BUILDSPACE

Funded by the European Union

POLISH PILOTS

Digital Twin Generation of the Construction of Faculty of Psychology, Warsaw University and the Rectorate building, Technical University of Poznan

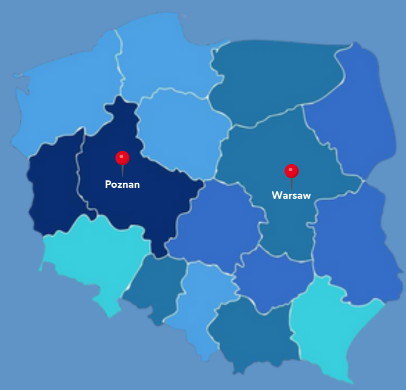
BUILDSPACE brought its innovative digital services into practice through four pilot sites across Europe. Each pilot addressed a different local challenge. The pilots demonstrate how BUILDSPACE solutions can support smarter construction, sustainable energy planning, and better protection of cities against heat and flooding.

CONTEXT & OBJECTIVES

Pilot Overview

Warsaw and Poznań are key urban and academic centers in Poland.
The University of Warsaw and the Poznan University of Technology provided an ideal setting for testing digital twin and energy efficient building technologies, thanks to their strong academic base and focus on green urban development.

Location: Poland



The 1st pilot took place at the Faculty of Psychology building in Warsaw

FEATURES:

- 6-storey overground
- 2-storey underground
- 30 classrooms
- 400-seat lecture hall, research laboratories
- sustainable features such as energy-saving systems and heat recovery solutions.

The 2nd pilot was conducted at the new Rectorate of Poznań University of Technology.

FEATURES

- five-storey glass and stone structure
- designed as a modern, near-zero energy building
- advanced insulation, mechanical ventilation with heat recovery, heat pumps supported by 12 geothermal boreholes, and 234 rooftop photovoltaic panels.

Strategic Importance

The Polish Pilots of the BUILDSPACE project represents a critical step in demonstrating the value of Digital Twin technologies in large-scale educational infrastructure. By applying both Digital Twin Generation and Digital Twin Enrichment the pilot tested how advanced digital models can optimize building processes, improve decision-making, and enhance efficiency across multiple construction phases.

Pilot Objectives

Testing Digital Twin Generation and Digital Twin Enrichment at the building level.
Evaluate the effectiveness of Digital Twins in facilitating construction works, coordination, and decision-making.
Demonstrate data integration during different phases of construction to improve monitoring, accuracy, and resource management.
Support sustainability goals by integrating energy-efficient installations, heat recovery systems, renewable energy sources, and condensing energy systems.
Assess scalability and replicability of Digital Twin applications for large educational and institutional buildings.
Contribute to EU climate-neutral construction targets by showing how Digital Twins can accelerate sustainable building delivery.

KEY STAKEHOLDERS

Mostostal WARSZAWA

POLITÉCNICA

UNIVERSITY OF CAMBRIDGE

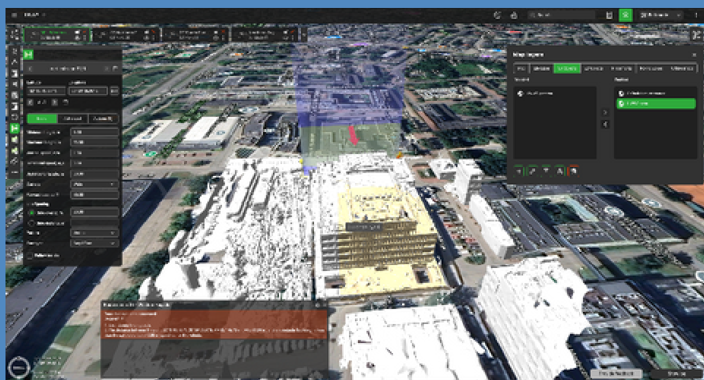
IMPLEMENTATION & LESSONS LEARNT

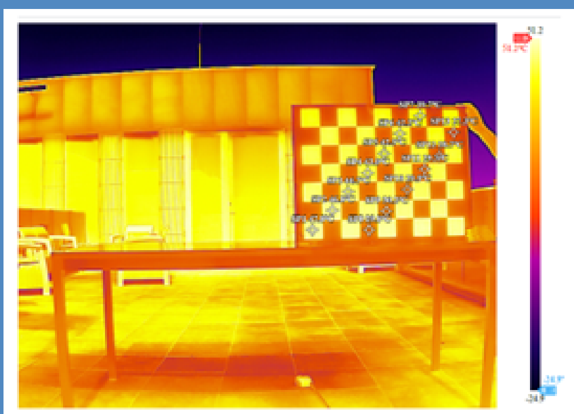
Phase 1: Preparation & Deployment plan

The first phase the end-user and the service providers established the **Use Cases** and defined the local implementation plan for Services 1 and 2.
Mostostal Warszawa provided the end-user perspective and led data collection, including LiDAR scanning and drone surveys.

In December 2023, the first photogrammetry drone mission created an initial building geometry, which was refined for subsequent thermal and photogrammetric flights.
Flight routes and parameters were carefully planned to ensure consistent, high-quality data.

The geometry achieved after the first flight was then used for planning of the next missions. The model of the building and its surroundings was uploaded in the KMZ format to the UgCS software to plan and adjust the flight route for the next photogrammetric thermal flights.

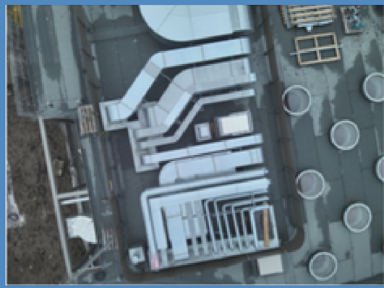




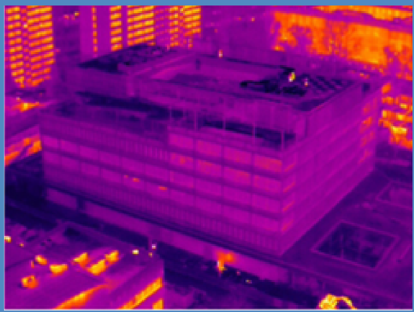
Calibration exercises supported Universidad Politécnica de Madrid in developing thermal digital twin algorithms. Data from each mission was processed and shared with the University of Cambridge, with scheduling data linked to the construction plan to enable comparison between drone captures and concrete works.

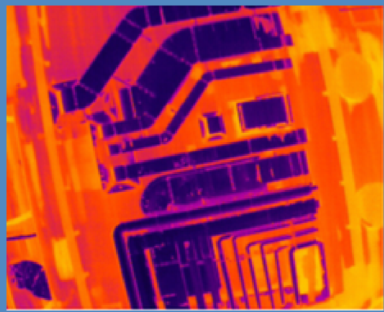
Phase 2: Implementation & Execution

The second phase moved into the execution of large-scale data collection.



In Warsaw, the complete Faculty of Psychology building was scanned, producing a comprehensive point cloud that combined nearly 1,800 individual scans into a dataset weighing 270 GB. This was processed floor by floor and connected through staircases to create a coherent model.



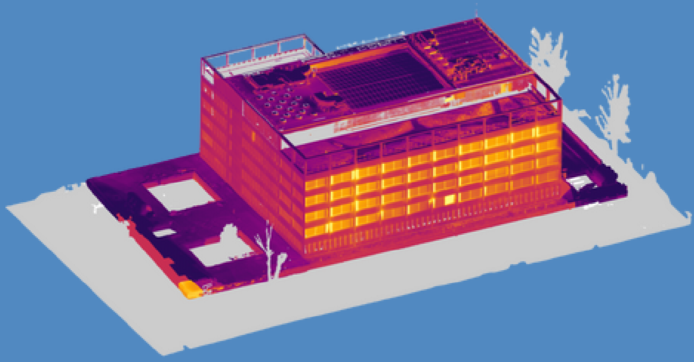


Drone missions were also carried out to capture both RGB and thermal imagery of the external envelope, although several flights had to be repeated due to weather conditions or technical challenges. The final mission, in March 2025, provided the necessary thermal dataset.

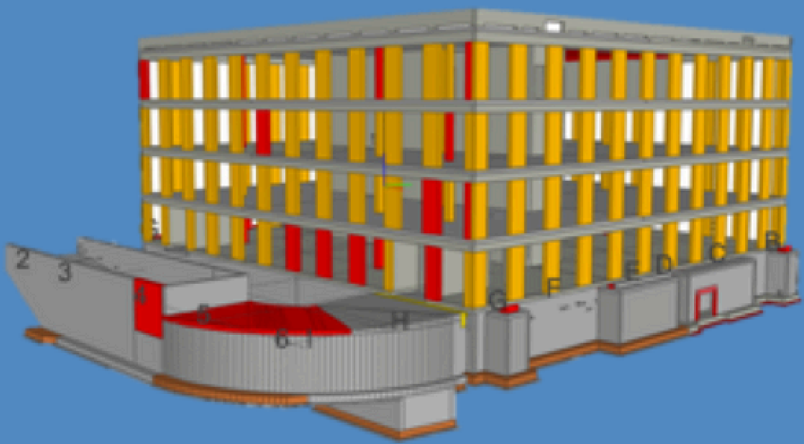
In Poznan, eleven drone flights were conducted between March and November 2024, documenting the construction progress of the structural elements. The resulting point clouds were uploaded to the common data environment and served as a record of the evolving site.

Phase 3: Completion

The final phase focused on generating and integrating the project outcomes.



Universidad Politécnica de Madrid developed high-resolution dense, georeferenced point clouds with millimeter accuracy.
These were enriched with thermal data, projected onto RGB point clouds to produce integrated datasets suitable for modelling, anomaly detection, and detailed analysis. Additionally, automated thermal anomaly reporting was implemented, and a web platform was developed to visualise the results.



University of Cambridge used the data provided by Mostostal to develop an algorithm capable of comparing point clouds with BIM models. This allowed automatic updates to the IFC model, assigning completion status to elements and flagging delays in red for easy identification. Together, these results finalized the pilots with robust digital models that integrated geometry, thermal performance, and construction progress into a comprehensive monitoring framework.

Key Lessons & Recommendations

- **Check airspace restrictions:** Some sites may fall within highly restrictive zones, making drone missions such as photogrammetry impossible. Always verify local regulations before planning.

- **Consider mission parameters:** Restrictions can affect operational details, such as maximum flight altitude (AGL). Adapt your mission plan accordingly.

- **Manage airspace conflicts:** If other drone activity is expected near your site, explore the option of reserving the airspace in advance.

- **Ensure compliance and training:** If carrying out missions independently, use drones that comply with current regulations and ensure personnel hold the necessary certificates and permissions.

- **Subcontract if needed:** To reduce regulatory and operational burdens, subcontracting drone missions can be an effective alternative.

- **Respect personal data:** Drone imagery may capture identifiable individuals. Always secure consent before recording or processing such data.

- **Plan thermal missions carefully:** Thermal imaging flights are subject to very strict weather requirements.

Technical requirements for end-user to receive service

In order to use the DIGITAL TWIN GENERATION AND ENRICHMENT application, the only requirements are connection to internet and a computer, ideally with a mouse to make the platform easier to use. It's also advisable for users to read the user manual in advance.

Results, Performance & Future Outlook

The 2 pilots managed by Mostostal Warszawa demonstrated how combining drone-based and LIDAR data collection with innovative software tools can significantly enhance construction monitoring and thermal auditing. These solutions offer measurable benefits in terms of construction processes' efficiency.

A few words from Mostostal

The integration of data from various sources allows us to create a complete and three-dimensional Digital Twin model of the building, enabling a detailed analysis of its condition, focusing on both geometry and thermal properties. Thermal scanning results allow for the rapid identification of areas with heat loss, thermal bridges, and potential insulation problems. Presenting these results within the 3D Digital Twin is significantly more convenient and understandable than reviewing a paper report or analyzing individual thermal camera photos. This centralized, visual approach aids immediate interpretation and decision-making. The only technical challenge encountered during this service was the accurate calibration of the drone's thermal camera.

The integration of regularly acquired point cloud data (from building scans) with the IFC model and the project schedule facilitates the instantaneous and precise verification of construction progress directly on site. AR glasses superimpose the virtual building model onto the actual construction site, enabling immediate on-site assessment of which structural elements were completed according to plan, and which are delayed. The ability to quickly compare the physical state of the object with the 4D model (3D geometry plus the dimension of time/schedule) without referencing paper plans significantly accelerates the analysis of construction progress.

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