UITP ADVANCING PUBLIC TRANSPORT | Ride2Rail

PROJECT BRIEF

ENHANCING INTELLIGENT MOBILITY SOLUTIONS TO PROMOTE THE COMBINATION OF RIDE-SHARING AND PUBLIC TRANSPORT

JUNE | 2023

INTRODUCTION

Access to rail, and to public transport in general, can sometimes prove challenging. It is a particular problem in rural areas and those with low demand, and is characterised by a lack of alternative transport solutions other than the private vehicle.[1] In these areas, it is not uncommon to see dozens of cars with only a single occupant. This Project Brief provides an overview of the methodology, findings and key takeaways of the RIDE2RAIL project, whose objective was to address this 'single car occupancy' issue by promoting the efficient combination of ride-sharing and public transport. UITP coordinated this EU-funded research project from 2019-2023.

RIDE2RAIL aimed to overcome the barriers to the adoption of ride-sharing in combination with public transport. The vision was to allow the use of intelligent mobility approaches to make ride-sharing an alternative for reaching mass transport services, particularly in rural and low population density areas. This would divert current demand from individual travel to collective mobility, and by so doing improve transport accessibility for all.

RIDE-SHARING

Ride-sharing is based on the concept of regular, prearranged trips that allow drivers and passengers to find people with whom to share the journey; it includes community-based arrangements and social media. A number of real-time ride-sharing technologies are emerging and have been piloted in several cities, but the lack of critical mass of users means the availability of on-demand ride-sharing is still relatively limited. Mobility policies must promote sustainable modes, particularly as the co-modality approach[2] has already proven effective and ride-sharing has emerged as a viable approach, thanks to mobile technologies[3]. Ride-sharing can be seen as a tool for reducing the overall distance travelled by single-occupancy private vehicles and as a feeder

1 EU 2020, Urban Mobility in the EU: No Substantial Improvement Is Possible without Member States' Commitment 2020. Available online: https://www.eca.europa.eu/Lists/ECADocuments/SR20_06/SR_Sustainable_Urban_Mobility_EN.pdf.

2 Co-mobility is defined as: "the efficient use of different modes on their own and in combination, [...] result[ing] in an optimal and sustainable utilisation of resources", European Commission. Mid-term review of the European Commission's 2001 Transport White Paper (2006) https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2006:0314:FIN:EN:PDF

3 Golightly et al 2019, Golightly, D., Houghton, R., Hughes, N., & Sharples, S. (2019). Human factors in exclusive and shared use in the UK transport system. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/773669/humanfactors.pdf

for high-capacity transport modes. There are, however, barriers that are restricting the uptake of ride-sharing; these include poor awareness of services, lack of trust and/or willingness to travel with strangers along with low flexibility in scheduling.

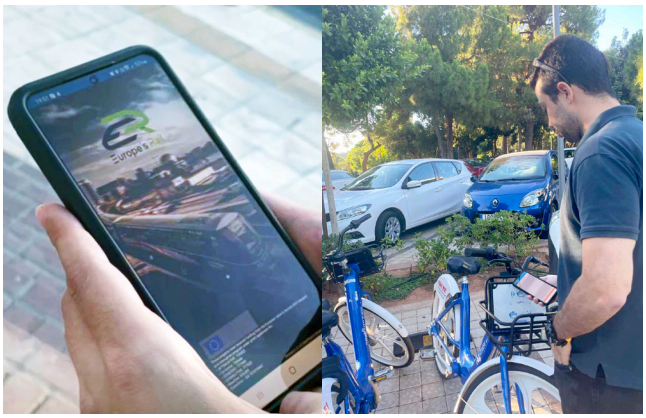
APPROACH

The overall objective of RIDE2RAIL was to develop an innovative framework that would support intelligent multimodal mobility by facilitating efficient connections between flexible and scheduled transport services. The framework has been developed in such a way as to integrate existing collective and on-demand transport services, thereby improving and reinforcing the mobility offer, particularly in rural and low-demand areas.

The project tested a digital ecosystem, and two of its interfaces, the Travel Companion (TC) and Driver Companion (DC) apps, in real-world demonstrations. Real users could test functionalities from these apps, such as (multimodal) journey planning, booking and ticket issuing, among others. RIDE2RAIL's main objective was to further enhance this Travel Companion, an Android[4] application developed by 'IP4 Call for Members' projects[5][6], with innovative functionalities and tools developed within the RIDE2RAIL project. The DC is an application developed by RIDE2RAIL partners, allowing each driver to make seats available in their vehicle, in order to attract potential passengers to share the ride. Transport service providers in four demonstration sites — Athens, Helsinki, Brno and Padua — were integrated into the Shift2Rail (S2R) ecosystem. This allowed travellers and drivers to test the TC and DC apps, to smoothly plan, book and execute a trip.

THE THREE MAIN ACTIVITIES RIDE2RAIL CARRIED OUT BY WERE:

- **Requirements** — how to take the traveller and their preferences into consideration when proposing trip options.
- **Technical Developments** — how to implement these requirements and include ride-sharing in the ecosystem.
- **Demonstrations** — test the developed modules in real-life situations.



Testing of the Travel Companion app during the Athens demo

PROJECT ACTIVITIES

REQUIREMENTS

The requirements activity process set out to analyse travellers' needs and preferences and to better understand how to categorise travel options. This made it possible to rank and filter the results on the TC app each time a traveller looked to plan a trip from A to B.

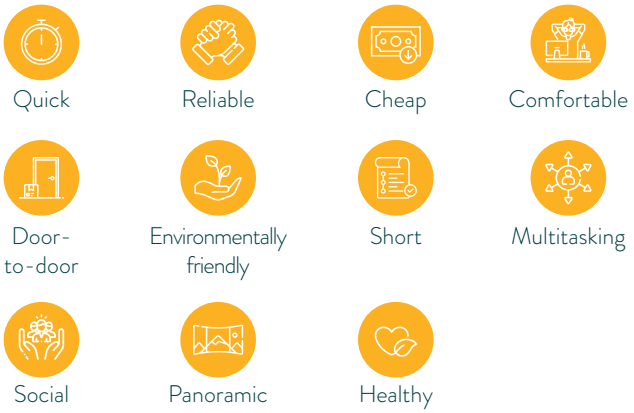
Another outcome of the requirements activity was an analysis of the regional differences and potential barriers to ride-sharing, in order to better understand the existing ride-sharing framework. This undertook an extensive review of definitions, ride-sharing systems, user characteristics and legislation (EU27 and UK). From this, it emerged that **ride-sharing — which is defined as "the common use of a motor vehicle by a driver and one or several passengers, in order to share the costs[7]" — is often not well regulated, and that the legal framework overall needs to be better defined.** It was also noted that there has been some pushback in certain regions as a result of **perceived unfair competition with taxi services, which has discouraged some governments from promoting ride-sharing further.** Also, by focusing on the motivations and constraints that users may experience when using ride-sharing services, the research identified four classes of ride-sharing users: household work user, solo work user, educational user and recreational/entertainment user.

The analyses have been validated by two surveys, which have been translated into 11 languages and distributed across Europe. The data collected on the choice criteria, multimodal travel preferences and expectations of over 600 European travellers has enabled the identification of use-cases for the implementation and final release of the RIDE2RAIL solutions.

4 https://www.android.com/
5 Members of Shift2Rail Joint undertaking https://rail-research.europa.eu/about-europes-rail/europes-rail-ju-members/
6 https://rail-research.europa.eu/research-development/ip4/
7 https://cms.uitp.org/wp/wp-content/uploads/2020/07/Report_MaaS_final.pdf

The survey results have been used to define the RIDE2RAIL catalogue of categories. This in turn has enabled the implementation of the Offer Categoriser, the Offer Matcher and Ranker, the Agreement Ledger and the Incentives Provider; all RIDE2RAIL developments integrated in the IP4 ecosystem, enriching the TC app as a result. Rather than creating an exhaustive list of all the possible offer categories, the catalogue contains only the most relevant as identified by the survey, and provides comprehensive descriptions of travel solutions in response to a mobility request.

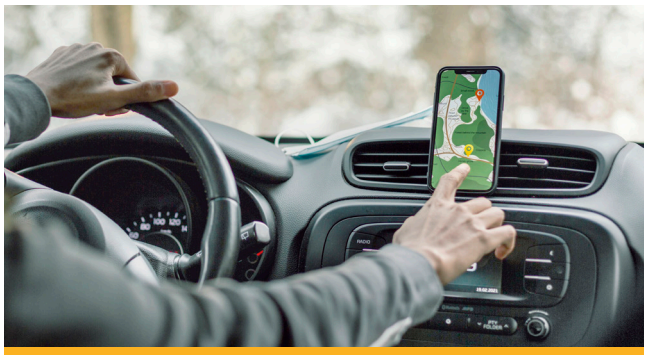
The offer categories, which are used to rank the travel offers in order of preference to help match each user preferences, are:



In terms of incentives, the surveys revealed that the highest-rated criteria were those that offered a more tangible incentive (material or financial) rather than those that were less tangible, such as gamification elements or consideration of environmental impacts.

TECHNICAL DEVELOPMENTS

The technical development activities introduced a novel system for improving the multimodal travel solutions proposed to the user according to their Travel Companion preferences.



RIDE2RAIL COMPONENTS INTEGRATED IN THE S2R ECOSYSTEM

For the TC app, besides testing already available functionalities such as Navigation, Journey Planner, Trip Tracking and Group Traveling, RIDE2RAIL also developed new functionalities:

- **Driver Companion:** an application enabling car drivers to share their rides with other passengers, a major project result.
- **Crowd based Travel Service Provider:** a system that publishes available shared rides, and that allows a driver to make visible on the Travel Companion the available seats in his/her car.
- **Offer Categoriser:** a tool that allows to give a 'score' to the travel options, based on different categories such as speed, reliability, pricing, making it easier for passengers to make a choice.
- **Offer Matcher & Ranker + Incentive Provider:** through a machine learning mechanism, this functionality learns the passengers' travel preferences (in terms of number of changes, overall travel time, etc.) and ranks options accordingly when searching for a travel solution on the Travel Companion. This allows users to receive offers classified accordingly to their own preferences.
- **Agreement Ledger:** a tool that allows the secure storing of travel related records using blockchain to ensure transparency and trust of operations.

Figure 1 provides a high-level overview of the interactions of users (drivers or travellers) with the various components during the technical developments of RIDE2RAIL.

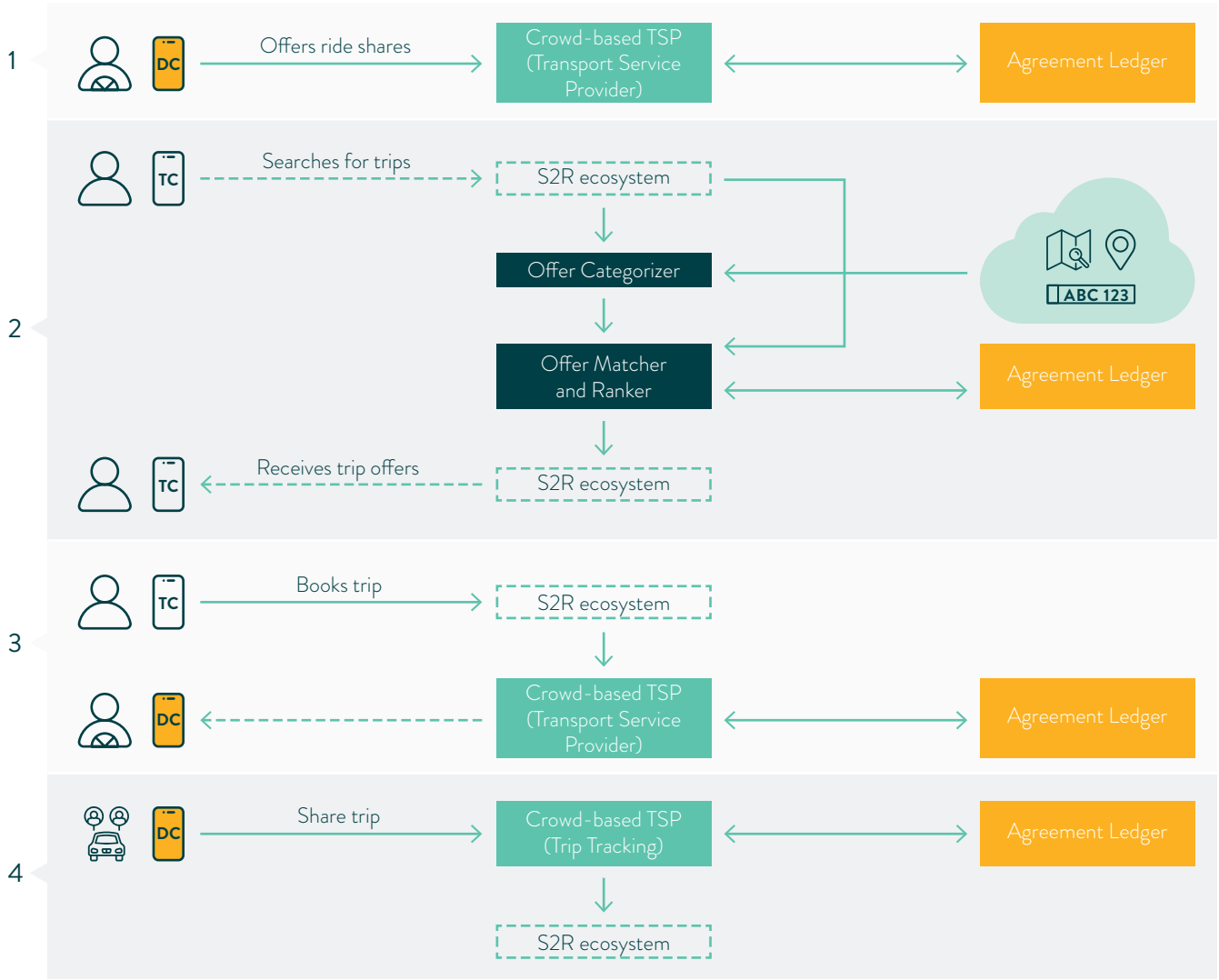


Figure 1: A high-level diagram of the user interactions with the R2R system. (1) A driver submits a new ride-sharing offer through the Driver Companion app (DC). (2) A traveller, using the Travel Companion (TC) app, searches for travel offers for a trip from A to B. These solutions are ranked according to this traveller's specific preferences, as earned by the ecosystem. (3) Once a suitable solution is found, the traveller accepts an offer and the driver is notified. Finally, (4) driver and passenger share their ride, while the trip-tracking capabilities of the Driver Companion update the Shift2Rail ecosystem about delays and incidents during the ride.

By treating a driver as a virtual transport provider and following the open-source SocialCar[8] project developments as a reference for the Driver Companion app, the project enabled drivers to offer shared rides by appearing as any other transport provider — such as a public transport operator — in the TC. This allows the driver to offer a rideshare with a certain number of available seats via the DC. A virtual Transport Service Provider (TSP), called 'Crowd-based TSP', is how the enabled users offer shared rides.

Travellers using the TC received personalised results based on their preferences. The Offer Categoriser uses the categories identified at the requirements stage to classify and evaluate/score the mobility options. These classifications made it possible to develop a recommendation algorithm, which learns user preferences over time based on the users' travel choices. Thus users benefit from better and more tailored travel offers and solutions over time.

In addition, travel offers can be associated with incentives, to encourage users to choose more eco-friendly modes of transport, such as public transport and shared rides. Furthermore, RIDE2RAIL has developed a state-of-the-art Agreement Ledger based on the HyperLedger Fabric technology. This is capable of deploying blockchain technology to track and store all interactions between drivers and passengers, while guaranteeing users' privacy and trust. The ledger module incorporates advanced technologies such as smart contracts and APIs to ensure the reliability and integrity of the data on the ledger and assists in automatically solving disputes between drivers, travellers, operators and service providers.

8 https://cordis.europa.eu/project/id/636427

DEMONSTRATION AND EVALUATION

During the demos, RIDE2RAIL tested the combined suite of software components presented above (the enhanced TC and the DC) in four areas. These areas, and the target stakeholders in each, have been selected to demonstrate that RIDE2RAIL can meet differing mobility challenges. Table 1 sets out the characteristics of the four demo areas.

Table 1. Description of demonstration sites.

	WHERE	TARGET USERS	BENEFITS
Athens	20km air-rail corridor Airport — Doukissis Plakentias, focusing on metro stations Park&Ride areas with designated carpooling lots.	Solo parkers at P+R Plakentias and Koropi Stations.	Foster smart multimodal solutions that integrate carpooling (increasing car occupancy and rail ridership). Enhance demand-responsive carpool connections with rural areas. Integrate carpooling road paths with the urban rail network.
Helsinki	Vuosaari, one of the fastest-growing areas in Helsinki, not sufficiently served by the current bus lines.	Commuters from/to rural and suburban areas.	Reduce single-occupant private car trips.
Brno	The City of Brno and surrounding areas.	Mainly commuters engaged through the commitment of the local PT authority and of the surrounding municipalities in the Brno hinterland.	To encourage rail commuters from suburbs to the city of Brno to share their car capacity with other travellers.
Padua	A 20 km area surrounding the city of Padua.	Commuter workers and students of the Ca' Foscari University of Venice.	Users receive recommendations to improve their mobility experience.

A key challenge of the project was to ensure that the demonstrations were accurately and objectively measured and linked to the wider activities of RIDE2RAIL. The diverse nature of demonstration sites allowed testing in several contexts, meaning that the consistent measuring of performance in these different settings needed to be rigorous. The evaluation activity worked with demonstration sites to establish seven targets and Key Performance Indicators (KPIs), measurable across all locations. A KPI monitoring methodology was designed to capture anonymised, aggregated trip data from within the RIDE2RAIL ecosystem. A short online survey supplemented the anonymous data and captured aspects such as trip purpose, perceptions of choice criteria and traveller demographics. In addition to the KPIs, the quality of the RIDE2RAIL user experience was measured by standardised usability metrics, such as the Software Usability Scale.[9]

HIGHLIGHTS OF RIDE2RAIL DEMOS

ATHENS DEMO

The Athens demo kicked off during the second half of July 2022, and lasted for over a week. The main objective was to improve the connectivity of the low-density Attica Region areas with public transport modes — particularly the metro — through the provision of demand responsive ride-sharing services. Both the DC and TC apps were tested, while the specific functionalities examined included Offer Categoriser, Offer Matcher and Ranker, Agreement Ledger,

9 Brooke, 1996, SUS: a "quick and dirty" usability scale. In: Jordan, P.W., Thomas, B., Weerdmeester, B.A., McClelland, A.L. (Eds.). Usability Evaluation in Industry.London: Taylor and Francis.

Incentive provider and the Crowd-Based TSP. Before the demonstration officially kicked off, an engagement strategy led by CERTH was established. This included dissemination through channels such as websites and social media. The demo team also organised and executed a Stated Preference Survey.

One of the main outcomes of both the demo and the subsequent survey was the fact that users mentioned that they would be happy to use and support a well-functioning ride-sharing app in combination with public transport.

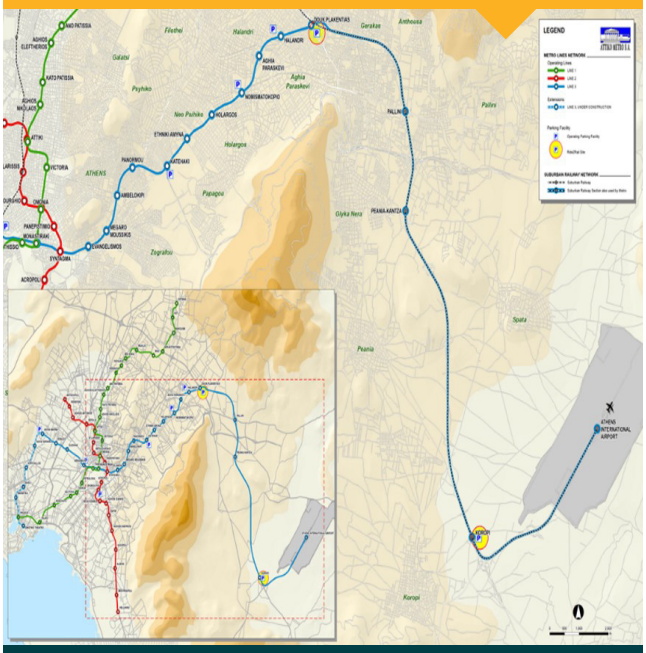


Figure 2: The Athens demo area

HELSINKI DEMO

The Helsinki demo was made up of two parts: the first focused on testing an automated robobus as part of a multi-modal, last-mile journey, integrated into the HSL (Helsinki Regional Transport Authority) travel planning application. In a demo period of approximately two months (October – November 2021), the robobus operated on a regular route in the Helsinki area of Vuosaari, integrated in the HSL journey planner (Reittiopas) as line number 90R, operating on public roads in the area similar to a regular bus. For safety reasons, a driver was present in the robobus. The demo attracted a total of 1,112 passengers, who were mostly satisfied with the service, and hoped to see the bus become a permanent service in the area.

Figure 3: The Helsinki automated robobus

The second part of the Helsinki demo focused on testing the DC app in combination with the enhanced TC personal application. Both were tested for two weeks in October 2022 with a trial user group of 30 people. The functionalities used in the Helsinki demo were Navigation, Journey Planner, Trip-Tracking and Group Traveling. Testers found the apps interesting, in particular because ride-sharing could reduce the number of vehicles in the streets, allowing better connections with low-demand areas not well-served by public transport.

BRNO DEMO

The Brno demonstration took place in November 2022 in the South Moravian Region of the Czech Republic. The demo focused on commuters travelling from the Znojmo district to the city of Brno, with the main objective of encouraging solo car drivers to share the unused capacity of their cars with other travellers. Both the DC and the TC apps were tested, while the specific functionalities studied in detail included Journey Planner, Offer Builder, Booking, Issuing, Validation and Asset Manager. To ensure the maximum number of testers, an engagement strategy was implemented that included leaflet distribution in public transport vehicles as well as through websites and social media campaigns.

A total of 60 testers took part in the demo, taking a total of 1,946 journeys.

Work undertaken included analysing the demonstration scenario with the selected testers, under the supervision of the project partners OLTIS and UNIZA. The main findings from the testers were that that apps are user-friendly, there is integration of all transport modes into a single travel solution and there is also the opportunity for sharing rides and saving costs.

Figure 4. One of the cars involved in testing the DC app in Brno

PADUA DEMO

The Padua demo took place within a 20km radius surrounding the urban centre of the town. It involved urban and regional mobility service providers in Veneto and encompassed rail, bus and ride-sharing as travelling modes. The demo took place in April 2023, and focused on commuters in the Padua province travelling to and from the University of Ca' Foscari.

The main objectives were to encourage ride-sharing (and increase its acceptance) as complementary to public transport, to improve the efficiency of public transportation services and to encourage lone car drivers to share the capacity of their car with other travellers. This would help reduce traffic, parking congestion and GHG emissions. The TSPs involved in the project were Busltalia (a bus operator) and Trenitalia (a rail operator). During the demo, both the DC and the TC apps were tested, while the specific functionalities examined 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 maximise the number of testers, a student engagement plan was rolled out, including a virtual training session. A total of 13 testers were involved in the demo, making a total of 387 journeys.

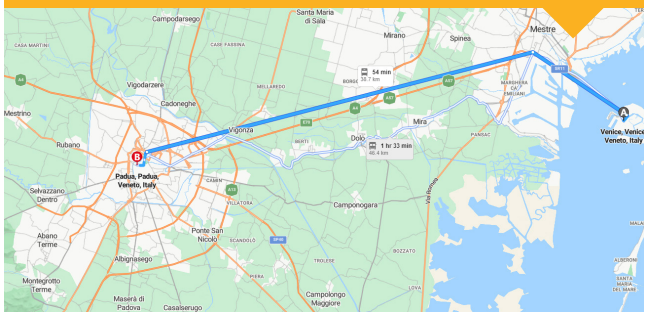


Figure 5: The Padua demo area
© Google Maps

IMPACT AND CONCLUSIONS

The feedback given by the demonstration participants provided vital insights into the relevance and application of the RIDE2RAIL concept. More than 100 participants covering the four demo sites provided survey responses and generated data on their trips through the use of RIDE2RAIL services, both in terms of the Travel Companion and the Driver Companion apps. The demographics of the participants was spread equally across all ages, gender and employment status.

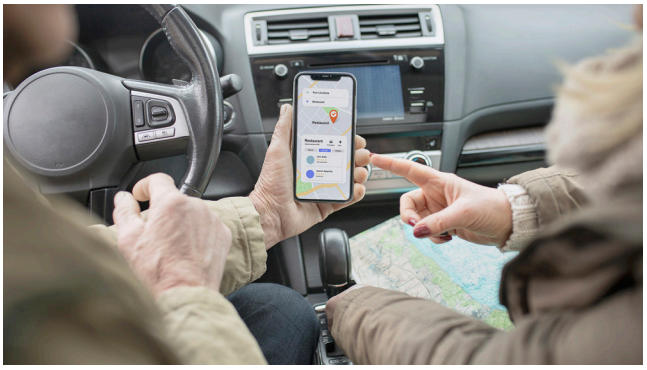
Usage and survey data indicated that over 2,000 trips during the demo period were organised using the RIDE2RAIL service, including 170 trips completed as multi-occupancy vehicle trips. Reflecting the needs of specific demo sites, a high number (75% or more) were commuter trips; many – particularly in the case of Brno – involved travel to or from urban areas.

Usability of the applications was rated by demo participants using the standardised System Usability Scale. The Driver Companion scored 58% and the Travel Companion 57%, both of which suggest good

usability for a demonstration application. The survey also showed that quick, reliable and cheap journeys were most important. This validated the findings of the literature review and the conversational surveys performed at the beginning of the project. These criteria can be considered the most important for shared rides.

A comparison survey in April 2023, conducted among citizens in the area around Newcastle upon Tyne has demonstrated that the RIDE2RAIL concept of combining ride-sharing with public transport is viewed positively in comparison to private car ownership. Some 77% of responses indicated that they would use the service, with 37% using it several times a month. This compares favourably with other forms of traditional and future (autonomous) shared travel services.

Finally, these outputs have been tied to an impact analysis with stakeholders from local authorities, public transit and academia in the four demonstration sites. This impact analysis demonstrates the significant benefits of RIDE2RAIL clearly lie in its potential for increasing public transport ridership and increasing rail connectivity.



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