



UNIVERSITY OF
PATRAS
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ

ΤΜΗΜΑ ΠΟΛΙΤΙΚΩΝ ΜΗΧΑΝΙΚΩΝ
ΠΟΛΥΤΕΧΝΙΚΗ ΣΧΟΛΗ
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ

Digital Twins technology – IES Software Presentation & team assignment

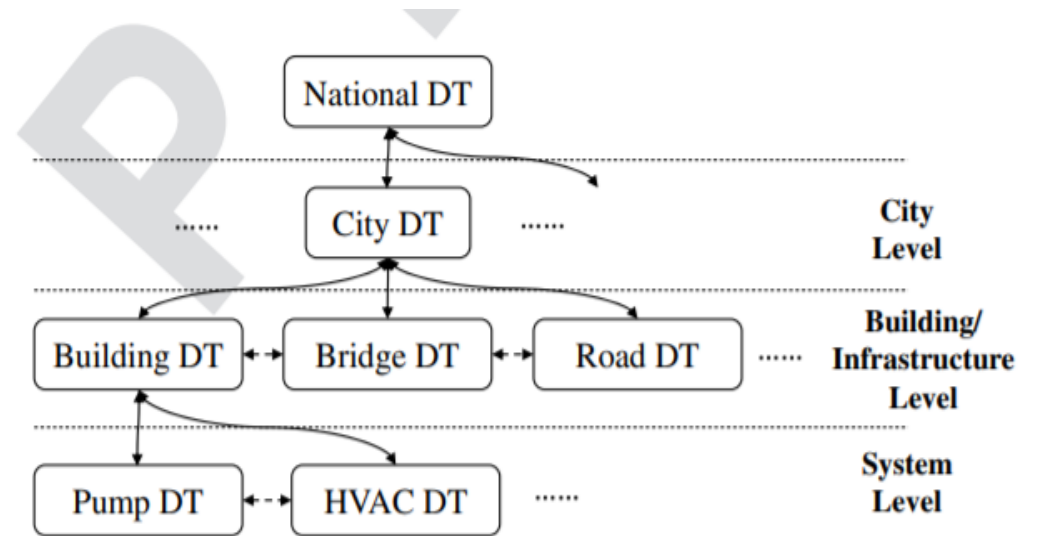




A city is a comprehensive system connecting the physical, social, and business aspects .

A city can be thus considered as an asset that integrates different subassets such as buildings, utilities, transportation infrastructure, and people.

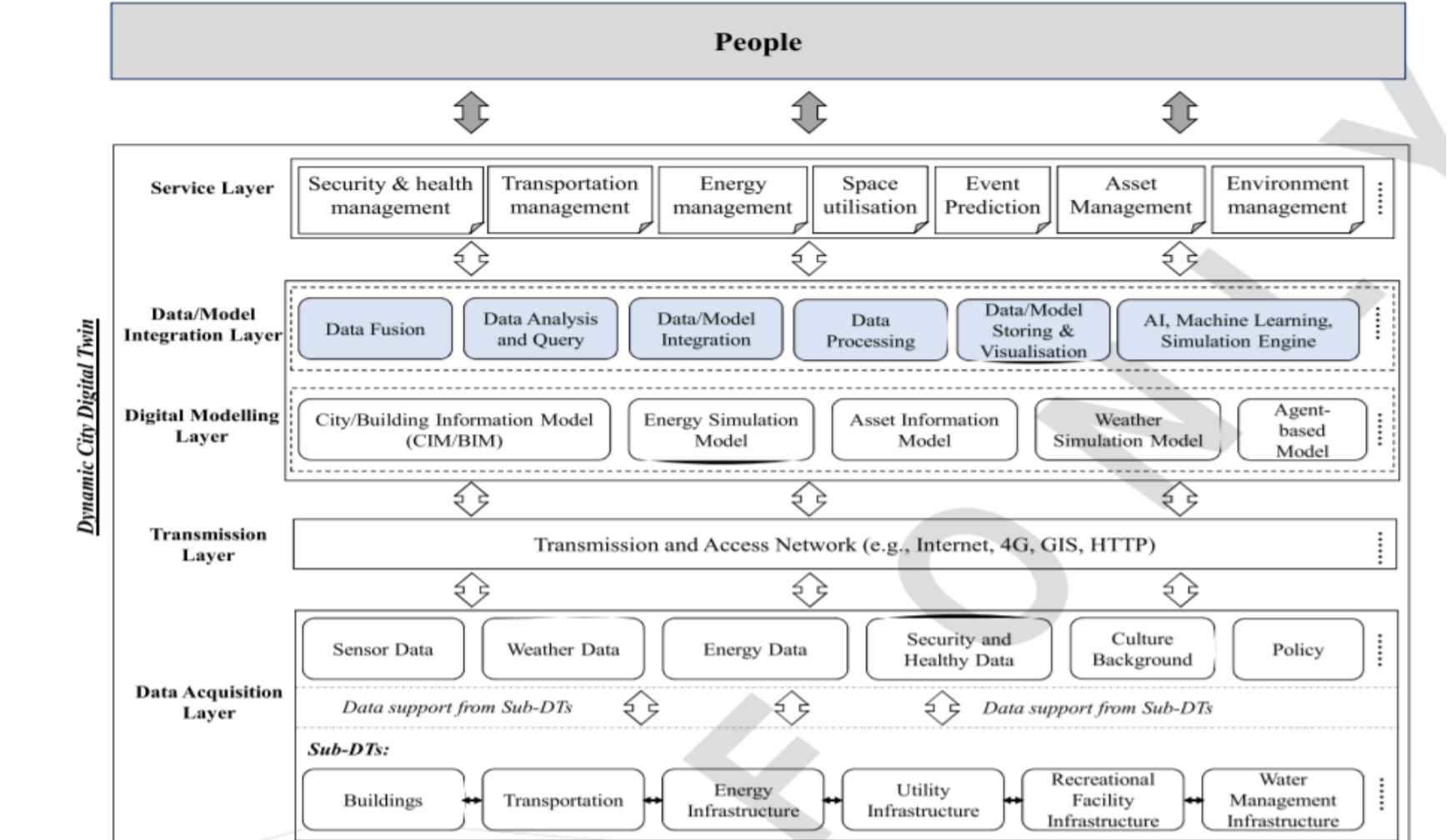
A DT at the city level is a dynamic digital replica of a city that integrates each sub-DT.



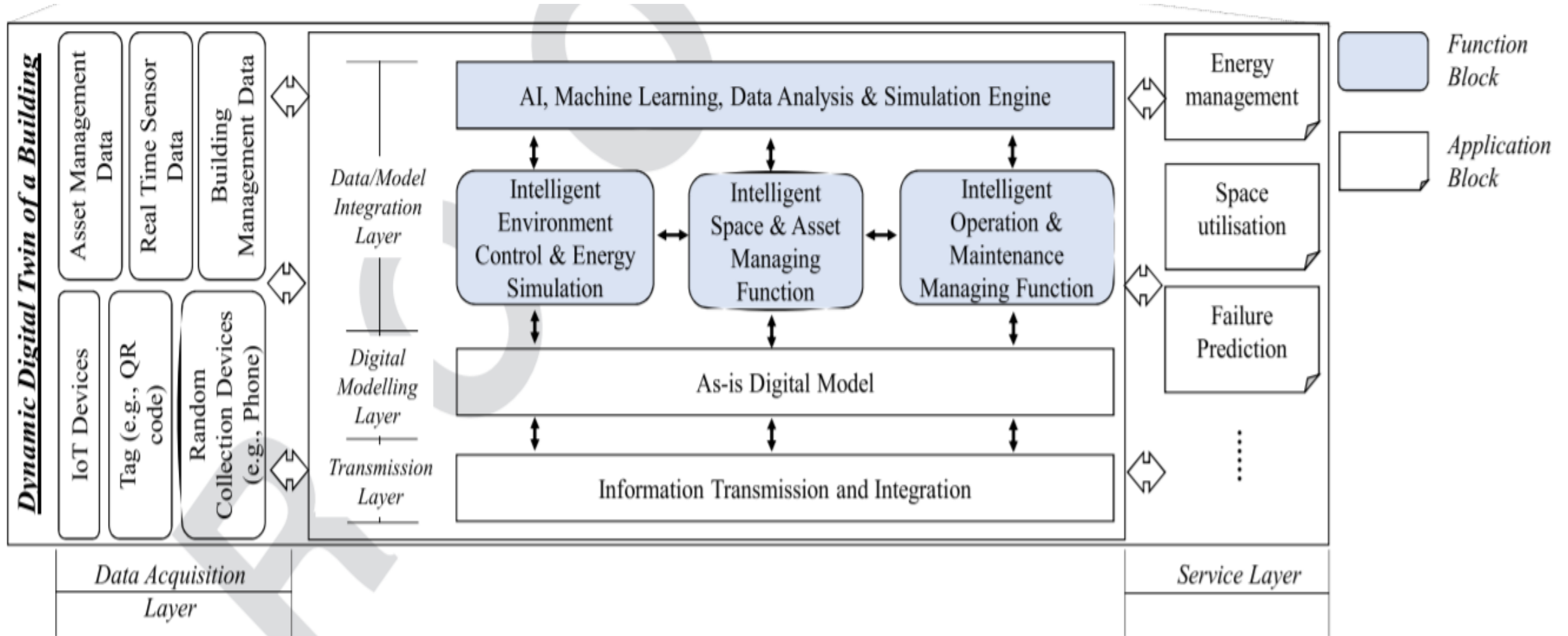
DTs in the upper level (e.g., city DT) interact with the sub-DTs (e.g., building DT) in a bidirectional way

This architecture for both Building and City level is composed of five layers:

- data acquisition layer
- transmission layer
- digital modeling layer
- data/model integration layer
- service layer



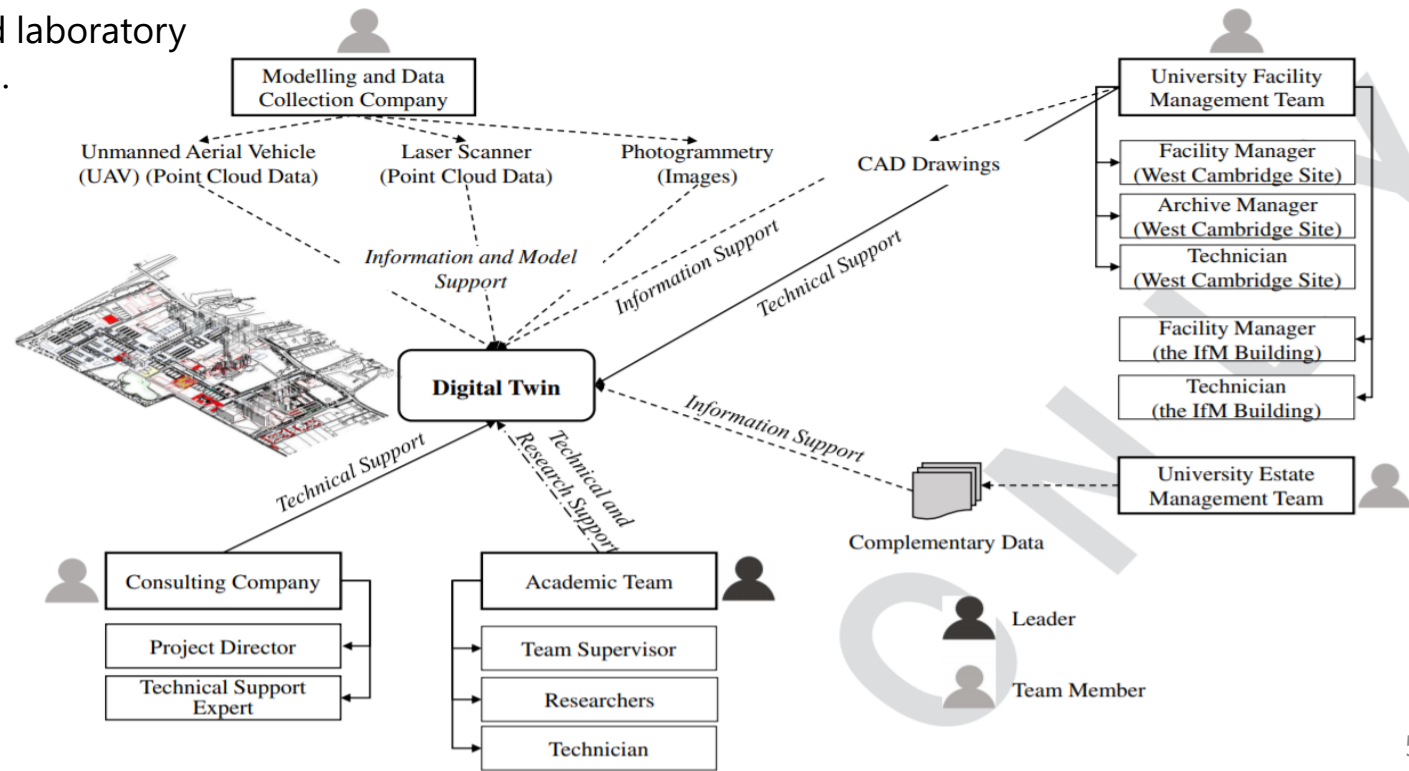
 System architecture of DT development at a building level



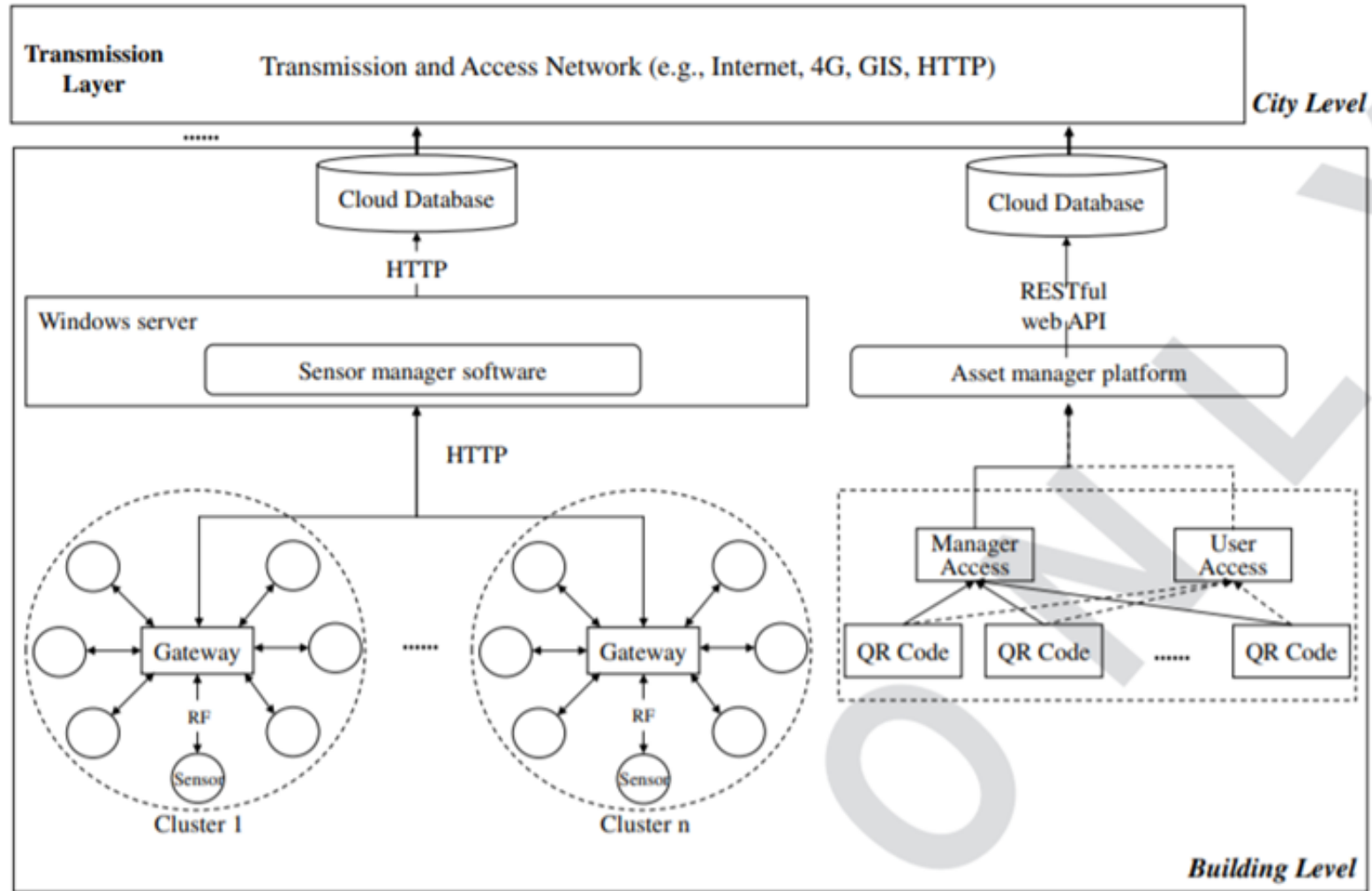


West Cambridge site of the University of Cambridge in the UK

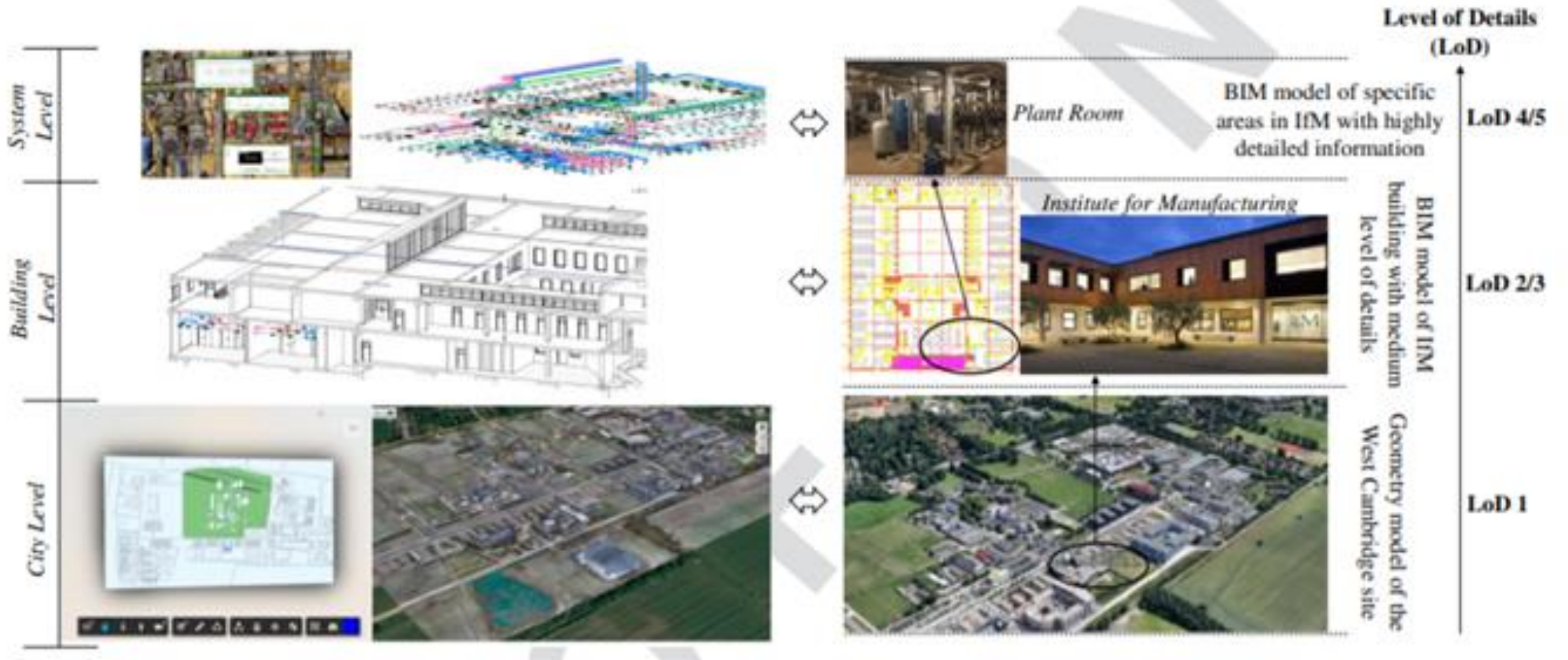
- The West Cambridge site includes more than 20 university buildings, sports centers, residence areas, main roads, parking places, and restaurants.
- This can be therefore be considered as a small example of a city and a promising testbed.
- For the building level, this study used the Institute for Manufacturing (IfM) building, which is a 3-story building at the West Cambridge site.
- This building includes teaching, study, office, research, and laboratory spaces and stands over a 40,000 sq ft comprehensive area.



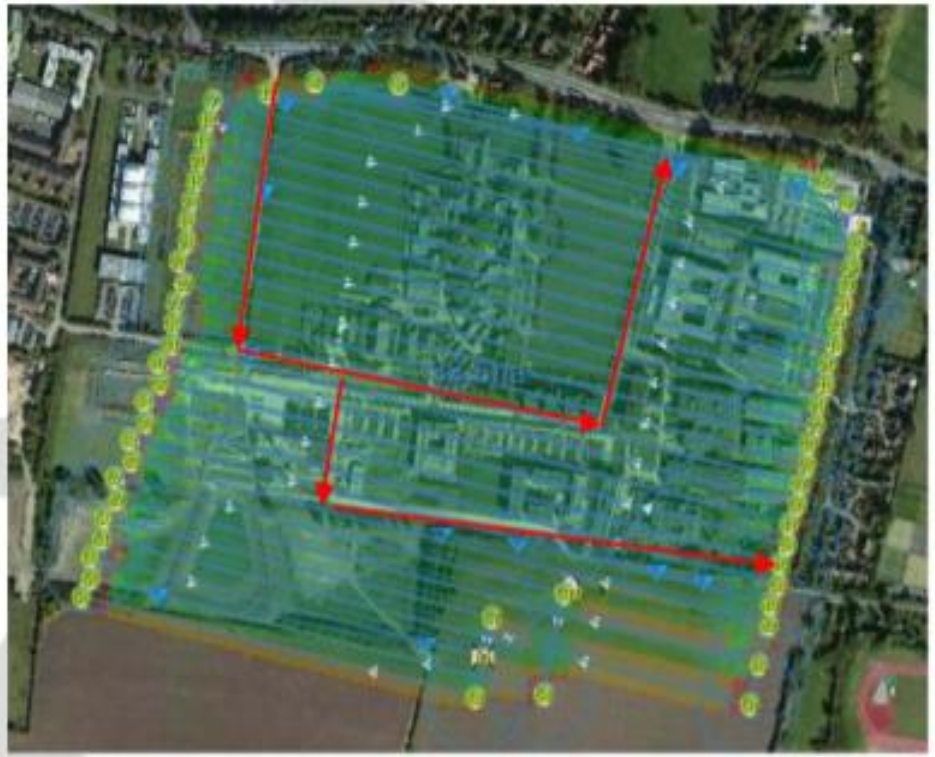
Data Acquisition and Transmission Layer



Data acquisition from :
Building management system (BMS)
Asset management system (AMS)
Space management system (SMS)



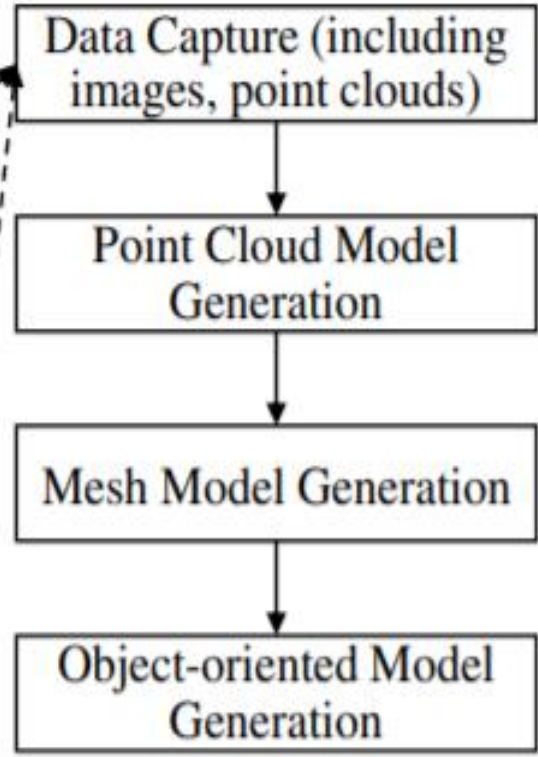
Digital modeling layer development of the city DT at the West Cambridge site



→
Route of vehicle-based scanning



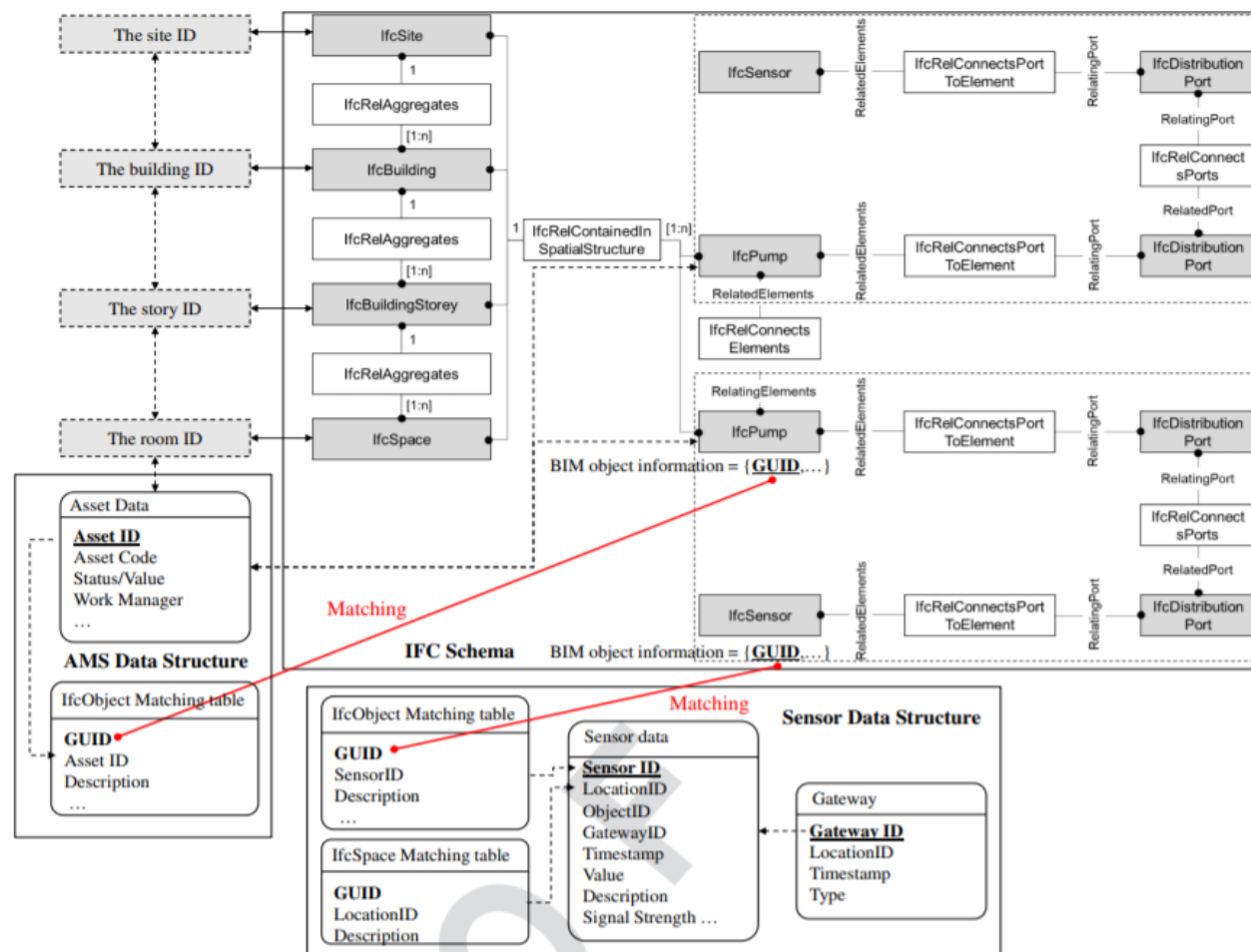
→
Route of fixed wing drone scanning



Model generation process and plan for West Cambridge site using fixed-wing drone and vehicle-based scanning



IFC schema mapping with other data resources using AMS as an example

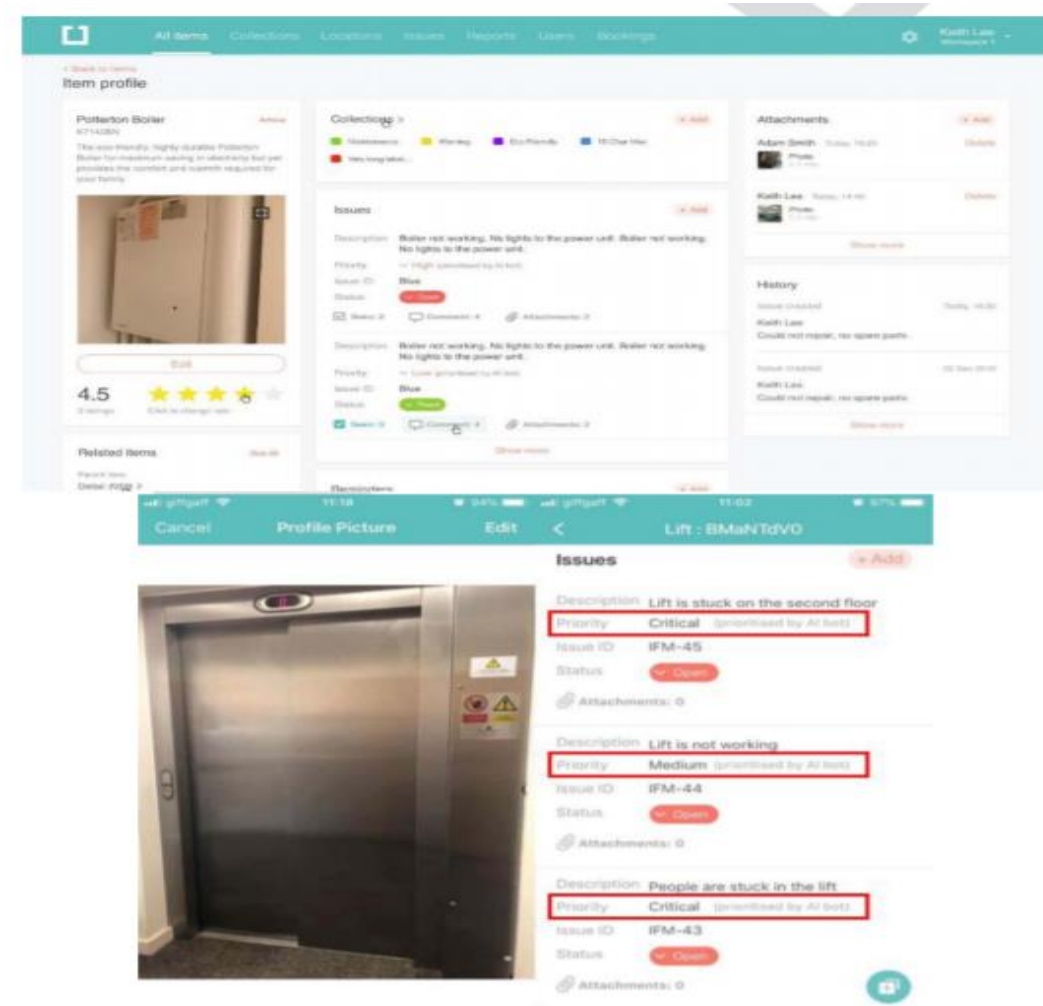




Service Layer (2/2)



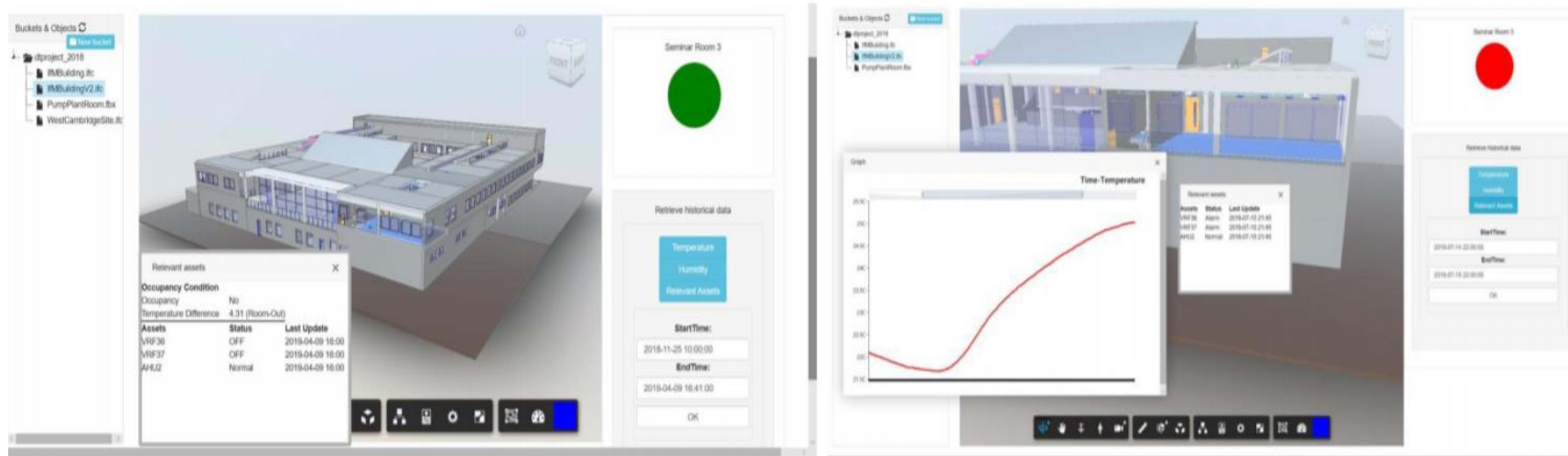
Environmentally Friendly Urban Energy Planning



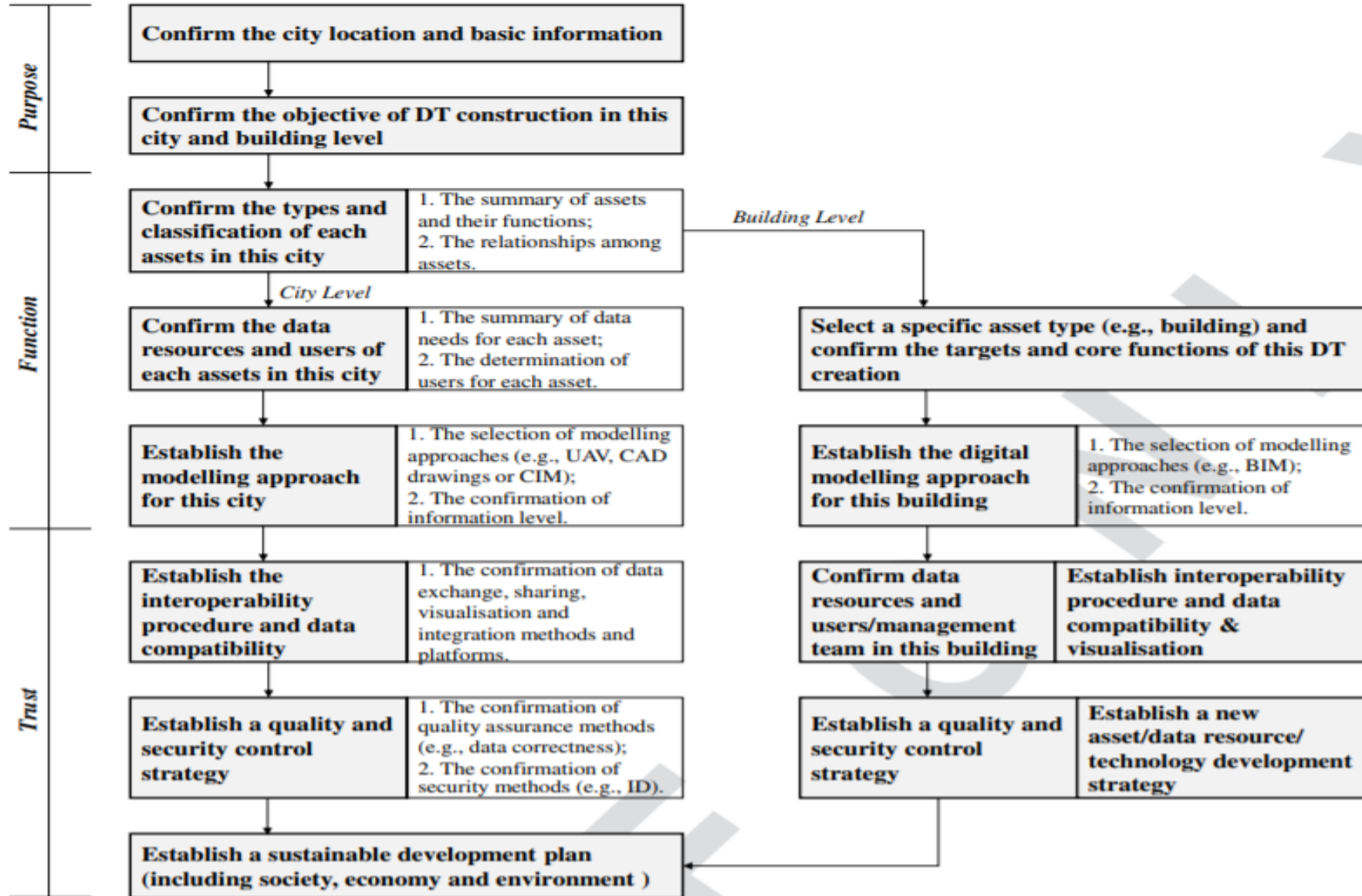
Maintenance/Repair Prioritization



Anomaly Detection in Pumps



Ambient Environment Monitoring



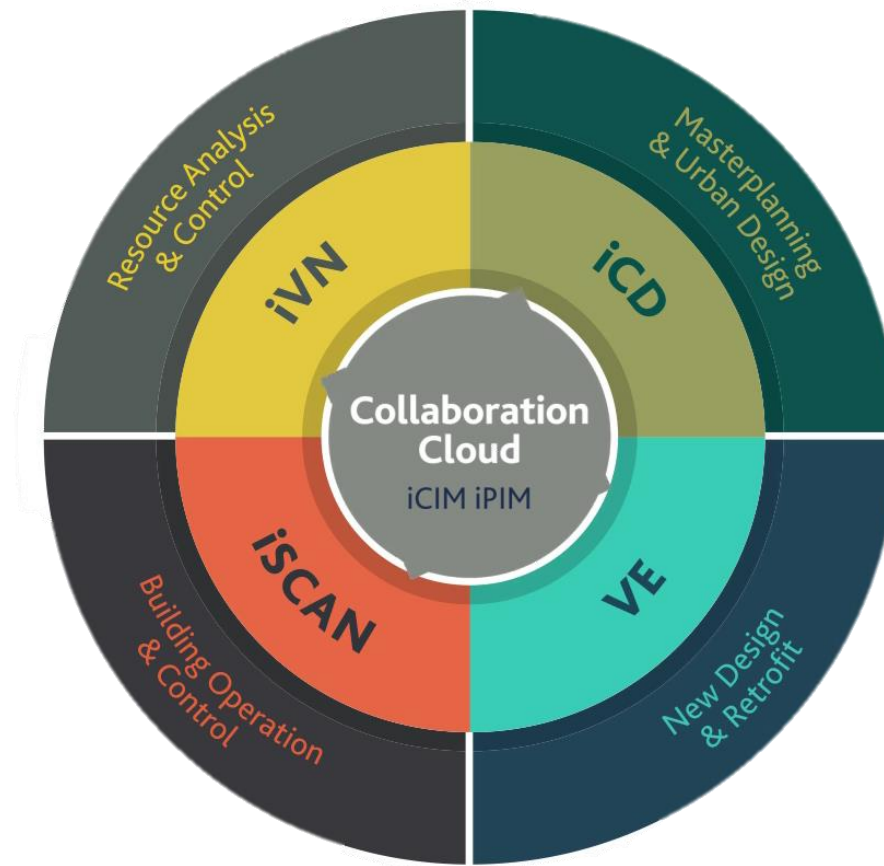
Bridging the gap between the real world and simulation, the ICL Digital Twin enables the energy efficient design and continuous operational optimisation of not just single but entire groups of buildings.

- Undertake sustainable master planning
- Operate buildings or communities more effectively
- Connect, visualise and analyse any data from any source
- Citizen and operational team collaboration and engagement
- Delve into zero-carbon construction/retrofitting of individual buildings
- Integrate with utilities and renewables to create local energy networks





Βήμα 1^ο: Αναζήτηση πληροφοριών σχετικά με το πρόγραμμα iCD

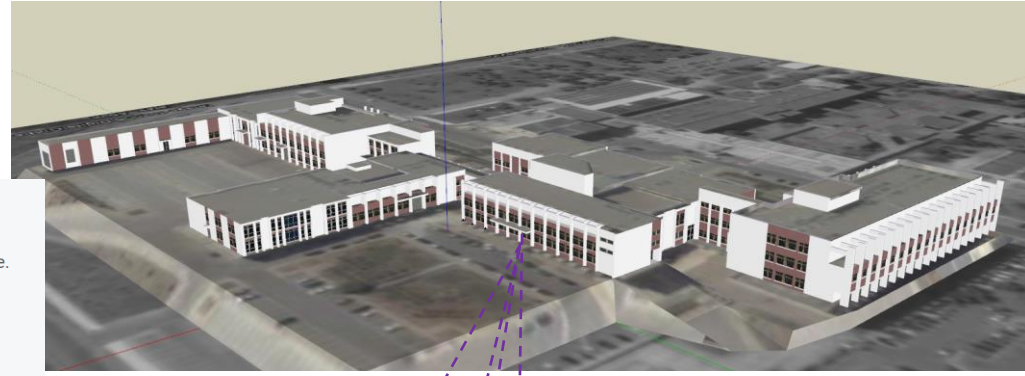


A Single Platform for Decarbonisation

Link for additional search [here](#)



iCD is a 3D urban master planning tool



Integrated Analysis Options

Quickly analyze multiple sustainability metrics directly within one central tool. Plan and visualise impact of changes over time.



Geography / Topography



Massing & Form



Energy Analysis



Water Analysis



Solar Potential



Renewables Feasibility



Integration with Utilities



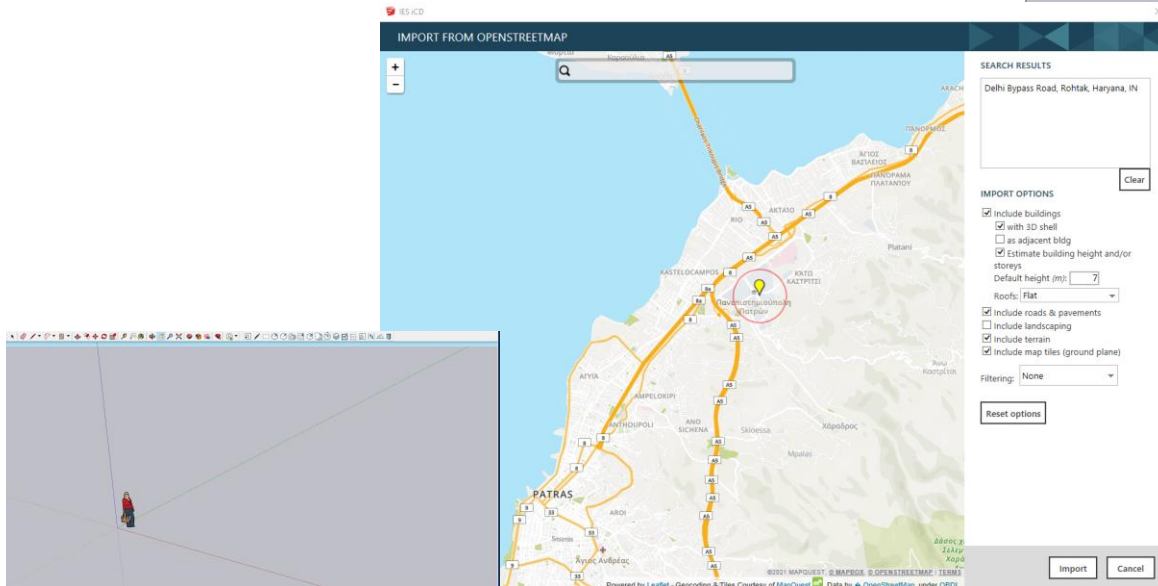
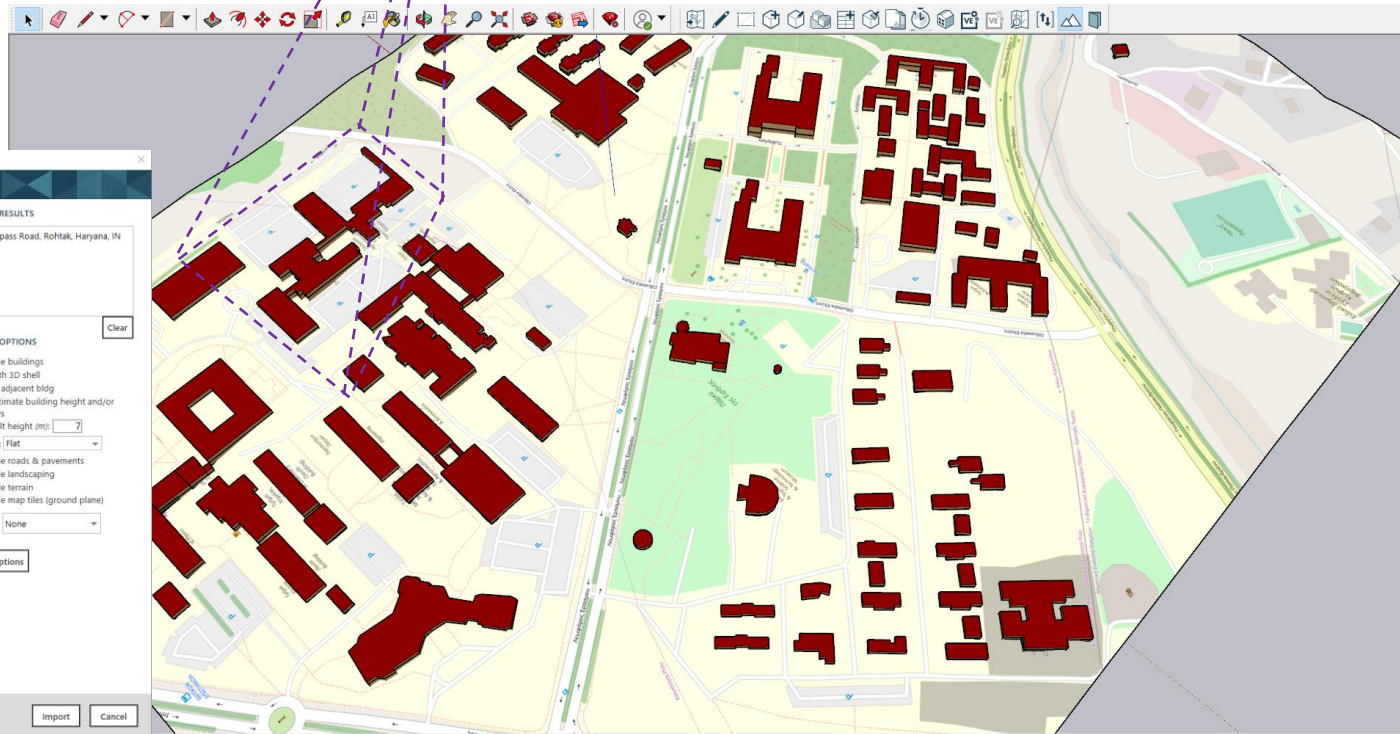
Zero-Carbon Plans

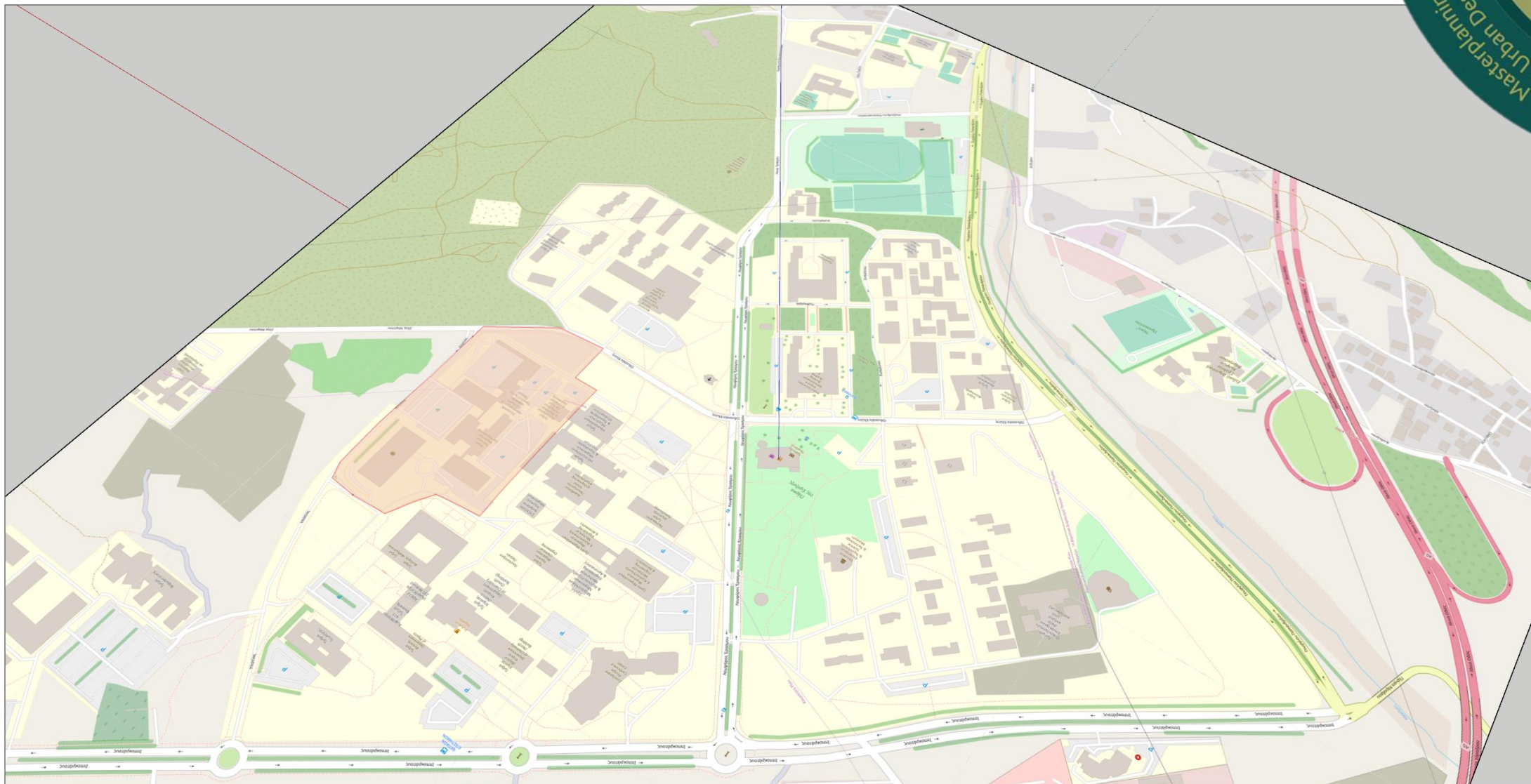


Active Travel



Electric Vehicles





UK "Level of Definition" LOD 2013

Stage number	1	2	3	4	5	6	7
Model name	Brief	Concept	Definition	Design	Build and commission	Handover and closeout	Operation
Systems to be covered	N/A	All	All	All	All	All	All
Graphical illustration (building project)							
Graphical illustration (infrastructure project)							
What the model can be relied upon for	Model information communicating the brief, performance requirements, performance benchmarks and site constraints	Models which communicate the initial response to the brief, aesthetic intent and outline performance requirements. The model can be used for early design development, analysis and co-ordination. Model content is not fixed and may be subject to further design	A dimensionally correct and co-ordinated model which communicates the response to the brief, aesthetic intent and some performance information that can be used for analysis, design development and early contractor engagement. The model can be used for co-ordination, sequencing and	A dimensionally correct and co-ordinated model that can be used to verify compliance with regulatory requirements. The model can be used as the start point for the incorporation of specialist contractor design models and can include information that can be used for fabrication, co-ordination,	An accurate model of the asset before and during construction incorporating co-ordinated specialist sub-contract design models and associated model attributes. The model can be used for sequencing of installation and capture of as-installed information	An accurate record of the asset as a constructed at handover, including all information required for operation and maintenance	An updated record of the asset at a fixed point in time incorporating any major changes made since handover, including performance and condition data and all information required for operation and maintenance The full content will be available in the yet to be published PAS 1192-3

Standard: [PAS - 1192-2](#)



USA AIA "Level of Development" LOD 2008

LOD 100	LOD 200	LOD 300	LOD 400	LOD 500
Conceptual	Approximate geometry	Precise geometry	Fabrication	As-built
The Model Element may be graphically represented in the Model with a symbol or other generic representation , but does not satisfy the requirements for LOD 200. Information related to the Model Element (i.e. cost per square metre, etc.) can be derived from other Model Elements.	The Model Element is graphically represented in the Model as a generic system, object, or assembly with approximate quantities, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.	The Model Element is graphically represented in the Model as a specific system, object, or assembly accurate in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.	The Model Element is graphically represented in the Model as a specific system, object, or assembly that is accurate in terms of quantity, size, shape, location, and orientation with detailing, fabrication, assembly, and installation information . Non-graphic information may also be attached to the Model Element.	The Model Element is a field verified representation accurate in terms of size, shape, location, quantity, and orientation. Non-graphic information may also be attached to the Model Element.

Source: [link](#)

Το πολυτιμότερο εργαλείο στην αρχική φάση μοντελοποίησης είναι ...



Building Information Data

2.1 Location / Orientation

Location	Data Source

2.2 Orientation

Orientation

2.3 General information

Buildings month of use	
Building days of use	
Building hours of use (Morning & Evening)	
Max Occupancy	

Βασικές πληροφορίες για την κατασκευή

Construction Data

** Feel free to add rows to the table as necessary to describe all different constructions.*

Category	Description	U value (W/m ² ·K)
Ground Floor		
Roof		
External Wall		
External Doors		
External Window & Roof Lights	External Window <ul style="list-style-type: none"> • g value= • Shading Coefficient = • Light Transmittance = 	
Internal Ceiling/Floor		
Internal Partition	Internal Partition (Stud Type)	

Κατασκευαστικές πληροφορίες για επιμέρους τμήματα της κατασκευής



Βήμα 3^ο & 4^ο: Επιλογή και αναζήτηση των απαραίτητων δεδομένων για τη εκτέλεση των σεναρίων

Systems

* Feel free to add rows to the table as necessary to describe all different zones.

Zone*	HVAC system	Room End Use

Πληροφορίες για συστήματα
κλιματισμού

Πληροφορίες για παραγωγή
ενέργειας ή συστημάτων
αξιοποίησης ΑΠΕ

Renewables

If applicable please complete the tables below:

PV		
PV module nominal efficiency		
Nominal cell temperature (NOCT)		deg C
Reference irradiance for NOCT		W/m2
Temperature coefficient for module efficiency		K
Degradation factor		
Shading factor		
Electrical Conversion efficiency		
Panel area		
Azimuth		deg clockwise from N
Inclination		deg from horizontal

CHP		
Fuel type		
Performance at rated output:		
Heat output		kw
Thermal efficiency		
Power efficiency		
Performance at minimum output:		
Fraction of rated heat output		
Thermal efficiency		
Power efficiency		

Στοιχεία σκίασης

Εκτίμηση του ποσοστού παραθύρων

Εκτίμηση αποστάσεων



Πληροφορίες για εγκατεστημένο εξοπλισμό

Εκτίμηση σχετικά με δυνατότητες εκμετάλλευσης στέγης

Search Where is this? Go

Node: Φοιτητική Εστία & Λέσχη Σίτισης / University Hall of Residence & Student canteen (360212434)

Version #4

β

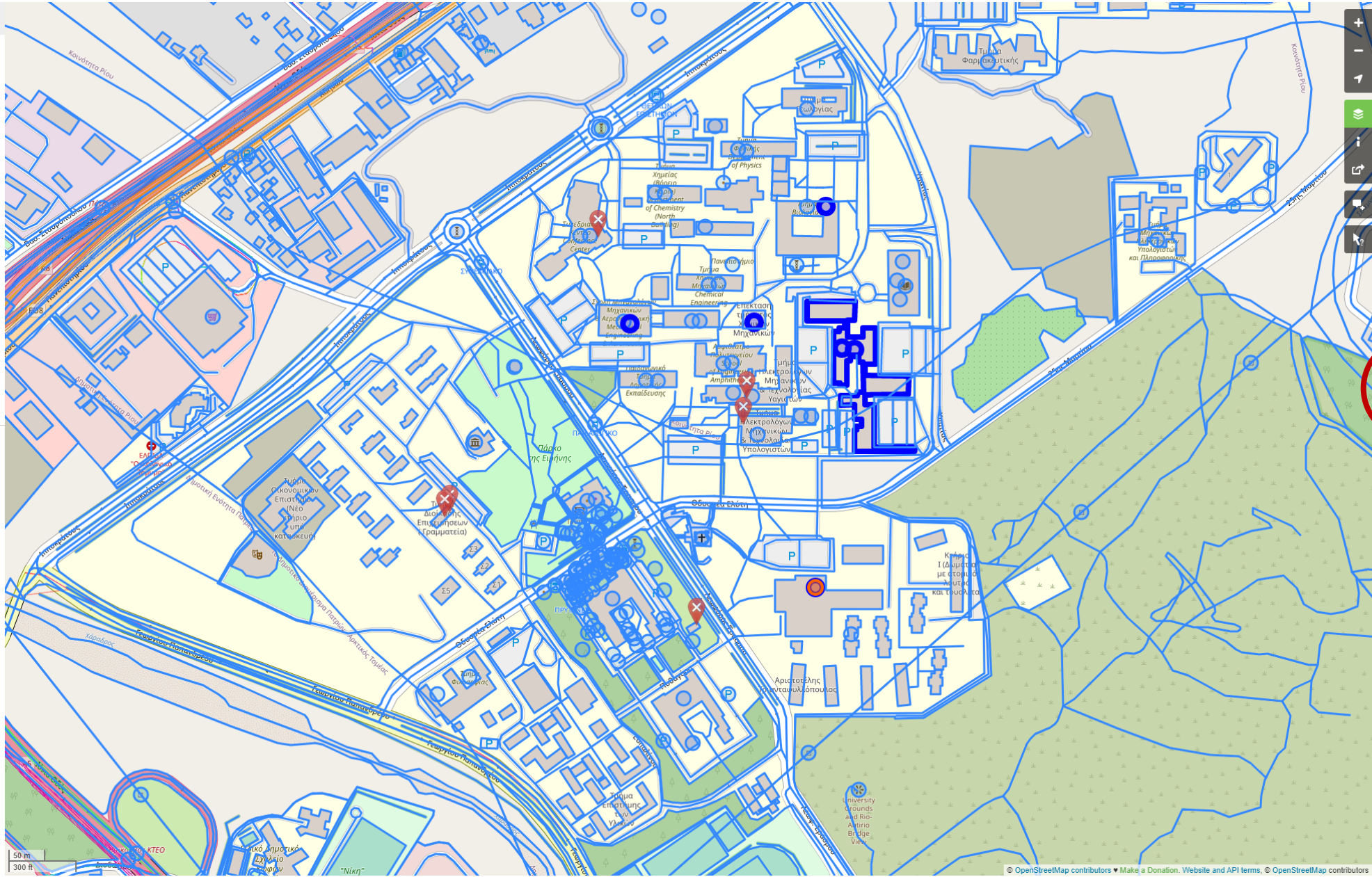
Edited about 1 year ago by Σεραφείμ · Changeset #79514612

Location: 38.2860479, 21.7899199

Tags

amenity	university
name	Φοιτητική Εστία & Λέσχη Σίτισης / University Hall of Residence & Student canteen

Download XML · View History

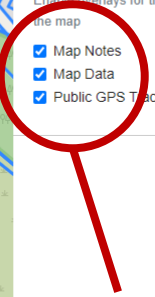


Map Layers

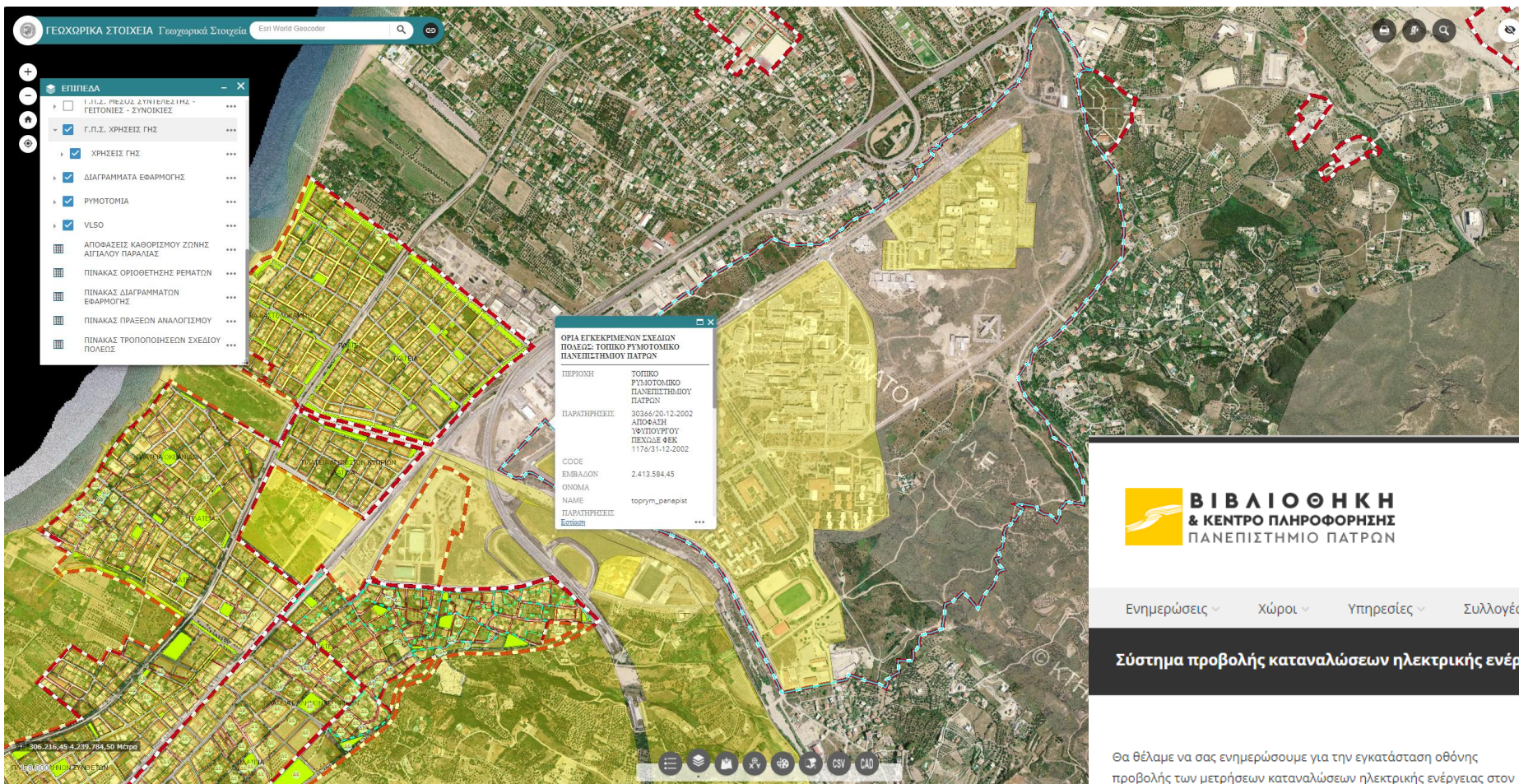
- Standard
- CyclOSM
- Cycle Map
- Transport Map
- ÖPNVKarte
- Humanitarian

Enable overlays for troubleshooting the map

- Map Notes
- Map Data
- Public GPS Traces



Ανοικτά δεδομένα



i Source: https://gissrvweb.geopatras.gr/publish_t/webapps/dp/startpage.php

i Διεύθυνση Εκτέλεσης και Συντήρησης Έργων



Θα θέλαμε να σας ενημερώσουμε για την εγκατάσταση οθόνης προβολής των μετρήσεων καταναλώσεων ηλεκτρικής ενέργειας στον 2ο όροφο της ΒΚΠ. Το σύστημα προβολής έχει στόχο να καταστήσει διαφανή την κατανάλωση ενέργειας στο Πανεπιστήμιο Πατρών και να ευαισθητοποιήσει περισσότερο την κοινότητα για τις ορθές πρακτικές χρήσης της. Το σύστημα βασίζεται στην τεχνολογία των "έξυπνων μετρητών", οι οποίοι έχουν δυνατότητες μέτρησης ενέργειας, τάσης, συχνότητας και άλλων μεγεθών, και δυνατότητα αμφίδρομης επικοινωνίας μέσω τηλεπικοινωνιακών μέσων με κέντρα συλλογής, αποθήκευσης, επεξεργασίας και διαχείρισης πληροφοριών. Η εφαρμογή των έξυπνων μετρητών στους καταναλωτές χαμηλής τάσης δίνει μεγάλες δυνατότητες και πλεονεκτήματα, τόσο στους καταναλωτές και στους προμηθευτές τους.



NEA

- Ελεύθερη πρόσβαση στο περιοδικό Med
- Βραβείο Βιβλίου "Trends in Classics" από τον De Gruyter
- Ελεύθερη πρόσβαση σε άρθρα και κεφάλαια βιβλίων του Springer Nature
- My Research Assistant της Clarivate
- Έναρξη υπηρεσίας ηχητικών ενημερωτικών δελτίων



The image shows a screenshot of the PlugShare application interface. The main area is a map of Patras, Greece, with several charging stations marked by icons. The sidebar on the left contains the following sections:

- Search:** Search for a Charging Location
- Legend:** (empty)
- Filters:**
 - Plugs (11 of 11):** Supercharger, CCS/SAE, CHAdeMO, J-1772, Tesla, Tesla (Roadster), Type 2, Type 3, Three Phase, Caravan Mains S..., Wall (Euro).
 - Networks (6 of 6):** Allego, Fastned, Ionity, Supercharger, Tesla Destination, Other*.
 - Include (3 of 5):** Payment Required Locations, Restricted Locations, Residential Locations, Currently In-Use Locations, Coming Soon Locations.
 - Amenities (0 of 9):** Minimum PlugScore (0)
- Map Controls:** Map, Terrain, Satellite, Zoom in (+), Zoom out (-).



Ανοικτά δεδομένα



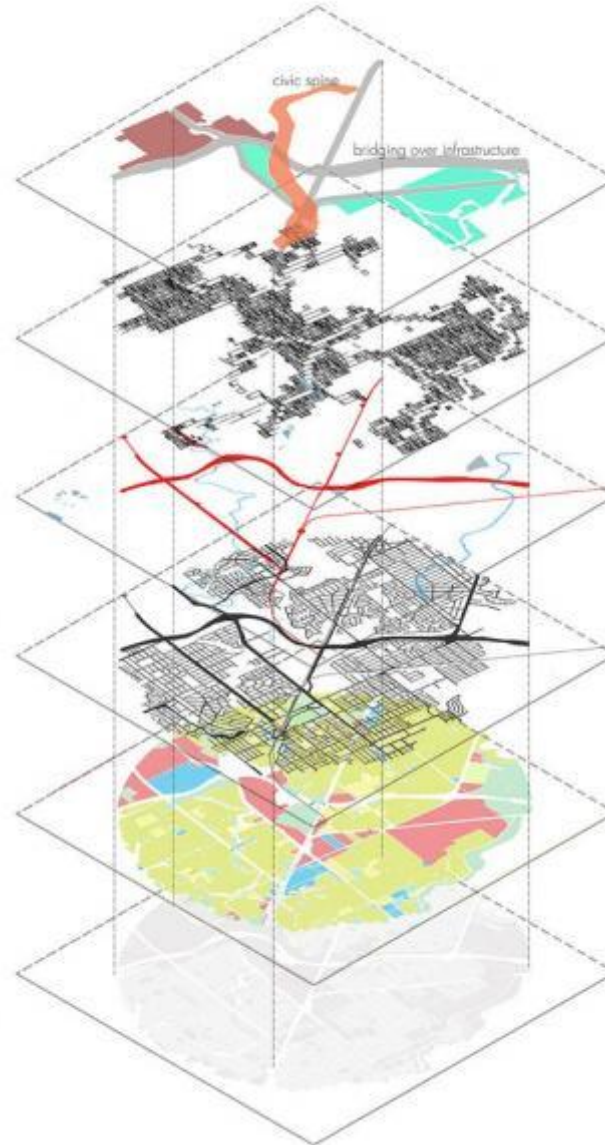
Bus lines and stops (e.g. link [here](#))



Λειτουργία υποδομών

Διασύνδεση με άλλες υποδομές

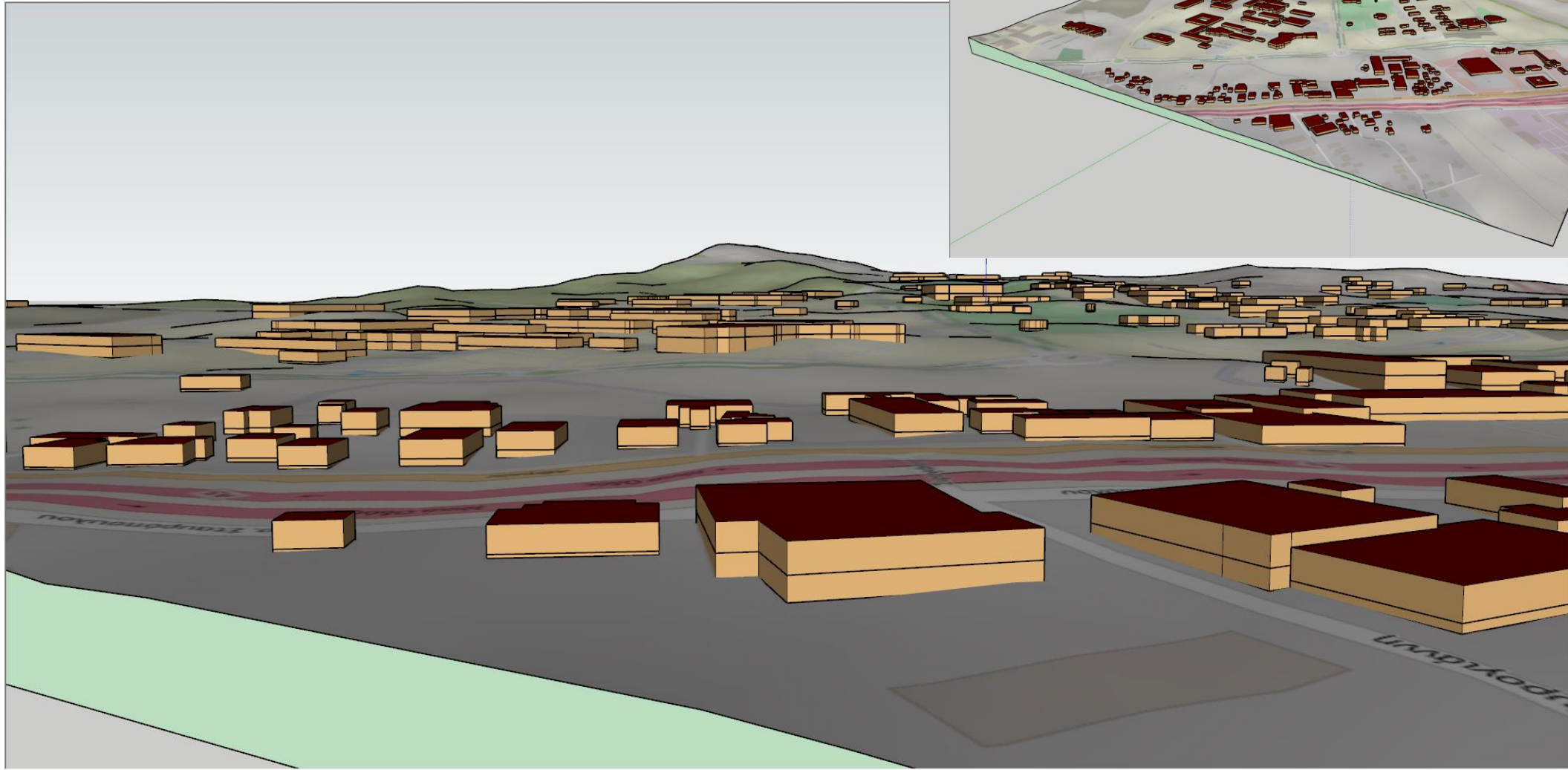
Κατηγοριοποίηση περιοχών



Χαρακτηριστικά υποδομών

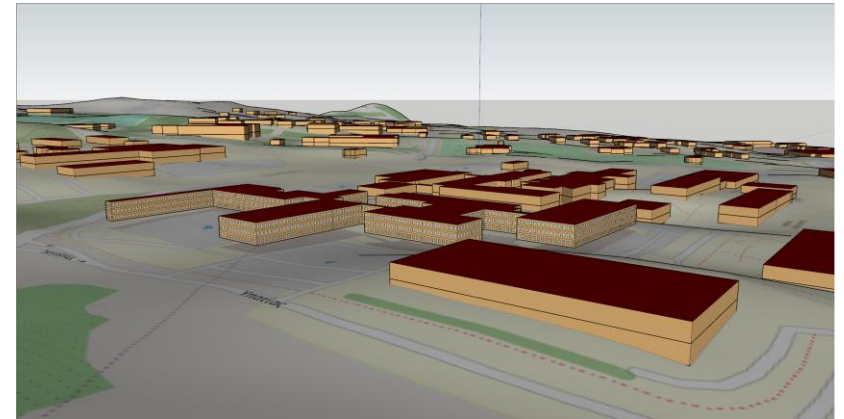
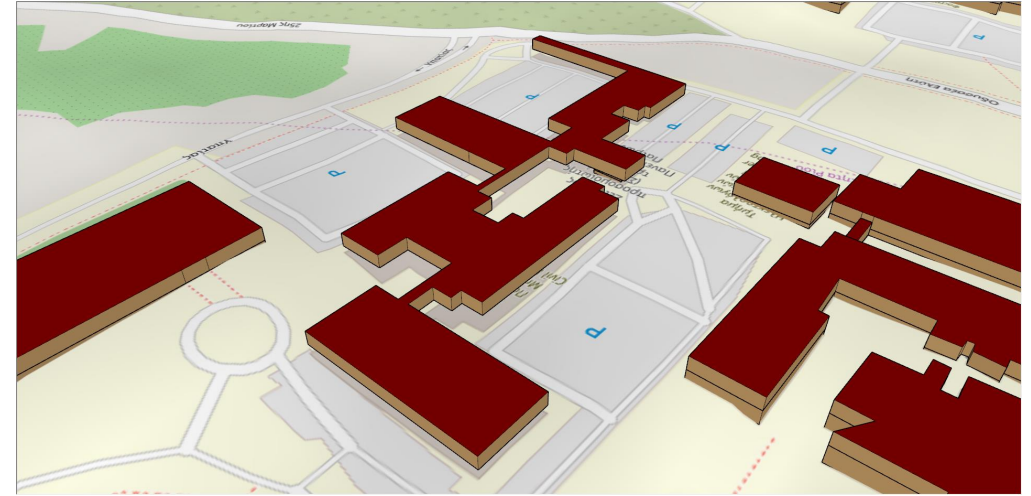
Διάταξη των υποδομών ενδιαφέροντος

Γεωγραφική απεικόνιση περιοχής





Σχεδιασμός – απαιτούνται παραδοχές



IMPORT FROM OPENSTREETMAP

Patras

SEARCH RESULTS

Patra, GR

Clear

IMPORT OPTIONS

- Include buildings
 - with 3D shell
 - as adjacent bldg
 - Estimate building height and/or storeys
- Default height (m):
- Roofs:
- Include roads & pavements
- Include landscaping
- Include terrain
- Include map tiles (ground plane)

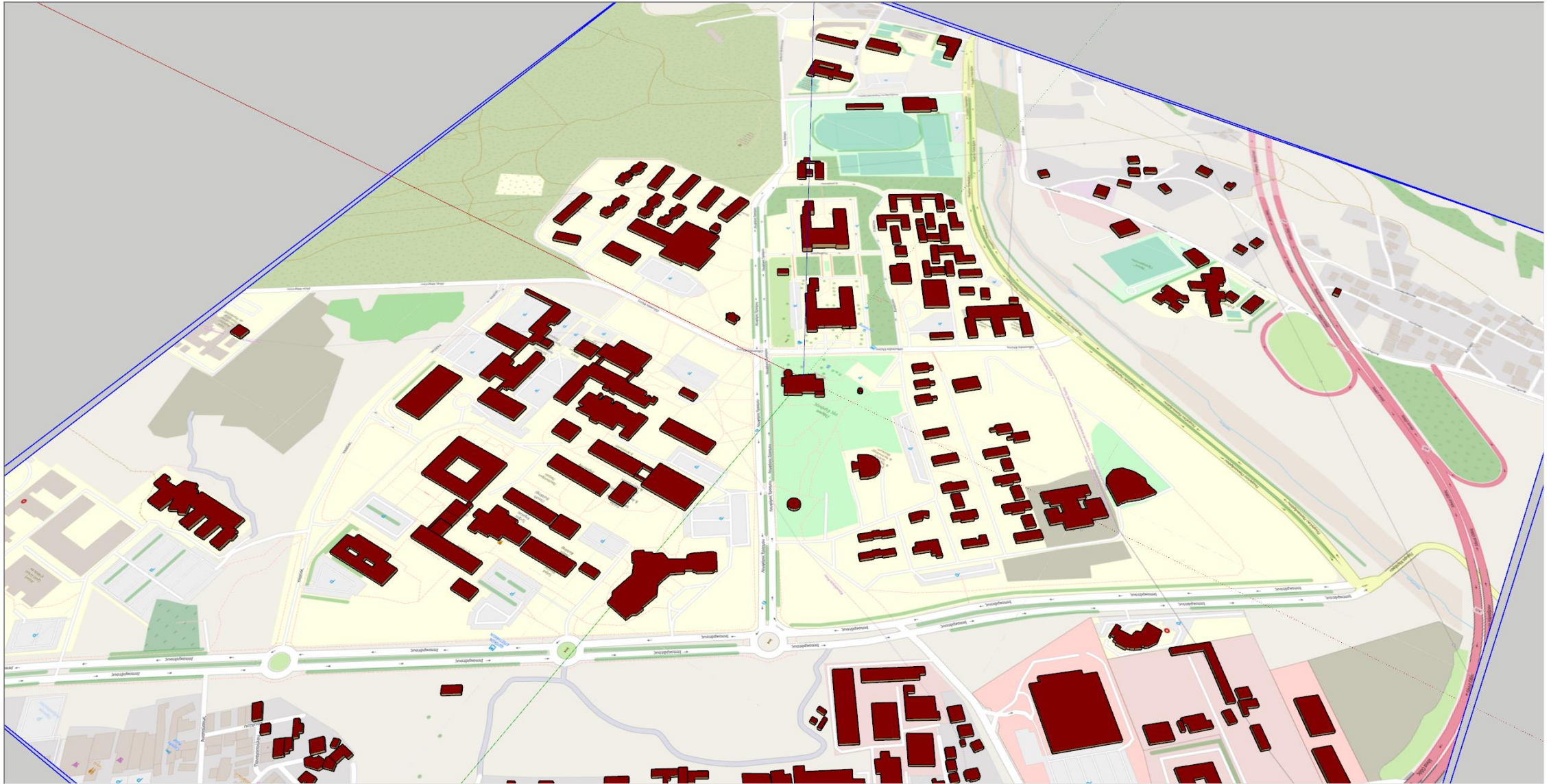
Filtering:

Reset options

Import Cancel

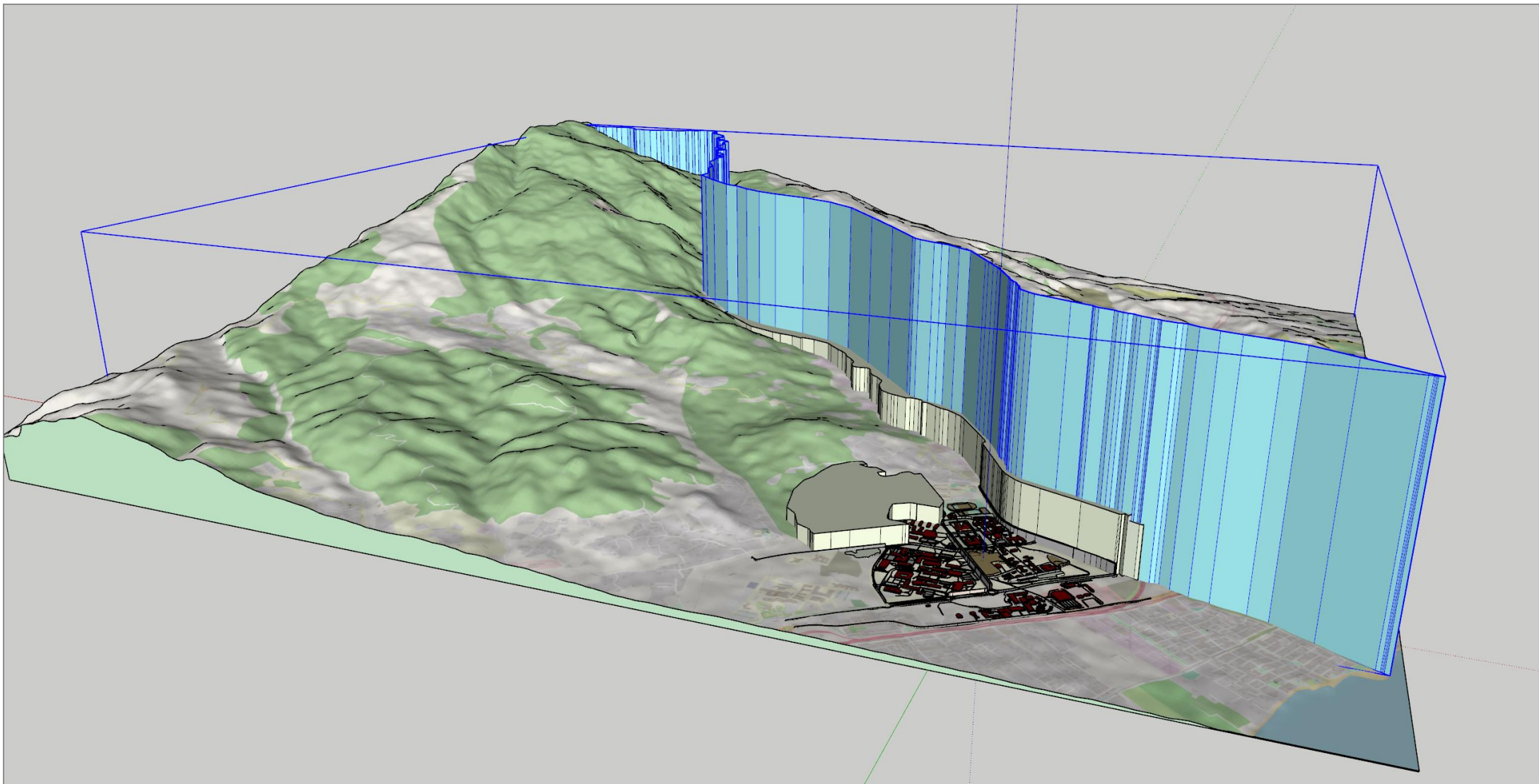
100 m
500 ft

©2021 MAPQUEST, © MAPBOX, © OPENSTREETMAP | TERMS
Powered by Leaflet - Geocoding & Tiles Courtesy of MapQuest Data by OpenStreetMap, under OBDL.

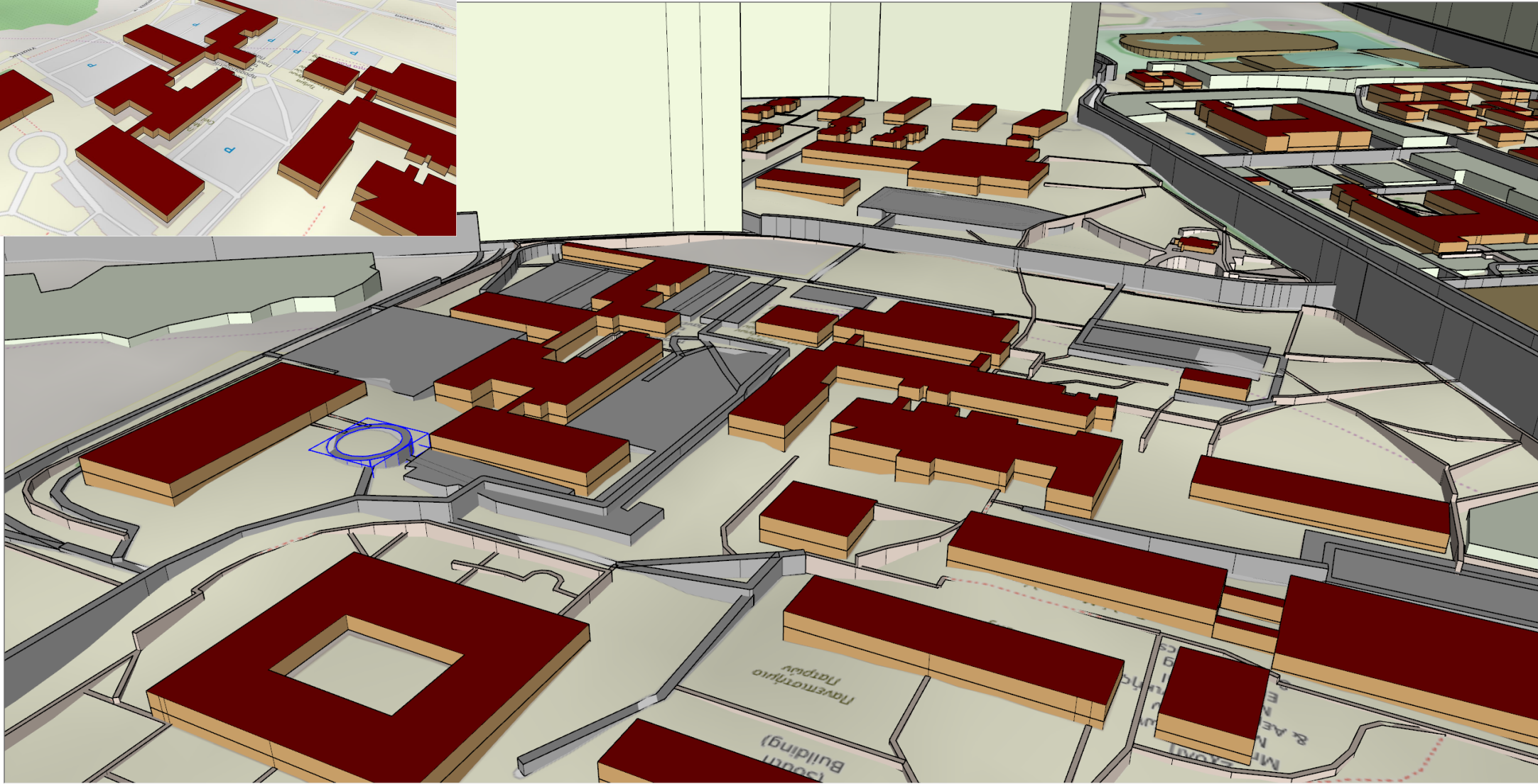
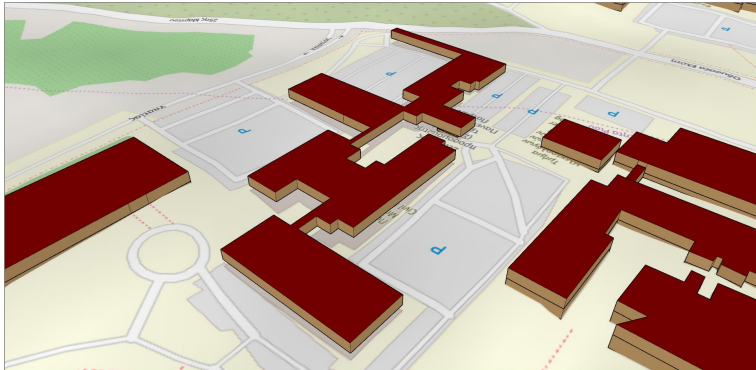




Αυτοματισμός – χρειάζεται προσοχή

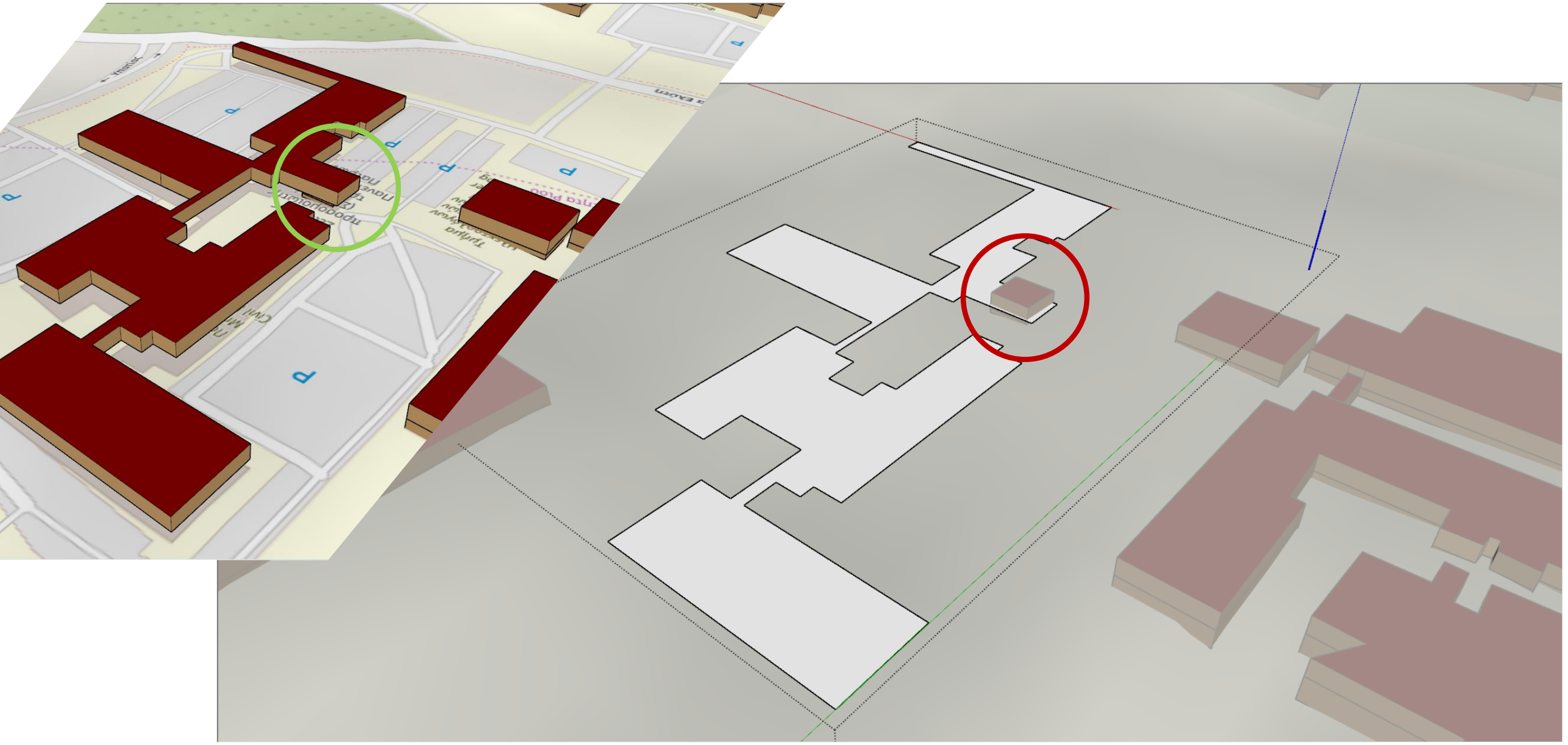


⚠️ Αυτοματισμός – χρειάζεται προσοχή





Αυτοματισμός – χρειάζεται προσοχή





The screenshot shows the 'EDIT OBJECTS' window in IES iCD. The window title is 'EDIT OBJECTS' and it has a year selector set to '2021'. The object name is '(empty)'. The 'GENERAL' section includes: Object type: Building; Number of storeys: 1; Building storey height (m): 5; Building type: Office; Space type: (not set); Glazing ratio (%): 30; Roof type: Flat; Roof angle (degrees): 30; Roof overlap (m): 0; Roof Glazing ratio (%): 0; Level of Detail - Building: Shell; Max bldg height (m): 5; Total floor area (m²): 8,319.37; Footprint area (m²): 8,319.37 *; Water fixtures: (not set); Z axis offset (m): 0. The 'HVAC SERVICE' section includes: HVAC service: (not set); Occupancy (m² per person): (not set); Fuel Type (heating & hot water): (not set). The 'DETAILS (OPTIONAL)' section includes: Address # / street: (not set); Address district: (not set); Address region: (not set); Address town: (not set); Condition: (not set); Country: (not set); Date Constructed: (not set); Date Demolished: (not set); Flood plain / risk: (not set).

Δεδομένα σχετικά με τον τύπο και τη γεωμετρία της κατασκευής

Πληροφορίες σχετικά με τη χρήση του κτηρίου





EDIT OBJECTS

Name: (empty)

ADVANCED - ENVELOPE

Ceiling	2 In. Light Weight C
Door	Wooden Door (U =
Ext wall	4 In. Face Brick 2 Ir
Ext window	Small Double-Glaze
Ground floor	Un-Insulated Solid
Int wall	Lightweight Plaster
Int window	Small Double-Glaze
Roof	19mm Asphalt 13m
Roof light	Polycarbonate Dou

ADVANCED - SYSTEMS

Override total floor area (m ²)	8,319.37
Power factor - dhw	(not set)
Power factor - general	(not set)
Power factor - heating	(not set)

SIMULATION RESULTS

BENCHMARKS

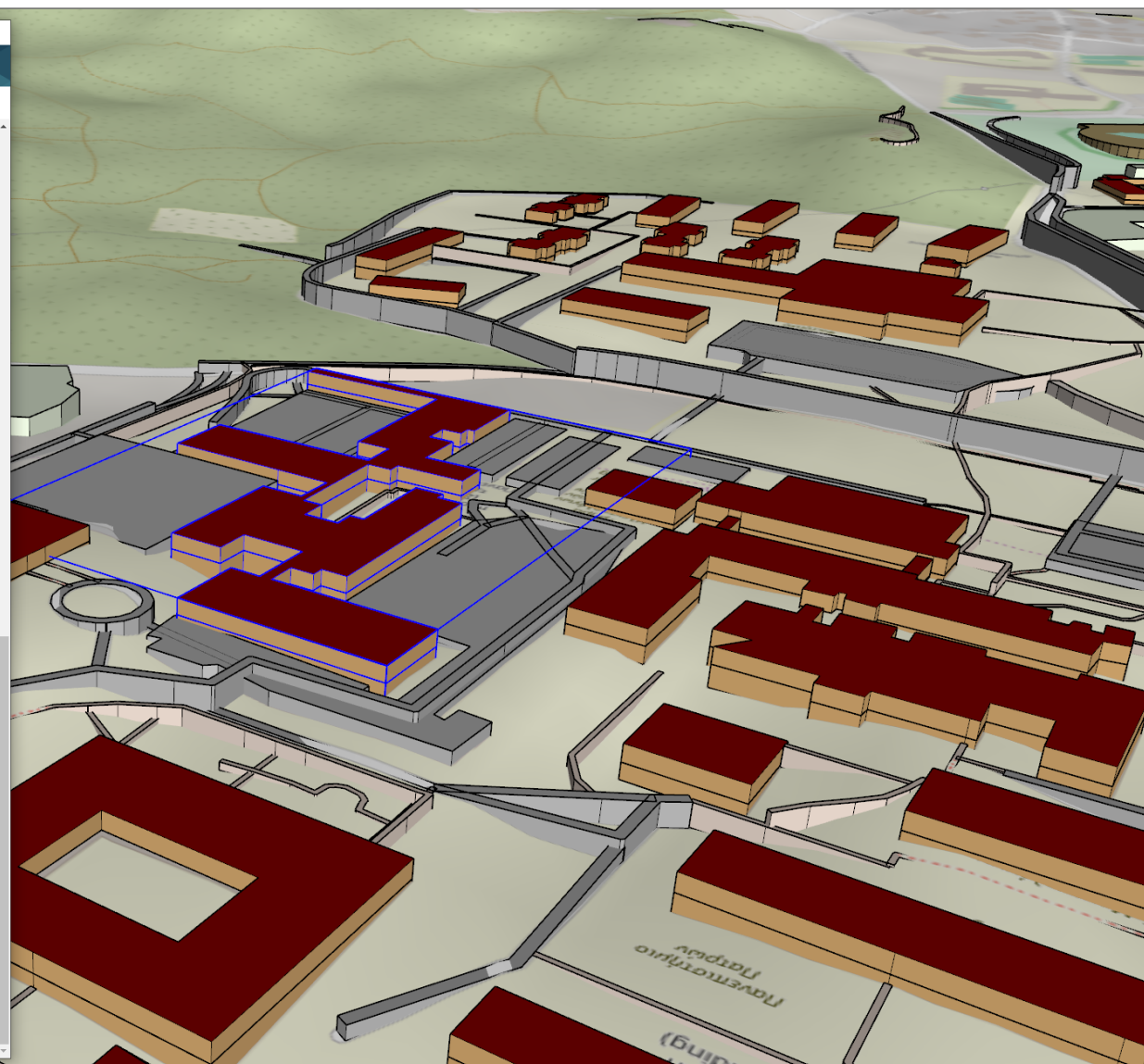
Benchmark cooling (demand) (kWh / m ² per year)	(not set)
Benchmark heating (demand) (kWh / m ² per year)	(not set)
Benchmark hot water (demand) (kWh / m ² per year)	(not set)
Benchmark lighting (demand) (kWh / m ² per year)	(not set)
Benchmark power (demand) (kWh / m ² per year)	(not set)
Benchmark total carbon (inc renewables) (CO ₂ kg/m ² per year)	(not set)
Benchmark total energy (demand only) (kWh / m ² per year)	(not set)
Benchmark total energy (inc renewables) (kWh / m ² per year)	(not set)
Renewable energy (elec generation) (kWh / m ² per year)	(not set)
Renewable energy (heat generation) (kWh / m ² per year)	(not set)

USER DEFINED

Additional description	(empty)
------------------------	---------

Δεδομένα σχετικά με το κέλυφος της κατασκευής

Δεδομένα από μετρήσεις που έχουν πραγματοποιηθεί στο παρελθόν





Βήμα 1^ο: Αναζήτηση πληροφοριών σχετικά με το πρόγραμμα iCD

Βήμα 2^ο: Επιλογή περιοχής μελέτης

Βήμα 3^ο: Επιλογή σεναρίων μελέτης

Βήμα 4^ο: Αναζήτηση των απαραίτητων δεδομένων για τη εκτέλεση των σεναρίων

Βήμα 5^ο: Εισαγωγή δεδομένων στο μοντέλο

Βήμα 6^ο: Διενέργεια προσομοιώσεων

Βήμα 7^ο: Αξιολόγηση αναφορών προσομοιώσεων

Βήμα 8^ο: Λήψη αποφάσεων για παρεμβάσεις και τροποποιήσεις



Βήμα Χ^ο: Πρόταση τροποποιήσεων στις υφιστάμενες υποδομές



END

