



## Enabling Innovative Space-driven Services for Energy Efficient Buildings and Climate Resilient Cities

### D4.3 BUILDSPACE Pilot's execution documentation – full- pilot phase

April 2025



## Document history

|                                        |                                                                                                                                                                  |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Project Acronym                        | BUILDSPACE                                                                                                                                                       |
| Project Number                         | 101082575                                                                                                                                                        |
| Project Title                          | Enabling Innovative Space-driven Services for Energy Efficient Buildings and Climate Resilient Cities                                                            |
| Project Coordination                   | SPACE HELLAS ANONYMI ETAIREIA SYSTIMATA KAI YPIRESIES<br>TILEPIKOINONION PLIROFORIKIS ASFALEIAS – IDIOTIKI EPICHEIRISI<br>PAROCHIS YPERISION ASFA (SPH) (Greece) |
| Project Duration                       | 1 <sup>st</sup> February 2023 – 31 <sup>th</sup> January 2026                                                                                                    |
| Deliverable Title                      | D4.3 BUILDSPACE Pilots’ execution documentation – Full pilot phase                                                                                               |
| Type of Deliverable                    | R – Document, Report                                                                                                                                             |
| Dissemination Level                    | C-UE/EU-C – EU Classified                                                                                                                                        |
| Status                                 | Final                                                                                                                                                            |
| Version                                | V5.0                                                                                                                                                             |
| Work Package                           | WP4 – Demonstration of BUILDSPACE towards sustainable and resilient buildings and cities                                                                         |
| Lead Beneficiary                       | UPM                                                                                                                                                              |
| Author(s)                              | UPM. MOS, RPR, MOP, IMZI, ALDA, NTUA, CARTIF, MOBICS, UOC                                                                                                        |
| Reviewer(s)                            | MOP, IMZI                                                                                                                                                        |
| Due Date of Delivery                   | 30/04/2025 (M27)                                                                                                                                                 |
| Actual 1st Submission Date             | 22/05/2025                                                                                                                                                       |
| Actual 2 <sup>nd</sup> Submission Date | 01/12/2025                                                                                                                                                       |

| Date       | Version | Contributors                                              | Comments |
|------------|---------|-----------------------------------------------------------|----------|
| 22/04/2025 | V01     | UPM. MOS, RPR, MOP, IMZI, ALDA, NTUA, CARTIF, MOBICS, UOC |          |
| 21/05/2025 | V02     | UPM. MOS, RPR, MOP, IMZI, ALDA, NTUA, CARTIF, MOBICS, UOC |          |
| 22/05/2025 | V03     | UPM. MOS, RPR, MOP, IMZI, ALDA, NTUA, CARTIF, MOBICS, UOC |          |
| 01/12/2025 | V04     | UPM. MOS, RPR, MOP, IMZI, ALDA, NTUA, CARTIF, MOBICS, UOC |          |
| 12/12/2025 | V05     | UPM. MOS, RPR, MOP, IMZI, ALDA, NTUA, CARTIF, MOBICS, UOC |          |

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## List of acronyms

| Acronym | Description                                   |
|---------|-----------------------------------------------|
| API     | Application Programming Interface             |
| AR      | Augmented Reality                             |
| BGI     | Blue-Green Infrastructure                     |
| CMIP6   | Coupled Model Intercomparison Project Phase 6 |
| CO      | Completion                                    |
| CWS     | Citizen Weather Station                       |
| DEM     | Digital Elevation Model                       |
| DSAI    | Data Storage and Analysis Infrastructure      |
| DSM     | Digital Surface Model                         |
| DT      | Digital Twin                                  |
| DTM     | Digital Terrain Model                         |
| EC      | Economic                                      |
| EF      | Effectiveness                                 |
| EG      | Engagement                                    |
| EGNSS   | European Global Navigation Satellite System   |
| EN      | Environmental                                 |
| FESTA   | Flexible Transport Services for All           |
| GA      | Grant Agreement                               |
| GIS     | Geographic Information System                 |
| IMZI    | Blue-green Infrastructure Institute           |
| KPI     | Key Performance Indicator                     |
| LiDAR   | Light Detection and Ranging                   |

|       |                                                  |
|-------|--------------------------------------------------|
| ML    | Machine Learning                                 |
| MoP   | Municipality of Piraeus                          |
| NPS   | Net Promoter Score                               |
| NTUA  | National Technical University of Athens          |
| NUTS  | Nomenclature of Territorial Units for Statistics |
| PV    | Photovoltaic                                     |
| QA/QC | Quality Assurance/Quality Control                |
| RGB   | Red Green Blue                                   |
| RPR   | Riga Planning Region                             |
| SC    | Scientific                                       |
| SE    | Service                                          |
| SLAM  | Simultaneous Localization and Mapping            |
| SMEs  | Small and Medium Enterprises                     |
| SO    | Social                                           |
| TE    | Technical                                        |
| TR    | Technology Release                               |
| UOC   | University of Cambridge                          |
| UPM   | Universidad Politécnica de Madrid                |
| VR    | Virtual Reality                                  |
| PME   | Preparation, Monitoring and Evaluation           |

## Executive summary

Deliverable D4.3, “BUILDSPACE Pilots’ Execution Documentation – Full pilot Phase,” is the third in a series of documents within the context of Work Package WP4, “Demonstration of BUILDSPACE towards Sustainable and Resilient Buildings and Cities.” This document is written as a continuation of D4.1, in which the foundations for monitoring and evaluation were prepared, and D4.2 in which the monitoring of the project on the pre-pilot phase was set. In this third deliverable of WP4, the progress and advancements in the implementation of the services in each of the pilots are monitored and evaluated on the Full-Pilot operation phase. Specifically, D4.3 focuses on the deployment of the full pilot after testing the technological outcomes of BUILDSPACE on the pre-pilot phase.

The deliverable includes several key elements:

- i. Full pilot deployment: A detailed account of the deployment of the full pilots in all test scenarios, including infrastructure setup, data collection, and pilot execution in each site including feedback on the services to improve them for the final release. This deployment is assessed through a Gantt chart to track the timeline and milestones for each pilot, ensuring all tasks adhere to the defined schedules. The implementation of the pilots is presented by scale: city scale and building scale.
- ii. The planning and progress status of the implementation of the strategy to engage various stakeholders in the project through workshops and live events
- ii. Evaluation of the project progresses for achieving the KPIs: This document updates the relevant KPIs to track the effectiveness and impact of BUILDSPACE during the full-pilot phase, ensuring they are aligned with the project's overall objectives.



# 1 Introduction

This deliverable (D4.3) is the third deliverable for WP4 – Demonstration of BUILDSPACE towards sustainable and resilient buildings and cities. In this deliverable the Full Pilot operation phase is presented, following former pre-pilot phase, fully described in Deliverable 4.2.

This document, titled ‘BUILDSPACE Pilots’ Execution Documentation – Full pilot operation phase’, contains the description of the activities conducted in order to fully deploy the demonstration of services designed in the pilots.

This deliverable gathers the information and documentation of the monitoring of the pilots at the building scale (T4.2), at the city level (T4.3) along with the methodologies and planning for the stakeholders’ engagement (T4.4) and the evaluation and level of achievement of the project goals (T4.5) at this full pilot stage.

This deliverable aims to report on the current status of services and their readiness for deployment in real-world environments. It describes all conducted actions and progress made in the pilots’ infrastructure setup, test scenarios, data collection, and technical readiness. Additionally, it serves as a comprehensive framework for monitoring pilot progress and includes updated Key Performance Indicators (KPIs) to evaluate project outcomes. Through this, the document lays the groundwork for verifying the effectiveness and performance of the services before full deployment in the subsequent pilot phases.

Deliverable D4.3, being the direct outcome of tasks T4.2, T4.3, T4.4 and T4.5, aims to report on progress and results during the full pilot phase through the project pilots. Being also the core component of WP4, D4.3 is strongly linked to other work packages and deliverables, as it serves as a mechanism to assess project progress, impact and efficiency in achieving pre-defined objectives.

As such, it is aligned with:

- D2.1 – BUILDSPACE User Requirements
- D2.2 – Use Cases and Design of Applications Dashboards
- D3.1 – BUILDSPACE core platform and services
- D4.1 – BUILDSPACE Evaluation Methodology and Baseline Assessment
- D4.2 – BUILDSPACE Pilot’s execution documentation – Pre-pilot phase
- D3.2 – BUILDSPACE core platform and services (interim)

The present document is organized in 6 different sections, as described below:

- **Section 1 [Introduction]:** Introduces the purpose and scope of the deliverable, providing context in relation to previous deliverables from WP4 (D4.1 and D4.2), and outlines the objectives for the full pilot phase.
- **Section 2 [BUILDSPACE Monitoring: Building Level Pilots Operation]:** presents the full pilot implementation progress of the BUILDSPACE services at the building scale (Service 1 and Service 2). The evaluation is based on a descriptive narrative that outlines the status of the different tasks (i.e., completed, in progress, delayed, new scheduling or cancelled). This narrative is complemented by a set of tables that serve as tracking and reporting tools: (i) a summary table of task progress; (ii) a Gantt chart including a red vertical line that marks the current status of implementation; and (iii) a validation tracker, newly introduced in this deliverable, that assesses the status and quality of service execution from the pilot partners’ perspective.



These tables provide a comprehensive view of the service evolution, highlighting any deviations from the original planning and enabling traceability across the execution timeline. Additionally, compared to D4.2, a new table has been incorporated to outline the forthcoming actions for each pilot, thereby enhancing forward-looking planning. The validation tracker, on the other hand, offers insights on the functionality and usability of the deployed platforms, based on structured feedback from pilot partners, and aims to inform the iterative refinement of the services.

- **Section 3 [BUILDSPACE Monitoring: City Level Pilots Operation]:** reports on the implementation status of the BUILDSPACE services deployed at the city scale (Service 3, Service 4, and Service 5). Similar to Section 2, the evaluation is structured around a detailed narrative describing the execution of tasks across the involved pilots, complemented by supporting tables that document progress and operational performance.

For each service, the section includes: (i) a summary progress table outlining the implementation status of key actions; (ii) an updated Gantt chart that incorporates a red vertical marker indicating the current point in time; and (iii) a newly introduced validation tracker, which gathers feedback from pilot partners regarding the usability and applicability of the platforms deployed. This feedback contributes directly to the ongoing improvement of the services and their alignment with user needs.

Additionally, this section introduces a table for each pilot, detailing the planned activities for the final implementation phase. This addition reinforces the planning and monitoring process by providing visibility into upcoming work and helping to anticipate potential bottlenecks.

- **Section 4 [Stakeholder Engagement and Social Acceptance]:** brings together the activities related to stakeholder involvement, awareness generation, and training support during the full pilot phase. It begins with an updated stakeholder mapping, which classifies participants based on their roles and relevance for each service. The section then details the engagement strategy implemented across the pilots, including co-creation sessions, dissemination actions, and feedback loops.

In addition to describing engagement actions, the section presents the training materials and communication resources produced to support user onboarding and improve service understanding. This includes tailored content such as flyers, infographics, tutorials, and explanatory videos, distributed through online platforms and local partner events. Finally, the section outlines the validation mechanisms used to evaluate user perception and acceptance, capturing feedback on platform usability, relevance, and opportunities for improvement.

- **Section 5 [Assessment from Economic, Social, and Environmental Perspectives]:** focuses exclusively on the analysis of Key Performance Indicators (KPIs) related to the BUILDSPACE services during the full pilot phase. It includes both service-specific KPIs, addressing technical effectiveness, usability, and responsiveness of each individual service, and general KPIs, which provide a transversal view of the project's impact and performance.

The section also reflects updates from previous versions of the KPIs and shows how progress has been tracked using clearly defined targets and data sources. This structured evaluation supports evidence-based assessment of the services' maturity, efficiency, and overall alignment with the BUILDSPACE objectives.

- **Section 6 [Conclusions]:** closes the deliverable by summarising the main findings from the full pilot execution and outlining the actions foreseen for the final stages of the project. It provides a high-level overview of the current status of service implementation and validation, as well as reflections on the alignment of BUILDSPACE outcomes with initial project objectives.



## BUILDSPACE

The section also presents a consolidated summary of KPIs, highlighting both achievements and remaining challenges. Finally, it defines the next steps toward Deliverable D4.4 and the project's conclusion, including planned iterations, final validations, and actions related to long-term sustainability, integration, and exploitation of BUILDSPACE services.

## 2 BUILDSPACE Monitoring. Building Level Pilots Operation

Task 4.2 Building Level Pilots Operation addresses the building-Level Pilots activities in 5 real-pilot sites: Warsaw, Poznan, Piraeus, Riga and Ljubljana in 4 Pilot partners: MOS, MoP, RPR and IMZI. The task focuses on testing and evaluating the services at building level (SE1: DT generation and SE2: DT semantic enrichment) in selected pilot buildings. The DT generation service is assessed during the construction of new building as well as in existing buildings, while the DT enrichment service is evaluated in a new building (in the Polish pilot) to check the quality of the construction and in existing buildings in Latvia (in the Riga pilot) to perform inspection for potential renovation. The task addresses also the organisation of live events (how much?), where external users are invited to see and test the services on their own.

### T4.2 Coordination activities

Task 4.2 is coordinated by MOS which also represents 2 pilot sites. Within T4.2 coordination activities, building-level Pilots monitoring, and follow-up meetings should be indicated. During those meetings building-level pilots shared the activities they had recently been involved in, particularly in relation to testing service 1 (UC1.1, UC1.2 and UC1.3) and service 2 (UC2.1 and UC2.2). They exchanged comments and ideas, provided feedback on how these services work and discussed how to organize the work related to testing and evaluation. As Task Leader, MOS coordinated all activities, explaining the tasks to be completed and ensuring that deadlines were met. What is more, the basis of the full-pilot phase validation tracker was prepared, defining essential data that should be included, and then the template for building-level Pilots was completed. Also, the evaluation for both Service 1 and 2 was prepared.

### 2.1 Service 1 – Digital Twin Generation

The objective of Service 1 is to generate the Digital Twin models from the point cloud data created from the Lidar or drone images. There are three user cases in the service one, the details of three user cases, the deliverables and the corresponding pilots are shown in below table:

| User case                                            | Scenario ID in below tables | Details and deliverables                                                                              | Test pilots      | Status and updates                                                       |
|------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------|
| UC1.1 – DT generation                                | S1.2                        | DT generation from the point cloud data<br><br>Deliverables: generated DT and its technical pipelines | Pilot 1, 2, 3, 4 | The service for UC1.1 has been completed and tested by all the pilots.   |
| UC 1.2 – DT updates with construction progress info. | S1.2                        | DT updates of construction progress information from the drone point cloud data                       | Pilot 1          | The service for UC1.2 has been completed and tested by all pilot 1 team. |

|                                      |      |                                                                                                                                                                                                       |         |                                                                                                                                                                                                              |
|--------------------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      |      | Deliverables: updated DT and its technical pipelines                                                                                                                                                  |         |                                                                                                                                                                                                              |
| UC 1.3 – DT updates with asset info. | S1.3 | <p>retrieve the semantic information of the fire equipment asset information from the panoramic video</p> <p>Deliverables: updated DT with the fire asset information and its technical pipelines</p> | Pilot 1 | <p>The service for UC1.3 is still under development. For the most up-to-date details, please refer to Section 3.1.0.1.</p> <p>This service is standalone and does not have any impact on other services.</p> |

## 2.1.0 Pilot 1 – Warsaw, Poland

### 2.1.0.1 Testbed Scenario Update

*Table 1. Operation testing for the (SE1, Pilot 1) case (Test Scenario S1.3).*

| Scenario ID      | S1.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Developer        | UOC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Pilot            | Warsaw, Poland [MOS]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Related Use Case | UC1.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Objective        | <p>This scenario aims to retrieve the semantic information of the fire equipment asset information from the image-based point cloud model based on the Machine Learning (ML) and Computer Vision (CV) technologies. The 360 images of indoor environment will be converted into rectilinear face images. These images will be processed based on the self-developed indoor fire equipment asset database to semantic segment into fire equipment asset entity. The extract 3D position will be projected back to the indoor point cloud data. In the final step, through coordinating the pcd and as-designed BIM model, the 3D location of the fire asset information can be retrieved in the digital twin model.</p> |
| Location         | <p>Warsaw, Banacha 2B street,</p> <p>Faculty of Psychology of the University of Warsaw,</p> <p>Coordinates: (1): 52.21282034 N, 20.9859821 E; (2): 52.20307146 N, 20.96895569 E; (3): 52.20387586 N, 20.97299458 E; (4): 52.2272656 N, 20.99728432 E.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Scale Scope</b>               | <p>Building ( )Figure 1</p> <p>Total net area: almost 21000 m<sup>2</sup>,</p> <p>Plot area: around 7500 m<sup>2</sup>.</p>                                                                                                                                                                                                                                                                                                                                                        |
| <b>Data</b>                      | 360 images and as-designed BIM model                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Resources</b>                 | <p>360 camera;</p> <p>self-developed fire asset database;</p>                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Workflow</b>                  | <ol style="list-style-type: none"> <li>1. Data collection - indoor BIM model, 360 images of indoor environment with fire asset equipment (M27)</li> <li>2. Image processing - 360 images to rectilinear face images conversion (M28)</li> <li>3. Fire asset semantic segmentation from rectilinear face images based on CV technologies (M29)</li> <li>4. Fire asset PCD and DT model coordination for fire equipment information visualisation in the indoor DT. (M29)</li> </ol> |
| <b>Additional Considerations</b> | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

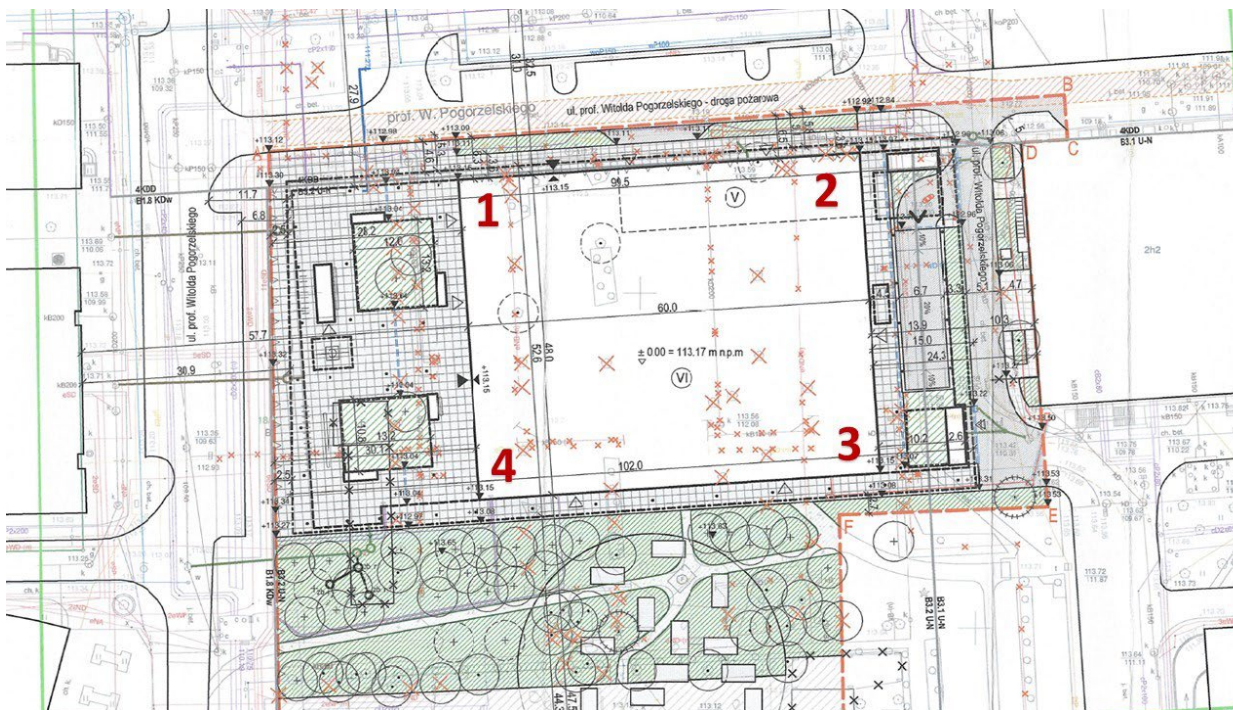


Figure 1. Building delineation for the conduction of scenario S1.3.





Because of the limitation of the realistic issue in the construction site, the Test Scenario 1.3 has been revised. The proposed new test scenario (Figure 2) will also focus on the DT updating of building indoor environment.

The new scenario aims to retrieve the semantic information of the fire equipment asset information from the image-based point cloud model based on the Machine Learning (ML) and Computer Vision (CV) technologies. The 360 images of indoor environment will be converted into rectilinear face images. These images will be processed based on the self-developed indoor fire equipment asset database to semantic segment into fire equipment asset entity. The extract 3D position will be projected back to the indoor point cloud data. In the final step, through coordinating the PCD and as-designed BIM model, the 3D location of the fire asset information can be retrieved in the digital twin model.

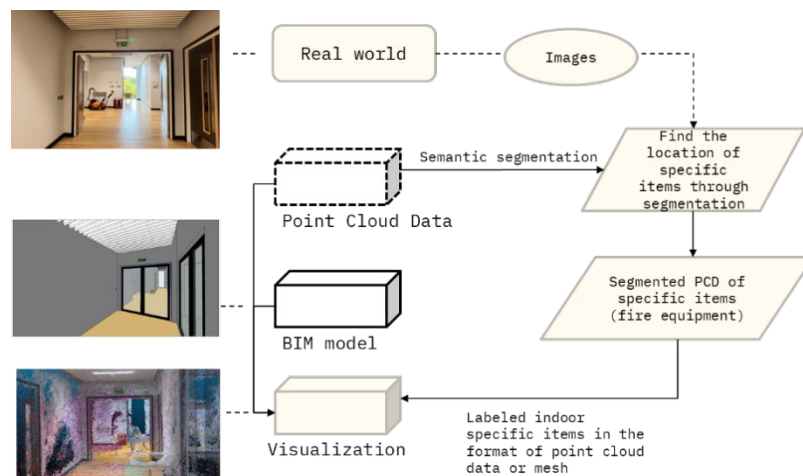


Figure 2. Workflow of new tested scenario

The functional testing of this function will be postponed until the end of M29. The potential test scenario will be:

| No. | Functions                                                                                                                        | Test scenarios deliverables                                                                   |
|-----|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1   | Fire asset segmentation based on the images                                                                                      | The set of images with fire asset labeling and the best CV model of the semantic segmentation |
| 2   | Projection from the image-based segmentation to the point cloud data                                                             | Point cloud data visualization of the indoor fire asset                                       |
| 3   | Coordination between the point cloud data and as-designed IFC model for integrated visualization of point cloud and digital twin | Integrated visualization of indoor DT with labeled fire asset data                            |

### 2.1.0.2 Gantt Chart

The MOS Pilot was provided with Service 1 that consisted of three use cases (user cases) - UC1.1, UC1.2 and UC1.3. Following the completion of the pre-pilot phase, during which the photogrammetric and laser scanning data was captured and provided, MOS has transitioned into the full –pilot phase, focusing on testing and evaluation of the service.

**UC1.1** was tested and evaluated. The DT Generation from point cloud data and connection to BIM model was verified on the usBIM platform and it was assessed that the geometry of the IFC model, resulting from the algorithm's operation, corresponds to the real geometry of the building, with the reference point being the photogrammetrically acquired data. The conclusion from the above is that the algorithm is functioning correctly. According to the Pilot Tracker (Table 23), MOS has provided UoC with feedback regarding the current state of the received service, recommending that the functionality related to the automatic creation of a Digital Twin be implemented into the core platform. Additionally, it would be important to enable the user to upload their own photogrammetric data and receive an IFC model in return, in order to ensure full automation. If these recommendations are considered, UC1.1 will be re-tested and evaluated by MOS.

**UC1.2**, addressing the display of on-time and delayed elements on the construction site has been tested and evaluated virtually on the provided usBIM platform. An additional functionality of this service is the visualization of delayed elements on the construction site through an AR interface. This feature has been implemented but will be tested at a later stage.

Regarding the development of UC1.3, due to changes in the service scope, UoC has established a new schedule for its implementation and testing. On the MOS side, 360-degree video footage from the construction site - captured at an advanced stage of progress after the installation of fire equipment - will be collected by May 2025. This data will then be sent to UoC, where it will be processed using an algorithm to enable the identification of the fire equipment. The final service will be evaluated by MOS and the feedback on its functioning as well as recommendations will be provided.

The further step for UC1.1 and UC1.2, 2 live events for external stakeholders are planned for June, organised in collaboration with UoC, UPM and ALDA, to present and explain the data acquisition process and the functioning of the algorithm, highlighting the potential benefits of using the service in the future.

*Table 2. (SE1, Pilot 1) Progress of tasks in the full-pilot phase related to Gantt Chart*

| Responsible Partner | Streams of Activities                            | Month   | Progress  | Results                                                                                         |
|---------------------|--------------------------------------------------|---------|-----------|-------------------------------------------------------------------------------------------------|
|                     | B. Infrastructure-related Activities             |         |           |                                                                                                 |
|                     | B.1 Technology/Equipment/Building                |         |           |                                                                                                 |
| MOS, UOC, UPM       | B1.1. Building selection                         | M10-M11 | Completed | Faculty of Psychology of the University of Warsaw; Rectorate of Poznan University of Technology |
| MOS, SLG            | B1.2. Drone/SLAM equipment rent                  | M12-M15 | Completed |                                                                                                 |
|                     | B2. Tool/Platform/Service Deployment/integration |         |           |                                                                                                 |





|                                                           |                                                                         |          |           |                                                                                                                  |
|-----------------------------------------------------------|-------------------------------------------------------------------------|----------|-----------|------------------------------------------------------------------------------------------------------------------|
| UOC                                                       | B2.1. EGNSS integration into building-scale model                       | M18-M20  | Completed | The geolocation has been added in the IFC format building-scale model                                            |
| UOC                                                       | B2.2. Provision of AR and VR interface                                  | M29      | Completed | The AR for SE2 has already been delivered,                                                                       |
| UOC                                                       | B2.3. Digital Twin and Point cloud integration into AR and VR interface | M29      | Completed | The AR for SE2 has already been delivered,                                                                       |
| C. Data Collection, Measurement and Evaluation Activities |                                                                         |          |           |                                                                                                                  |
| C1. Data Collection                                       |                                                                         |          |           |                                                                                                                  |
| MOS                                                       | C1.1. Definition of data collection procedure                           | M6 – M14 | Completed | specifications                                                                                                   |
| MOS                                                       | C1.2. XYZ coordinates                                                   | M14      | Completed | photo points localised in accordance with System 2000 zone 7 (EPSG 2178)                                         |
| MOS                                                       | C1.3. Thermal information                                               | M14      | Completed | 3535 images                                                                                                      |
| MOS                                                       | C1.4. RGB information                                                   | M14      | Completed | 4184 photogrammetric images in .NAV format file                                                                  |
| MOS, MOBICS                                               | C1.5. EGNSS location                                                    | M13-M17  | Completed | Information delivered as coordinates of photo points localised in accordance with System 2000 zone 7 (EPSG 2178) |
| C2. Operation Testing                                     |                                                                         |          |           |                                                                                                                  |
| C2.1. Testbed scenario S1.1                               |                                                                         |          |           |                                                                                                                  |
| MOS                                                       | C2.1.1. Drone flyover - photogrammetric                                 | M14      | Completed | 4184 photogrammetric images in .NAV format file                                                                  |
| MOS, UPM                                                  | C2.1.2. Flight data processing to obtain point cloud                    | M13-M16  | Completed |                                                                                                                  |
| MOS, UOC                                                  | C2.1.3. DT Generation from point cloud data and connection to BIM model | M16-M18  | Completed |                                                                                                                  |
| UOC, MOBICS                                               | C2.1.4. DT connection with EGNSS data                                   | M18-M20  | Completed | The geolocation has been added in the IFC format building-scale model                                            |



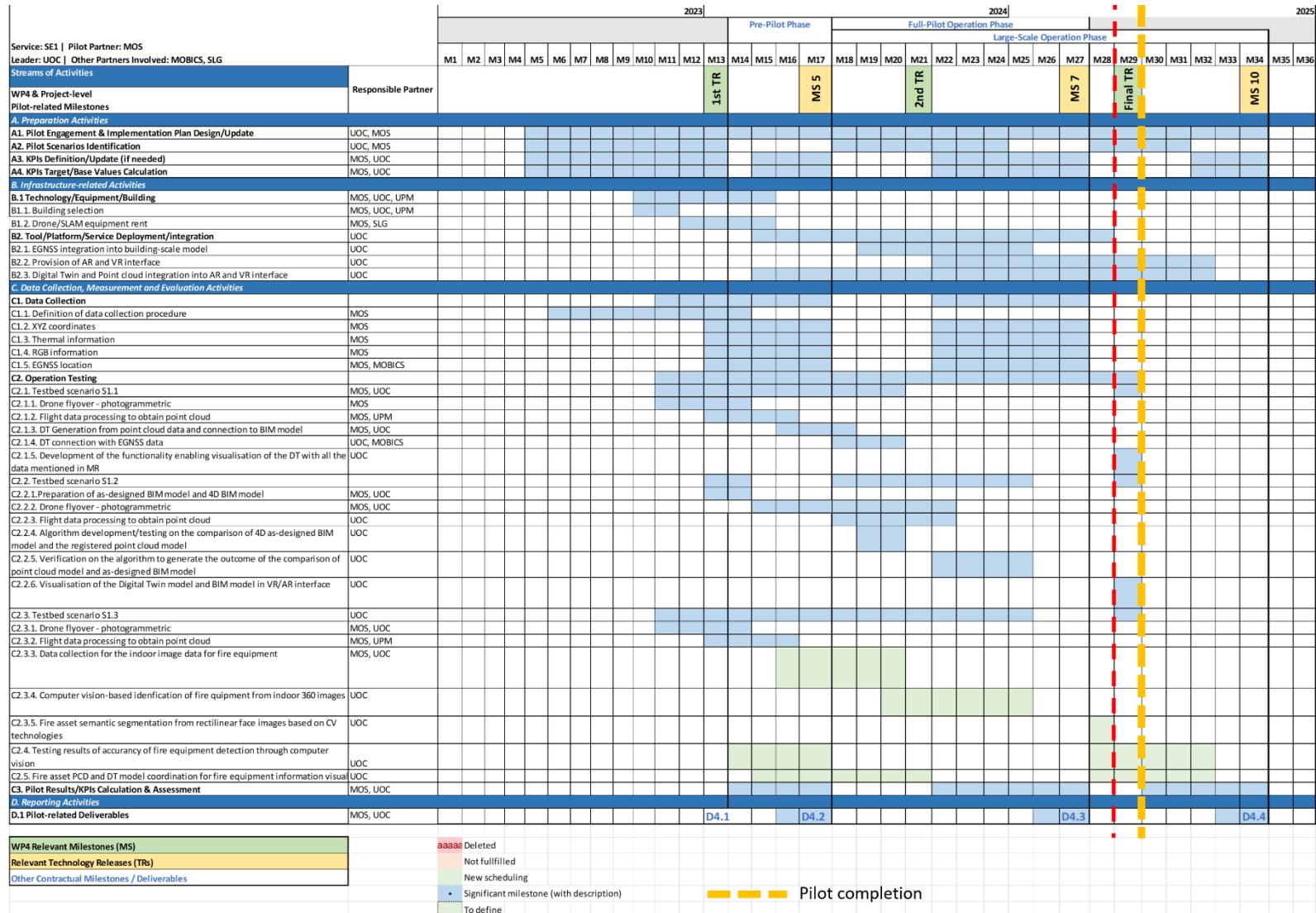
|          |                                                                                                                                |         |           |                                                                                                 |
|----------|--------------------------------------------------------------------------------------------------------------------------------|---------|-----------|-------------------------------------------------------------------------------------------------|
| UOC      | C2.1.5. Development of the functionality enabling visualisation of the DT with all the data mentioned in MR                    | M29     | Completed | The functions are realized in visualisation tool                                                |
|          | C2.2. Testbed scenario S1.2                                                                                                    |         |           |                                                                                                 |
| MOS, UOC | C2.2.1.Preparation of as-designed BIM model and 4D BIM model                                                                   | M13-M14 | Completed |                                                                                                 |
| MOS, UOC | C2.2.2. Drone flyover - photogrammetric                                                                                        | M15-M22 | Completed |                                                                                                 |
| UOC      | C2.2.3. Flight data processing to obtain point cloud                                                                           | M18-M22 | Completed |                                                                                                 |
| UOC      | C2.2.4. Algorithm development/testing on the comparison of 4D as-designed BIM model and the registered point cloud model       | M19-M20 | Completed |                                                                                                 |
| UOC      | C2.2.5. Verification on the algorithm to generate the outcome of the comparison of point cloud model and as-designed BIM model | M22-M25 | Completed |                                                                                                 |
| UOC      | C2.2.6. Visualisation of the Digital Twin model and BIM model in VR/AR interface                                               | M29     | Completed |                                                                                                 |
|          | C2.3. Testbed scenario S1.3                                                                                                    |         |           |                                                                                                 |
| MOS, UOC | C2.3.1. Drone flyover - photogrammetric                                                                                        | M14     | Completed | 4184 photogrammetric images in .NAV format                                                      |
| MOS, UPM | C2.3.2. Flight data processing to obtain point cloud                                                                           | M13-M16 | Completed |                                                                                                 |
| MOS, UOC | C2.3.3. Data collection for the indoor image data for fire equipment                                                           | M16-M20 | Completed | 360 videos at Warsaw site were carried out and shared with UoC                                  |
| UOC      | C2.3.4. Image processing - 360 images to rectilinear face images conversion                                                    | M28     | Completed | Rectilinear face images has been generated                                                      |
| UOC      | C2.3.5. Fire asset semantic segmentation from rectilinear face images based on CV technologies                                 | M29     | Completed | Fire asset has been detected through CV technologies                                            |
| UOC, MOS | C2.4. Testing results of accuracy of fire equipment detection through computer vision                                          | M30     | Completed | The accuracy of the fire equipment automatic identification and DT enrichment will be evaluated |



## BUILDSPACE

|     |                                                                                                               |     |           |                                                  |
|-----|---------------------------------------------------------------------------------------------------------------|-----|-----------|--------------------------------------------------|
| UOC | C2.5. Fire asset PCD and DT model coordination for fire equipment information visualisation in the indoor DT. | M29 | Completed | Updated DT visualisation tool has been developed |
|-----|---------------------------------------------------------------------------------------------------------------|-----|-----------|--------------------------------------------------|

Table 3. (SE1, Pilot 1) Gantt Chart progress. Full-Pilot phase



### 2.1.0.3 Pilot Tracker

#### UC1.1

Table 4. (SE2, Pilot 3) Pilot Tracker. Full-Pilot phase. UC 1.1

| 7<br>8 | Pilot Partner | Service | USE CASE | Technical requirements<br>for end-user to receive the<br>service | Next Steps specified<br>Timeline |                         |                                                                            |                                                                 |            |                                           | Data collection                               |                    |                                       | Responsibility /<br>Leading the<br>use of service<br>Department |
|--------|---------------|---------|----------|------------------------------------------------------------------|----------------------------------|-------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------|------------|-------------------------------------------|-----------------------------------------------|--------------------|---------------------------------------|-----------------------------------------------------------------|
|        |               |         |          |                                                                  |                                  |                         |                                                                            |                                                                 |            |                                           | Percentage of<br>completed<br>data collection | Data missing       | Execution date<br>for missing<br>info |                                                                 |
| 11     | MOS           | SE1     | yes      |                                                                  | Testing inside<br>the SE1        | Feedback<br>no1 for UoC | Live event<br>planning/or<br>ganising for<br>EU level<br>partners<br>(ENG) | Feedback no2<br>for UoC (after<br>enrichment of<br>the service) | Live event | Publicity/com<br>munication<br>activities | 100%                                          | No missing<br>data | No missing<br>data                    | MOS,<br>Digitalisation<br>and Innovation<br>Office              |
| 12     |               |         |          |                                                                  | M25 - M26                        | M26                     | MM25-M28                                                                   | M28                                                             | M28-M29    | M30-M31                                   |                                               |                    |                                       |                                                                 |

#### UC1.2

Table 5. (SE2, Pilot 3) Pilot Tracker. Full-Pilot phase. UC 1.2

|               | UC 1.2  |          |                                                            |                                  |                      |                                                             |                                                        |            |                                      |                                         |                 |                                 |                                                              |
|---------------|---------|----------|------------------------------------------------------------|----------------------------------|----------------------|-------------------------------------------------------------|--------------------------------------------------------|------------|--------------------------------------|-----------------------------------------|-----------------|---------------------------------|--------------------------------------------------------------|
| Pilot Partner | Service | USE CASE | Technical requirements for end-user to receive the service | Next Steps specified<br>Timeline |                      |                                                             |                                                        |            |                                      | Data collection                         |                 |                                 | Responsibility /<br>Leading the use of service<br>Department |
|               |         |          |                                                            |                                  |                      |                                                             |                                                        |            |                                      | Percentage of completed data collection | Data missing    | Execution date for missing info |                                                              |
| MOS           | SE1     | yes      |                                                            | Testing inside the SE1           | Feedback no1 for UoC | Live event planning/or ganising for EU level partners (ENG) | Feedback no2 for UoC (after enrichment of the service) | Live event | Publicity/co mmunicatio n activities | 100%                                    | No missing data | No missing data                 | MOS,<br>Digitalisation and Innovation Office                 |
|               |         |          |                                                            | M26 - M27                        | M27                  | MM25-M28                                                    | M29                                                    | M28-M29    | M30-M31                              |                                         |                 |                                 |                                                              |

#### UC1.3

Table 6. (SE2, Pilot 3) Pilot Tracker. Full-Pilot phase. UC 1.3

| UC 1.3        |         |          |                                                            |                               |                        |                      |                                     |  |  |                                         |                 |                                 |                                                        |  |
|---------------|---------|----------|------------------------------------------------------------|-------------------------------|------------------------|----------------------|-------------------------------------|--|--|-----------------------------------------|-----------------|---------------------------------|--------------------------------------------------------|--|
| Pilot Partner | Service | USE CASE | Technical requirements for end-user to receive the service | Next Steps specified Timeline |                        |                      |                                     |  |  | Data collection                         |                 |                                 | Responsibility / Leading the use of service Department |  |
|               |         |          |                                                            |                               |                        |                      |                                     |  |  | Percentage of completed data collection | Data missing    | Execution date for missing info |                                                        |  |
| MOS           | SE1     | yes      |                                                            | Data delivery to UoC          | Testing inside the SE1 | Feedback no1 for UoC | Publicity/com munication activities |  |  | 100%                                    | No missing data | No missing data                 | MOS, Digitalisation and Innovation Office              |  |
|               |         |          |                                                            | M27                           | M33                    | M33                  | M34                                 |  |  |                                         |                 |                                 |                                                        |  |

## 2.1.0.4 Evaluation Tracker

### UC1.1

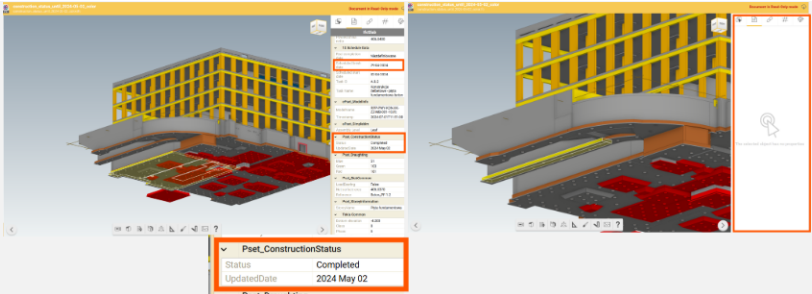
Table 7. (SE1, Pilot 1) Evaluation Tracker. Full-Pilot phase UC1.1

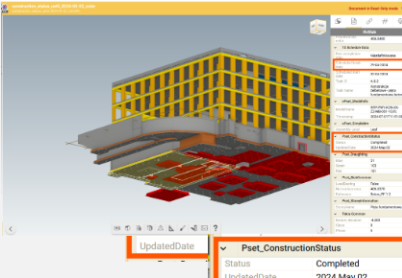
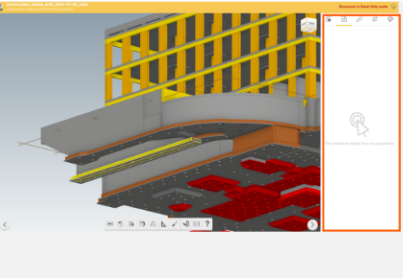
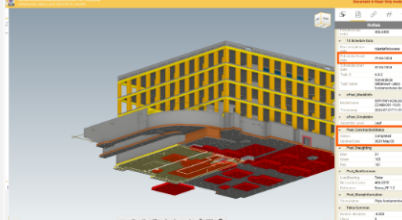
| GENERAL EVALUATION                                             | Evaluating Pilot partner | Description of the current state of the service                                                                                                                                                                                                                                                                                                                      | Rating (1-7) | Recommendations for the improvements of the service                                                                                        |
|----------------------------------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Ease of use of the service (1-7)                               | MOS                      | The integration of the service into the core platform should be defined. Once done, the ease of use could be assessed.                                                                                                                                                                                                                                               | 4            | Models should be integrated into the core platform in order to be easily accessible.                                                       |
| Usability of the service from the end user's perspective (1-7) | MOS                      | The service is valuable for the end user, who can obtain the .ifc model from the delivered point cloud. However, the possibility of uploading the user's own point cloud and its processing by the algorithm should be considered. We believe this will deliver the full potential of the tool, which is the automatisisation of the generation of the digital twin. | 5            | Possibility of uploading user's own point cloud should be integrated to ensure the automatisisation of the generation of the digital twin. |

### UC1.2

Table 8. (SE1, Pilot 1) Evaluation Tracker. Full-Pilot phase UC1.2

| GENERAL EVALUATION                                             | Evaluating Pilot partner | Description of the current state of the service                                                                        | Rating (1-7) | Recommendations for the improvements of the service                                  |
|----------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------|
| Ease of use of the service (1-7)                               | MOS                      | The integration of the service into the core platform should be defined. Once done, the ease of use could be assessed. | 4            | Models should be integrated into the core platform in order to be easily accessible. |
| Usability of the service from the end user's perspective (1-7) | MOS                      | Very useful, especially in real construction site conditions                                                           | 7            |                                                                                      |

| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS                                    |     | Screenshot                                                                           | Description of the current state of the service                                                                                                                                                                                                                                                                                                           | Rating (1-7) | Recommendations for the improvements of the service                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------|-----|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Showing the structural elements constructed on time compared to the construction schedule data | MOS |  | <p>The user is able to see structural elements constructed on time (compared to the construction schedule data included in the 'Schedule data' Property Set -&gt; 'Scheduled finish date' property). The element is depicted in orange/ brown colour and in the Property Set 'Pset_ConstructionStatus' the 'Status' property has a value: 'Completed'</p> | 5 (MOS)      | <p>We would suggest changing the orange/brown colour of the elements constructed on time to green colour. We would find it more intuitive to name the property 'Completed on time' rather than 'Completed'. In our opinion, it provides a more comprehensive view of the issue. It also seems as not every element constructed on time has properties assigned (as shown on the picture on the right side) - it is worth revising (MOS).</p> |

|                                                                                          |     |                                                                                    |                                                                                     |                                                                                                                                                                                                                                                                                                                                  |         |                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Showing the delayed structural elements compared to the construction schedule data       | MOS |  |  | The user is able to see delayed structural elements (in comparison to the construction schedule data, included in the 'Schedule data' Property Set -> 'Scheduled finish date' property). The element is depicted in red colour and in the Property Set 'Pset_ConstructionStatus' the 'Status' property has a value: 'Undetected' | 6 (MOS) | In our opinion it would be more intuitive for the end user if the 'Status' property had the value: 'Delayed'. Considering that the end user may not be familiar with how the algorithm works, we believe 'Delayed', would be easier for them to understand than 'Undetected' (MOS).                                                                                |
| Showing structural elements that were not planned to be constructed by a particular date | MOS |  |  | Structural elements that were not planned to be constructed by a particular date are not depicted in any colour and do not have the Property Set 'Pset_ConstructionStatus'                                                                                                                                                       | 6 (MOS) | It would be more intuitive for the end user if those elements would have assigned the information about the fact that they were not planned to be constructed by this particular date. We suggest that they have Property Set 'Pset_ConstructionStatus' assigned with the 'Status' property and its value: 'Not applicable' or 'Later planned construction' (MOS). |

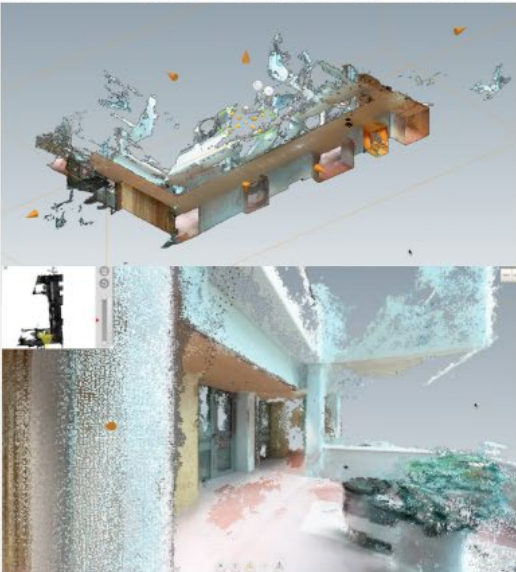
### UC1.3

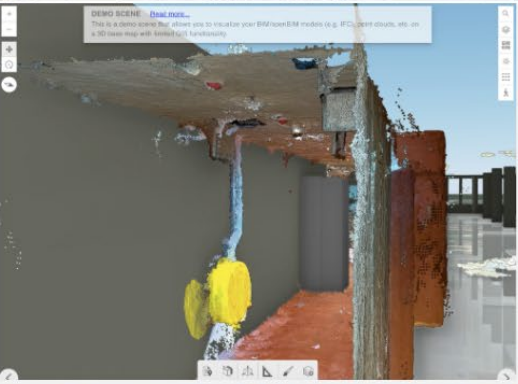
Table 9. (SE1, Pilot 3) Evaluation Tracker. Full-Pilot phase UC1.3

| GENERAL EVALUATION                                             | Description of the current state of the service            | Rating (1-7) | Recommendations for the improvements of the service |
|----------------------------------------------------------------|------------------------------------------------------------|--------------|-----------------------------------------------------|
| Ease of use of the service (1-7)                               | The service is well adapted to the ACCA software.          | 7            | No                                                  |
| Usability of the service from the end user's perspective (1-7) | The service is easy to use through the visualisation tool. | 7            | No                                                  |





| UC 1.3                                                              |                                                                                     |                                                               |              |                                                     |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------|-----------------------------------------------------|
| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS         | Screenshot                                                                          | Description of the current state of the service               | Rating (1-7) | Recommendations for the improvements of the service |
| The location of the project in GIS map                              |   | The user is able to see the location of the Pilots on the map | 7            | No                                                  |
| The visaulsiation of the point cloud model generated from 360 video |  | The user is able to see the point cloud of the Pilot          | 6            | The point cloud could be cleaner.                   |

|                                                                                                |                                                                                     |                                                                           |          |           |
|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------|-----------|
| <p>The integrated visualisation of IFC model and the point cloud model of the testbed area</p> |   | <p>The user can see the point cloud properly located in the IFC model</p> | <p>7</p> | <p>No</p> |
| <p>The highlights of the indoor fire asset</p>                                                 |   | <p>The indoor fire equipment was automatically detected and segmented</p> | <p>7</p> | <p>No</p> |
| <p>Accuracy of the fire asset's location</p>                                                   |  | <p>The accuracy is sufficiently enough</p>                                | <p>7</p> | <p>No</p> |

## 2.1.1 Pilot 2 – Riga, Latvia

### 2.1.1.1 Gantt Chart

This scenario by testing the generation of the Digital Twin of a building from locally sourced geometry data was completed and provided for testing to Pilot. Following the completion of the pre-pilot phase, during which foundational datasets were provided by GeoRiga and the Riga Energy Agency, involving also data from CulturHistorical Data, Riga Planning Region has transitioned into the Full Pilot Phase. This phase is the next step forward in the practical testing and integration of Digital Twin (DT) technologies within the urban environment of Riga. The pilot focuses on the Former Riga Technical University Administrative Building in the Old Town of Riga, identified as a strategic site in BUILDSPACE due to its architectural and infrastructural complexity and its suitability for demonstrating the capabilities of services in a real-world setting and usage.

During the full pilot phase, the primary objective is to integrate and test the Service within the potential for further use in the future. This involves:

- Enhancing the accuracy of the DT.
- Aligning the Digital Twin interface with practical usage, details what to evaluate;
- Evaluating the DT’s ability to support planning, monitoring, and decision-making activities of Riga municipality.
- RPR’s role includes providing continuous feedback on usability and user-friendly interface.

Afterwards, a dedicated training program will be launched to familiarize Riga’s municipality representatives, the ministry persons, academic staff, including students, and urban planners, architects, with the Digital Twin’s tools and interfaces. This ensures the system is not only technically sound but also practically adoptable by its end users. Furthermore, a demonstration event will be organized to showcase the DT system to relevant stakeholders highlighting its potential for supporting sustainable and data-driven urban development.

*Table 10. (SE1, Pilot 2) Progress of tasks in the full-pilot phase related to Gantt Chart*

| Responsible Partner | Streams of Activities                             | Month   | Progress  | Results                                            |
|---------------------|---------------------------------------------------|---------|-----------|----------------------------------------------------|
|                     | B. Infrastructure-related Activities              |         |           |                                                    |
|                     | B.1 Technology/Equipment/Building                 |         |           |                                                    |
| RPR                 | B1.1. Building selection                          | M10-M11 | Completed | Former Riga Technical University                   |
| UOC                 | B2. Tool/Platform/Service Deployment/Integration  |         |           |                                                    |
| UOC, MOBICS         | B2.1. EGNSS integration into building-scale model | M19-M25 | Completed | The screen-based mode interface has been confirmed |

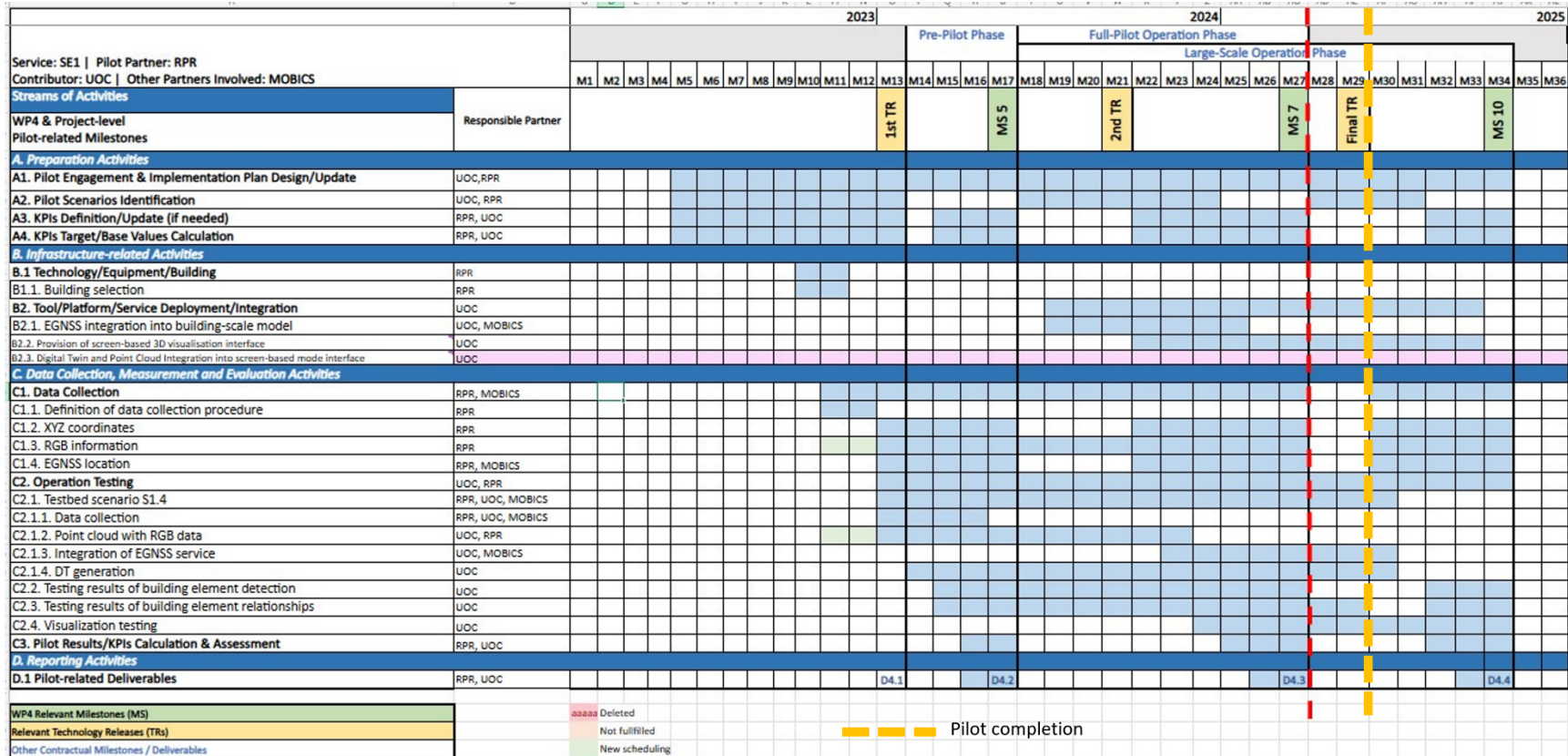
|                                                           |                                                                                             |         |           |                                                                                                                                     |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------|---------|-----------|-------------------------------------------------------------------------------------------------------------------------------------|
| UOC                                                       | B2.2. DT and Point cloud integration into AR and VR interface (merged with B2.3 to be B2.2) | M22-M33 | Completed | The point cloud and digital twin model has been integrated separately into the screen-based mode interface                          |
| C. Data Collection, Measurement and Evaluation Activities |                                                                                             |         |           |                                                                                                                                     |
| C1. Data Collection                                       |                                                                                             |         |           |                                                                                                                                     |
| RPR                                                       | C1.1. Definition of data collection procedure                                               | M11-M12 | Completed | Data requested (it was decided to choose a building with the existing laser scanning data of the municipality)                      |
| RPR                                                       | C1.2. XYZ coordinates                                                                       | M13-M17 | Completed | Data (Point Cloud Data of target building and surrounding buildings) obtained from the municipality of Riga and provided to the UOC |
| RPR                                                       | C1.3. RGB information                                                                       | M13-M17 | Completed | Data (RGB data of the target building) obtained from the municipality of Riga and provided to the UOC                               |
| RPR, MOBICS                                               | C1.4. EGNSS location                                                                        | M13-M17 | Completed | EGNSS location of the building provided                                                                                             |
| C2. Operation Testing                                     |                                                                                             |         |           |                                                                                                                                     |
| C2.1. Testbed scenario S1.4                               |                                                                                             |         |           |                                                                                                                                     |
| RPR, UOC, MOBICS                                          | C2.1.1. Data collection                                                                     | M13-M16 | Completed | Data has been provided to SE1 developer                                                                                             |
| UOC, RPR                                                  | C2.1.2. Point cloud with RGB data                                                           | M13-M23 | Completed | Point cloud data with RGB values for selected building provided to UOC                                                              |
| UOC, MOBICS                                               | C2.1.3. Integration of EGNSS service                                                        | M23-M30 | Completed | The Geo location of RPR pilot project is received, UOC will work on the integration of geolocationing of DT                         |
| UOC                                                       | C2.1.4. DT generation                                                                       | M14-M30 | Completed | DT created. Algorithm is being improved                                                                                             |

|     |                                                         |         |           |                                                                                     |
|-----|---------------------------------------------------------|---------|-----------|-------------------------------------------------------------------------------------|
| UOC | C2.2. Testing results of building element detection     | M15-M27 | Completed | The IFC element is generated for walls, windows and openings. Algorithm is improved |
| UOC | C2.3. Testing results of building element relationships | M15-M29 | Completed | Spatial relationship between wall, opening and window have been built.              |
| UOC | C2.4. Visualization testing                             | M24-M34 | Completed | Visualization tools are developed                                                   |



# BUILDSPACE

Table 11. (SE1, Pilot 2) Progress of tasks in the full-pilot phase related to Gantt Chart





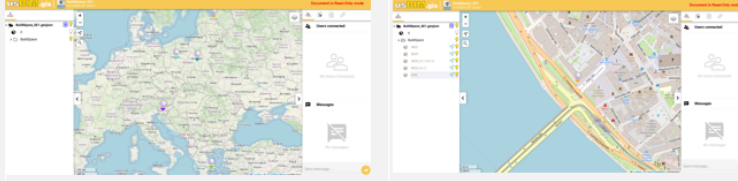
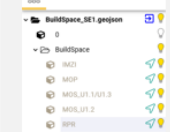
### 2.1.1.2 Pilot Tracker

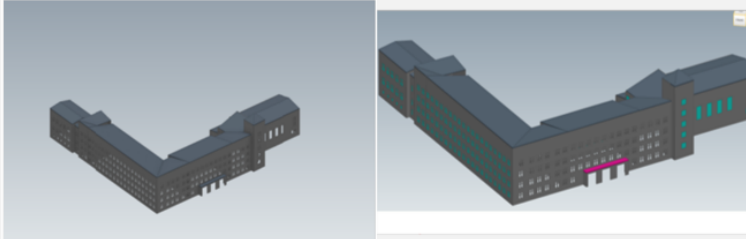
Table 12. (SE1, Pilot 2) Pilot Tracker. Full-Pilot phase

| UC 1.1        |         |          |                                                            |                               |                                                            |                                                 |          |                                   |                                    |                                         |                 |                                 |                                                        |
|---------------|---------|----------|------------------------------------------------------------|-------------------------------|------------------------------------------------------------|-------------------------------------------------|----------|-----------------------------------|------------------------------------|-----------------------------------------|-----------------|---------------------------------|--------------------------------------------------------|
| Pilot Partner | Service | USE CASE | Technical requirements for end-user to receive the service | Next Steps specified Timeline |                                                            |                                                 |          |                                   |                                    | Data collection                         |                 |                                 | Responsibility / Leading the use of service Department |
|               |         |          |                                                            |                               |                                                            |                                                 |          |                                   |                                    | Percentage of completed data collection | Data missing    | Execution date for missing info |                                                        |
| RPR           | SE1     | yes      |                                                            | Testing inside the SE1        | Live event planning/organising for EU level partners (ENG) | Live event planning/stakeholder engagement (LV) | Feedback | Practical seminar for stakeholder | Publicity/communication activities | 100%                                    | No missing data | No missing data                 | GEO Rīga, RPR, Riga municipality                       |
|               |         |          |                                                            | M25 - M26                     | M29                                                        | M29                                             | M30      | M30                               | M30-M34                            |                                         |                 |                                 |                                                        |

### 2.1.1.3 Evaluation Tracker

Table 13. (SE1, Pilot 2) Validation Tracker. Full-Pilot phase

| UC 1.1                                                      |                          |                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                                                              |              |                                                                                                                                                                                                                    |
|-------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS | Evaluating Pilot partner | Screenshot                                                                          |  | Description of the current state of the service                                                                                                                                                                                                                                                                                                                                                              | Rating (1-7) | Recommendations for the improvements of the service                                                                                                                                                                |
| Showing the Pilot location integrated with GIS data         | RPR                      |  |  | <p>URL - <a href="https://service.usbim.com/link/5Bjnt9Z4kqbXvg1HFL9CISPA">https://service.usbim.com/link/5Bjnt9Z4kqbXvg1HFL9CISPA</a></p> <p>The user is able to see the location of the Pilots on the map, see the name of the pilot in hover pop-up, but user cases are visible only for MOS.</p> <p>User can double-click on the pilot to zoom by steps or use "fly to" on the left pane to zoom in.</p> | 5            | <p>The mark should be better visible (colour).</p> <p>Name pilots by the city (and maybe country), not the organization:</p>  |

|                                                                                         |     |                                                                                    |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Showing the point cloud model                                                           | RPR |   |  | <p>URL - <a href="https://service.usbim.com/link/RWqlrMghPRVn8iS1x5vdhj2H">https://service.usbim.com/link/RWqlrMghPRVn8iS1x5vdhj2H</a></p> <p>The user is able to see the point cloud model, from which the IFC model was generated. User can interact with the model.</p> <p>Navigation in the model is not intuitive and easy.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6 | <p>Core/ SE1 platform should include easy accessible manual of key functions (for example, info button), including navigating (right mouse button to adjust the angle, Hold down the middle mouse wheel to pan the model etc.) and key functions of the toolbar functionalities that are meaningful to use with the point cloud model.</p> <p>Point cloud model could have "about" information, where, for example, point density is mentioned, so that user can compare from what data what result can be obtained.</p>                                                                                                   |
| Showing the IFC model - the outcome of the DT automatic generation from the point cloud | RPR |  |  | <p>URL - <a href="https://service.usbim.com/link/NGbw5hjb0xIolduhRcZKmMm7">https://service.usbim.com/link/NGbw5hjb0xIolduhRcZKmMm7</a></p> <p>The user is able to see the outcome of the DT automatic generation - the IFC model generated from the point cloud.</p> <p>The user can interact with the model by changing colors of the roof and wall elements. Windows can be seen, if openings are set to View, but there are no openings defined for one wall (see the picture).</p> <p>Other functionality can be used to interact with the model.</p> <p>Heights, angles, surface areas can be measured. Model can be zoomed in/out, turned, panned, but navigation is not intuitive.</p> <p>There is an option to explore building storeys, but it is not clear how they are divided (in addition - Level 08 options differs from other levels).</p> | 4 | <p>Make openings visible by default. Make openings for all walls.</p> <p>Core/ SE1 platform should include easy accessible manual of key functions (for example, info button), including navigating (right mouse button to adjust the angle, Hold down the middle mouse wheel to pan the model etc.) and key functions of the toolbar and left pane functionalities (for example, changing colors, finishing surface area measurements, shadow tool functionalities) that are meaningful to use with the IFC model.</p> <p>Exploring storeys either should be removed or storeys (levels) should be defined correctly.</p> |



|                                                                                                                                                   |     |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Showing the Federated model - photogrametric representation with the IFC model (the outcome of the automatic DT generation from this point cloud) | RPR |  | <p>URL - <a href="https://service.usbim.com/link/Y7S2KKCcJZnsWk8QEiqJx8E7">https://service.usbim.com/link/Y7S2KKCcJZnsWk8QEiqJx8E7</a></p> <p>The user is able to see the Federated model (photogrammetry and the DT). The user can see that these models align, which indicates that the algorithm functions correctly. This is a feature that demonstrates the reliability of the service.</p> <p>It is possible to interact with the model, for example, change color, navigate etc.</p> <p>It is possible for user to view point and ifc models together or to switch off one and see and explore only one of them, so all previously mentioned things apply to this model as well. Navigation and interaction with model is hard.</p> | 5 | <p>Core/ SE1 platform should include easy accessible manual of key functions (for example, info button), including navigating (right mouse button to adjust the angle, Hold down the middle mouse wheel to pan the model etc.) and key functions of the toolbar and left pane functionalities that are meaningful to use with the Federated model.</p> <p>Core platform should have easy accessible About information, where the used data are described.</p> <p>Interface should be more intuitive and easier to use, otherwise it is good to have this Federated model, where it is possible to explore Point cloud model and IFC model separately as well.</p> |
|                                                                                                                                                   | RPR |                                                                                    | lack of the possibility                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 | We recommend implementing this functionality in the core/SE1 platform, as it could be the most interesting thing for stakeholders.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| The resulting DTs will be linked with EGNSS data for integration into city-scale models.                                                          | RPR |                                                                                    | lack of the integration with the EGNSS data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1 | We recommend implementing this functionality in the core/ SE1 platform                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                                                                                   | RPR |                                                                                    | The only place, where location visible is in the first map ( <a href="https://service.usbim.com/link/5B)nt9Z4kbXvg1HFL9CI SPA">https://service.usbim.com/link/5B)nt9Z4kbXvg1HFL9CI SPA</a> ). Besides that (in point cloud, ifc, federated model viewers) it is impossible to find location or coordinates of the building.                                                                                                                                                                                                                                                                                                                                                                                                                | 2 | Implement overview map in in the core/ SE1 platform.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| The information of IFC elements can be checked                                                                                                    | RPR |                                                                                    | In point cloud, ifc, federated model viewers it is impossible to find any attribute information of elements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1 | We recommend adding attribute information to building elements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## 2.1.2 Pilot 3 – Piraeus, Greece

### 2.1.2.1 Gantt Chart

Following the completion of the pre-pilot phase, the Municipality of Piraeus has entered the full pilot operation phase. This phase focuses on the deployment and testing of the high-fidelity multi-modal Digital Twin at the building scale, validating its applicability in building monitoring and hotspot identification. The full pilot focuses on the selected site (the 21st Elementary School of Piraeus), which was identified as the most suitable location for the implementation of the BUILDSPACE technologies.

The data collection process (summer 2024) included 2 key field visits:

Aerial reconnaissance was conducted to create a rough 3D model of the building and topographic work was performed to measure photo-stable points on the ground and the building, as required by the project team. By the end of the first fieldwork day, preliminary data was processed to build a basic 3D model, which served as the basis for designing flight trajectories for lateral shots.

The first stage of the full pilot phase involves deploying and testing the DT within the selected environment. The integration of the geo-referenced data collected will be refined to improve system performance and accuracy. The usability of Digital Twin in real-world conditions will be assessed, to ensure compatibility with the proposed workflows.

A structured training program will be developed to familiarize municipal personnel and stakeholders with the DT system and its applications. Additionally, an event will be organized to demonstrate the potential of DT technologies to public authorities, urban planners, and industry professionals.

During months M22–M26, the Municipality of Piraeus will participate in evaluating BUILDSPACE components to assess both usability and performance levels. The assessment will focus on:

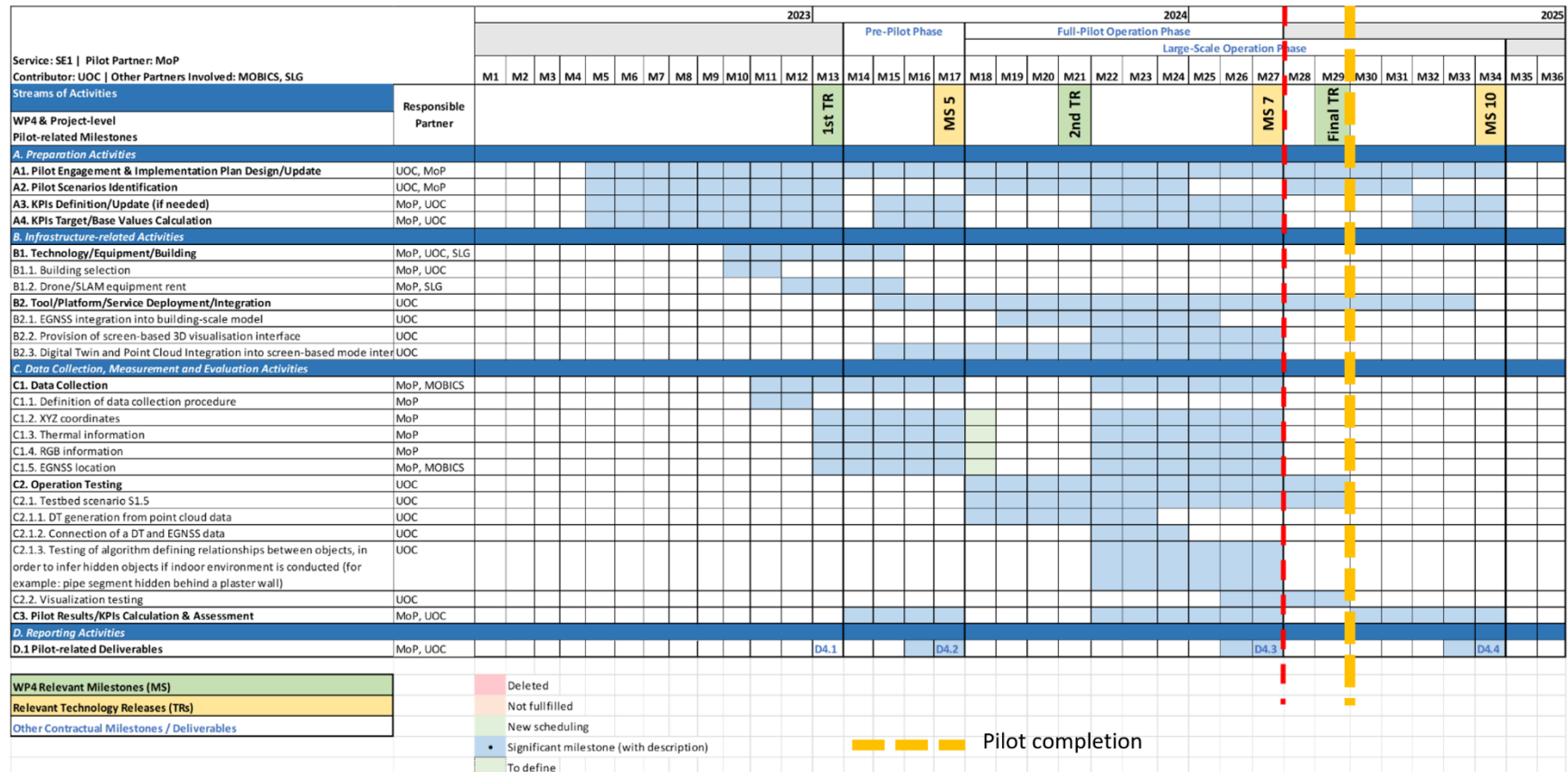
- Functionality
- Accuracy
- User Experience
- Impact

*Table 14. (SE1, Pilot 3) Progress of tasks in the full-pilot phase related to Gantt Chart*

| Responsible Partner | Streams of Activities                             | Month | Progress  | Results                                                               |
|---------------------|---------------------------------------------------|-------|-----------|-----------------------------------------------------------------------|
|                     | B. Infrastructure-related Activities              |       |           |                                                                       |
|                     | B1. Technology/Equipment/Building                 |       |           |                                                                       |
| MoP, UOC            | B1.1. Building selection                          |       | Completed | 21st Elementary School of Piraeus' building                           |
| MoP, SLG            | B1.2. Drone/SLAM equipment rent                   | M17   | Completed | Postponed to June                                                     |
|                     | B2. Tool/Platform/Service Deployment/Integration  |       |           |                                                                       |
| UOC                 | B2.1. EGNSS integration into building-scale model |       | Completed | The geolocation has been added in the IFC format building-scale model |

|                                                           |                                                                                                                                                                                                   |           |           |                                                                                                                          |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|--------------------------------------------------------------------------------------------------------------------------|
| UOC                                                       | B2.2. Provision of AR and VR interface                                                                                                                                                            |           | Completed | The screen-based mode interface has been confirmed                                                                       |
| UOC                                                       | B2.3. Digital Twin and Point cloud integration into AR and VR interface                                                                                                                           |           | Completed | The point cloud and digital twin model has been integrated sperately and federately into the screen-based mode interface |
| C. Data Collection, Measurement and Evaluation Activities |                                                                                                                                                                                                   |           |           |                                                                                                                          |
| C1. Data Collection                                       |                                                                                                                                                                                                   |           |           |                                                                                                                          |
| MoP                                                       | C1.1. Definition of data collection procedure                                                                                                                                                     | M11 - M16 | Completed |                                                                                                                          |
| MoP                                                       | C1.2. XYZ coordinates                                                                                                                                                                             | M17 - M18 | Completed |                                                                                                                          |
| MoP                                                       | C1.3. Thermal information                                                                                                                                                                         | M17 - M18 | Completed |                                                                                                                          |
| MoP                                                       | C1.4. RGB information                                                                                                                                                                             | M17 - M18 | Completed |                                                                                                                          |
| MoP, MOBICS                                               | C1.5. EGNSS location                                                                                                                                                                              | M17 - M18 | Completed |                                                                                                                          |
| C2. Operation Testing                                     |                                                                                                                                                                                                   |           |           |                                                                                                                          |
| C2.1. Testbed scenario S1.5                               |                                                                                                                                                                                                   |           |           |                                                                                                                          |
| UOC                                                       | C2.1.1. DT generation from point cloud data                                                                                                                                                       |           | Completed | Digital twin model has been gerenated based on point cloud data                                                          |
| UOC                                                       | C2.1.2. Connection of a DT and EGNSS data                                                                                                                                                         |           | Completed | The object-based IFC element has been generated                                                                          |
| UOC                                                       | C2.1.3. Testing of algorithm defining relationships between objects, in order to infer hidden objects if indoor environment is conducted (for example: pipe segment hidden behind a plaster wall) |           | Completed | The spatial relationship among the building elements are generated in the IFC format model                               |
| UOC                                                       | C2.2. Visualization testing of MR/VR visualisation                                                                                                                                                |           | Completed | The point cloud model and digital twin model can be visulised through the screen-based visulisation interface            |

Table 15. (SE1, Pilot 3) Gantt Chart progress. Full-Pilot phase



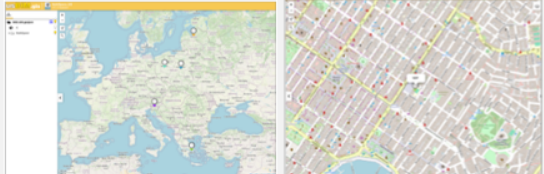
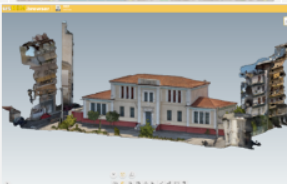
### 2.1.2.2 Pilot Tracker

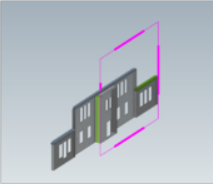
Table 16. (SE1, Pilot 3) Pilot Tracker. Full-Pilot phase

| UC 1.1        |         |          |                                                            |                               |                      |                   |                                                        |                                   |                                     |                                         |                 |                                 |                                                        |
|---------------|---------|----------|------------------------------------------------------------|-------------------------------|----------------------|-------------------|--------------------------------------------------------|-----------------------------------|-------------------------------------|-----------------------------------------|-----------------|---------------------------------|--------------------------------------------------------|
| Pilot Partner | Service | USE CASE | Technical requirements for end-user to receive the service | Next Steps specified Timeline |                      |                   |                                                        |                                   |                                     | Data collection                         |                 |                                 | Responsibility / Leading the use of service Department |
|               |         |          |                                                            |                               |                      |                   |                                                        |                                   |                                     | Percentage of completed data collection | Data missing    | Execution date for missing info |                                                        |
| MoP           | SE1     | yes      |                                                            | Testing inside the SE1        | Feedback no1 for UoC | Training planning | Feedback no2 for UoC (after enrichment of the service) | Practical seminar for stakeholder | Publicity/com munication activities | 100%                                    | No missing data | No missing data                 | IT Department of the Municipality of Piraeus           |
|               |         |          |                                                            | M25 - M26                     | M26-M27              | MM25-M28          | M28                                                    | M28-M29                           | M30-M31                             |                                         |                 |                                 |                                                        |

### 2.1.2.3 Evaluation Tracker

Table 17. (SE1, Pilot 3) Evaluation Tracker. Full-Pilot phase

| UC 1.1                                                      |                          |                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                     |              |                                                                            |
|-------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------------|
| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS | Evaluating Pilot partner | Screenshot                                                                          |  | Description of the current state of the service                                                                                                                                                                                                                                                                                                     | Rating (1-7) | Recommendations for the improvements of the service                        |
| Showing the Pilot location integrated with GIS data         | MoP                      |  |  | The user is able to see the location of all Pilots on the map and user cases applicable to each of them. The user can use the "fly to" function to zoom in the selected User Case. In the "properties" section the user can see the EGNSS location of the UC. This is shown on the usBIM.gis platform which is a temporary platform for the project | 6            | We recommend implementing this functionality in the core/ SE1 platform     |
| Showing the point cloud model                               | MoP                      |  |  | The user is able to see the photogrametric data building representation and interact with it by creating 3D sections for example.                                                                                                                                                                                                                   | x            | Right-click option Visibility>Invert does not work - not sure what it does |

|                                                                                                                                                   |     |                                                                                   |                                                                                   |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                      |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Showing the IFC model - the outcome of the DT automatic generation from the point cloud                                                           | MoP |  |  |                                                                                    | The user is able to see the outcome of the DT automatic generation - the IFC model generated from the point cloud. The user can interact with the model by changing colors on the various elements (see screenshot) including the openings, and also their transparency. Other functionality can be used to interact with the model like creating 3D sections (see screenshot). However this feature is hard to use. | x | In the storey options the levels are not shown correctly (level 0 selects the whole building, level 1 selects only some elements of level 1 and level 2 selects the roof). In the core platform there should be more instruction on the use of all available tools.                                                                                                                                                                                              |
| Showing the Federated model - photogrametric representation with the IFC model (the outcome of the automatic DT generation from this point cloud) | MoP |  |  |  | The user is able to see the Federated model (photogrammetry and the DT) and can see that these models align, which indicates that the algorithm functions correctly. This is a feature that demonstrates the reliability of the service.                                                                                                                                                                             | x | In the storey options the levels are not shown correctly (level 0 selects the whole building, level 1 selects only some elements of level 1 and level 2 selects the roof). In the core platform there should be more instruction on the use of all available tools. The choose colour function does not appear equally good in all elements (see yellow wall in the screenshot). The 3D section tool is not easy to use and would benefit from some instructions |

## 2.1.3 Pilot 4 – Ljubljana, Slovenia

### 2.1.3.1 Gantt Chart

In the full pilot phase, full pilot data collection activities were successfully completed by the selected building geometry datasets providing XYZ coordinates and RGB information (C1.2 and C1.3) provided by IMZI. Then EGNSS location was provided by determining the positions (lat, long and altitude).

Following data collection, this phase focuses on the deployment and testing of the high-fidelity multi-modal Digital Twin at the building scale, validating its applicability in building visualisation and monitoring. The pilot focuses on the modern building (built in 2014) in the City of Ljubljana, identified as a suitable location for the implementation of the BUILDSPACE technologies and for demonstrating the capabilities of services in a real-world setting and usage.

During the full pilot phase, the primary objective is to integrate and test the service within the potential for further use in the future. Operation testing was done through Testing results of building element detection (C2.2), Testing results of building element detection and object relationships (C2.3), and Visualization testing (C2.4).

During months M28–M34, the IMZI will participate in refining BUILDSPACE components to assess both usability and performance levels.

*Table 18. (SE1, Pilot 4) Progress of tasks in the full-pilot phase related to Gantt Chart*

| Responsible Partner | Streams of Activities                                                           | Month     | Progress pre-pilot phase | Results                                                                   |
|---------------------|---------------------------------------------------------------------------------|-----------|--------------------------|---------------------------------------------------------------------------|
|                     | B. Infrastructure-related Activities                                            |           |                          |                                                                           |
|                     | B.1 Technology/Equipment/Building                                               |           |                          |                                                                           |
| IMZI                | B1.1. Building selection                                                        | M13       | Completed                | The FKKT-FRI building of the University of Ljubljana                      |
|                     | B2. Tool/Platform/Service Deployment/Integration                                |           |                          |                                                                           |
| UOC, MOBICS         | B2.1. EGNSS integration into building-scale model in the platform               | M19 - M25 | Completed                | The geolocation has been added in the IFC format building-scale model     |
| UOC                 | B2.2. Provision of screen-based 3D visualisation interface                      | M22 - M33 | Completed                | The screen-based mode interface has been confirmed                        |
| UOC                 | B2.3. Digital Twin and Point Cloud Integration into screen-based mode interface | M25 - M29 | Completed                | The point cloud and digital twin model has been integrated separately and |



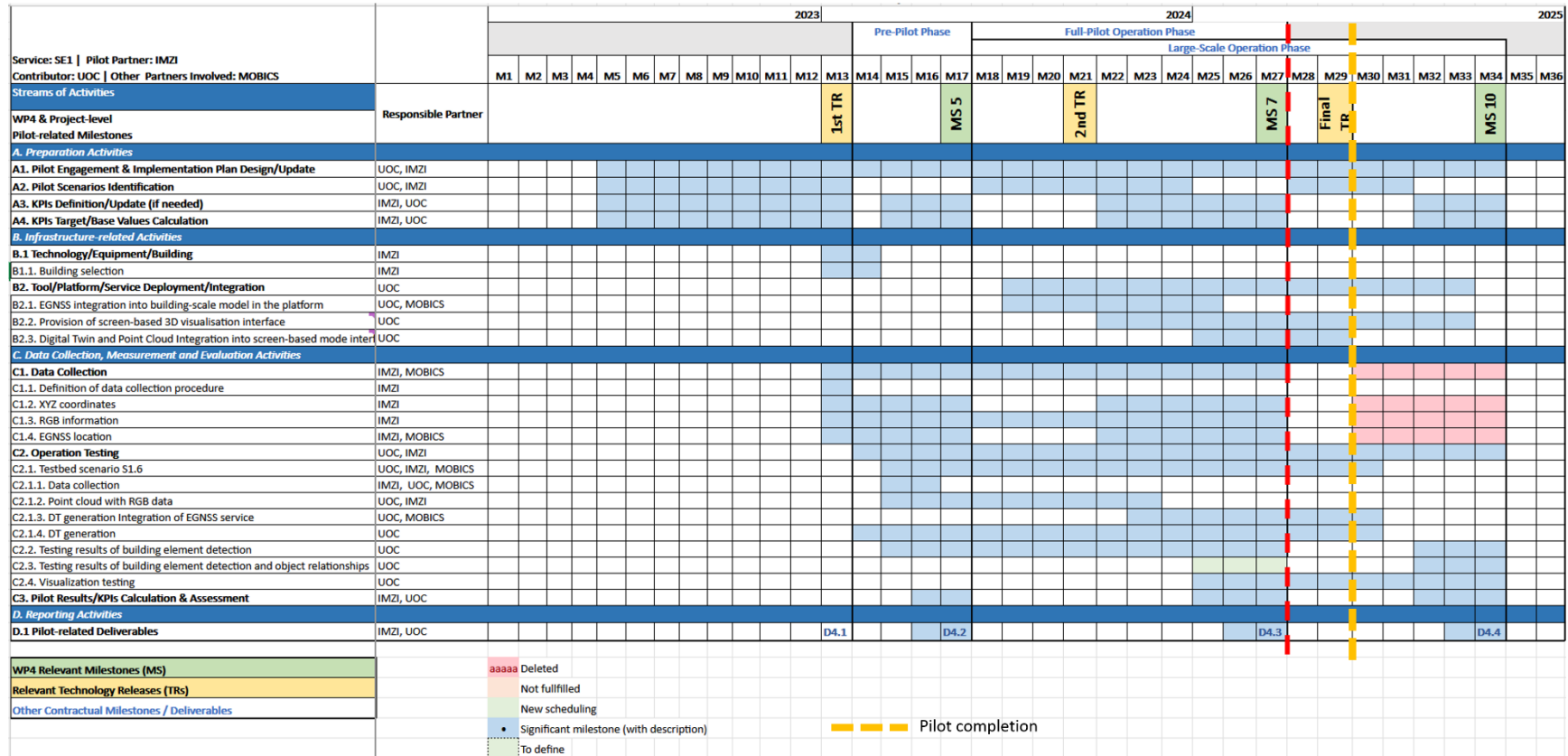
|                                                           |                                                     |           |           |                                                                                                    |
|-----------------------------------------------------------|-----------------------------------------------------|-----------|-----------|----------------------------------------------------------------------------------------------------|
|                                                           |                                                     |           |           | federately into the screen-based mode interface                                                    |
| C. Data Collection, Measurement and Evaluation Activities |                                                     |           |           |                                                                                                    |
| C1. Data Collection                                       |                                                     |           |           |                                                                                                    |
| IMZI                                                      | C1.1. Definition of data collection procedure       | M13       | Completed | specifications                                                                                     |
| IMZI                                                      | C1.2. XYZ coordinates                               | M14       | Completed | Coordinates of GCPs (EPSG 3794 horizontal and EPSG 10246 vertical)                                 |
| IMZI                                                      | C1.3. RGB information                               | M14       | Completed | Photogrammetry images of P1 and P4RTK sensors, Panoramic images and flyovers (P1 > 3_misc folder), |
| IMZI, MOBICS                                              | C1.4. EGNSS location                                | M13 - M17 | Completed | Positions (lat, long and altitude)                                                                 |
| C2. Operation Testing                                     |                                                     |           |           |                                                                                                    |
| C2.1. Testbed scenario S1.6                               |                                                     |           |           |                                                                                                    |
| IMZI, UOC, MOBICS                                         | C2.1.1. Data collection                             | M14       | Completed | point cloud in PLY format, 3D model (mesh) in OBJ format, orthophoto in JPG                        |
| UOC, IMZI                                                 | C2.1.2. Point cloud with RGB data                   | M14       | Completed | point cloud data in .ply and .obj formats                                                          |
| UOC, MOBICS                                               | C2.1.3. DT generation Integration of EGNSS service  | M23 - M30 | Completed | The geolocation has been added in the IFC format building-scale model                              |
| UOC                                                       | C2.1.4. DT generation                               | M14 - M17 | Completed | Digital twin model has been generated based on point cloud data                                    |
| UOC                                                       | C2.2. Testing results of building element detection | M15 - M17 | Completed | The object-based IFC element has been generated                                                    |





|     |                                                                              |           |           |                                                                                                               |
|-----|------------------------------------------------------------------------------|-----------|-----------|---------------------------------------------------------------------------------------------------------------|
| UOC | C2.3. Testing results of building element detection and object relationships | M32 - M34 | Completed | The spatial relationship among the building elements are generated in the IFC format model                    |
| UOC | C2.4. Visualization testing                                                  | M25 - M34 | Completed | The point cloud model and digital twin model can be visulised through the screen-based visulisation interface |

Table 19. (SE1, Pilot 4) Gantt Chart progress. Full-Pilot phase



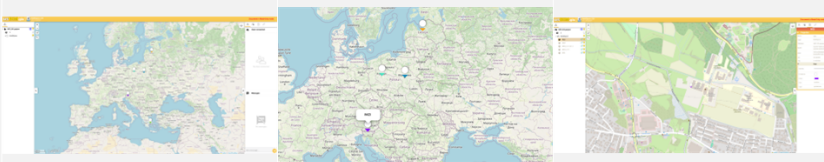
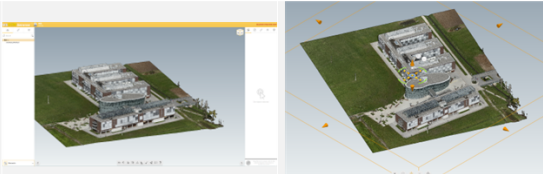
### 2.1.3.2 Pilot Tracker

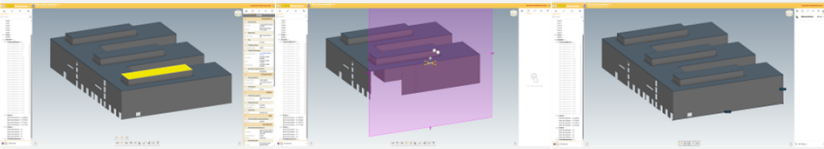
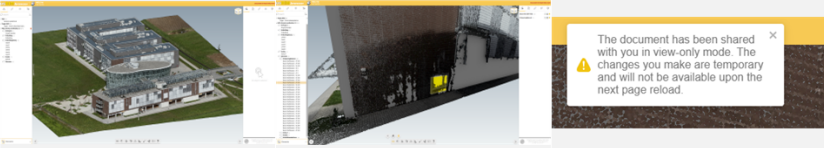
Table 20. (SE1, Pilot 4) Pilot Tracker. Full-Pilot phase

| UC 1.1        |         |          |                                                            |                               |                      |                                                         |                                    |   |   |                                         |                 |                                 |                                                        |
|---------------|---------|----------|------------------------------------------------------------|-------------------------------|----------------------|---------------------------------------------------------|------------------------------------|---|---|-----------------------------------------|-----------------|---------------------------------|--------------------------------------------------------|
| Pilot Partner | Service | USE CASE | Technical requirements for end-user to receive the service | Next Steps specified Timeline |                      |                                                         |                                    |   |   | Data collection                         |                 |                                 | Responsibility / Leading the use of service Department |
|               |         |          |                                                            |                               |                      |                                                         |                                    |   |   | Percentage of completed data collection | Data missing    | Execution date for missing info |                                                        |
| IMZI          | SE1     | yes      |                                                            | Testing inside the SE1        | Feedback no1 for UoC | Feedback no2 for UoC (after refinements of the service) | Publicity/communication activities | x | x | 100%                                    | No missing data | No missing data                 | IMZI & LUZ Infrastructure planning department          |
|               |         |          |                                                            | M25 - M26                     | M26                  | M30                                                     | M30-M34                            |   |   |                                         |                 |                                 |                                                        |

### 2.1.3.3 Evaluation Tracker

Table 21. (SE1, Pilot 4) Validation Tracker. Full-Pilot phase

| UC 1.1                                                     |                          |                                                                                     |  |  |                                                                                                                                                                                                                                                                                                                                                          |              |                                                                        |
|------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------------------------------------------------------|
| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECT | Evaluating Pilot partner | Screenshot                                                                          |  |  | Description of the current state of the service                                                                                                                                                                                                                                                                                                          | Rating (1-7) | Recommendations for the improvements of the service                    |
| Showing the Pilot location integrated with GIS data        | IMZI                     |  |  |  | The user is able to see the location of the Pilots on the map and user cases applicable to each of them. The user can use the "fly to" function to zoom in the selected User Case. In the properties section the user can see the EGNSS location of the Use Case. This is shown on the usBIM.gis platform which is a temporary platform for the project. | 7            | We recommend implementing this functionality in the core/ SE1 platform |
| Showing the point cloud model                              | IMZI                     |  |  |  | The user is able to see the photogrammetric data building representation and interact with it by creating 3D sections for example. This is shown on the usBIM.brower platform which is a temporary platform for the project.                                                                                                                             | 7            | We recommend implementing this functionality in the core/ SE1 platform |

|                                                                                                                                                    |      |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Showing the IFC model - the outcome of the DT automatic generation from the point cloud                                                            | IMZI |  | <p>The user is able to see the outcome of the algorithm functioning - the IFC model (DT) generated from the photogrammetric data. The IFC generated corresponds to the actual geometry of the object. The elements of the IFC model have the correct entity assigned, e.g., IfcWall, IfcSlab. The user can interact with the IFC model by using different camera projections, creating 3D sections, make the measurements and provide making a screenshot. This is shown on the usBIM.brower platform which is a temporary platform for the project.</p> | 5 | <p>We recommend implementing this functionality in the core/ SE1 platform. Information Structure of the Model doesn't provide users to expand and select specific elements at all. Right-click on to adjust its visibility, change its color, set transparency levels, or zoom in on the selected object for better visualization don't work. Additionally, it would be valuable to provide the user with an explanation of how the DT is generated from the point cloud (how the algorithm functions).</p> |
| Showing the Federated model - photogrammetric representation with the IFC model (the outcome of the automatic DT generation from this point cloud) | MOS  |  | <p>The user is able to see the Federated model (photogrammetry and the DT) and the user can see that these models align, which indicates that the algorithm functions correctly. This is a feature that demonstrates the reliability of the service.</p>                                                                                                                                                                                                                                                                                                 | 5 | <p>We recommend implementing this functionality in the core/ SE1 platform. Information Structure of the Model doesn't provide users to expand and select specific elements at all. Right-click on to adjust its visibility, change its color, set transparency levels, or zoom in on the selected object for better visualization don't work. Additionally, it would be valuable to provide the user with an explanation of how the DT is generated from the point cloud (how the algorithm functions).</p> |

## 2.2 Service 2 – Digital Twin Enrichment

### 2.2.0 Pilot 1 – Poland, Warsaw

#### 2.2.0.1 Testbed Scenario

No modifications have been introduced to the originally defined testbed scenario for case S2.1. Despite encountering several technical and operational challenges during the development process, these issues have been effectively addressed, enabling the implementation of all core components as initially planned. In particular, significant progress has been made in establishing the required infrastructure for data acquisition and processing, integrating internal and external spatial models, and developing algorithms for the identification and classification of thermal bridges.

Nevertheless, as of the submission of the present deliverable, the development of certain service-level functionalities remains ongoing, particularly those related to the automated generation of analytical reports. These components, although not yet finalized, are already well advanced and will be completed, documented, and thoroughly evaluated in the subsequent project deliverable, which will provide a comprehensive assessment of the implemented scenario.

#### Scenario 2.1

*Table 22. Operation testing for the (SE2, Pilot 1) case (test scenario S2.1).*

| Scenario ID      | S2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Developer        | UPM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Pilot            | Warsaw, Poland [MOS]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Related Use Case | UC2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Objective        | The objective of this scenario is to test the feasibility of dynamically controlling a building, with a focus on identifying anomalies in the envelope, particularly thermal bridges. The DT of the building will be enhanced with a functionality that utilizes thermal scanning data to identify and categorize thermal bridges, and the generation of a thermal bridges report will be enabled. Furthermore, thermal scanning will be employed to oversee the control of solar panel cells. The building chosen for the testbed scenario is newly constructed and heated; it also features a photovoltaic installation. All of the above aspects enable the identification of thermal bridges and the assessment of solar panel cell energy performance. |
| Location         | Similar to S1.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Scale Scope      | Similar to S1.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Data             | Geo-location data (XYZ),<br>RGB information (images),                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | Thermal information (images).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Resources</b>                 | <p>Hardware:<br/>Drone equipped with thermal and RGB camera (UAV) and GPS (georeferenced) for the external envelope, and mobile mapping (SLAM) and GPS (georeferenced) for the inner envelope.</p> <p>Software:<br/>Pix4D,<br/>Agisoft Metashape,<br/>Reality capture,<br/>Context Capture or Drone Deploy,<br/>Manufacture SLAM software.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Workflow</b>                  | <ol style="list-style-type: none"> <li>1. Data collection,</li> <li>2. Flight data processing to obtain the point cloud with RGB and thermal data,</li> <li>3. Processing of the internal part of the building,</li> <li>4. Integration of internal and external point clouds,</li> <li>5. DT generation and connection to the BIM model (IFC),</li> <li>6. Development and testing of the algorithm that uses delivered thermal scanning to identify thermal bridges and visualize them in the DT,</li> <li>7. Development and testing of the algorithm that uses Machine Learning to categorize thermal bridges as connected to, for example: doors, windows, reinforced concrete slab ring beam, roof rafters, thermal insulation discontinuity, thermal insulation metal connectors, and building corners,</li> <li>8. Development and testing of the report functionality concerning thermal bridges generation,</li> <li>9. Development and testing of the algorithm that uses delivered thermal scan of external envelope of a building to control the quality of solar panel cells, categorizing them as: functioning and non-functioning (functioning at too low efficiency, for the complete panel, not cells),</li> <li>10. Development and testing of the functionality concerning the generation of solar panel cells quality report generation.</li> </ol> |
| <b>Additional Considerations</b> | <ul style="list-style-type: none"> <li>- The technical specifications for the data collection within SE2 operation testing are presented in Appendix III and Appendix IV of D4.1.</li> <li>- The resolution of the image depends on the distance between the drone and the building, that is, on the ratio called GSD (Ground Sample Distance).</li> </ul> <p>Position the scanner at a distance that ensures the laser can capture the façade with the desired resolution.</p> <p>The overlap of at least 20-30% is required between consecutive scans to provide enough common data points for accurate registration. The overlap may need to be increased for complex geometries or when scanning intricate detail.</p> <p>Conduct a grid-based approach by dividing the façade into sections that each scan will cover, considering the overlap. Use a consistent pattern for scanning, such as top to bottom and left to right, to maintain organization.</p>                                                                                                                                                                                                                                                                                                                                                                                                       |

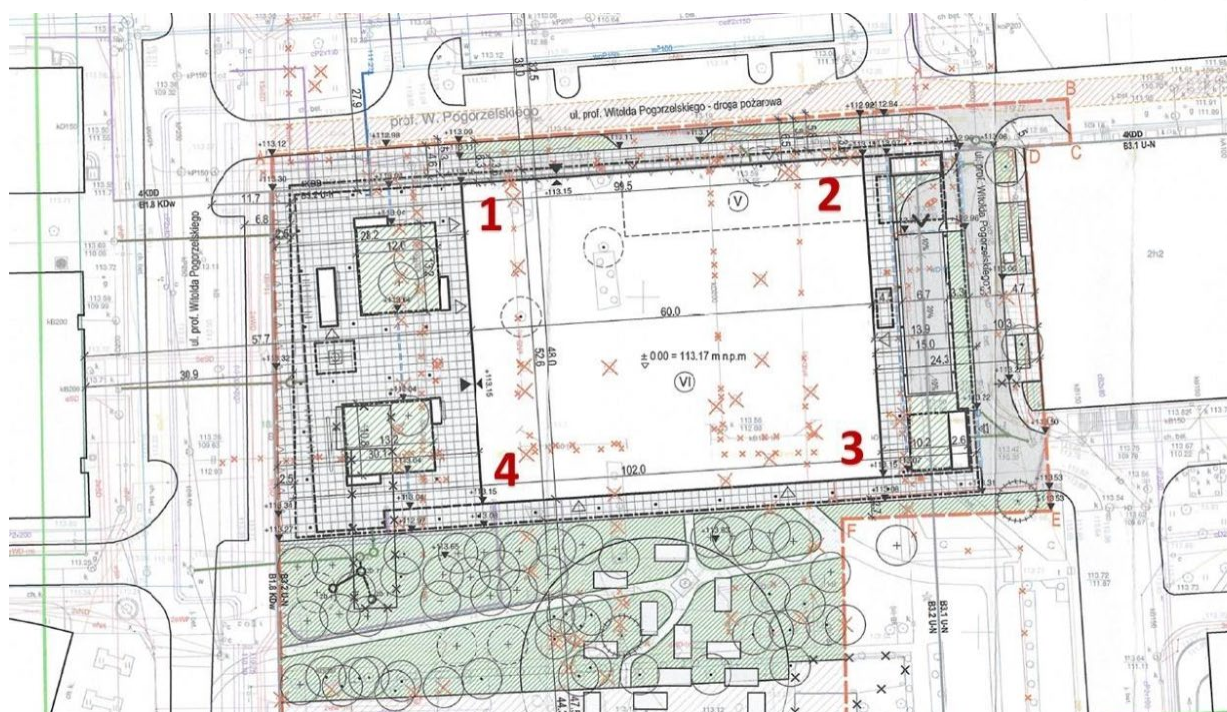


Figure 3. Building delineation for the conduction of scenario S2.1.

### 2.2.0.2 Gantt Chart

In the full pilot phase at the Faculty of Psychology of the University of Warsaw, all data acquisition tasks were successfully completed. Two drone flight campaigns were conducted: the first in M14 and the second in M27, with the latter yielding 2,418 thermal images to complement the existing dataset. A total of 3,643 RGB images were captured during M11, and 2,418 additional RGB images in M27. Georeferencing was carried out with 23 control points, and detailed metadata (weather, coordinate system) was collected for each mission. SLAM-based RGB imagery and 3D point clouds were acquired in M21. The camera calibration (B2.1) was also completed.

Multiple algorithms were developed, including:

- Thermal bridge detection from aerial thermal scans (C2.1.4)
- ML-based classification of bridge types (C2.1.5)
- Automated report generation (C2.1.6)
- Solar panel diagnostics from thermal imaging (C2.1.7 & C2.1.8)

However, as drone data processing (C2.1.1) has not yet been completed, these algorithms could not yet be implemented on the real dataset. Currently, work is focused on completing C2.1.1 and C2.1.3.

In parallel, the visualization platform (C3.1) and model integration (C3.2) are in active development and will host the enriched outputs once the datasets are fully processed. These tools will support the assessment of building envelope performance and solar energy systems.

Table 23. (SE2, Pilot 1) Progress of tasks in the full-pilot phase related to Gantt Chart



| Responsible Partner                                              | Streams of Activities                         | Month     | Progress  | Results                                           |
|------------------------------------------------------------------|-----------------------------------------------|-----------|-----------|---------------------------------------------------|
| <b>B. Infrastructure-related Activities</b>                      |                                               |           |           |                                                   |
| <b>B1. Technology/Equipment/Building</b>                         |                                               |           |           |                                                   |
| MOS, UPM                                                         | B1.1. Building selection                      | M11       | Completed | Faculty of Psychology of the University of Warsaw |
| MOS, SLG                                                         | B1.2. Drone/SLAM equipment rent               | M14 - M27 | Completed | Drone                                             |
|                                                                  |                                               | M16       | Completed | SLAM                                              |
| <b>B2. Tool/Platform/Service Deployment/Integration</b>          |                                               |           |           |                                                   |
| UPM                                                              | B2.1. Cameras calibration using mesh          | M11 - M21 | Completed |                                                   |
| <b>C. Data Collection, Measurement and Evaluation Activities</b> |                                               |           |           |                                                   |
| <b>C1. Data Collection</b>                                       |                                               |           |           |                                                   |
| MOS, UPM                                                         | C1.1. Definition of data collection procedure | M6 – M14  | Completed |                                                   |
| MOS, UPM                                                         | C1.2. RGB images (drone)                      | M11       | Completed | 3643 images                                       |
|                                                                  |                                               | M27       | Completed | 2418                                              |
| MOS, UPM                                                         | C1.3. Thermal images (drone)                  | M14       | Completed | 4142                                              |
|                                                                  |                                               | M27       | Completed | 2418                                              |
| MOS, UPM                                                         | C1.4. RGB images (SLAM)                       | M21       | Completed |                                                   |
| MOS, UPM                                                         | C1.5. 3D point cloud (SLAM)                   | M21       | Completed |                                                   |
| MOS, UPM                                                         | C1.6. Georeference                            | M14       | Completed | 17 points                                         |
|                                                                  |                                               | M27       | Completed | 23 points                                         |
| MOS, UPM                                                         | C1.7. Metadata                                | M14       | Completed | Weather, coordinates system                       |
|                                                                  |                                               | M27       | Completed | Weather, coordinates system                       |
| <b>C2. Operation Testing</b>                                     |                                               |           |           |                                                   |
|                                                                  | C2.1 Testbed scenario S2.1                    | M15 – M29 | Completed |                                                   |
| UPM                                                              | C2.1.1. Drone: flights data processing        | M15 – M29 | Completed |                                                   |
| UPM                                                              | C2.1.2. SLAM: scan data processing            | M15 – M25 | Completed |                                                   |



|     |                                                                                                                                                                                                                                                                                       |           |           |                                                                      |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|----------------------------------------------------------------------|
| UPM | C2.1.3. Integration of internal and external point clouds                                                                                                                                                                                                                             | M15 – M29 | Completed | Thermal anomalies and solar panels algorithms applied.               |
| UPM | C2.1.4. Development/Testing of the algorithm that uses delivered thermal scanning data to identify thermal bridges.                                                                                                                                                                   | M15 – M29 | Completed |                                                                      |
| UPM | C2.1.5. Development/Testing of the algorithm that uses ML to categorise thermal bridges (e.g. as connected to doors, windows, thermal insulation discontinuity, thermal insulation metal connectors, building corners).                                                               | M16 – M29 | Completed |                                                                      |
| UPM | C2.1.6. Development/testing of the functionality of report concerning thermal bridges generation.                                                                                                                                                                                     | M17 – M29 | Completed |                                                                      |
| UPM | C2.1.7. Development/Testing of the algorithm that uses delivered thermal scan of external envelope of a building to control quality of solar panel cells and categorise them as: functioning/ not-functioning. Functioning at too low efficiency (for the complete panel, not cells). | M18 – M29 | Completed |                                                                      |
| UPM | C2.1.8. Development/Testing of the functionality of solar panel cells quality report generation.                                                                                                                                                                                      | M20 – M29 | Completed |                                                                      |
|     | C3 Plaform generation (visualization)                                                                                                                                                                                                                                                 |           |           |                                                                      |
| UPM | C3.1. Platform Generation                                                                                                                                                                                                                                                             | M25-M30   | Completed | Integration of the complete 3d point cloud in the platform completed |
| UPM | C3.2. Model integration                                                                                                                                                                                                                                                               | M26-M29   | Completed |                                                                      |



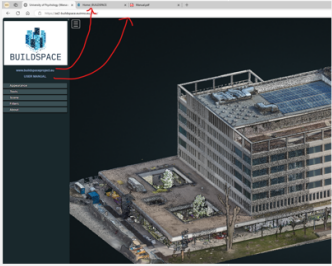
### 2.2.0.3 Pilot Tracker

Table 25. (SE2, Pilot 1) Pilot Tracker. Full-Pilot phase

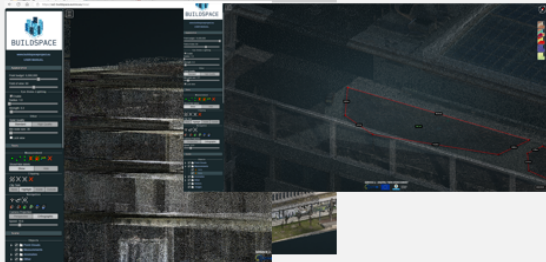
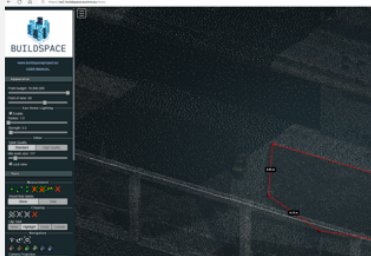
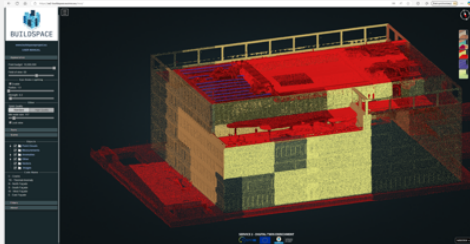
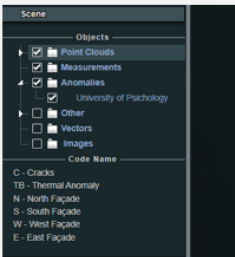
| UC 2.1        |         |          |                                                            |                               |                      |                                                            |                                                        |            |                                    |                                         |                            |                                 |                                                        |
|---------------|---------|----------|------------------------------------------------------------|-------------------------------|----------------------|------------------------------------------------------------|--------------------------------------------------------|------------|------------------------------------|-----------------------------------------|----------------------------|---------------------------------|--------------------------------------------------------|
| Pilot Partner | Service | USE CASE | Technical requirements for end-user to receive the service | Next Steps specified Timeline |                      |                                                            |                                                        |            |                                    | Data collection                         |                            |                                 | Responsibility / Leading the use of service Department |
|               |         |          |                                                            |                               |                      |                                                            |                                                        |            |                                    | Percentage of completed data collection | Data missing               | Execution date for missing info |                                                        |
| MOS           | SE2     | yes      | How to install                                             | Testing inside the SE2        | Feedback no1 for UPM | Live event planning/organising for EU level partners (ENG) | Feedback no2 for UPM (after enrichment of the service) | Live event | Publicity/communication activities | 50%                                     | Thermal drone flyover data | No missing data                 | MOS, Digitalisation and Innovation Office              |
|               |         |          | User manual platform                                       | M26                           | M26                  | M28-M30                                                    | M28                                                    | M28-M29    | M30-M31                            | TOTAL                                   | 50%                        |                                 |                                                        |

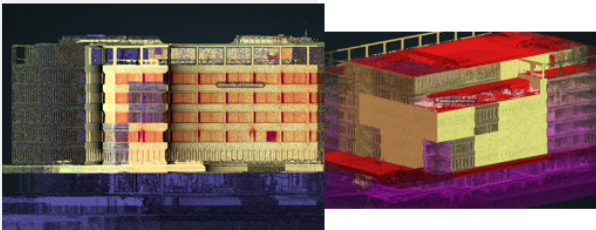
### 2.2.0.4 Evaluation Tracker

Table 26. (SE2, Pilot 1) Validation Tracker. Full-Pilot phase

| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS                                      | Evaluating Pilot partner | Screenshot                                                                         | Description of the current state of the service                                                                                                                  | Rating (1-7) | Recommendations for the improvements of the service |
|--------------------------------------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------------------------|
| <b>Functionality of links</b><br>Do the links to the BSP web and the user manual work correctly? | MOS                      |  | The user is able to access external resources from the platform, such as the BUILDSPACE website and the user manual, via dedicated links located in the sidebar. | 7            | Nothing to add. Works as expected.                  |



| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS                                                                                                            | Evaluating Pilot partner | Screenshot                                                                          | Description of the current state of the service                                                                                                                                                                                                                                                                                                                                                                       | Rating (1-7) | Recommendations for the improvements of the service                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ease of use and intuitive experience</b><br><br>Is the platform intuitive and easy to use for new users?                                                            | MOS                      |   | The user can interact with the 3D viewer and platform functionalities through a structured interface. Basic actions such as tool selection, layer switching, and point cloud navigation are generally understandable. However, some elements of the user experience are currently being reviewed and improved.                                                                                                        | 5 (MOS)      | Simple measurements are possible, but when we tried to do multiple measurements for example repeating measurements is not possible or deleting just selected measurements. Additionally, the point cloud quality is as times too bad to complete a measurement. (MOS)                                           |
| <b>Sidebar organization</b><br><br>Do you find all the information in the sidebar useful?<br><br>Would you remove or reorganize any section to improve the experience? |                          |   | The sidebar presents different tabs such as Appearance, Tools, Scene, Filters, Thermal Anomalies, and About. While this structure currently allows access to the main functionalities, its organization is under revision to improve clarity and user flow.                                                                                                                                                           | 7 (MOS)      | Sidebar organisation is great.                                                                                                                                                                                                                                                                                  |
| <b>Platform tools</b><br><br>Would you add or remove any tool from the current set?<br><br>Do all available tools function correctly?                                  | MOS                      |  | The tools provided (e.g., measurement, clipping, navigation presets) are grouped under the "Tools" tab. Each tool includes buttons with icons and descriptive labels. Most tools are functional, but some (e.g., volume measurement, speed control) are currently inactive or under development, which should be taken into account during evaluation.                                                                | 5 (MOS)      | Importantly, there the 'Sections' tool is missing. The 'Clipping' tool is hard to operate, and it was close to impossible to view parts of the point cloud. We also had issues with the 'Splat Quality', 'High Quality' option. It does not seem to work at times. Other tools work good and as expected. (MOS) |
| <b>Scene management</b><br><br>Is accessing point clouds clear and straightforward?<br><br>Does switching between different scalar visualizations work smoothly?       | MOS                      |  | The user can access and manage point cloud datasets and interact with different scalar visualizations (e.g., RGB, elevation, classification). However, thermal data visualization is not yet available within the Scene tab. This module is under development. At the same time, the structure and organization of the Scene panel are being improved to enhance usability and better accommodate future data layers. | 5 (MOS)      | Some functions are missing or do not do anything. Switching between Objects does not result in changes to the visualisation. Navigation pane is very useful though. Switching between Perspective and Orthographic works fine. (MOS)                                                                            |

| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS                                                                                        | Evaluating Pilot partner | Screenshot                                                                           | Description of the current state of the service                                                                                                                                                                                                                                                                                         | Rating (1-7) | Recommendations for the improvements of the service                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------------------------------------------------------------------------|
| <b>Clarity of point clouds</b><br><br>Are the point clouds displayed clearly and easy to interpret?                                                | MOS                      |    | The point cloud visualization offers adjustable point size, lighting (EDL), and color options to enhance clarity. Users can easily identify geometry and façade details, especially when using high-quality splat rendering and proper lighting.                                                                                        | 5            | High quality is needed to perform measurements. (MOS)                                                   |
| <b>Appearance and visual representation</b><br><br>Do the colors used in the layers (temp, rgb...) allow for a correct identification of elements? | MOS                      |    | The platform allows switching between RGB, elevation, thermal, and classification color schemes. These are visually distinct and supported by legends. The color palettes help users differentiate between building elements, anomalies, and zones.                                                                                     | 6 (MOS)      | Colour marking for the temperature works great. Classification colours could be explained better. (MOS) |
| <b>Usefulness and readability of reports</b><br><br>Are the generated reports readable and useful for decision-making?                             | MOS                      |                                                                                      | Reports are not yet available within this pilot.                                                                                                                                                                                                                                                                                        | - (MOS)      | Does not seem to work for Warsaw pilot (MOS)                                                            |
| <b>Functionality of filters and classification</b><br><br>Do classification and filtering buttons work correctly?                                  | MOS                      |  | The classification system allows users to filter by point class (e.g., façade, ground, vegetation). Buttons for enabling/disabling layers or categories work in real time and are located in the Filters tab. The feature is functional and aids in focusing the analysis, particularly when combined with scalar data or measurements. | 7 (MOS)      | Works as expected (MOS)                                                                                 |



| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS                                                                                                                                                                                                                                      | Evaluating Pilot partner | Screenshot | Description of the current state of the service                                                                                                                                                                                                     | Rating (1-7) | Recommendations for the improvements of the service                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Interpretation of thermal anomalies</b><br><br>Is the legend used to represent thermal anomalies clear and easy to interpret?                                                                                                                                                                 | MOS                      |            | Thermal anomalies are not yet available within this pilot.                                                                                                                                                                                          | xxx (MOS)    | xxx (MOS)                                                                                                                                                                                                                                                  |
| <b>Usefulness for Presenting Results to Clients or the Public</b><br><br>How useful do you find the platform for showcasing results to clients or the general public?<br><br>Does the visualization effectively communicate key insights and findings?<br><br>Would you consider using this tool | MOS                      |            | The 3D viewer and its functionalities provide an effective tool for presenting complex building data in an accessible way. Point cloud and thermal visualizations are visually compelling and can be used in meetings, reports, or public displays. | 5 (MOS)      | The platform which allows quick and simple access to the point cloud data as well as the assessment of thermal information has potential to speed up and simply work of Civil Engineers. Adjustments in the platform could help maximise its impact. (MOS) |



## 2.2.1 Pilot 3 – Piraeus, Greece

### 2.2.1.1 Testbed Scenario

The testbed scenario defined for case S2.2 has been successfully implemented in accordance with the original specifications. All essential components have been developed, including the full data acquisition and processing workflow, the generation of a Digital Twin linked to the BIM model, and the implementation of algorithms for the detection, classification, and reporting of critical areas in the building envelope using thermal scanning data.

One adjustment was made during the implementation phase: the SLAM-based interior mapping workflow was excluded from the final setup. This modification does not compromise the objectives of the scenario, as all necessary data for anomaly detection and visualisation were successfully obtained and processed.

#### Scenario 2.2

*Table 27. Operation testing for the (SE2, Pilot 3) case (test scenario S2.2).*

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Scenario ID</b>               | <b>S2.2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Developer</b>                 | UPM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Pilot</b>                     | Municipality of Piraeus, Greece [MoP]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Related Use Case</b>          | UC2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Objective</b>                 | The objective of this scenario is to identify areas of intervention in a municipal building, with a focus on identifying anomalies in the envelope, particularly thermal bridges. The Digital Twin of the building will be enhanced with functionality utilising thermal scanning data to identify and categorise critical areas, and the generation of a critical areas report will be enabled.                                                                                                                                                                                                                                                                         |
| <b>Location</b>                  | Similar to S1.5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Scale Scope</b>               | Similar to S1.5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Data</b>                      | Similar to S1.5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Resources</b>                 | Similar to S1.5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Workflow</b>                  | <ol style="list-style-type: none"> <li>1. Data collection,</li> <li>2. Flight data processing to obtain point cloud with RGB and thermal data,</li> <li>5. DT generation and connection to the BIM model (IFC),</li> <li>6. Development and testing of the algorithm that uses delivered thermal scanning data to identify critical areas and visualise them in the DT,</li> <li>7. Development and testing of the algorithm that uses ML to categorise critical areas as connected to, for example: thermal bridges and type, dampness on the wall,</li> <li>8. Development and testing of the functionality of report concerning critical areas generation.</li> </ol> |
| <b>Additional Considerations</b> | Similar to S1.5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |



*Figure 4. Building delineation for the conduction of scenario S2.2*

### 2.2.1.2 Gantt Chart

During the full pilot phase at the 21st Elementary School of Piraeus, all planned data collection activities were successfully carried out. A total of 6,554 RGB and thermal images were acquired using drones, with georeferencing supported by 30 control points and comprehensive metadata, including weather conditions and coordinate systems. The initially planned camera calibration task (B2.1) was excluded, as the subcontracted operator delivered pre-calibrated outputs.

Due to limited applicability and budget restrictions, SLAM-based data acquisition and the integration of internal and external point clouds were not pursued. After image acquisition, the processing of both RGB and thermal datasets (C2.1.1) was completed. The algorithm for detecting thermal anomalies (C2.1.4) is currently under testing, while two critical developments—the classification of vulnerable areas such as thermal bridges and moisture zones (C2.1.5), and the automatic report generation module (C2.1.6)—have been finalized.

The development of the visualization platform (C3) is ongoing, including the implementation of a user-friendly interface (C3.1) and the integration of analytical models and results (C3.2).

This phase of Service 2 (Digital Twin Enrichment) focused on enhancing the Digital Twin of the school building with detailed thermal and environmental information. The high-resolution RGB and thermal imagery, paired with accurate geospatial data, allowed a precise representation of the building's condition. These enriched datasets provided valuable insights, including temperature distribution and detection of thermal inefficiencies.

Advanced image analysis techniques were applied to identify critical structural and envelope issues. As a result, the enriched Digital Twin can now support diagnostic processes and facilitate preventive maintenance strategies. Once the platform is completed, stakeholders will be able to interact with the



data and visual outputs, enabling informed decisions on building performance upgrades and energy-saving interventions.

Overall, the pilot demonstrates the effectiveness and added value of enriched Digital Twins in promoting sustainable building management.

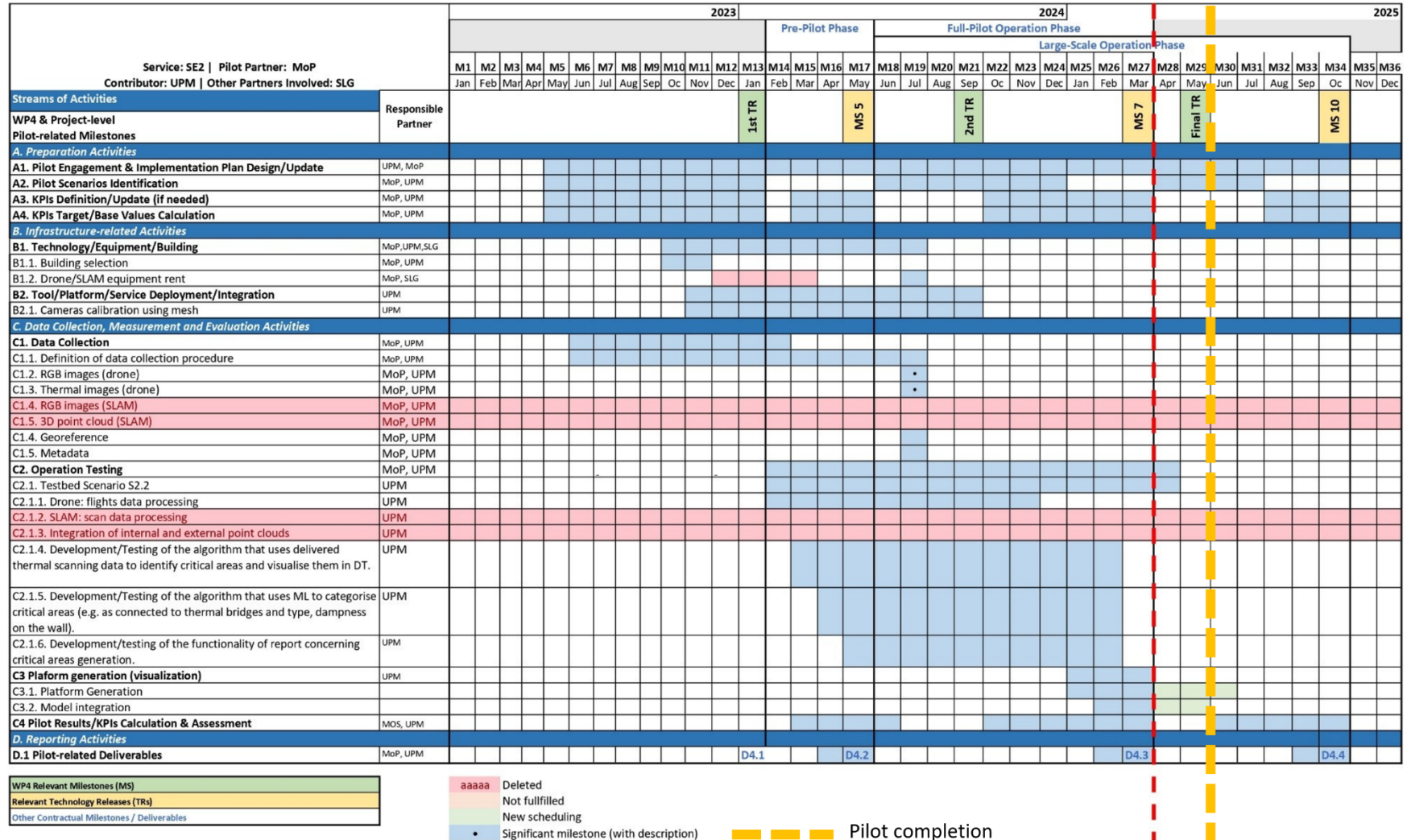
*Table 28. (SE2, Pilot 3) Progress of tasks in the full-pilot phase related to Gantt Chart.*

| Responsible Partner | Streams of Activities                                                                                                                       | Month     | Progress  | Results                                                       |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|---------------------------------------------------------------|
|                     | <b>B. Infrastructure-related Activities</b>                                                                                                 |           |           |                                                               |
|                     | <b>B1. Technology/Equipment/Building</b>                                                                                                    |           |           |                                                               |
| MoP, UPM            | B1.1. Building selection                                                                                                                    | M11       | Completed | 21st Elementary School building of Piraeus                    |
| MoP, SLG            | B1.2. Drone/SLAM equipment rent                                                                                                             | M18       | Completed |                                                               |
|                     | <b>B2. Tool/Platform/Service Deployment/Integration</b>                                                                                     |           |           |                                                               |
| UPM                 | B2.1. Cameras calibration using mesh                                                                                                        |           | Deleted   | The company in charge of the flight will calibrate the drone. |
|                     | <b>C. Data Collection, Measurement and Evaluation Activities</b>                                                                            |           |           |                                                               |
|                     | <b>C1. Data Collection</b>                                                                                                                  |           |           |                                                               |
| MoP, UPM            | C1.1. Definition of data collection procedure                                                                                               | M6 - M19  | Completed |                                                               |
| MoP, UPM            | C1.2. RGB images (drone)                                                                                                                    | M18 - M19 | Completed | 6554                                                          |
| MoP, UPM            | C1.3. Thermal images (drone)                                                                                                                | M18 - M19 | Completed | 6554                                                          |
| MoP, UPM            | C1.4. RGB images (SLAM)                                                                                                                     |           | Deleted   |                                                               |
| MoP, UPM            | C1.5. 3D point cloud (SLAM)                                                                                                                 |           | Deleted   |                                                               |
| MoP, UPM            | C1.4. Georeference                                                                                                                          | M18 - M19 | Completed | 30 points                                                     |
| MoP, UPM            | C1.5. Metadata                                                                                                                              | M18 - M19 | Completed | Weather, coordinates system                                   |
|                     | <b>C2. Operation Testing</b>                                                                                                                |           |           |                                                               |
|                     | <b>C2.1. Testbed Scenario S2.2</b>                                                                                                          |           |           |                                                               |
| UPM                 | C2.1.1. Drone: flights data processing                                                                                                      | M18 - M23 | Completed |                                                               |
| UPM                 | C2.1.2. SLAM: scan data processing                                                                                                          |           | Deleted   |                                                               |
| UPM                 | C2.1.3. Integration of internal and external point clouds                                                                                   |           | Deleted   |                                                               |
| UPM                 | C2.1.4. Development/Testing of the algorithm that uses delivered thermal scanning data to identify critical areas and visualise them in DT. | M15 - M26 | Completed |                                                               |



|                                        |                                                                                                                                                               |           |           |                                                                      |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|----------------------------------------------------------------------|
| UPM                                    | C2.1.5. Development/Testing of the algorithm that uses ML to categorise critical areas (e.g. as connected to thermal bridges and type, dampness on the wall). | M16 - M26 | Completed |                                                                      |
| UPM                                    | C2.1.6. Development/testing of the functionality of report concerning critical areas generation.                                                              | M17 - M26 | Completed |                                                                      |
| C3 Platform generation (visualization) |                                                                                                                                                               |           |           |                                                                      |
| UPM                                    | C3.1. Platform Generation                                                                                                                                     | M17 - M28 | Completed |                                                                      |
| UPM                                    | C3.2. Model integration                                                                                                                                       | M17 - M29 | Completed | Integration of the complete 3d point cloud in the platform completed |

Table 29. (SE2, Pilot 3) Gantt Chart progress. Full-Pilot phase



### 2.2.1.3 Pilot Tracker

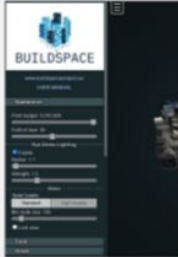
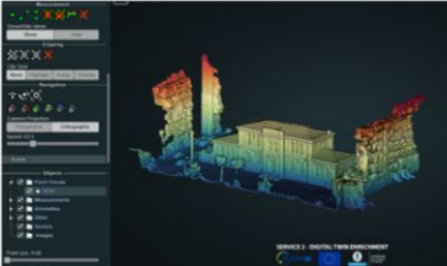
Table 30. (SE2, Pilot 3) Pilot Tracker. Full-Pilot phase

| UC 2.2        |         |          |                                                            |                               |                      |                        |                                                        |                                    |                                         |                 |                                 |                                                        |
|---------------|---------|----------|------------------------------------------------------------|-------------------------------|----------------------|------------------------|--------------------------------------------------------|------------------------------------|-----------------------------------------|-----------------|---------------------------------|--------------------------------------------------------|
| Pilot Partner | Service | USE CASE | Technical requirements for end-user to receive the service | Next Steps specified Timeline |                      |                        |                                                        |                                    | Data collection                         |                 |                                 | Responsibility / Leading the use of service Department |
|               |         |          |                                                            |                               |                      |                        |                                                        |                                    | Percentage of completed data collection | Data missing    | Execution date for missing info |                                                        |
| MoP           | SE2     | yes      | How to install                                             | Testing inside the SE2        | Feedback no1 for UPM | Testing inside the SE2 | Feedback no2 for UPM (after enrichment of the service) | Publicity/communication activities | 100%                                    | No missing data | No missing data                 | IT Department of the Municipality of Piraeus           |
|               |         |          | User manual platform                                       | M25-M26                       | M26                  | M26-M28                | M28                                                    | M30-M31                            |                                         |                 |                                 |                                                        |
| TOTAL         |         |          |                                                            |                               |                      |                        |                                                        |                                    | 100%                                    |                 |                                 |                                                        |

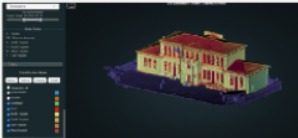
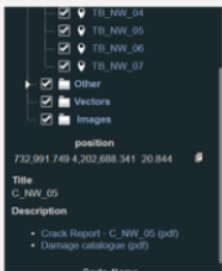
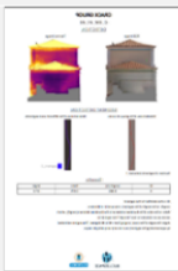
### 2.2.1.4 Evaluation Tracker

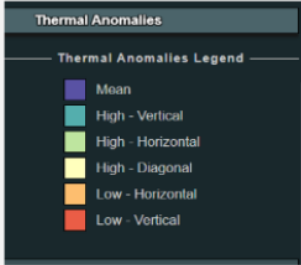
Table 31. (SE2, Pilot31) Evaluation Tracker. Full-Pilot phase

| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS                                          | Evaluating Pilot partner | Screenshot                                                                          | Description of the current state of the service                                                                                                                  | Rating (1-7) | Recommendations for the improvements of the service |
|------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------------------------|
| <b>Functionality of links</b><br><br>Do the links to the BSP web and the user manual work correctly? | MoP                      |  | The user is able to access external resources from the platform, such as the BUILDSPACE website and the user manual, via dedicated links located in the sidebar. | 7 (MoP)      | xxx (MoP)                                           |

|                                                                                                                                                                               |     |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------------------------------------------------------------------------------|
| <p><b>Ease of use and intuitive experience</b></p> <p>Is the platform intuitive and easy to use for new users?</p>                                                            | MoP |    | <p>The user can interact with the 3D viewer and platform functionalities through a structured interface. Basic actions such as tool selection, layer switching, and point cloud navigation are generally understandable. However, some elements of the user experience are currently being reviewed and improved.</p>                                                                                                                                                            | 6 (MoP) | xxx (MoP)                                                                       |
| <p><b>Sidebar organization</b></p> <p>Do you find all the information in the sidebar useful?</p> <p>Would you remove or reorganize any section to improve the experience?</p> | MoP |     | <p>The sidebar presents different tabs such as Appearance, Tools, Scene, Filters, Thermal Anomalies, and About. While this structure currently allows access to the main functionalities, its organization is under revision to improve clarity and user flow.</p>                                                                                                                                                                                                               | 6 (MoP) | The sidebar is generally clear and easy to navigate. The hide option is useful. |
| <p><b>Platform tools</b></p> <p>Would you add or remove any tool from the current set?</p> <p>Do all available tools function correctly?</p>                                  | MoP |   | <p>The tools provided (e.g., measurement, clipping, navigation presets) are grouped under the "Tools" tab. Each tool includes buttons with icons and descriptive labels. Most tools are functional, but some (e.g., volume measurement, speed control) are currently inactive or under development, which should be taken into account during evaluation.</p>                                                                                                                    | 6 (MoP) | All sofar available tools are useful and function correctly.                    |
| <p><b>Scene management</b></p> <p>Is accessing point clouds clear and straightforward?</p> <p>Does switching between different scalar visualizations work smoothly?</p>       | MoP |  | <p>The user is able to access and manage point cloud datasets from the Scene tab. Switching between different scalar visualizations (RGB, elevation, classification, etc.) works correctly, and users can select individual objects or elements within the scene. While all functionalities are currently operational, some information layers are still pending integration, and the structure of the Scene panel is being revised to improve clarity and user interaction.</p> | 6       | This functionality works well                                                   |



|                                                                                                                                                           |     |                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                |   |                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Clarity of point clouds</b></p> <p>Are the point clouds displayed clearly and easy to interpret?</p>                                                | MoP | (image showing the functionality/ feature/ aspect being mentioned)                                                                                                     | <p>The point cloud visualization offers adjustable point size, lighting (EDL), and color options to enhance clarity. Users can easily identify geometry and façade details, especially when using high-quality splat rendering and proper lighting.</p>                                                                                        | 5 | High quality splat does not seem to work                                                                                                                                                                                                              |
| <p><b>Appearance and visual representation</b></p> <p>Do the colors used in the layers (temp, rgb...) allow for a correct identification of elements?</p> | MoP |     | <p>The platform allows switching between RGB, elevation, thermal, and classification color schemes. These are visually distinct and supported by legends. The color palettes help users differentiate between building elements, anomalies, and zones.</p>                                                                                     | 6 | The visual representations work well and help identify elements. The scalar range in the Thermal Anomalies function does not seem to work                                                                                                             |
| <p><b>Usefulness and readability of reports</b></p> <p>Are the generated reports readable and useful for decision-making?</p>                             | MoP |   | <p>Reports generated through the analysis tools (e.g., thermal anomalies, measurements) are available in the form of annotations or structured outputs. They are visually accessible from the scene or via an external viewer. These outputs support decision-making, especially for technical assessments or presentations</p>                | 6 | Would be useful for the reports to be issued (clickable) from the sidebar and not only from hovering above the anomalies on the model (see screenshot). The reports in themselves are useful but will be further evaluated form the city stakeholders |
| <p><b>Functionality of filters and classification</b></p> <p>Do classification and filtering buttons work correctly?</p>                                  | MoP | (image showing the functionality/ feature/ aspect being mentioned)                                                                                                     | <p>The classification system allows users to filter by point class (e.g., façade, ground, vegetation). Buttons for enabling/disabling layers or categories work in real time and are located in the Filters tab. The feature is functional and aids in focusing the analysis, particularly when combined with scalar data or measurements.</p> | 7 | These all work properly                                                                                                                                                                                                                               |

|                                                                                                                                                                                                                                                                                                                                       |     |                                                                                   |                                                                                                                                                                                                                                                                                                                    |   |                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Interpretation of thermal anomalies</b><br><br>Is the legend used to represent thermal anomalies clear and easy to interpret?                                                                                                                                                                                                      | MoP |  | Thermal anomalies are visualized with a dedicated color ramp and an accompanying legend. The legend is clear and provides thresholds for interpretation. This enables non-expert users to understand the critical areas detected. Interpretability depends on the color scale and its contrast with the background | 7 | the legend is clear                                                                                                                                                                                                                                 |
| <b>Usefulness for Presenting Results to Clients or the Public</b><br><br>How useful do you find the platform for showcasing results to clients or the general public?<br><br>Does the visualization effectively communicate key insights and findings?<br><br>Would you consider using this tool for presentations or public reports? | MoP | (image showing the functionality/ feature/ aspect being mentioned)                | The 3D viewer and its functionalities provide an effective tool for presenting complex building data in an accessible way. Point cloud and thermal visualizations are visually compelling and can be used in meetings, reports, or public displays.                                                                | 6 | The 3D viewer and its functionalities provide an effective tool for presenting complex building data in an accessible way. Point cloud and thermal visualizations are visually compelling and can be used in meetings, reports, or public displays. |



### 3 BUILDSPACE Monitoring. City Level Pilots Operation

This task will evaluate BUILDSPACE apps services at city level addressing urban stakeholders, namely SE3 Energy monitoring, forecast and climate resilience, SE4 Urban Heat analysis and resilience and SE5 Urban flood analysis. These services will be tested in Pilot 2 (Riga), Pilot 3 (Piraeus), and Pilot 4 (Ljubljana), respectively. This will enable us to test the dimensions of Energy, Heat and Flood proposed by BUILDSPACE. This task will organize three live events, one per pilot, where external users will be invited to the real demonstration of the services.

#### *T4.3 coordination activities*

To ensure effective coordination and oversight of the service implementation at city level during the Full-Pilot Phase, several targeted activities were carried out under Task 4.3. In addition to continuing the structured monitoring approach established in the previous period through the enhanced Gantt chart, new coordination tools and procedures were introduced to strengthen collaboration among pilot partners and service developers. Joint coordination meetings were held with all city-level pilots and also service developers, focusing on the progress and practical implementation of City-level services. These sessions facilitated direct exchange between partners and developers, enabling real-time feedback and fostering a shared understanding of service objectives, technical challenges, and user needs. As part of the coordination framework, evaluation templates were developed and distributed to all pilot partners. These templates provided a harmonized structure for testing, documenting feedback, and assessing the usability and performance of the respective services. This unified approach made the evaluation process more streamlined and comparable across different pilots.

Furthermore, each city-level pilot has completed a schematic activity plan detailing the foreseen implementation steps for the Full-Pilot Phase. These plans contributed to a shared monitoring overview, helping to align timelines and expectations across the consortium. The activity plans, together with the Gantt chart and the feedback from coordination meetings, served as key tools in tracking progress, identifying delays, and facilitating timely adjustments where needed. All city-level pilots have received the relevant services, all testing activities are completed by the pilots.

#### 3.1 Service 3 - Built Environment Climate Scenarios

Initial testing of SE3 focused on a limited set of functionalities in a reduced pilot area, mainly covering heating demand estimation and rooftop PV potential assessment. For the full-pilot phase, the service now includes all planned functionalities, and the scenarios have been updated accordingly:

- **S3.1 – Estimation of current and future energy demand** for the residential building stock at full pilot-city scale, based on CMIP6 climate change scenarios (SSP245, SSP370, SSP585) and multiple time horizons (2030, 2040, 2050), with interactive map-based visualisation, analytics and filtering options.
- **S3.2 – Assessment of solar PV potential** for building rooftops at yearly resolution, including estimation of potential investment costs.
- **S3.3 – Evaluation of retrofitting strategies** at building level, applying selected passive measures to set a scenario, and providing comparative information for baseline versus post-intervention energy demand, along with estimated intervention costs.



This updated set of scenarios reflects the complete capabilities of SE3 and ensures consistency with the full range of functionalities.

### 3.1.0 Pilot 2 – Riga, Latvia

During the Full-Pilot Phase of Service 3, progress was achieved in implementing and testing the developed services, extending the scope from a limited pilot area to the entire city of Riga. The focus of this phase was to operationalize the service using a comprehensive data package and validate its performance across all residential buildings in the city.

The developed Full-Pilot Phase version of Service 3 was completed and tested. The updated information was also included, e.g. the street name changes done by Riga Municipality. The service covers the full housing stock of Riga, comprising approximately 30,000 residential buildings. The model was enhanced with calibration and validation of the calculated energy demand with Energy Performance Certificates (EPCs) and district heating consumption data. This contributed to improving the accuracy of the energy performance estimates and identifying the most energy-demanding buildings within the city.

In addition to previously available datasets, new thematic layers were integrated, including public information from GeoRiga (Geospatial Information Portal of Municipality of Riga) data, pricing for photovoltaic (PV) system installation, and a district-level classification of urban areas. A comprehensive solar radiation analysis was finalized, and results were compared with the PVGIS model to ensure consistency and validate the solar potential calculations. Based on the RPR as the pilot feedback and testing outcomes, several improvements in the Service 3 were implemented to ensure clearer interpretation of information, more intuitive interaction, and better decision-making support.

#### 3.1.0.1 Gantt Chart

In the full-pilot phase, Service 3 development is nearly complete. The base map has been finalized, along with the development of three climate scenarios across three time-frame options. A solar radiation map has also been completed. All relevant data—including information on heritage buildings—has been provided to the service developers.

Future climate change scenarios related to energy demand have been finalized and are visualized through colour-coded maps. The services are now available via a user-friendly interface and have already been tested with input from RPR, the designated pilot site. RPR has been tested and provided feedback during the full pilot phase to NTUA and CARTIF, who also have made service improvements based on the suggestions.

*Table 32. (SE3, Pilot 4) Progress of tasks in the full-pilot phase related to Gantt Chart*

| Responsible Partner | Streams of Activities                            | Month | Progress  | Results        |
|---------------------|--------------------------------------------------|-------|-----------|----------------|
|                     | B. Infrastructure-related Activities             |       |           |                |
|                     | B.1 Technology/Equipment/Area                    |       |           |                |
| RPR, CARTIF, NTUA   | B1.1. Area selection                             | M10   | Completed | Riga city area |
|                     | B2. Tool/Platform/Service Deployment/Integration |       |           |                |



## BUILDSpace

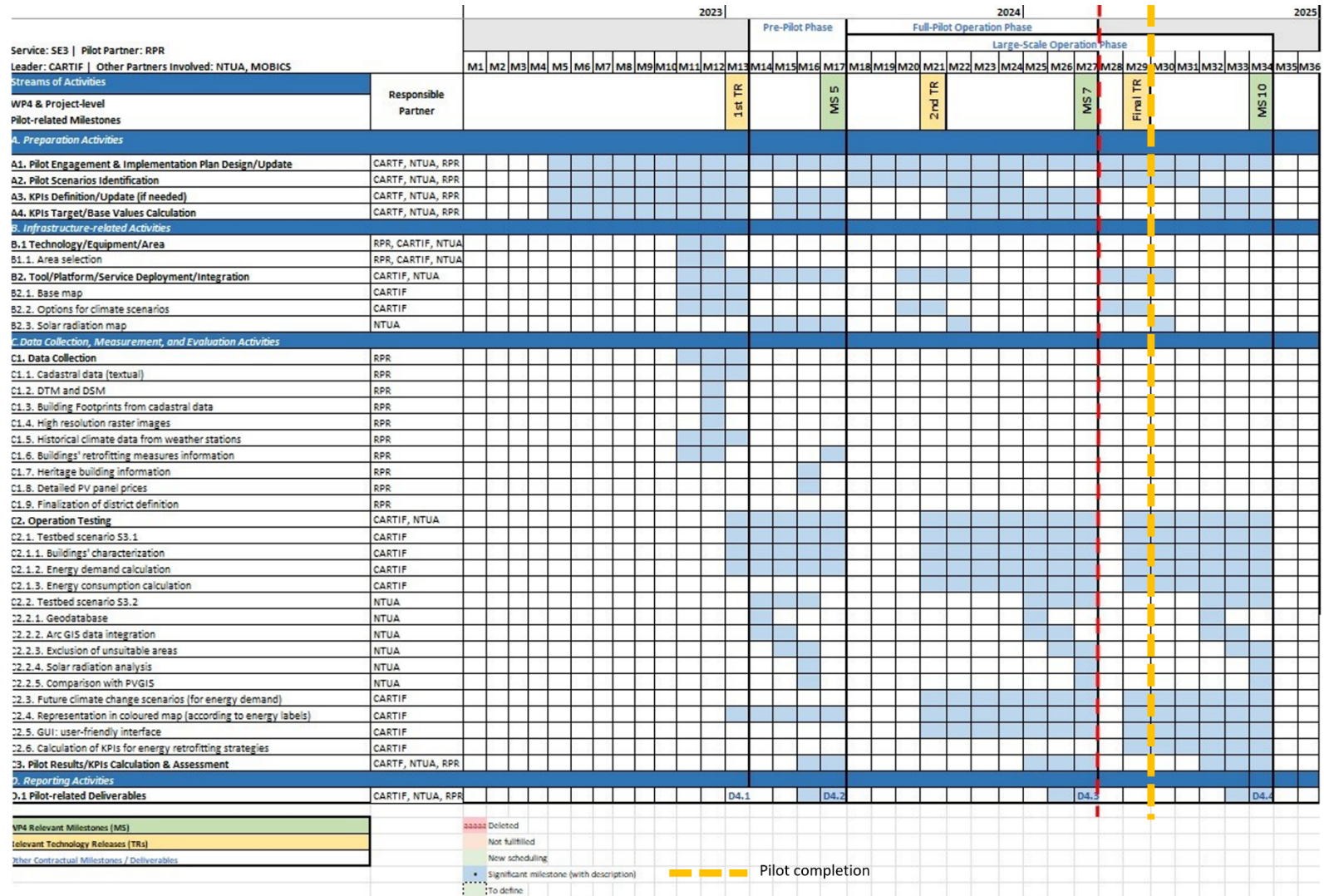
|                                                           |                                                                                                                                                                    |     |           |                                                                                                                                    |
|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------|------------------------------------------------------------------------------------------------------------------------------------|
| CARTIF                                                    | B2.1. Base map                                                                                                                                                     | M17 | Completed | Energy demand calculated for the whole city, available through the web-based tool                                                  |
| CARTIF                                                    | B2.2. Options for climate scenarios                                                                                                                                | M21 | Completed | Climate change scenarios feature available to apply to the base map and compare scenario with baseline, through the web-based tool |
| NTUA                                                      | B2.3. Solar radiation map                                                                                                                                          | M22 | Completed | Raster file                                                                                                                        |
| C. Data Collection, Measurement and Evaluation Activities |                                                                                                                                                                    |     |           |                                                                                                                                    |
| C1. Data Collection                                       |                                                                                                                                                                    |     |           |                                                                                                                                    |
| RPR                                                       | C1.1. Cadastral data (textual)                                                                                                                                     | M10 | Completed | Data collection                                                                                                                    |
| RPR                                                       | C1.2. DTM and DSM                                                                                                                                                  | M10 | Completed | Data collection                                                                                                                    |
| RPR                                                       | C1.3. Building Footprints from cadastral data                                                                                                                      | M10 | Completed | Data collection                                                                                                                    |
| RPR                                                       | C1.4. High resolution raster images                                                                                                                                | M10 | Completed | Data collection with images                                                                                                        |
| RPR                                                       | C1.5. Historical climate data from weather stations                                                                                                                | M10 | Completed | Data collection                                                                                                                    |
| RPR                                                       | C1.6. Buildings' retrofitting measures information                                                                                                                 | M10 | Completed | Data collection, incorporated to the passive retrofitting scenarios options                                                        |
| RPR                                                       | C1.7. Heritage building information                                                                                                                                | M17 | Completed | Informative data                                                                                                                   |
| RPR                                                       | C1.8. Detailed PV panel prices                                                                                                                                     | M16 | Completed | Informative data                                                                                                                   |
| RPR                                                       | C1.9. Finalization of district definition                                                                                                                          | M16 | Completed | Informative data                                                                                                                   |
| RPR                                                       | C1.7. Heritage building information                                                                                                                                | M21 | Completed | Informative data                                                                                                                   |
| C2. Operation Testing                                     |                                                                                                                                                                    |     |           |                                                                                                                                    |
| CARTIF                                                    | C2.1. Testbed scenario S3.1                                                                                                                                        |     |           |                                                                                                                                    |
|                                                           | Scenario tested: estimation of the energy demand of residential buildings in a neighbourhood, coloured map with applied Latvian EPCs label for the heating demand. |     |           |                                                                                                                                    |
| CARTIF                                                    | C2.1.1. Buildings' characterization                                                                                                                                | M12 | Completed | Buildings characterised: geometry, typology, use, year of construction, thermal characteristics                                    |



## BUILDSpace

|        |                                                                   |     |           |                                                                                                                                                                                                                                                     |
|--------|-------------------------------------------------------------------|-----|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CARTIF | C2.1.2. Energy demand calculation                                 | M12 | Completed | Energy demand algorithm applied                                                                                                                                                                                                                     |
|        | C2.2. Testbed scenario S3.2                                       |     |           |                                                                                                                                                                                                                                                     |
| NTUA   | C2.2.1. Geodatabase                                               |     | Completed | Data integrated                                                                                                                                                                                                                                     |
| NTUA   | C2.2.2. Arc GIS data integration                                  | M11 | Completed | Data integrated - Map completed                                                                                                                                                                                                                     |
| NTUA   | C2.2.3. Exclusion of unsuitable areas                             | M11 | Completed | Shapefile integration                                                                                                                                                                                                                               |
| NTUA   | C2.2.4. Solar radiation analysis                                  | M11 | Completed | Raster file                                                                                                                                                                                                                                         |
| NTUA   | C2.2.5. Comparison with PVGIS                                     | M27 | Completed | Accuracy achieved 98,2-99,1 %                                                                                                                                                                                                                       |
| CARTIF | C2.3. Future climate change scenarios (for energy demand)         | M23 | Completed | Functionality available for all buildings in the city through the web-based tool. Three climate change scenarios (SSP245, SSP370 and SSP585) and three time frames (2030, 2040 and 2050). Including functionality of compare scenario with baseline |
| CARTIF | C2.4. Representation in coloured map (according to energy labels) | M22 | Completed | Dynamic coloured map according to EPC Latvian labels available in the web-based tool                                                                                                                                                                |
| CARTIF | C2.5. GUI: user-friendly interface                                | M22 | Completed | Web-based tool with dynamic and intuitive, user-friendly interface                                                                                                                                                                                  |
| CARTIF | C2.6. Calculation of KPIs for energy retrofitting strategies      | M34 | Completed | Retrofitting strategies scenarios feature available through the web-based tool. Users can select a building and apply different measures to the envelope, and analyse the reduction of the energy demand along with their cost-efficiency           |

Table 33. (SE3, Pilot 2) Gantt Chart progress. Full-Pilot phase



### 3.1.0.2 Pilot Tracker

Table 34. (SE3, Pilot 4) Pilot Tracker. Full-Pilot phase

| Pilot Partner | Service | USE CASES (USER STORIES) |     |     | Technical requirements for end-user to receive service                                                                                                                                                                                                                                                                                                      |                                    | Next Steps specified Timeline |                               |                                         |                                                                     |                                                      |          |                                   |  | Data collection          |                                                                                                    | Responsibility / Leading the use of service Department |           |                          | Target completed |
|---------------|---------|--------------------------|-----|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------|-------------------------------|-----------------------------------------|---------------------------------------------------------------------|------------------------------------------------------|----------|-----------------------------------|--|--------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----------|--------------------------|------------------|
|               |         | UC1                      | UC2 | UC3 | TR1: Filled by technical developer                                                                                                                                                                                                                                                                                                                          | TR2: Filled by technical developer |                               |                               |                                         |                                                                     |                                                      |          |                                   |  | Data collection complete | What kind of data missing?                                                                         |                                                        |           |                          |                  |
| RPR           | SE3     | yes                      | no  | no  | CARTIF: No special requirements are needed just a computer and an internet connection since the service is deployed as a web application that only requires a browser to run.<br>NTUA: No special requirements are needed just a computer and an internet connection since the service is deployed as a web application that only requires a browser to run |                                    | Testing inside the SE3        | Validation of the testing/imp | Define & adapt scenarios for live event | No 1 Live event planning/organising for stakeholder engagement (LV) | No 2 Live event planning for EU level partners (ENG) | Feedback | Practical seminar for stakeholder |  | 100%                     | All information has been provided. Extra information has been requested to develop better service. | Keeping service                                        | Publicity | Stakeholder consultation | 90%              |
|               |         |                          |     |     |                                                                                                                                                                                                                                                                                                                                                             |                                    | M27                           | M28                           | M27                                     | M29                                                                 | M29                                                  | M30      | M32                               |  |                          |                                                                                                    | GEO RIGA                                               | REA       | RPR, REA                 |                  |



# BUILDSPACE

## 3.1.0.3 Evaluation Tracker

Table 35. (SE3, Pilot 4) Evaluation Tracker. Full-Pilot phase

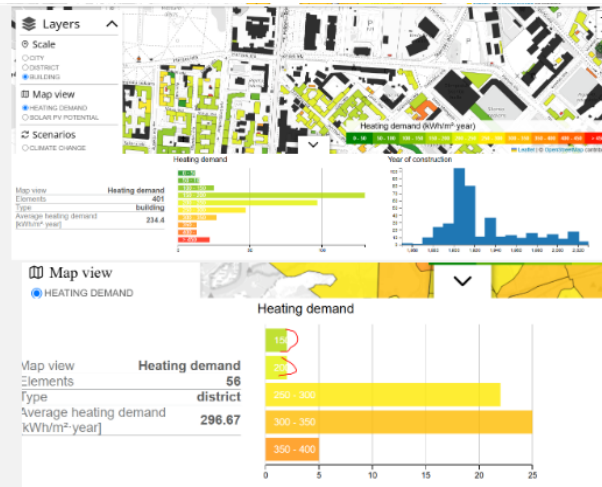
| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS    | Evaluating Pilot partner | Screenshot | Description of the current state of the service                                                                                                                                                                                                         | Rating (1-7) | Recommendations for the improvements of the service                                                                                                                                                          |
|----------------------------------------------------------------|--------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General map with the heating demand at building level          | RPR                      |            | Residential buildings are coloured by heating demand (green to red), other buildings that are not considered in the project are black. Problem - not all coloured buildings are residential. Hoover pop-up is showing heating demand for each building. | 4            | Right use type of the buildings should be applied either from cadastral data or OSM data. Change of building scale to district scale could be at smaller scale than now. Graphical scale bar could be added. |
| General map with the heating demand at district and city level | RPR                      |            | Average values of districts and city can be seen, when scale is changed. Hoover pop-up is showing heating demand for district or city. District popup is showing neighbourhood name.                                                                    | 6            | Change of building scale to district scale could be at smaller scale than now. Graphical scale bar could be added                                                                                            |



## BUILDSPACE

Dashboards with analytics of what is displayed in the screen for the general map and filtering of the buildings

RPR



Dashboard is interactive and filters objects on the map, when selected in graphs. Functionality is really usable and user friendly, makes possibility of some analysis (for building scale heating demand and year of construction can be combined to filter objects on screen).

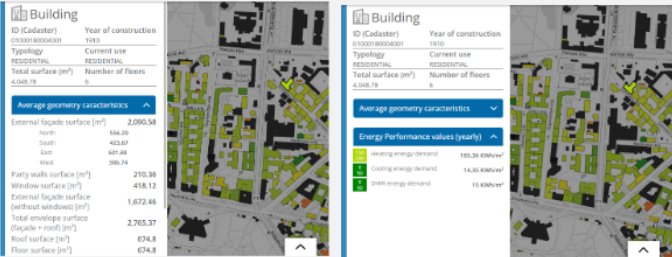
6

Really nice functionality, just some small details:  
Arrow of dashboard could be smaller (I guess it depends on monitor resolution; I opened it at home, and it is huge).  
At some times number cannot fit in the bar chart and then it becomes partly invisible (second picture)





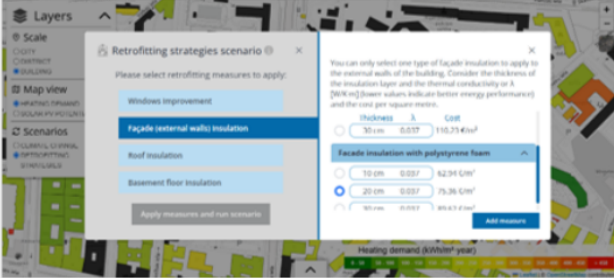
## BUILDSPACE

|                                                                                                                                                             |     |                                                                                      |                                                                                                                                                                                                                                                                                  |   |                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Additional information of building or district (depending on the scale) when clicking on them at the left-hand side                                         | RPR |    | It is possible to see a lot of additional information about the building /district/city. User can expand and collapse sections. Very informative and user friendly tool.                                                                                                         | 6 | <p>Reduce information of average values for District and City level. In some cases average values are not relevant (construction year, number of floors).</p> <p>Explanations of field names and how they have been calculated should be added (for example, what is party walls, how window surface was calculated etc.)</p> |
| Climate Change Scenario selector (and explanations provided)                                                                                                | RPR |    | Hoover pop-up is showing heating demand for district or city. District popup is showing neighbourhood name.                                                                                                                                                                      | 6 | Graphical scale bar could be added.                                                                                                                                                                                                                                                                                           |
| Climate Change Scenarios visualisation                                                                                                                      | RPR |   | Dashboard is interactive and filters objects on the map, when selected in graphs. Functionality is really usable and user friendly, makes possibility of some analysis (for building scale heating demand and year of construction can be combined to filter objects on screen). | 6 | Really nice functionality with some small details                                                                                                                                                                                                                                                                             |
| Climate Change Scenarios visualisation: additional information of building or district (depending on the scale) when clicking on them at the left-hand side | RPR |  | Dashboard is interactive and filters objects on the map, when selected in graphs. Functionality is usable and user friendly, makes possibility of some analysis                                                                                                                  | 6 | Arrow of dashboard could be smaller (we guess it depends on monitor resolution; when opened at other computer, it is huge).                                                                                                                                                                                                   |



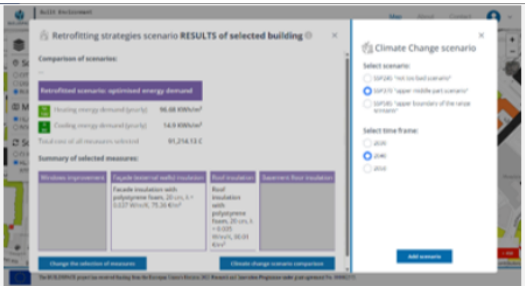
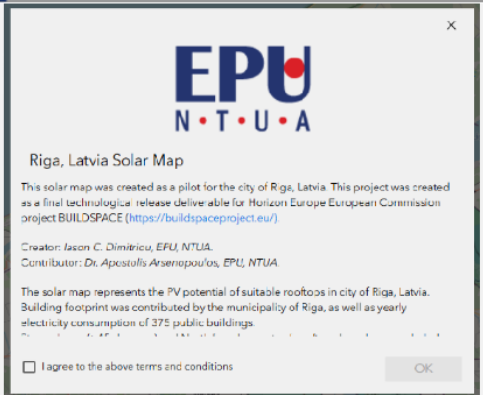


# BUILDSPACE

|                                                                                                                                             |     |                                                                                      |                                                                                                                                                                                                                                                                           |   |                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------|-----|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Climate Change Scenarios comparison with baseline feature                                                                                   | RPR |    | Dashboard is interactive and filters objects on the map, when selected in graphs. Functionality is usable and user friendly, makes possibility of some analysis (for building scale heating demand and year of construction can be combined to filter objects on screen). | 6 | At some times number cannot fit in the bar chart and then it becomes partly invisible (second picture).                                                                                                            |
| Climate Change Scenario selector comparison with baseline: additional information compared when clicking on a building                      | RPR |    | Dashboard interactively compares two different climate scenarios visualising changes in energy demand in selected area/buildings.                                                                                                                                         | 7 | no                                                                                                                                                                                                                 |
| Retrofitting Strategies Scenarios selector (easy to use and understood, information about each measure to select)                           | RPR |   | Dashboard offers selection of retrofitting measures for detailed calculation and options to refine selected measure.                                                                                                                                                      | 5 | There can be some relation to selected building materials and other available datasets about building                                                                                                              |
| Retrofitting Strategies Scenarios visualisation: information displayed, valuable comparison with baseline situation (current energy demand) | RPR |  | Dashboard shows the results of calculation of selected measure and compares this with baseline information.                                                                                                                                                               | 5 | As offered retrofitting strategies are very general (that could fit all) selection of them is quite narrow, but still gives user the opportunity to become an overview about economic and ecologic impact of them. |

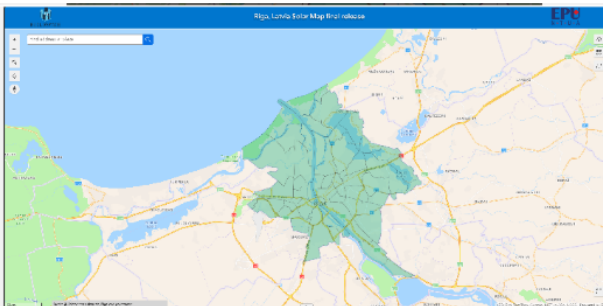
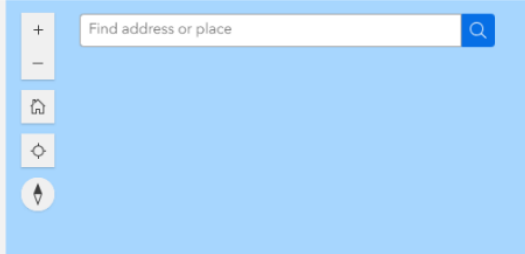
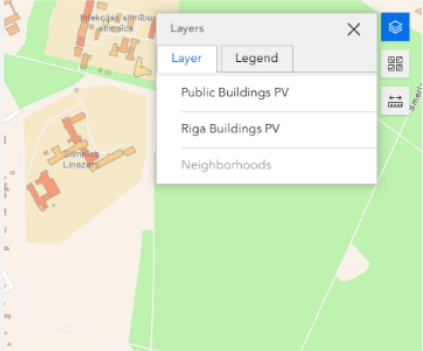


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|                                                                                                                                                                      |            |                                                                                     |  |                                                                                                                                                 |          |                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Retrofitting Strategies Scenarios: additional option to compare the retrofitting measures in future climate change scenario. SELECTOR</p>                         | <p>RPR</p> |   |  | <p>Dashboard offers to use additional comparison – to visualise results of retrofitting strategies under different climate change scenarios</p> | <p>5</p> | <p>However, it is hard to provide more comparable data, scenarios.</p>                                                                                                                           |
| <p>Retrofitting Strategies Scenarios: visualisation of comparison of the retrofitting measures scenario currently and in future climate change scenario selected</p> | <p>RPR</p> |   |  | <p>Dashboard visualises impact of retrofitting measures today and in selected year in the future with impact of climate change.</p>             | <p>5</p> | <p>The structure might be differently used to provide better readability</p>                                                                                                                     |
| <p>Description of data implementation and map functionalities, with terms and conditions</p>                                                                         | <p>RPR</p> |  |  | <p>User can read what data and software were used, terms of use, creator etc.</p>                                                               | <p>6</p> | <p>Few details have been already reported (Text should be changed to "Data contributed by The State Land Service of Latvia and Riga Local Government", the font size needs to be equalized).</p> |

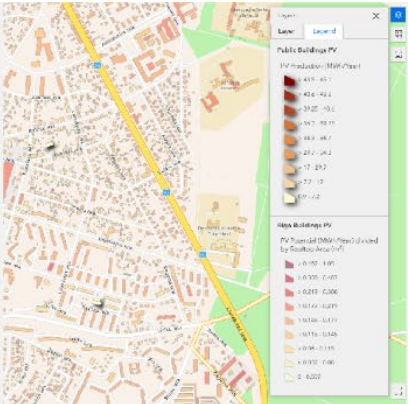
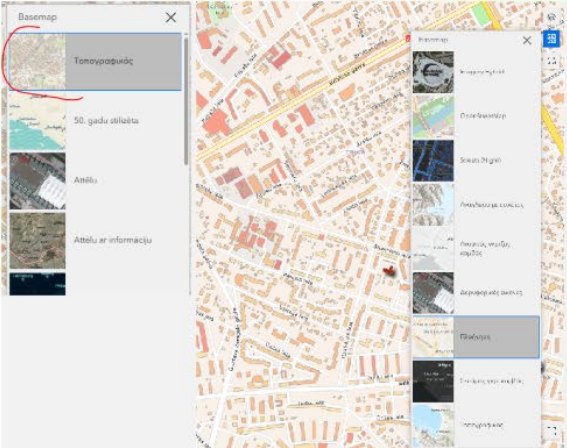


## BUILDSPACE

|                             |     |                                                                                     |                                                                                                                                            |   |                                                                                                                               |
|-----------------------------|-----|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------|
| Friendly user map interface | RPR |   | The user is able to zoom in, zoom out and explore the PV potential map of Riga. Interface and map is intuitive and simple - user friendly. | 6 | Scale limits could be defined (out beyond could be 1:300 000)                                                                 |
| Adress search banner        | RPR |   | The user is able to search a specific address on the map with 2 geocoders.                                                                 | 5 | Functionality to search cadastral designation from map layers could be added. Search widget should be added in small screens. |
| Layer banner                | RPR |  | The user is able to enable or disable the layers of Public buildings PV potential, General buildings PV potential and Neighborhoods        | 7 | No                                                                                                                            |

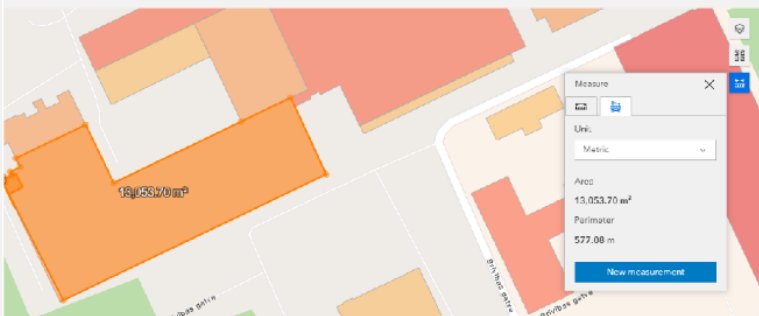
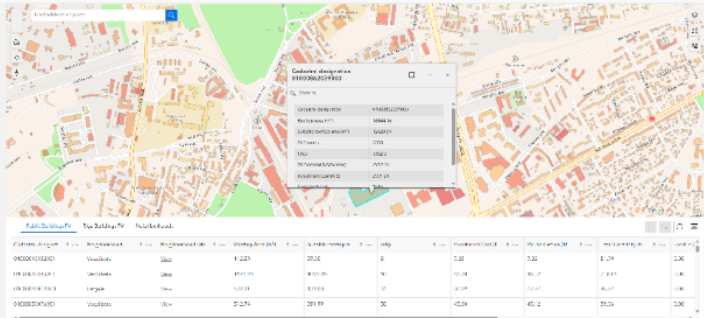


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|                |     |                                                                                     |                                                                                                                                                   |   |                                                                                                                                                                                                                                                                     |
|----------------|-----|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Legend banner  | RPR |   | The user may explore the PV potential Legend colours by using the legend banner.<br>Legend is interactive and shows only layers that are enabled. | 7 | No                                                                                                                                                                                                                                                                  |
| Basemap banner | RPR |  | The user can change basemap from variety of different maps.                                                                                       | 5 | Default basemap's name should be changed to English.<br>Default basemap (Topographical) is incomplete and doesn't have half of Riga's buildings, it has old information. The best basemap for Riga is OSM, but it seems that using it has some unsolvable problems? |



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| Perform measurements | RPR                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The user can measure distance and area by using the measurement banner | 7                    | No                 |             |                      |                    |             |                      |                    |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |                                                                                                                                                                        |   |                                                                                           |
|----------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------|--------------------|-------------|----------------------|--------------------|-------------|----------------------|--------------------|------------|------|------|------------|------|------|------------|------|------|------------|------|------|------------|------|------|------------|------|------|------------|------|------|------------|------|------|------------|------|------|------------|------|------|------------|------|------|------------|------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------|
| Map Attribute table  | RPR                  |  <table><thead><tr><th>Volume (m³)</th><th>Year of construction</th><th>Year of renovation</th><th>Volume (m³)</th><th>Year of construction</th><th>Year of renovation</th><th>Volume (m³)</th><th>Year of construction</th><th>Year of renovation</th></tr></thead><tbody><tr><td>1000000000</td><td>2000</td><td>2000</td><td>1000000000</td><td>2000</td><td>2000</td><td>1000000000</td><td>2000</td><td>2000</td></tr><tr><td>1000000000</td><td>2000</td><td>2000</td><td>1000000000</td><td>2000</td><td>2000</td><td>1000000000</td><td>2000</td><td>2000</td></tr><tr><td>1000000000</td><td>2000</td><td>2000</td><td>1000000000</td><td>2000</td><td>2000</td><td>1000000000</td><td>2000</td><td>2000</td></tr><tr><td>1000000000</td><td>2000</td><td>2000</td><td>1000000000</td><td>2000</td><td>2000</td><td>1000000000</td><td>2000</td><td>2000</td></tr></tbody></table> | Volume (m³)                                                            | Year of construction | Year of renovation | Volume (m³) | Year of construction | Year of renovation | Volume (m³) | Year of construction | Year of renovation | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | 1000000000 | 2000 | 2000 | The user can explore the attribute table of the buildings, by clicking on an available rooftop (pop-up) and by exploring the attribute table on the bottom of the map. | 5 | Pop-up and attribute table still have to be improved (have been already reported to NTUA) |
| Volume (m³)          | Year of construction | Year of renovation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Volume (m³)                                                            | Year of construction | Year of renovation | Volume (m³) | Year of construction | Year of renovation |             |                      |                    |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |                                                                                                                                                                        |   |                                                                                           |
| 1000000000           | 2000                 | 2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1000000000                                                             | 2000                 | 2000               | 1000000000  | 2000                 | 2000               |             |                      |                    |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |                                                                                                                                                                        |   |                                                                                           |
| 1000000000           | 2000                 | 2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1000000000                                                             | 2000                 | 2000               | 1000000000  | 2000                 | 2000               |             |                      |                    |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |                                                                                                                                                                        |   |                                                                                           |
| 1000000000           | 2000                 | 2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1000000000                                                             | 2000                 | 2000               | 1000000000  | 2000                 | 2000               |             |                      |                    |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |                                                                                                                                                                        |   |                                                                                           |
| 1000000000           | 2000                 | 2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1000000000                                                             | 2000                 | 2000               | 1000000000  | 2000                 | 2000               |             |                      |                    |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |            |      |      |                                                                                                                                                                        |   |                                                                                           |



## BUILDSPACE

|                     |     |                                                                                    |                                                                                                                                                                                                                |   |                                                                                                                                                                                                                                                                                         |
|---------------------|-----|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shareable URL       | RPR | N/A                                                                                | The map is builded as an Experience builder on the NTUA ArcGIS Server and is shareable to all plarforms through dedicated URL. It can be embended on platforms and sites                                       | 7 | This brings added value and it is planned that map will be published in Riga municipality's geoportal GEO RĪGA (georiga.eu).                                                                                                                                                            |
| Header              | RPR |  | Map has a header with map title, BUILDSPACE and NTUA logos and links to homepages.                                                                                                                             | 5 | Header should be fixed for smaller screens.                                                                                                                                                                                                                                             |
| Symbology of layers | RPR |  | Public Building PV and Riga Building PV has different symbology, so that Public buildings stand out, at the same time similar color shema has been maintained.<br>Neighborhood's symbology is simple and good. | 5 | Riga Building PV layer could have smaller outline or it can be without outline, so that map doesn't look gray, when zoomed out.<br>Public building PV layer's symbology could still be improved, so that buildings doesn't look levitating and whith very sharp shadow, when zoomed in. |

## 3.2 Service 4 - Urban Heat Analysis and Resilience

### 3.2.0 Pilot 3 – Piraeus, Greece

SE4 was developed within a single testbed scenario and encompasses three use cases:

**UC4.1 - Urban Heat Analysis:** Estimation of the Urban Heat Risk (UHR), derived by overlaying data on heat exposure, hazard and vulnerability.

**UC4.2 - Urban Heat Exposure:** Initially, this use case was associated to the account effects of urban heat on buildings. Later, this use case followed the las IPCC guidelines and focused on identifying areas with higher population density and buildings with higher energy demand.

**UC4.3 - Urban Heat Vulnerability:** Assessment of Urban Heat Vulnerability (UHV), based on demographic and socio-economic indicators. It also evaluates adaptive capacity, considering the feasibility of implementing urban interventions.

Although the initial plan was to conduct the analysis using NUTS units, it became apparent that even the smallest NUTS level was too coarse to meet the analytical needs of the service-namely, achieving neighbourhood-scale resolution. Consequently, the urban heat analysis was redefined to begin at the metropolitan scale of Athens and subsequently refined to the census tract level.

#### 3.2.0.1 Gantt Chart

Moving from initial preparations to real-world testing, Municipality of Piraeus (MoP) will apply Service 4 in an urban setting to assess urban heat risks. This involves using sociodemographic and energy demand data to create predictive models that help understand and address urban heat challenges. Data collection and processing efforts will continue, so that all relevant information is available and accurately integrated. Collaboration with technical partners (UPM, CARTIF, MOBICS) will refine calculations on energy use, to improve data quality and generate high-resolution urban heat maps.

A structured training program will be developed to familiarize municipal personnel and stakeholders with the SE4 system and its applications. Additionally, a dedicated seminar will be organized to demonstrate the potential of SE4 to public authorities, urban planners, and industry professionals.

Through this pilot, MoP aims to confirm that SE4 works effectively and is useful in practice. The project team will closely monitor the system's performance, engage with local stakeholders, and collect feedback to enhance the service. The results will provide the foundation for expanding the system in future phases, helping the city better understand heat-related risks and improve urban climate resilience.

During the months M22–M29, the MoP will participate in evaluating BUILDSPACE components to assess both usability and performance levels. The assessment will focus on:

- Functionality
- Accuracy
- User Experience
- Impact



Table 36 . (SE4, Pilot 3) Progress of tasks in the full-pilot phase related to Gantt Chart

| Responsible Partner                                      | Streams of Activities                                          | Month | Progress  | Results                 |
|----------------------------------------------------------|----------------------------------------------------------------|-------|-----------|-------------------------|
| <b>B. Data selection &amp; Storage</b>                   |                                                                |       |           |                         |
| <b>B1. Indicators Selection</b>                          |                                                                |       |           |                         |
| UPM                                                      | B1.1 Hazard indicators                                         | M14   | Completed | List of indicators      |
| UPM, MOBICS, MoP                                         | B1.2 Vulnerability indicators                                  | M14   | Completed | List of indicators      |
| UPM, MoP, MOBICS                                         | B1.3 Exposure indicators                                       | M14   | Completed | List of indicators      |
| <b>B2. Open databases identification and integration</b> |                                                                |       |           |                         |
| MoP, UPM                                                 | B2.1 Hazard databases                                          |       |           |                         |
| UPM                                                      | B2.1.1 ERA5                                                    |       |           |                         |
| UPM                                                      | B2.1.1.1 ERA5 data download                                    | M14   | Completed | Data downloaded         |
| UPM                                                      | B2.1.2 CWS                                                     |       |           |                         |
| UPM                                                      | B2.1.2.1 CWS data download                                     | M15   | Completed | Data downloaded         |
| UPM                                                      | B2.1.2.2 QC/QA                                                 | M15   | Completed | Data processed          |
| UPM                                                      | B2.1.2.3 CWS density point optimisation                        | M18   | Completed | Data optimised          |
| UPM                                                      | B2.1.2.4 CWS final point data integration                      | M18   | Completed | Data integrated         |
| MOBICS, UPM, MoP                                         | B2.2 Vulnerability indicators                                  |       |           |                         |
| MOBICS, UPM, MoP                                         | B2.2.1 Vulnerability data selection, download and integration  | M14   | Completed | Data integrated         |
| MOBICS, UPM, MoP                                         | B2.3 Exposure indicators data download                         |       | Completed | Data downloaded         |
| MOBICS, UPM, MoP                                         | B2.3.1 Exposure indicators data download & integration         | M14   | Completed | Data integrated         |
| <b>C. Operation Activities</b>                           |                                                                |       |           |                         |
| <b>C1. Urban Heat Risk Assessment</b>                    |                                                                |       |           |                         |
| UPM                                                      | C1.1 Hazard Assessment                                         |       |           |                         |
| UPM                                                      | C1.1.1 Reference heat map                                      | M16   | Completed | Urban heat severity map |
| UPM                                                      | C1.1.2 Preliminary CDD/HDD data                                |       |           |                         |
| UPM                                                      | C1.1.2.1 Urban climate severity (CDD/HDD) preliminary - points | M16   | Completed | CSV file                |



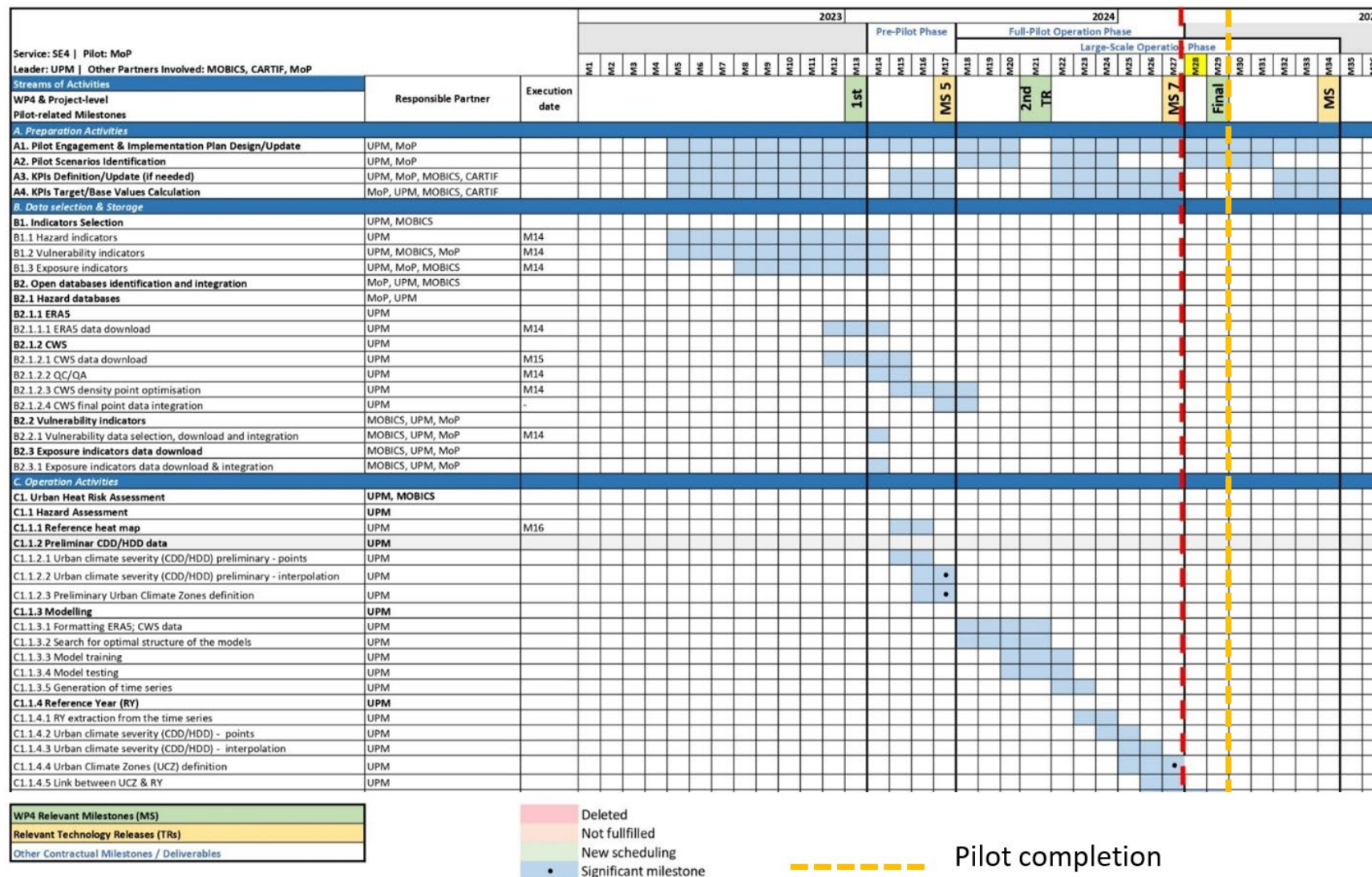
|                               |                                                                       |     |           |                                |
|-------------------------------|-----------------------------------------------------------------------|-----|-----------|--------------------------------|
| UPM                           | C1.1.2.2 Urban climate severity (CDD/HDD) preliminary - interpolation | M17 | Completed | -                              |
| UPM                           | C1.1.2.3 Preliminary Urban Climate Zones definition                   | M17 | Completed | -                              |
| UPM                           | C1.1.3 Modelling                                                      |     |           |                                |
| UPM                           | C1.1.3.1 Formatting ERA5; CWS data                                    | M21 | Completed | CSV file                       |
| UPM                           | C1.1.3.2 Search for optimal structure of the models                   | M21 | Completed | Python scripts                 |
| UPM                           | C1.1.3.3 Model training                                               | M22 | Completed | Python scripts                 |
| UPM                           | C1.1.3.4 Model testing                                                | M22 | Completed | Python scripts                 |
| UPM                           | C1.1.3.5 Generation of time series                                    | M23 | Completed | CSV file                       |
| UPM                           | C1.1.4 Reference Year (RY)                                            |     |           |                                |
| UPM                           | C1.1.4.1 RY extraction from the time series                           | M24 | Completed | CSV file                       |
| UPM                           | C1.1.4.2 Urban climate severity (CDD/HDD) - points                    | M25 | Completed | Points file (X,Y)              |
| UPM                           | C1.1.4.3 Urban climate severity (CDD/HDD) - interpolation             | M26 | Completed | Urban Heat severity map        |
| UPM                           | C1.1.4.4 Urban Climate Zones (UCZ) definition                         | M27 | Completed | Shapefile                      |
| UPM                           | C1.1.4.5 Link between UCZ & RY                                        | M27 | Completed | -                              |
| UPM                           | C1.1.4.6 UWEC generation                                              | M29 | Completed | Weather files (.epw)           |
| UPM                           | C1.1.4.7 UWEC testing                                                 | M29 | Completed | -                              |
| UPM                           | C1.1.5 Hazard Hotspots                                                |     |           |                                |
| UPM                           | C1.1.5.1 Preliminary delimitation of hotspots in GIS                  | M17 | Completed | Preliminary Hotspots shapefile |
| UPM                           | C1.1.5.2 Delimitation of hotspots in GIS                              | M27 | Completed | Hotspots shapefile             |
| C1.2 Vulnerability Assessment |                                                                       |     |           |                                |
| MOBICS                        | C1.2.1 Calculation of indicators                                      |     |           |                                |
| MOBICS                        | C1.2.1.1 Sensitivity indicators                                       | M16 | Completed | List of indicators             |
| MOBICS                        | C1.2.1.2 Adaptation capacity indicators                               | M16 | Completed | List of indicators             |
| MOBICS                        | C1.2.2 Sensibility assessment                                         |     |           |                                |
| MOBICS                        | C1.2.2.1 Sensitivity assessment                                       | M17 | Completed | Sensitivity (shapefile) maps   |
| MOBICS                        | C1.2.2.2 Preliminary Sensitivity maps                                 | M17 | Completed | Sensitivity (shapefile) maps   |

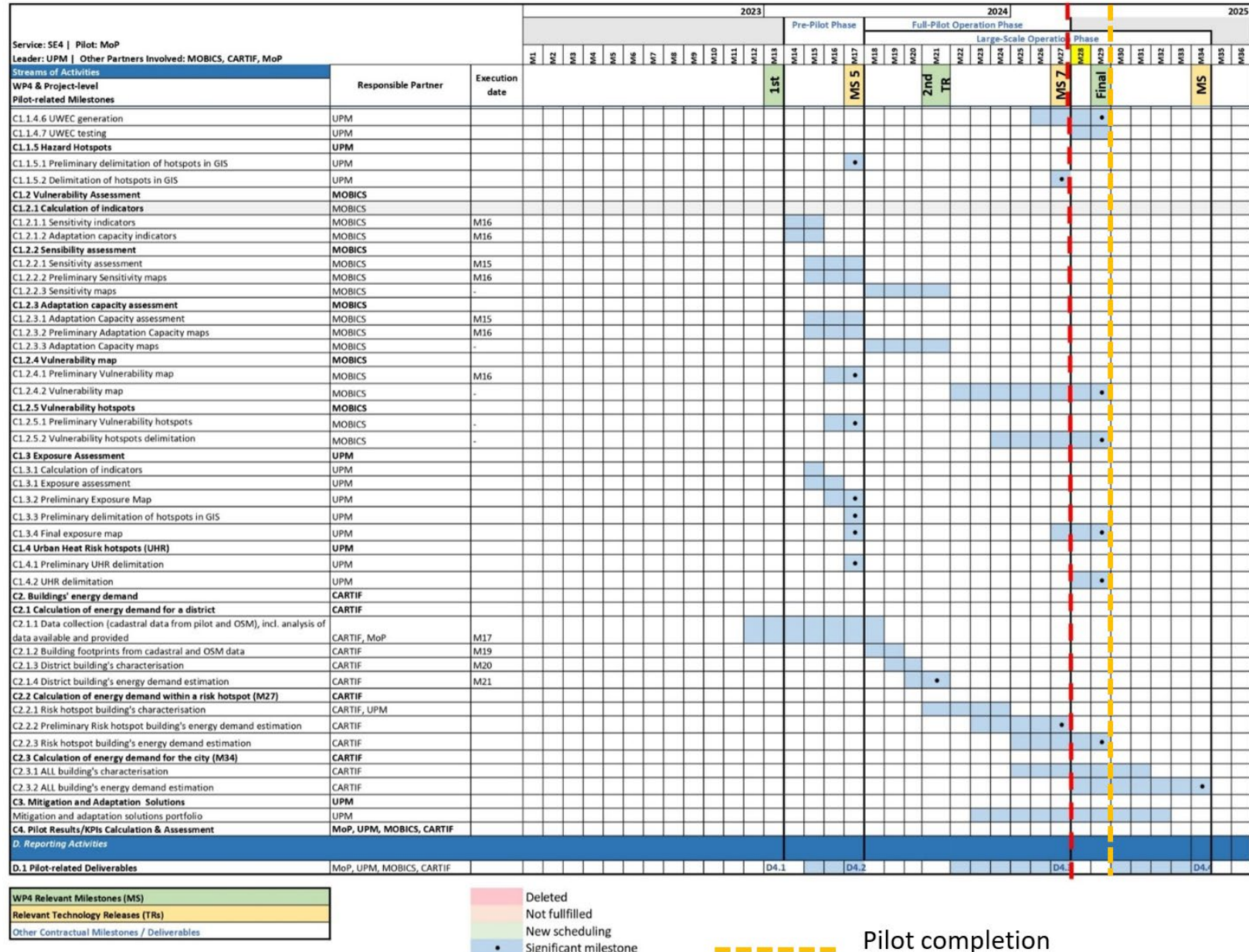
|                                     |                                                                                                           |     |           |                                        |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------|-----|-----------|----------------------------------------|
| MOBICS                              | C1.2.2.3 Sensitivity maps                                                                                 | M21 | Completed | Sensitivity maps (shapefile)           |
| MOBICS                              | C1.2.3 Adaptation capacity assessment                                                                     |     |           |                                        |
| MOBICS                              | C1.2.3.1 Adaptation Capacity assessment                                                                   | M15 | Completed | A.C. maps (shapefile)                  |
| MOBICS                              | C1.2.3.2 Preliminary Adaptation Capacity maps                                                             | M16 | Completed | A.C. maps (shapefile)                  |
| MOBICS                              | C1.2.3.3 Adaptation Capacity maps                                                                         | M21 | Completed | A.C. maps (shapefile)                  |
| MOBICS                              | C1.2.4 Vulnerability map                                                                                  |     |           |                                        |
| MOBICS                              | C1.2.4.1 Preliminary Vulnerability map                                                                    | M16 | Completed | Vulnerability map (shapefile)          |
| MOBICS                              | C1.2.4.2 Vulnerability map                                                                                | M17 | Completed | Vulnerability map (shapefile)          |
| MOBICS                              | C1.2.5 Vulnerability hotspots                                                                             | M29 | Completed | Vulnerability hotspot map (shapefile)  |
| MOBICS                              | C1.2.5.1 Preliminary Vulnerability hotspots                                                               | M17 | Completed | Vulnerability hotspots map (shapefile) |
| C1.3 Exposure Assessment            |                                                                                                           |     |           |                                        |
| UPM                                 | C1.3.1 Calculation of indicators                                                                          | M15 | Completed | List of indicators                     |
| UPM                                 | C1.3.1 Exposure assessment                                                                                | M16 | Completed | Exposure maps (shapefile)              |
| UPM                                 | C1.3.2 Preliminary Exposure Map                                                                           | M17 | Completed | Exposure maps (shapefile)              |
| UPM                                 | C1.3.3 Preliminary delimitation of hotspots in GIS                                                        | M17 | Completed | Exposure hotspots maps (shapefile)     |
| UPM                                 | C1.3.4 Exposure hotspots delimitation                                                                     | M29 | Completed | Shapefile                              |
| UPM                                 | C1.4 Urban Heat Risk hotspots (UHR)                                                                       |     |           |                                        |
| UPM                                 | C1.4.1 Preliminary UHR delimitation                                                                       | M17 | Completed | UHR map (shapefile)                    |
| UPM                                 | C1.4.2 UHR delimitation                                                                                   | M29 | Completed | Shapefile                              |
| <b>C2. Buildings' energy demand</b> |                                                                                                           |     |           |                                        |
| CARTIF                              | C2.1 Calculation of energy demand for a district                                                          |     |           |                                        |
| CARTIF                              | C2.1.1 Data collection (cadastral data from pilot and OSM), incl. analysis of data available and provided | M17 | Completed | -                                      |
| CARTIF                              | C2.1.2 Building footprints from cadastral and OSM data                                                    | M19 | Completed | Shapefile                              |
| CARTIF                              | C2.1.3 District building's characterisation                                                               | M20 | Completed | Data (CSV)                             |

|                                                |                                                                     |     |           |                   |
|------------------------------------------------|---------------------------------------------------------------------|-----|-----------|-------------------|
| CARTIF                                         | C2.1.4 District building's energy demand estimation                 | M21 | Completed | Shapefile         |
| CARTIF                                         | C2.2 Calculation of energy demand within a risk hotspot (M27)       |     |           |                   |
| CARTIF                                         | C2.2.1 Risk hotspot building's characterization                     | M24 | Completed | Shapefile         |
| CARTIF                                         | C2.2.2 Preliminary Risk hotspot building's energy demand estimation | M27 | Completed | Shapefile         |
| CARTIF                                         | C2.3 Calculation of energy demand for the city (M34)                |     |           |                   |
| CARTIF                                         | C2.3.1 ALL building's characterization                              | M31 | Completed | Buildings' data   |
| CARTIF                                         | C2.3.2 ALL building's energy demand estimation                      | M34 | Completed | BED shapefile     |
| <b>C3. Mitigation and Adaptation Solutions</b> |                                                                     |     |           |                   |
| UPM                                            | C3.1 Mitigation and adaptation solutions portfolio                  | M32 | Completed | Web app portfolio |



Table 37. (SE4, Pilot 3) Gantt Chart progress. Full-Pilot phase





### 3.2.0.2 Pilot Tracker

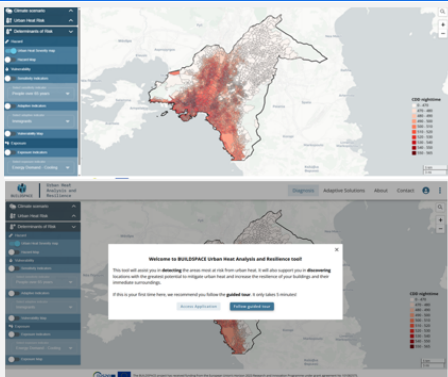
Table 38. (SE4, Pilot 3) Pilot Tracker. Full-Pilot phase

| Pilot Partner | Service | USE CASES (USER STORIES) |     |      | Technical requirements for end-user to receive service                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Next Steps specified Timeline |                                        |                                         |                                                                      |                                                      |          |                                    | Data collection          |                                                                                                                                                                                                                | Responsibility / Leading the use of service Department |                                     |     | Target completed |
|---------------|---------|--------------------------|-----|------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------------------------|-----------------------------------------|----------------------------------------------------------------------|------------------------------------------------------|----------|------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------------------|-----|------------------|
|               |         | UC1                      | UC2 | UC 3 | TR1: Filled by technical developer                                                                                     | TR2: Filled by technical developer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                               |                                        |                                         |                                                                      |                                                      |          |                                    | Data collection complete | What kind of data missing?                                                                                                                                                                                     |                                                        |                                     |     |                  |
| MoP           | SE4     | yes                      | yes | yes  | In order to use the SE4 application, as it is a web application only connection to internet is required and a browser. | The user will be able to download GIS format data. QGIS is a open software that allows working with GIS data. QGIS technical requirements: Processor - CPU: Core i3 2.7 Ghz (minimum), Core i7 3.5 Ghz (recommended), Memory RAM: 2 Gb (minimum), 8 Gb or more (recommended), Hard Disk: 500 Gb SATA (minimum), SSD 128 Gb or 500 Gb SATA (recommended), Graphic card: 1 Gb RAM (minimum), 2 Gb RAM (NVIDIA GeForce) (recommended), Operating System: Windows 7-10, MacOS, Linux, BSD, and (Various Android apps) for mobile and tablets. Installation guide: https://qgis.org/resources/installation-guide/ | Testing inside the SE4        | Validation of the testing/improvements | Define & adapt scenarios for live event | No 1 Live event planning/ organising for stakeholder engagement (GR) | No 2 Live event planning for EU level partners (ENG) | Feedback | Practical seminar for stakeholders | 80%                      | No other data are available. Available data from Mapathon has been incorporated as appropriate; additional inputs are pending completion of the Mapathon.Building's footprint ALL building's characterisation. | Keeping service                                        | Publicity, Stakeholder consultation |     | 90%              |
|               |         |                          |     |      |                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | M25                           | M26                                    | M26                                     | M27                                                                  | M28                                                  | M28      | M32                                |                          |                                                                                                                                                                                                                | MoP IT+Technical Department                            | MoP                                 | MoP |                  |
|               |         |                          |     |      |                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | TOTAL                         |                                        |                                         |                                                                      |                                                      |          |                                    |                          |                                                                                                                                                                                                                |                                                        |                                     |     |                  |



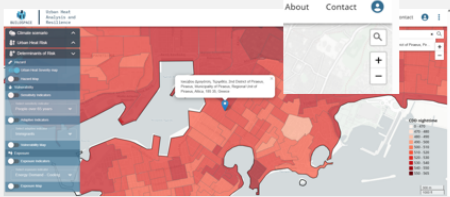
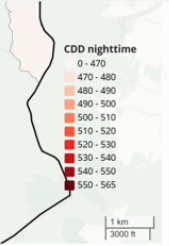
### 3.2.0.3 Evaluation Tracker

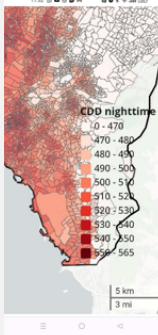
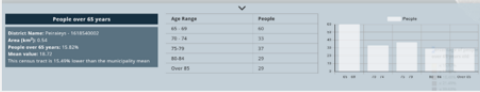
Table 39. (SE4, Pilot 3) Pilot Evaluation. Full-Pilot phase

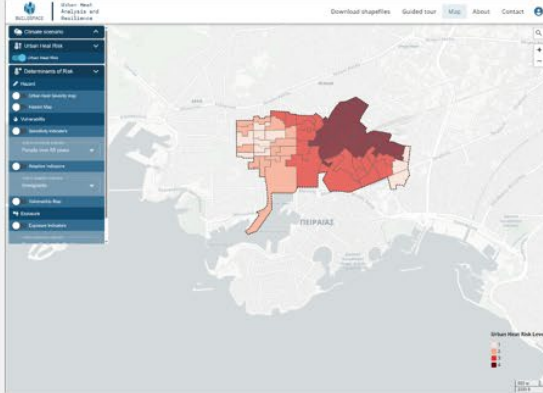
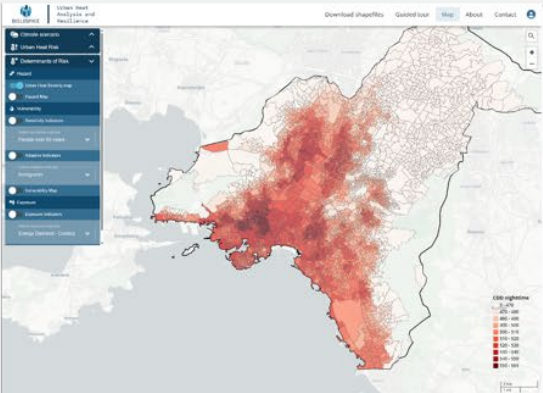
| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS           | Evaluating Pilot partner | Screenshot                                                                          | Description of the current state of the service                                                                                                                                                                                                                                                                                                                                | Rating (1-7) | Recommendations for the improvements of the service                                                                                                                                                                             |
|-----------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| User interface clarity: Is the interface intuitive and user-friendly? | MoP                      |   | The interface is intuitive and user-friendly, with a clean layout that makes it easy to navigate between different features. Key functions like switching heat layers, zooming in/out, and selecting tools are clearly labeled and easily accessible. The color schemes and legends on the heat maps help users interpret the data quickly.                                    | 5            | The guided tour feature doesn't function as expected. Improving this feature, or providing a more comprehensive tutorial, could enhance the onboarding process, especially for those unfamiliar with urban heat analysis tools. |
| Performance and speed: How fast does the map load and render?         | MoP                      |  | The map generally loads quickly, and heat maps and other data visualizations render smoothly when displaying large areas of the city. However, when clicking on different features/indicators or applying multiple variables, the map can occasionally freeze or fail to render properly, becoming unresponsive. This can result in the page not displaying the expected data. | 4            | While the platform performs well in most cases, improving responsiveness when interacting with multiple features would enhance the user experience.                                                                             |

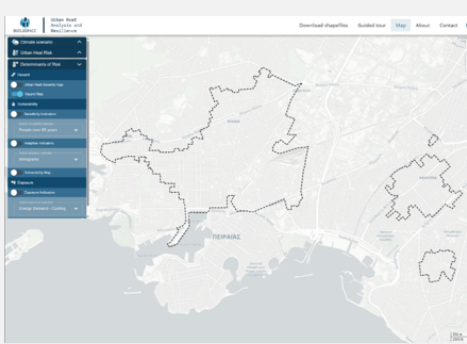
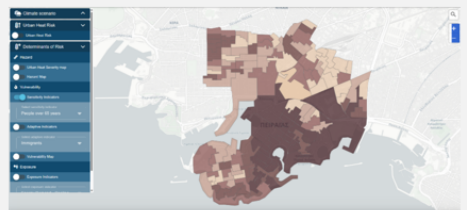
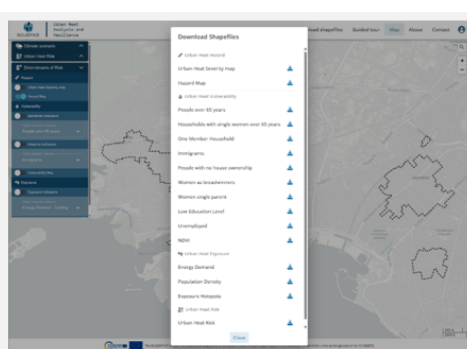
|                                                                               |     |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                 |   |                                                                                                                             |
|-------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------|
| Responsiveness: Does it work well on different devices and screen sizes?      | MoP |  | The platform works well on larger screens, providing a smooth user experience with responsive design that adapts to different screen sizes. In the mobile version, the platform menu overlaps the map, which can interfere with the user experience. When selecting a (variable) in the menu, users must close the menu to view the map, which is inconvenient. | 5 | Improving the mobile layout to avoid this overlap and enhance navigation would significantly improve the mobile experience. |
| Customizability: Should be included more customizable layers functionalities? | MoP | Not applicable                                                                     | The platform offers a range of layers that can be toggled, allowing users to view various aspects of urban heat analysis, such as temperature or socio-economic data.                                                                                                                                                                                           | 5 | The ability to customize these layers further could enhance the user experience.                                            |
| Pan and zoom functionality: Smoothness and responsiveness of navigation       | MoP | Not applicable                                                                     | The map responds well overall to user inputs, and the transition between zoom levels is generally smooth.                                                                                                                                                                                                                                                       | 6 |                                                                                                                             |



|                                                                          |     |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                    |   |                                                                                          |
|--------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------|
| Feature selection and identification: Click on a feature to view details | MoP | Not applicable                                                                      | The platform allows users to click on specific features to view detailed information. Feature identification is intuitive, with clear markers or highlights indicating clickable areas. When a feature is selected, relevant data is displayed promptly. However, when multiple features are selected simultaneously, the platform becomes less responsive, affecting the overall user experience. | 5 |                                                                                          |
| Search and geolocation: Ability to find places                           | MoP |   | The platform includes search functionality that allows users to find specific places or locations within the map using the search tool or geolocation.                                                                                                                                                                                                                                             | 5 | Geolocation search works well, however the search tool suggestions are not very helpful. |
| Legend and symbology: Clear representation of data                       | MoP |  | Well-defined symbology. The color schemes and icons on the heat maps are visually distinct.                                                                                                                                                                                                                                                                                                        | 6 |                                                                                          |

|                                                                                                                               |     |                                                                                    |                                                                                                |   |   |
|-------------------------------------------------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---|---|
| Layer visibility and opacity                                                                                                  | MoP |  | Applicable in all layers                                                                       | 6 |   |
| Should be included Filtering and Querying in the application?, if so, what type of filtering and querying would be desirable? | MoP | Not applicable                                                                     | Please describe the service                                                                    | x |   |
| Documentation and help resources: User guide, tutorial                                                                        | MoP | **This functionality must be updated by service provider partner**                 | **This functionality must be updated by service provider partner**                             | - | - |
| Usability and readability of statistical information: Vulnerability and Exposure indicators                                   | MoP |  | The statistical information is well-organized, making it easy for users to interpret the data. | 6 |   |

|                                                   |     |                                                                                     |                                                                                                                                                                           |   |
|---------------------------------------------------|-----|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Urban Heat Risk map readability and usability     | MoP |   | Highly readable, with clear color gradients and distinct markers that easily identify areas with varying heat levels.                                                     | 6 |
| Urban Heat Severity map readability and usability | MoP |  | The readability of the map is generally good, with a well-organized legend and color schemes that allow users to quickly understand the heat severity of different zones. | 6 |

|                                                              |     |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |   |                                                                                                                                                                                   |
|--------------------------------------------------------------|-----|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hazard map readability and usability                         | MoP |   | <p>The Hazard Map is generally clear for visualizing areas at risk. The color schemes and legends are well-designed, making it easy to interpret the data and understand the severity of hazards in different zones.</p> <p>The map's features, such as zooming, panning, and viewing detailed hazard information, work well for exploring the data.</p> <p>However, when multiple indicators are selected simultaneously, the map occasionally experiences some delays in rendering or becomes less responsive. This can affect the smoothness of user interactions, especially when toggling between different hazard layers or applying multiple data variables at once.</p> | 5 | Improve the responsiveness of the platform when selecting multiple indicators                                                                                                     |
| Vulnerability indicators map readability and usability       | MoP |   | <p>The Vulnerability Indicators Map performs well, offering clear visual cues and a well-organized legend to help users easily interpret areas of vulnerability. The map's color schemes effectively highlight regions at higher risk, making it easy to understand the data.</p>                                                                                                                                                                                                                                                                                                                                                                                               | 6 |                                                                                                                                                                                   |
| Ability to export maps: Download functionality and usability | MoP |  | <p>The process is straightforward, enabling users to download heat or hazard maps for further analysis or sharing.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5 | Enhancing the export options, such as providing different file formats (e.g., PNG, PDF, or shapefile), would improve usability and offer more flexibility for various user needs. |

### 3.3 Service 5 - Urban Flood Resilience

#### 3.3.0 Pilot 4 - Ljubljana, Slovenia

##### 3.3.0.1 Gantt Chart

During the full pilot phase, Urban Atlas Cover successfully completed full pilot data collection activities for the service's calculations and CORDEX projections, which were used for local climate-driven hydrology scenarios and blue-green infrastructure impact analysis (C1.2.1). Meteorological data from weather stations was used for local RCP scenarios (C1.2.2), and fieldwork was carried out to verify urban green areas and validate data on their extension (C1.2.3).

Following GIS data collection, the deployment of models' results to the tool (B2.2) was completed. Copernicus data deployment (from APIs to the tool) (B2.4) was carried out by CLC and C3S services, which were used for the service's calculations, as well as satellite imagery for background mapping. The methodology for assessing flood damage (B2.5) and the data visualisation component for integrating blue-green factor data (B2.6) were integrated. Data deployment from sensors to the tool (B2.3) was removed as the subcontracted operator provided pre-calibrated outputs for local RCP scenarios.

Climate-driven hydrology scenarios were generated (C2.4), including an analysis of historical local precipitation data (C2.4.1) and future precipitation data (C2.4.2). Future climate change IPCC scenarios (RCP2.6, RCP4.5 and RCP8.5) were also provided for the pilot area (C2.4.3).

The final refinements to use case no. 2, testing the results of BGI impact (C2.5), testing the results of satellite data implementation (C2.6) and testing the BGI impact visualisation (C2.7), have also been completed.

Guidance with retrofitting instructions (C3) has been included directly on the 'About' page of the application. Blue-green infrastructure measures were defined (C3.1) and instructions for building renovations and BGI design and implementation was produced.

*Table 40. (SE5, Pilot 4) Progress of tasks in the full-pilot phase related to Gantt Chart*

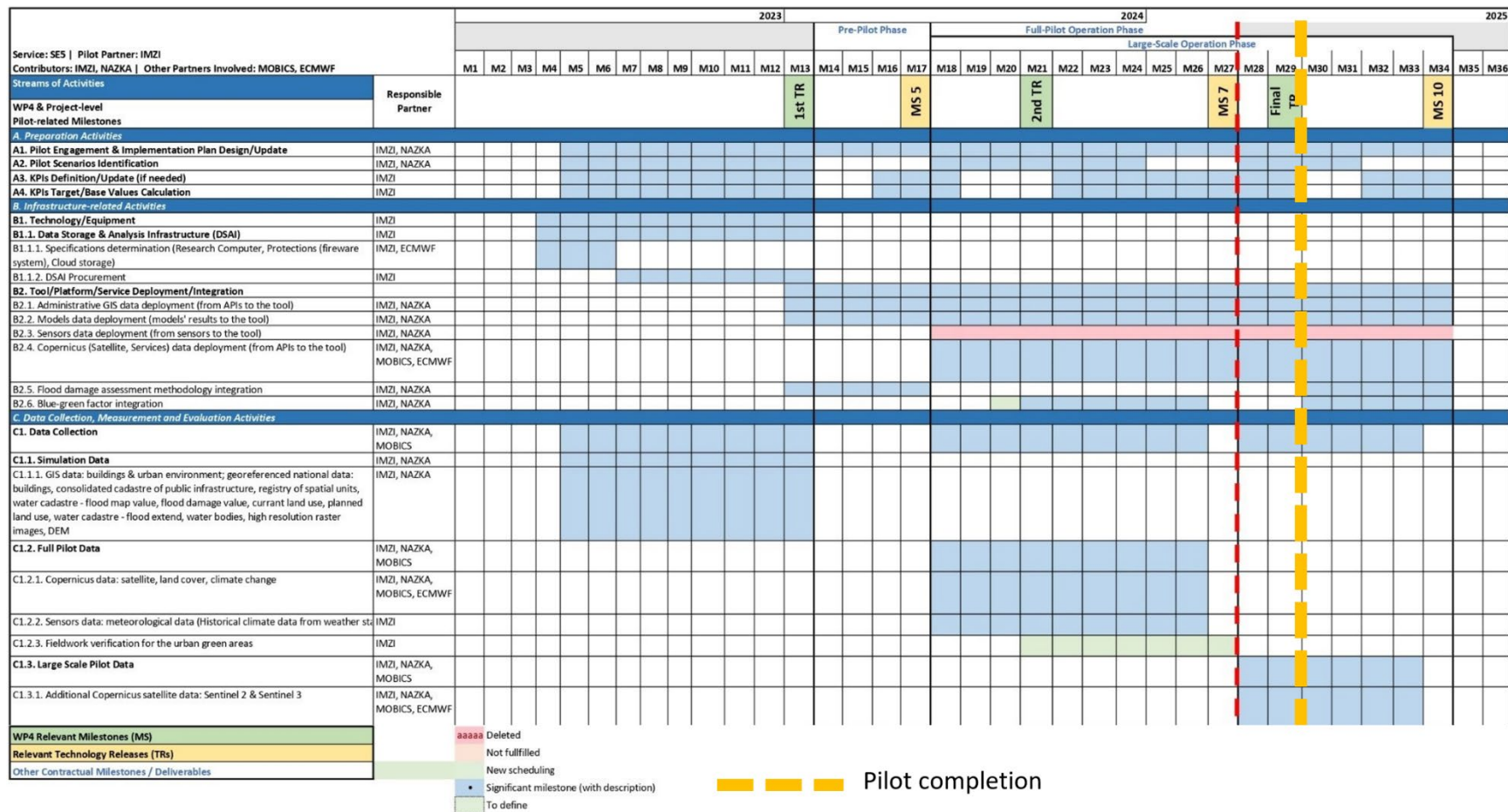
| Responsible Partner | Streams of Activities                                                                                  | Month | Progress  | Results           |
|---------------------|--------------------------------------------------------------------------------------------------------|-------|-----------|-------------------|
|                     | B. Infrastructure-related Activities                                                                   |       |           |                   |
|                     | B1. Technology/Equipment                                                                               |       |           |                   |
| IMZI, ECMWF         | B1.1.1. Specifications determination (Research Computer, Protections (fireware system), Cloud storage) | M5    | Completed | specifications    |
| IMZI                | B1.1.2. DSAI Procurement                                                                               | M7    | Completed | computers, system |
|                     | B2. Tool/Platform/Service Deployment/Integration                                                       |       |           |                   |

|                                                           |                                                                                                                                                                                                                                                                                                                                               |           |           |                                                                 |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------------------------------------------------------------|
| IMZI, NAZKA                                               | B2.1. Administrative GIS data deployment (from APIs to the tool)                                                                                                                                                                                                                                                                              | M13 - M34 | Completed | 7 datasets                                                      |
| IMZI, NAZKA                                               | B2.2. Models data deployment (models' results to the tool)                                                                                                                                                                                                                                                                                    | M13 - M34 | Completed | 3 model results                                                 |
| IMZI, NAZKA                                               | B2.3. Sensors data deployment (from sensors to the tool)                                                                                                                                                                                                                                                                                      | M18 - M34 | Deleted   |                                                                 |
| IMZI, NAZKA, MOBICS                                       | B2.4. Copernicus (Satellite, Services) data deployment (from APIs to the tool)                                                                                                                                                                                                                                                                | M18 - M34 | Completed | Copernicus Climate Change Service, Copernicus Land Service data |
| IMZI, NAZKA                                               | B2.5. Flood damage assessment methodology integration                                                                                                                                                                                                                                                                                         | M13       | Completed | application                                                     |
| IMZI, NAZKA                                               | B2.6. Blue-green factor integration                                                                                                                                                                                                                                                                                                           | M20 - M26 | Completed | application                                                     |
| C. Data Collection, Measurement and Evaluation Activities |                                                                                                                                                                                                                                                                                                                                               |           |           |                                                                 |
| C1. Data Collection                                       |                                                                                                                                                                                                                                                                                                                                               |           |           |                                                                 |
| C1.1. Simulation Data                                     |                                                                                                                                                                                                                                                                                                                                               |           |           |                                                                 |
| IMZI, NAZKA                                               | C1.1.1. GIS data: buildings & urban environment; georeferenced national data: buildings, consolidated cadastre of public infrastructure, registry of spatial units, water cadastre - flood map value, flood damage value, current land use, planned land use, water cadastre - flood extend, water bodies, high resolution raster images, DEM | M13       | Completed | 10 datasets                                                     |
| C1.2. Full Pilot Data                                     |                                                                                                                                                                                                                                                                                                                                               |           |           |                                                                 |
| IMZI, NAZKA, MOBICS                                       | C1.2.1. Copernicus data: satellite, land cover, climate change                                                                                                                                                                                                                                                                                | M18 - M26 | Completed | Copernicus Climate Change Service, Copernicus Land Service data |
| IMZI                                                      | C1.2.2. Sensors data: meteorological data (Historical climate data from weather stations)                                                                                                                                                                                                                                                     | M18 - M26 | Completed | 3 scenarios IPCC: RCP2.8, RCP4.5, RCP8.5                        |
| IMZI                                                      | C1.2.3. Fieldwork verification for the urban green areas                                                                                                                                                                                                                                                                                      | M21 - M27 | Completed | validation of BGF methodology                                   |
| C1.3. Large Scale Pilot Data                              |                                                                                                                                                                                                                                                                                                                                               |           |           |                                                                 |

|                     |                                                                                |                          |           |                                                                                                |
|---------------------|--------------------------------------------------------------------------------|--------------------------|-----------|------------------------------------------------------------------------------------------------|
| IMZI, NAZKA, MOBICS | C1.3.1. Additional Copernicus satellite data: Sentinel 2 & Sentinel 3          | M28 - M33                | Completed | background layers in the application                                                           |
|                     | C2. Operation Testing                                                          |                          |           |                                                                                                |
| IMZI, NAZKA         | C2.1. Testing results of flood damage analysis                                 | M14                      | Completed | application                                                                                    |
| IMZI, NAZKA         | C2.2. Testing of flood damage analysis visualisation                           | M16 - M34                | Completed | application                                                                                    |
|                     | C2.3. Testbed Scenario S5.1                                                    |                          |           |                                                                                                |
| IMZI                | C2.3.1. Geodatabase creation                                                   | M13                      | Completed | 1 geodatabase created                                                                          |
| IMZI                | C2.3.2. Building and Land Use data analysis with ArcGIS                        | M13                      | Completed | 2 shapefiles created                                                                           |
| IMZI                | C2.3.3. Attribute damage values                                                | M13                      | Completed | 1 xlsx file                                                                                    |
| NAZKA               | C2.3.4. Data applied to the tool                                               | M14 - M17                | Completed | application                                                                                    |
| NAZKA               | C2.3.4. Visualisation                                                          | M15 - M17                | Completed | coloured maps, graphs, tables, map slider                                                      |
| IMZI                | C2.3.5. Evaluation with Userback tool                                          | M16 - M17                | Completed | application                                                                                    |
| IMZI                | C2.4. Generation of climate scenarios (hydrology)                              |                          |           |                                                                                                |
| IMZI                | C2.4.1. Analysis of historical precipitation data                              | M20-M21; M30-M34         | Completed | 3 scenarios IPCC: RCP2.8, RCP4.5, RCP8.5                                                       |
| IMZI, ECMWF         | C2.4.2. Analysis of future precipitation data (and IPCC scenarios)             | M21-M23; M30-M34         | Completed | 3 scenarios IPCC: RCP2.8, RCP4.5, RCP8.5                                                       |
| IMZI                | C2.4.3. Future climate change scenarios                                        | M22-M26; M30-M34         | Completed | 4 scenarios IPCC: RCP2.8, RCP4.5, RCP8.5                                                       |
| IMZI                | C2.5. Testing results of BGI impact                                            | M21 - M26                | Completed | application                                                                                    |
| IMZI, NAZKA         | C2.6. Testing results of satellite data implementation                         | M21 - M26                | Completed | application                                                                                    |
| IMZI, NAZKA         | C2.7. Testing of BGI impact visualisation                                      | M21 - M27                | Completed | application                                                                                    |
| IMZI                | C3. Guidance with retrofitting instructions                                    |                          |           |                                                                                                |
| IMZI                | C3.1. Definition of BGI measures                                               | M15-M19; M24-26; M30-M34 | Completed | 3 BGI scenarios considered: Buildings to Green roofs, Grass to BGI, Unpermeable pavings to BGI |
| IMZI                | C3.2. Instructions for buildings renovations and BGI design and implementation | M15-M17; M25-27; M33-M34 | Completed | application                                                                                    |



Table 41. (SE5, Pilot 4) Gantt Chart progress. Full-Pilot phase. Part 1

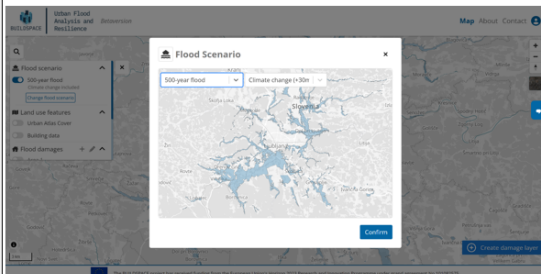
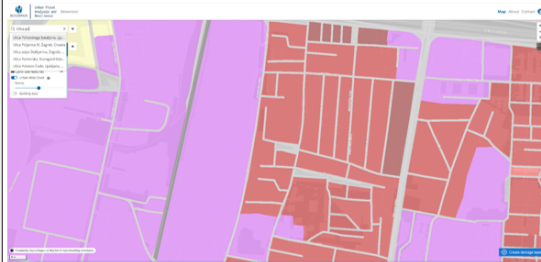
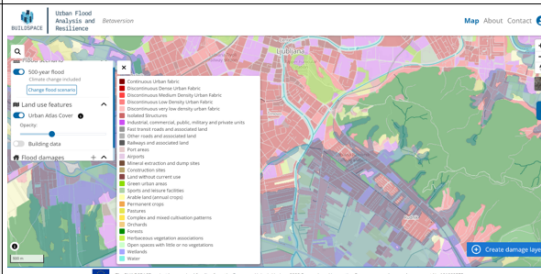


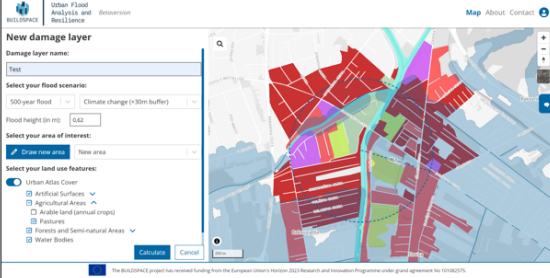
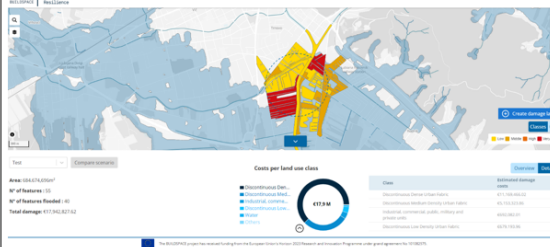
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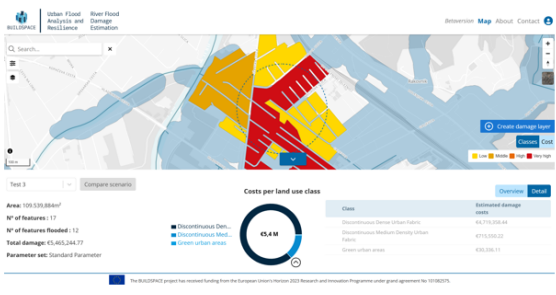
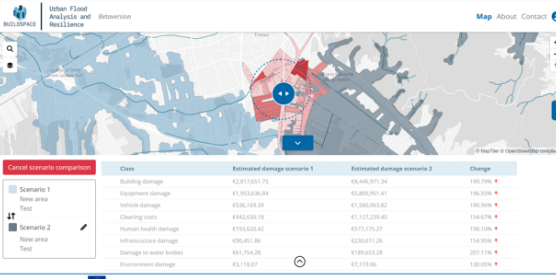
| Pilot Partner | Service | USE CASES (USER STORIES) |     |     | Technical requirements for end-user to receive service                                                                                                                  |                                    | Next Steps specified Timeline |                                        |                                         |                                                                 |                                                                      |                                |                                    | Data collection          |                            | Responsibility / Leading the use of service Department |                                                         |  | Target completed |     |
|---------------|---------|--------------------------|-----|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------|------------------------------------|--------------------------|----------------------------|--------------------------------------------------------|---------------------------------------------------------|--|------------------|-----|
|               |         | UC1                      | UC2 | UC3 | TR1: Filled by technical developer                                                                                                                                      | TR2: Filled by technical developer |                               |                                        |                                         |                                                                 |                                                                      |                                |                                    | Data collection complete | What kind of data missing? |                                                        |                                                         |  |                  |     |
| IMZI          | SE5     | yes                      | yes | no  | No special requirements are needed, just a computer and an internet connection- since the service is deployed as a web application that only requires a browser to run. |                                    | Testing inside the SE5        | Validation of the testing/improvements | Define & adapt scenarios for live event | No 1 Live training event organising for EU level partners (ENG) | No 2 Live demonstration event organising for local stakeholders (SI) | No 1 Live training event (ENG) | No 2 Live demonstration event (SI) | Feedback                 | 100%                       | All information has been provided.                     | Keeping service, Publicity and stakeholder consultation |  |                  | 90% |
|               |         |                          |     |     |                                                                                                                                                                         |                                    | M25                           | M26                                    | M26 - M27                               | M26 - M28                                                       | M26 - M28                                                            | M28                            | M29                                | M29                      |                            |                                                        | NAZKA, IMZI                                             |  |                  |     |

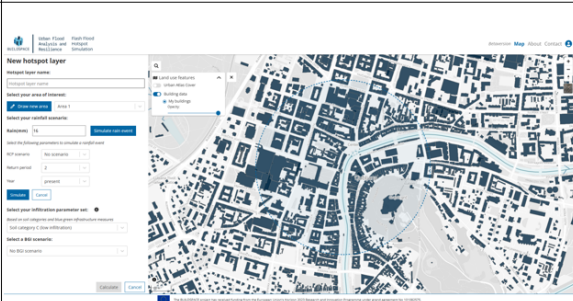
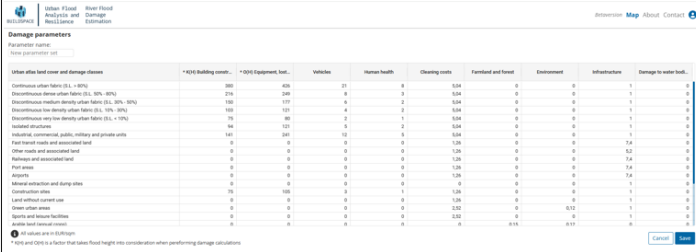
### 3.3.0.3 Evaluation Tracker

Table 43. (SE5, Pilot 4) Pilot Evaluation. Full-Pilot phase.

| EVALUATION OF INDIVIDUAL FUNCTIONALITIES/ FEATURES/ ASPECTS                                                       | Evaluating Pilot partner | Description of the current state of the service                                      | Rating (1-7) | Recommendations for the improvements of the service                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Selecting a flood scenario in "Flood Damage Hotspots" module or precipitation scenario in "Urban Runoff Hotspots" | IMZI                     |    | 7            | No                                                                                                                                                  |
| Searching by address (street name)                                                                                |                          |   | 5            | To enable searches including house numbers                                                                                                          |
| Selecting land use features                                                                                       | IMZI                     |  | 6            | Even if the user doesn't select buildings, he misses them as a map background. We recommend to show the buildings even selecting Urban Atlas Cover. |

|                                                 |      |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |   |                                                                                                                                      |
|-------------------------------------------------|------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------|
| Creating a damage layer and an area of interest | IMZI |   | The user can create a damage layer based on a number of parameters. A user can name a damage layer. This layer will be saved to the profile of the user. The user then selects a flood scenario he wants to use in the simulation. Next, he can enter a flood height to use. Further, the user needs to select an area of interest. A user can choose to draw a new area of interest. Then the map will go into drawing mode and the user can draw a circle, a rectangle or a free drawing. Areas will also be saved to the user's profile and can be reused later. Finally, the user selects if he wants to do the damage calculations for the building file, or by using the UAC. If the second option is picked, the user can opt to select or deselect certain categories. | 7 | To add the functionality of uploading own area of interest file and flood scenario file.                                             |
| Increasing or decreasing the opacity            | IMZI |    | An opacity slider allows the user to increase or decrease the opacity of both the UAC and the building layer. This allows for overlaying the flood extent clearly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 6 | To show the buildings even when selecting Urban Atlas Cover or Urban Atlas Cover even when selecting buildings - in reduced opacity. |
| Visualizing a damage layer on the map.          | IMZI |  | Damage layers can be visualised on the map in two different manners. Firstly, there is a categorical visualisation where fixed categories have been used, ranging from low to very high. This allows for cross area comparisons as the classes are exactly the same for each created damage layer. Secondly, a user can also decide to use a continuous scale that is relative for this specific damage layer. This scale, which is always coloured red, will use the lowest value in the damage layer as the lightest shade of red and the highest as the darkest shade. This way, a user can clearly see the differences and nuances within the researched area.                                                                                                             | 7 | No                                                                                                                                   |

|                                                     |      |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                                                                                          |
|-----------------------------------------------------|------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------------------------------------------------------------------------------------------------------|
| Visualizing a damage calculations in the data panel |      |  | <p>The user can open the data panel by clicking the blue button on the bottom. The panel will open from the bottom and show several visualisations. On the left there is some general information about the calculated damage layer such as the total damage and the number of features flooded. Next to the general info, there is a circle graph located that shows the distribution of the different damage classes. The same information is shown more in detail in the table on the right. For damage layers based on the UAC, the user can scroll down and show a similar visualisation showing the distribution of damages among the different UAC categories.</p> | 5 | To download result data and reports, the user would be able to download GIS format data and PDF reports. |
| Comparing two damage/runoff layers                  | IMZI |  | <p>To meet the needs of the target groups, a comparison tool was developed. When a comparison is started, a user can decide which damage/runoff layers need to be compared. Both layers will be loaded into the map and a map slider will appear. The user can navigate the map slider from left to right to compare the two damage/runoff layers. The data panel shows a comparison both in table as in graph mode, e.g. calculating the increase or decrease of each damage/runoff class.</p>                                                                                                                                                                           | 7 | No                                                                                                       |

|                                                                   |      |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |                                                                                          |
|-------------------------------------------------------------------|------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------|
| Creating (Calculating) a runoff layer and an area of interest     | IMZI |  | <p>The user can create a runoff hotspot map similar to a flood damage map. The user can enter a name that will be used when the file is saved. Next, the user needs to select or draw an area of interest. The functionality is the same here as for the other mode. Next, the user needs to input how much rain should fall in the simulation. If the user does not have the background knowledge to know this information, he can choose to simulate a rain event. Then, three dropdowns will appear where a user can choose a climate RCP scenario, a return period and a year. Based on this parameters, a rainfall amount will be estimated. Further, the user selects a soil category that will have an effect on the retention capacity of the urban land. Finally, the user can opt to simulate the effects of a BGI scenario.</p> | 7 | To add the functionality of uploading own area of interest file and flood scenario file. |
| Changing the runoff parameters (runoff) or damage values (damage) | IMZI |  | <p>For the flood damage calculations, user can change the monetary value per m<sup>2</sup> for each damage category and UAC. For the runoff calculations, the urban retention capacity can be adapted to create custom soil datasets. All parameter sets can be named, saved, edited and deleted by the user.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 7 | No                                                                                       |



## 4 BUILDSPACE Monitoring. Stakeholders Engagement and Social Acceptance

As introduced in D4.2, Task 4.4 focuses on the engagement of stakeholders and the social acceptance of BUILDSPACE services, essential for their successful deployment and the long-term sustainability of the project. The activities of this task are divided into:

- i) engagement of stakeholders in the use of the services (section 5.1.)
- ii) specific awareness and training programmes (section 5.2.)
- iii) Training materials (section 5.3.)

This section provides an overview of the current status of the preceding sections and details the progress achieved in engaging stakeholders. To achieve this, two levels of engagement are considered:

- ❑ **European Level:** Communication and outreach efforts are centralized through the project's channels to engage stakeholders across Europe. Additionally, all BUILDSPACE partners will identify and recommend relevant European bodies, networks, and organizations that may have an interest in the project's services or activities, with the goal of inviting them to participate in the open call within WP5 (as detailed in D5.3).
- ❑ **Local Level:** Managed by pilot partners with support from service partners and ALDA. This level ensures that local stakeholders are actively involved in the project's activities while fostering a local network to support the project's implementation.

Stakeholder engagement is built upon the insights from D2.1 and D2.2, which identify the target groups of BUILDSPACE and the specific target audiences for each service.

The following subsections outline the process of stakeholder engagement.

### 4.1 Stakeholders Engagement

During M16, ALDA organized a **stakeholder engagement workshop**, where pilot partners shared their key motivations for engaging stakeholders. They highlighted the importance of raising awareness about BUILDSPACE technologies and utilising a decision-making tool to gather feedback on the services.

During the workshop, the pilot partners identified two primary objectives for engaging local stakeholders:

- **Promoting the BUILDSPACE solution:** This involves raising awareness and building community support, enabling stakeholders to become advocates for the project.
- **Identifying and engaging potential end-users:** This aims to ensure that the services meet user needs by evaluating their ease of use and assessing the likelihood of recommendations.

#### 4.1.0 Stakeholder Mapping

The stakeholder mapping activity is a core part of the stakeholder engagement process. To ensure effective engagement, project partners are continuously utilising the stakeholder mapping (Table 41), provided by ALDA. This tool allows for the identification, categorization, and adaptation of engagement strategies based on stakeholder interests and needs, ensuring a targeted and dynamic approach throughout the project.





*Table 44. Stakeholder Mapping for Pilots and Services*

[illegible]

#### 4.1.1 Stakeholder Engagement Guidelines

Based on the input from the workshop, in M19, ALDA created a set of **stakeholder engagement guidelines**. This internal document outlines BUILDSPACE's stakeholder engagement strategy at the local level, ensuring effective stakeholder participation and contributions to the project. The guidelines offer suggestions to pilot partners, which can be adapted to their specific needs.

The strategy is structured around five key questions:

## 1. WHY: Objectives of the Stakeholder Engagement Strategy

This section emphasizes the importance of stakeholder engagement in fostering collaboration, ensuring stakeholders actively participate in the project's activities. Engagement is critical for raising awareness, encouraging feedback, and building relationships that support the long-term adoption of BUILDSPACE services.

Key objectives:

- **Promote the BUILDSPACE solution** by creating awareness and local support.
- **Engage end-users** to ensure the project aligns with their needs and expectations.
- **Encourage collaboration** to co-design and test services in real-world applications.
- **Build long-term relationships** to enhance sustainability and social acceptance of the project.

## 2. WHAT: Definition and Methodology of the stakeholder engagement strategy

Stakeholder engagement is defined as a systematic and ongoing process through which individuals and organizations affected by the project are actively involved in decision-making and development. The methodology follows a three-step approach:

1. Identifying Stakeholders and Assessing Their Engagement Levels:
  - a. Mapping stakeholders and understanding their motivations.
  - b. Utilizing tools such as the Stakeholder Map, Letter of Invitation, and Memorandum of Understanding (MoU) to define engagement levels.
2. Designing the Process and Active Engagement:
  - a. Creating an engagement plan tailored to stakeholders' needs.
  - b. Assigning roles and responsibilities for pilot partners.
3. Process Monitoring and Long-Term Engagement:
  - a. Continuously analysing feedback and adapting engagement strategies.
  - b. Ensuring relationships extend beyond the project's lifespan.



Stakeholder engagement is a continuous and dynamic process that requires flexibility, transparency, and strong communication.

### 3. WHO: Target Groups

Identifying the right stakeholders is essential for effective engagement. BUILDSPACE categorizes stakeholders into different target groups that benefit from the project:

- Citizens, tenants, and owners
- Facility managers
- SMEs, companies, and entities
- Policymakers
- Utilities
- Constructors and contractors
- Investors

Each pilot partner prioritizes target groups based on the specific needs of their region and project implementation.

### 4. HOW: Involvement and Synergies

BUILDSPACE offers five levels of stakeholder engagement, categorized into low-level and high-level involvement:

#### 4.1.1.1 Low-Level Engagement

1. **Be Informed:** Stakeholders receive project updates via newsletters and social media.
2. **Collaborate:** Stakeholders help disseminate information and promote the project.

#### 4.1.1.2 High-Level Engagement

3. **Be Consulted:** Stakeholders provide feedback in meetings and workshops.
4. **Be Involved:** Stakeholders actively participate in peer exchange events to discuss challenges and solutions.
5. **Empower:** Stakeholders engage in co-creation activities, training sessions, and hands-on demonstrations of the BUILDSPACE services.

The strategy is flexible, allowing stakeholders to choose their level of engagement and adjust it over time based on their needs.

### 5. WHEN: Suggested Timeline and Action Plan

Considering the upcoming activities of the project, ALDA has suggested key phases in the engagement strategy to reinforce stakeholder participation, while maintaining the principle of flexibility. The key phases are presented in the table below and reflect not only the foreseen actions but also the preparatory work done throughout the project to build awareness and readiness in the local territories.

It is worth noting that the timing of the activities, particularly those concentrated towards the later stages of the project, was strategically designed. To ensure meaningful engagement, it was necessary to first create awareness among local stakeholders, build trust, and allow time for the BUILDSPACE services to mature and be ready for real-life demonstration. These considerations informed the schedule, and while activities like the live events and training might appear late in the project, they are the culmination of continuous groundwork carried out by each partner.



Table 45. Common strategy suggested by ALDA

| Activity                                | Description                                                        | Suggested duration           | Responsible                       |
|-----------------------------------------|--------------------------------------------------------------------|------------------------------|-----------------------------------|
| Identify local stakeholders             | Map and understand their needs and level of engagement             | Ongoing                      | Pilot partners, ALDA              |
| Dissemination of materials              | Distribution of BUILDSPACE materials                               | M18 - M29                    | Pilot partners, ALDA              |
| Training & raising awareness activities | Webinar or in-presence training                                    | M24 - M29                    | Services and pilot partners, ALDA |
| BUILDSPACE community                    | A platform for local stakeholders to connect                       | M24 - M29                    | Pilot partners, ALDA              |
| Live event                              | Demonstration of the services - how the service is put into action | M30 - M32                    | Pilot partners                    |
| Evaluation                              | Evaluation and feedback of the services, done by the stakeholders  | M30 - M32                    | Pilot partners                    |
| Continuous engagement and education     | Digital toolkit of the project and other materials of the project  | Until the end of the project | Pilot partners, ALDA              |

**Map of local stakeholders:** As detailed in section 5.1.0, ALDA has created a stakeholder map to support BUILDSPACE partners in monitoring local stakeholders and adapting the engagement strategy based on their needs and interests. The mapping process is ongoing to ensure that engagement remains relevant and effective, identifying any emerging stakeholders as the project progresses.

**Dissemination of materials:** As mentioned in section 5.3 the project includes the creation of promotional and dissemination materials to increase the visibility of BUILDSPACE and its objectives. These materials are crucial for spreading awareness of the project's services and ensuring that stakeholders are informed and motivated to participate.

**Training and raising awareness activities:** As outlined in section 5.2, the Grant Agreement includes the implementation of targeted awareness-raising and training programs. These activities are designed to engage building users and city stakeholders, demonstrating the tangible benefits of BUILDSPACE services. The timing of these activities between M24 and M29 reflects the need for stakeholders to first become familiar with the project and its services before participating in training. This approach helps to ensure deeper and more effective engagement once the services are ready to be showcased.

**BUILDSPACE community:** To foster a strong and sustainable stakeholder community, BUILDSPACE leverages an online platform, including a dedicated LinkedIn group. This platform serves as a hub for networking, collaboration, and staying informed about project developments. By facilitating online interaction, stakeholders can share insights, address concerns, and work on collaborative opportunities.



**Live event:** As part of the Grant Agreement, five live events are planned across the project's pilots to demonstrate the BUILDSPACE services in action. These events will provide an opportunity for external users to experience the services first-hand. As introduced in section 5.2.0.4, the live events will follow the training programs and can take place either on the same day or on a different day. Their position in these months is strategically planned: this allows for a fully functional and tested version of the service to be presented, maximizing impact and ensuring the demonstrations are convincing and valuable for stakeholders.

These events are designed to increase engagement by showcasing the practical application of BUILDSPACE technologies.

**Evaluation:** Evaluation is a crucial component of stakeholder engagement. After each training session and live event, feedback will be collected to assess the effectiveness of the services. The evaluation will focus on key performance indicators (KPIs) such as:

- KPI16: Evaluation of the ease of use of the BUILDSPACE services
- KPI17: Measuring the likelihood of users recommending the service to others (Net Promoter Score)
- KPI20: Value recognition

These KPIs will provide valuable insights into user satisfaction and contribute to the overall evaluation of BUILDSPACE's success. ALDA will work closely with pilot partners to distribute evaluation forms at the end of each event, and NTUA will be responsible for analysing and measuring the results.

**Continuous engagement and education:** Long-term stakeholder engagement is crucial for the sustainability of BUILDSPACE and the ongoing adoption of its services. To support this continued involvement, materials developed throughout the project, such as the Digital Educational Toolkit (WP6), will be regularly shared with stakeholders, ensuring ongoing learning about the project's solutions.

## 4.2 Awareness and Training Programmes

### 4.2.0 Training Programmes

In M22, ALDA developed training and awareness guidelines to assist pilot and service partners in engaging stakeholders and designing training programmes. These guidelines align with T4.4 Stakeholder Engagement and Social Acceptance and T5.4 Market Uptake Launch Events, which focus on targeted training sessions. The objectives of these initiatives are to:

- Motivating the stakeholders on the real benefits of BUILDSPACE services and explaining their operation both from the system and methodological perspectives.
- Raise awareness of BUILDSPACE's activities and results, as well as its potential and benefits, to ensure a greater impact and a larger number of people interested in the project.
- Equip participants on how to use the project's methods and tools so they can successfully apply its results in other regions.

#### 4.2.0.1 Key steps to organize a training

To support pilot partners in developing effective training programmes, the following key steps were identified:

1. Identify stakeholders/target groups



- a. Local engagement (demonstration purposes): Citizens, tenants, facility managers, SMEs, policymakers, utilities, contractors, investors, and more. Managed by pilot partners with support from service partners and ALDA.
  - b. European engagement (replication purposes): Networks of cities/regions, municipalities, energy agencies, cooperatives, NGOs, and other organizations focused on sustainable buildings and cities.
2. Define the training goal and objectives
  3. Select appropriate training methods based on stakeholder needs.
  4. Prepare for the training:
    - Set date and duration.
    - Secure a venue (for in-person/hybrid) or choose an online platform.
    - Define roles and responsibilities.
    - Draft an agenda.
    - Develop training materials (presentations, demos, real-life scenarios, handouts, and guides).
  5. Invite stakeholders: send invitations
  6. Conduct the training
  7. Evaluate the program: after the training, collect feedback.

#### 4.2.0.2 Training Content

The training sessions aim to introduce stakeholders to BUILDSPACE's pilots, technologies, and services, ensuring participants are well-prepared for live service demonstrations during pilot-led events. To support this, ALDA has proposed key topics that the training can cover.

The following table serves as a starting point, but pilot partners are encouraged to tailor the content to their specific needs and those of their stakeholders.

*Table 46. Training content suggested by ALDA*

|                          | Suggested content                                                                                                                                                                                                                                                                                  |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pilot                    | <ul style="list-style-type: none"> <li>– Characteristics of the Pilot</li> <li>– Target group</li> <li>– Location and duration of the pilot</li> </ul>                                                                                                                                             |
| Technologies             | <ul style="list-style-type: none"> <li>– Type of technology</li> <li>– Examples of how these technologies can be used</li> <li>– What are the benefits of using these technologies?</li> </ul>                                                                                                     |
| Service                  | <ul style="list-style-type: none"> <li>– Characteristics of the service</li> <li>– How does it work? Demonstrate how it can be used, explaining the main features, functionalities and workflows.</li> <li>– Use a live demo to familiarise them with the system layout and operations.</li> </ul> |
| Benefits and Replication | <ul style="list-style-type: none"> <li>– What are their benefits and potential for replication potential?</li> <li>– Scalability to similar projects in other urban or rural areas</li> </ul>                                                                                                      |



### 4.2.0.3 Timeline of the training

Since M22, ALDA has organized a series of bilateral meetings, first with pilot partners, then with both pilot and service partners, to structure training sessions and define the next steps for implementation.

As a result, tentative training dates and event agendas have been outlined:

*Table 47. Training identified after the bilateral meetings*

| Pilot   | Training Focus | Tentative schedule |
|---------|----------------|--------------------|
| Pilot 1 | SE1            | M29                |
| Pilot 1 | SE1 & SE2      | M29                |
| Pilot 2 | SE3            | M29                |
| Pilot 3 | SE4            | M28                |
| Pilot 4 | SE5            | M28                |

Currently, pilots and service partners are collaborating on a concept note to define each training session. This document will clearly outline the training objectives and agenda while also serving as the foundation for a communication toolkit to promote the event.

### 4.2.0.4 Live Event

Although live events are not part of T4.4, they are closely linked to the stakeholder engagement process and training sessions. Given this strong connection, this section reports on the progress made toward their organization.

As outlined in the Grant Agreement, the project includes live events aimed at providing external users with a real-time demonstration of BUILDSPACE services at selected pilot sites. While ALDA is not responsible for organizing these events, it has actively supported pilot partners in their preparation, ensuring a strong focus on stakeholder engagement.

*Table 48. Live events identified after the bilateral meetings*

| Pilot   | Live Event Focus | Tentative date |
|---------|------------------|----------------|
| Pilot 1 | SE1              | M29            |
| Pilot 1 | SE1 & SE2        | M29            |
| Pilot 2 | SE3              | M29            |

|         |     |     |
|---------|-----|-----|
| Pilot 3 | SE4 | M28 |
| Pilot 4 | SE5 | M29 |

Depending on the needs of pilot partners and local stakeholders, these events may take place on the same day as the training sessions or shortly after.

Live events, whether in-person, virtual, or hybrid, provide an opportunity to engage stakeholders, showcase BUILDSPACE services, and gather feedback on user experience and replicability.

#### Live Event Organization

To assist pilot partners, key organizational tips for planning and conducting live events have been included in the Training and Raising Awareness Guidelines. These covers:

- Before the event: Defining objectives, logistics, agenda, and promotion.
- During the event: Coordinating activities, ensuring smooth execution, and managing unforeseen issues.
- After the event: Evaluating impact, collecting feedback, and following up with participants.

Further details on the recommendations for the organisation of the live events are also available in the *Stakeholder Engagement Guidelines*, drafted and shared by ALDA for pilot partners.

## 4.3 Training and Engagement Materials

To support training activities and ensure continuous stakeholder engagement, BUILDSPACE materials are developed and updated regularly. These materials help disseminate project results, facilitate training sessions, and maintain long-term relationships with stakeholders.

### 4.3.0 Promotional and Training Materials

To assist service and pilot partners in effectively promoting BUILDSPACE and engaging stakeholders, ALDA has developed a comprehensive document (Table 49) that serves as a database of all promotional materials created under Work Package 6 (WP6).

This document provides a centralized and easily accessible repository where partners can quickly find and utilize key resources for their outreach efforts. It also includes guidance on how to use these materials strategically, suggesting specific target audiences for each resource to maximize impact.

The materials collected so far include:

- Roll-up banners: For use at events, exhibitions, and meetings to visually introduce BUILDSPACE.
- PowerPoint presentation templates: Standardized slides to ensure consistent and professional project presentations
- Brochures: Concise overviews of BUILDSPACE objectives, activities, and expected impacts, suitable for stakeholders unfamiliar with the project.





- Infographics: Visual summaries that break down complex concepts, ideal for quick understanding and social media sharing.
- Project factsheets: Key information about BUILDSPACE services, pilots, and technologies, designed for policymakers, investors, and decision-makers.
- Publications: Articles, reports, and research findings that support the credibility of BUILDSPACE and its methodologies.
- Newsletters: Regular updates on project progress, shared with partners, stakeholders, and the wider community.

Table 49. BUILDSPACE Promotional Materials

| BUILDSPACE PROMOTIONAL MATERIALS |                                                                                                                                 |                                     |                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                        |                                  |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Office on the web Frame          |                                                                                                                                 |                                     |                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                        |                                  |
| Type of Material                 | Title                                                                                                                           | Description                         | Suggestion                                                                                                                                                                                        | Target audience                                                                                                                                                                                                                                                                                        | Link to the material             |
| Roll-up                          | BUILDSPACE<br>Enabling Innovative<br>Space-driven Services<br>for Energy Efficient<br>Buildings and Climate<br>Resilient Cities | BUILDSPACE + project partners logos | Print for events                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>- Researchers and Academia</li> <li>- Citizens, tenants, and owners</li> <li>- Facility managers</li> <li>- SMEs, companies, and entities</li> <li>- Policy makers</li> <li>- Utilities</li> <li>- Constructors and contractors</li> <li>- Investors</li> </ul> | <a href="#">Roll-up</a>          |
| PPT presentation                 | BUILDSPACE<br>Enabling Innovative<br>Space-driven Services<br>for Energy Efficient<br>Buildings and Climate<br>Resilient Cities | BUILDSPACE presentation template    | Official presentation of BUILDSPACE                                                                                                                                                               | <ul style="list-style-type: none"> <li>- Researchers and Academia</li> <li>- Citizens, tenants, and owners</li> <li>- Facility managers</li> <li>- SMEs, companies, and entities</li> <li>- Policy makers</li> <li>- Utilities</li> <li>- Constructors and contractors</li> <li>- Investors</li> </ul> | <a href="#">PPT Presentation</a> |
| Brochure                         | Unveiling<br>BUILDSPACE - Your<br>Blueprint to Innovation                                                                       | General overview of the project     | <ul style="list-style-type: none"> <li>- Disseminate on your social media channels, as well as within your newsletters and networks;</li> <li>- Official presentation of BUILDSPACE at</li> </ul> | <ul style="list-style-type: none"> <li>- Researchers and Academia</li> <li>- Facility managers</li> <li>- SMEs, companies, and entities</li> <li>- Policy makers</li> <li>- Utilities</li> <li>- Constructors and contractors</li> </ul>                                                               | <a href="#">Brochure</a>         |

By organizing these materials in one place, ALDA ensures that partners have immediate access to essential resources, making communication and outreach more efficient. The document also provides best practices and recommendations on which materials are best suited for specific stakeholder groups, helping partners tailor their engagement strategies effectively.

To enhance training sessions and stakeholder engagement, additional materials will be developed based on the needs of pilot partners. These resources ensure that training is engaging and effective.

- Promotional materials: ALDA will provide templates for event announcements, banners, and document layouts to support the dissemination of training events.
- Training materials: The service and pilot partners will create the actual content, including:
  - PowerPoint presentations
  - Manuals or guides of use
  - Replication guidelines
  - Demonstration materials

These materials ensure that stakeholders receive clear, structured information during training and awareness activities, supporting long-term engagement and replication of BUILDSPACE solutions.



### **4.3.1 Awareness and Continuous Engagement Materials**

Maintaining long-term stakeholder engagement is critical to the success of BUILDSPACE. Beyond initial interactions during trainings and live events, it is essential to continue involving stakeholders through various project initiatives and resources.

Materials such as the Digital Educational Toolkit, hackathons, podcasts, infographics, and project factsheets, all developed under WP6, serve as key tools to keep stakeholders engaged over time. These materials reflect the project's progress and results, while also fostering continued collaboration. For example, the Digital Educational Toolkit (currently under development by NTUA and expected for release by M28) will integrate key project findings and be available on the BUILDSPACE website. This resource will not only provide valuable content for higher education institutions, students, and researchers but will also be accessible to the wider public, keeping stakeholders engaged well after training and live events.

Additionally, materials such as infographics and newsletters will continue to communicate project outcomes and engage stakeholders in ongoing activities. These resources allow for consistent updates on the project's progress and encourage stakeholders to remain active in the BUILDSPACE network. By sharing these materials through the BUILDSPACE website and other platforms, stakeholders are invited to collaborate, offer feedback, and participate in future initiatives, ensuring sustained engagement long after the initial events.

This ongoing flow of materials is part of a coordinated strategy across work packages, ensuring that stakeholder engagement remains strong and dynamic throughout the project's lifecycle.

### **4.3.2 BUILDSPACE community**

The BUILDSPACE Community plays a key role in sustaining long-term engagement through the ongoing sharing of materials and knowledge. ALDA has established a LinkedIn group (Figure 5) designed to connect stakeholders from all pilot projects. This platform provides an opportunity for members to stay engaged by sharing and discussing relevant BUILDSPACE materials such as infographics, newsletters, and project updates.

The community encourages continuous collaboration by facilitating discussions, sharing project progress, and promoting upcoming initiatives. It serves as an interactive space for stakeholders to exchange ideas, provide feedback, and engage in ongoing dialogue about the project. This continuous interaction helps maintain and strengthen relationships with stakeholders, further supporting the long-term success of BUILDSPACE.

By participating in the LinkedIn group, stakeholders can remain informed about the project's developments, contribute to its progress, and collaborate with others who share similar interests, ensuring sustained engagement beyond initial training and live events.



BUILDSPACE



Figure 5. BUILDSPACE LinkedIn Group



## **5 BUILDSPACE Monitoring. Assessment from economic, social, and environmental perspective**

### **5.1 Key Performance Indicators**

The evaluation of the project is made through a collection Key Performance Indicators that covers all aspects related to economic, social and environmental perspective.

#### **5.1.0 Services Specific KPIs**

In this section, we describe the set of KPIs defined for the evaluation of the service developed in BUILDSPACE, reflecting platform effectiveness, user satisfaction, or entailing “horizontal” application to all services, as described in D4.1 (Table 48)

Table 50. List of services' specific KPIs.

| KPI ID | Title                              | Description                                                                                                                                                                                                                                | Service |     |     |     |     | Unit | Target                                                    | Responsible | State of the target                                                                                                                                 | % Achieved (M27) | Comments (M27)                                                                                                             |
|--------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|-----|-----|-----|------|-----------------------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------|
|        |                                    |                                                                                                                                                                                                                                            | SE1     | SE2 | SE3 | SE4 | SE5 |      |                                                           |             |                                                                                                                                                     |                  |                                                                                                                            |
| KPI 1  | Percentage of Envelope Constructed | The envelop area of DT model compared to the point cloud collection area. The collected point cloud data might be of low-quality in some areas due to the bad lighting situation or the inclusion of the surrounding buildings or objects. | •       |     |     |     |     | %    | 90% per façade/roof of the collected data of the building | UOC         | This service aims to detect the services for 5 user cases in the 4 pilots. The scope of the pilot 1, U1.3 has changed, so the current status is 80% | 80%              | UOC and MOS is working on the new scope towards the U1.3.                                                                  |
|        |                                    |                                                                                                                                                                                                                                            |         | •   |     |     |     |      |                                                           | UPM         | The service is going to evaluate 4 different scenarios (RGB and thermal for each pilot) and at the full-pilot phase they just tested 3 of           | 75%              | Information has been obtained from all pilots, but only 3 scenarios could be processed. 1 scenario remains to be processed |



|          |                                              |                                                                   |   |   |  |  |  |  |    |          |          |     |     |                                                                                                                                                                                                                                                                                               |  |  |  |  |  |
|----------|----------------------------------------------|-------------------------------------------------------------------|---|---|--|--|--|--|----|----------|----------|-----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| KPI<br>2 | <u>Surface Point<br/>Cloud<br/>Noise</u> [1] | Similarity<br>between real<br>surface and point<br>cloud surface. |   |   |  |  |  |  |    |          |          |     |     |                                                                                                                                                                                                                                                                                               |  |  |  |  |  |
|          |                                              |                                                                   | • | • |  |  |  |  | mm | [10, 50] | UPM, UOC | 1/2 | 50% | Due to delays in data acquisition, it has not been possible to complete one of the point clouds for SE2. As a result, only one final point cloud is currently available, and the KPI analysis has only been conducted for this case. The remaining process will be completed at a later stage |  |  |  |  |  |
|          |                                              |                                                                   |   |   |  |  |  |  |    |          |          |     |     | them, so the state of target is 3/4.                                                                                                                                                                                                                                                          |  |  |  |  |  |



|       |                 |                                                      |   |   |   |  |  |     |                            |          |                                                                                                        |      |                                                                                                                                                                                          |
|-------|-----------------|------------------------------------------------------|---|---|---|--|--|-----|----------------------------|----------|--------------------------------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| KPI 3 | Level of Detail | The Level of Detail of the constructed geometric DT. | • | • |   |  |  | LOD | <u>LOD1.2 – LOD 3.3[2]</u> | UOC, UPM | The current output DTs of SE1 has archived the LOD 200. It is already within the target's requirement. | 100% | For some cases, e.g., the RPR pilot, the pilot team requires the windows are presented as an object. UOC and RPR are working tgr to see if the higher LOD can be archived before the M29 |
| KPI 4 | IPCC Scenarios  | The number of IPCC scenarios considered.             |   |   | • |  |  | #   | 3                          | CARTIF   | Achieved (3 scenarios IPCC considered: SSP245, SSP370, SSP585)                                         | 100% | -                                                                                                                                                                                        |





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|       |                          |                                                                                                                                                                              |  |  |   |  |   |   |     |        |                                                                                                               |      |                                                                |
|-------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|---|--|---|---|-----|--------|---------------------------------------------------------------------------------------------------------------|------|----------------------------------------------------------------|
| KPI 5 | Retrofitting Scenarios   | The number of retrofitting scenarios generated. Retrofitting measures and strategies will be developed and the user will be able to choose one or more to apply and compare. |  |  | • |  |   | # | 3   | CARTIF | Achieved (4 types of passive measures to add, with several options of different materials and thickness each) | 100% | -                                                              |
|       |                          |                                                                                                                                                                              |  |  |   |  | • |   |     | IMZI   | Achieved (3 BGI scenarios considered: Buildings to Green roofs, Grass to BGI, Unpermeable pavings to BGI)     | 100% | -                                                              |
| KPI 6 | Solar Radiation Accuracy | Accuracy estimation of the usable solar radiation of suitable rooftops.                                                                                                      |  |  | • |  |   | % | 85% | NTUA   | 98,2-99,1 %                                                                                                   | 100% | We performed a sample test, using PVGIS as an accuracy target. |



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|       |                     |                                                                                            |  |  |   |  |        |     |      |                    |      |                                                                                                                                                     |
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| KPI 7 | Cost Reduction      | % of cost reduction in the energy bill for buildings.                                      |  |  | • |  | %      | 15  | NTUA | -0,68% to -217,57% | 100% | We implemented a Bill Cost reduction methodology, on 375 public buildings of Riga, using anual electricisy consumption and PV potential limitations |
| KPI 8 | Emissions Reduction | % of carbon emissions reductions due to energy efficiency and energy consumption services. |  |  | • |  | %      | 8   | NTUA | -0,67% to -99,87%  | 100% | We implemented a CO2 reduction (%) methodology, on 375 public buildings of Riga, using anual electricisy consumption and PV potential limitations   |
| KPI 9 | Urban Climate Zones | Ability to generate Urban Climate Zones (UCZs) according                                   |  |  | • |  | Binary | Yes | UPM  | 30%                | 30%  | First steps have been taken by training the models in order to be able to                                                                           |



|                                                                                                                |
|----------------------------------------------------------------------------------------------------------------|
| <b>delimit the UCZ. It's expected to achieved the 100% by the end of May</b>                                   |
| The resolution achieved for the climate severity maps is 30 metres, tripling the established target.           |
| The resolution achieved for the flood damage and urban runoff maps is 50 meters. This is two times the target. |

[1] Surface noise refers to the deviation of the scanned surface from a perfect plane. To calculate this deviation, the distance of each point of the captured surface with respect to the perfect plane is calculated, which must be less than 50mm. To measure this KPI in the pilots, all planar surfaces such as façades or roofs will be detected and compared with a perfect plane in order to get the maximum, minimum and average deviation of each.

[2] The value depends on the data quality, the purpose, and the construction (Biljecki et al. (2016)).

[3,4] KPIs 7 and 8 were calculated where energy demand was available and with the assumption that energy demand is similar or same with energy consumption. It will be re-calculated for the next releases with the energy consumption calculation (considering the energy source) for selected buildings.

### **5.1.1 General KPIs**

In this section, we describe the set of KPIs defined for the evaluation of general dimensions of the BUILDSPACE system, reflecting platform effectiveness, user satisfaction, or entailing “horizontal” application to all services, as described in D4.1 (Table 48)

Table 51. List of general KPIs

| KPI ID | Title                 | Description                                                                                                                                | Dimension          | Unit | Target                                               | Responsible            | State of the target                      | % Achieved (M27)                          | Comments (M27)                                                                                                                                                                                                                                                                                                                                       |
|--------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------|------------------------------------------------------|------------------------|------------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| KPI 11 | Data Diversity        | Number of distinct data types accessed. The aim is to ensure that the platform facilitates access to an adequate number of datasets types. | Platform, Data     | #    | 10                                                   | SLG                    | 10                                       | 100%                                      | -                                                                                                                                                                                                                                                                                                                                                    |
| KPI 12 | Open Source Resources | The number of open source resources integrated in BUILDSPACE solutions.                                                                    | Platform, Services | #    | Platform: 6; SE1: 3; SE2: 1; SE3: 2; SE4: 4; SE5: 10 | UOC, UPM. CARTIF, IMZI | SE1: 3/3; SE2: 4/5; SE3: 4/2; SE5: 11/10 | SE1: 100%; SE2: 80%; SE3: 200%; SE5: 110% | <b>SE1:</b> CloudCompare, IfcOpenShell, USBIM<br><b>SE2:</b> CloudCompare, ImageJ, own software, Potree<br><b>SE3:</b> open data integrated: OSM, TABULA/EPISCOPE, PVGIS and Copernicus Climate Change service (C3S)<br><b>SE4:</b> Copernicus Climate Change Service, Copernicus Land Service, OSM, WUDAPT<br><b>SE5:</b> Copernicus Climate Change |



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|        |                      |                                                                                            |          |   |    |      |    |       |                                                                                                                                                                                                                                          |
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|        |                      |                                                                                            |          |   |    |      |    |       | Service, Copernicus<br>Land Service,<br>OpenStreetMap                                                                                                                                                                                    |
| KPI 13 | User<br>Requirements | In-scope user requirements<br>that addressed, based on<br>outcomes of Deliverable<br>D2.2. | Services | # | 30 | NTUA | 33 | >100% | Four new user<br>requirements,<br>labelled as<br>"addressed", are<br>considered. However,<br>four user<br>requirements of the<br>initial set are finally<br>labeled as non-<br>applicable. Thus, the<br>number remains the<br>same (33). |



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| KPI 14 | Copernicus Integration Accuracy | Percentage of successful data integrations from Copernicus APIs                 | Platform, Data | % | 90 | SLG  | 90% | 100%  | During the testing of the Copernicus API, we have measured the successful data requests, and the results show a success rate at least 90% as anticipated.                                          |
| KPI 15 | Copernicus Data Diversity       | Number of distinct Copernicus datasets accessed through the BUILDSPACE platform | Data           | # | 12 | SLG  | 350 | >100% | Copernicus API provides access to all datasets from Climate change and Atmosphere services. For the Land Service, a manual process is followed due to the specific nature of the Land Service API. |
| KPI 16 | Usability                       | Evaluation of the ease of use of the BUILDSPACE services                        | Services       | % | 70 | ALDA | 0   | 0%    | The ease of use evaluation is planned after the final technology release (M29) and will be collected during the pilots' training/live events.                                                      |





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|        |                                                               |                                                                                         |                    |   |                     |      |    |      |                                                                                                                                                                                                                                                       |
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| KPI 17 | Social Acceptance of BUILDSPACE Services by Engaged End-Users | Measure the likelihood of users to recommend a service to others (Net Promoter Score).  | Services           | % | 80                  | ALDA | 0  | 0%   | The Net Promoter Score evaluation is planned after the final technology release (M29) and will be collected during the pilots' training/live events. Since these activities are scheduled for Year 3, only the final target value will be considered. |
| KPI 18 | Data Accessibility                                            | Number of pilots' datasets accessible by the intelligent querying                       | Data               | # | 3 Y1, 6 Y2, 10 Y3   | SLG  | 10 | 100% |                                                                                                                                                                                                                                                       |
| KPI 19 | Diversification                                               | Number of countries without a space tradition where BUILDSPACE services tested          | Services           | # | 4                   | SLG  | 4  | 100% |                                                                                                                                                                                                                                                       |
| KPI 20 | Value Recognition                                             | Number of stakeholders/organizations recognizing business value on BUILDSPACE solutions | Platform, Services | # | 20 Y1, 40 Y2, 80 Y3 | ALDA | 0  | 0    | The evaluation of this KPI is planned after the final technology release (M29) and will be collected during the pilots' training/live events. It will follow the methodology stated in D4.1. Partner                                                  |



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|  |  |  |  |  |  |  |  |  |  |                                                                                                                                                  |
|--|--|--|--|--|--|--|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |  |  |  | responsible for this KPI has been shifted from SLG to ALDA, as this is the partner responsible for monitoring and evaluating the questionnaires. |
|--|--|--|--|--|--|--|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------|

## 6 Conclusions and Next Steps

This document reflects the monitoring and evaluation process of the deployment of all services in their pilots, the stakeholder's engagement and the impact of the project in its full phase.

Progress has been made both at the building level and the city level and some aspects that have not been achieved are expected to be made and reported in next deliverable, as services are closing by June 2025. All services are being implemented in their corresponding pilot and an adequate impact can be foreseen.

### 6.1 Building Level

Following the successful implementation and testing during the Full-Pilot Phase, service development remains on schedule and aligned with the original roadmap. Close collaboration between service developers, pilot partners, and the management team continues to ensure efficient coordination and timely delivery across all sites. Thanks to the structured deployment and monitoring activities, all pilots have been able to receive, test, and evaluate the services as planned, with no significant deviations.

Significant progress has been made in refining and completing key functionalities in both SE1 and SE2. For SE1, the development of the virtual environment has been finalized and tested by the MOS pilot together with the integration of the Digital Twin and Point Cloud into the VR interface. This has been supported by additional data collection, including indoor image data for fire equipment (e.g., 360° videos from the Warsaw site). Furthermore, major functionalities such as rectilinear image conversion, semantic segmentation of fire assets, and computer-vision-based detection of fire equipment have been completed and validated through accuracy testing.

For SE2, the remaining pending tasks have also been successfully addressed. These include the correct integration of internal and external point clouds and the validation of the thermal-scanning-based algorithm for identifying thermal bridges, which has shown good performance during testing. Additionally, the functionality for generating reports on detected thermal bridges has been developed and incorporated into the service platform.

While some minor adjustments are still required to further tailor elements of SE1 and SE2 to specific user needs, and certain pilots are still catching up on data availability, these issues are not expected to impact the continuation of the demonstration.

the next phase of the Large-Scale Operation will focus on stakeholder engagement, strategic outreach, and increasing the visibility of the services. Planned activities include live demonstration events at selected pilot sites, tailored training sessions to strengthen adoption, and expanded communication efforts—such as new promotional and instructional videos—to reinforce awareness and support final validation in real operational contexts.

### 6.2 City Level

Following the implementation and testing of services during the Full-Pilot Phase, the development remains on track and aligned with the initial implementation plans. The strong collaboration between service developers, pilot partners, and the management team has continued, allowing technical and coordination to be effective and according to the timeframe. Regular monitoring and structured coordination activities have ensured that each aspect of the service deployment is carefully followed and

provided for the pilots. No significant deviations from the service development roadmap have been identified – all pilots received the services, which have been tested and provided the evaluation afterwards.

Substantial progress has been achieved in advancing and finalizing key components of the city-level services. For SE4, the calculation of Urban Climate Severity based on CDD/HDD, as well as the subsequent delineation of Urban Climate Zones, has been completed. This allowed for the update of urban heat hotspots and the generation of Urban Weather Files. In addition, the urban heat risk layers—including vulnerability, exposure, and risk hotspots—were updated, and the mitigation and adaptation portfolio was finalized.

For SE5, the integration of the blue–green factor was successfully completed. Testing activities progressed as planned, including the visualization of flood damage analysis and the assessment through the Userback tool. Furthermore, the results of BGI impact assessments were tested and complemented with satellite data integration and visualization. Instructions for building-level renovation measures and for BGI design and implementation were also developed and validated.

The upcoming Large-Scale Operation phase's 2<sup>nd</sup> part will shift focus toward stakeholder engagement, awareness raising, and outreach activities to promote the developed services and gather feedback from end users. Key next steps include the organization of live events in pilot cities, during which stakeholders will be introduced to the services and their functionalities. These events will serve as platforms for direct interaction, demonstration, and feedback collection.

Additionally, structured training will be delivered to targeted user groups to facilitate service uptake and build capacity for practical use. Stakeholder feedback collected will be used to further refine service usability and effectiveness. To complement these efforts, communication and promotional activities will be intensified, including the production of explanatory and promotional videos to increase visibility and reach broader audiences, and validate the services in real-life setting.

### **6.3 Stakeholders Engagement**

Section 5 outlines the key activities implemented to engage stakeholders and foster the social acceptance of BUILDSPACE services. A comprehensive and adaptive engagement strategy has been developed, integrating stakeholder mapping, targeted awareness initiatives, training programs, and the creation of project materials. These activities aim to ensure active participation at both local and European levels. To date, key activities, such as the stakeholder engagement workshop and the development of two sets of guidelines, have laid the foundation for fostering long-term collaboration and knowledge sharing among stakeholders.

Stakeholder engagement remains an ongoing process, continuously evolving through feedback from both project partners and stakeholders. In the upcoming deliverable, ALDA will provide a detailed report on the results of stakeholder engagement activities, highlighting key insights gained from training programs and live events. These findings will be instrumental in evaluating the effectiveness of engagement efforts to maximize the long-term impact.

### **6.4 Key Performance Indicators**

The detailed monitoring of the pilots and the development of the services are presented in this deliverable, divided by scale—building and urban. In general terms, the KPIs related to the services have

been achieved. However, since some services or their functionalities are still under development, or due to some difficulties encountered during the deployment of the pilots, some KPIs have not yet been reached. This is not expected to pose a problem, as the anticipated results are expected to be achieved in the coming months.

Regarding the overall project KPIs, 100% of them have been achieved, except for those related to user feedback (KPI 16, 17 and 20). This is because the life events and workshops designed to engage various stakeholders, both at the European and regional levels, are scheduled to take place in the coming months.

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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101082575.

