TRACE

inTegration & haRmonizAtion of logistiCs opErations

D6.1 Report on organisational readiness of the pilot setup (A)

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Peer Review

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	Reviewer Name	Organization	Date

Legal Disclaimer

Executive Summary

The executive summary is maximum one-page, which provides a short summary of the whole deliverable. It is intended to give an "executive" overview to the readers and help them evaluate the content of the deliverable before starting to read all deliverable sections.

The executive summary should start with a short summary of the deliverable purpose and audience, followed by a short summary of the main sections. The executive summary should also include 2-3 points to reassure the benefit of reading the full deliverable like outcomes and conclusions.

As part of the setup of the TRACE demonstration activities (real-world tests of the TRACE platform, TRACE components, AVs, etc.), the preparatory steps of implementation, setup and learning are collected in three continuous reports (D6.1A, D6.1B, D6.1C). The first report of this row (D6.1A) focuses on the methodology applied, while the subsequent reports will emphasize the contextual readiness of the demonstrators. All three reports will follow the same structure. The respective processes are monitored and evaluated, allowing learnings to be derived from the demonstrators.

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Definitions, Acronyms and Abbreviations

Abbreviation	Definition
WP	Work Package
M	Month
D	Deliverable
GDPR	General data protection regulation
TUW	TU Wien
ACS	ACS Postal Services SA
HT	Hellenic Train
DMS	Data management system
DMP	Data management plan
EETT	Hellenic Telecommunications & Post Commission
BTC City	Shopping, business and leisure centre in Ljubljana
KPI	Key performance indicator
ISIG	Instituto di Sociologia Internazionale di Gorizia
MASA	Modena Automotive Smart Area
SAE levels	scheme to classify different levels of autonomy for automated driving
SAE level 3	Conditional automation
V2I	Vehicle-to-infrastructure
API	Application programming interface

1 Introduction

1.1 Aim and scope of deliverable

The primary aim of this deliverable is to detail the organisational and infrastructural preparedness necessary for the deployment of TRACE platform demonstrators. Aligned with Task 6.1 objectives, this deliverable describes the approach taken to gather required information, reviews the current status of pilot sites, and outlines how the consortium aims at ensuring TRACE's compliance with both infrastructural standards and data governance across diverse deployment environments.

The scope of Task 6.1 centers on two core objectives: ensuring a successful infrastructure transfer for TRACE platform deployment and establishing ongoing data management policy monitoring at each pilot site. This dual focus underpins the systematic readiness evaluation essential to the demonstration phase, including comprehensive risk assessment, compliance with legal and ethical requirements, and sustained organisational support.

1.2 Relation with other work packages/deliverables: Organigram

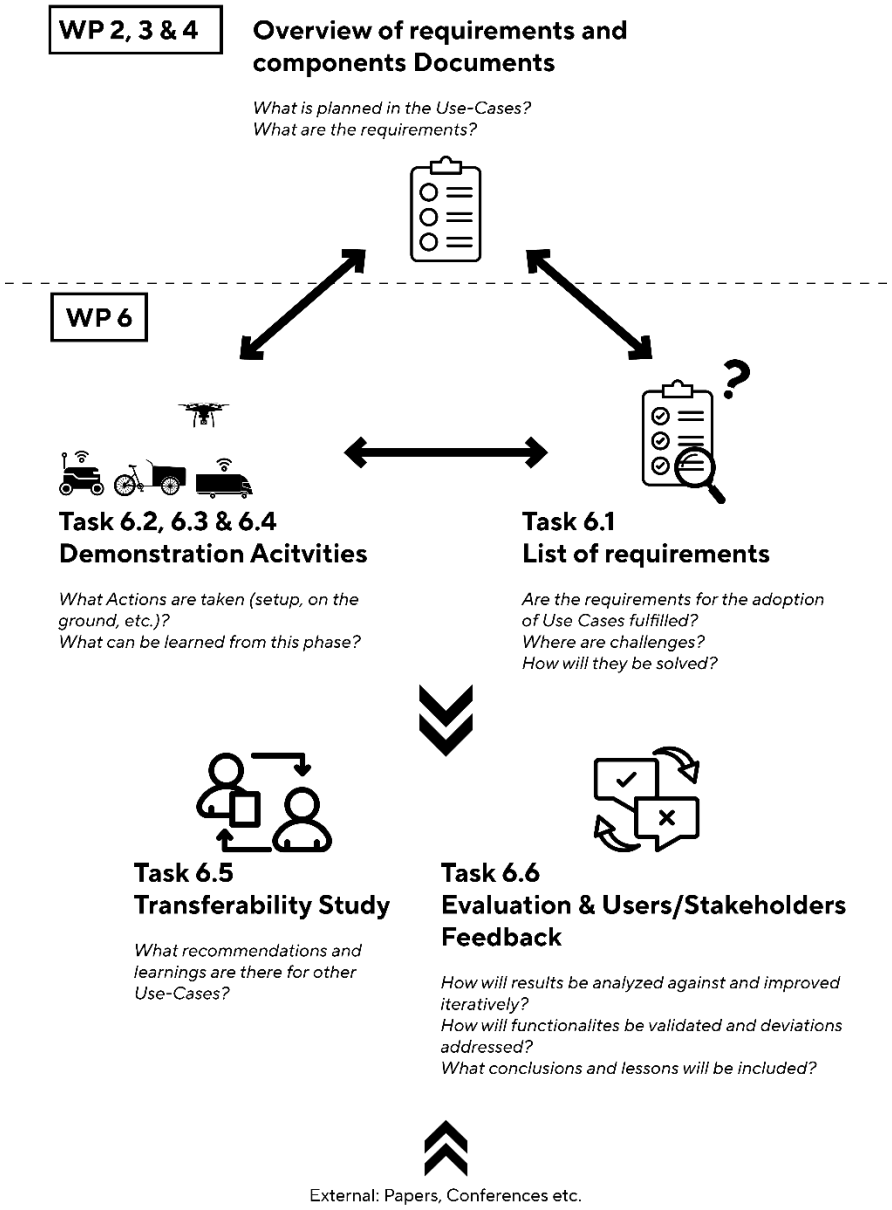

Figure 1 Organigram showing the relationship between work packages and deliverables

Task 6.1 provides supporting functions within the TRACE project by focusing on organisational and infrastructural readiness for demonstrator deployment across pilot sites. Task 6.1 contributes to aligning local deployment efforts with the broader TRACE requirements and assists in adapting use cases to meet

pilot-specific conditions. Through its activities, Task 6.1 collaborates with several Work Packages (WPs), tasks, and deliverables to help ensure that each pilot is equipped for TRACE platform integration.

Work Packages 2, 3, and 4 provide essential requirements and documentation on TRACE components, serving as a reference for Task 6.1's readiness activities. These WPs outline planned use cases, specify technical, non-technical and infrastructural requirements, and define available components for deployment and testing.

By reviewing the respective deliverables from WPs 2, 3 and 4, Task 6.1 helps verify that all necessary elements are prepared at each pilot site, ensuring that infrastructure and resources align with the expectations set in WP2, WP3, and WP4. This alignment assists in creating a suitable environment for each use case and facilitates consistent testing and evaluation of TRACE components across different sites.

Task 6.1 is closely linked to other pilot-specific tasks in WP6—namely Task 6.2 (Greek pilot), Task 6.3 (Italian pilot), and Task 6.4 (Slovenian pilot). Each of these tasks implements and monitors TRACE demonstrators within a specific regional context. Task 6.1's role includes maintaining regular communication with these pilot-specific tasks, gathering updates, and identifying site-specific requirements and adjustments needed to support local deployments.

This collaboration allows the activities in Task 6.1 to document regional insights on infrastructure, regulations, and data management policies that may impact TRACE operations, thereby contributing to a growing knowledge base of adaptations and considerations needed across different pilot locations. These insights are valuable for refining approaches and optimizing conditions for ongoing and future pilots.

Task 6.1 also maintains a checklist of requirements to track whether conditions for adapting use cases have been met at each site. This includes confirming that infrastructure and regulatory requirements are addressed, as well as monitoring data management practices. Task 6.1 provides periodic updates on whether these requirements are fulfilled and identifies any remaining challenges. In collaboration with pilot teams, Task 6.1 helps develop solutions for these challenges, enabling smoother project implementation at each site.

In support of Task 6.5's Transferability Study and Task 6.6's Evaluation and Useability, Task 6.1's documentation of pilot site requirements, challenges, and adaptations contributes relevant insights for evaluating TRACE's adaptability in different contexts and to enhance its usability. Task 6.5 will draw on these learnings to develop recommendations for future use cases and additional regions. Task 6.1's

observations and updates, thus, offer useful background information that aids in assessing the broader applicability and scalability of the TRACE platform, supporting Task 6.5's goal of enhancing TRACE's transferability. Task 6.6 will use results, findings and learnings from 6.1. when evaluating the overall outcomes and the applied methodology as well as the application of the platform in the pilot contexts.

1.3 Intended audience

The report is public, aiming to inform project partners, expert audience but also the interested public. It provides an overview on the methodology applied to continuously monitor the preparation of the demonstrator activities and reflects on specifics of each single demonstrator. The methodological definition is also accompanied by a standardisation of the documentation processes.

1.4 Deliverable structure

This deliverable, D6.1-A, is the first of a series of three deliverables (D6.1-A, B, and C) planned over the course of the TRACE project. As the initial instalment, this document primarily focuses on establishing the methodology for Task 6.1, detailing the approach and tools used to assess organisational and infrastructural readiness for the demonstrators. This deliverable lays the groundwork for the subsequent phases, offering a structured process for monitoring, documenting, and supporting each pilot as they progress through their individual timelines.

While this document provides some preliminary insights into the current status of each pilot, its primary focus is on the design and implementation of foundational methodologies, such as the checklist, interview plan, and Gantt Chart approach. Subsequent deliverables in this series will build upon this initial framework, presenting more extensive findings and concrete results as each pilot advances through the demonstration and evaluation stages.

2 Relevant framework from the TRACE project

In the demonstration activities, several individually developed aspects of the TRACE project come together:

2.1 Framework development and requirements

TRACE has established a list of requirements (data, infrastructure, networks, connectivity...), see D2.1 Report on Technical Requirements and D2.3 Report on Ecosystem Development, Safety and Use Cases.

2.2 TRACE Platform components

TRACE has developed components necessary for the platform, to be adopted and tested in the demonstrators. For the platform (components), see D3.1 Report on reference architecture and D3.2 alpha release of TRACE platform.

2.3 Infrastructure and ecosystem

TRACE has developed components for the physical and digital infrastructure. See D4.1 Report on Infrastructure Elements of the TRACE Platform, D4.2 Report on Synchromodal operations and optimization of shared resources and D4.3 Report on Security scheme and Visual interfaces.

2.4 Ethics and data protection

TRACE has established a set of ethics and data protection principles guiding the work of the project to ensure compliance with ethical and GDPR principles and provisions. To this end, specific procedures and tools have been prepared and provided for the implementation of project activities and are included in D1.2 – Data Management Plan (A) prepared at M6 (November 2023) and in its updated version D1.3 (M18, November 2024).

All data collected within the domain of the Demonstrator activities will be treated according to the TRACE ethical framework. Also, all activities involving testing will not go against the principles defined therein.

Ethics principles are listed and described in Section 6.2 of D1.2 and its updated version (D1.3). These principles are consistent with the overarching principles articulated in Article 19 of the Horizon Europe Regulation. Additionally, principles aimed at upholding research integrity, as defined in the Code of Conduct for Research Integrity, are applied universally across all research activities in the project.

Each partner involved in TRACE bears the responsibility to ethically and responsibly handle data, especially personal data, throughout the entirety of the project. Article 5 of the GDPR outlines a set of principles that safeguard the right to personal data protection, encompassing "lawfulness, fairness, and transparency; purpose limitation; data minimization; accuracy; storage limitation; integrity and confidentiality; accountability". TRACE embraces a series of data protection principles aligned with the GDPR and concerning the processing of personal data. The principles are outlined in Section 6.3 of D1.2 and its updated version (D1.3).

Measures to ensure data protection are included in Section 6.4 of D1.2 and its updated version (D1.3), including data storage, informed consent procedures, technical and organisational measures, anonymization and pseudonymization techniques to be applied throughout the project.

Informed consent form templates and recruitment procedures, included in D1.2 and D1.3, will be adapted to the specific needs of the demonstrators upon request. A set of guidelines and procedures to ensure ethically sound pilot implementation will be developed prior to the implementation to guide the work of the pilots in terms of compliance and their application will be continuously monitored throughout the duration of the pilots. The structure of this process and its timeline are described in Section 3.7 of the present document.

3 Methodology

3.1 Elements of Demonstrators: Tasks and Subtasks

The core elements of Task 6.1, as outlined in the project proposal, have been systematically divided into six (6) specific subtasks to ensure a comprehensive and structured approach to organizational and infrastructural readiness across demonstration sites. These subtasks encompass the following key activities: (1) Ensuring the transfer and deployment of the TRACE platform, (2) Establishing and monitoring data management policies across pilot sites, (3) Securing necessary organisational permissions, including permits for vehicles, (4) Identifying resources and competencies essential for the execution of demonstrators, (5) Mapping relevant data protection laws and formal regulations, and (6) Integrating and observing ethical principles that apply to the gathered data within each region.

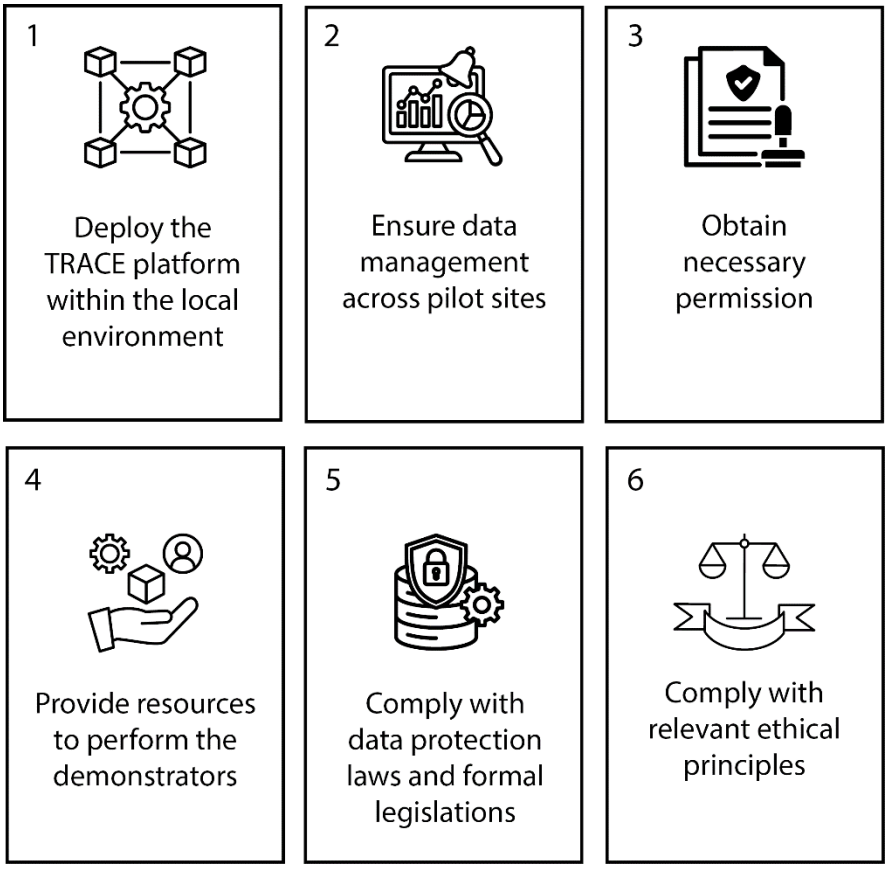

Figure 2 Subtasks for measuring organizational and infrastructural readiness

TUW holds primary responsibility for the coordination of Task 6.1 and serves as the central oversight body for this activity across all pilot sites. To facilitate effective implementation, each pilot site has been asked to designate a local contact point, who acts as the primary liaison with TUW. This local contact person is charged with overseeing the execution of subtasks specific to their pilot and is responsible for ensuring that each site aligns with the objectives and requirements of Task 6.1.

It is important to recognize that the focus and prioritization of each subtask may vary depending on the unique infrastructural and organizational contexts of each pilot. Tailoring these subtasks to local conditions allows each demonstration to address specific requirements and challenges effectively, thereby enhancing the overall robustness and adaptability of the TRACE platform implementation.

TUW's role in this process is one of both facilitation and guidance. Through active observation and engagement with each pilot site, TUW supports the progression of the demonstrators by reminding local teams of critical milestones and requirements. This collaborative involvement not only aids in maintaining consistency across pilot sites but also allows TUW to synthesize valuable insights and lessons learned from the implementation processes. These learnings are expected to provide significant contributions to the project's overall understanding of infrastructural readiness and will inform best practices for future TRACE platform deployments.

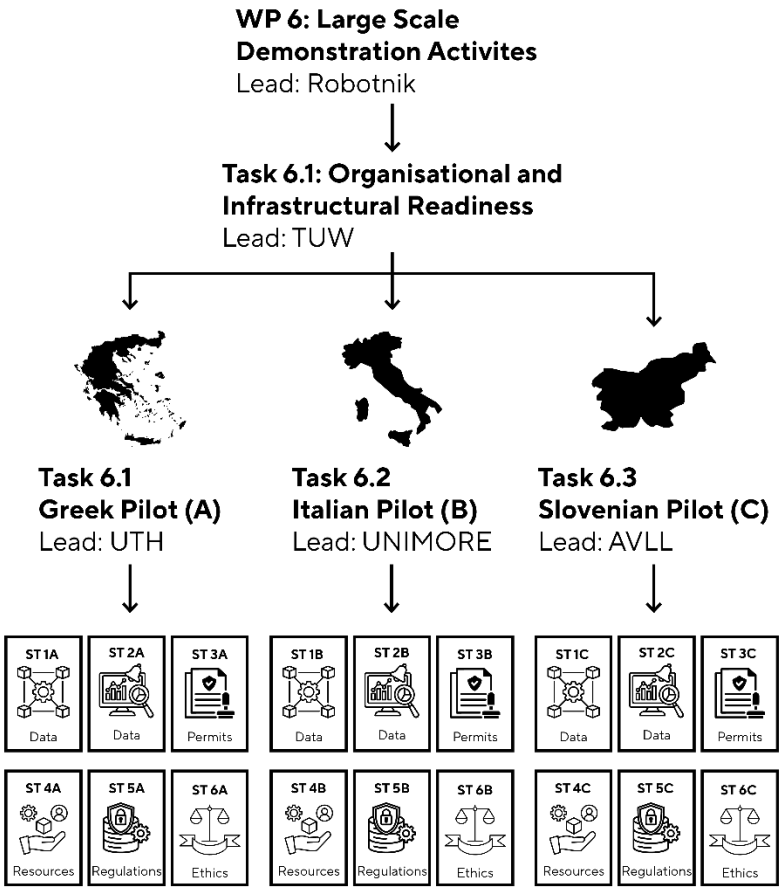

Figure 3 Structure of Tasks in Work Package 6

3.2 Checklist Approach

To systematically document the outcomes of Task 6.1 and ensure structured progress monitoring across all demonstrators, a checklist format has been selected. This checklist, created and distributed by TUW, serves as a standardised tool for tracking the completion of each subtask within the scope of Task 6.1. Development of the checklist will involve project partners to refine its content and align it with the specific needs and contexts of each pilot site.

The checklist encompasses items relevant to all six subtasks, thereby ensuring comprehensive coverage of each critical element: TRACE platform deployment, data management policies, organisational permissions (including vehicle permits), identification of necessary resources and competencies, adherence to data protection regulations, and compliance with ethical principles. There will be one customized checklist per demonstrator, tailored to capture both the general requirements and pilot-specific needs.

Purpose and Functionality of the Checklist

The checklist format was chosen for its effectiveness in facilitating the continuous monitoring of subtask progress, thereby reducing the risk of oversight in critical areas such as permits, resource allocation, and regulatory compliance. This standardized approach aligns with previously established project methodologies, promoting consistency in data collection and monitoring across pilot sites. By providing a structured framework, the checklist also simplifies the identification of any outstanding items and serves as a preventive measure against potential future challenges.

The checklist is divided into two sections: a general section applicable to all demonstrators, covering the six key subtasks, and a specific section tailored to each pilot's unique operational context. This dual-structure approach ensures that general requirements are met consistently across all sites, while still accommodating localized priorities and challenges, enhancing the checklist's adaptability and relevance to individual pilot needs.

The checklists are used at regular intervals, ensuring regular monitoring, and deal with the same blocks of questions. Each survey round is based on the answers from the previous round. Thus, the content of the previous round can be verified again and the project genesis, changes and delays are automatically recorded. Each survey round is subsequently processed and evaluated so that it can serve as a basis for the next turn.

To ensure the effective implementation of the checklist and gain a dynamic understanding of each pilot's readiness and ongoing progress, we initiated a series of structured assessments:

- **August Questionnaire:** An initial round of discussion with relevant WP6 partners, complemented by a questionnaire was conducted in August 2024 to gain a baseline overview of each pilot site's status. This survey captured preliminary insights into infrastructural readiness and highlighted key areas requiring additional support or resources.
- **October Interviews**: In October, follow-up interviews were conducted with all pilot leads, offering a more detailed and current understanding of the evolving needs and challenges at each site. These interviews provided a platform for deeper insights and allowed for realignment of priorities where necessary.
- **Regular Follow-up Interviews**: To maintain real-time oversight and document ongoing progress, interviews with pilot leads are scheduled approximately every four weeks. Using an individual

scheduling system through Pick-a-Date Doodle, this process allows us to capture timely updates, address emerging needs, and document critical learnings continuously.

During each of these check-ins, TUW and the pilot leads collaboratively review and update the checklist. As we move through each interview cycle, items on the checklist are gradually completed and aligned, ensuring a thorough and progressive approach to monitoring subtask completion.

Blended learnings derived from these interviews and checklist updates are presented in regular project updates and documented in the project deliverables. This approach not only keeps stakeholders informed but also provides a cumulative record of best practices and insights that will support future implementations and serve as valuable reference material for subsequent project phases.

3.3 Checklist Design

The checklist covers essential items relevant to all six subtasks, ensuring thorough attention to each critical component: deployment of the TRACE platform, data management strategy, organizational permissions (including vehicle permits), identification of required resources and competencies, adherence to data protection regulations, and compliance with ethical standards.

The following Table 1 provides an overview of the checklist questions used in interviews. It includes main questions along with sub-questions that delve deeper if issues arise during the interview, indicating a subtask may have been overlooked or not worked on yet. The sub-questions then explore the timeline for completing the subtask and clarify where responsibilities lie.

Additionally, each sub-question addresses potential dependencies that might cause delays, as well as any support or resources needed from other partners or pilots. This approach aims to identify shared challenges that could impact all three pilots and may require resolution at a higher, cross-pilot level.

Table 1 Checklist

Number	Question	Classification
0	What is the current status of the pilot? Are there any major challenges currently?	P (permanent question)
1	**Ensure transfer of TRACE platform deployment**	
1.1	Are necessary platform requirements for your demonstrator scenarios stated in the Components-List (WP3 and WP4)?	P
1.1.1	(If Yes) Who is responsible in your local team?	F (filter question, dependent on previous answers)
1.1.2	(Yes) By when will it be done?	F
1.2	Anything else needed for platform deployment?	P
1.2.1	(Yes) What is needed?	F
1.2.2	(Yes) Who is responsible from your point of view?	F
1.2.3	(Yes) Priority?	F
1.2.4	(Yes) Needed by when at the latest?	F
1.3	Are there dependencies that could lead to a delay in the overall pilot schedule?	P
1.3.1	(Yes) Which Dependencies?	F
1.4	Were there any important aspects (like delays/learnings/insights) during the adoption and use of the components?	P
1.5	Overall assessment: readiness of subtask for your pilot at the moment? (Skala 1 -5. 1: not ready at all. 5: ready to go)	P
2	**Data Management policies across pilot sites**	
2.1	Has a DMP been created?	P
2.1.1	(No) Who is responsible in your local team?	F
2.1.2	(No) Needed by when at the latest?	F
2.1.3	(Yes) When was it updated last time?	F
2.2	What were the 3 biggest challenges within the last month / since our last talk concerning data management policies?	P

2.3	Have you developed a study design to measure the impact of the demonstration?	P
2.3.1	(Yes) What activities have been undertaken in this regard?	F
2.4	Do you have a documentation strategy?	P
2.5	Are there aspects of the DMP, that should be coordinated with other demonstrators/partners?	P
2.5.1	(Yes) What?	F
2.5.2	(Yes) Who takes responsibility for making this happen?	F
2.6	Dependencies that could lead to a delay in the overall pilot schedule?	P
2.6.1	(Yes) Which ones?	F
2.7	Overall assessment: readiness of subtask for your pilot at the moment? (Skala 1 -5. 1: not ready at all. 5: ready to go)	P
3	**Obtain organizational permissions, including permits for vehicles**	
3.1	Are permissions required?	P
3.1.1	(No) Really?	F
3.1.2	(Yes) What permissions are needed and for what? (Pending? Applied? Received?)	F
3.1.3	(Yes) Insurance (liability insurance)?	F
3.2	What are the respective timetables for pending/applied permissions? (Prospective date of issue of applied permissions)	P
3.3	What were the 3 biggest challenges within the last month / since our last talk concerning obtaining of permissions?	P
3.4	Dependencies that could lead to a delay in the overall pilot schedule?	P
3.4.1	(Yes) Which ones?	F
3.5	Overall assessment: readiness of subtask for your pilot at the moment? (Skala 1 -5. 1: not ready at all. 5: ready to go)	P
4	**Identify resources and competences to perform the demonstrators**	
4.1	What resources needed (human ressources, finance, vehicles, infrastructure and technology, ...)?	P

4.2	Are they in place?	P
4.2.1	(No) What is missing?	F
4.2.2	(No) Who is responsible?	F
4.2.3	(No) Priority Level?	F
4.3	Coordination with involved parties (municipality, ...)	P
4.4	Consideration – if necessary – potential preparation of test track?	P
4.5	Is a pre-test considered?	P
4.6	Time plan for demonstration (preparatory time plan / detailed test schedule)?	P
4.7	Is a communication and information strategy foreseen?	P
4.8	Are there any resource-related dependencies that could lead to a delay in the overall pilot schedule?	P
4.9	Overall assessment: readiness of subtask for your pilot at the moment? (Skala 1 -5. 1: not ready at all. 5: ready to go)	P
5	**Relevant data protection laws and formal regulations**	
5.1	Overview on relevant laws and responsible institutions?	P
5.1.1	(No) Where are gaps?	F
5.1.2	(No) Who is responsible for that?	F
5.1.3	(No) Need for support on this task within team?	F
5.2	Does pilot comply with data protection laws?	P
5.2.1	(No) Aspects of deviation identified?	F
5.2.2	(No) Who is responsible?	F
5.2.3	(No) Necessary support from TRACE team to find solution?	F
5.2.4	(No) Until when shall be resolved?	F
5.3	Identified laws or formal regulations that pose significant barriers for demonstration?	P
5.4	Dependencies that could lead to a delay in the overall pilot schedule?	P
5.4.1	(Yes) Which ones?	F

5.5	Overall assessment: readiness of subtask for your pilot at the moment? (Skala 1 -5. 1: not ready at all. 5: ready to go)	P
6	**Comprehensive overview of relevant ethical principles**	
6.1	Have you discussed ethical principles with ISIG?	P
6.1.1	(No) Who is responsible?	F
6.1.2	(No) When will you do that?	F
6.2	Are there relevant issues that you have not discussed with ISIG?	P
6.2.1	(Yes) Which ones?	F
6.2.2	(Yes) Who is responsible?	F
6.2.3	(Yes) When will you do that?	F
6.3	Dependencies that could lead to a delay in the overall pilot schedule?	P
6.3.1	(Yes) Which ones?	F
6.4	Overall assessment: readiness of subtask for your pilot at the moment? (Skala 1 -5. 1: not ready at all. 5: ready to go)	P

3.4 Interview-guide and plan

The interview process is designed to facilitate regular discussions with pilot leads, with the primary goal of reviewing and updating the checklist for Task 6.1. Instead of asking the pilot leads to fill out the checklist independently, we will conduct structured interviews that allow for an open, conversational approach. This method is intended to gather not only checklist data but also contextual insights, challenges, and any unanticipated factors that might influence the implementation process.

The decision to conduct interviews, rather than relying solely on checklist submissions, reflects our interest in understanding the nuanced dynamics behind each pilot's progress. By discussing the checklist in real-time, pilot leads are encouraged to speak freely about their experiences, including any obstacles, delays, or resource constraints they encounter. This approach allows us to capture valuable "side-stories" that may not be evident through a standard checklist format alone, offering a richer perspective on each site's progress and needs.

Additionally, this method reduces the administrative burden on pilot leads, as minimal preparation is required. Rather than dedicating time to preparing and completing forms, the pilot leads can participate

directly in open-ended discussions. This conversational setting is intended to foster a comfortable exchange where pilot leads can provide honest insights without the constraints of formal documentation.

Interviews will be held approximately every four weeks with each pilot lead, with specific dates organized through the Pick-a-Date Doodle tool. Each session will focus on updating the checklist with real-time data, addressing any unresolved items, and discussing the current status of each subtask. Key topics will include:

- **Progress on Subtasks**: Review of each subtask's completion status and any areas where additional support is needed.
- **Challenges and Delays**: Identification of any emerging challenges or delays, with a focus on understanding underlying causes and discussing potential solutions.
- **Resource and Regulatory Needs**: Verification of the resources and regulatory compliance necessary for each pilot and whether any adjustments are required.
- **Insights and Learnings**: Collection of anecdotal insights or observations that could provide valuable lessons for other pilots or future implementations.

Each interview will be documented, and the insights gathered will be integrated into the ongoing checklist updates and project reports. Through this interview-based approach, Task 6.1 aims to provide a flexible, responsive framework that supports each pilot's needs while ensuring consistent progress monitoring across all sites.

3.5 Gantt Chart

In addition to the checklist and regular interviews, each pilot is asked to complete a Gantt Chart as a high-level planning tool for their demonstration activities. This Gantt Chart serves as an overview of the anticipated timeline and key milestones for each pilot, supporting Task 6.1's objective of monitoring readiness and progress across sites.

Each pilot lead is responsible for marking their internal, pilot-specific milestones on the Gantt Chart, which provides a visual summary of where each pilot currently stands in the demonstration process. By using the Gantt Chart, pilots are encouraged to consider realistic timelines and to identify any necessary preparatory actions early on, allowing for a proactive approach to potential challenges. This approach promotes structured planning and helps ensure that critical steps—such as securing permits, allocating resources, and finalizing technical configurations—are scheduled well in advance.

The Gantt Chart is not intended to capture extensive detail but rather to present an overarching timeline of each pilot's primary activities. It includes essential requirements that are also addressed in the checklist, allowing for alignment between the two tools and providing an additional layer of accountability. The Gantt Chart thus complements the checklist and interview process by offering a concise, visual overview of each pilot's planned milestones.

The Gantt Charts completed by each pilot lead are included in the annex of this deliverable, offering a consolidated view of all pilots' projected timelines. This inclusion allows project stakeholders to easily assess the overall progress and scheduling across demonstration sites. Regular updates to the Gantt Chart, as informed by the checklist and interview discussions, ensure that each pilot's timeline remains accurate and adaptable to any changes in requirements or unforeseen delays.

3.6 Developing the Deployment-Assessment Method

Table 2 Classification of Suitability of Applied Methods

	Suitable for...	Not suitable for...	Synthesis
Gantt Chart	- Assessing major milestones and major changes in the time plan - Assessing risks for the whole demonstrator - Establish Accountability - Overview of Pilot process	- Detailed insights into task status - Complex dependencies and risks	- Pending standardization across pilots and concerning content - Milestones for subtasks are mostly missing - Pilot specific Milestones stated
Checklist (standardised, written Questionnaire)	- Time Efficiency - Questions that require Answers listing e.g. specific regulations and policies - Questions that require coordination with other partners in the pilot to be answered - Standardized Questions	- Questions that require in-depth answers, explanations of dependencies - Complex Questions that need explanations to be understood by the partners (risks about misunderstandings) - Assessment of importance of Information given in the Answers (Context of tone, body language and other non-verbal communication is missing) - Identifying important matters not listed in the standardized questions	- Complex Matters, that would require further explanations are cut short - Works Better compared to interview if Language Barriers exist - More precise answers compared to interview if it is required to list specifics
Interviews (guideline-based)	- Explanation of Dependencies in the Pilot - In-Depth Questions as Interviewers can act flexible and follow up on questions - Evaluation of importance of given information (e.g. impact of risks can be assessed)	- Risk of Misunderstandings, especially in case of language barriers - Time consuming in preparation and further evaluation of answers	- Interviews are very dependent on the interviewee (level of knowledge, individual perception of the pilot, ...) - Interview as a first step, explaining the aim of the Task and Questions crucial to prevent misunderstandings and improve the quality of answers

In the coming months, our methodology will be closely aligned with our goals, utilizing each method strategically to minimize the risk of misunderstandings. This period will last from M18, November 2024,

until the individual demonstrator starts. The objective is to use the Gantt chart, written checklist questions, and interviews in a complementary way, allowing us to gather information on the organisational readiness of pilots as effectively and efficiently as possible.

3.7 Ensuring ethical and data protection compliance across pilots

The safeguard of fundamental rights, the application of ethical and GDPR principles and provisions, as well as a continuous monitoring and adherence to national and international laws and regulations regarding protection and privacy of personal data is a priority for the project.

The project operates under **ethical principles** aligned with Horizon Europe Regulation (Article 19) and the Code of Conduct for Research Integrity. Such principles ensure research integrity and guide all project activities. TRACE Consortium members are responsible for the ethical and responsible handling of data, particularly **personal data**, throughout the project and adhere to GDPR principles, including lawfulness, fairness, transparency, purpose limitation, data minimisation, accuracy, storage limitation, integrity, confidentiality, and accountability.

To ensure GDPR, data protection, and ethical compliance during the implementation of the TRACE project pilots, a robust and systematic approach will be adopted. Building on the established ethical framework developed under WP1 and WP2, procedures and tools will be adapted and applied to guarantee continuous oversight and adherence to ethical and GDPR principles.

ISIG, leading the ethical assessment and monitoring efforts, will support pilot leaders in the identification of relevant compliance activities and integrating procedures and tools at pilot site level. This will involve the organisation of dedicated online meetings for each pilot, ensuring targeted guidance. These meetings will allow for the further joint development and adaptation of tools provided under Tasks T1.6 and T2.3 (notably included in D1.2, D1.3, D2.1) to align with the specific needs of each pilot.

This process will unfold in two key phases:

1. **Preparation for pilot implementation**: bilateral online sessions with each pilot coordinators and relevant partners involved in the demonstrations will be organised and will focus on the joint identification of key elements to align self-assessment tools and checklists with specificities of the pilot. Such meetings will allow for the definition of criteria for the development/adaptation of the relevant tools. Among the items to be analysed, the meetings will focus on: organisational aspects

of the pilot, participants to pilot activities, location, timing, roles of participants. The identification and analysis of such elements, will allow the elaboration of:

- Customised selection criteria, based on the target groups and role of pilot participants.
- Tailored recruitment procedures, based on target group, recruitment setting and timeframe, and methods for recruitment.
- Pilot-specific procedure/checklist providing general guidelines on the different steps to be followed before, during and after a demonstration.
- Moreover, ethics assessment questionnaire will be developed to investigate personal experience of participants before, during and after the pilot demonstration.
- Checklists for recruitment of research participants and informed consent forms (provided in D1.2 and D1.3) will always have to be used by pilot leaders.

This phase will take place starting from M19 (December 2024).

2. **Implementation and monitoring:** continuous oversight and support will be provided to pilot coordinators and relevant involved partners to ensure that the principles are actively applied and refined as needed, fostering accountability and adaptability throughout the pilot implementation. This phase will last throughout the whole pilots implementation period (until M36, May 2026).

This structured approach will ensure that the TRACE project pilots are conducted in full compliance with GDPR, data protection, and ethical standards.

Moreover, data management issues are governed by TRACE Data Management Plan (in its first and second release: D1.2 and D1.3), led by the project coordinator (NKUA), while security concerns related to the technological development of the TRACE platform have been initially addressed in D4.5 – Security scheme and Visual interfaces (A) (M18, November 2024) which reports on the preliminary activities of T4.6 and T4.7, setting the scene for more detailed discussion regarding security and privacy controls definition for addressing potential vulnerabilities. The document provides a subset of controls recommended for the TRACE demonstrators, which will be further discussed and adapted (to be reported in D4.6 at M36, May 2026).

4 Status of the demonstrators

This chapter provides an overview of the current status of each pilot demonstrator within the TRACE project, reflecting the progress made and any challenges encountered in implementing the platform at the pilot sites. The aim is to outline the advancements in infrastructure readiness, organizational support, and compliance with data management and regulatory standards across each location, in line with the objectives of Task 6.1.

Each section in this chapter presents a first update on the key milestones achieved, as well as any region-specific considerations that have influenced the rollout process. By documenting these updates, we can monitor the readiness of each site to begin active demonstrations and identify any outstanding needs that may impact the timeline or scope of their implementations.

The status updates presented here draw on information gathered from the checklist reviews, interviews with pilot leads, and progress tracking tools such as the Gantt Chart. This consolidated overview enables stakeholders to gain a clear understanding of where each pilot stands in relation to the broader project timeline and offers a foundation for planning any required adjustments or support for the next phases of deployment.

4.1 Greece

4.1.1 Demonstration goals

The Greek Pilot comprises of three parts. Parts A and B focus on the Thessaloniki-Athens corridor, where trucks and trains will be used to test intermodal logistics operations and responses to disruptive events. ACS and HT are coordinating the transportation of shipments between warehouses across Greece, utilizing TRACE logistics services.

Part C takes place on the NKUA campus, concentrating on safe exchange areas for deliveries carried out by autonomous vehicles, e.g., robots. Multiple parcels will be delivered to various customers on campus using unmanned vehicles, combining services from different last-mile delivery companies. The mobile robot *RB-VOGUI* provided by ROBOTNIK will be used for a number of attempts delivering one parcel per attempt. During the pilot, the consortium will examine if multiple compartments can be mounted on the vehicle for attempting multiple deliveries in one journey.

In Part A and B intermodal logistics operations will be optimized with TRACE logistics services to coordinate shipments between ACS and Hellenic Train. Key activities comprise the planning and execution of shipments between ACS hubs in Thessaloniki and Athens, reducing trucks by 50% through the integration of railway services provided by HT. TRACE will be responsible for facility shipment allocation, real-time monitoring, and operational integration with ACS and HT, thus assuring seamless and effective logistics.

The general idea behind this pilot is thus to develop better efficiency in shipment transfers, reduce operational costs, and minimize environmental impact due to the logistics operation. By putting fewer trucks on the road, this pilot adds rail transport in targeting large cuts in fuel use, emissions, and general energy expenditure. This contributes to sustainable logistics and helps outline how the TRACE platform might be resilient and flexible to optimize intermodal operations.

Key steps of the approach are highlighted below: TRACE does the allocation of the roller cages, containing shipments, and computes the estimated time of arrival for every route. Further, it provides optimized schedules to both ACS and HT. Continuous monitoring is done for each roller cage using sensors. TRACE handles real-time communication and integration with the two companies' systems for data integration. It applies Blockchain on TRACE to enable secure, transparent tracking of the Shipment ID and creates Smart Contracts for firming up the agreement between ACS and HT. TRACE goes ahead to calculate the best route and monitors all stages of shipment transfer; it readjusts schedules when necessary and assures dependable delivery from Thessaloniki to Athens.

4.1.2 Status (Checklist)

The Greek demonstration is currently focused on developing components related to Work Packages 3 and 4, specifically for Pilot A, including the transfer in Thessaloniki. While general platform testing and development was conducted (see D3.3), pilot-specific testing has not yet begun as some necessary components for deployment are currently being developed. A specific testing date for all three parts has not been set. Currently, there are no critical risks or major issues mentioned in the interview. For the February meeting in Brussels, a video will be presented to explain the process for logistics companies to collaborate effectively.

4.1.2.1 Adoption of TRACE components

The necessary platform requirements for the Greek demonstration system are listed according to the components that will be used for this pilot.

4.1.2.2 Data documentation strategy and data management plan

Methods for data retrieval and processing are being developed in alignment with the TRACE Strategy. The Greek Pilot team is creating strategy guidelines that align with TRACE's overall objectives and adhere to privacy, security, and policy requirements. The Data Management System (DMS) will oversee the collection, usage, and processing of data from partners to support scenario deployment effectively

4.1.2.3 Relevant Permissions

For scenarios A and B, no additional permission is required beyond the General Permission for courier services from EETT (Hellenic Telecommunications & Post Commission), which ACS already holds. For scenario C, testing autonomous vehicles on company or university premises does not require special permissions (for the use of aerial vehicles without a permission, all the relevant regulatory issues will be fully adopted and applied). According to Goverment Gazzette No 6414/2022, issued by the Greek government, such testing is permitted under these conditions if an academic partner or research center is involved. However, broader deployment of the autonomous robots would require regulatory approvals, and the regulatory framework in Greece is not yet mature for general autonomous vehicle use.

The Greek pilot is not subject to any regulatory approval and does not require a mitigation plan to be implemented.

4.1.2.4 Relevant Resources

There is a time plan in place and all components must be developed by a specified date, with certain actions, such as development, scheduled to be completed before testing can begin.

Apart from the pilot testing further financial resources would be needed if TRACE were adopted for a broader use. Furthermore, personnel resources are in place, no new recruitments are needed, only some training of the autonomous vehicle users in Part C.

4.1.2.5 Relevant regulations

The following relevant regulations regarding data protection and ethics have been identified:

- **Greek National AI Strategy:** currently under development with the coordination of the Hellenic Ministry of Digital Governance (MDG). The development of such strategy is involving a high number of stakeholders in Greece and it aims at developing a framework for skills, trust, data policy and ethical principles to ensure safe AI development and use; defining national priorities to leverage AI for societal benefit and economic growth.

- **Digital Transformation Bible 2020-2025:** outlines the goals for digital transformation across all sectors of the economy and public administration. It details more than 400 specific projects focused on enhancing technological infrastructure, digital skills, and the use of digital technologies to make public services more modern and drive economic growth.
- **Greek Data Protection Law (Law 4624/2019):** national law that implements and complements the GDPR, providing detailed provisions on data processing activities.
- Guidelines from the Hellenic Data Protection Authority (HDPA): offering guidance on compliance with data protection laws.

4.1.2.6 Pilot Details

Physical Infrastructure: Regarding the physical infrastructure, potential risks have been assessed and no significant risks are anticipated, as sensors are used to ensure safety.

Trucks: For Part A and B Trucks are already in use for the daily operations of ACS. It is business as usual, so there is no need for testing.

Autonomous Robots: New infrastructure will be studied, more specifically compartments that will be transported by Robotnik's robot. Contacts with manufacturers are underway to identify a suitable solution.

Communication Activities: This is still under consideration. ACS believes there should be an event after the completion of the pilot cases to communicate the outcomes to the public and potential stakeholders. The event should be coordinated by the academic partners.

4.2 Slovenia

4.2.1 Demonstration goals

The Slovenian Pilot focuses on first- and last-mile delivery within the shopping, business, and leisure center of BTC City Ljubljana, a district of Ljubljana. A minimum of three different modes of transportation will be utilized in this pilot, including existing vehicles from Slovenian Post and autonomous delivery robots provided by Robotnik, as well as a commercially available delivery robot. The selection of different vehicles, including autonomous delivery robots, is an important aspect of the Slovenian demonstration, as it showcases autonomous delivery supported by the TRACE platform, which optimizes delivery times, costs and emissions.

Three scenarios are included in this pilot:

1 Last-mile delivery: This scenario represents the delivery of shipments from the mid-mile to the inside of BTC City area, as presented in Figure 4.

Figure 4 Last-mile delivery scheme

2 First-mile pick-up: First-mile pickup is the reverse process of the last-mile logistics process. Vehicles will collect shipments and mail inside the pilot area and deliver them to the Urban Consolidation Centre (BTC LC or PS office), as shown in Figure 5. From these UCCs, various mid-mile logistic operator may manage mid mile transport.

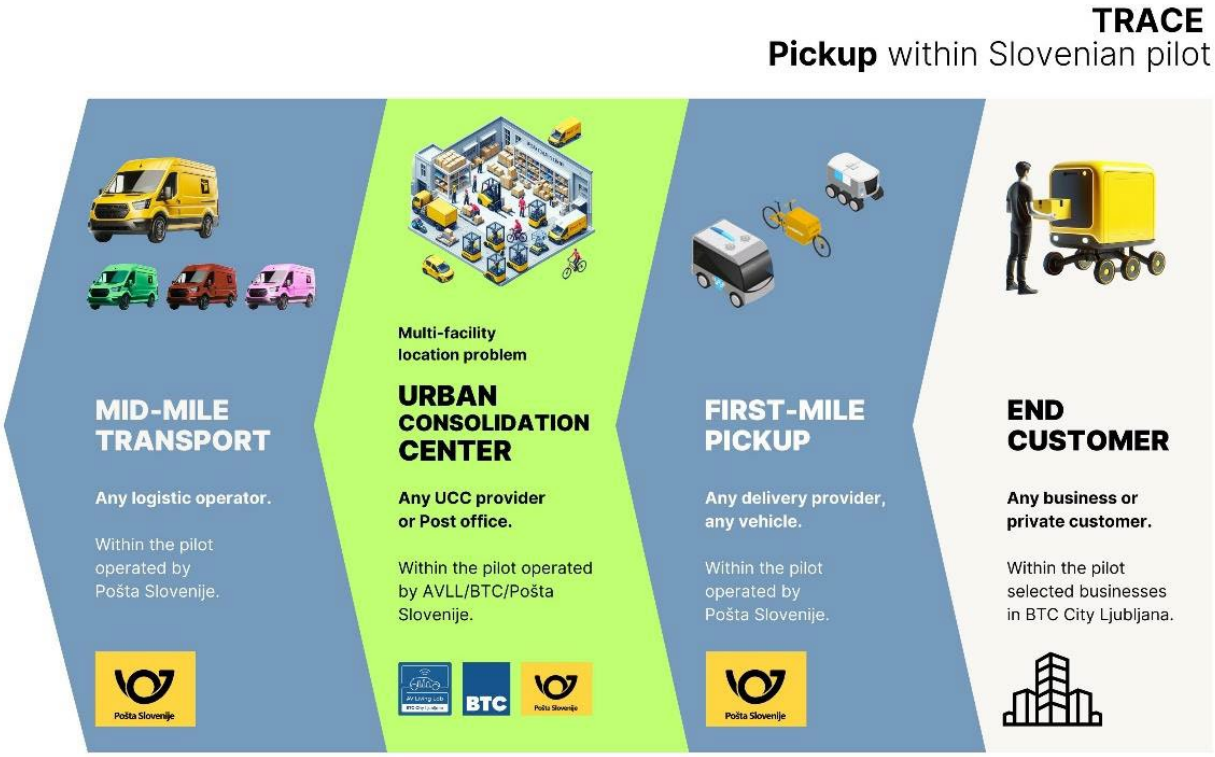

Figure 5 First-mile pick-up scheme

3 Pick-up and delivery: This scenario represents a case where last-mile delivery and first-mile pick-up are executed simultaneously. In this scenario, the shipments in BTC City are both delivered (last-mile) and picked up (first-mile) at the same time. In this case, the last-mile Delivery Agent and the first-mile pick-up agent are the same logistics company.

Within the project, Slovenian partners will establish (virtual) Urban Consolidation Center, similar to consolidation hubs located just outside city centers. Within this pilot, the hub will receive deliveries (or simulate deliveries) from a separate logistics provider.

4.2.2 Status (Checklist)

The Slovenian pilot team meets every two weeks. Overall, the pilot ecosystem is well-prepared, with no major adjustments or physical interventions required. Testing will involve robots operating on sidewalks

and bicycles on bike lanes, potentially sharing the road with other vehicles (street crossing or shared traffic areas). The vehicles and robots have already been selected, including a commercial robot from Twinswheel, which will be acquired by Pošta Slovenije (Slovenian Post/PS) for the duration of the demonstration activities. In total, there will be combination of at least three different types of transport, including a delivery robot and existing zero emission vehicles from Slovenian Post, such as cargo bikes and electric vans.

4.2.2.1 Adoption of TRACE components

The WP2 requirements list was recently updated, although in practice, some categories will likely be treated as optional or flexible. The data that will be available and the scope of its accessibility have already been determined.

TRACE Platform and Interoperability: One of the critical challenges identified during the preparation phase of the Slovenian TRACE pilot was the non-scalability and inefficiency of manual coordination between the postal backend systems and the TRACE logistics orchestration platform. Although the original resource plan did not foresee deep system integration, the project consortium has since recognized the importance of automated data exchange and agreed to proceed with the development of a direct API-based integration between the postal IT infrastructure and the TRACE platform.

This integration layer will serve as a middleware bridge for seamless, real-time communication between both systems. It ensures high interoperability, minimizes manual overhead, and enables dynamic orchestration of deliveries using low-emission autonomous vehicles, which is key to the pilot's success in the BTC area of Ljubljana.

This API framework enables a streamlined and automated integration between the postal backend system and the TRACE platform. It supports efficient import of vehicles, shipment data, and delivery constraints while allowing real-time monitoring of vehicle movement and delivery progress. This technical infrastructure is essential for a robust, scalable, and low-emission delivery service, as envisioned in the TRACE pilot implementation.

4.2.2.2 Data documentation strategy and data management plan

The Slovenian demonstration partners have already started identifying and classifying the data. The key priority to avoid GDPR issues and align with ethical requirements is that the Slovenian demonstration would not collect any personal information, as the pilots will focus exclusively on B2B deliveries.

The question of how operational data will be stored and how the impact of the demonstration will be measured is still under discussion. A common approach needs to be established project-wide, with other pilots. One challenge is that the demonstrators are not large-scale demonstrations, making it difficult to derive meaningful KPIs from these smaller tests. A specific calculation method will be necessary to effectively assess the impact.

From the perspective of the Slovenian pilot, further discussion is needed regarding Data Management. In their view, WP6 should take responsibility for developing this aspect, as a standardized approach or "common ground" is essential.

4.2.2.3 Relevant Permissions

Under Slovenian legislation, autonomous delivery robots (ADR) are not defined as vehicles, which means no specific permissions are required for testing and operation activities. Also, no additional permissions are required for testing in the AV Living Lab's ecosystem of BTC City Ljubljana, as it is a privately owned area. No mitigation plan was developed since no permits are necessary for the demonstrator test execution.

Nevertheless, the pilot team has been in close contact with the relevant ministries and city government with a view to possibly expanding the demonstration areas. They are encouraging them to begin considering relevant policies as this technology is expected to become a reality in the coming years. A regular contact with the relevant municipalities and the Ministry of Public Administration is maintained, as they are responsible for coordinating the policy sandbox. Bicycles, trucks, and vans are standardized, so no additional permissions are required for their operation. Additionally, adequate ADR insurance must be provided.

4.2.2.4 Relevant Resources

Financial Resources: The budget will depend primarily on the cost of sensors for vehicles that currently lack them and acquiring an autonomous delivery robot for testing period.

Personnel: No additional skills are required, as all necessary expertise is provided by TRACE consortium partners. Robotnik will lead the autonomous delivery robots testing, while a provider of another ADR TwinswHeel's has the skills needed for both autonomous delivery robot testing and employee training.

4.2.2.5 Relevant regulations

The following relevant regulations regarding data protection and ethics have been identified:

- **National Program for the Promotion of the Development and Use of Artificial Intelligence in the Republic of Slovenia until 2025** (Nacionalni program spodbujanja razvoja in uporabe umetne inteligence v Republiki Sloveniji do leta 2025 – NpUI)[1]: outlines ethical principles and guidelines for the use of AI, focusing on transparency, fairness, and accountability.
- **Slovenian Personal Data Protection Act** (Zakon o varstvu osebnih podatkov - ZVOP-2): implements GDPR provisions at the national level[2].
- **Guidelines from the Information Commissioner of the Republic of Slovenia:** provides recommendations and compliance checklists for data processing activities, ensuring alignment with GDPR and national regulations[3].

(Potential) Impact of regulations in demonstrator activities:

- **Formal Regulations:** Each postal item must be protected from the external environment. The Slovenian Post has raised some safety concerns regarding this requirement.
- **Laws:** Level 3 automation testing is currently permitted, but applies to the vehicles only. The primary challenge at the moment is addressing GDPR concerns related to tracking workers operating the vehicles (bikes) without violating individual privacy rights.

4.2.2.6 Pilot Details

Physical Infrastructure: To optimise costs and demonstrate real-world applications, existing communication infrastructure will be utilised, including commercially available 4G/5G mobile networks and optionally indoor Wi-Fi in low-signal or unavailable areas. In terms of physical infrastructure, the existing premises of Pošta Slovenije and BTC Logistic Company will be utilised for synchromodal operation, and existing outdoor road and pedestrian infrastructure, owned by BTC Company, will be used.

However, the Consolidation Center will not operate at full scale. It is still uncertain whether it will be a more virtual space or a small physical space within BTC, as renting a large space is not considered optimal for low-scale demonstration activities. The exact location for parking and charging the robots will be defined.

The necessary preparation tests on the track are progressing well. The robots have already been tested in the field (pre-testing), and the route is flexible, allowing for easy adjustments.

Robots: The Slovenian Post has held meetings with Robotnik to address the need for closed compartments on the robots, which are currently not available in Robotnik's model. While this issue is still under discussion, the intention is to ensure the robot will have secure, closed compartments. Slovenian Post is also in contact with other robot suppliers (Twinswheel) to explore options for addressing this need. The robots will operate on public sidewalks and other shared traffic areas and a team member will accompany the robots when crossing streets.

Bicycles: A decision still needs to be made on whether the bicycles used in the pilot will be electric or manual, depending on availability and current weather conditions.

Sensors: Sensors are installed on both ADRs, which will be connected to the TRACE platform, which still needs to be defined. There are no sensors on the other Slovenian Post vehicles, and they are not connected. If the location of these vehicles is monitored, additional sensors and special permits from the employees who will use these vehicles for testing purposes would be needed. Cameras may be excluded because of GDPR concerns or will track/record only limited information.

Communication Activities: A communication and information strategy has not yet been established, but there are plans to organize a public event. This event would invite decision-makers, companies, media, and political representatives to showcase the TRACE platform and the potential of autonomous delivery robots. It could also be used to collect data for TRACE and highlight how IT solutions can drive competition and demonstrate the consolidation of various last-mile delivery methods in cities.

4.3 Italy

4.3.1 Demonstration goals

At the Italian pilot site in Modena, advanced autonomous delivery technologies are being tested with cargo bikes (pilot B) and drones (pilot A), focusing on integrating V2I communication with MASA infrastructure to track real-time vehicle data and monitor delivery status for the Trace platform.

In pilot B, platooning will allow one operator to manage multiple cargo bikes, and interoperability with drones is being explored for alternate delivery paths when cargo bikes face limitations. The platoon will

be implemented in such a way that it falls within the L3 SAE level, i.e., the first bike will be driven by a human, and the other bikes, despite L4 capabilities, will follow it autonomously.

In pilot A, use of drones for special logistics is addressed. Multimodal transport and complementarity with cargo bikes is addressed, which is also accounted in pilot B. A special payload container named Lifebox is developed, extending the tracking and monitoring capabilities to special freight, regardless of the vehicle being used. This extends the objectives of TRACE to special logistics use cases of medical delivery.

Both pilots are designed to optimize urban delivery and enhance operational flexibility through smart city logistics. A key test within Pilot B involves a platooning system for cargo bikes, where a single operator guides a group of semi-autonomous bikes. This approach aims to offer a viable alternative to traditional delivery vans by enabling comparable load capacity and labor deployment, while significantly reducing emissions. Additionally, interoperability between different vehicles—such as cargo bikes and drones—will be explored to ensure adaptive delivery solutions when specific vehicle types face operational constraints. Real-time V2I connectivity with TRACE will support responsive route adjustments, enabling efficient and sustainable urban deliveries under varying conditions.

The Italian use case pilot B in Modena exploit the dynamic routing feature solution of TRACE platform that logistics operators can query for optimal delivery paths. TRACE calculates these routes—including potential platooning configurations—to deliver parcels efficiently within and around Modena's *Diagonale Verde*. Upon dispatch, the MASA infrastructure, using V2I connectivity with MQTT over 4G/5G, supports real-time data sharing on vehicle operations with TRACE. This continuous exchange allows TRACE to monitor delivery progress and adapt routes if unexpected events arise, ensuring timely and flexible parcel distribution across the area.

Special demonstration goals are introduced with DEM 2A (Italian Demonstrator – Urgent Medical Deliveries via UAVs). Validate the use of drones for urgent medical logisti: demonstrate the feasibility and value of using drones for fast, time-sensitive deliveries of biomedical materials (such as blood samples or diagnostic kits).

Implement multimodal logistics with interoperability showing how drones and cargo bikes can work together in a coordinated logistics chain. The LifeBox smart container can be transferred between vehicles, enabling flexible deliveries even in areas where drones or bikes alone cannot operate.

Highlight interoperability and platform intelligence. Demonstrate how the TRACE platform can manage mission scheduling, vehicle telemetry, routing, and real-time monitoring. Show how TRACE handles communication between vehicles and infrastructure and uses blockchain for smart contract execution.

Assess operational feasibility in a real urban environment. Test drone operations in realistic city conditions, taking into account route segmentation, population density, flight restrictions, heliport coordination, and infrastructure limitations. Explore how dismissed railway corridors and new bike paths can support flexible route planning.

Prepare for scalable regional deployment. Use the Modena pilot as a model for future expansion in other urban or regional contexts. Leverage evolving infrastructure like the upcoming bike road to demonstrate how this solution can be scaled and replicated elsewhere.

4.3.2 Status (Checklist)

The project progress varies across the different components:

Pilot A: The drone pilot component is well ahead of schedule, with all necessary tasks completed and only a minor delay of about one week. The project timeline, as laid out in the Gantt chart, remains largely unaffected by this small delay.

Pilot B: The bike pilot section is experiencing significant delays. The bike provider (OLV) is undergoing a corporate reorganization involving the closure of its legal entity.

The project's coordinators have already been informed and the discussion and meetings on how handle the handover is still an ongoing process. This decision may impact OLV's responsibilities in the TRACE project activity timeline. It has led to several development delays, and an additional 3-4 months may be needed to obtain the required bike.

Two options have been proposed by OLV to address this:

- Continuing project activities under a new entity.
- Transfer responsibilities to Spin Italia.

The situation is closely monitored and the impact on the project schedule being assessed, with regular updates in coordination with project partners.

4.3.2.1 Adoption of TRACE components

TRACE Platform: Development of the TRACE platform is on schedule, with ongoing efforts in data modelling and interface identification. The platform is live, and connection will soon be available, with login data expected to be shared soon. A communication protocol is still under discussion, and the platform's integration with partners (e.g., DiFly, Unimore and Urbico) is planned, though direct communication with MASA's servers (Modena Automotive Smart Area) platform the data will be shared also in the TRACE platform. This s not anticipated due to privacy considerations. Instead, additional AV's real-time information will be also visualized through a digital twin of Modena (USCV – Unreal Smar City Visualizer) with a proper visualization, with the use of stylized 3D objects. USCV is capable of showing smart entities real-time data as GPS position of the cargo bikes and drones in a 3D map environment with the use of Unreal Engine 5 and Cesium. Urbico is expected to use TRACE for routing and surveillance purposes. Challenges have arisen during the TRACE platform's implementation, particularly in defining the REST APIs and other deployment details. Nevertheless, it is mentioned there are currently no substantial risks.

4.3.2.2 Data documentation strategy and data management plan

The documentation strategy is seen to primarily concern the TRACE platform rather than the demonstrator itself. The team is awaiting guidance from the overall project on how best to approach and align documentation processes across components. The MASA platform with a digital twin platform of the city of Modena has been adapted to work with live data within different smart cites environments. While the TRACE platform needs to handle data effectively, especially concerning logistics companies, TRACE has already outlined plans for this, including potential KPI tracking by the project's end.

However, the documentation strategy must still be aligned across the TRACE project, as the demonstrator component does not directly engage with logistics company data.

Although there are no concrete plans yet, the team sees potential in defining how and what data to collect to address KPIs in the future. The idea remains in a "consideration" phase, with no confirmed steps toward implementation, but the team believes it is an achievable goal.

4.3.2.3 Relevant Permissions

Since the City of Modena is a project partner, the potential to request and obtaining for the pilot B permits, even if they were not necessary, poses no significant challenge. The MASA area in Modena is already certified for testing autonomous vehicles, and Italian law provides a regulatory framework for testing autonomous technologies. Data flows within Modena's infrastructure (MASA), ensuring GDPR compliance.

The situation is more complex on the drone side. The test area has been moved from an airport zone to a hospital area within Modena to avoid airspace restrictions near Bologna's airport. Permissions for drone operations are still pending but are anticipated to be in place by January 2025, aligning with the project's timeline (as noted in the Gantt chart, row 18). Plans are also underway for a public demonstration in public areas and potentially in the MVF *Motor Valley Fest* in June.

Regarding data protection and privacy, GDPR requirements (as specified in requirement 2.2) are addressed by complying with relevant Italian and EU laws. Additionally, the platooning setup for autonomous bikes simplifies the implementation: the lead bike will be operated by a human, placing it in Level 3 autonomy, which reduces regulatory complexity compared to Level 4 autonomous systems. There are considerations around liability insurance, but specifics remain to be confirmed.

4.3.2.4 Relevant Resources

The MASA platform is in place, but the TRACE platform is still missing. While much of the infrastructure is ready, the routing algorithm is the key component that remains incomplete. Efforts are underway to push partners to resolve this issue. Specifically, the TRACE routing algorithm is still under development as the infrastructure. There is ongoing communication with routing algorithm providers, and Urbico Logistics is involved in efforts to address these challenges.

4.3.2.5 Relevant Regulations

The following relevant regulations regarding data protection and ethics have been identified:#

- **Italian Strategy for Artificial Intelligence 2024-2026 (Strategia Italiana per l'Intelligenza Artificiale 2024-2026)**: focuses on establishing a robust framework for AI development, setting

national priorities to leverage AI for societal and economic benefits, and proposing specific actions and pilot projects to implement these priorities.

- **Italian Data Protection Code (D.Lgs. 101/2018):** national law implementing GDPR principles in Italy.
- **Guidelines from the Garante per la Protezione dei Dati Personali:** the Italian Data Protection Authority provides specific guidance on data processing, security measures, and compliance requirements for innovative technologies, including AI.

4.3.2.6 Pilot Details

Sensors: The sensors on the vehicles are mounted in a way that allows for comprehensive data collection. The approach is to equip the vehicles with as many sensors (GPS, LIDAR, Radar, Antennas) as possible to determine the best combination for optimal performance. This includes cameras, LIDARs, antennas, and other sensors. The idea is that with a partially autonomous vehicle, fewer sensors may be needed, but the city itself requires more sensors for comprehensive data collection. This is an ongoing research effort, with many technologies being explored, though no definitive solutions have been found yet.

Communication Activities: Communication with the public is managed by the City of Modena. Different dissemination activities have already been done within Modena Smart Life Festival in 2025. At the moment, there are no specific communication plans in place. There is still one proposal to enhance pedestrian awareness by installing a screen on the bikes that will provide updates and information about ongoing activities.

4.3.3 Risk Mitigation Plan

4.3.3.1 Use Case B – Cargo Bike Platooning and Drone Interoperability

Carbo-bike development delays: The cargo-bikes, integrated with V2I/V2V communication and autonomous driving technologies, are prerequisite to the achievement of the pilot goals. OLV's inability to deliver them within schedule may cause significant delays. To avoid potential delays, Unimore is completing the development of the autonomous system software stack on an in-house rover. This vehicle will also be suitable for running the demonstration activities of Use Case B, with certain limitations, so that the pilot goals can still be achieved.

Regulatory Relevance: The platooning of cargo bikes is not subject to regulatory approvals, as it involves a human-led convoy (Level 3 autonomy) where only the leading bike is operated manually, and the others follow autonomously at safe distance. Given the nature of the pilot activities and the urban areas (Diagonale Verde and MASA) in which the technologies will be demonstrated, the fundamental use of public space and infrastructure will not be altered. Therefore, special authorisation is not required and no specific regulatory approvals are needed for this operation.

However, exploring the multimodality capabilities of TRACE through drone-based interoperability requires more caution, as it is subject to local and national UAV regulations, particularly in urban or populated areas. An example activity, in this context, is a drone transferring a parcel from a cargo-bike to a destination for last mile delivery. This issue is addressed by designating specific locations within the demonstration area for drone operations that are off-limits to the public. This simplifies the flight authorisation request procedure. Choosing the location for handover, that is a virtual micro hub for logistics, at the end of the available Diagonale verde bike lane, where construction is in place to transform former railway in bike lane, provides a suitable combination of a place accessible by bikes to a non populated area that can be flown by drones.

Potential Risks:

(A) Authorization for drone flights in inhabited urban environments may not be granted in time or at all due to legal or safety constraints.

(B) Due to the handover of the prototypical development of the two cargo bikes with actuators and sensors from OLV to SPINITALIA — and the delays caused by this transition, including the transfer of responsibilities and the amendment process — the delivery of the cargo bikes will be significantly delayed.

Mitigation Measures for (A):

1. **Fallback 1 – Emulated Delivery in Rural/Test Zone:** If drone flights in urban areas will not be authorized, a simulated delivery will be performed in an open agricultural field or authorized test zone. The drone will take off, travel a short distance, simulate a parcel drop-off, and return to the origin point. This will allow testing of interoperability protocols and drone command systems without breaching regulations.
2. **Fallback 2 – Ground-based Interoperability:** In the event drone flight is completely restricted, **a VAN, ground vehicle or a single operator on footh** will be used to emulate the drone's role in the logistics chain. This allows the validation of interoperability and data exchange logic using alternative transport modes.

Mitigation Measures for (B):

UNIMORE, as the leader of Use Case B, is taking proactive steps to avoid blocking dependencies between the cargo bikes and the integration of the SBADS (Smart Bike Autonomous Driving System) with the hardware (cargo bikes). To this end, the first phase of SBADS integration is currently being carried out internally using available hardware in Unimore laboratory, specifically a rover platform.

4.3.3.2 Use Case A – Drone Delivery of medical urgent parcels

Regulatory Relevance: Drone usage is central to this use case and hence **subject to UAV regulatory approvals.** The likelihood for receiving approvals is based on the scenario and some factors are challenging:

- drone size is one of them, but limiting to Maximum Take Off mass (MTOM) lower than 25 kg offers a good compromise between total payload (up to 10 kg) and area of flight; this explains the technical choices for the drone;
- Beyond Visual Line of Sight (BVLOS) operations are necessary to connect distant places, which is the case for logistics; this excludes all scenarios of Open category of operations (according to European drone regulation EU 947/2019), therefore specific category operations are necessary, which require approval by National Aviation Authority (NAA);
- flight restrictions on drones for airspace use are a further concern; in some cases they can be mitigated by low altitude flights, so that drone routes can be adapted to avoid restricted airspace; in some cases particular authorizations and coordination with authorities are necessary, an example is the fact that most hospitals have heliports for emergency (HEMS) and complex coordination is paramount and mandatory; .
- Urban environment is a further limitation, probably the most important, because drones cannot fly over populated areas (we exclude high level of integrity aircraft certified for these applications); this issue is addressed with accurate design of routes to avoid high population density areas but it poses a limitation on the actually practible routes, according to regulations; it is also to be considered that crossing highways is considered a high risk situation because of the risk to traffic and this also limits the routes that can be done with drones.

Potential Risk: Flight authorization in the demonstration area may be delayed or denied by Italian aviation authorities and a coordination with other authorities, as heliports must be achieved.

Mitigation Measures:

1. Routes of the use case have been split in separated legs corresponding to different levels of risk assessment; this will support discussion with NAA offering the possibility of having only a portion of the route authorized for drone flight; other portions can benefit of complementary vehicles like cargo bikes (see Part A and Part B communalities) for the use case demonstratins; for non-

authorized routes, the project will leave a clear understanding of technical and regulatory gaps to make more logistics use cases feasible;

2. **Fallback – Simulated GPS-based Drone Test:** In case real flight is not feasible, a **simulated drone delivery** will be conducted in compliant zones. The drone will fly in a legally permitted rural/test area, while **GPS coordinates are modified** in the TRACE platform to match the originally intended delivery route. This ensures that the system and logic are fully validated, albeit in an alternative flight area.
3. **Communication Validation:** All data transfer, mission planning, and integration with the TRACE platform will be performed as originally designed, ensuring that the demonstration remains valid from a software and interoperability standpoint. The LifeBox, an item connected itself to TRACE platform, allows testing to be extended in any location when it is not loaded on the drone but transported by humans or cargo bikes, providing a continuoum of logistic tracking across different scenarios and means of transport, which is a primary goal of TRACE.

5 Outlook

As stated, this report is the first of a series of three deliverables (D6.1 A, B, C). Thus, the focus of the first report was on establishing a methodology and respective tools, serving as a basis for the subsequent issues (M24, M30). The following issues will focus on the preparation and implementation processes of the demonstrators, presenting more extensive findings and concrete results for each pilot, as well as potential synthesis across demonstrators.

Nonetheless, some common challenges have already been identified:

- The Greek and Slovenian demonstrators encountered a challenge with Robotnik's **robot**, which currently lacks secure, closed compartments for delivery. Addressing the need for these compartments is under active discussion, with the goal of ensuring secure storage on the robot. Both pilot teams are also exploring options with other companies to meet this requirement.
- All three pilots currently have neither a data collection strategy nor a DMP and see the responsibility for this at a higher level.
- All three pilots agree that an information and communication strategy to inform the general (local) public about the pilot activities would be useful. A detailed strategy has not yet been developed.