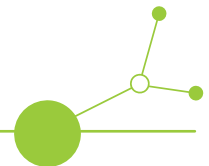


D 2.1.2 Solution 1 codesigned Mobility Management coordination dashboard





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1. Introduction

The GreenPATH project, funded under the Interreg Central Europe Programme, addresses one of the main challenges affecting Functional Urban Areas (FUAs): supporting the transition towards more sustainable, integrated and data-driven commuter mobility systems. The project promotes a collaborative governance model involving public authorities, Area Mobility Managers, Company Mobility Managers, transport operators, employers and other territorial stakeholders to improve Home-to-Work mobility while contributing to climate neutrality, reduced transport-related emissions and enhanced accessibility.

Green mobility solutions for Pioneering Actions Towards a Healthy and sustainable commuting

Commuting from nearby places into cities is a major source of urban greenhouse gas emissions and the lack of sustainable mobility options heavily contributes to the problem. The GreenPATH project co-designs smart and green mobility options for students and employees together with mobility managers. More concretely, the partners develop a joint strategy for the integrated governance of commuter flows and draft action plans for functional urban areas. Innovative and collaborative solutions suggested in these plans will be tested and evaluated in three pilot areas.



Figure 1 - GreenPath Project

Rather than developing isolated mobility measures, GreenPATH adopts a systemic approach combining territorial analysis, stakeholder engagement, digital innovation and policy integration. The project aims to strengthen institutional cooperation and evidence-based decision-making through the development of common methodologies, digital tools and governance models capable of supporting long-term sustainable mobility planning. By integrating technical innovation with collaborative governance, GreenPATH seeks to generate solutions that can be transferred and replicated across different Functional Urban Areas in Central Europe.

Following the territorial needs assessment conducted within Work Package 1 (WP1), which analysed commuter mobility patterns, governance arrangements and organisational needs across the participating Functional Urban Areas, Work Package 2 (WP2) aims to co-design, implement and validate innovative pilot actions capable of addressing the mobility challenges identified during the analytical phase. Its objectives are to develop collaborative mobility solutions together with local stakeholders, test new governance approaches under real operating conditions, evaluate their technical and organisational performance through a common monitoring methodology, and generate transferable knowledge supporting both the GreenPATH Strategy and future policy recommendations. Through this approach, WP2 transforms the analytical findings produced in WP1 into concrete operational solutions while demonstrating how digital innovation and institutional cooperation can improve commuter mobility management. To ensure consistency across all pilot actions, GreenPATH established a common implementation methodology



covering the entire pilot lifecycle, including stakeholder engagement, co-design, implementation, monitoring, evaluation and assessment of transferability. This methodological framework enables comparable assessment of technical performance, organisational effectiveness and governance impacts, ensuring that the experience gained within each pilot contributes to a common body of knowledge supporting replication in other Functional Urban Areas.

Within this framework, the Ravenna Functional Urban Area (FUA) was selected as one of the pilot territories for testing new approaches to Mobility Management. The pilot focused on strengthening cooperation among mobility stakeholders and improving the availability and usability of mobility data through the development of a digital coordination platform. In this context, EMMA (Electronic Mobility Manager Application) represents the operational implementation of the WP2 objectives, providing a practical tool to support collaborative Mobility Management, data-driven decision-making and coordinated monitoring of sustainable mobility measures. EMMA is the Mobility Management coordination dashboard developed within the GreenPATH project. The platform provides a shared digital environment supporting the collection, management and analysis of mobility data for Home-to-Work Travel Plans (HTWPs), while enabling coordinated monitoring and decision-making across multiple stakeholders.



Figure 2. Solution 1 objectives

The dashboard addresses one of the main operational barriers to effective Mobility Management: fragmented data collection and limited interoperability among organisations involved in commuter mobility planning. By adopting common data structures, workflows and reporting procedures, EMMA enables the production of consistent and comparable mobility information at both organisational and territorial level.

The platform supports the complete Mobility Management workflow, including employee mobility surveys, Origin-Destination (O/D) matrices, automatic generation of HTWPs, geospatial visualisation of commuting



patterns, statistical reporting and environmental performance indicators. These functionalities provide a common evidence base for Mobility Managers and public authorities responsible for planning and monitoring sustainable mobility measures.

Beyond its analytical functions, EMMA acts as a coordination dashboard supporting information sharing between Area Mobility Managers, Company Mobility Managers, public authorities and transport operators. The platform improves transparency, facilitates monitoring activities and provides a common operational framework for Mobility Management implementation.

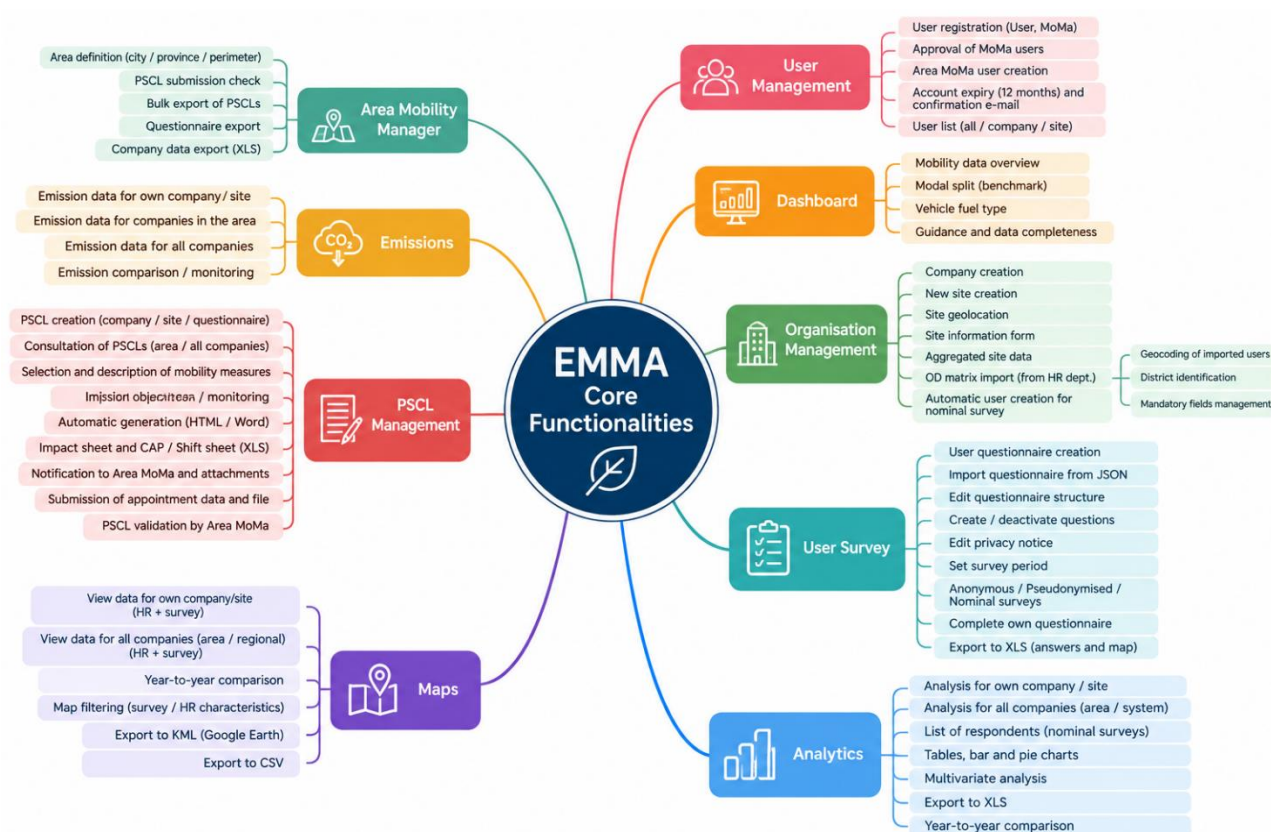


Figure 3. EMMA Sections and functionalities overview

The solution was operationally validated through pilot implementation in the Ravenna Port Area, where its core functionalities - including standardised HTW preparation, automated reporting, geospatial analysis and secure data exchange - were successfully tested in a real operational environment. Although validation was carried out in a single Functional Urban Area, the solution was developed using a modular and configurable architecture specifically intended for replication. The pilot therefore provides evidence of technical feasibility and operational applicability, while the transferability framework presented in this report defines the conditions required for adoption in other territorial contexts.

The development of **GreenPATH Solution 1** was supported by a structured co-design process involving all pilot partners throughout the project. Through a combination of online and in-person peer-review workshops, partners continuously exchanged experiences, validated emerging results and jointly refined the governance, technical and operational components of the Solution. This collaborative approach ensured that Solution 1 was not the outcome of a single pilot, but the result of shared learning and cross-fertilisation among all project partners.



Three co-design sessions were organised during the project:

1. **Ex-Ante Peer-Review Workshop** (26 February 2025 - Online)
Partners reviewed each other's pilot designs using a collaborative assessment tool and provided recommendations to strengthen the baseline configuration, implementation methodology and expected outcomes of all pilot actions.
2. **Interim Peer-Review Workshop** (21 October 2025 - Osijek, Croatia)
Organised by the Lead Partner (ITL), this in-person workshop consisted of structured one-to-one consultation sessions, allowing each pilot partner to discuss its progress with all the others. The objective was to identify transferable practices, discuss implementation challenges and jointly improve the ongoing pilot activities.
3. **Ex-Post Peer-Review Workshop** (25 March 2026 - Online)
During the final peer-review session, partners assessed the completed pilot actions and identified the key elements that should be retained and further developed to transform each pilot into a long-term and transferable solution. The discussion focused on governance arrangements, technical developments, organisational models and policy recommendations, providing the foundation for the final design of **GreenPATH Solution 1**.

Finally, following the testing phase, in July 2026 the platform was presented to the entire consortium during a dedicated meeting aimed at presenting every feature in detail, allowing partners to gain hands-on insight into its actual usage

2. From Pilot Testing to Consolidated Solution

EMMA evolved from a pilot implementation into a consolidated Mobility Management coordination dashboard through a structured process combining technical development, institutional governance, operational testing and progressive integration within the digital ecosystem of the Emilia-Romagna Region. The pilot provided the opportunity not only to validate the platform under real operating conditions but also to consolidate its technical architecture, implementation methodology and integration within a regional digital environment.

The consolidation process was structured into a sequence of interconnected phases. The first phase consisted of a market assessment of available Mobility Management platforms, carried out to identify a solution capable of supporting the operational requirements of the GreenPATH pilot while offering adequate conditions for future institutional adoption and territorial replication. This assessment led to the identification of EMMA, a platform already in use in the Piemonte Region, as the solution most closely aligned with the objectives of the pilot. Following this assessment, the Emilia-Romagna Region and the Piemonte Region signed an institutional agreement for the acquisition and implementation of EMMA under the software reuse framework applicable to public administrations. The agreement established a basis for interregional cooperation in the promotion of sustainable mobility, with particular reference to the digitalisation and coordination of Mobility Management activities. Building on this institutional framework, ITL and the Emilia-Romagna Region formalised a further agreement for the deployment of an EMMA Proof of Concept directly within the regional digital infrastructure. The application was subsequently installed on the regional servers and integrated into the technical and organisational procedures governing the regional ICT environment. The deployment phase was followed by security, accessibility and usability assessments,



functional testing with the participating companies and a dedicated analysis of privacy and GDPR requirements. Feedback generated through these activities was translated into corrective actions and evolutionary developments, addressing both issues identified during operational testing and requirements raised by the Emilia-Romagna Region. This phased process enabled the platform to progress from an initially selected reusable solution to a technically validated and institutionally embedded Mobility Management coordination dashboard.

The pilot was implemented in the Ravenna Port Area between June 2025 and June 2026 under the coordination and management of the Institute for Transport and Logistics (ITL), in collaboration with the Emilia-Romagna Region (associated partner) and the Municipality of Ravenna (associated partner) and with the involvement of several stakeholders: the Ravenna Port Authority, Agenzia Mobilità Romagnola (AMR), Start Romagna, Confindustria Romagna (business association) and twenty port companies. This operational environment represented a complex multi-stakeholder context suitable for validating the platform in conditions representative of Mobility Management activities within a Functional Urban Area. The implementation followed a structured sequence including requirements definition, stakeholder consultation, platform customisation, integration with the regional digital infrastructure, pilot deployment and operational validation. Continuous interaction among Mobility Managers, public authorities, regional ICT services, software developers and technical partners supported the progressive adaptation of the platform, ensuring alignment between technical functionalities, institutional procedures and operational requirements.

A key implementation decision concerned the deployment architecture. Rather than adopting an externally managed cloud-hosted solution, ITL, in agreement with the Emilia-Romagna Region decided to install EMMA directly within regional data centre infrastructure. This approach, led by ITL, maximised the possibility for the future adoption of the platform as the unique digital tool for Mobility Management throughout the regional territory. Furthermore, it allowed the platform to be managed according to the Region's established ICT governance procedures, cybersecurity policies and operational standards, facilitating long-term institutional adoption and ensuring consistency with the digital services already operating within the regional ecosystem. The deployment therefore followed the standard application onboarding process required for software solutions integrated into the regional ICT infrastructure. From an application architecture perspective, EMMA was designed as a web-based solution developed using an open-source technology stack. The platform adopts a layered architecture composed of a backend developed with CakePHP 4, a frontend based on VueJS and a MySQL 8 database management system. The interaction between the different software components is managed through REST APIs, ensuring modularity, maintainability and the possibility of future technological evolution. The main technological components include PHP 8.3, NGINX, MySQL 8 and VueJS 2.x, providing a standardised and interoperable environment consistent with modern web application development practices. The onboarding process started with a formal application intake request and continued through a series of technical workshops involving regional ICT services and the platform developers. These activities were aimed at defining the infrastructure requirements, software architecture, technological dependencies and operational characteristics necessary for deployment. Comprehensive technical documentation was prepared to describe the application architecture, software components, interfaces with other information systems, authentication mechanisms, service availability requirements and technological stack. This documentation constituted the technical profile of the application and provided the reference framework for its lifecycle management within the regional ICT environment.

Software integration was performed according to the secure software development framework adopted by the Emilia-Romagna Region, which is based on secure development lifecycle principles defined by national AgID guidelines. The application security model includes mechanisms for user authentication and access control based on user credentials and OAuth2 protocols. Data transmission is protected through HTTPS



encryption, while sensitive information stored within the database is protected through encryption mechanisms.

The application also adopts a role-based access model, defining different user profiles according to operational responsibilities, including administrator users, company Mobility Managers, namely the professionals responsible for planning, managing and monitoring sustainable mobility measures concerning employees' home-to-work journeys, and Area Mobility Managers, namely the professionals appointed by the competent local authorities to coordinate Company and School Mobility Managers and ensure the integration of organisational mobility plans with territorial transport and sustainable mobility policies. The role-based access model of the platform is reported in the picture below:

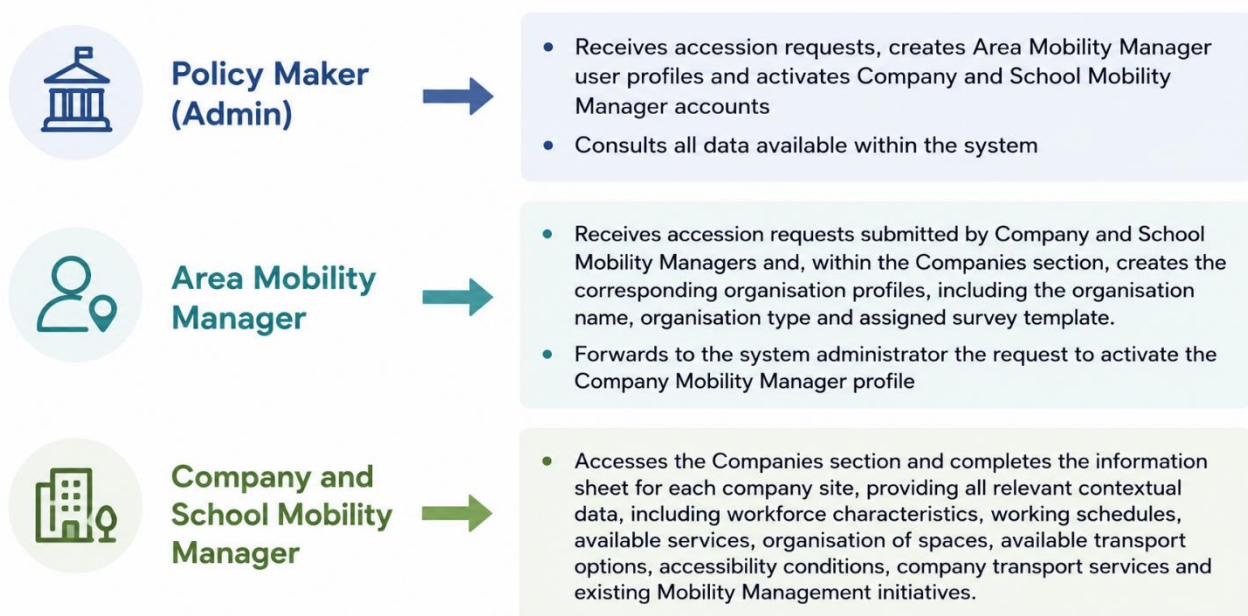


Figure 4 - User profiles

This approach supports the application of the principle of least privilege and ensures that access to platform functionalities is aligned with the specific tasks performed by each user category. Rather than requiring direct source code evaluation, the regional ICT governance process requires software suppliers to demonstrate compliance with predefined development practices through structured technical documentation, security checklists and evidence covering the entire application lifecycle. These materials supported the subsequent verification activities and provided the technical basis for the security assessment. Operational continuity requirements were also considered during the deployment process. The platform configuration includes daily backup procedures with off-server storage and mechanisms supporting disaster recovery through data redundancy and restoration capabilities. These measures contribute to ensuring service availability and reducing the risks associated with infrastructure failures or accidental data loss.

The EMMA platform is organised into a set of integrated functional modules supporting the entire Mobility Management process, from data collection and mobility analysis to the preparation, implementation and monitoring of Home-to-Work Travel Plans (PSCL). Its core functionalities include:

- **User and role management**, including authentication, user registration and differentiated access profiles for Company, Area and School Mobility Managers.



- **Organisation management**, allowing the creation and management of companies, sites and organisational information, together with the import and geocoding of employee data.
- **Mobility surveys**, supporting the design and administration of anonymous, pseudonymised or nominal questionnaires, with configurable privacy settings.
- **Data analytics and dashboards**, providing interactive analyses of commuting patterns, modal split, benchmarking, KPIs and year-on-year comparisons.
- **Geographical analysis**, including interactive maps, origin-destination visualisation, spatial filtering and export of geographic datasets.
- **PSCL management**, supporting the preparation, submission, validation and monitoring of Home-to-Work Travel Plans, together with the automatic generation of reports and supporting documentation.
- **Emission monitoring**, enabling the estimation and comparison of CO₂ emissions associated with commuting patterns.
- **Area Mobility Manager functions**, including territorial management, verification of submitted PSCLs and consolidated export of mobility data and plans for regional and local planning purposes.

The technical assessment included a comprehensive security verification programme conducted under the supervision of the regional ICT infrastructure and cybersecurity teams. An independent third-party organisation performed a grey-box penetration test, in which authenticated access credentials were provided while detailed knowledge of the internal implementation was not disclosed to the assessors. The assessment evaluated the application's exposure to known vulnerabilities and produced a detailed technical report identifying security findings according to their severity level. The results initiated a remediation process during which the development team implemented corrective actions to address the identified issues.

Accessibility and usability represented an additional validation stream. Dedicated assessments evaluated compliance with accessibility requirements and the overall quality of the user interface. The verification process was supported by a dedicated accessibility checklist, used to assess conformity with the requirements applicable to digital services within the public administration context. The resulting reports generated structured feedback on aspects including interface consistency, accessibility compliance and usability improvements. The identified issues were progressively addressed by the development team through successive software revisions, improving both technical robustness and user experience before operational deployment.

Following completion of security, accessibility and technical compliance checks, a dedicated testing environment was activated within the regional infrastructure. This environment enabled functional verification under realistic operating conditions and supported the final acceptance process before production release. During this phase, the platform was integrated with the regional Identity Management infrastructure, enabling authentication through both institutional credentials and the Italian Public Digital Identity System (SPID). These integrations ensured consistency with authentication services already adopted across the regional digital ecosystem and simplified access management for different categories of users.

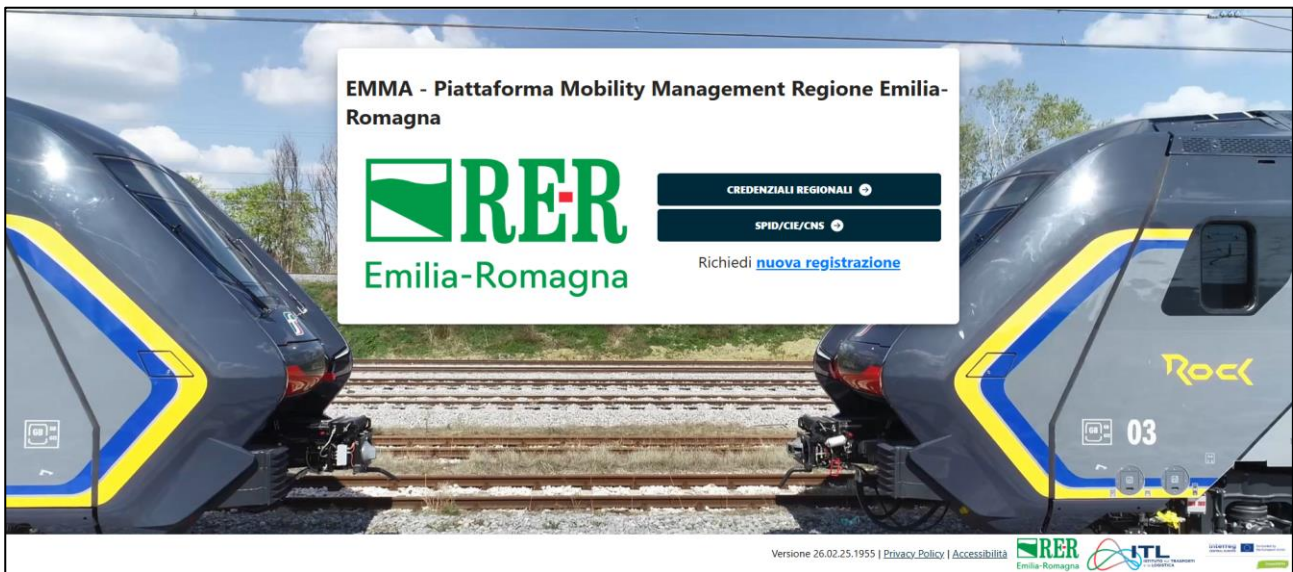


Figure 5 - Emma login page

The validation activities confirmed that the dashboard supports the complete digital workflow required for Mobility Management, from questionnaire administration and data acquisition to the automated preparation of Home-to-Work Travel Plans (HWTPs). The initial configuration of the platform was dimensioned to support approximately 100 users, including concurrent access scenarios, with a database size estimated at around 1 GB. This configuration was considered adequate for the operational requirements of the Ravenna Port Area pilot and provides a scalable basis for future adoption in other Functional Urban Areas. The pilot demonstrated the reliability of the platform's core functionalities, including standardised survey management, harmonised data collection, geospatial analysis, automated reporting, environmental performance indicators and secure authentication through regional digital identity services. Operational testing demonstrated that the platform significantly simplifies Mobility Management activities by automating data collection, processing and reporting procedures. Standardised questionnaires and harmonised datasets reduce administrative effort while ensuring methodological consistency across organisations. At the same time, aggregated and anonymised information enables Area Mobility Managers to analyse mobility patterns across multiple organisations without compromising data protection requirements.

2.1. Legal examination

During the pilot phase, a comprehensive legal analysis was undertaken to establish a robust governance and compliance framework which represents a main outcome of GreenPATH Solution 1. This work focused on three closely interconnected aspects: first, identifying the legal basis for data processing by each stakeholder through the correct legal classification of both the data and the roles of the parties involved; second, translating these legal considerations into operational practice through the preparation of the necessary administrative acts and supporting documentation; and third, developing the participation forms and the technical protocol required to ensure the effective implementation of the system.

The EMMA dashboard is designed as an information system that collects mobility data at its source, within companies and schools, and progressively makes it available, through a structured chain of stakeholders, to the public authorities responsible for mobility and public transport planning. The architecture of this data flow - specifically who processes which data, in what capacity, and at what level of detail - constitutes the core of the legal analysis underpinning the platform.



The review of the legal framework at the start of the pilot showed that, although the regulatory structure was sound in terms of the allocation of roles, it presented two main issues that could have undermined its compliance with data protection requirements.

An important outcome of the pilot was that the legal analysis produced not only technical recommendations but also legally effective instruments. The legal assessments, governance framework and supporting documentation developed during the pilot were formally endorsed by the Emilia-Romagna Region through **Regional Executive Determination No. 12953 of 1 July 2026**. This formal adoption demonstrates how the pilot results were translated into an operational and institutional framework, providing a legally robust basis for the implementation and future deployment of the EMMA platform across the region.

The first aspect addressed by the legal analysis concerned the correct classification of the data. The information collected by Company Mobility Managers for the analysis of home-to-work travel had previously been described as “anonymous”, with the postcode used as the standard geographical unit of disaggregation. The analysis concluded, and provided the legal reasoning to support this conclusion, that such a classification conflates two distinct concepts: data aggregation, or geographical generalisation, and anonymisation.

Under the concept reflected in Recital 26 of the GDPR and consistently applied by the Court of Justice of the European Union, data may be considered anonymous only where there are no means reasonably likely to be used to identify the data subject. This is a relational and contextual test, rather than an intrinsic characteristic of an individual data field. Within a company context, such means of identification are structurally available. Employers hold complete employee records, including residential address, tax identification number, workplace, working hours and job role. Surveys are generally distributed through individual links or authentication systems. More importantly, the combination of workplace, job role, working time slot, residential postcode and transport mode may, in many cases, allow individuals to be re-identified, particularly in small workplaces or low-density areas. Therefore, even in the absence of direct identifiers, the data remain attributable to an identifiable person and must be regarded as personal data rather than anonymous data. The practical consequence of this clarification is not merely terminological. Incorrectly classifying personal data as anonymous would remove the processing, from the outset, from the safeguards provided by the GDPR, including the requirement for a legal basis, transparency obligations, data-subject rights and appropriate security measures. This initial error would consequently affect the legality of the entire processing chain.

The analysis therefore proposed a three-stage data-classification process:

- **personal data**, held internally by the entity acting as controller at the data-collection stage;
- **pseudonymised data**, used for internal circulation and controlled data transfers;
- **anonymous or aggregated data**, limited to outputs from which any reasonable possibility of re-identification has effectively been removed, and which may therefore be shared with actors responsible for coordination and mobility planning.

The fact that the final output is aggregated does not alter the personal nature of the data processing carried out at the earlier stages.

The second strand of the legal analysis concerned the application of the data minimisation principle. This principle does not require data to be reduced to the absolute minimum in abstract terms; rather, it requires data to be “adequate, relevant and limited to what is necessary” in relation to the purposes of the processing. The relevant benchmark is therefore fitness for purpose, not reduction for its own sake. In this context, the purpose is not the use of the postcode as such, but the design and implementation of effective



measures to reduce the environmental impact of commuting. These measures may include dedicated shuttle services, agreements with public transport operators, car-pooling schemes, cycling infrastructure, the identification of parking and pick-up points, and the assessment of alternative workplace locations.

For many of these measures, postcode-level data are too coarse. In medium-sized and large municipalities, a single postcode may cover neighbourhoods with very different characteristics, non-comparable cycling distances and significantly different levels of access to public transport. Where a proposed measure requires a level of detail below the postcode scale (e.g. assessing the feasibility of a dedicated shuttle route, identifying ride-sharing hubs, or calculating the cycling catchment area within a given distance from a workplace) street-level, sub-municipal or coordinate-based data may be necessary and proportionate.

Arguing otherwise would mean imposing, in the name of privacy, a form of minimisation that reduces the mobility plan to a purely formal compliance exercise. This would undermine both the statutory purpose of the plan and, paradoxically, the principle of minimisation itself, which is intended as a test of adequacy rather than a requirement to sacrifice data utility.

On this basis, a two-tier model was proposed to reconcile data minimisation with operational effectiveness:

- **At internal level**, the Company Mobility Manager, acting under the responsibility of the employer as data controller, processes data at a level of granularity proportionate to the measures actually envisaged in the mobility plan, including precise residential location, geographical coordinates and detailed working-time information.
- **At external level**, when data are shared with the Area Mobility Manager, the Region or public transport operators, they circulate exclusively in aggregated or pseudonymised form, with cell-suppression rules applied to ensure compliance with defined k-anonymity thresholds.

Under this model, data granularity is determined by the purpose of the processing, while detailed data remain at all times within the responsibility and control of the entity that originally collected them.

The third component concerns the definition of the governance architecture for the controllership of, and responsibility for, personal data processing.

The allocation of roles follows a two-tier structure:

- **The Emilia-Romagna Region acts as an independent data controller** for the data falling within its own remit, including the accreditation of Mobility Managers, aggregated data used for planning purposes, and data required for the operation of the portal.
- **At the same time, the Emilia-Romagna Region acts as a data processor pursuant to Article 28 GDPR**, appointed by companies and municipalities exclusively for the technical management of the platform, including authentication, technical operation, updates and data storage. These activities are carried out within the limits of the documented instructions provided upon accession to the platform, as set out in Annex 5 to the Guidelines.
- **Companies, schools and municipalities act as independent data controllers** for the data uploaded to the platform in connection with the activities of their respective Mobility Managers.

The proper implementation of this framework requires a strict separation, including at architectural level, between the processing activities carried out by the Region as data controller and those carried out in its capacity as data processor, supported by separate traceability mechanisms and access logs. This separation is not merely formal. It ensures that, for planning purposes, the Region operates exclusively on anonymised



and aggregated data, while the technical and operational processing remains strictly limited to the documented instructions issued by each data controller.

The legal classifications outlined above would not be effective without a corresponding technical implementation capable of making them binding within the operation of the platform. The two-tier model – personal data remaining within the perimeter of the data controller that collects them, and only anonymous and aggregated data being made available to all other actors – was therefore translated into a coordinated set of technical and organisational measures. These measures were subsequently formalised in the **Technical Security Protocol for the operation of EMMA Emilia-Romagna**.

The core principle governing the data flow is that data may be processed in identifiable form, and at the level of granularity required, only within the responsibility and control of the organisation that collects them. When data are made available to other actors, they circulate exclusively in transformed form. The progressive transformation of data from identifiable to anonymous is ensured through a combination of complementary techniques:

- **Geohashing of location data.** Residential locations, origins and destinations are not transmitted as exact addresses or precise coordinates. Instead, they are converted into alphanumeric strings representing geographical cells of calibrated size. By shortening the Geohash string, the location can be progressively generalised – from an exact point to a wider neighbourhood-level area – thereby preventing the identification of a specific address while preserving the statistical value required for origin-destination matrix analysis.
- **Generalisation of potentially identifying variables.** Exact values, such as specific working times or ages, are replaced with broader time bands and age groups.
- **Statistical aggregation.** Only collective indicators, including totals, averages, percentages and distributions by area or category, are made available, rather than information relating to individual data subjects.
- **Cell suppression based on k-anonymity.** In outputs made available to actors other than the original data controller, values are suppressed where the combination of workplace, geographical cell, transport mode and time band relates to fewer data subjects than a predefined threshold, k . This measure is designed to prevent indirect re-identification, particularly in low-density areas.

These measures are complemented by encryption both in transit and at rest, access monitoring through separate logs for activities performed in the capacity of data controller and data processor, strong authentication through Italian digital identity systems such as SPID, CIE and CNS, segregated authorisation profiles, and a prohibition on transferring data outside the European Union.

The spatial resolution of the Geohash is calibrated in relation to the applicable k-anonymity thresholds. It is precisely through the combined use of these two parameters – geographical resolution and aggregation threshold – that the model reconciles the effectiveness of mobility planning with the protection of data subjects.

From an accountability perspective, the analysis also recommended carrying out a **platform-level Data Protection Impact Assessment (DPIA)**. This recommendation reflects the fact that the processing meets criteria identified in the Article 29 Working Party Guidelines WP248, particularly those relating to systematic monitoring and the regular processing of geolocation data. A modular DPIA template was also proposed for accredited data controllers, with the aim of ensuring economies of scale and a consistent assessment approach across the Emilia-Romagna Region.



A particularly significant outcome of the pilot embedded in the Solution 1 is the development of a comprehensive legal, administrative and technical documentation package that translates these principles into operational and enforceable arrangements. The package includes:

1. a technical and legal opinion on the EMMA Emilia-Romagna platform, defining privacy responsibilities and permitted uses for each category of actor;
2. a platform-level Data Protection Impact Assessment under Article 35 of the GDPR;
3. a standard Article 13 GDPR privacy notice for employees, to be adapted by participating organisations, including differentiated legal bases and the two-tier data-flow model;
4. a Technical Security Protocol for the operation of EMMA Emilia-Romagna, formally adopted by the Emilia-Romagna Region through Executive Determination No. 12953 of 1 July 2026 as an annex to the regional guidelines;
5. updated platform-access and participation templates for Company and District Mobility Managers, Area Mobility Managers and School Mobility Managers;
6. the Emilia-Romagna Region's Executive Determination No. 12953 of 1 July 2026, formally approving the Technical Security Protocol and the revised participation templates.

The value of this package goes beyond the regional pilot. It provides a ready-to-adapt governance framework through which other Italian and European Regions and Functional Urban Areas can implement comparable Mobility Management platforms without having to develop the legal, organisational and technical arrangements from scratch. Its transferability is strengthened by its basis in GDPR concepts and safeguards common across the European Union, while leaving sufficient flexibility for adaptation to different institutional and territorial contexts.

The pilot also confirmed that successful implementation depends not only on technical performance but equally on organisational readiness and effective governance arrangements. Continuous interaction among Mobility Managers, regional ICT services, software developers, and institutional stakeholders proved essential throughout the implementation process, enabling technical requirements, accessibility needs, and operational procedures to be addressed collaboratively. The experience highlighted several implementation challenges. Procurement and administrative procedures affected the timing and sequencing of certain technical activities, particularly where coordination among institutional actors and formal agreements were required. Participating organizations also applied heterogeneous Mobility Management practices, used different data collection methods and presented varying levels of experience in preparing Home-to-Work Travel Plans. In some cases, limited internal resources or the absence of established Mobility Management procedures increased the support required during onboarding and data preparation. Additional complexity derived from the operational characteristics of the port area, including dispersed workplaces, different company sizes, multiple working schedules and shift-based mobility patterns. These factors required continuous coordination and progressive adaptation of survey structures, analytical functions and implementation procedures. These lessons contributed to improvements in usability, interoperability, data governance and deployment methodology, while strengthening onboarding procedures, governance arrangements and capacity-building activities for future implementations.

The outcome of this process is a consolidated Mobility Management coordination dashboard, and related legal documentation, combining standardised data collection, automated PSCL preparation, harmonised reporting and secure information sharing within a single digital environment. The operational version of the platform developed within the pilot is available online through the Emilia-Romagna Region digital environment at: <https://emma.regione.emilia-romagna.it/dashboard>. The reuse agreement subsequently signed with the Emilia-Romagna Region demonstrates that EMMA has progressed beyond a project pilot towards stable institutional adoption. Although some operational configurations remain specific to the Ravenna Port Area, particularly those reflecting local stakeholders and mobility demand characteristics, the



core software architecture, data model, implementation workflow, ICT governance process and deployment methodology are independent of the pilot context and can be fully replicated in other Functional Urban Areas with limited configuration effort.

3. Value Proposition and Strategic Added Value

The strategic value of EMMA lies in its ability to provide a shared Mobility Management coordination dashboard that supports evidence-based decision-making through harmonised mobility data, standardised workflows and integrated monitoring. By replacing fragmented practices with a common digital environment, the platform improves coordination between public bodies in charge of mobility planning at different territorial level, private companies and schools, operating within the same Functional Urban Area (FUA).

The platform has been designed to support the operational needs of different stakeholder groups while maintaining a common data environment and governance framework.

- Public authorities gain access to harmonised mobility information that supports policy design, territorial monitoring and evaluation of sustainable mobility measures across multiple organisations.
- Area Mobility Managers are provided with a digital coordination dashboard supporting survey management, monitoring of PSCL implementation, analysis of Origin-Destination patterns and assessment of mobility indicators at territorial level.
- Company Mobility Managers benefit from the automation of data collection and PSCL preparation, reducing administrative effort while ensuring consistency with national Mobility Management guidelines. Standardised workflows also improve comparability between organisations.
- Transport operators can use aggregated commuting patterns to better align transport services with actual mobility demand.
- Companies benefit from structured decision-support tools that facilitate sustainable mobility planning and contribute to broader corporate sustainability, employee welfare and organizational efficiency objectives. By simplifying survey administration, data analysis and the preparation of Home-to-Work Travel Plans, EMMA also lowers the operational barriers for companies that are not subject to mandatory Mobility Management requirements, including organizations with fewer than 100 employees. These companies can access a structured methodology and prepare a voluntary Home-to-Work Travel Plan without having to develop dedicated procedures or digital tools independently. The shared territorial framework also facilitates the creation of networks among companies addressing similar commuting needs. By identifying common mobility patterns and recurring operational requirements, EMMA supports cooperation on measures that may be difficult to implement at individual company level, such as shared transport services, coordinated actions with public transport operators or joint initiatives for sustainable commuting. Employees benefit indirectly from mobility measures developed on the basis of more reliable evidence and stronger cooperation among organizations operating within the same territory.

The dashboard generates a consistent set of analytical outputs – including Origin-Destination matrices, modal split indicators, georeferenced maps, statistical reports, and environmental assessments – that support operational monitoring and strategic planning. Standardised indicators also enable longitudinal analyses and comparisons across organisations and reporting periods. By introducing common methodologies, indicators and reporting formats, EMMA improves data quality and reduces fragmentation in Mobility Management practices.

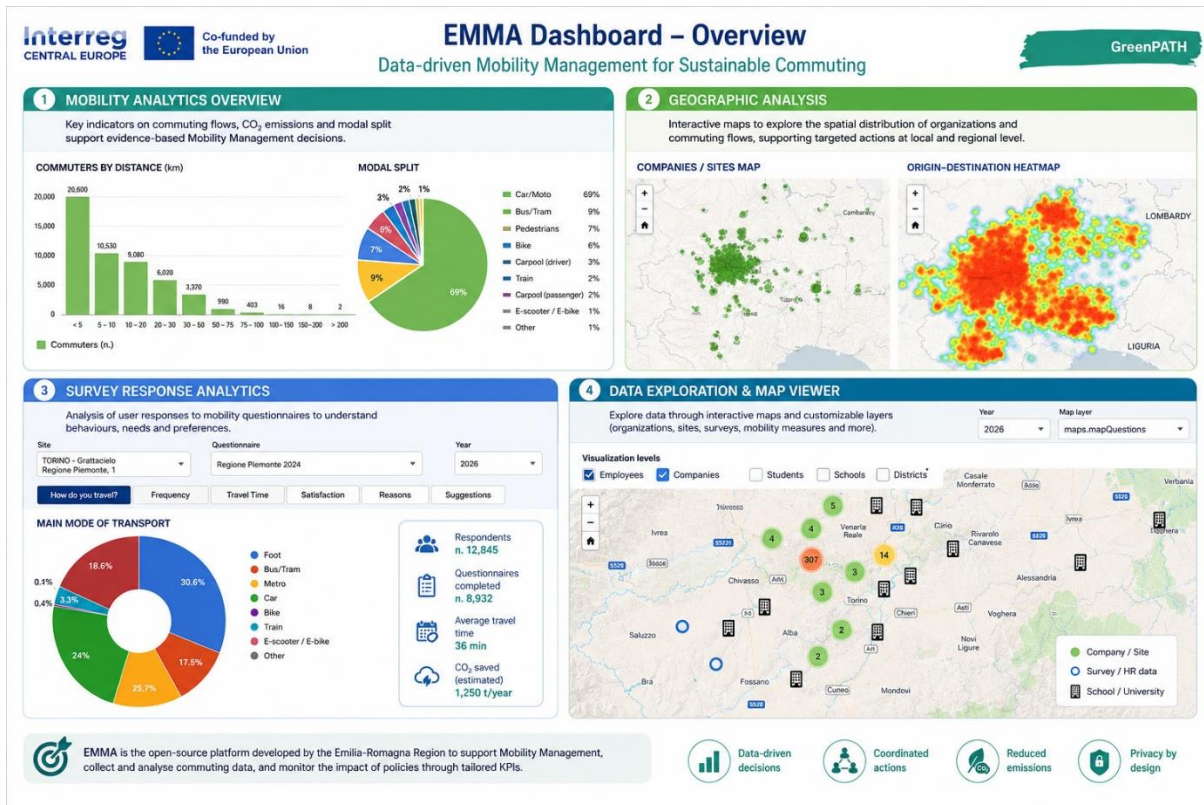


Figure 6. EMMA Dashboard - GreenPATH Solution 1

The platform also strengthens coordination between Company Mobility Managers, Area Mobility Managers and public authorities, facilitating integrated governance of commuter mobility within Functional Urban Areas. An additional strategic value derives from the platform's governance model, which enables territorial mobility analyses without requiring centralised access to identifiable employee information. By separating operational data management from aggregated analytical functions, EMMA allows different institutional actors to collaborate on a shared evidence base while maintaining clear allocation of data responsibilities. This approach increases confidence among participating organisations and reduces barriers to data sharing that often limit inter-organisational Mobility Management initiatives.

Automation of data processing, geocoding, reporting and PSCL generation reduces manual activities and improves operational efficiency. Traceability mechanisms and system logging further enhance transparency and accountability throughout the Mobility Management process. The principal added value of EMMA is the creation of a single, structured mobility data environment supporting multiple organisations through common standards and shared information. This enables more reliable territorial analyses, improves the consistency of Mobility Management activities and establishes a stronger evidence base for future policy development. Its contribution to regional policy objectives is addressed in Chapter 8.

3.1. Geohashing: a Privacy-by-Design Enhancement Emerging from the Pilot

One of the most significant technical developments introduced during the pilot activities was the implementation of Geohash-based spatial aggregation within the EMMA platform. This enhancement originated from one of the key challenges identified during the pilot activities: reconciling the need for sufficiently detailed commuting data to support Mobility Management with the protection of employees' personal data under the GDPR.



The legal and technical analyses carried out during the pilot showed that postcode-level information was often too coarse to support effective mobility planning, while the use of precise residential addresses or geographic coordinates significantly increased the risk of identifying individual workers. Addressing this issue required the development of a technical solution capable of preserving the analytical value of mobility data without exposing personal information.

To meet this requirement, EMMA introduced a privacy-by-design geohashing mechanism, whereby residential locations and origin-destination points are converted into geographical cells rather than stored or shared as exact coordinates. The spatial resolution of these cells can be calibrated according to the analytical needs and combined with aggregation and k-anonymity thresholds, ensuring that detailed data remain exclusively within the organisation acting as data controller, while only anonymised and aggregated information is made available for territorial analysis and policy planning.

The adoption of geohashing therefore represents not only a technical enhancement of the EMMA dashboard but also one of the main innovations generated through the GreenPATH pilot. It demonstrates how legal requirements and operational needs can be effectively combined to support evidence-based Mobility Management, while ensuring full compliance with European data protection principles.

Geohash is a geocoding system that represents a geographic location (latitude and longitude) as an alphanumeric string. The longer the string, the higher the spatial precision; shorter strings correspond to larger geographical areas.

The underlying principle is straightforward. The Earth's surface is considered as the starting point (level 0). It is divided into rectangular cells and each additional Geohash character progressively refines the previous cell, reducing its size and increasing location precision.

Geohash length	Approximate cell size	Typically used in:	Used in EMMA
4 characters	39.1 km × 19.5 km		
5 characters	4.9 km × 4.9 km		
6 characters	1.2 km × 0.6 km		
7 characters	150 m × 150 m	Neighbourhood or street-block level analysis	

Table 1. EMMA's positioning compared to geohash precision levels

Using a 6-character Geohash, EMMA does not identify an exact address or location, but rather a geographical area that is sufficiently large to protect individual privacy while remaining sufficiently precise to support mobility planning. Compared with postcode-based analysis, this level of spatial resolution enables more meaningful origin-destination analyses and supports the design of effective commuting measures, such as shuttle services, shared mobility schemes and cycling infrastructure.

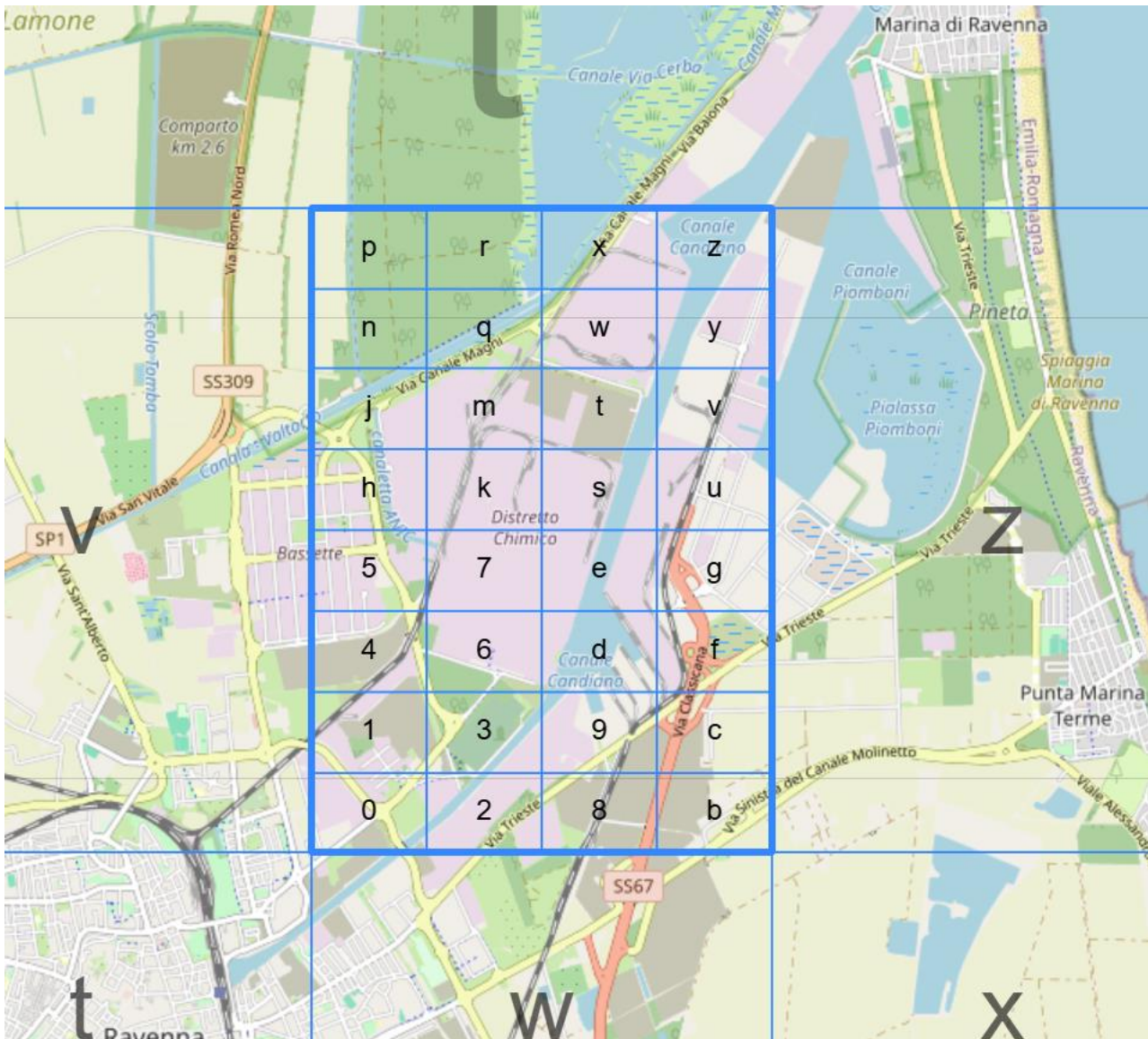


Figure 7. Example: <https://geohash.softeng.co> (area surrounding the Ravenna port).

4. Impact Assessment

The pilot implementation of EMMA in the Ravenna Functional Urban Area (FUA) provided evidence of the platform's operational feasibility and its capacity to improve Mobility Management processes. The assessment distinguishes between impacts directly observed during the pilot and impacts expected from wider deployment.

The pilot demonstrated that a shared digital dashboard could strengthen coordination between the organisations involved in Mobility Management. The implementation established a common operational framework involving the Emilia-Romagna Region, the Municipality of Ravenna, the Port Authority, AMR, Start Romagna and participating companies.

Observed governance impacts include:



- standardisation of Mobility Management workflows;
- improved coordination between Area Mobility Managers and Company Mobility Managers;
- availability of harmonised mobility information for territorial monitoring;
- creation of a structured process for sharing mobility data while preserving privacy.

These outcomes were directly observed during pilot implementation and represent validated evidence of improved governance capacity.

At organisational level, the pilot confirmed the feasibility of replacing fragmented manual procedures with a standardised digital workflow. Participating organisations were able to collect, process and analyse commuting data through a common operational environment.

The main organisational impacts observed were:

- simplified data collection;
- automated PSCL preparation;
- reduction of manual processing activities;
- improved consistency of mobility datasets;
- availability of standard analytical outputs.

These improvements reduced administrative effort while increasing the quality and comparability of mobility information.

The pilot demonstrated the value of harmonised mobility data for supporting operational and strategic decision-making. Standardised datasets enabled more reliable analysis of commuting patterns and facilitated the identification of mobility priorities at company and territorial level.

The dashboard provides:

- Origin-Destination analysis;
- modal split indicators;
- georeferenced visualisations;
- environmental performance indicators;
- standard statistical reporting.

These outputs improve the evidence base available to Mobility Managers and public authorities for planning sustainable mobility measures.

A clear distinction should be made between impacts validated during the pilot and impacts expected from future deployment.

The following outcomes were directly demonstrated:

- functioning of the dashboard;
- successful integration of multiple stakeholders;
- standardised data collection;
- automated reporting;
- creation of a harmonised mobility dataset;
- improved coordination processes.



The following impacts are expected as adoption expands beyond the pilot area:

- regional harmonisation of Mobility Management practices;
- wider availability of comparable mobility datasets;
- stronger support for regional transport planning;
- increased adoption by Area Mobility Managers across Emilia-Romagna;
- improved coordination between neighbouring Functional Urban Areas.

These expected impacts are supported by the technical characteristics of the platform, that, due to its modular structure, can be transferred and replicated in different contexts without starting from scratch. The Emilia-Romagna Region has already officially decided to adopt the platform as the standard tool for Mobility Management at a regional level. To implement this, the Region has actively engaged all 13 Area Mobility Managers across the territory. The response has been highly positive: 5 out of 13 already expressed formal commitment to adopting EMMA for the 2026 Home-to-Work Travel Plan campaign and started the onboarding process, while the remaining half are scheduled to come on board in 2027.

5. Transferability and Replication Framework

The transferability of the EMMA Mobility Management Platform depends on a combination of institutional, technical, organizational and data governance conditions enabling its adoption in different Functional Urban Areas (FUAs). To support deployment across the Emilia-Romagna territory, the Region established a formal administrative and regulatory framework following the agreement with the Piemonte Region for the reuse of the EMMA software. This framework includes regional Guidelines governing platform use, standard application procedures for the different categories of Mobility Managers, a data processing agreement and a technical specification defining security requirements, information flows and access responsibilities. Together, these instruments provide a structured implementation package supporting institutional adoption and replication beyond the original pilot context.

Although validated in a single functional urban area, EMMA was conceived from the beginning as a transferable governance model. Its core components, including data structures, operational workflows, user roles and governance principles, are designed to be replicated while allowing configuration according to different territorial conditions. Replication does not require the reproduction of the Ravenna implementation model in its entirety, but rather the adoption of a common framework that can be adapted to the institutional, organisational and technological characteristics of each territory. The replication of EMMA requires a stable institutional framework involving the public authorities responsible for Mobility Management coordination at regional and territorial level.

The governance model identified during the pilot is based on three main functions: system governance, territorial coordination and operational implementation. These functions can be assigned to different institutional actors depending on the administrative organisation of each territory. In the Ravenna implementation context, the Emilia-Romagna Region acts as system administrator, while Area Mobility Managers coordinate activities at territorial level and Company, School and District Mobility Managers support operational implementation. This structure represents a transferable governance principle rather than a fixed organisational model. Different regions or FUAs may assign these responsibilities to different actors provided that clear ownership, coordination and data management responsibilities are defined. Replication also requires formal cooperation mechanisms between public administrations and participating organisations.



In the GreenPATH pilot, long-term adoption was supported by an agreement for software reuse between public administrations, developed according to national administrative procedures. Such agreements represent an important enabling condition for transferability, as they provide a legal and organisational basis for platform adoption beyond the project context.

EMMA is based on an open-source, modular and scalable web architecture designed to support adaptation to different institutional environments. From a technical perspective, replication requires a secure hosting environment, adequate cybersecurity measures, and compatibility with existing digital infrastructures operated by public administrations.

The platform architecture is composed of separate functional layers, including user interfaces, application services, database management components and analytical functionalities. This modular structure facilitates maintenance, scalability and future integration with additional digital services.

Interoperability is supported through standardised data structures and secure communication protocols. In the GreenPATH implementation, data exchange relies on XML-based structures, while communication between system components is protected through HTTPS protocols using TLS 1.2 or higher.

Authentication mechanisms can be adapted according to the digital identity systems available in each territory. In Emilia-Romagna, access is supported through national digital identity systems (SPID, CIE and CNS) for external users and institutional credentials for internal operators.

These technical components are not dependent on the specific pilot context and can be configured according to the digital infrastructure available in different regional or local administrations.

A key element for replication is the definition of clear data governance procedures ensuring both analytical usability and compliance with data protection requirements.

EMMA adopts a dual-level data governance model in which identifiable mobility information remains under the responsibility of the organisation collecting the data, while exchanges between different actors rely exclusively on anonymised and aggregated datasets. This approach represents one of the main transferable elements of the solution, as it allows territorial-level mobility analysis without requiring central storage of individual mobility records. The platform applies aggregation and anonymisation mechanisms, including geospatial encoding techniques and suppression procedures, to prevent identification of individual users while maintaining the analytical value of mobility datasets.

Access rights are structured according to user responsibilities, with differentiated permissions for regional administrators, Area Mobility Managers and organisation-level Mobility Managers.

Replication therefore requires:

- clearly identified data controllers and processors;
- defined access responsibilities;
- compliance with GDPR principles;
- documented allocation of controller and processor responsibilities, together with standardised information notices and procedures supporting the exercise of data subject rights;
- common procedures for data collection, processing and sharing.

Under the Emilia-Romagna governance framework, each accredited organization remains an independent data controller for the information collected and processed within its own Mobility Management activities.



The Emilia-Romagna Region acts as an independent controller for data falling within its institutional competence and is designated by participating organizations as data processor pursuant to Article 28 GDPR, exclusively for the technical management, operation and maintenance of EMMA RE-R. This allocation of responsibilities is formalized through the data processing agreement accompanying the platform accession procedure.

These requirements are organisational and regulatory conditions for successful adoption rather than technical limitations of the platform. Experience gained during implementation also demonstrated that transferability benefits from the early preparation of privacy and governance documentation, including clearly defined roles, information notices, access policies and technical operating procedures. Although these organisational artefacts are not software components, they facilitate institutional adoption by reducing legal uncertainty and accelerating onboarding activities.

Successful replication depends not only on technical deployment but also on the organisational readiness of the actors involved.

Mobility Managers must have adequate capacity to manage digital mobility datasets, coordinate data collection activities and use analytical outputs for the preparation and monitoring of Mobility Plans.

The pilot highlighted the importance of:

- structured onboarding procedures;
- training activities;
- methodological guidance;
- continuous support during initial adoption phases.

The digitalisation of mobility management processes requires a transition from fragmented and manual practices towards standardised data collection and reporting workflows. This transition may require organisational change, particularly in contexts where Mobility Management activities are not yet fully institutionalised or where dedicated personnel are not available.

The GreenPATH pilot identified several factors that may influence replication in other territories. Administrative procedures represent a potential barrier, particularly when software reuse requires coordination between different public administrations.

Additional challenges may include:

- heterogeneous Mobility Management practices among organisations;
- limited availability of structured mobility data;
- different levels of digital maturity among users;
- coexistence with existing proprietary mobility management solutions.

These elements do not represent limitations of the EMMA model itself, but conditions that should be addressed during deployment planning. Replication strategies should therefore include preliminary assessment of territorial readiness, stakeholder engagement and capacity-building actions.

Although some elements of EMMA were developed according to the characteristics of the Ravenna Port Area, the core model is independent from the specific pilot context.

Transferable components include:



- the digital workflow for Mobility Management;
- standardised data collection procedures;
- analytical methodologies;
- governance principles;
- role-based access mechanisms.

Adaptation is mainly required for territorial characteristics, stakeholder configuration and available digital infrastructures. One example concerns employee mobility surveys, which constitute the primary source of mobility information within the platform. The overall survey methodology is defined through guidelines prepared by the Area Mobility Manager, while individual organisations may request additional questions to address specific operational needs. To preserve the comparability of mobility information across organisations, a coordinated governance approach defines a common core dataset that remains mandatory for all participating organisations, while allowing supplementary questions where required. Different survey templates may therefore coexist within the same territory, provided that the common information necessary for territorial analyses and monitoring is consistently maintained. For example, industrial areas with dispersed workplaces and complex shift patterns may require specific configuration of survey structures and analytical indicators, while metropolitan areas may require integration with broader urban mobility datasets. The modular design of EMMA allows such adaptations without altering the underlying governance logic of the system.

The GreenPATH pilot provided evidence that EMMA has moved beyond a prototype stage towards a structured and transferable solution. The formal agreement with the Emilia-Romagna Region for platform reuse represents an important step towards institutional adoption. The expressed interest of area mobility managers in future deployment activities further supports the potential for regional scaling. This process has already evolved beyond the pilot phase through the establishment of a national community of platform users and public authorities interested in adopting EMMA. The community provides a permanent forum for exchanging operational experience, discussing future developments and sharing improvement proposals, thereby supporting the continuous evolution of the platform while preserving a common governance framework. This collaborative approach further strengthens the replicability of the solution by allowing future deployments to benefit from the experience accumulated during previous implementations. However, replication in additional territories will require validation through further implementations.

The current evidence demonstrates technical feasibility, organisational applicability and governance compatibility, while large-scale impacts will need to be assessed through future deployment experiences.

Overall, EMMA can be considered a transferable Mobility Management governance model whose adoption depends on the alignment of institutional commitment, technical infrastructure, data governance procedures and organisational capacity.

6. Governance and Implementation Model

The EMMA Mobility Management Platform is governed through a multi-level institutional model designed to ensure operational continuity, accountability and long-term integration within Mobility Management processes. The governance model defines how responsibilities are distributed among public authorities, territorial coordinators and operational users, ensuring that the platform functions as a structured governance tool rather than as a stand-alone digital application.

The implementation model is based on three fundamental principles:

- clear ownership and management responsibilities;



- structured coordination among different stakeholder levels;
- controlled management and sharing of mobility data.

This approach ensures that digitalization is supported by an organizational framework capable of maintaining the system beyond the project implementation phase.

The Emilia-Romagna Region acts as the institutional reference authority for EMMA implementation and manages the platform as a regional Mobility Management coordination instrument. The platform is hosted within regional digital infrastructures, ensuring alignment with public administration IT requirements and continuity of service. Hosting management, system maintenance and technical evolution are ensured through the regional digital infrastructure framework, while operational governance remains under the responsibility of the designated administrative authority. Within this framework, the Region performs the role of system administrator, ensuring:

- management of user activation procedures;
- maintenance of the overall system configuration;
- coordination of territorial users;
- supervision of data governance procedures.

The regional role does not replace the responsibilities of individual data owners, but provides the organisational framework required to ensure consistent platform management.

The adoption of EMMA is further supported by institutional agreements allowing software reuse between public administrations, providing a structured mechanism for long-term deployment and maintenance.

The EMMA governance model reflects the institutional organisation of Mobility Management activities through three main user categories.

- The Emilia-Romagna Region acts as the system administrator and is responsible for overall platform governance. Its responsibilities include:
 - managing user registration and activation processes;
 - creating and managing Area Mobility Manager profiles;
 - defining territorial areas of competence;
 - ensuring consistency of system configurations;
 - supervising overall data governance procedures.

The regional administrator ensures system coherence and provides the institutional reference point for platform evolution.

- Area Mobility Managers represent the territorial coordination level between regional governance and individual organisations. Their responsibilities include:
 - coordinating participating companies and institutions;
 - supporting onboarding activities;
 - managing territorial mobility information;
 - validating Mobility Plans;
 - monitoring implementation of mobility measures.



The area mobility manager plays a central role in transforming individual organisational data into territorial knowledge supporting mobility planning. Through EMMA, Area Mobility Managers can access aggregated mobility information and analytical outputs supporting territorial evaluation.

- Company, School and District Mobility Managers are responsible for operational implementation. Their main tasks include:
 - collecting and updating mobility information;
 - managing internal mobility surveys;
 - preparing Home-to-Work and Home-to-School Travel Plans;
 - providing structured data required for analysis.

Within this framework, employee mobility surveys are managed according to methodological guidelines defined by the Area Mobility Manager. While organisations retain the possibility of introducing additional questions reflecting their specific mobility needs, data collection is structured around a common set of core information to ensure consistency and comparability across the territory.

Companies are responsible for ensuring the quality and completeness of organisational information, including workforce characteristics, working patterns and mobility needs. Their role is essential for ensuring that the platform remains connected to real mobility behaviours and operational requirements.

Coordination within EMMA is based on a structured interaction between institutional and operational stakeholders.

The platform supports a common digital workflow connecting:

- regional authorities;
- Area Mobility Managers;
- companies and institutions;
- transport stakeholders.

The main function of the governance model is to reduce fragmentation between actors that traditionally manage mobility data through different procedures and formats.

Coordination is reinforced through:

- regional operational guidelines;
- institutional agreements;
- stakeholder meetings;
- technical support activities;
- training and onboarding processes.

During the Ravenna pilot, coordination activities involved public authorities, transport operators, business associations and companies operating within the port area. This experience demonstrated that active coordination structures are necessary to ensure continuous data flow and effective use of the platform.

Data management follows a distributed responsibility model:



- Company and institutional Mobility Managers are responsible for collecting mobility information from their users and ensuring data quality at source.
- Employees contribute by providing information through structured mobility surveys.
- Area Mobility Managers are responsible for reviewing aggregated information and using analytical outputs for territorial planning purposes.
- The regional administrator ensures consistency of the overall system and manages access permissions.

EMMA does not require centralisation of all raw mobility data. Instead, it enables controlled sharing of aggregated information while preserving the responsibility of individual data owners. External data exchange is based on anonymised and aggregated datasets. This approach ensures that data protection principles are integrated into the operational governance model of the platform. To support this governance model, access to information is aligned with institutional responsibilities through role-based authorisation mechanisms. Individual organisations retain access to identifiable data strictly required for operational Mobility Management activities, whereas Area Mobility Managers and regional authorities operate on aggregated analytical datasets generated by the platform. This allocation of responsibilities strengthens accountability, facilitates regulatory compliance and enables coordinated territorial planning without requiring the centralisation of personal information.

EMMA supports continuous monitoring of Mobility Management activities through both technical and operational indicators.

System monitoring includes:

- user access tracking;
- activity logging;
- verification of system operations;
- monitoring of data processing activities.

Logging mechanisms support security, traceability and auditability of platform operations.

From a Mobility Management perspective, the platform supports monitoring through:

- analysis of mobility indicators;
- comparison of mobility patterns over time;
- evaluation of implemented measures;
- monitoring of Home-to-Work and Home-to-School Travel Plans.

Area Mobility Managers can use analytical outputs to assess changes in commuting behaviours and evaluate the effectiveness of mobility measures.

The monitoring function transforms EMMA from a data collection tool into a continuous policy support instrument. EMMA is designed to become an integrated component of the Mobility Management governance framework rather than an isolated digital solution.

At regional level, the platform supports coordination between institutional actors and provides a common operational framework for Mobility Management activities. The alignment with regional transport, environmental and energy strategies is analysed in detail in chapter 8.

The long-term sustainability of EMMA depends on its institutional integration, ensuring:



- stable ownership;
- continuous maintenance;
- progressive expansion of the user community;
- integration with future Mobility Management initiatives.

The transition from project-based implementation to structural governance requires continuous institutional commitment and active involvement of area mobility managers. The governance model developed through GreenPATH demonstrates that effective digital Mobility Management requires the combination of technological infrastructure, organisational responsibilities and coordinated institutional action.

7. Communication and Stakeholder Engagement Strategy

The communication and stakeholder engagement strategy developed for EMMA aimed to support adoption of the Mobility Management dashboard by creating a shared understanding among institutional, organizational and operational stakeholders. The objective was not only to inform users about the existence of a digital tool, but to facilitate the organizational change required to move from fragmented mobility management practices towards a common digital workflow.

The strategy was based on three complementary principles:

- early involvement of relevant stakeholders;
- continuous dialogue throughout implementation;
- capacity building to support autonomous use of the system.

This approach recognises that the success of a digital governance tool depends on user acceptance and institutional engagement as much as on technical performance.

The EMMA pilot involved a multi-level stakeholder ecosystem including public authorities, transport actors, business organisations, companies and commuters. Stakeholders were classified according to their institutional role and expected interaction with the platform:

- regional authorities, responsible for institutional coordination and long-term adoption;
- local authorities, supporting territorial implementation;
- Area Mobility Managers, responsible for coordination and monitoring activities;
- Company, School and District Mobility Managers, representing operational users;
- transport operators, contributing to the analysis of mobility demand;
- companies and employees, providing mobility information and benefiting from improved planning processes.

The GreenPATH pilot involved the Emilia-Romagna Region, the Municipality of Ravenna, the Ravenna Port Authority, Agenzia Mobilità Romagna (AMR), Start Romagna, Confindustria Romagna and companies operating in the Ravenna Port Area. These stakeholders represent different levels of the mobility management ecosystem and were engaged according to their responsibilities within the governance model.

The communication strategy pursued four main objectives:

1. increasing awareness of Mobility Management objectives and benefits;
2. encouraging participation in data collection activities;
3. supporting introduction and acceptance of the digital platform;



4. strengthening cooperation between Mobility Managers operating at different levels.

Communication activities were designed to position EMMA not only as a technical application, but as a common framework for improving coordination and decision-making. A key communication objective was to demonstrate the practical value of structured mobility data for organisations. The platform was presented as a tool capable of reducing administrative effort, improving comparability of mobility information and supporting more effective planning of sustainable mobility measures. The awareness campaign “Tu come vai al lavoro?” supported engagement with employees by encouraging reflection on commuting behaviour and highlighting the relationship between mobility choices, sustainability and workplace wellbeing. This approach helped connect the digital tool with the real mobility needs of users, improving participation in data collection activities.

The pilot included:

- institutional meetings involving public authorities, transport operators and companies;
- technical workshops with Mobility Managers;
- survey activities to collect mobility information;
- communication materials supporting employee participation.

During implementation, the Ravenna Port Authority facilitated stakeholder dialogue through dedicated meetings involving companies and institutional actors. These engagement activities created a continuous feedback loop between users and developers, supporting the progressive refinement of platform functionalities.

Training activities supported Mobility Managers in:

- understanding the EMMA workflow;
- managing structured mobility datasets;
- preparing Home-to-Work and Home-to-School Travel Plans;
- interpreting analytical outputs.

Workshops focused on the use of platform functionalities, including:

- georeferenced visualisations;
- statistical analysis;
- mobility indicators;
- automated generation of planning outputs.

Training was designed to reduce the technological barrier associated with digitalisation and to enable users to integrate EMMA into their existing mobility management activities. The experience of the pilot highlighted that technical deployment alone is insufficient to guarantee adoption. Continuous support, clear guidance and user involvement are required to ensure that digital tools become part of routine organisational processes. The introduction of EMMA required a gradual organisational transition from heterogeneous and partially manual Mobility Management practices towards standardised digital procedures.

The change management approach was based on:

- involvement of users from early implementation phases;
- demonstration of practical benefits;



- simplification of existing workflows;
- institutional support from public authorities.

The platform contributed to repositioning Mobility Management as a strategic activity linked to sustainability, corporate welfare and organisational efficiency. By reducing administrative complexity and providing standardised analytical outputs, EMMA supports organisations in moving from compliance-based mobility planning towards data-driven decision-making.

The pilot identified several factors that may limit adoption. These included:

- voluntary participation of companies not subject to mandatory Mobility Management obligations;
- different levels of organisational maturity;
- absence of dedicated Mobility Management resources in some organisations;
- coexistence with existing proprietary solutions.

These challenges require specific support actions during future deployments, including training, technical assistance and continuous communication with users. Peer-feedback highlighted the importance of involving Mobility Managers in the evolution of platform functionalities and ensuring transparency regarding data management procedures. User acceptance of EMMA is strengthened by the combination of technical, organisational and institutional factors.

Key drivers include:

- reduction of administrative effort;
- availability of standardised analytical outputs;
- improved comparability between organisations;
- institutional recognition of the platform.

The main lesson from the pilot is that digital adoption depends on trust, perceived usefulness and active participation of users throughout the implementation process. The communication and engagement strategy therefore represents a permanent component of EMMA deployment, supporting not only initial adoption but also long-term consolidation of the platform within Mobility Management governance structures.

8. Policy Integration and Alignment

The EMMA Mobility Management Platform supports the implementation and monitoring of sustainable mobility policies by providing a structured digital environment for the collection, analysis and interpretation of mobility data. Its role is not to replace existing planning frameworks, but to provide an operational tool that strengthens their implementation through more consistent data, improved coordination and evidence-based monitoring. The platform is positioned within a multi-level policy framework involving municipal, regional, national and European strategies related to sustainable mobility, climate neutrality and transport decarbonisation. The main contribution of EMMA is the creation of a common information basis supporting policy implementation across different governance levels.

EMMA is aligned with the principles of Sustainable Urban Mobility Planning (SUMP), particularly with regard to monitoring, evaluation and stakeholder coordination. Within the SUMP framework, the platform supports the implementation of mobility measures by providing structured information on commuting patterns and travel behaviours. The system supports monitoring activities related to Home-to-Work and Home-to-School



Travel Plans (PSCL/PSCS), enabling the assessment of mobility measures adopted by organisations and institutions. By providing comparable and repeatable data outputs, EMMA strengthens the evidence base available to local authorities for mobility planning and policy evaluation.

The platform can support:

- analysis of commuting patterns;
- identification of mobility demand characteristics;
- assessment of modal split evolution;
- evaluation of potential sustainable mobility measures.

These functions support existing sump processes by improving data availability and coordination between mobility actors.

At regional level, EMMA contributes to the digitalisation and coordination of Mobility Management activities within Emilia-Romagna. The platform supports a common framework connecting regional authorities, Area Mobility Managers and organisation-level Mobility Managers. This structure facilitates consistency between different territorial actions while maintaining the flexibility required by different local contexts.

Within the Regional Integrated Transport Plan (PRIT 2025), Mobility Management is recognised as an important component for managing systematic mobility flows and promoting sustainable transport solutions. EMMA supports this objective by improving the availability of structured mobility information and facilitating monitoring of commuting-related measures. Its contribution consists in providing the digital and organisational conditions necessary for more effective implementation of mobility management actions.

Mobility demand management represents an important component of climate and environmental strategies aimed at reducing transport-related emissions. EMMA contributes to these objectives by enabling monitoring of commuting behaviours and supporting the identification of opportunities for modal shift and lower-impact mobility solutions.

Within the Regional Air Quality Plan (PAIR 2030), Mobility Management is identified as a relevant instrument for reducing transport impacts on air quality. EMMA supports this objective by providing data that can contribute to evaluating mobility measures and their effects on travel behaviour.

Similarly, the Regional Energy Plan (PER 2030) identifies transport decarbonisation as a priority area. Through the collection of standardised mobility information and the generation of environmental indicators, EMMA supports the monitoring of actions aimed at reducing transport-related energy consumption and emissions.

EMMA should therefore be considered an enabling tool supporting the implementation and assessment of regional strategies.

EMMA is consistent with the Italian regulatory framework governing Mobility Management activities. The platform supports the roles and responsibilities introduced by:

- Decreto Rilancio (D.L. 34/2020);
- Ministerial Decree D.M. 179/2021 defining Mobility Manager responsibilities;
- D.M. 209/2021 providing guidance for Home-to-Work Travel Plans;
- Law 221/2015 introducing the School Mobility Manager role.



The platform provides digital support to existing regulatory requirements by facilitating data collection, plan preparation and monitoring activities. The governance model is also compatible with public administration cooperation mechanisms regulated by national administrative law, including agreements for software reuse between administrations.

At European level, EMMA contributes to objectives related to:

- sustainable urban mobility;
- transport decarbonisation;
- climate neutrality;
- digitalisation of public services.

By supporting better knowledge of mobility demand and improving policy monitoring capacity, EMMA contributes indirectly to European climate and mobility objectives.

One of the main contributions of EMMA is the improvement of monitoring capacity through structured and comparable mobility datasets.

The platform generates analytical outputs including:

- modal split indicators;
- Origin-Destination analyses;
- georeferenced mobility representations;
- environmental performance indicators;
- comparative analyses over time.

These outputs enable public authorities and mobility managers to assess the effectiveness of mobility measures and identify areas where additional actions may be required. The possibility of comparing mobility patterns across organisations and reporting periods supports longitudinal evaluation of policy impacts. Data processing follows the governance framework described in previous chapters, ensuring that only appropriate aggregated and anonymised information is used for territorial analysis. This ensures that policy monitoring capability is developed without compromising data protection requirements.

EMMA strengthens integration between different levels of Mobility Management governance by connecting regional authorities, Area Mobility Managers and individual organisations through a common digital environment.

The platform contributes to reducing fragmentation by introducing:

- common data structures;
- standardised indicators;
- shared monitoring procedures;
- coordinated workflows.

This represents a shift from individual organisational mobility planning towards a more integrated territorial approach.

The Ravenna pilot demonstrated the feasibility of this approach in a complex industrial context and provided the basis for future expansion. Future deployment at larger scale will allow further assessment of EMMA's contribution to regional policy implementation and long-term decarbonisation objectives.



The implementation also demonstrates alignment with broader European principles on trustworthy digital public services by integrating privacy-by-design, data minimisation and accountability mechanisms into the operational governance of the platform. These principles reinforce the sustainability of the solution and facilitate its adoption by public administrations operating within different regulatory and organisational contexts.

9. Strategic SWOT Analysis

The SWOT analysis of the EMMA Mobility Management Platform summarizes the main findings emerging from the GreenPATH pilot implementation in the Ravenna Functional Urban Area (FUA). The analysis considers four main dimensions: governance capacity, technical characteristics, organizational adoption and conditions for future scaling.

Since validation was conducted within a single FUA, strengths and weaknesses refer mainly to observed pilot evidence, while opportunities and threats address conditions that may influence future deployment.

EMMA establishes a clear governance framework connecting regional authorities, Area Mobility Managers and organization-level Mobility Managers. The pilot demonstrated that a shared digital environment can improve coordination between stakeholders traditionally operating through fragmented processes.

The main strength of EMMA is therefore not only the digital platform itself, but the combination of digital functions with a clear distribution of governance responsibilities. The platform introduces common procedures for mobility data collection, processing and reporting. During the pilot, EMMA enabled the creation of a harmonised dataset on commuting patterns within the Ravenna Port Area, supporting:

- Origin-Destination analysis;
- modal split assessment;
- geospatial visualisation;
- environmental indicators.

This standardization improves data comparability between organizations and provides a more reliable basis for mobility planning.

EMMA is based on an open-source, modular architecture designed to support adaptation to different institutional contexts. The platform enables configuration according to territorial needs while maintaining common workflows and data structures. The software reuse approach represents an additional enabling condition for scaling, as it reduces duplication of development efforts and supports adoption by other public administrations. The platform strengthens the ability of Mobility Managers and public authorities to analyse commuting patterns and evaluate mobility measures. By replacing isolated datasets with structured information flows, EMMA supports more consistent decision-making processes.

The main limitation of the pilot concerns the geographical scale of validation. EMMA was tested within one Functional Urban Area and therefore some impacts related to large-scale deployment cannot yet be fully demonstrated. Further implementations are required to validate performance across different administrative, organisational and mobility contexts. At the same time, the process of institutional expansion has already progressed beyond a purely prospective stage. Five of the 13 Area Mobility Managers operating in Emilia-Romagna have confirmed their intention to use EMMA in 2026 and have started the onboarding process, while the remaining eight have indicated that they plan to adopt the platform from



2027 onwards. Although the operational results of this wider deployment remain to be assessed, these commitments demonstrate the consolidation of EMMA as the Emilia-Romagna Region's reference platform for Mobility Management in the coming years.

The pilot highlighted heterogeneous levels of readiness among participating organisations. Some companies had limited previous experience with structured Mobility Management activities or lacked dedicated internal resources. This affected the effort required for onboarding, data preparation and platform adoption. The effectiveness of analytical functions depends on the availability and quality of input data. In the pilot context, limited availability of historical mobility information reduced opportunities for baseline comparison. Future deployments should include early data assessment activities to ensure adequate configuration and benchmarking.

Some larger organisations already used proprietary mobility management tools. This created potential overlap between existing systems and EMMA workflows. Future integration strategies should consider interoperability mechanisms to avoid duplication and facilitate coexistence with existing solutions.

The institutional adoption process initiated by the Emilia-Romagna Region creates concrete conditions for expansion beyond the pilot area. As said before, all 13 Area Mobility Managers operating across the regional territory have been involved in the deployment process and five have already confirmed their intention to adopt EMMA for the 2026 Home-to-Work Travel Plan campaign and have begun onboarding activities, while the remaining eight are expected to adopt the platform from 2027 onwards. This progressive expansion represents a significant opportunity to consolidate EMMA as a common regional framework, increase the availability of comparable mobility datasets and strengthen the value of territorial analysis across different Functional Urban Areas.

EMMA contributes to the transition from manual and heterogeneous Mobility Management practices towards structured digital workflows. This creates opportunities for improving efficiency, reducing administrative effort and strengthening monitoring capacity.

The platform can support implementation and evaluation of mobility strategies by providing evidence on commuting behaviours. Its analytical capabilities can contribute to better targeting of sustainable mobility measures.

The modular architecture allows adaptation to different FUA typologies, including:

- industrial areas;
- metropolitan contexts;
- university districts;
- mixed urban territories.

The transferability potential is particularly relevant for territories where multiple organisations need to coordinate mobility actions.

The adoption of a common Mobility Management platform may encounter resistance where organisations are accustomed to independent processes or existing internal tools.

Future sustainability depends on the availability of resources for:

- technical maintenance;
- cybersecurity updates;



- system evolution;
- user support activities.

Institutional embedding and clear ownership responsibilities are therefore essential to avoid dependence on project-based funding. In the Emilia-Romagna context, this requirement has already been addressed through the allocation of regional resources intended to support EMMA over the next four years. This financial commitment reduces the immediate risk of dependence on short-term project funding and provides a more stable basis for technical maintenance, cybersecurity activities, platform evolution and user assistance during the regional deployment phase. Continued institutional oversight will nevertheless remain necessary to ensure that the allocated resources are translated into effective operational support and long-term integration within the regional Mobility Management framework.

The continuous evolution of digital infrastructures and interoperability requirements requires periodic technical updates. Without adequate maintenance, digital platforms may progressively lose compatibility with external systems. Changes in organisational structures, staff turnover or reduced priority assigned to Mobility Management may affect platform utilisation. Long-term user engagement requires continuous training, communication and institutional support.

The SWOT analysis highlights several priorities for successful consolidation and scaling of EMMA.

Long-term adoption requires stable governance arrangements, clear ownership and integration within existing Mobility Management frameworks. Training and continuous assistance remain essential to ensure that Mobility Managers can effectively use the platform. Future implementations should include preliminary assessment of available mobility information and organisational capacity. The evolution of EMMA should maintain compatibility with existing digital ecosystems while preserving the modular nature of the platform. Further deployments are necessary to confirm scalability and assess impacts at larger geographical levels.

The SWOT analysis confirms that EMMA represents a technically feasible and strategically relevant approach for digital Mobility Management governance. The pilot demonstrated that the main value of the solution derives from the combination of standardised data, digital workflows and coordinated governance. Future deployment should focus not only on technological replication but also on ensuring the institutional and organisational conditions required for long-term adoption.

10. Conclusions

The EMMA RE-R Mobility Management Platform developed and co-design within the GreenPATH project represents a consolidated digital solution supporting the coordination, monitoring and planning of sustainable mobility actions within Functional Urban Areas (FUAs).

The **Electronic Mobility Manager Application (EMMA)** is a public, open-source platform designed as a transferable digital solution for Regions and Functional Urban Areas across Europe. It supports the preparation and implementation of Home-to-Work and Home-to-School Travel Plans by enabling policymakers and Mobility Managers to collect and analyse commuting data, share evidence on actual mobility demand across municipal, FUA and regional levels, and design coordinated sustainable and multimodal mobility measures. Thanks to its modular and reusable architecture, EMMA can be adapted by other European Regions seeking to strengthen data-driven Mobility Management, improve cooperation among local authorities and assess the impacts of commuting policies through common indicators.



A major achievement of the GreenPATH Solution 1 was, in addition, the development of a comprehensive legal, administrative and technical framework that translates the platform's data-protection principles into concrete and enforceable arrangements. The resulting documentation package includes the technical and legal assessment of the EMMA Emilia-Romagna platform, the platform-level Data Protection Impact Assessment pursuant to Article 35 GDPR, a standard privacy notice for employees, the Technical Security Protocol, updated accession and participation templates for the different categories of Mobility Managers, and the formal regional act approving these instruments.

The formal adoption of the Technical Security Protocol and the revised participation templates by the Emilia-Romagna Region through Executive Determination No. 12953 of 1 July 2026 confirms that the pilot generated not only recommendations, but also operational instruments with institutional and legal effect.

The relevance of this outcome extends beyond the Emilia-Romagna pilot. The documentation package provides other Italian and European Regions and Functional Urban Areas with a ready-to-adapt framework for deploying comparable digital Mobility Management solutions without having to build the underlying legal, organisational and technical architecture from the outset. As it is grounded in GDPR principles and safeguards shared across the European Union, the model offers strong transferability while remaining sufficiently flexible to accommodate different governance structures and territorial contexts.

The results demonstrate that a structured digital environment can support Mobility Management activities by improving data availability, standardising operational workflows and strengthening coordination between public authorities, organisations and Mobility Managers. The GreenPATH pilot validated the capability of EMMA to support the digitalisation of Home-to-Work Travel Plans (PSCL) and related Mobility Management activities.

The platform enabled:

- structured collection of mobility information;
- creation of harmonised commuting datasets;
- generation of analytical outputs;
- support to monitoring and evaluation activities.

The pilot involved 20 companies and 28 Mobility Managers, demonstrating the feasibility of implementing a shared Mobility Management workflow within a complex industrial context. These results confirm that EMMA can effectively support the transition from fragmented data collection practices towards standardised and evidence-based mobility management processes.

The pilot demonstrated that the platform's strategic value derives from the combination of data management capabilities and a clear governance model connecting different actors involved in mobility management. By establishing a common framework for data collection, analysis and monitoring, EMMA improves coordination between:

- Policy makers at Regional-Fua and local authorities;
- Area Mobility Managers;
- Company Mobility Managers;
- Mobility planning stakeholders.

The platform therefore acts as a coordination and monitoring instrument supporting more coherent mobility planning processes. The experience shows that digital tools can effectively support mobility governance



only when they are accompanied by appropriate institutional arrangements and user engagement mechanisms.

Although EMMA was validated within a single Functional Urban Area, the pilot demonstrated that the core elements of the model are transferable. The transferable components include:

- governance principles;
- standardised mobility data workflows;
- analytical methodologies;
- role-based access structures;
- implementation procedures.

The pilot action served as a test to identify the conditions required for replication for future scalability. The modular architecture and the software reuse approach adopted within the project provide the basis for adaptation to other territorial contexts. The agreement with the Emilia-Romagna Region represents an important step towards institutional adoption beyond the pilot phase. Future deployments will provide additional evidence on performance, scalability and long-term impacts at larger territorial levels.

EMMA introduces an innovative approach to Mobility Management by integrating:

- digital data collection;
- coordinated governance;
- monitoring capabilities;
- evidence-based decision support.

The innovation does not consist only in the development of a digital platform, but in the creation of a common operating model for actors that previously worked through heterogeneous procedures. By improving the availability and comparability of mobility information, EMMA strengthens the capacity of public authorities and organisations to design and evaluate sustainable mobility measures.

The future deployment of EMMA should focus on maintaining the conditions that enabled successful pilot implementation. The main priorities are:

- Long-term adoption requires stable ownership, clearly defined responsibilities and integration within existing Mobility Management frameworks.
- Training, onboarding and technical assistance remain essential to ensure effective use of the platform.
- Increasing participation across different territories will strengthen the value of shared mobility datasets and comparative analysis.

The platform should maintain interoperability with evolving digital infrastructures and adapt to future Mobility Management requirements.

The GreenPATH experience confirms that EMMA is a technically validated and strategically relevant solution for digital Mobility Management coordination. The platform has demonstrated its capacity to transform mobility data into a structured knowledge base supporting better coordination, monitoring and policy implementation.



While additional deployments are required to assess impacts at larger scale, the pilot provides sufficient evidence that EMMA represents a transferable model capable of supporting the evolution of Mobility Management governance in Functional Urban Areas and beyond.