TRANSFERABILITY AND RECOMMENDATIONS HANDBOOK

Deliverable D 6.4

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 881825

Project Acronym	Ride2Rail
Starting date	01/12/2019
Duration (in months)	41
Deliverable number	D6.4
Call Identifier	S2R-OC-IP4-01-2019
GRANT Agreement no	881825
Due date of the Deliverable	30/04/2023
Actual submission date	15/06/2023
Responsible/Author	UIC
Dissemination level	PU
Work package	WP6
Main editor	David SARFATTI (UIC)
Reviewer(s)	EURNEX, UNIFE
Status of document (draft/issued)	ISSUED

Reviewed: yes

Consortium of partners

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METROPOLIA	Finland

DOCUMENT HISTORY		
Revision	Date	Description
0.1	15/03/2023	Draft submitted to contributors for comments
0.2	15/04/2023	Revision of the draft with first comments
0.3	15/05/2023	Revision by R2R partners
1.0	31/05/2023	Final version submitted to official reviewers and consortium
1.1	15/06/2023	Submission

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Content

List of Figures

1. EXECUTIVE SUMMARY

The project implemented demonstrations of the Ride2Rail service in four locations – Padua, Italy; Athens, Greece; Brno, Czech Republic; Helsinki, Finland. A critical aspect of these demonstrations is to disseminate and transfer their performance against the aims of the project, and in terms of supporting sustainability actions in these locations.

The aim of this deliverable is to describe the possible transferability approach to be used in WP6 and for Ride2Rail as a whole. This followed the Open Call for Transferability launched in 2021 and the Transferability Workshop held in Paris in 2022.

2. ABBREVIATIONS AND ACRONYMS

CFM	Calls for Members
DL	Dissemination and exploitation leader
DoA	Description of the Action
EL	Ethical leader
EU	European Union
FS	Financial Statement
GA	Grant Agreement
H2020	Horizon 2020
IP4	Innovation Programme 4
OC	Open Call
PC	Project coordinator
PM	Project manager
PMO	Project Management Office
PMT	Project Management Team
PO	Project Officer
PT	Public Transport
QAC	Quality Assurance Committee
S2R JU	Shift2Rail Joint Undertaking
TL	Technical leader
TSP	Travel Service Provider
WP	Work Package
WPL	Work package leader

3. BACKGROUND

3.1. Shift2Rail context

Shift2Rail is the first European rail initiative to seek focused research and innovation and market-driven solutions by accelerating the integration of new and advanced technologies into innovative rail product solutions. Shift2Rail promotes the competitiveness of the European rail industry and meets changing EU transport needs. Research carried out under this Horizon 2020 initiative develops the necessary technology to complete the Single European Railway Area.

The delivery of Shift2Rail is based around five Innovation Programmes (IPs); the focus of this report is IP4 – IT solutions for attractive rail services. To become a more attractive option, rail must respond to customer needs to support anytime, anywhere, door-to-door, intermodal journeys encompassing distinct modes of transportation. Rail must achieve interoperability with other transport modes and mobility services, with regions, cities and people engaged in social and economic activities, and with the key elements of the supply chains which can make rail products and services available to those people. In order to achieve this, rail needs to take due advantage of the increasing connectivity of people and objects, the availability of European Global Navigation Satellite System-based locations, the advances in cloud computing, big, linked and open data and the propagation of internet and social media. The step towards sharing data needs to be considered and progressively developed, in order to enable service developers to provide connected travellers with the services they need and expect.

3.2.Ride2Rail context

A key aspect of delivering more attractive services is by delivering end-to-end (or first- and last-mile) travel services that enable rail as their core mode of mobility. This can be challenging in a rural environment, where connectivity to rail is problematic. It is also relevant in urban or peri-urban environments where there may be poorer provision of public transit or congestion of roads.

Contributing to Shift2Rail's IP4, Ride2Rail's overall objective is to develop an innovative framework for intelligent mobility, facilitating the efficient combination of flexible (ridesharing) and scheduled transport services (rail, bus, and other public transport services), thus enhancing the performance of the overall mobility system. Ride2Rail should, in particular, address the first and last mile problem by offering a wider range of transit options, while harnessing the capacity of single occupancy vehicles, along with existing, or future, demand responsive transit.

Ride2Rail aims to integrate multiple (public/private/social) data sets and existing transport platforms for promoting an effective ride sharing practice of citizens, making it a complementary transport mode that extends public transport networks.

The objectives of the Ride2Rail project are:

- To develop an innovative framework for intelligent mobility, facilitating efficient combination of flexible and scheduled transport services, integrating real-time information about public transport and ride sharing;
- To facilitate the comparison and the choice between multiple options/services classified by a set of criteria, for example environmental, travel time, comfort, cost;
- To encourage carpooling (and ride sharing acceptance) as complementary for public transport;
- To enhance the performance of the overall mobility system, reducing road congestion and environmental impact, reinforcing the mobility offer in rural and low-demand areas;
- To combine travel offer classifications and software components, integrating them into existing collective and on-demand transport services;
- To induct the access to high-capacity services thanks to easy-to-use multimodal and integrated travel planning, booking, ticketing and payment features;
- To design, develop and test in four real demonstrators a set of software components for the IP4 ecosystem, including an enhanced Travel Companion and the crowd-based Transport Service Provider;
- To produce recommendations for replicability.

3.3.Work Package 6 context

The activities performed in WP6 were targeted at disseminating the ongoing project results and activities to the widest possible audiences. Some of the most important events in transport research and innovation have been organized between M31 and M36. Project partners and the coordinator had the chance to present and discuss the project in several meetings (on national/international level), to submit of abstracts and posters, to draft articles and to perform additional communication activities.
The Taks 6.3 started in M12. The Leader UIC worked on the MS19 “Launch of Open Call For Transferability”, in order to foster the replicability of the RIDE2RAIL solutions in other locations. This was the first step towards the D6.4 Transferability and recommendations handbook submitted that constitutes this document.
After the first, second and third iterations of the open call (officially launched in July 2021), no positive feedbacks have been collected and, according to the calendar, the call was re-opened (but with a broader audience). 100 additional municipalities and potentially interested stakeholders have been contacted and UIC, the leader of this task, did also involve POLIS, EUROCITIES and MaaS Alliance. No candidates were found, none

of the city replied. Promotion for the open call was performed on social media and online, and also with direct mailing.
In a first stage, as UIC saved some budget dedicated to the Stakeholders' Workshop, incentives (reimbursment of travel expenses) were given to the winners of the open call for transferability in order to visit the demo cities and participated to the local events in demo sites. This was included in the RIDE2RAIL amendment n.1.
In a second stage, as no European city wished to participate to the Open call for transferability, the Task leader decided to Organize on November 23rd, 2022, a Transferability Workshop and invite all to participate and learn more about the RIDE2RAIL results.
To allow the workshop to be more efficient, all speakers were requested to come to Paris and participate in person. A total of 40 participants met on the transferability workshop held on the afternoon of 23 November 23rd, 2022, at the UIC headquarter in Paris and online. They were equally distributed between in person and online (connected via Zoom).
The workshop demonstrated the achievements of the EU Shit2Rail RIDE2RAIL project with its various efficient pieces of software available and their deployment in three large European cities for multimodal transportation (at the time of the event, Padua demo was not yet performed).

Figure 1: Pictures from the Paris Transferability Workshop

All the presentations and the recording of the event are available on the UIC dedicated meeting webpage: https://uic.org/events/ride2rail-transferability-workshop

4. OBJECTIVES AND SCOPE OF THE DELIVERABLE

4.1. Deliverable objectives

The objective of Task 6.3 is to transfer results and technologies developed across different demo locations both, to other relevant mobility stakeholders in those specific demo sites and beyond (for further roll-out), as well as to all project partners not directly involved in these activities.

This action contributes to transfering the usability of measures implemented, from the demo locations to other potentially interested stakeholders, on a regional level and to a small/rural City group with the aim of achieving further potential replication.

RIDE2RAIL designed, developed and tested in 4 real demonstrators (Padua, Brno, Athens, Helsinki) a set of software components for the S2R IP4 ecosystem, including an enhanced Travel Companion and a so-called crowd-based Transport Service (CB TSP), a component acting as a real TSP, fostering valuable combination of flexible and scheduled transport services. The advanced Travel Companion is an enriched version of the Shift2Rail Travel Companion, integrated with components developed by RIDE2RAIL partners.

The approach used for managing the RIDE2RAIL project is based on several main pillars:

- Definition of choice criteria for journey planning;
- State of the art, analysis and recommendations for a successful ridesharing in a multimodal journey.
- Identification of requirements and specifications for complementary travel expert services in the Shift2Rail IP4 ecosystem;
- Definition of algorithms for optimal synchronisation of shared-mobility and mass transit;
- Development of RIDE2RAIL components (Offer Categorizer, Offer Matcher and Ranker, Incentive Provider, Agreement Ledger, Crowd Based TSP, Driver Companion);
- Implementation of the demos in four Europe-wide demo sites through identification of the current mobility situation in the demo sites, looking at potential improvements for those locations, creating of an evaluation framework and acquiring the KPIs;
- Evaluation and Impact Assessment, carried out per each demo site.

Employing the successful collaboration, the IP4 solution, represented by the Enhanced Travel Companion and the Driver Companion applications, have been demonstrated in four demo sites, Athens, Helsinki, Brno and Padua. Despite the challenges linked to the post-COVID new mobility patterns and other operational challenges of different nature, these tools have been tested in real environment, with a total of more than 120 testers overall. To

provide quality feedback, a complex evaluation was carried out, monitoring a set of pre-defined KPIs. These KPIs have been measured using qualitative and quantitative data from both the IP4 ecosystem and the users' feedback collected via questionnaires, in Brno also through daily reports.

4.2. IT Scope

Five software modules were developed in the Ride2rail projects:

- Offer Categorizer (T.3.1): a service to compute scores for each offer returned by the Travel Companion with respect to a set of Offer Categories.
- Offer Matcher and Ranker and Incentive Provider (T.3.2): a tool that learns contextual preferences of users and ranks classified trips accordingly.
- Crowd-based Travel Service Provider (T.3.3) and Driver Companion (T.3.4): collect and publish ridesharing offers.
- Agreement Ledger (T.3.5): a digital ledger based on blockchain technology that register events related to ridesharing and secures smart contracts related to it.

4.3. Ride2Rail Data Flow

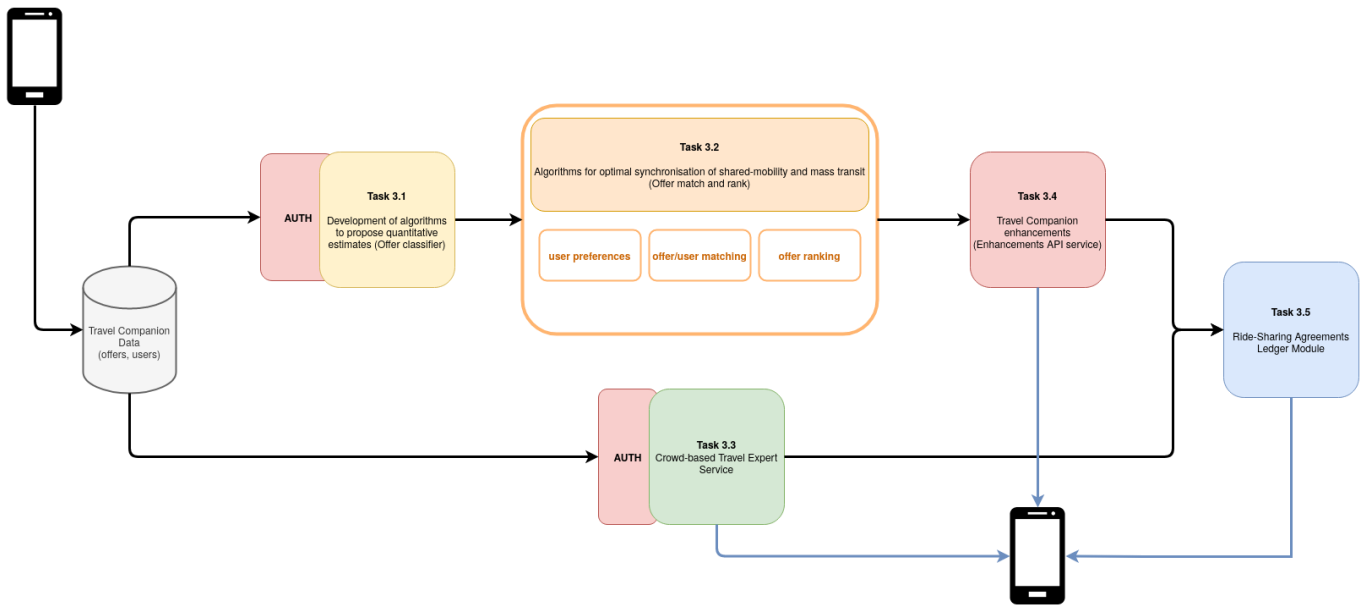

Figure 2: Data Flow in R2R

4.4. Inputs

All Demonstrations sites have deployed and tested the Ride2Rail IT architecture. Their results will help the transfer of the measures implemented, with the aim of achieving further potential replication.

5. HELSINKI RESULTS AND ACHIEVEMENTS

The Helsinki demo involved the operation of an automated electric bus, known as the Robobus, between September 25th and November 17th, 2021. This bus was available free of charge to all users and operated in two modes: scheduled and on-demand. For the on-demand mode, passengers could request the bus using a web-based application. The service received positive feedback from users, who found it easy to use, comfortable, and convenient. Despite encountering technical issues such as sudden braking, passengers were satisfied with the overall experience. Over the course of the demo, 1112 passengers utilized the Robobus, covering a distance of over 2000 kilometers. Valuable suggestions for improvement included increasing the size of the vehicle to accommodate more passengers and extending the service hours to cater to different travel needs.

Figure 3: Automated Robobus tested in Helsinki

The RIDE2RAIL functionalities have been tested, as much as possible integrated with existing Helsinki Region Transport (HSL) mobility platform (e.g. public transport routeplanner) through available open-source interfaces. The tests were performed for two weeks in Helsinki region on 3-16. October 2022.

Helsinki demo was organized for a limited test group only. Testing the apps needed a certain level of background information and explanation of how the apps work. The test group of 20 persons consisted finally of people recruited by the demo actors Forum Virium Helsinki and Metropolia University of Applied Sciences. 17 persons answered the survey. Between drivers and passengers, a total of around 30 people could use the applications at least once.

The tests started on time and applications worked for the two weeks. Reported problems were solved promptly.
The functionalites used were Navigation, Journey planner, Trip tracking and Group travelling. Functionalities planned but not used because of the HSL sandbox environment were Issuing, Validation and Inspection.

6. BRNO RESULTS AND ACHIEVEMENTS

The Brno demo site, located in the South Moravia Region of the Czech Republic, focused on testing the Ride2Rail ridesharing platform. The primary objective was to address the transportation needs of commuters traveling from the Znojmo district to the city of Brno.

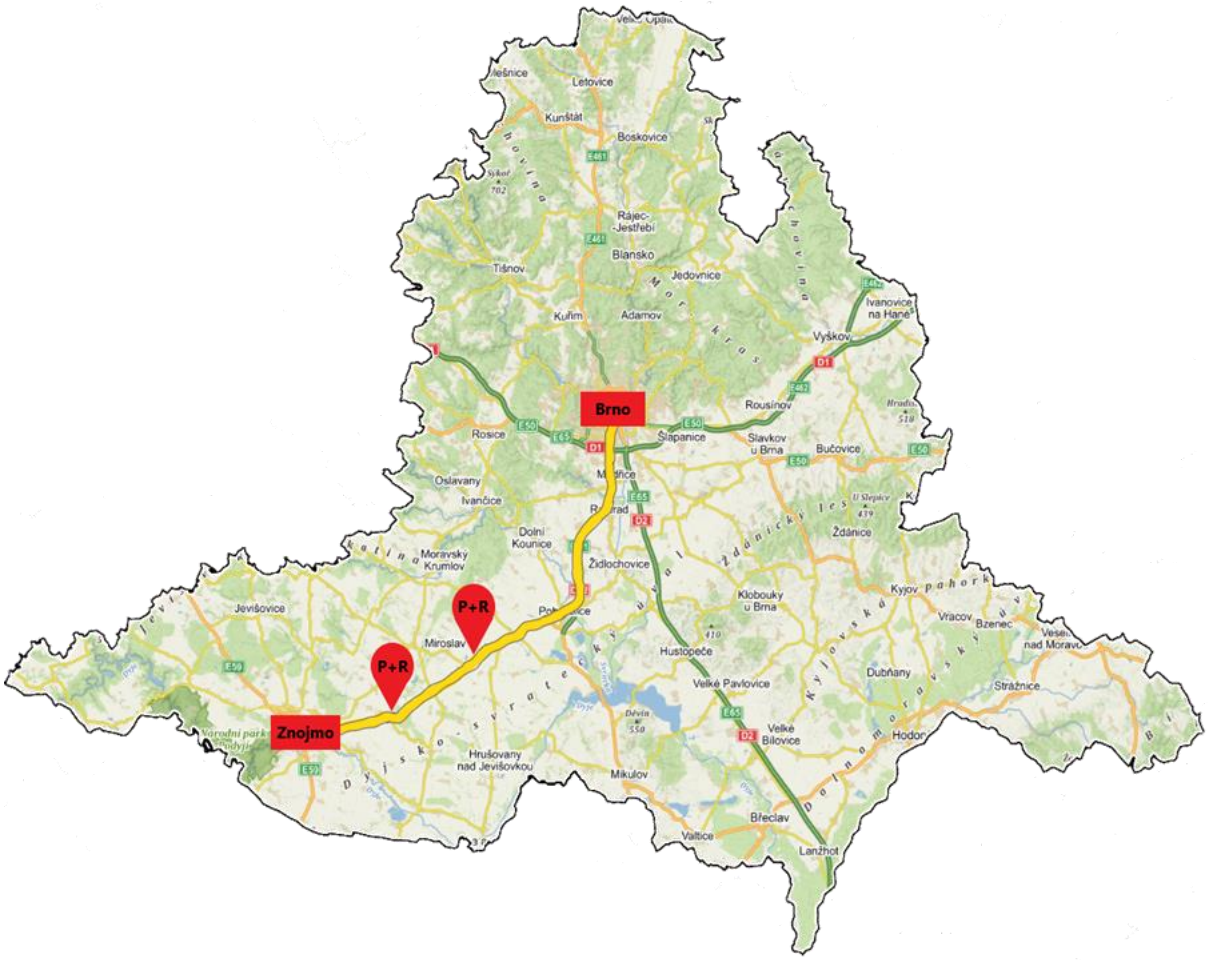

Figure 4: Brno demo area

The demo took place for two weeks, from October 31st to November 13th, 2022. The test group consisted of 60 participants, including both passengers and drivers. The applications tested in this demo were the enhanced Travel Companion and Driver Companion, offering a wide range of functionalities previously identified by the demo team. The demo resulted in 1946 rides, with 76 of them being shared rides. Valuable feedback was collected through surveys and daily reports from passengers and drivers, providing insights into the user experience, functionality, and areas for improvement.

7. PADUA RESULTS AND ACHIEVEMENTS

The Padua demo site, situated in the Veneto Region of Italy, aimed to support rural commuters and enhance the efficiency of public transportation services. The demo focused on encouraging carpooling and ride-sharing as complementary modes of travel, with the objective of reducing greenhouse gas emissions and alleviating traffic congestion. The demo took place from April 17th to April 21st, 2023, primarily targeting commuters traveling to/from the University of Ca' Foscari in Padua. The Driver and Travel Companion apps were tested during this period, assessing various functionalities such as preference & profile settings, trip planning, trip sharing, navigation, issuing, booking, and traveler's feedback. The demo witnessed 79 app downloads, with more than 50 participants engaging in a total of 387 rides. Feedback from users highlighted the ease of use of the apps, although some users experienced challenges related to ticket purchasing and redundant questions. These insights provide valuable input for refining the user experience and addressing the identified issues.

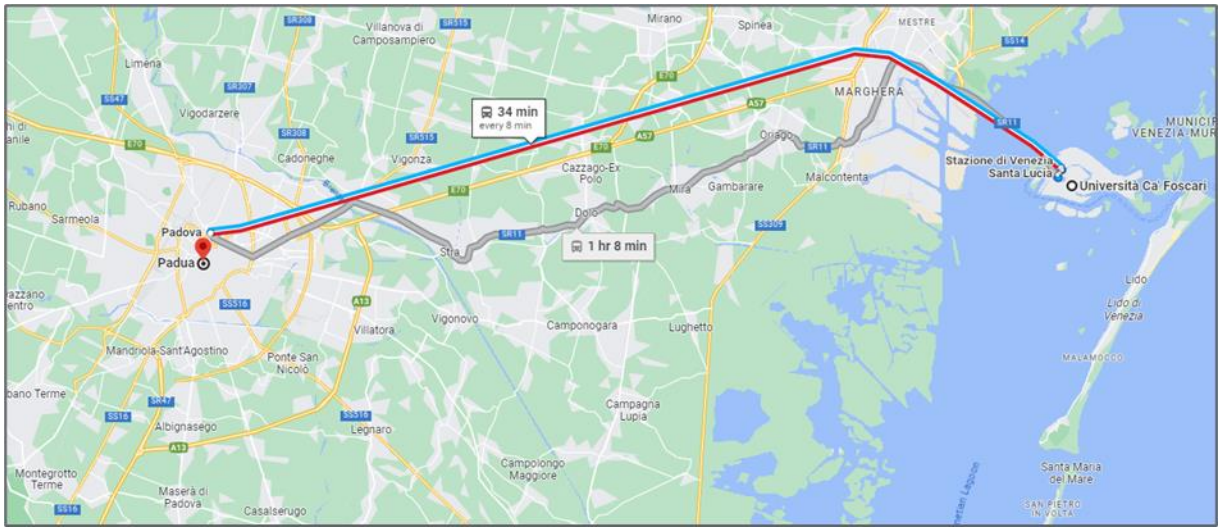

Figure 5: Padua demo site

During the demo, both the Driver and the Travel Companion apps were tested, while the specific functionalities put under the spotlight included Preference & Profile, Trip Planner, Trip Sharing, Navigation, Issuing, Booking, Traveller's Feedback, Guest User, Offering a Ride, View your Journey and Collaborative Space. In order to ensure the largest possible number of testers, a student engagement plan was structured through emails sent by university staff to students' mailboxes, including "Save the date" emails, reminders and an Engagement event on the Padua Demo and the TC and DC apps that took place on April 14th, 2023. The goal was to train the Testers so that they could fruitfully tackle the demo. No incentives and/or gifts were provided to Testers so as to encourage participation in the demo. The demo included the testing of demonstration scenario with the support of project partners OLTIS, FIT CONSULTING and CEFRIEL.

Figure 6: Cover of the Engagement event

8. ATHENS RESULTS AND ACHIEVEMENTS

The Athens demo site aimed to improve the connectivity between low-density areas and public transportation, particularly by integrating demand-responsive ridesharing services with existing modes of transportation such as metros. The demo tests were conducted over a span of four days, specifically from July 18th to July 22nd, 2022. A total of 28 individuals participated in the testing process, with 19 acting as passengers and 9 as drivers. Out of these participants, 17 filled out the survey, which was incentivized with rewards for travellers and for drivers. Feedback received from the Athens demo site included suggestions for improving the registration process, optimizing the award code recognition system, and ensuring accurate translations in the application.

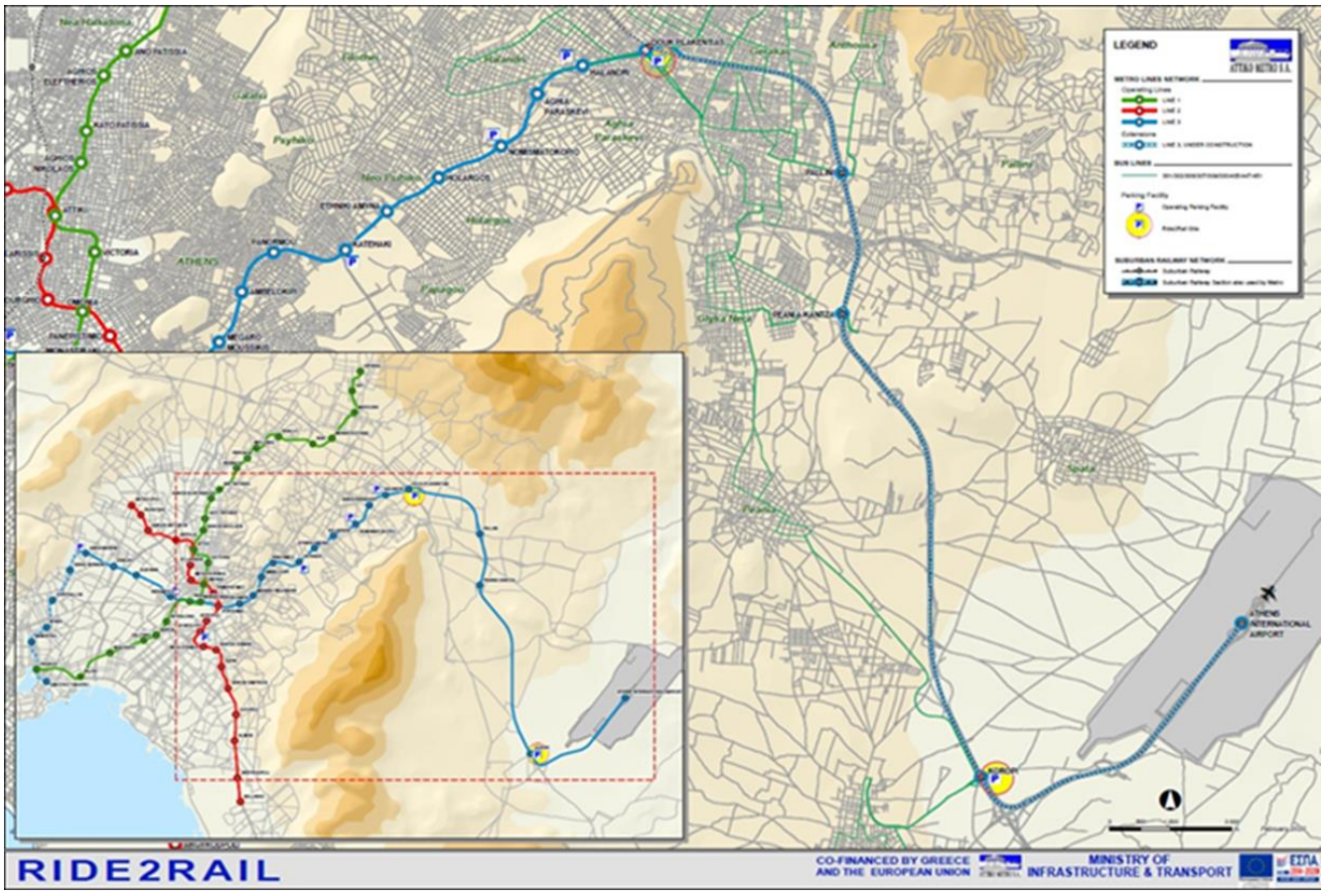

Figure 7: Athens demo area

9. RECOMMENDATIONS FOR TRANSFERABILITY

This paragraph recaps the recommendations developed through the experience in RIDE2RAIL demos, the transferability workshop results and all inputs gathered along the project.

9.1. Detailed recommendations from each demo site

During the tests, the use of the OpenMaaS API was successful, although some results differed when displayed in the Ride2rail Travel Companion. It was recommended to place more emphasis on user experience during app development, as some users found the vocabulary and logic of the apps difficult to understand. Integrating the Driver Companion as a feature of the Travel Companion would make the use of ridesharing functionality easier.

Some peculiar routes and results were observed in the apps, such as the Travel Companion assuming a private car waiting at the end of the journey. Furthermore, the apps did not allow users to make changes in the rides offered or communicate with the driver or passenger. User location sharing was restricted due to anonymization of participants' data for GDPR compliance, hindering smoother communication between the passenger and the driver. Occasionally, the Travel Companion showed routes with no names or suggested waiting times of up to 6 hours.

Some test users had difficulty understanding the survey questions or found them too detailed for the two-week testing period. It was recommended to extend the testing period to increase user engagement and allow users to reuse the applications multiple times.

In summary, important outcomes from the tests include the need for comprehensive testing and clear explanations of app functionality to ensure a positive transformation in mobility habits. The development process prioritizes user experience and aims to address reported issues to refine and optimize the ridesharing experience. The exceptional features of the apps may sometimes resemble technical errors due to their sophisticated and innovative design. Enthusiastic test users provided valuable feedback, highlighting their eagerness to contribute to the app's improvement. Testing the apps in a later phase of development would yield more fruitful results, enabling comprehensive refinement and enhancement based on valuable insights.

For the successful replication of Ride2Rail activities, it is crucial to engage closely with the Call For Members (CFMs) project partners responsible for managing the ecosystem. These partners, including Thales, Indra, HaCon, and CS Group, provide access to tools, integration guidelines for transport service providers (TSPs), an overview of functionalities, and training on tool usage. Close collaboration and effective communication among all stakeholders, including CFMs, technical partners, and demo

leaders, are essential for replicating Ride2Rail results. The project partner EURECAT, leading the development of Ride2Rail functionalities, should be engaged for further information and assistance.

9.2. Main recommendations for Ride2Rail project transferability

Based on the experiences and feedback gathered from the demo sites, several recommendations for the transferability and future implementations of ridesharing solutions can be made. These recommendations include:

Emphasizing user experience: Ensuring that the vocabulary and logic used in the ridesharing apps are user-friendly and intuitive, making it easier for users to understand and navigate the platform.

Integrating Driver Companion functionality: Incorporating the Driver Companion features into the Travel Companion app to provide a seamless and integrated user experience, enabling passengers to easily find and connect with available drivers for ridesharing.

Addressing issues related to peculiar routes: Resolving any issues related to peculiar routes or unexpected suggestions, ensuring that the app provides accurate and relevant options for users.

Enhancing communication features: Improving the communication features between passengers and drivers, such as adding location sharing capabilities, to facilitate coordination and enhance the overall user experience.

Extending the testing period: Extending the duration of the testing period to increase user engagement and allow for multiple app usages, which can provide more comprehensive feedback and insights for further improvements.

10. LINK AND ACCESS TO THE RIDE2RAIL RESULTS

To access a comprehensive collection of public documents related to the project, you have the opportunity to join the Zenodo community maintained by EURNEX, where they diligently keep track of all the project's public documents. By visiting the following link, you can explore a wealth of valuable resources: https://zenodo.org/communities/ride2rail/?page=1&size=20

EURECAT, a prominent contributor within the Ride2Rail initiative, has made significant technological advancements that have greatly impacted the project. These advancements include the development of essential functionalities such as the offer categorizer/ranker, crowd-based Transport Service Provider (TSP), and agreement ledger. All these remarkable functionalities have been seamlessly integrated into the enhanced S2R Travel Companion. Furthermore, as part of their efforts, the project has successfully delivered a Driver Companion, enriching the overall experience for all stakeholders involved. The Travel Companion Personal Application, enriched with R2R functionalities and the Shift2Rail IP4 framework, forms the solid foundation of the robust RIDE2RAIL IT architecture.

To facilitate easy access and promote collaboration, EURECAT has made all these remarkable software components freely available on GitHub. By visiting the following link, you can explore and leverage the full potential of these components: https://github.com/Ride2Rai l .

In the realm of application deployment, Docker emerges as an invaluable tool that enables the seamless automation of deploying applications within lightweight containers. This remarkable technology empowers applications to function efficiently across diverse environments. If you're interested in exploring the capabilities and advantages of Docker, the following link provides detailed documentation: https://docs.docker.com/language/java/deploy/

11. CONCLUSIONS

RIDE2RAIL takes great pride in their extensive work, encompassing design, development, and testing in four real-life demonstrators located in Padua, Brno, Athens, and Helsinki. These demonstrators showcase a remarkable array of software components for the S2R IP4 ecosystem. Notably, they include an advanced Travel Companion and a crowd-based Transport Service Provider, both contributing to a seamless and personalized multimodal mobility experience in diverse environments. This visionary approach greatly facilitates the widespread acceptance and adoption of these innovations in the market. It's important to note that the advanced Travel Companion is an enhanced version of the renowned Shift2Rail Travel Companion, meticulously integrated with components developed by RIDE2RAIL partners.

Furthermore, the achievements and breakthroughs realized in these diverse RIDE2RAIL demo locations are not confined to the specific stakeholders involved. The transfer of results and technologies extends its reach to other relevant mobility stakeholders within these demo sites, facilitating further expansion and implementation. Moreover, even entities not directly associated with these activities can benefit from the knowledge and resources made accessible through the various repositories in this document.

This endeavor holds significant potential, as it not only transfers the effectiveness and practicality of implemented measures from the demos to the regional level but also aims to replicate these positive outcomes in small and rural cities. By broadening the scope of impact, RIDE2RAIL seeks to create a lasting transformation and foster further replication opportunities.

The Ride2Rail European Shift2Rail Project has successfully demonstrated the potential of ridesharing platforms and applications in different demo sites across Europe. The Helsinki, Brno, Padua, and Athens demos have provided valuable insights and feedback for further improvements and refinements of the ridesharing solutions. The recommendations for transferability outlined in this report will guide future implementations of ridesharing platforms in different regions, taking into account user experience, functionality, and user engagement to ensure the successful integration of ridesharing services with existing transportation systems.