  I  HERSUS
Project Reference: 2020-1-RS01-KA203-065407

CYPRUS WORKSHOP
HERSUS Intro Presentation
Strovolos

With a population of nearly 70,000, it is the second most populated municipality in Cyprus, after Limassol, and the most populated municipality of Nicosia District.
Erasmus+ Key Action: Cooperation for innovation and the exchange of good practices
Action Type: Strategic Partnerships for higher education
Enhancing of Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education  |  HERSUS
Project Reference: 2020-1-RS01-KA203-065407

H-BIM Modeling Strategy

**INPUT**

- Existing Conditions Information
- Conservation state analysis
- Existing Conditions Survey

**OUTPUT**

- Families Generation / Classification & Material Composition
- Structural and thermal condition integration with NDT
- Historical Data Integration
- A series of project parameters are imported to Revit -Project information section as shared parameters to enrich the model with all historical data: Construction, Current conditions, Owner, Original Use, Date, Period, Main material, Finishing, Municipality, Occupation Status, Repository Location, Listing Status etc.
- 3D Geometrical Reconstruction of Cultural Asset
- H-BIM Model- ifc file
- 2D drawings
- 4D typology
- 5D -BOQ
- 6D -LCA
- H-BIM - Digital twin
This document is intended to serve as a guide for UP BIM team, handling IFC data and providing a better understanding of the settings that are available within BIM software, discussing the way they can influence the quality and the content of IFC files.
Enhancing of Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education  
HERSUS
Project Reference: 2020-1-RS01-KA203-065407

U-Periscope Platform

Existing Conditions Information
h-BIM  NDT  LCA  Interactive visualization

Checklist:
H-BIM model (Revit), IFC File & H-BIM model export files (WIP)

These checklists are intended to standardize the performance of all the repetitive activities that take place during the h-BIM design phase as well as to verify the correct BIM implementation.
Erasmus+ | Key Action: Cooperation for innovation and the exchange of good practices
Action Type: Strategic Partnerships for higher education
Enhancing of Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education | HERSUS
Project Reference: 2020-1-RS01-KA203-065407

Non-Destructive Testing
Enhancing of Heritage Awareness and Sustainability of Built Environment in Architectural and Urban Design Higher Education | HERSUS

Project Reference: 2020-1-RS01-KA203-065407

Digital Twin

Web browser link: https://api2.enscape3d.com/v1/view/0a12d3c8-95d8-4656-b3a1-39c026d388ed

* Exe file
The Project PERIsCOPE INTEGRATED/0918/0034 is co-financed by the European Regional Development Fund and the Republic of Cyprus through the Research Innovation Foundation.

This document is copyright of partners of PERIsCOPE Portal for hERItage buildingS integration into the COntemPorary built Environment. It is released under a Creative Commons license Attribution – Non-Commercial -Share alike 4.0 international (CC BY-NC-SA 4.0).