INNOVATIVE BIM TOOLS FOR BUILDING RENOVATION: **3DASH tool**

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CARTIF Technology Centre

Sustainable Places 2022,
Nice, France,
Sep. 7, 2022

SUSTAINABLE PLACES 2022
Sep. 6 - Sep. 9, 2022 | Nice, France

BIM SPEED

CONTENT

- Overview
- 3DASH process
- Demonstration
- Results
- Conclusions
- Publications

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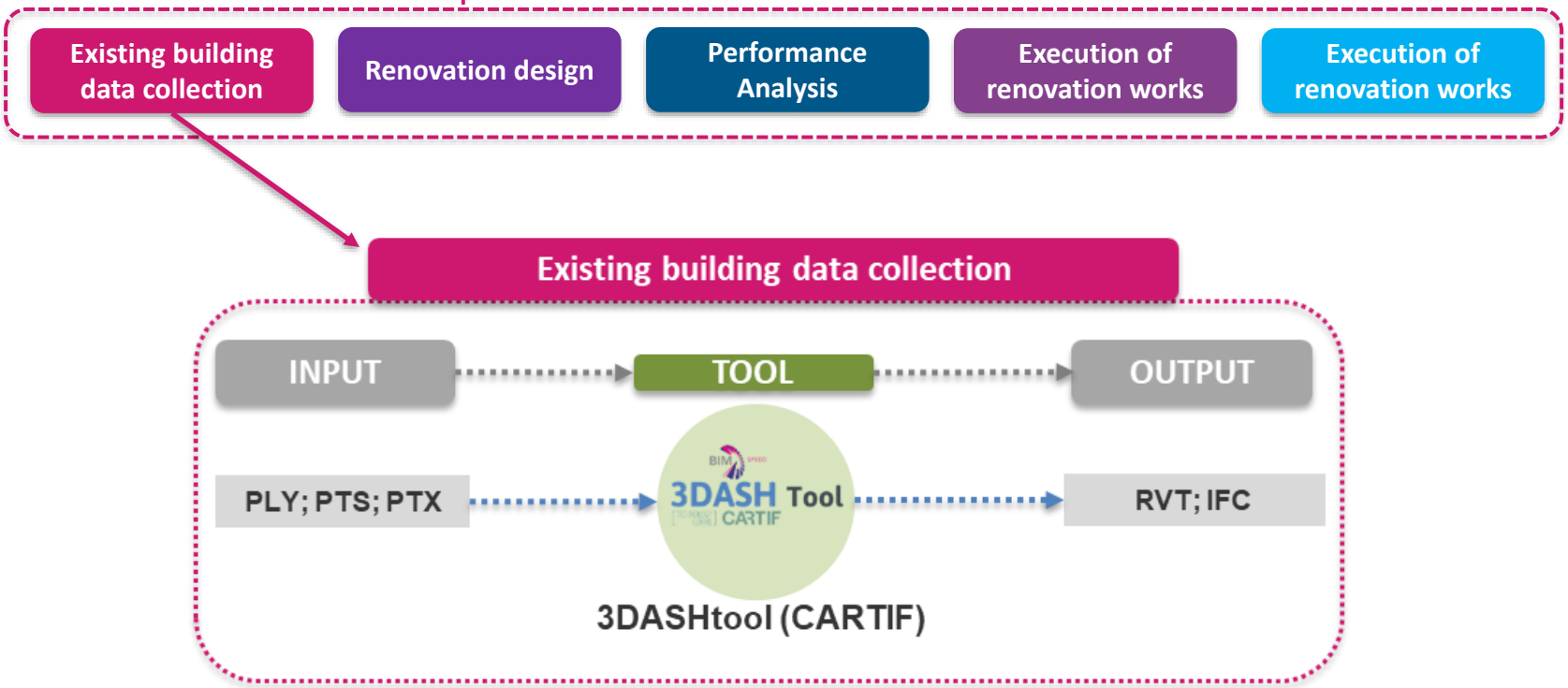
3DASH TOOL: OVERVIEW

- The tool allows the **automatic generation of walls in BIM** (Building Information Modelling) using **point clouds as input**, to facilitate the creation of the **As-Built BIM** models of the buildings **(with a low Level of Development (LOD), such as LOD200)** ⇨ **Scan2BIM**
- **Integrated as a plug in the REVIT software** to simplify the own processes and to avoid the minor use of different software, in contrast to other existing examples where different tools have to be used.
- The 3DASH tool does **not require the manual selection of point clouds**.

3DASH TOOL: OVERVIEW

BIM-SPEED renovation phases



3DASH TOOL: PROCESS

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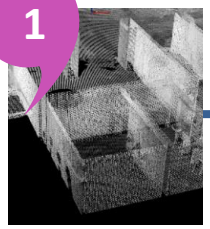
1. Obtain 3D point clouds
2. Launch 3DASH tool service from BIM-SPEED Platform
3. Download and install 3DASH tool in REVIT
4. Automatic generation of walls (point clouds →RVT)

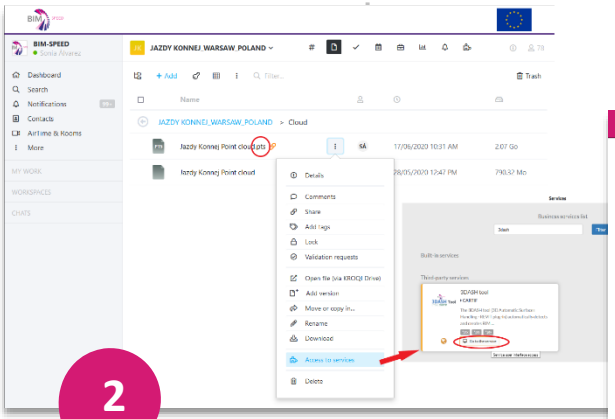


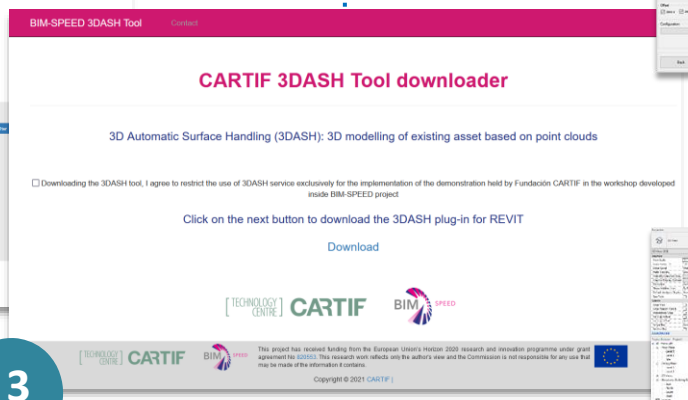
BIM SPEED Platform

BIM Con.

BIM SPEED 3DASH Tool [TECHNOLOGY CENTRE] CARTIF

3DASH Tool [TECHNOLOGY CENTRE] CARTIF

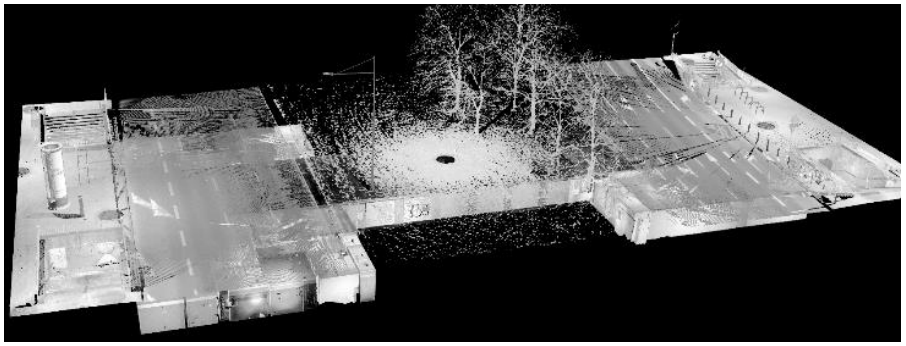


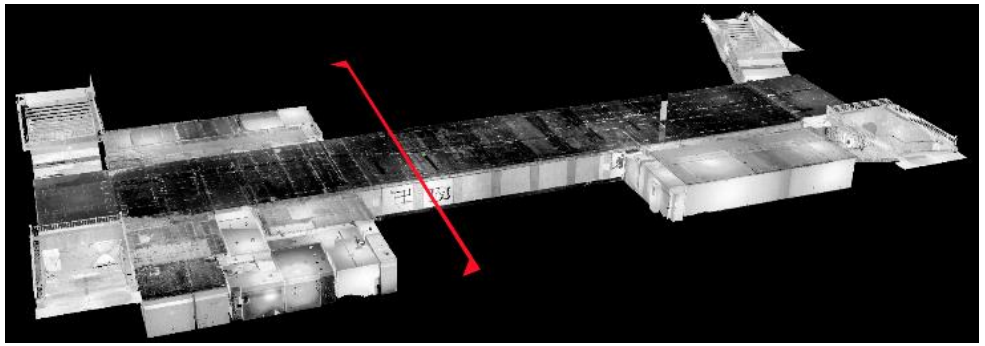


3DASH TOOL: DEMONSTRATION

Warsaw demo site, Poland

- The main goal of the project was to renovate and adapt an underground passage.
- The **documentation** of the existing space was **out of date** and only **available in paper form**
- It was also a **pilot project** for the City of Warsaw to test **openBIM standards**





Before (left) and after (right) the pre-processing of the point cloud.

3DASH TOOL: DEMONSTRATION

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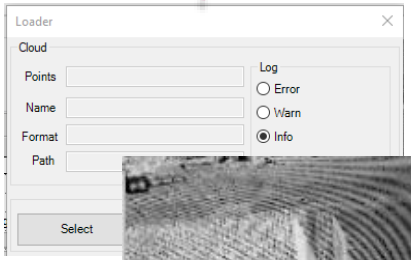
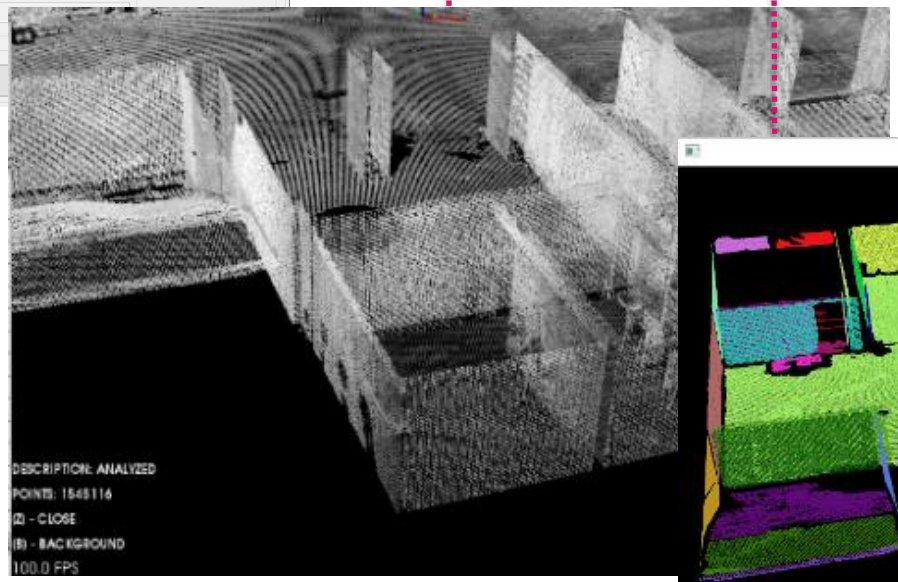
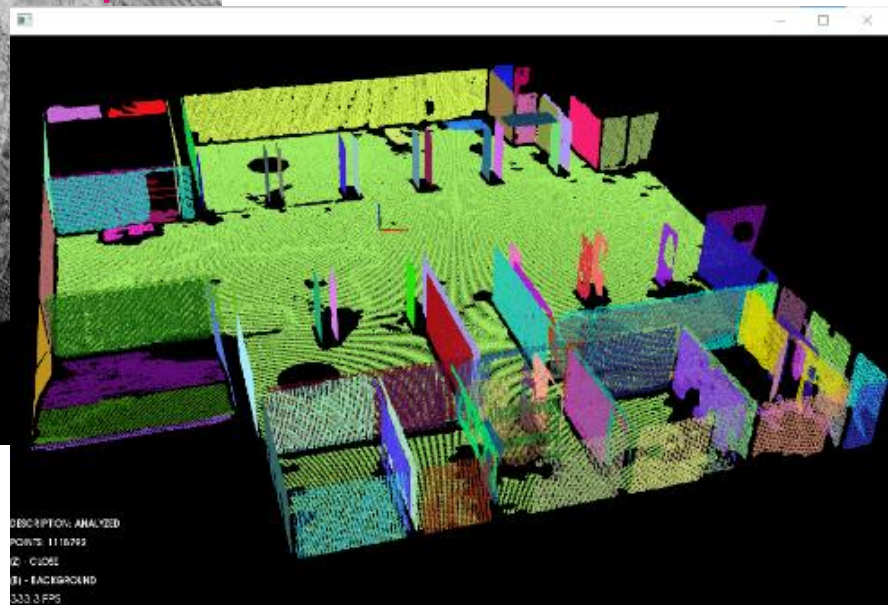
BIM SPEED

LOADER /ANALYSED → PRE-PROCESSING → SEGMENTATION → ANALYSIS → PARAMETERISATION

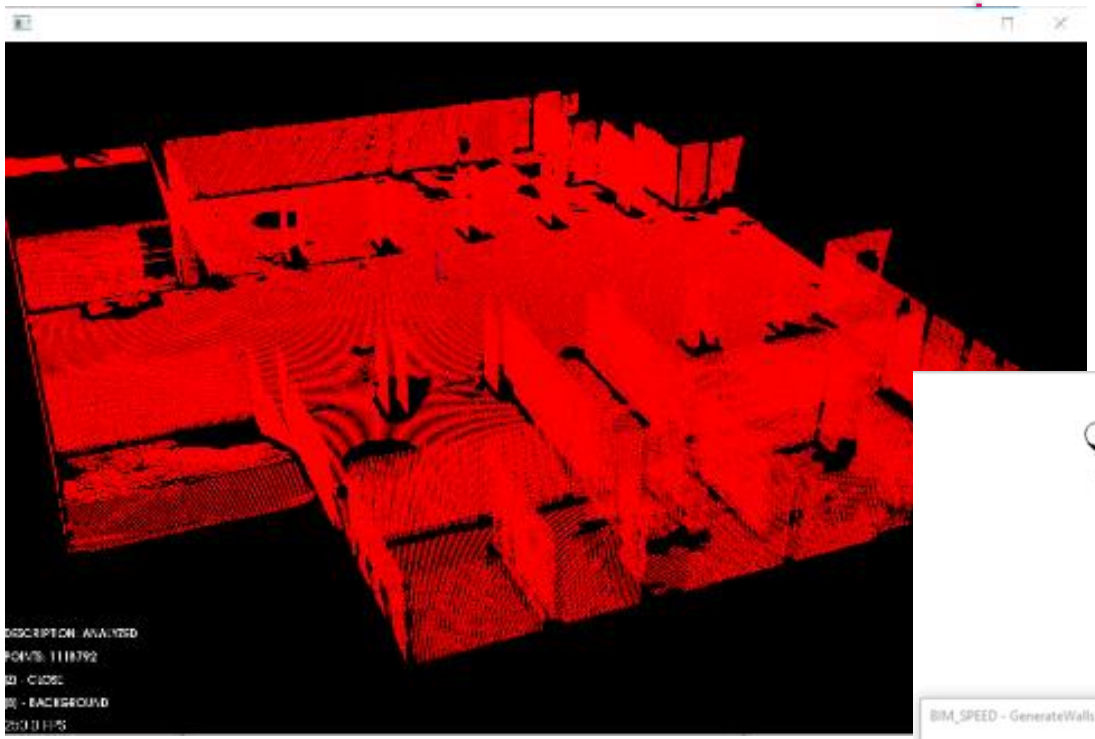


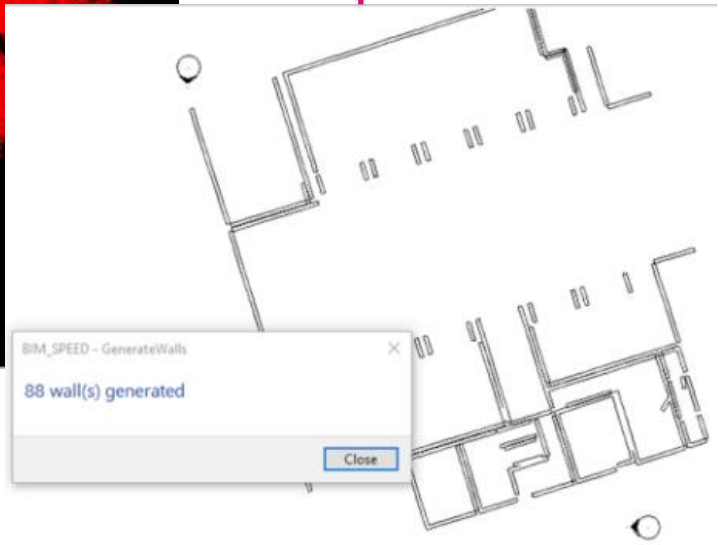




3DASH TOOL: DEMONSTRATION

LOADER /ANALYSED → PRE-PROCESSING → SEGMENTATION → ANALYSIS → PARAMETERISATION





3DASH TOOL: RESULTS

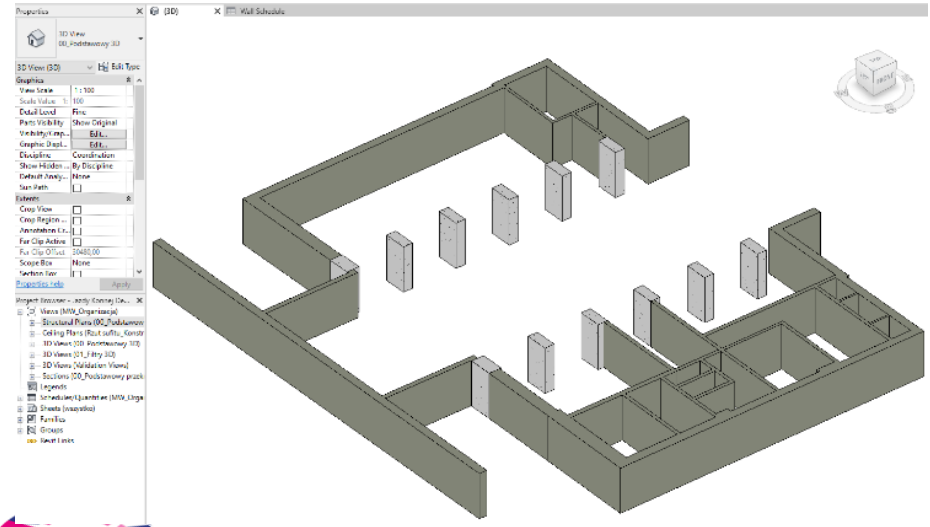
TRADITIONAL WAY

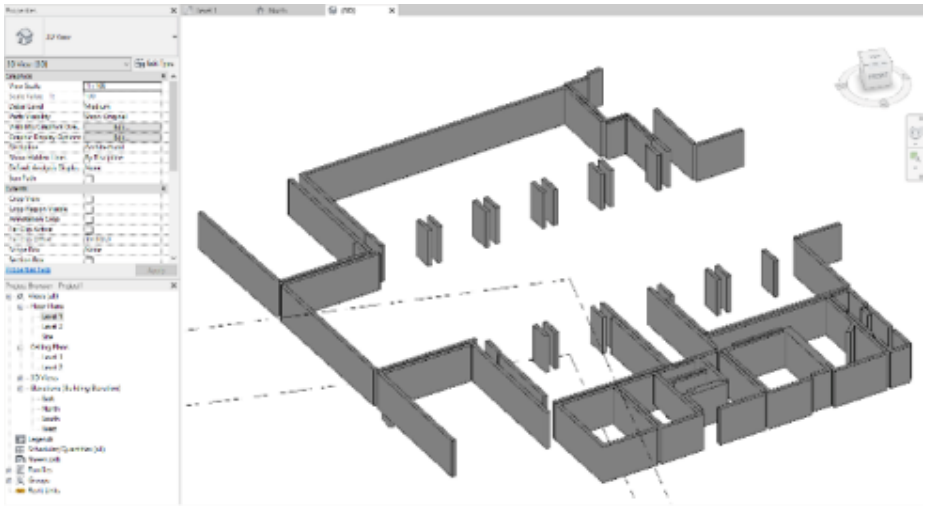
The creation of the model from the pre-processed point cloud took **2 hours and 10 minutes**, where **36 walls and 12 columns** were modelled

Time

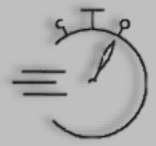
3DASH tool

As a final result of the application of the 3DASH in the demo site, **88 walls** have been generated automatically in **2.26 minutes**





3DASH TOOL: CONCLUSIONS

TRADITIONAL WAY		3DASH tool
The user generates the walls manually using the point clouds as a template, it is a **manual selection of the points**	 **Time reduction**	For the generation of the As-Built BIM models and for comparison with previous existing models of the building
	 **Accuracy**	A **mathematical process based on algorithms** for the detection and generation of walls from point clouds as input automatically

3DASH TOOL: PUBLICATIONS

- (2022) Álvarez-Díaz, S, Román-Cembranos, J., Łukaszewska, A., Dymarski, P. "**3D Modelling of Existing Asset Based on Point Clouds: A Comparison of Scan2BIM Approaches**" (2022). *In proceedings from:* ***IEEE MetroLivEnv 2022****: 2022 IEEE International Workshop on Metrology for Living Environment (MetroLivEnv), Cosenza, Italy, 25-27 May 2022,* https://doi.org/10.1109/MetroLivEnv54405.2022.9826964

- (2022) Álvarez-Diaz, S. **Use Case for buildingSmart** "**3D Modeling of Existing Asset Based on Point Clouds (Scan2BIM)**" https://ucm.buildingsmart.org/use-case-details/2388/en

COLOPHON

THANK YOU!

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Sustainable Places 2022

Workshop: Comfort Eye and Acoustic tool

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IEQ in building renovation process

IEQ assessment in terms of:

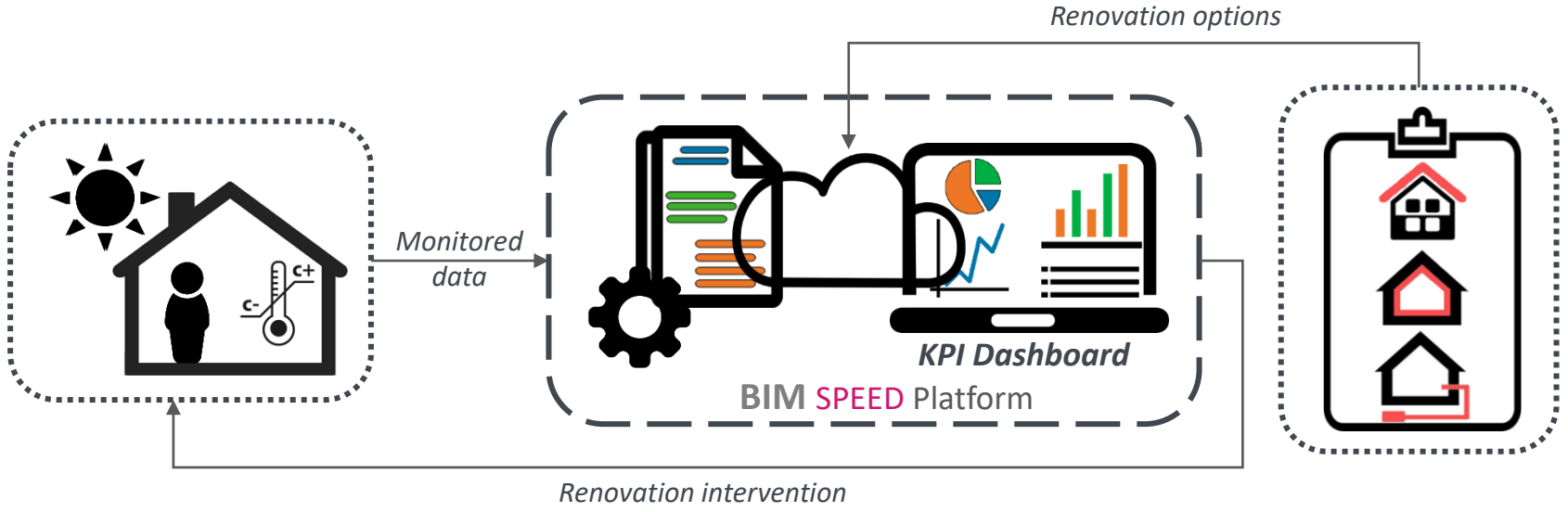
- **Indoor air quality**
- **Thermal comfort**
- **Acoustic comfort**

EN16798, ISO7730, EN12354-3

Methodologies and tools for the holistic building performance assessment.

Framework to **compare building performance pre and post renovation**.

Dashboard for KPI to support the design team, stakeholders and inhabitants to select the optimal renovation solution.



Warmond Demo Case (NL)

These residential apartment blocks were built in 1969 in the village of Warmond in The Netherlands.
Sensor installation and monitoring has been performed in July 2021.

Demo site

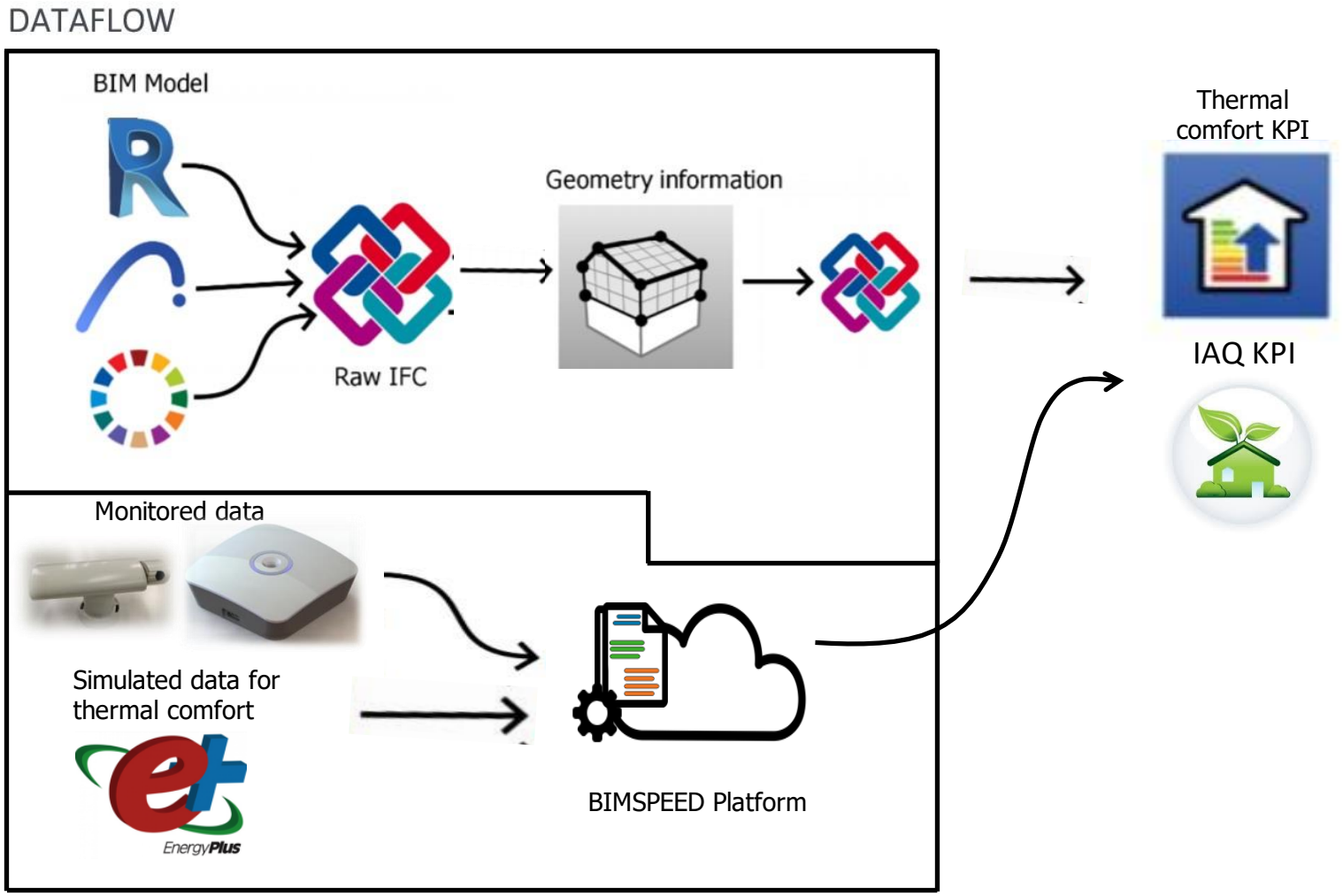
Comfort Eye and Comfort Air installation

Environmental Noise monitoring

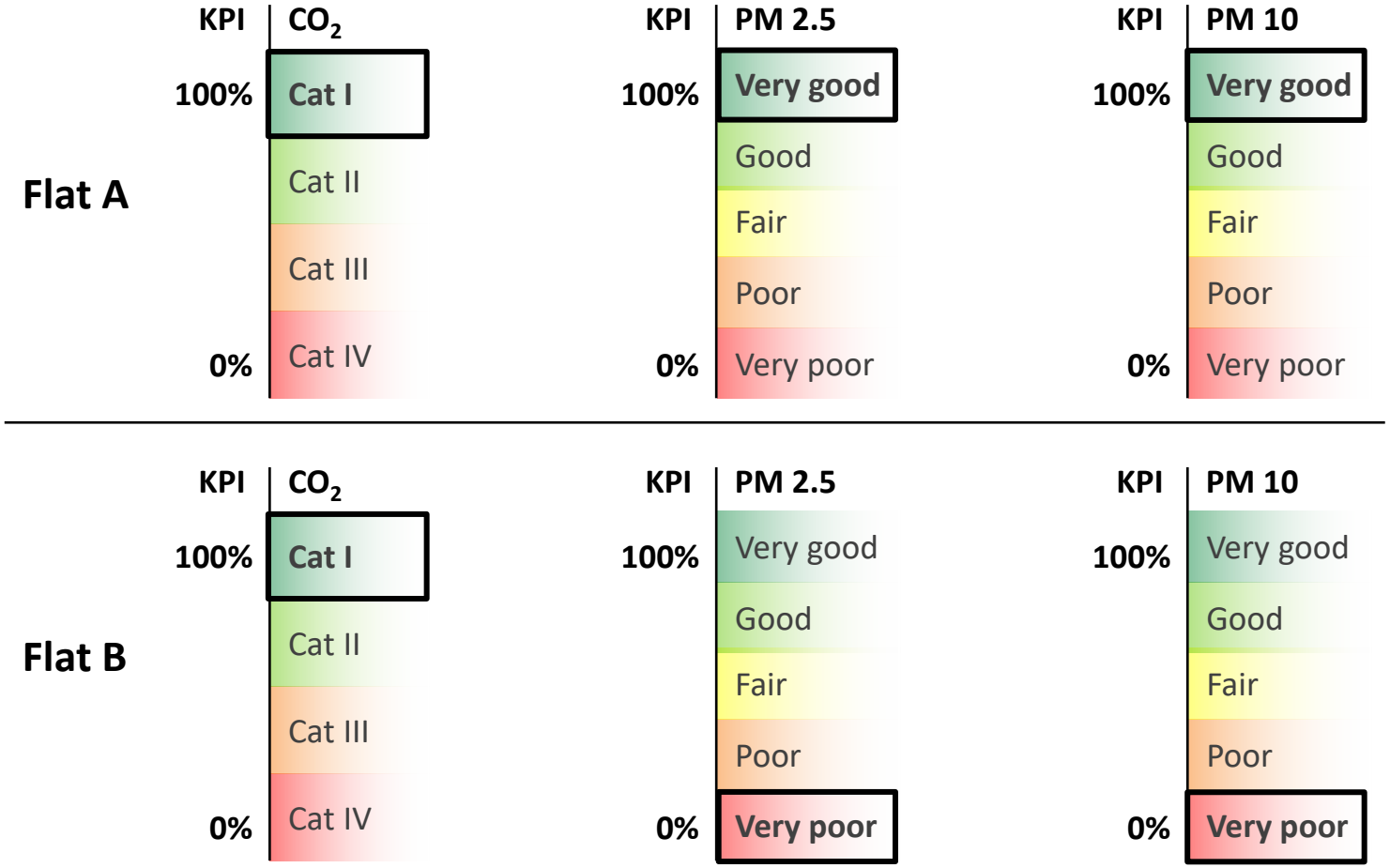
Thermal Comfort and Indoor Air Quality

Collection of information of building **geometric information**

Measured data for the Thermal comfort and Indoor Air Quality



Demo Case - IAQ



Comfort Air

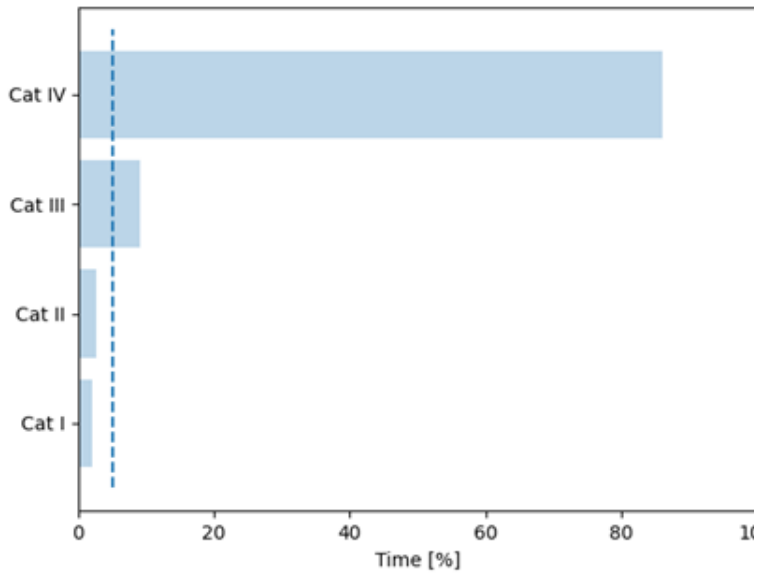
Monitoring period: **summer 2021**

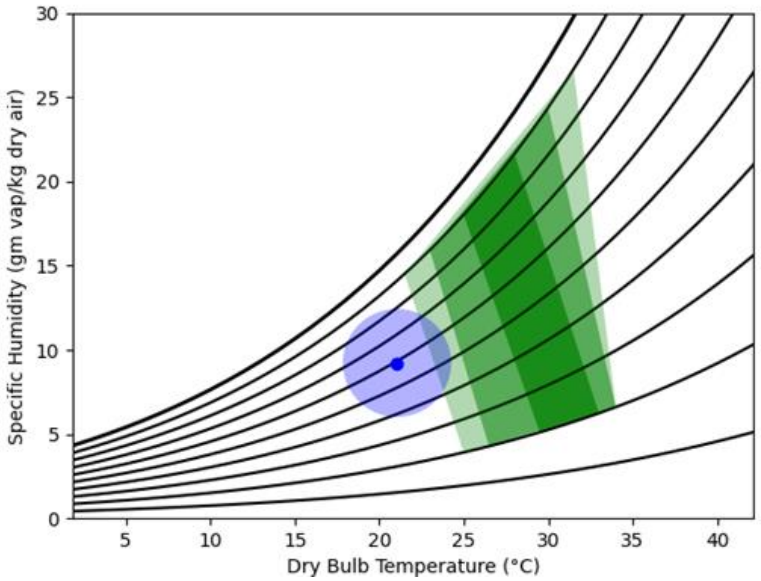
Two apartments in the **same urban area**

It is important to evaluate IAQ also in **winter** due to **lower natural ventilation**.

The difference can be caused by a **different behavior** between inhabitants.

Demo Case – Thermal Comfort





Comfort Eye + **Comfort Air**

Monitoring period: **summer 2021**

Most impacting factors are mean radiant temperature T_{r} and the air temperature T_{a}

Poor performance of **building envelope**

Measured quantities
T_a: air temperature
T_{r}: mean radiant temperature
RH: relative humidity

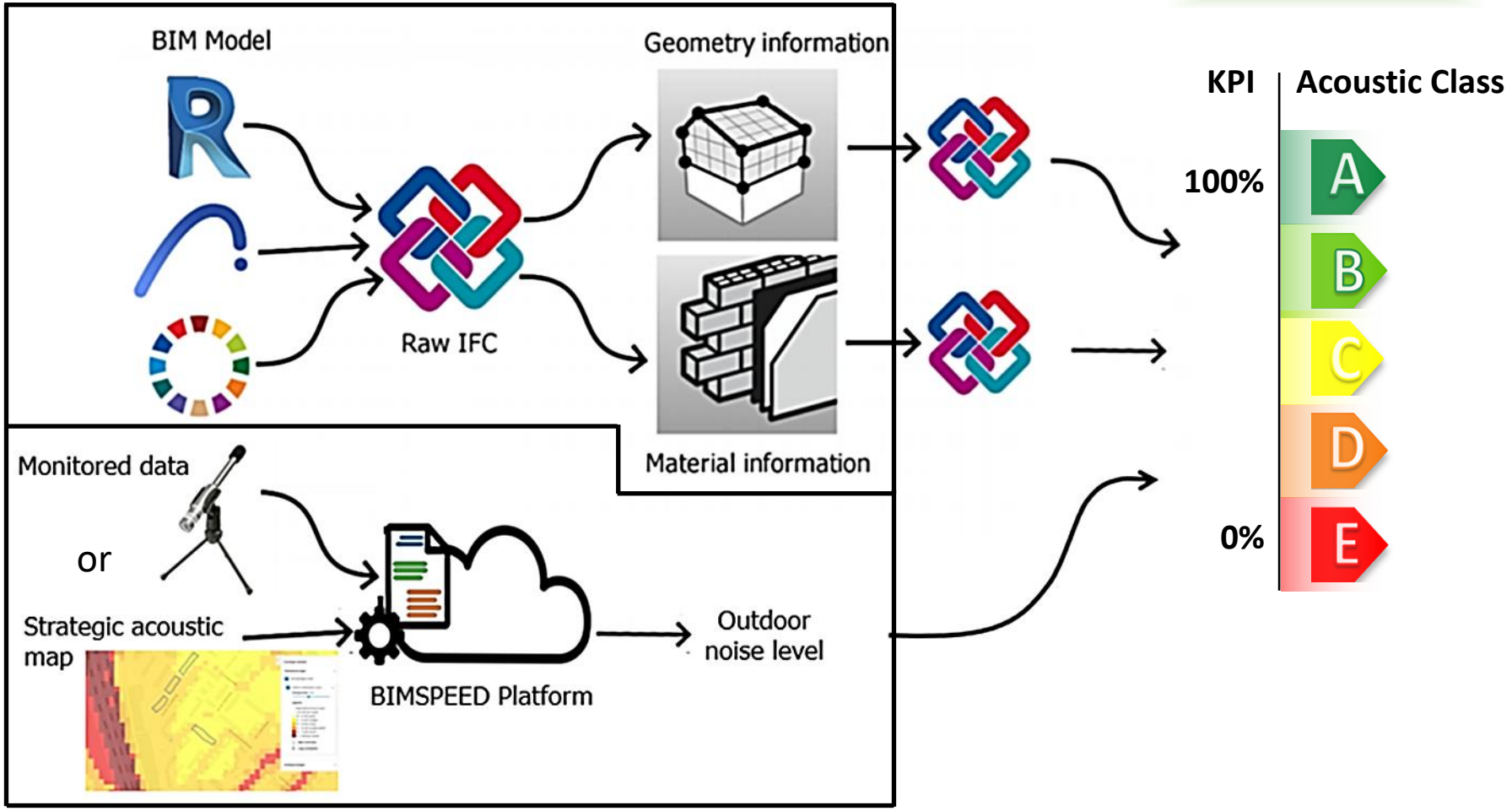
Assumed quantities	
V_a: air speed	0.05 m/s
M: metabolic rate	1.2 met
I_{cl}: clothing insulation	0.5 clo

KPI	**PMV Category**	
100%	Cat I	PMV ±0.2
	Cat II	PMV ±0.5
	Cat III	PMV ±0.7
0%	Cat IV	PMV ±1

Acoustic Comfort

Calculation of
Sound Reduction Index
of external façades

Collection of information on
Outdoor Noise Level



IFC4Acoustic parser (CARTIF)

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1. Generate IFC file
2. Launch ETL from Platform
3. Extract, Transform, Load IFC→JSON
4. Acoustic assessment calculation (JSON output)
5. Store results in Platform

	Building	Room	Elements in façade	Walls
Input	Land use (countryside, residential area, urban area)	End use, volume, floor area, shape, floor level, external noise pressure level, balcony material/ width	Element type (window, door, small element)	Layer thickness/ density

5


```
"Buildings": {
    "Building Class": "A",
    "Building ID": 1,
    "Building KPI": 95,
    "Building Message": "High level of building acoustic comfort: retrofit interventions on building envelope are not required",
    "Critical Room Facades Class": "E",
    "Critical Room Facades ID": 81,
    "District Class": "A",
    "District KPI": 95,
    "District Message": "High level of district acoustic comfort: retrofit interventions on buildings are not required"
},
```

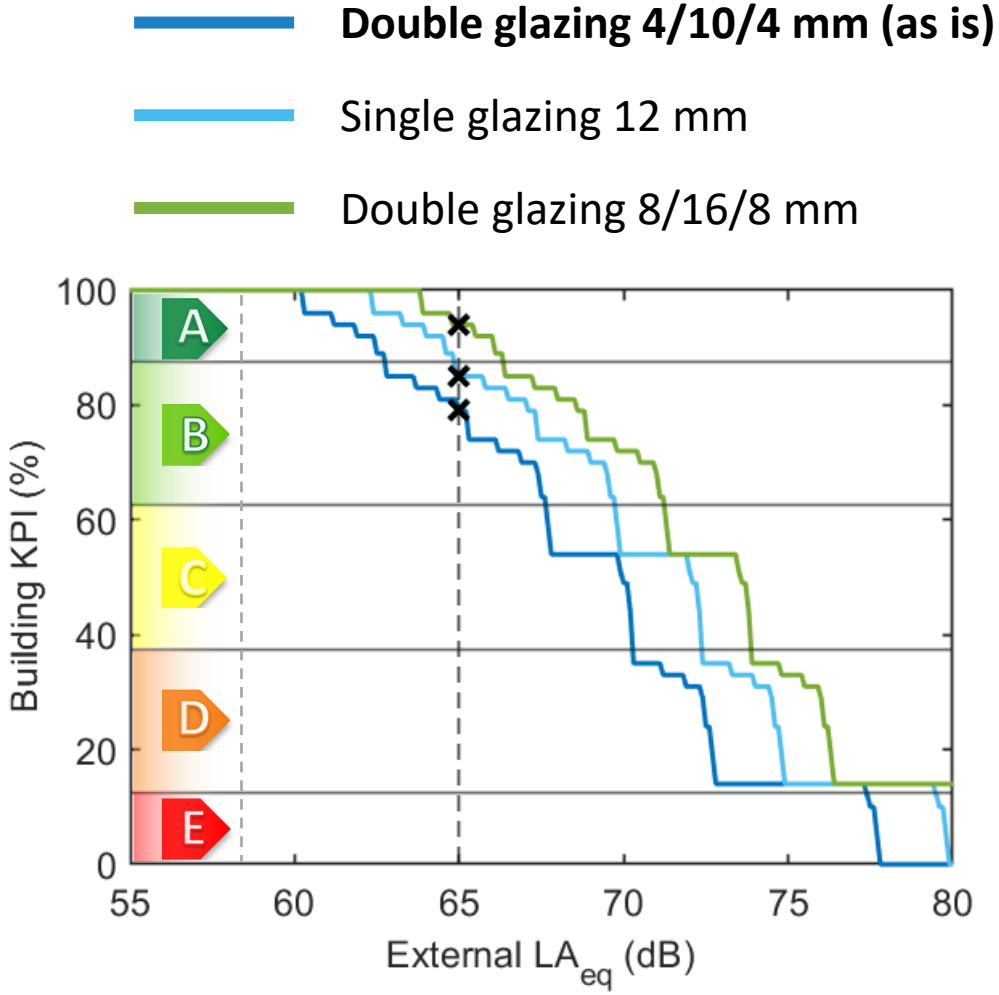
Evaluation of Renovation scenarios

Building KPI with ACOUSTIC SIMULATOR TOOL

For renovation scenarios a peak level of external noise is considered.
Noisy condition: outdoor noise level peak = 65 dB

Strategic noise mapping outdoor level 58 dB

Measured outdoor level 65 dB



COLOPHON

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