



IBPSA-NORDIC
The Nordic regional affiliate
of IBPSA World

Workflow for the generation of multiple illuminance files for distinct daylit spaces in apartment blocks.

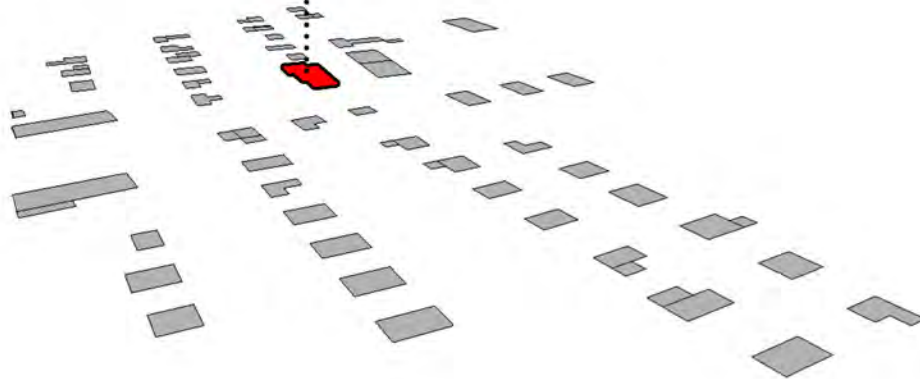
Iason Bournas

Energy and Building Design, Department of Architecture and the Built Environment, LTH, Lund, Sweden

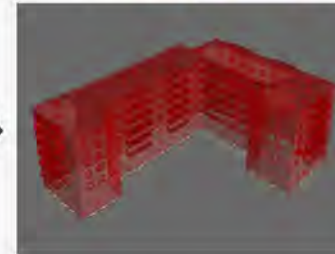
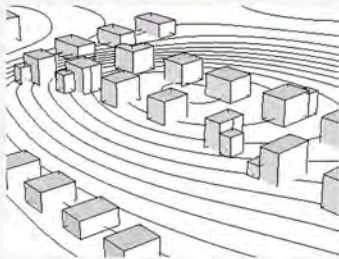
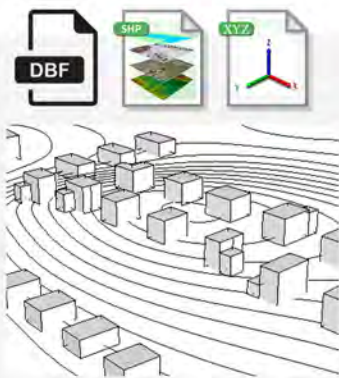
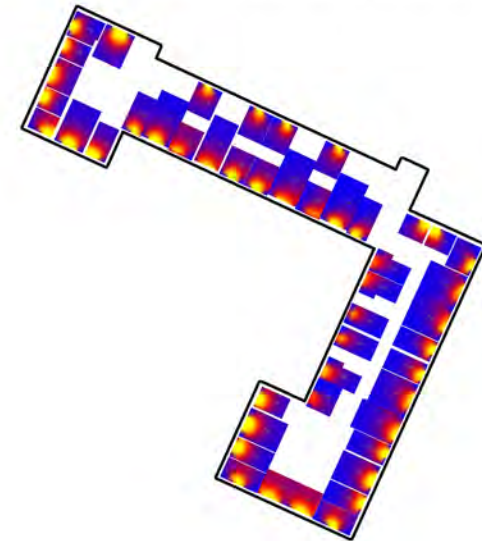


LUND
UNIVERSITY

Building footprint



Illuminance per room

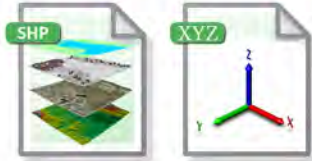


Terrain + Surroundings Drawings retrieval Raster-to-CAD Daylight model Simulation run Results



Terrain generation

Import shp or xyz file formats

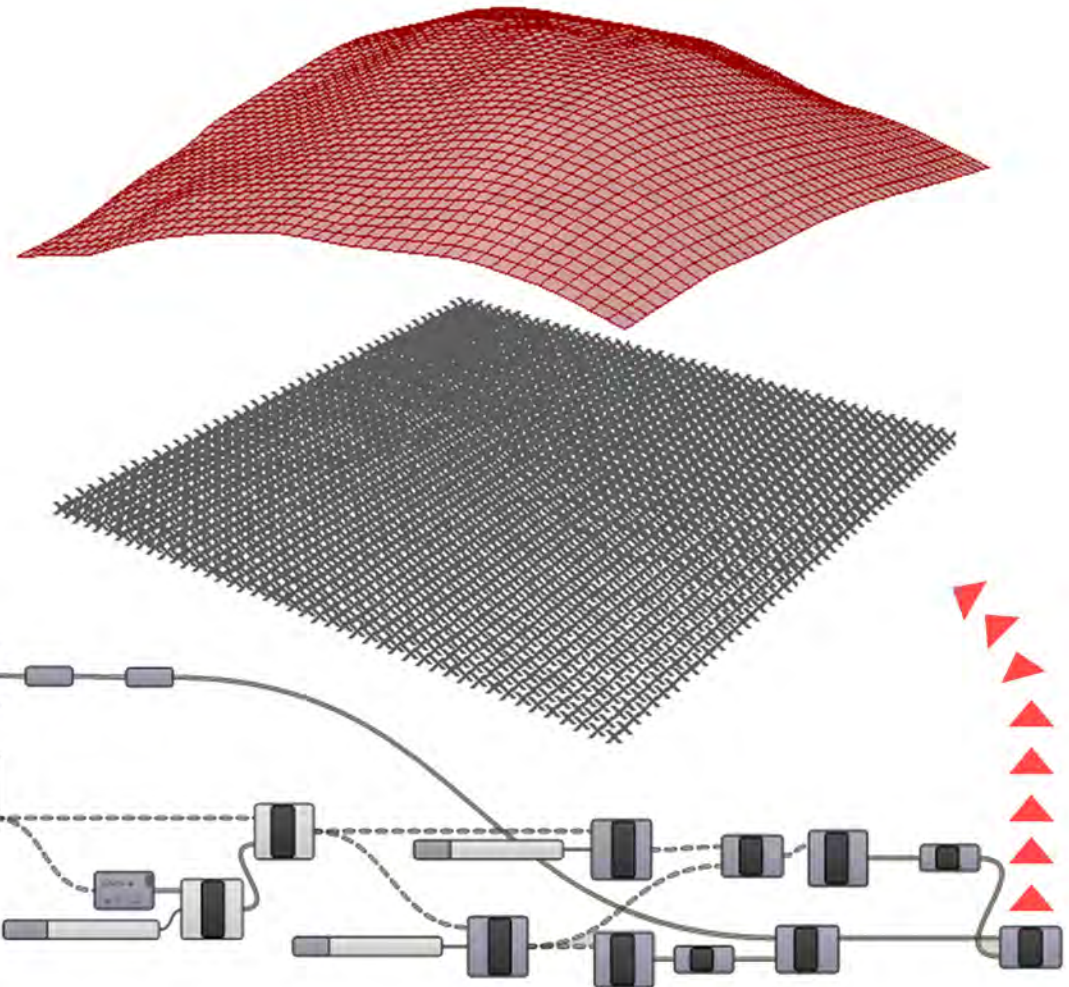


1. Geometry (points)

Import dbf file format



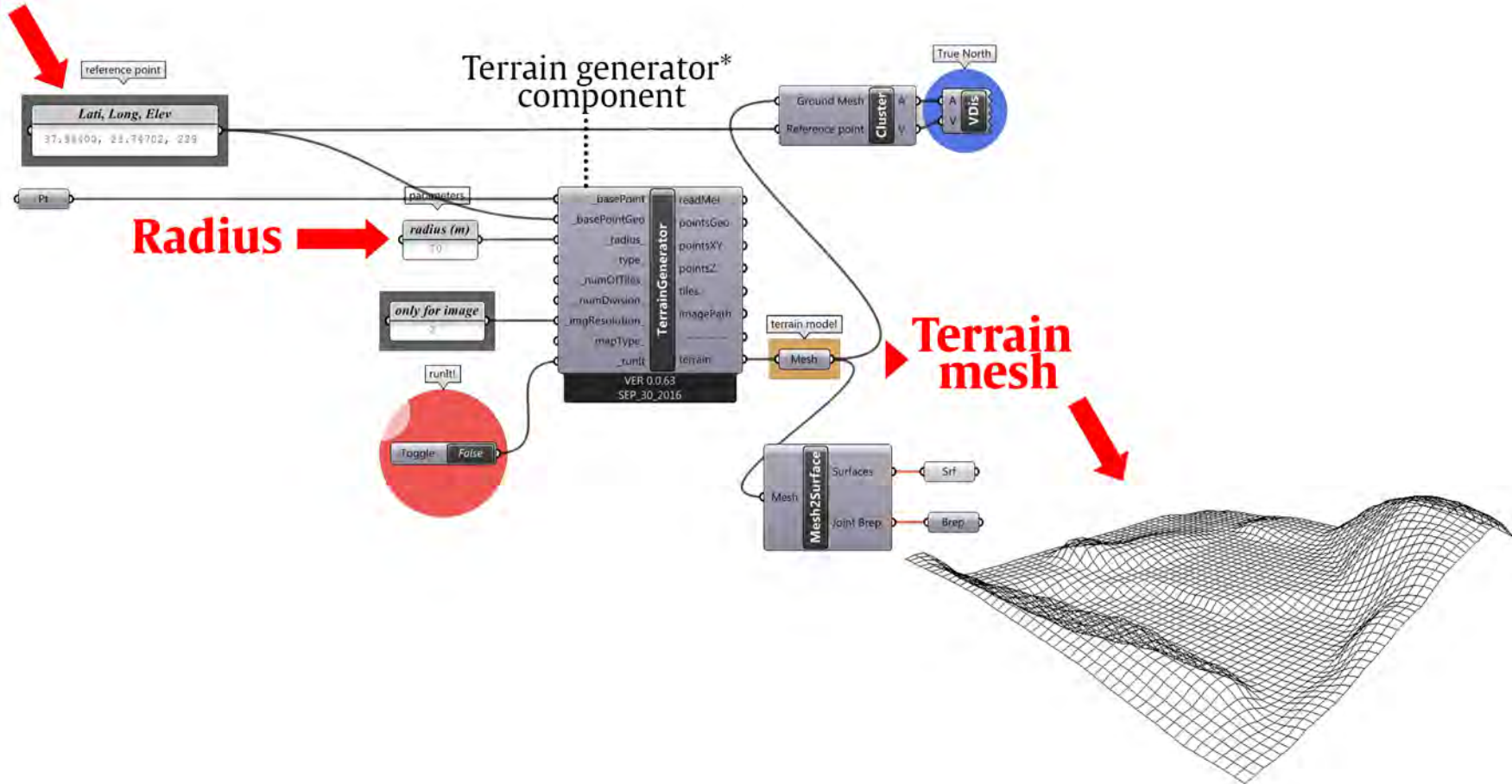
2. Attributes (elevation)



Terrain generation (alternative)

Center point (3 inputs)

1. Latitude
2. Longitude
3. Elevation



* Developed by Antonello Di Nunzio for "Ladybug: A plugin for environmental analysis"

Terrain generation (alternative)



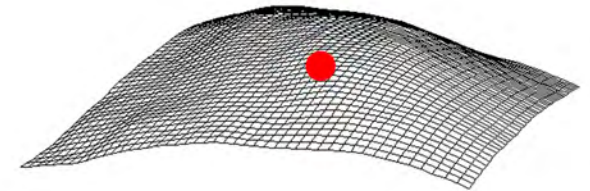
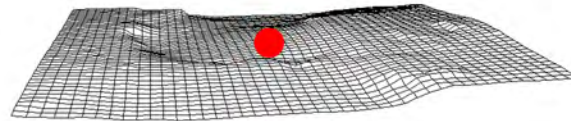
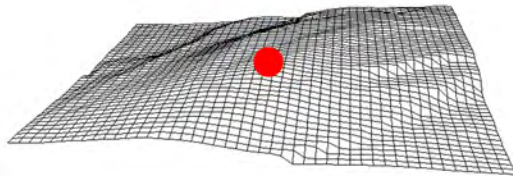
Hasleparken, Oslo



Ørstedsparken, København



Malminkartanonhuippu, Helsinki



Surroundings

Import shp or xyz file formats



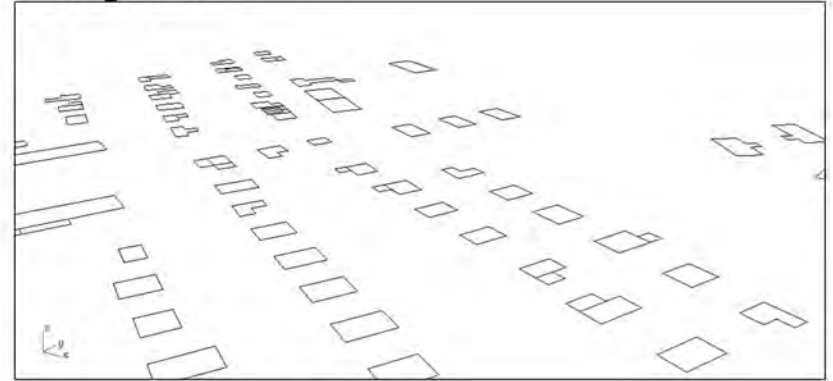
1. Geometry (footprints)

Import dbf file format

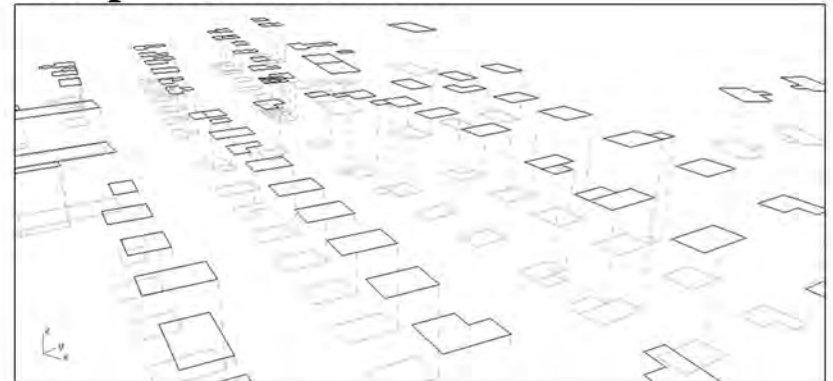


2. Attributes (elevation, height)

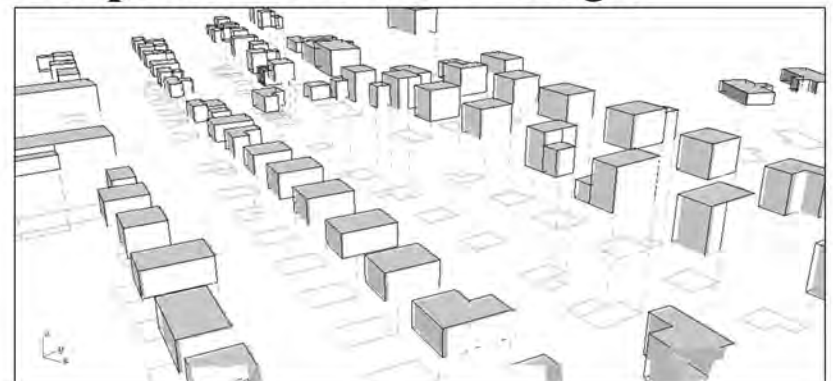
Footprints



Footprints + Elevation

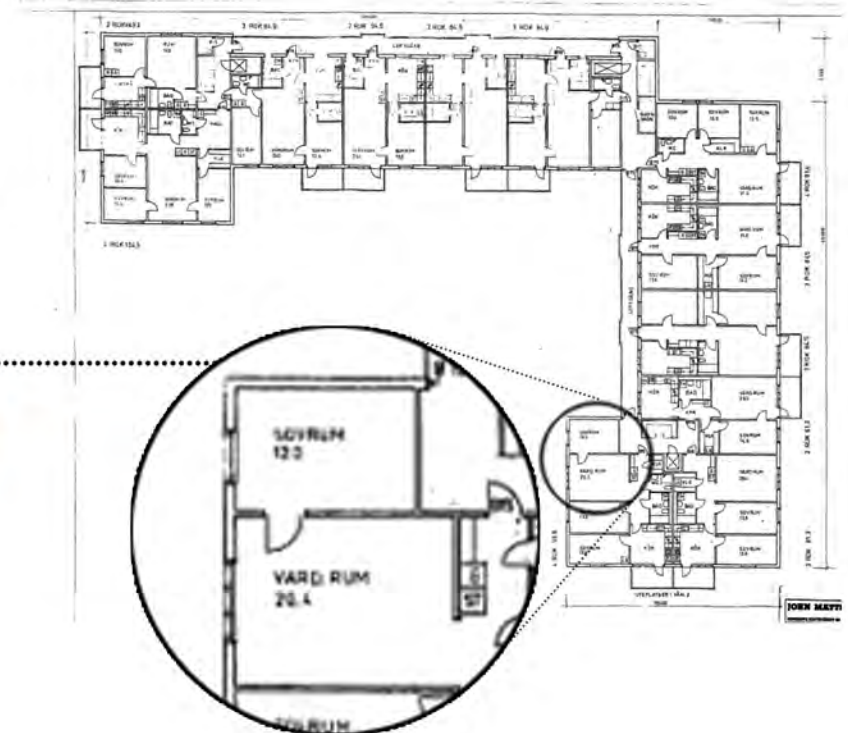
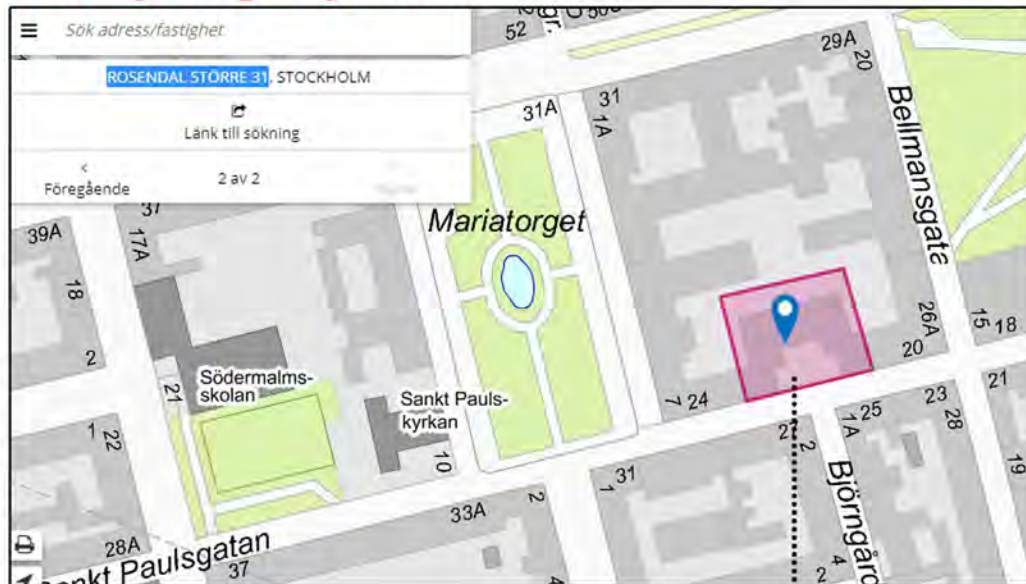


Footprints + Elevation + Height

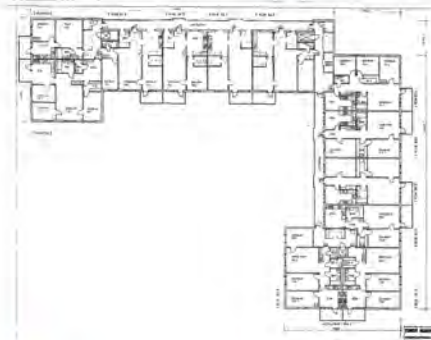


Drawing access

Find by Property Name



CAD format



A

Input geometry

1. External wall line
2. Room wall line
3. Window (3 segments)

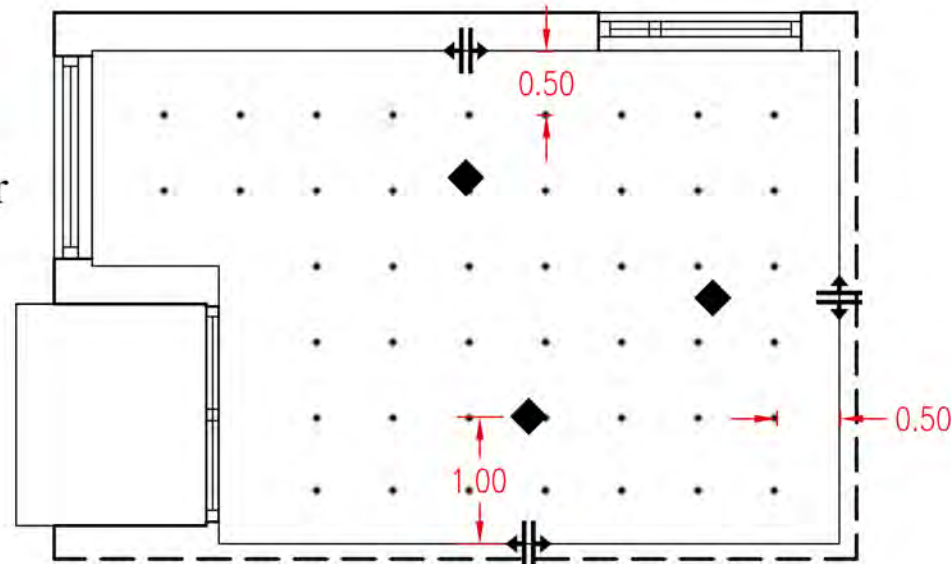
B

Input text string

1. Floor nr
3. Apartment nr

`_2_Livingspace_15`

2. Room type



Measurement sensors: ◆ Point • Grid

Room types

Bedroom

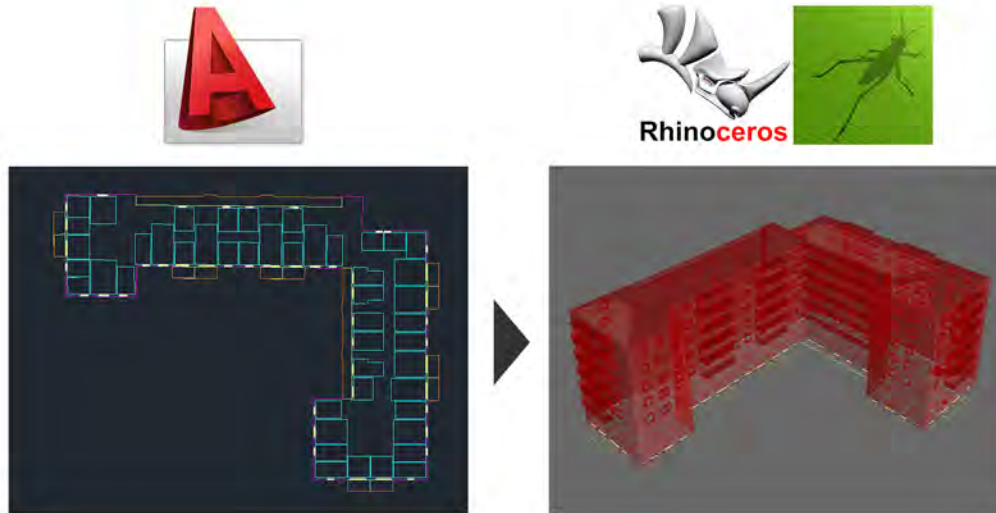
Livingspace

Kitchen

Dining room



Model from 2D to 3D



A Input geometry

1. External wall line

1.1 Facade wall

1.2 Floor slabs

2. Room wall line

1.1 Interior walls

1.2 Room floor

3. Window (3 segments)

1.1 Head

1.2 Sill

1.2 Glass

1.4 Dividers

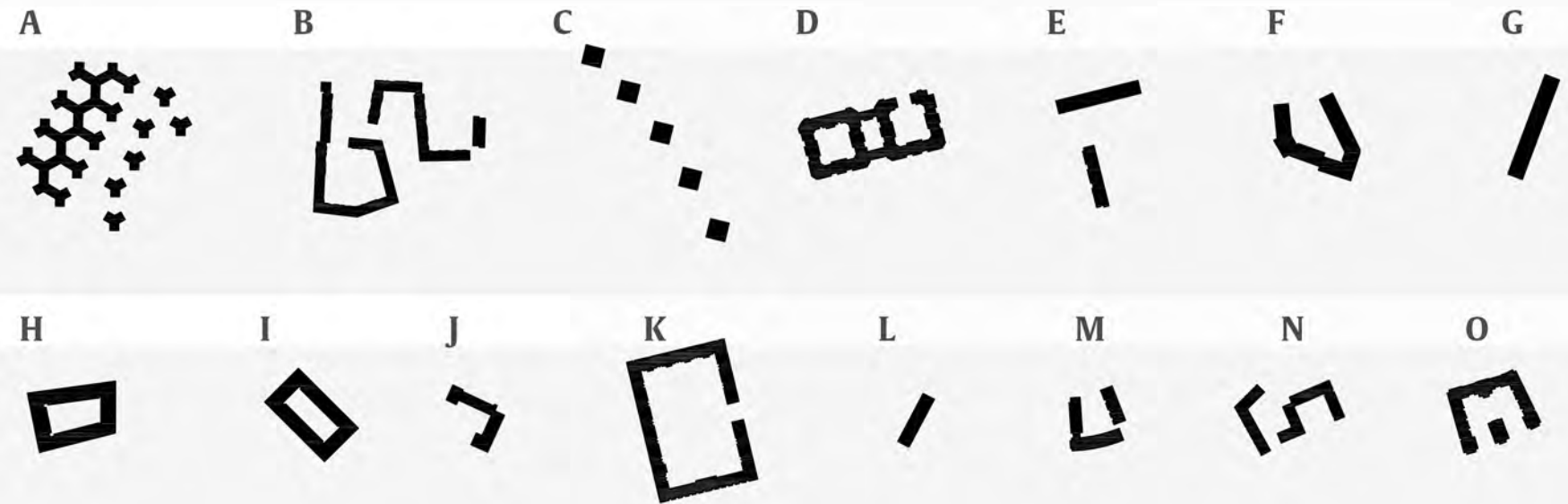


Buildings sample



occupied more than occasionally

STUDIED DEVELOPMENTS

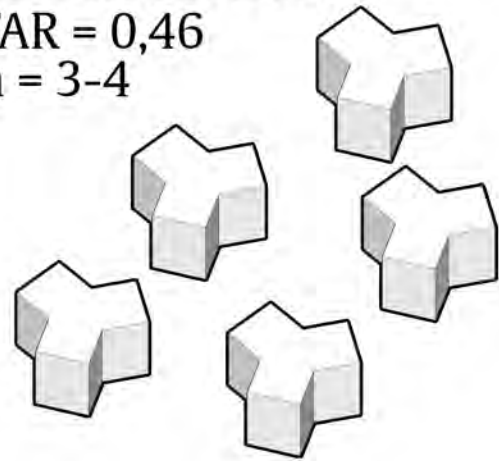


Buildings sample

TYPES

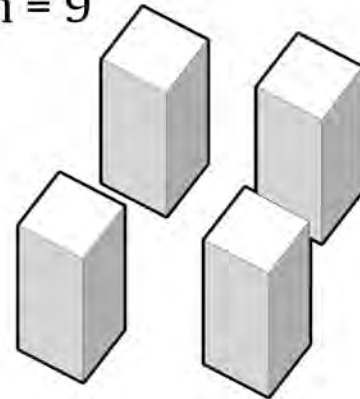
Low rise towers

FAR = 0,46
n = 3-4



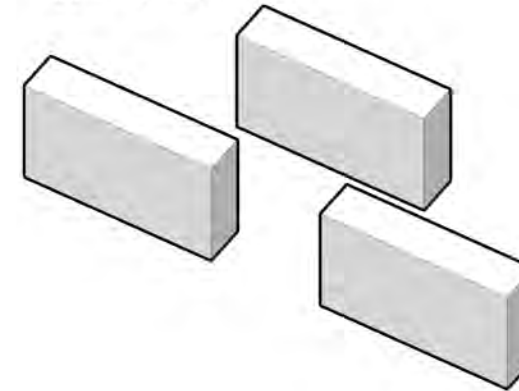
High rise towers

FAR = 1,10
n = 9



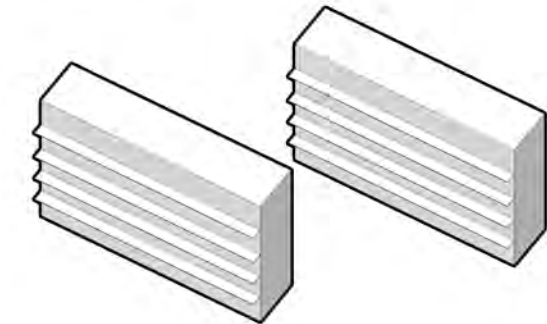
High rise elongated

FAR = 0,60
n = 3-5



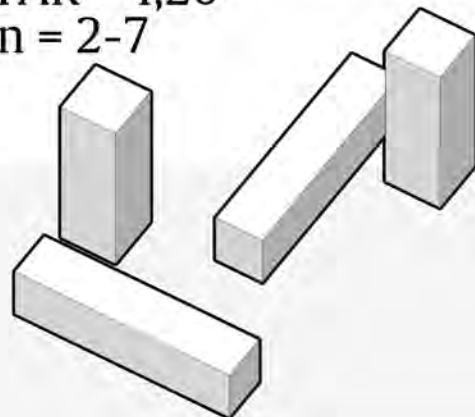
Exterior circulation

FAR = 0,90
n = 5



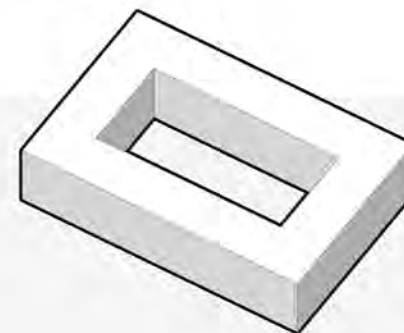
Low + High combination

FAR = 1,20
n = 2-7



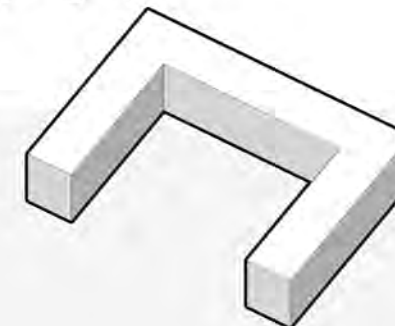
Large courtyard blocks

FAR = 1,70
n = 4-5



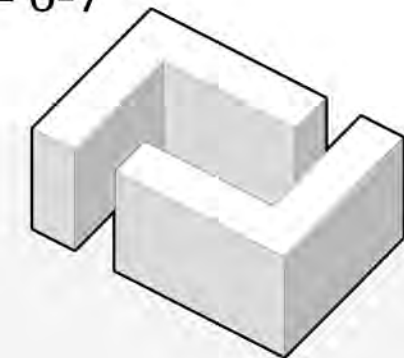
Semi-open courtyard

FAR = 0,60
n = 3-4



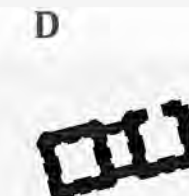
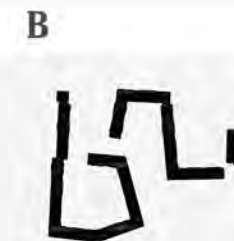
Post modern reforms

FAR = 2,10
n = 6-7



**Multi-story dwellings represent
51 % of the Swedish building stock**

STUDIED DEVELOPMENTS



Buildings sample - performance by type

% of rooms where DFp $\geq$ 1 %		98	93	77	61	47	47	39	36
		High-rise tower	Semi-open courtyard	Low-rise tower	High-rise elongated	High-rise + Low-rise	Exterior circulation	Large courtyard	Post-modern reform quarters
(of total room number per type)	Average DF (%)	3,8	2,5	2,3	2,7	2,0	1,8	1,5	1,9
	Median DF (%)	2,3	1,5	1,3	1,8	1,1	1,0	0,8	0,9
	Average DFp (%)	2,2	1,6	1,3	1,8	1,4	1,0	0,9	0,9
	Average U (-)	0,19	0,15	0,13	0,15	0,17	0,16	0,13	0,12

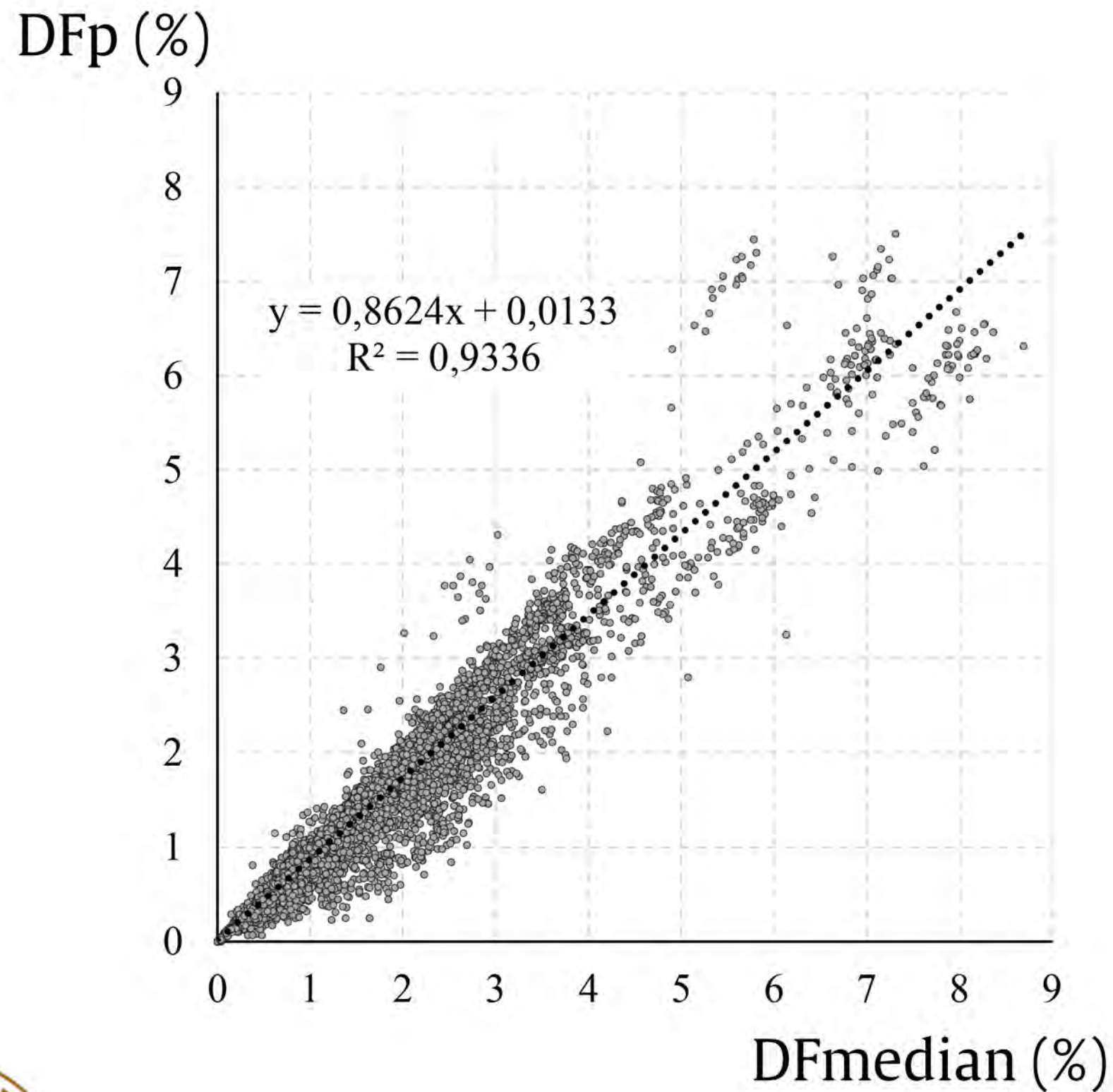
Bold: Highest value

Percentile: ≥ 80 ≥ 60 ≥ 40 ≥ 20 < 20

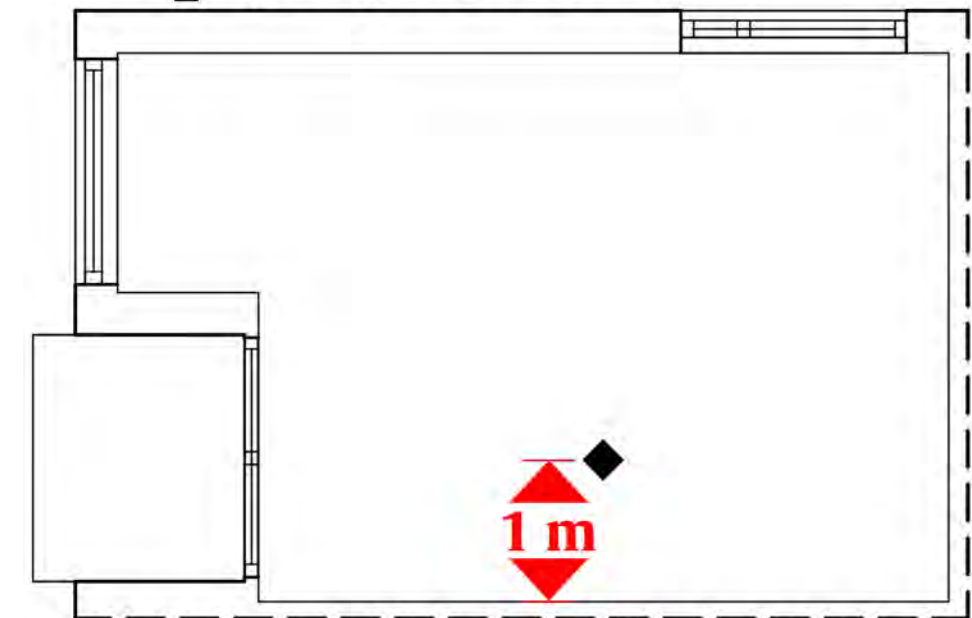


Buildings sample - Alternative room measurement

Subtitute DFp with DFmedian over a floor grid

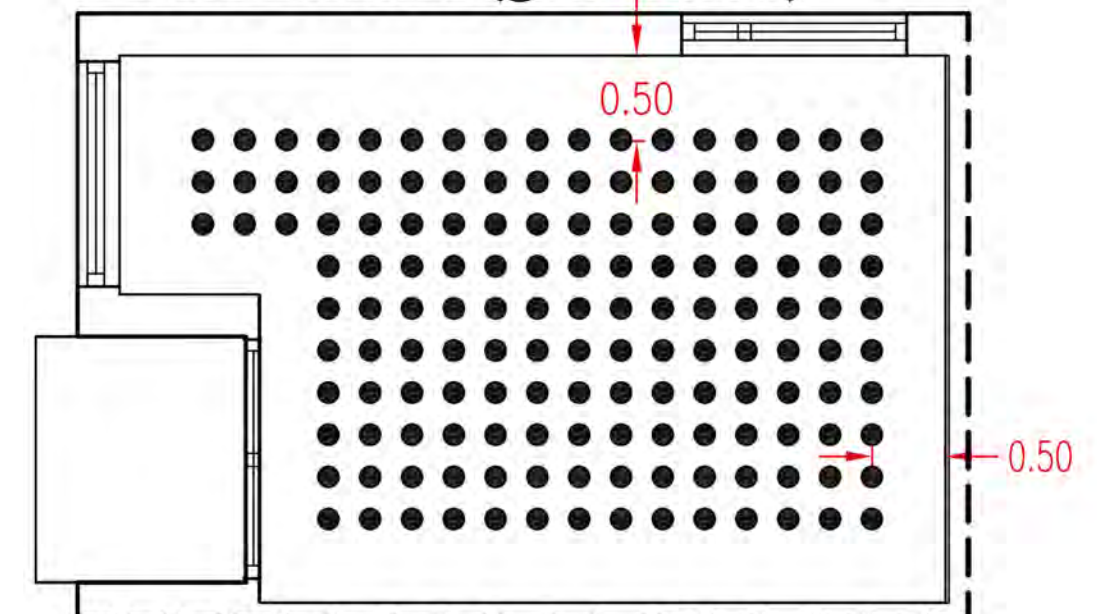


DFp (one point-based)



Measurement sensors: ◆ single point

DFmedian (grid-based)

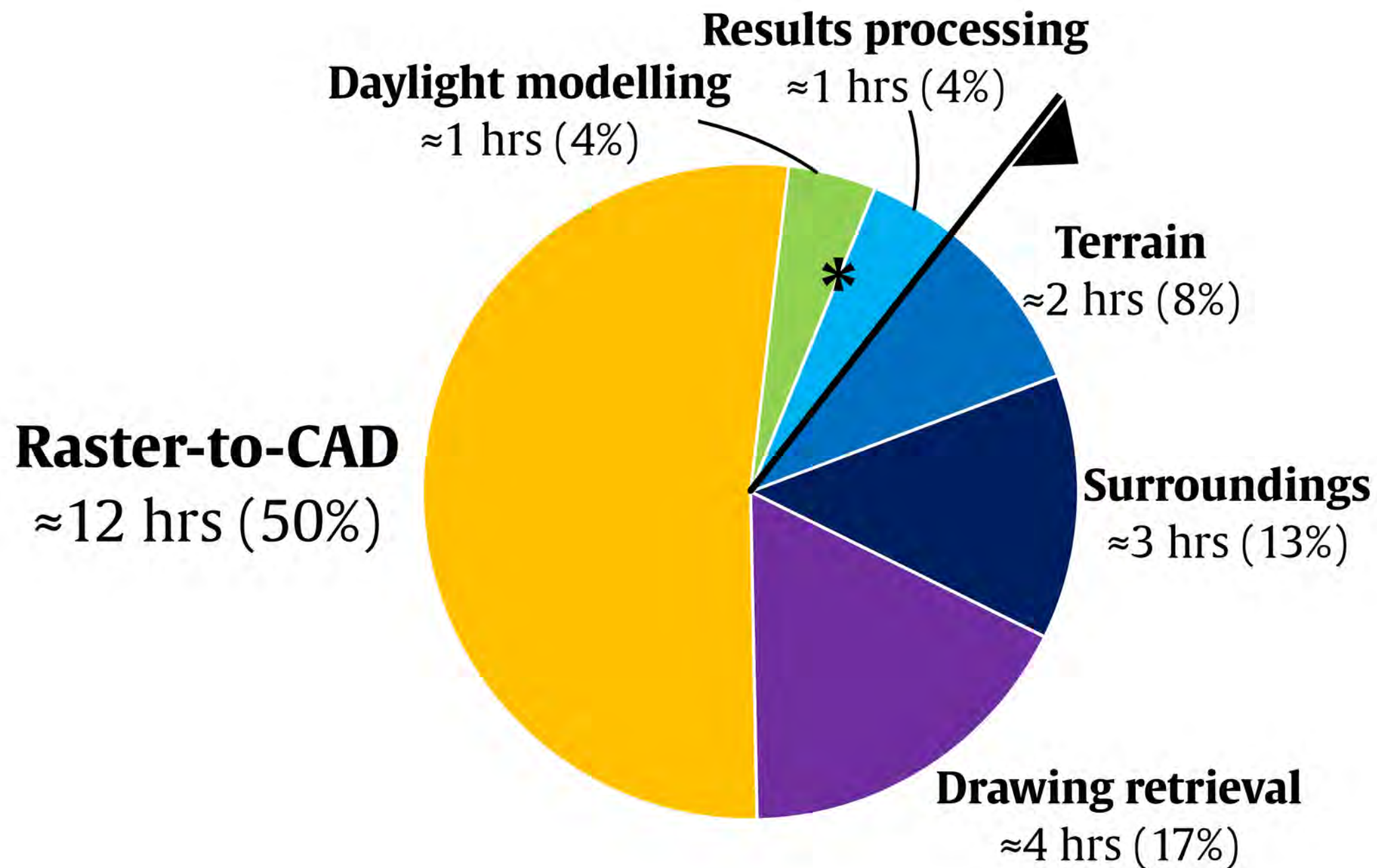


Measurement sensors: • Grid



Future work: Raster-to-CAD

Approximate duration for each process



* + Simulation time



THANK YOU

*Workflow for the generation of multiple illuminance files
for distinct daylit spaces in apartment blocks.*

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