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Pilot Testing of Digital Solutions in Construction

PILOT PROJECT IN CROATIA

Machine learning for reduction of necessary sensors and expert effort to achieve smart building operation

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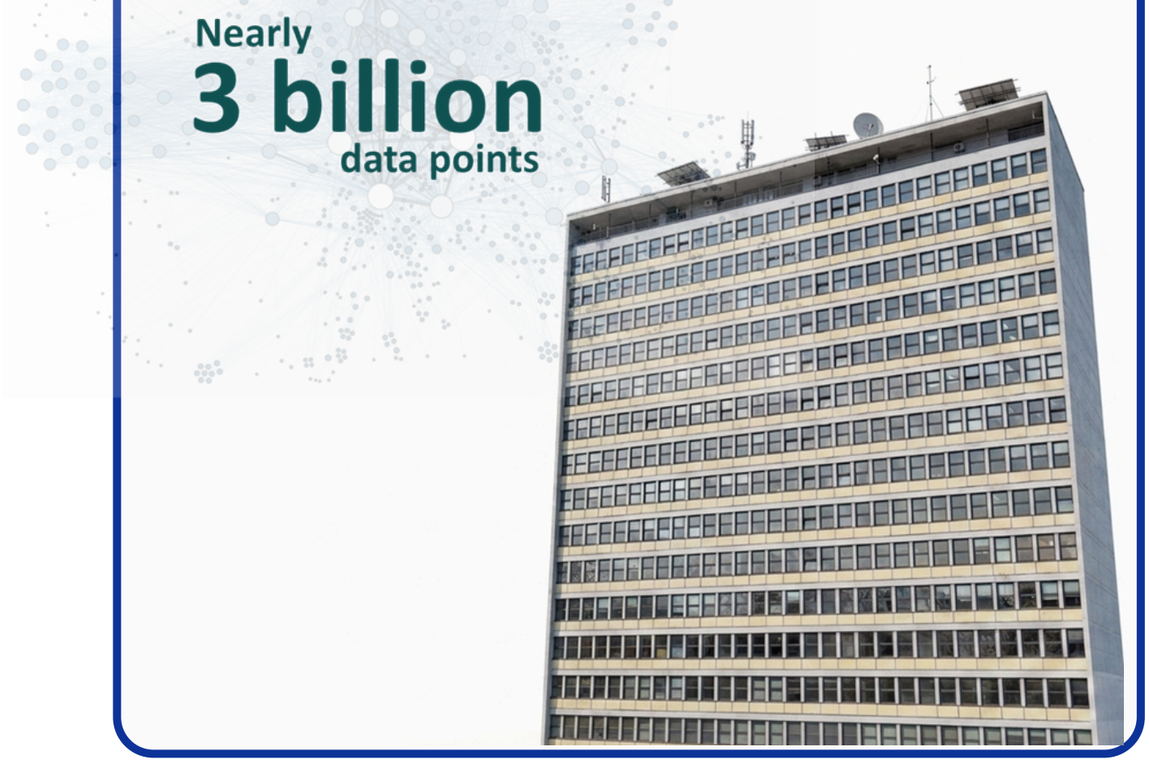
Pilot Documentation

Real office building in Croatia



13 floors

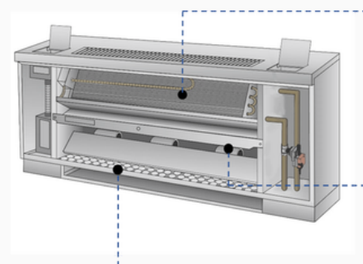
248 zones

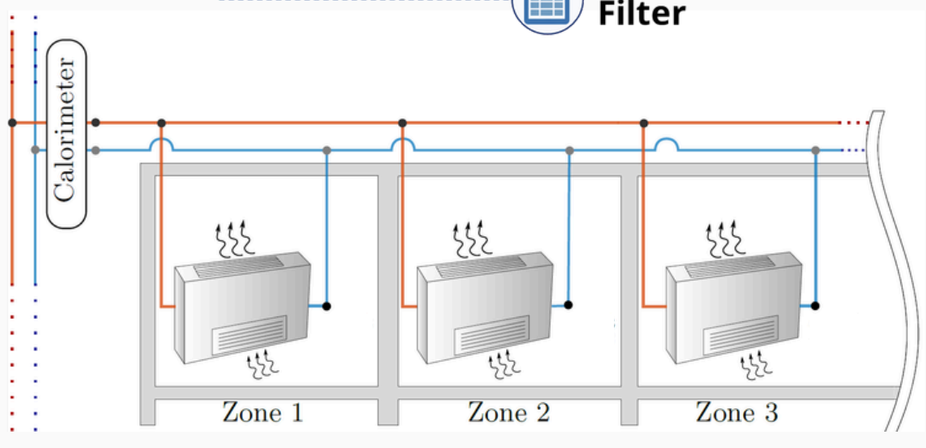
368 FCUs

26 calorimeters

DATA:

- Room air temperature in **248** zones
- FCU fan speed in **368** FCUs
- Supply temperature, return temperature and flow at **26** calorimeters
- 1-minute operational data over **5 years**
- **~ 1.5 million** measurements per day





Research Objective

To develop and validate a **data-driven**, **reduced-sensor** methodology for identifying accurate static energy models of Fan Coil Units (FCUs), enabling scalable and reliable building-level modeling for smart operation.

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Methodology

- Hybrid machine learning and physics-based methodology
- Data validation and filtering
- Operating-regime clustering
- Building-level validation

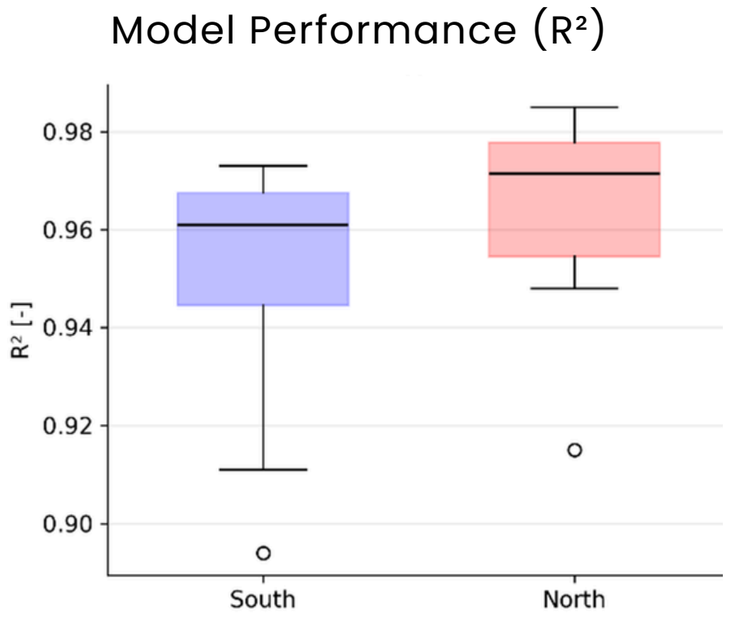
Faster model development

Scalable across buildings

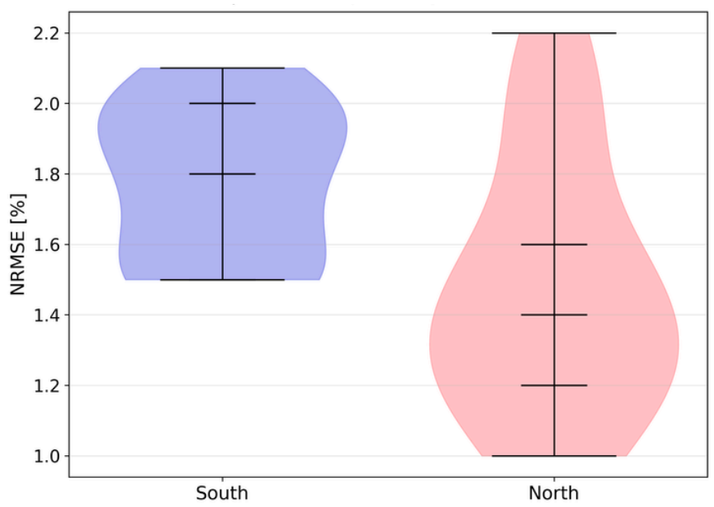
Reduced digitalization and deployment costs

Model Performance

Building-level model validation



NRMSE (Normalized Root Mean Square Error)



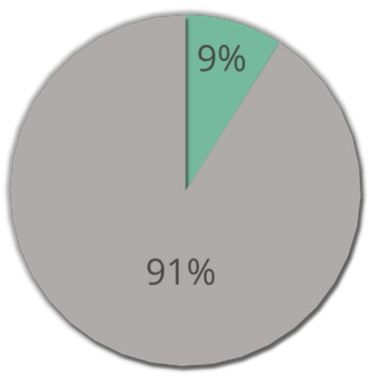
Higher R^2 and lower NRMSE indicate better model performance.

Key Findings

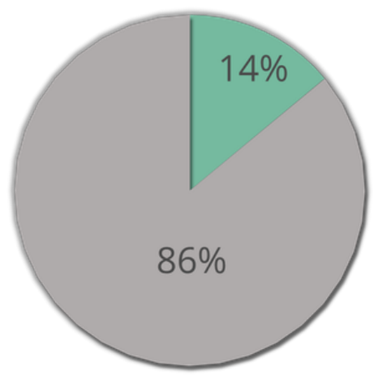
Only a small fraction of data (9-15%) is suitable for reliable static model identification

Valid

Non-valid



11th floor south branch



11th floor north branch

Useful identification data can be collected within a few weeks through temporary control reconfiguration that increases stationary operation.

No dedicated test campaign

No noticeable comfort impact

Usable data within weeks

Conclusion

The pilot demonstrates a transferable pathway toward reduced-sensor model identification in real buildings, enabling scalable deployment with lower hardware requirements, lower digitalization cost, and faster commissioning.

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PILOT PROJECT IN BULGARIA

Improving management of materials and infrastructure activities through digitalization, traceability and data-based decision-making

Objective

- Improve material and infrastructure management through digitalization and traceability.
- Enable full lifecycle tracking of resources, including reuse and recycling.
- Create a scalable model for use in other municipalities and organizations.

Scope & Methodology

The scope of the pilot project included structured data on objects, materials, and activities from a real municipal infrastructure scenario. It covered key route elements such as pipes, flanges, concrete rings, temporary depots, and transition stages for reuse preparation. For each element, the model included core attributes such as type, quantity, description, and usage context. This scope enabled lifecycle tracking, operational control, reporting, and analysis of reuse and recycling potential.

Key Insights

- Tracking materials across use, dismantling, preparation, reintegration, and recycling makes reuse opportunities visible and manageable.
- The pilot shows where materials retain value, helping prevent loss and extend the life of infrastructure components.
- Connected data and flow visualisations support better decisions on recovery, transfer, reuse, and recycling of municipal resources.
- Standardised data and early cross-department coordination are key to scaling circular practices beyond one pilot case.

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Data Highlight

Analytics

Filter by materials...

Create Record

Dashboard | Sankey Diagram | Network Diagram | Circular Graph | Chord Diagram | Table View

10	10	100%	1
Total Flows	Circular Flows	Circularity Rate	Reused Components

Record Categories

Construction	9
Deconstruction	1

Lifecycle Stages

Secondary Input	12
Primary Input	6
Reused Component	1
Processing	1

Environmental Impact

122.0 kg CO_2	10.3 %	0 records	0 records
Total Emissions	Avg Material Loss	Upcycled	Downcycled

Materials (10)

Concrete (4) Processing	Hotel Wall (3) Processing	Cement (1) Primary Input	School Building (1) Product	Sand (2) Primary Input	Clay Tile (1) Primary Input
Recycled Bricks (2) Processing	Hotel Building (2) Processing	Brick (3) Processing	Water (1) Primary Input		

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Search... ⌘ K

Data

Import

Analytics

client3
Authenticated

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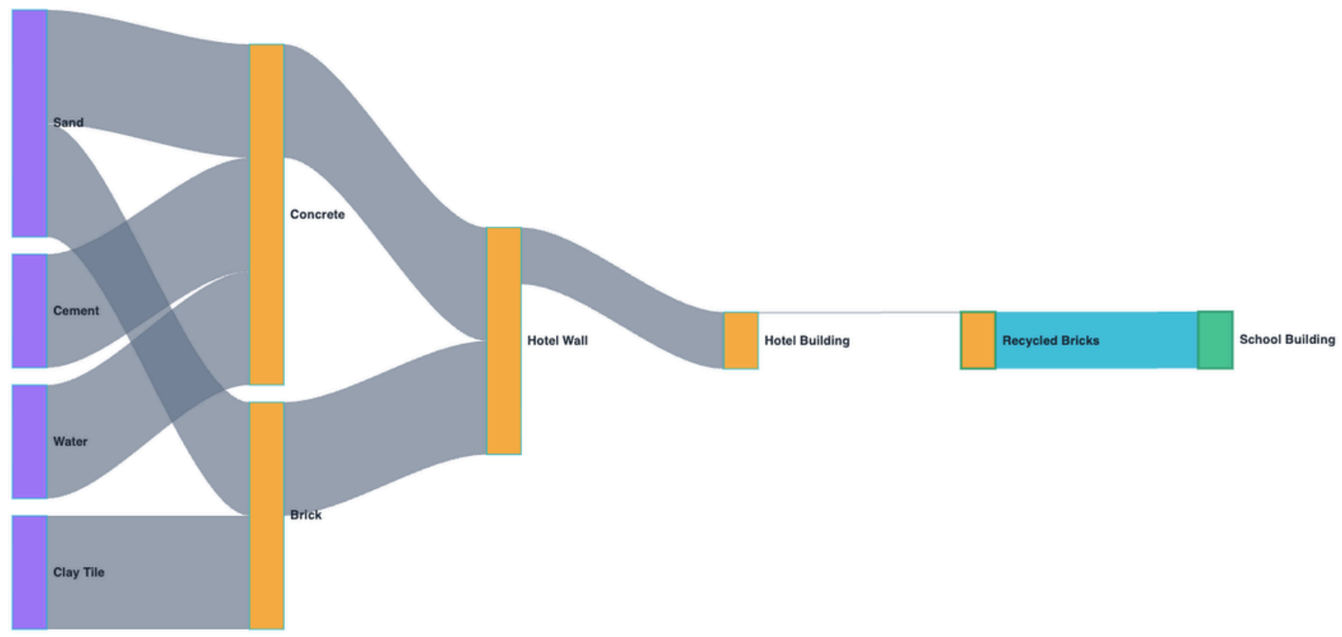
Analytics

Filter by materials...

Create Record

Dashboard | Sankey Diagram | Network Diagram | Circular Graph | Chord Diagram | Table View



Flow Types: Recycling | Reuse | Standard | Waste • Hover over flows for details

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ReCheck

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PILOT AUSTRIA

RAPID ESTIMATION OF MATERIAL RESOURCES CONTAINED IN BUILDINGS

Christina Koch | Austria Wirtschaftsservice

Research Overview

- Addresses lack of accessible data on material composition in existing buildings
- Development of a scalable digital tool for material estimation

Objective

- Enable fast and reliable estimation of building material stocks
- Support decision-making in urban planning and sustainability
- Reduce need for costly and time-consuming on-site assessments

Documentation

Methodology

- Combines geospatial data with building archetype database
- Uses inputs such as building type, year and height
- Processes data through a digital backend and automated calculations

Key Insights

- Achieved over 90% accuracy with limited input data
- High-quality geospatial data significantly improves results
- Tool is scalable, user-friendly, and suitable for large-scale analysis

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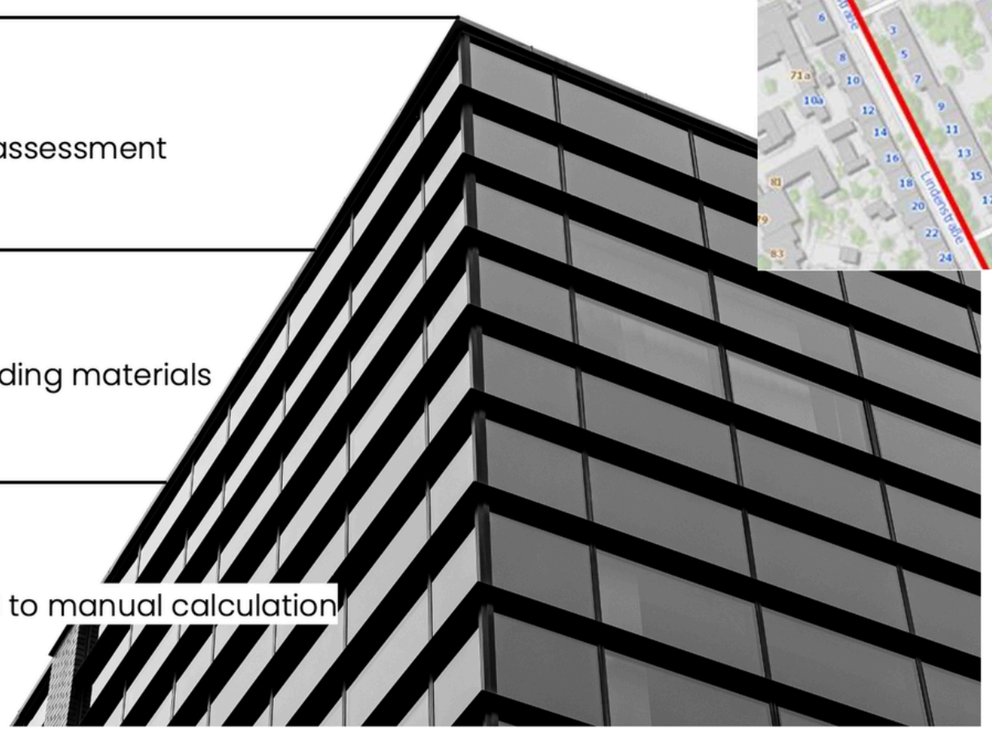
Rapid estimation of material resources contained in buildings

RESULTS Volume captured: **30.783 m³**
GWP Total (in m): **8,6 kg CO_2 eq**

+90% Accuracy in the overall assessment

<3% Deviation in mineral building materials

80% Time savings compared to manual calculation



Material mapping of 6 building blocks in 6020 Innsbruck, AT

Conclusion

The pilot study demonstrated that material flows can be estimated with high accuracy at the district level without visiting the project site. This is possible by using a combined approach of open data and the material database. These material insights can be used for tendering, demolition, and recycling activities.

Contact:

aws austria wirtschaftsservice

Austrian promotional bank
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Additional information

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Institute of Architecture Technology,
Graz University of Technology