IBPSA Project 1

Space boundary tool algorithms for model analysis

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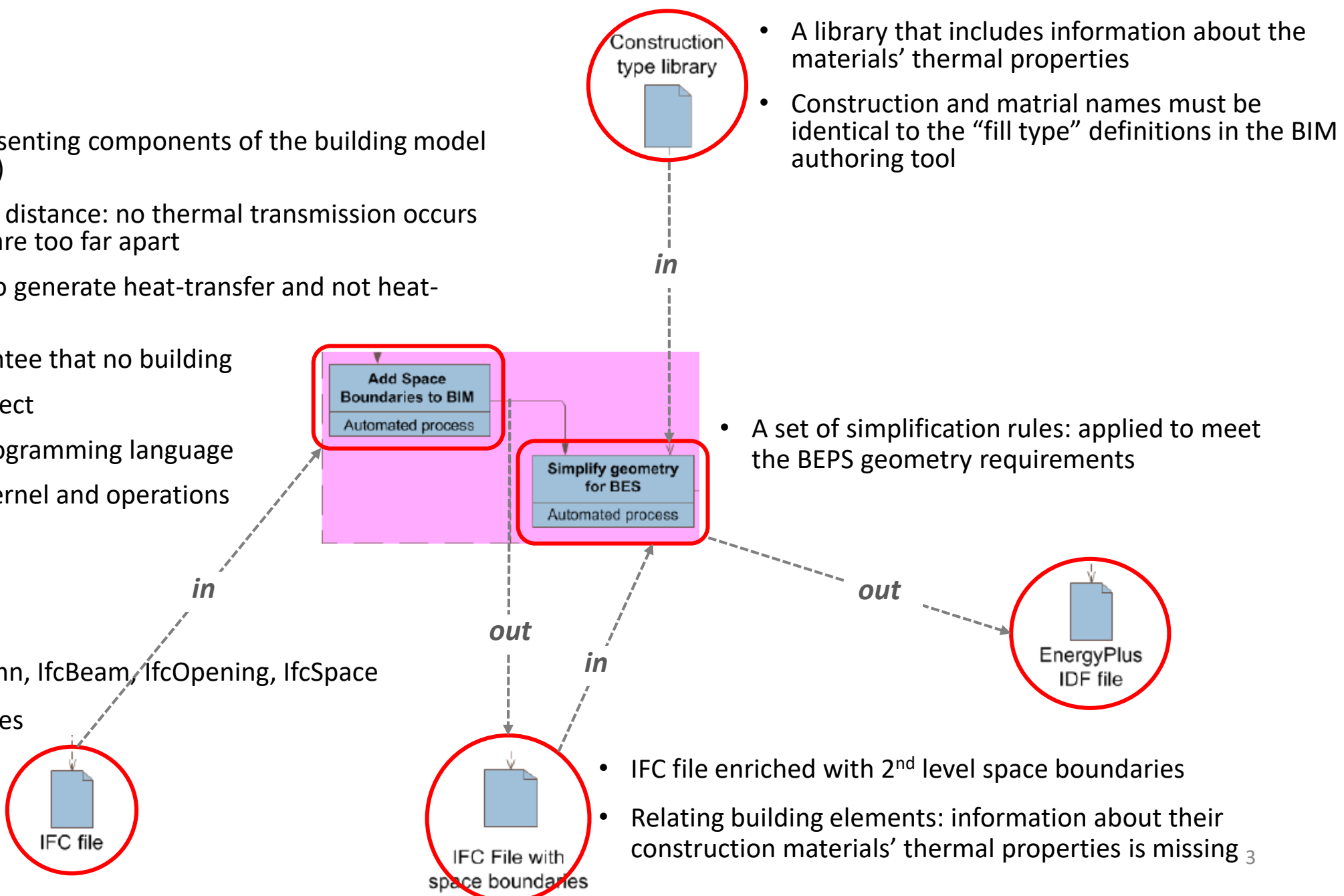Dimitrios Rovas   *University College London, UK*
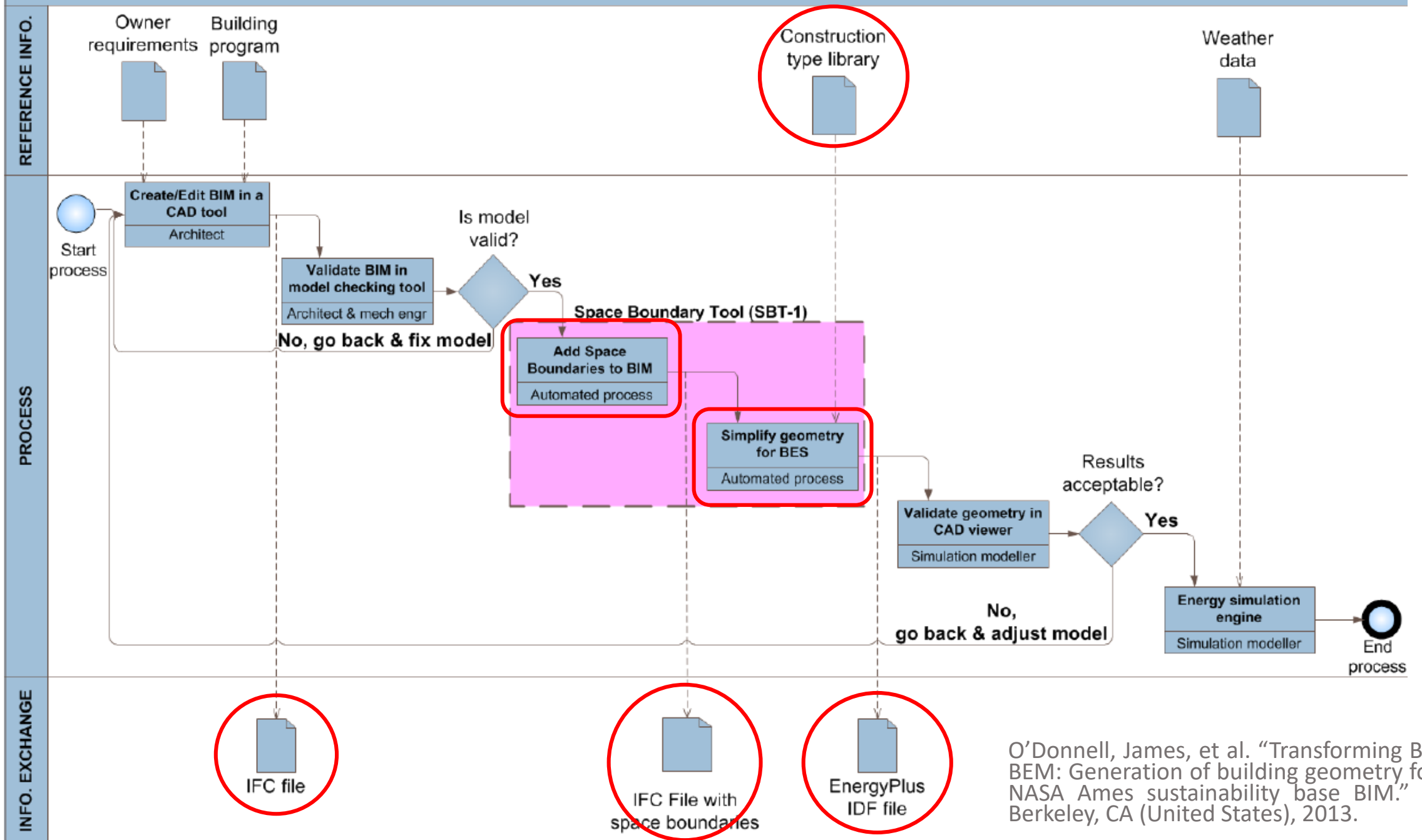
O'Donnell, James, et al. "Transforming BIM to BEM: Generation of building geometry for the NASA Ames sustainability base BIM." LBNL, Berkeley, CA (United States), 2013.

- A library that includes information about the materials' thermal properties

- Construction and matrial names must be identical to the "fill type" definitions in the BIM authoring tool
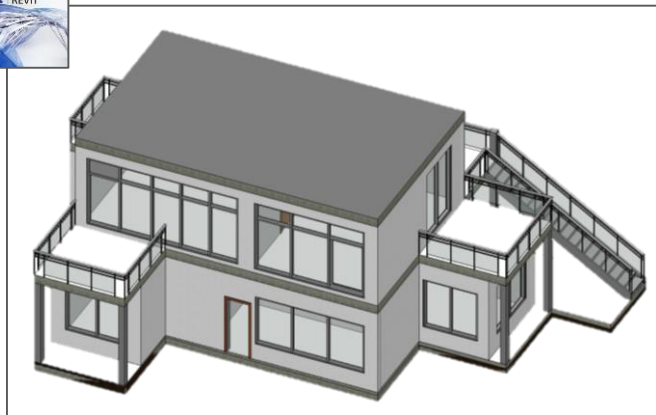
- Undirected graph representing components of the building model (based on graph theory)

- Maximum Transmission distance: no thermal transmission occurs between surfaces that are too far apart

- Traversal of the graph to generate heat-transfer and not heat-transfer boundaries

- Preprocessing to guarantee that no building

  element or space intersect

- Implemented in C++ programming language

- CGAL for a geometric kernel and operations

- A set of simplification rules: applied to meet the BEPS geometry requirements

- IfcWall, IfcSlab, IfcColumn, IfcBeam, IfcOpening, IfcSpace

- 1st level space boundaries

- IFC file enriched with 2nd level space boundaries

- Relating building elements: information about their construction materials' thermal properties is missing

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BIM

Incorrect or Missing 1st Level Space Boundaries

OptEEmAL | OPTIMISED ENERGY EFFICIENT DESIGN PLATFORM FOR REFURBISHMENT AT DISTRICT LEVEL

https://www.opteemal-project.eu/
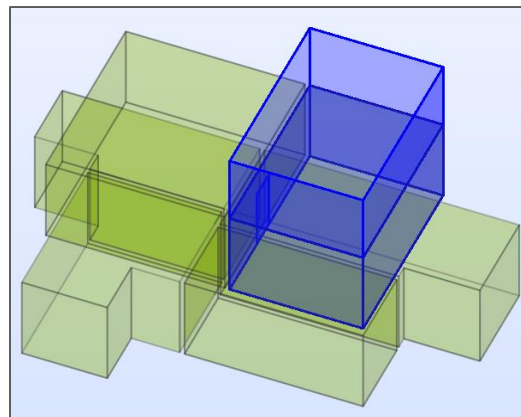
Correct population of the 2nd level space boundaries
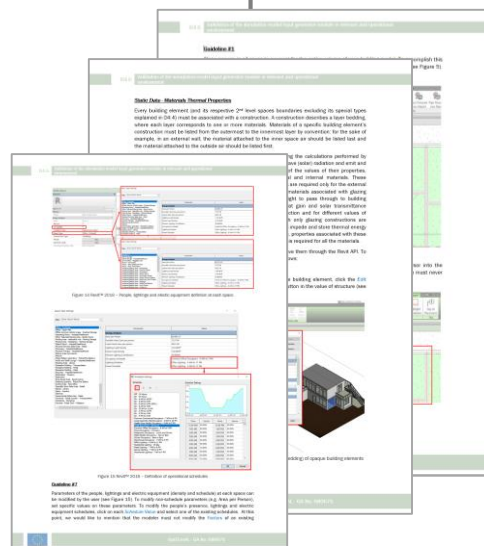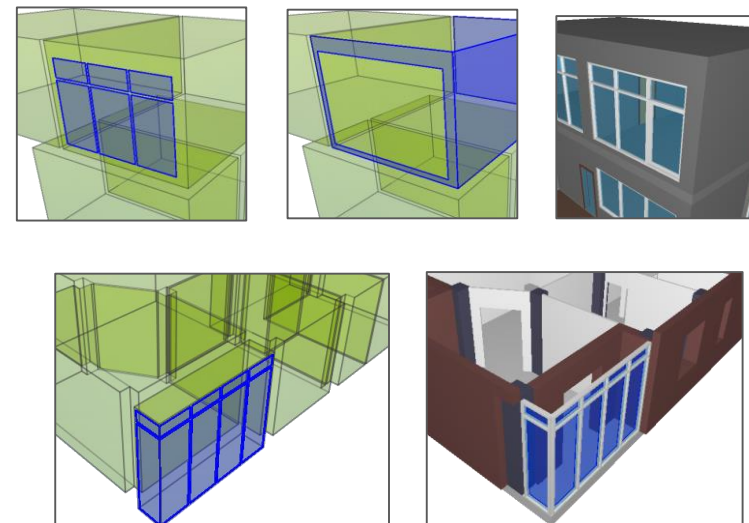
Design Guidelines

Export IFC

File name: C:\Users\Kyriakos\Desktop\Demo4.ifc   Browse ...

Current selected setup: IFC4 Design Transfer View   Modify setup ...
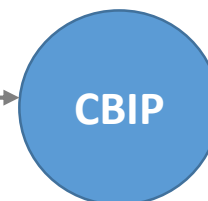
IFC Version: IFC4 Design Transfer View

Projects to export:

☑ Demo4.rvt

Modified version to support the OptEEmAL Project   Export   Cancel

IFC exporter modification

CBIP

Lilis, Georgios N., Georgios I. Giannakis, and Dimitrios V. Rovas. "Automatic generation of second-level space boundary topology from IFC geometry inputs." *Automation in Construction* 76 (2017): 108-124.

Level 1:
Project Title: Space Boundary Tool 1

Developed by the Interoperability Team of the Simulation Research Group at LBNL.
http://simulationresearch.lbl.gov/

REFERENCE INFO.

Owner requirements | Building program | Design Guidelines | IFC exporter modification | Construction type library | Weather data

PROCESS

Start process

Create/Edit BIM in a CAD tool — Architect

Validate BIM in model checking tool — Architect & mech engr

Is model valid?

Yes

No, go back & fix model

Space Boundary Tool (SBT-1)

Add Space Boundaries to BIM — Automated process

Simplify geometry for BES — Automated process

Validate geometry in CAD viewer — Simulation modeller

Results acceptable?

Yes

No, go back & adjust model

Energy simulation engine — Simulation modeller

End process

IfcCurtainWall

Missing or incorrect 1st level space boundaries

Compatible with IFC4

INFO. EXCHANGE

IFC file

IFC File with space boundaries

EnergyPlus IDF file

O'Donnell, James, et al. "Transforming BIM to BEM: Generation of building geometry for the NASA Ames sustainability base BIM." LBNL, Berkeley, CA (United States), 2013.