



OPTIMISED ENERGY EFFICIENT DESIGN  
PLATFORM FOR REFURBISHMENT  
AT DISTRICT LEVEL

## Building Data on the Web Building Geometry & Placement

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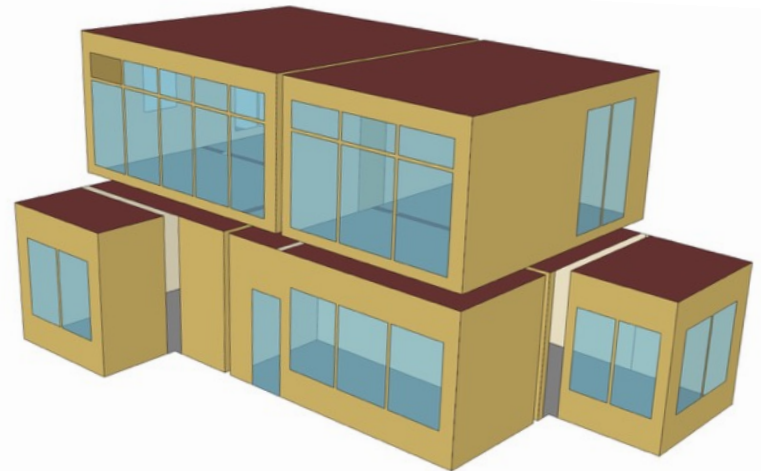
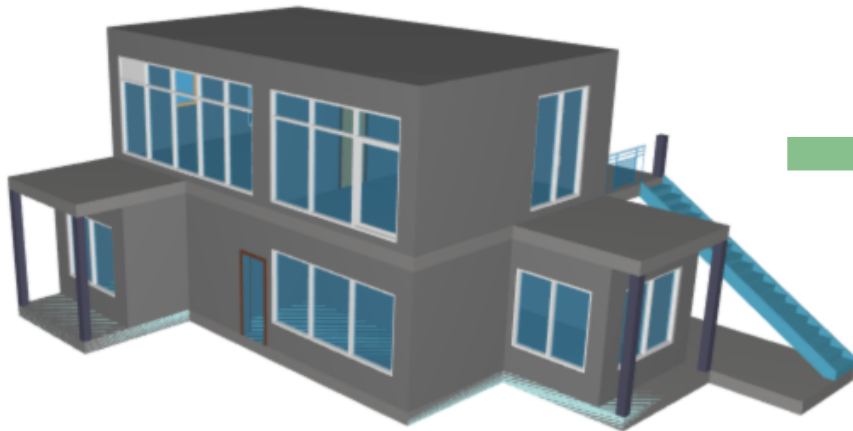
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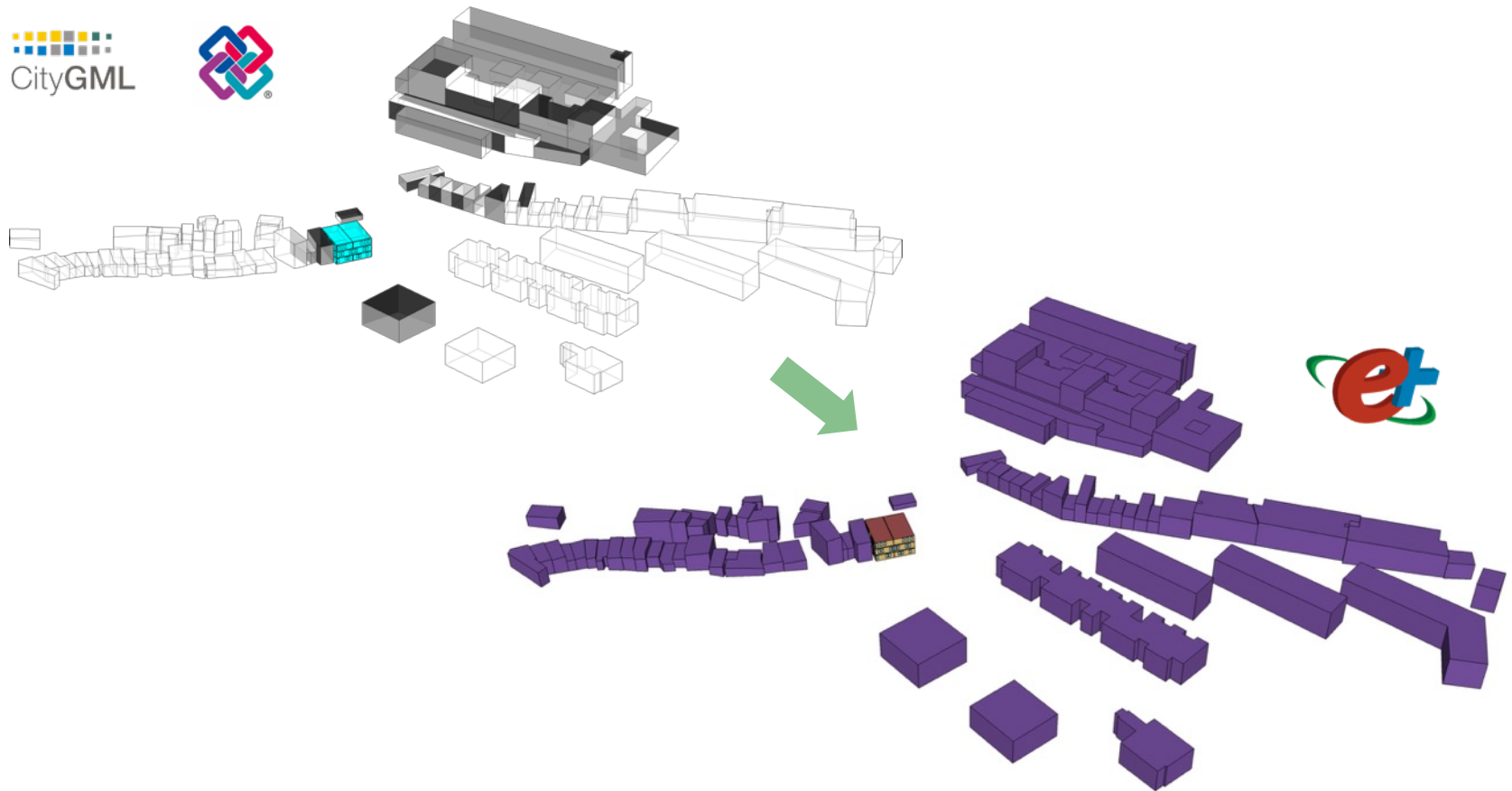
Cloud-based platform able to design energy efficient retrofitting projects that are based on different energy conservation measures to improve the behavior of a district.

- Diagnosis and formulation of scenarios.
- **Evaluation** and Optimization.
- Best scenario selection and data exportation.

Evaluation of Scenarios:

- Automatic generation of detailed Simulation Data Models combining **BIM** and **GIS** information.
- Calculation of some District Performance Indicators based on the simulation results.





## BIM data (IFC4 DTV)

- Detailed 3D representation of infrastructure (spatial elements, building elements, products, etc.)
- Additional information for the objects (dimensions, quantities, materials, schedules, documents, custom properties, etc.)
- Building placement (orientation, elevation) ?

## GIS data (CityGML 2.0)

- Simple 3D representation of all buildings (LOD1)
- Precise building placement (using global reference coordinate system)

- **Building Geometry**
- Materials (layer bending, thermal properties)
- HVAC Systems (demand side, supply side, connections)
- Zones (group of spaces, thermostats, simulation parameters)
- Schedules (internal gains, occupancy patterns, lights)

## IFC Exportation Issues (REVIT 2018)

- IFC Exporter is not fully compatible with concepts of Design Transfer View.
- The usage of Join Geometry tool affects to the exportation results.
- 2<sup>nd</sup> level space boundaries are often wrong or not exported.

## IFC Specification Issues

- The IFC specification does not support detached shading elements with shape representation and placement.
- Geometric annotations (or definition shapes) parts of wall above/below grade, parts of floor over air/earth etc.

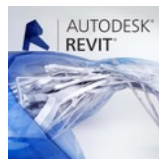
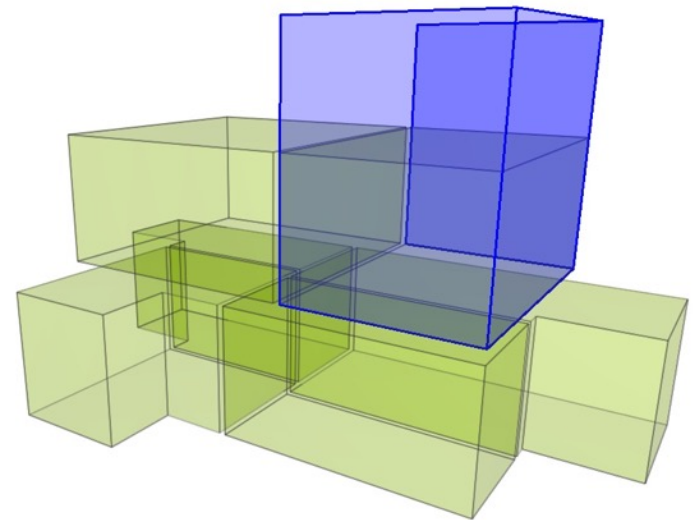
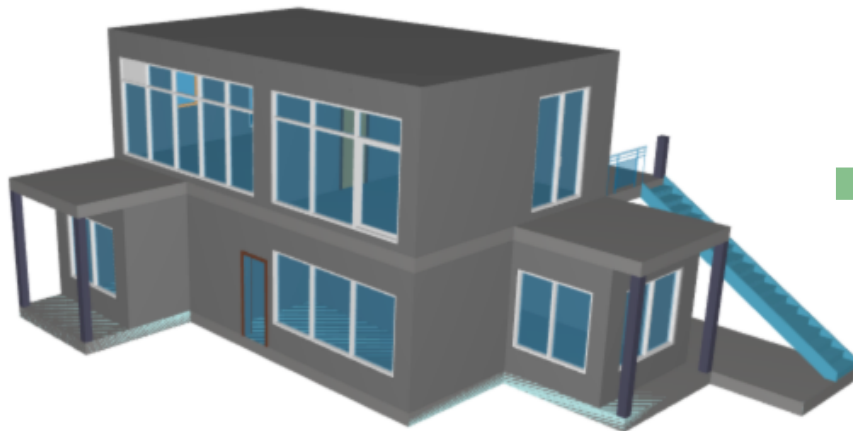
## IFC Exportation Issues (REVIT 2018)

- The IFC Exporter has been modified to support better the DTV concepts.
- BIM Guidelines document has been initiated.
- The CBIP algorithm is used to calculate the space boundary topology of the building. Was developed in C/C++.
- A Cloud-based service was developed to enhance the IFC with the 2<sup>nd</sup> level space boundaries. Was developed in Java.

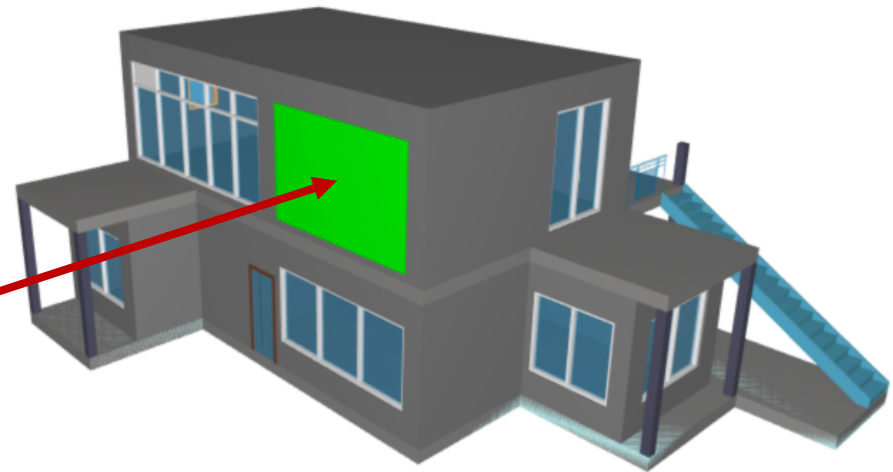
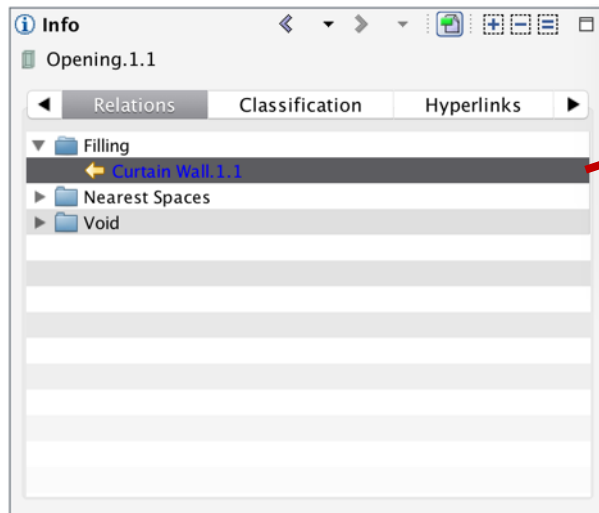
## IFC Specification Issues

- **SimModel/SimModel OWL** has been selected to provide all the required information that cannot be retrieved from IFC/ifcOWL.





Boolean Operations to support better DTV concepts. If the intersection of the opening (solid) and the curtain wall (solid) is non empty then the script creates the inverse relation FillVoids.



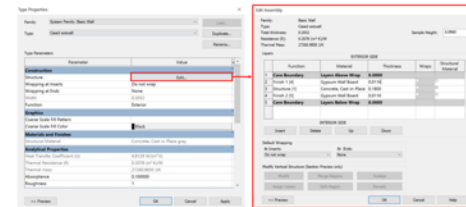
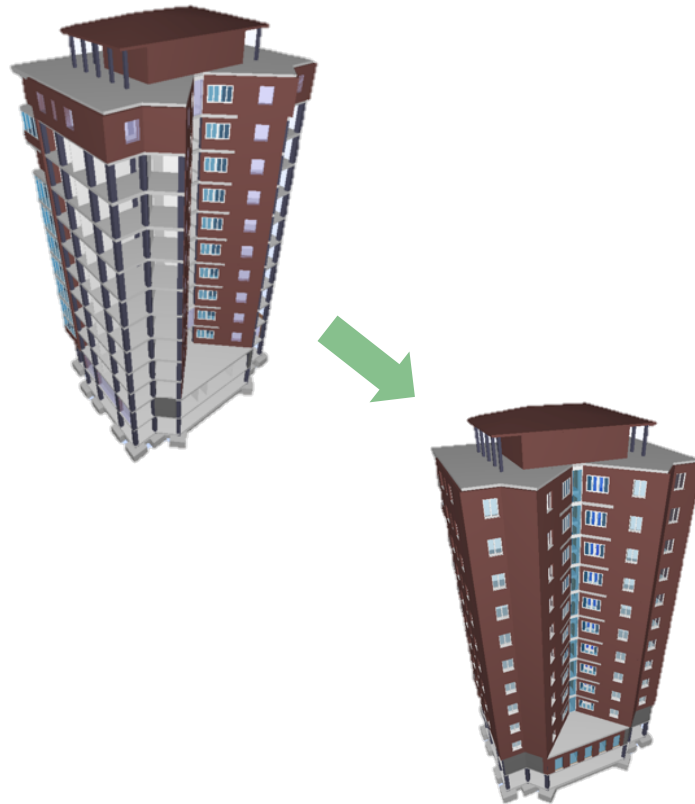


Figure 3: Edit the construction (material layer bedding) of opaque building elements

Finally, for each material layer (row) click the [three dots](#) button next to the material name and add its thermal properties (see Figure 3).

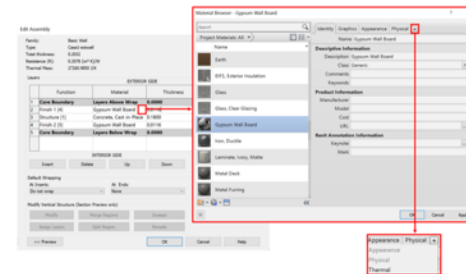


Figure 4: Path to add the thermal properties for each material of opaque building elements

select the building component, click the [construction's value](#) from the predefined



glazing building element

Most IFC to energy simulation transformation methods currently default construction and material thermal properties of building elements. Although IFC could incorporate information about the thermal and optical properties of each building entity construction's material (e.g. an object for thermal conductivity (kThermalConductivityMeasure)), current versions of the IFC-exporter are not able to export such information. To overcome such limitation, the REVIT IFC exporter has been modified properly to support exportation of such information. Hence, installation of the [OptEEmAL IFC4 exporter](#) is prerequisite (see the [Installation Requirements](#) section).

## Static Data - Rooms, Spaces and HVAC Zones

Revit uses the space component to maintain information about the area where it is placed. Spaces store values for a variety of parameters that affect the heating and cooling simulation. Spaces should be placed throughout the model, including unoccupied areas such as plenums areas, since an accurate heating and cooling loads simulation can only be accomplished if spaces are placed (created) in all areas to account for the entire volume of your building model. A room is a subdivision of space within a building model, based on elements such as walls, floors, roofs, and ceilings. These elements are defined as room-bounding. Revit refers to these room-bounding elements when computing the perimeter, area, and volume of a room. You can turn on/off the Room Bounding parameter of many elements. You can also use room separation lines to further subdivide space where no room-bounding elements exist.

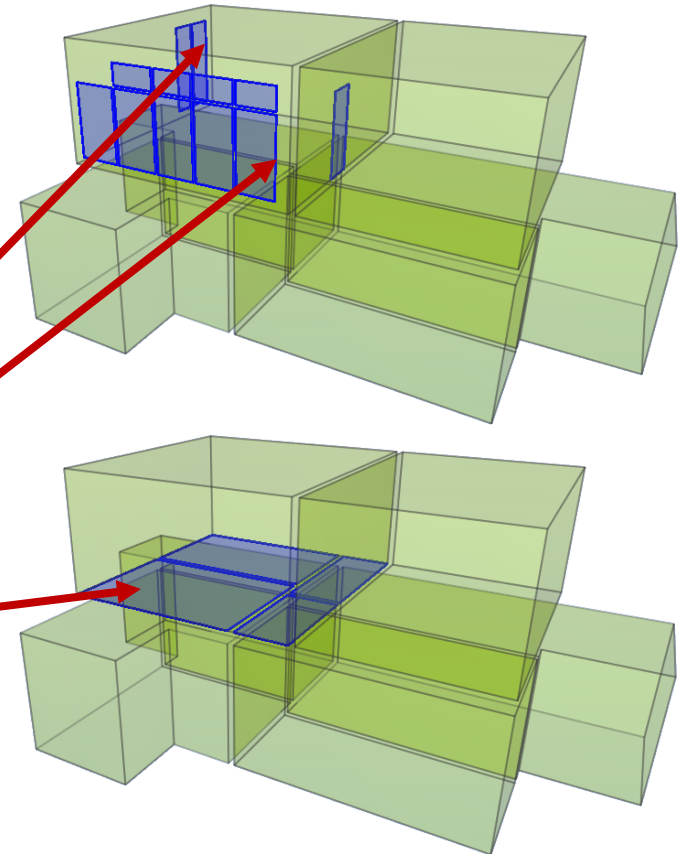
Rooms and spaces are independent components used for different purposes. Rooms are architectural components used to maintain information about occupied areas. Spaces are exclusively used for the MEP disciplines to analyze volume. They contain parameters that maintain information about the areas in which they have been placed. While spaces definition throughout the model is prerequisite, rooms definition is not.

**Info**

Space.1.1 : office\_5[5]

Identification	Location	Quantities	Profile	Relations
Pset_SpaceInternalGainsDesign				
Mechanical - Flow	Other	Phasing	Pset_SpaceCommon	
Electrical - Loads	Energy Analysis		Identity Data	
Hyperlinks	Constraints	Dimensions	Electrical - Lighting	
Space Boundaries		Space Boundary Areas		Classification

Component	Type	Area
Door	30" x 80" 2	16.66 sq ft
Plate	Solid	5.46 sq ft
Plate	Glazed	150.21 sq ft
Roof	RoofExt	364.64 sq ft
Slab	Case 1-floor	345.73 sq ft
Wall	Case 1-intwall	193.74 sq ft
Wall	Case 1-extwall	558.38 sq ft
Window	extwindow	12.00 sq ft



An algorithm for generating the minimal set of **neighbor building shading surfaces** for every CityGML envelope is required.

